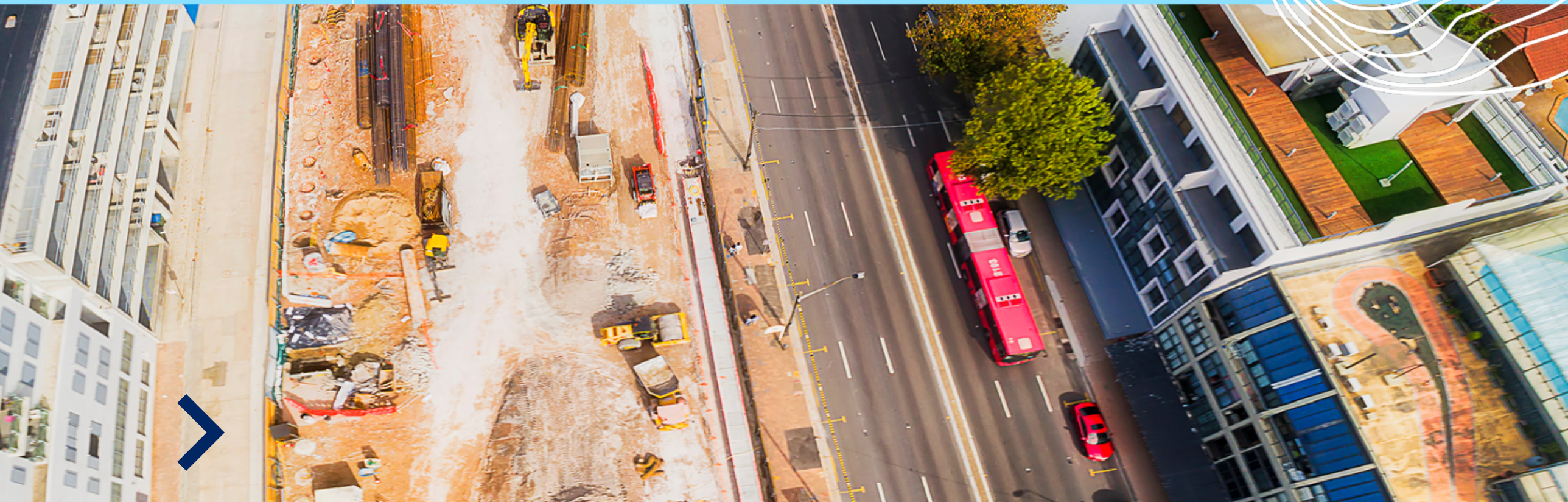
Guide to Transport Impact Assessment

Technical guidance for transport practitioners

TS 00085 | Version 1.1



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Acknowledgement of Country

Transport acknowledges the traditional custodians of the land and pays respect to Elders past and present.

We acknowledge Aboriginal people as the traditional custodians of the lands and waterways on which we build infrastructure, deliver projects and serve Transport's customers and are grateful to Elders past and present for their continual leadership.

Transport acknowledges for tens of thousands of years the continuous deep relationship and connections of Aboriginal people to their land, language, song, dance, art and story. Transport pays respect to those ancestors who defended, walked and managed these lands for many generations before us and who have left a legacy of strong cultural wisdom and knowledge embedded within Country today.

Transport acknowledges many of the transport routes we use today – from rail lines to roads and water crossings – follow traditional Songlines, trade routes and ceremonial pathways in Country that Aboriginal people followed for thousands of years.

Transport is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas, and their rich contribution to society. We recognise the impacts we make on Aboriginal culture and heritage through our infrastructure projects and commit ourselves to a future with reconciliation and restorative programs at their heart.

Our future projects will positively reflect the values, sustainability and spirituality of the Aboriginal cultures in the areas where we work. We acknowledge that our First Nations people and our customers today are still travelling these ancient Songlines, still doing business and still moving resources.

To do this, we will engage early with Aboriginal people on projects; respect and value their expertise; and integrate their understanding of Country and place into the design process and outcome. This is Planning for Country and Designing with Country.

Guide to Transport Impact Assessment

Version 1.1 First edition of the Guide to Transport Impact Assessment

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Overview:

The Guide to Transport Impact Assessment (the Guide) is the first full update to the Guide to Traffic Generating Developments (GTGD) since 2002. The Guide has been updated with new guidance on multimodal transport network impacts, site access design, travel demand management, trip generation methods and parking guidance.

This version:

This document is the first published version of the Guide to Transport Impact Assessment. It builds on the draft Guide v1.0 that was released for industry consultation between 20 March to 31 May 2024, and has incorporated updates to address feedback received.

This Guide supersedes the Guide to Traffic Generating Developments (GTGD 2002) and Updated Traffic Surveys Technical Direction (TDT 2013/04a). Practitioners may use this Guide wherever these documents are referenced in existing Environmental Planning Instruments (EPIs), Development Control Plans (DCPs) or other or other development assessment requirements.

Standards ID. TS 00085 | Version 1.1

Previous versions:

- Guide to Traffic Generating Developments v2.2, 2002
- Guide to Traffic Generating Developments v2.0, 1993
- Policies, Guidelines and Procedures to Traffic Generating Developments, 1984

Commencement:

This Guide supersedes the GTGD 2002 and TDT 2013/04a on 4 November 2024.

This Guide applies to TIAs commenced and development applications lodged on or after 4 November 2024.

This Guide will be updated periodically with new guidance, data and tools. For this reason, all TIAs should reference the version number of the Guide used in the introduction, to ensure consent authorities or referred agencies are able to review the TIA with the same guidance used by the preparer.

Transitional Arrangements:

This Guide does not apply to TIAs commenced and development applications lodged before 4 November 2024.

Disclaimer:

This Guide has been prepared by TfNSW to provide guidance only. TfNSW has taken care to ensure that the Guide is correct at the time of publication. It does not make any representations or warrant that the Guide is free from error, is current, or, where used, will ensure compliance with any legislative, regulatory or general law requirements. TfNSW disclaims all and any guarantees, undertakings and warranties (expressed or implied) and is not liable, including for negligence, for any loss (incidental or inconsequential), injury, damage or other consequences arising directly or indirectly from the use of the Guide.

Professional advice should be obtained before applying the guidance in this document to particular circumstances.

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Chapter

1 About the Guide

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1.1 Introduction

1.1.1 Purpose

Local councils and Transport for NSW (TfNSW) are responsible for the safe and efficient management of transport networks. Land use developments generate trips that may impact the surrounding transport network, its users, and the surrounding community. This Guide provides guidance on how to undertake and review transport impacts for proposed trip generating developments to ensure travel demand can be managed while attempting to mitigate potential issues prior to construction and occupation.

The Guide builds on the latest national guidance for assessing transport impacts and network management, provided in the Austroads Guide to Traffic Management, while also focusing on NSW specific circumstances and requirements.

This Guide is useful for professionals in traffic engineering, transport planning, town planning, consent authorities, determining authorities, councils, developers and others involved in the preparation or review of the Transport Impact Assessment (TIA) or Transport Impact Statement (TIS). The Guide provides common information and best practice guidance on assessing transport impact of trip generating developments, outlining a range of the transport aspects that should be considered when submitting and assessing DAs.

This Guide provides educators with an updated information source for developing course materials for university students and graduates to understand how the transport impact of trip generating developments should be assessed and mitigated.

1.1.2 Background

The Roads and Traffic Authority's Guide to Traffic Generating Developments (GTGD) was released in 1991 and then revised in 2002. In 2013, the former Roads and Maritime Services published the Updated Traffic Surveys Technical Direction (TDT 2013/04a) to update the GTGD's trip generation and parking information.

This 2024 Guide to Transport Impact Assessment represents the first major revision since the GTGD was published.

1.1.3 Limitations

The recommendations in this Guide may not be appropriate in all development situations. Discretion and professional judgement should always be exercised and clearly documented with justification. Where substantial departures from the guidance are proposed, practitioners should present sufficient information to consent authorities to support such departures. It is recommended that users of this Guide consider the following:

- This Guide does not provide a 'one-size-fits-all' approach to TIAs due to the variation in development types and site contexts.
- The key to the interpretation of technical requirements is to make assessments on a case-by-case basis with professional judgement.
- The desired levels of parking supply may vary based on local, State or strategic policies, as well as the local context such as the transport network and accessibility of local amenities.
- Any requirement embodied in existing or future planning legislation, overrides this Guide to the extent of any inconsistency.

1.1.4 Disclaimer

This Guide has been prepared by TfNSW to provide guidance only. TfNSW has taken care to ensure that the Guide is correct at the time of publication. It does not make any representations or warrant that the Guide is free from error, is current, or, where used, will ensure compliance with any legislative, regulatory or general law requirements. TfNSW disclaims all and any guarantees, undertakings and warranties (expressed or implied) and is not liable, including for negligence, for any loss (incidental or inconsequential), injury, damage or other consequences arising directly or indirectly from the use of the Guide. Professional advice should be obtained before applying the guidance in this document to particular circumstances.

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1.2 Using the Guide

1.2.1 Version control

The Guide is planned to be updated periodically in the future in order to provide users with up to date guidance. Users should refer to the latest version of this Guide when undertaking a new TIA. Reviewers should also refer to the same version of the Guide used by the TIA preparer. Superseded versions of the Guide will be maintained online to ensure preparers and reviewers are working from the same document.

1.2.2 Document structure

The Guide is available online in two forms, an interactive pdf and a printable pdf. The interactive pdf contains links for easy access to relevant content in the Guide and also provides links to relevant external webpages and technical resources.

The Guide is separated into chapters which cover a key area or theme, as summarised in Table 1.1. A Table of Contents proceeds each chapter to assist the user in locating relevant sections covering a specific aspect. A list of significant terms and their definitions are provided in the Glossary.

Table 1.1. **Summary of chapters**

Chapter	Purpose
Chapter 1 – About the Guide	Overview of the purpose, limitations, and structure of the Guide
Chapter 2 – Legislation, strategic direction and standards	Key legislation, strategic guidance and standards relevant to TIAs
Chapter 3 – Undertaking a Transport Impact Assessment	Introduction to TIAs and the methodology for conducting these assessments
Chapter 4 – Travel demand management (TDM)	Application of TDM measures and Travel Plan guidance
Chapter 5 – Land use trip generation	Trip generation principles, estimation approaches and summaries of surveys from a number of land uses
Chapter 6 – Multimodal network impacts	Assessing impacts of development on the transport networks and potential mitigating measures
Chapter 7 – Site access and design	Managing site design for development, including access, internal circulation and on-site transport related facilities
Chapter 8 – Parking provision and design	Parking management principles, off-street parking provision and design for various modes and reference rates for a number of land uses

The Guide provides a collection of appendices serving as detailed technical supplements, templates and reference material. These are cross-referenced where appropriate throughout the Guide.

- Appendix A – Technical references
- Appendix B – List of Roads Act sections relevant to transport matters
- Appendix C – List of State Environmental Planning Policies relevant to transport matters
- Appendix D – TIA report structure outline
- Appendix E – Scoping checklist
- Appendix F – Level of service for intersections.

1.3 Development and review process

1.3.1 Industry feedback

TfNSW welcomes continued feedback on the Guide by email at GTIA@transport.nsw.gov.au. Users are encouraged to provide feedback on aspects of the guidance where further work should be undertaken in updates to the Guide. Users may also provide contributions of data, case studies and other inputs to inform future updates of the guidance. This will assist TfNSW in ensuring the Guide remains useful, functional and continues to reflect best practice in TIAs.

1.3.2 Revisions and new guidance

The Guide is an agile platform which aims to keep pace with advancements in transport planning and engineering. Individual chapters or appendices will be revised periodically to align with user feedback and comments. Additional resources may also be developed to address any gaps in guidance provided or to enhance clarity.

Any changes or updates will be shared on the TfNSW Standards Portal as a draft for public comment. The draft documentation would then be revised to address industry feedback and published on the website, following TfNSW approval.

Figure 1.1. **Content update and revision process**

Chapter

2 Legislation, strategic direction and standards

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2.1 Overview

2.1.1 Purpose

This chapter provides an overview of legislation, strategic guidance and standards relevant to preparing and assessing a Transport Impact Assessment (TIA). It provides useful context in understanding and interpreting the transport impacts of development, particularly linked to rising travel demand.

2.1.2 Land use development and assessment context

The land use planning and development system is guided by legislation and supporting regulations, and Environmental Planning Instruments (EPIs). EPIs comprise State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).

Legislation and government strategic policies govern how land use should be planned and assessed. Government agencies develop strategies and plans to support the implementation of strategic policies as well as developing guidance to implement the strategies and plans.

2.1.3 Development Referrals Guide

The Development Referrals Guide (Department of Planning, 2023) (DRG) provides the information to help councils and development applicants to understand if a development application requires input from a referral authority. The DRG provides details of:

- when an integrated development approval, concurrence or referral is required
- the referral authority's lodgement requirements
- how the referral authority will assess an application
- what outcome applicants should expect.

Table 2.1. **Relationship between the Guide and the broader legislative, strategic and guidance context**

Legislation/ strategic policy	EP&A Act 1979 State Environmental Planning Policies (SEPPs)	EP&A Regulation 2021 Roads Act 1993	Transport Admin Act 1988 Road Rules 2014
	Local Environmental Plans (LEPs)		
Strategy/ plans	Transport strategies and plans DPHI Regional and District Plans Council Local Strategic Planning Statements (LSPS), Development Control Plans (DCP), strategies and codes		
Guidance	**Strategic and technical guidance** Movement and Place Transport Modelling Guidelines, etc. Active Transport Planning Guides Australian Standards Building Codes of Australia		
	Land use rezoning/network and area-wide planning transport guidance Network Planning in Precinct Guide Transport Management and Accessibility Plan Guidelines		**Development construction/ transport guidance** Guide to Transport Impact Assessment (GTIA)
Application	Precinct and structure plans	Master plans and planning proposals	Development Applications (SSD, SSI, DA)

2.1.4 Structure

This chapter is structured as follows:

- Section 2.2 outlines key acts, regulations and EPIs relating to developments and the assessment of transport impacts
- Section 2.3 describes some of the relevant strategic directions that should be considered in the design of a development
- Section 2.4 provides an overview of technical standards and guidelines that are relevant to transport planning and engineering.

2.2 Legislation

This section outlines legislation, including relevant acts, regulations and EPIs, relating to developing and assessing transport impacts and mitigating measures. A TIA or TMAP may be required for different approvals and concurrences under various EPIs.

The following sections provide an overview and do not consider the specific context of a proposed development. Always refer to the NSW Legislation website to review the current in-force legislation. Legal advice should be sought when required.

2.2.1 Transport Administration Act 1988

The Transport Administration Act 1998 establishes the functions of the public transport agencies including:

- TfNSW
- Transport Asset Holding Entity
- Sydney Ferries
- Sydney Trains
- NSW TrainLink
- Sydney Metro
- Transport Advisory Board
- Other public and private subsidiary corporations.

Those involved with preparing TIAs should have a broad understanding of the roles of each organisation and note, as necessary, several Schedules to the Transport Administration Act, including:

- Schedule 1 – Functions of TfNSW and other public transport agencies
- Schedule 6A – Powers relating to rail infrastructure facilities and land
- Schedule 6AA – Access undertakings
- Schedule 6B – Special provisions for underground rail facilities.

2.2.2 Roads Act 1993

The Roads Act 1993 (Roads Act) establishes a road classification system for roads and identifies TfNSW and other public authorities, such as local councils, as roads authorities and sets out their functions (see Sections 7 and Section 64 of the Roads Act). It confers on those authorities certain functions in relation to roads.

When preparing TIAs for development applications (DAs), or seeking concurrence, practitioners should have a broad understanding of the Roads Act and familiarise themselves with the sections of the Roads Act (refer to Appendix B), which are commonly relevant to TfNSW.

Road Rules 2014

The Road Rules 2014 consolidate in a single instrument the road rules that are applicable in NSW. The Road Rules provide legislation governing the safe and efficient movement of all road users including drivers, bicycle riders and pedestrians. An understanding of the Road Rules is fundamental to assessing development impacts and proposing any improvements. Some useful components include signage rules, delineation, parking restrictions and pedestrian facilities (crossings) and bicycle facilities.

Delegation and traffic committee

TfNSW is responsible for the control of traffic on all roads in NSW under the Roads Act 1993 and the Road Transport Act 2013. It also retains both the control of traffic on the State's classified road network and the control of traffic signals on all roads, TfNSW delegated certain aspects of the control of traffic on local roads to councils. The main delegation to councils limits the types of prescribed traffic control devices and traffic control facilities that council may authorise and requires councils to comply with certain conditions when doing so. One of these conditions requires councils to obtain advice from TfNSW and NSW Police prior to proceeding with proposals at a Local Traffic Committee. The Local Traffic Committee is an advisory body only. It is primarily a technical review committee that is required to advise the council on traffic related matters referred to it by council.

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2.2.3 Heavy Vehicle National Law (NSW)

The Heavy Vehicle National Law is applied and modified as a law of NSW by the NSW Heavy Vehicle Act 2013. Developments involving the use of heavy vehicles should take note of the requirements stipulated in this law in relation to transport related matters such as managing the impact of heavy vehicles on road infrastructure and ensuring the efficiency in the road transport of goods and passengers by heavy vehicles.

2.2.4 Environmental Planning and Assessment Act 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act) is the primary legislation regulating land use planning and development in NSW. It regulates the way that developers, consent authorities, determining authorities, councils, and other government agencies can undertake planning and development activities.

2.2.5 Environmental Planning and Assessment Regulation 2021

There are several sections in the Environmental Planning and Assessment Regulation 2021 which have specific relevance to transport matters.

- Section 35 Additional requirements for development applications in certain areas of Sydney. This stipulates locations where the applicant must submit an assessment of the consistency of the development with the relevant EPI for where the development is located. Section 35A specifically requires a traffic and transport study to be carried out for a DA on Site F in the Frenchs Forest Precinct. The study must be endorsed by TfNSW.
- Part 5 Modification of development consent regulates the process of modifying development consents. TfNSW may have a function as the concurrence authority for modification applications. Section 109 Notification of concurrence authorities and approval bodies specifies that consent authority must formally refer the modification application to any concurrence authority or approval body (such as TfNSW when it performs its concurrence function under the rail and roads EPI provisions as part of the original DA) if the proposed modification affects a condition imposed by the concurrence authority and the general terms of approval of the approval body.

Part 6 Complying developments regulates the process of application and certification for a complying development. Section 128 Traffic generating complying development stipulates the types and scales of complying developments that are required to obtain a certificate issued by the relevant roads authority certifying that any impacts on the surrounding road network, as a result of the development, are acceptable or will be acceptable, if the requirements specified in the certificate issued by the relevant roads authority are met.

2.2.6 State Environmental Planning Policies

SEPPs have their legislative basis in the EP&A Act. There are specific SEPP provisions that have direct references to TfNSW including the need to give notice to TfNSW and consider its submissions or to obtain TfNSW's concurrence. The Development Referrals Guide details the situation where a DA may trigger a SEPP and/or other EPI provisions that requires referral to TfNSW (including Maritime), Sydney Trains and Sydney Metro.

2.2.7 Local Government (General) Regulation 2021

Subdivisions 3 in Division 5 regulates matters relating to the operation of a public car park. Section 53 matters to be taken into consideration by council in determining approval of a public car park, requires council taking into consideration TfNSW views in determining an application under Section 68 of the Local Government Act 1993 to operate a public car park. Section 65 stipulates that council must not approve a public car park without the concurrence of TfNSW.

2.2.8 Local Environmental Plans and controls

In addition to SEPPs, land use and development in NSW is generally regulated by LEPs and Development Control Plans (DCPs) within each council's local government area.

Applicants should always consult with Council prior to lodging a DA and seek advice on the relevant LEP and DCP applicable to the development site. Concurrences and referrals for development impacting assets of TfNSW may be triggered under provisions of an LEP or DCP. To access relevant planning instruments, search the NSW Planning Portal.

2.3 Strategic direction

NSW Government develops plans and strategies that set priorities and strategic direction to inform future planning and set the direction for improving the transport system to benefit the community and the economy. This includes improving connectivity, enabling multimodal mobility, providing equitable access and supporting safer journeys.

Every DA is unique and its impact on the transport network will vary. The strategic directions outlined in this section are generally relevant for consideration when preparing a TIA for a DA that pose impact to the wider transport network and services. Refer to Chapter 3 for guidance on how to undertake a transport impact assessment.

2.3.1 Transport strategies and plans

The Future Transport Strategy outlines the strategic directions for how transport and land use planning can achieve world-leading mobility for customers and communities. It is part of a suite of government strategies, policies and plans that integrate and guide land use and transport planning across NSW.

The Future Transport Strategy recognises that as the NSW population grows, congestion on the transport network will continue to be challenging, affecting the communities' productivity and wellbeing. There are several responses from the strategy that should be considered in the planning and design phases of a DA. For example:

- Supporting car-free, active, sustainable transport options
- Integrating emerging mobility choices
- Facilitating efficient freight connectivity and access
- Improving the safety of people walking and cycling
- Improving parking provision and management
- Improving the efficiency of freight in centres and neighbourhoods
- Promoting travel behaviour change to manage networks
- Stabilising Greater Sydney's traffic
- Facilitating digital connectivity and smart city technology.

NSW's population is expected to grow to 11.5 million by 2061, increasing the demand for statewide transport connectivity. The population will require better alternatives to driving and a more sustainable transport system that fosters participation and inclusion.

TIAs for DAs can help link visions and strategic directions to an individual development by planning for the most sustainable transport into new, extended and upgraded developments. This can be achieved by considering travel demand management principles during the planning and design of a development to prioritise and encourage the use of public transport, walking and cycling, and reduce the demand for private vehicle usage and parking.

The Active Transport Strategy, is one of the supporting plans to the Future Transport Strategy, providing the strategic guidance on the planning, investment and priority actions for active transport across NSW. A full list of the supporting plans to the Future Transport Strategy can be found here.

Application:
When preparing or assessing a TIA for a DA, consideration should be given to the strategic direction outlined in the current government strategy documents. For example, industry stakeholders should take the strategy documents as guidance on how the planning and design of a development could support the strategic outcomes such as improving access to sustainable transport and contributing to the liveability of places around the development.

Consent authorities may review and check TIAs against the objectives and targets of strategy documents and seek clarifications from developers on how the development's design could contribute towards the strategic intent, if appropriate.

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2.3.2 NSW Movement and Place Framework

Movement and Place is a multi-disciplinary, place-based approach to the planning, design, delivery and operation of transport networks. It recognises and seeks to optimise the network of public spaces formed by roads and streets and the spaces they adjoin and impact.

The NSW Movement and Place Framework recognises that roads and streets are not just about moving people and goods – they are also places for people to live, work and spend time. Delivering on NSW policy and strategy, Movement and Place is about getting the right mix of transport in the right locations to create successful places. The framework consists of guidance and a supporting toolkit for practitioners and evaluators relevant to the DA process.

The Practitioner's Guide to Movement and Place outlines how to apply the approach in NSW and tasks practitioners with balancing the movement of people and goods with the amenity and quality of places. The framework supports practitioners with an approach to identifying street environments based on their place intensity and movement function.

The many different road and street types within these environments, as defined in the Design of Roads and Streets Guide, reflect an aspiration for how NSW roads and streets should be designed to serve their users and to fit their context.

The Network Planning in Precincts Guide presents principles for planning and designing a multimodal transport network that integrates land use and transport at a precinct level. It offers guidance on managing transport impact through TDM measures, which should be supported by a Travel Plan, including a management strategy for delivering long-term behavioural change and sustainable travel patterns across a precinct or organisation.

In addition to the above supporting guides to the Framework, there are a suite of tools available to assist applying the design principles of the Framework under different circumstances.

Application:
When preparing or assessing a TIA, consideration must be given to the network of public spaces formed by roads and streets as well as the spaces they adjoin and impact. The desired movement and place function of each road and street shall guide how to design and manage them and mitigate impacts when additional trips are generated by the development.

Development industry and the consent authority may consider applying the relevant principles and tools, as set out in the above guides supporting the NSW Movement and Place Framework, when preparing a TIA and identify any improvements that are required to achieve the target levels (which are relevant to the development context) for the surrounding roads and streets.

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2.3.3 Towards Zero

The safety of the development's users is a key part of the assessment undertaken in a TIA.

The NSW Government has campaigned Towards Zero to achieve the Future Transport Strategy's long-term goal of a trauma-free transport network. This requires many agents involved in decision-making and transport users to play their part in achieving a transport system with zero deaths and serious injuries. The vision of Towards Zero is supported by the "Safe System Approach" to road design. The following principles underpin this approach:

- The human body has physical limits to withstand the impact of a crash.
- People are human and sometimes make mistakes – a simple mistake shouldn't cost anyone their life.
- Roads, roadsides and vehicles need to be designed to minimise crashes or reduce forces if a crash happens.
- Road safety is a shared responsibility – everyone must make safe decisions on and around the road to prioritise safety.

Figure 2.1. **The Towards Zero "Safe Systems Approach"**

The Safe System Approach is outlined in the 2026 Road Safety Action Plan. Developments typically influence a range of safe system elements – safe people, safe roads and safe speeds. Road safety is a shared responsibility. Appropriate design of new, extended and upgraded developments can contribute to the safety of users accessing the development and others in the surrounding area.

Application:
Regardless of whether it is a single lot development or a large subdivision release, the geometric design of accesses and roads should promote safe movement of all road users and have safe design speeds to minimise the risk of crashes. A TIA or TIS should document their consideration of the above principles in the planning and design of the development.

2.3.4 The NSW Smart Places Strategy

The NSW Smart Places Strategy aligns with, and brings together the outcomes sought within the NSW Government's metropolitan and regional infrastructure, economic, land use and digital strategies.

The use of smart technology in transport management relies upon sensors and digitally connected infrastructure to generate data to make better, evidence-based decisions about improving the productivity, liveability and resilience of cities, towns and communities.

Following the release of the strategy in 2020, the NSW Government developed the SmartNSW Roadmap 2022-27 to identify the actions required to enable the outcome envisioned in the strategy. Actions relevant to development, for example, EN5, treat digital connectivity as a basic utility in new developments and redeveloped areas. Refer to the Smart Places Playbook for technical guidance on how to enable digital infrastructure for smart places.

In addition, the Future Transport Technology Roadmap outlines the technology toolkit and priority programs undertaken by TfNSW to integrate digital technology and data solutions into the transport network that best deliver to our customers and communities. For example, the use of intelligent systems and sensor technologies.

Application:
Deploying sensors technologies that enable real-time monitoring of developments may be considered where appropriate. The generated data can help inform better evidence-based transport layout design in developments in the following ways for examples:

- Using sensors and cameras for real-time monitoring of generated trips associated with the development and using this data in forecasting or measuring against the objectives of a Travel Plan.
- Enhancing the understanding of parking requirements by using a smart parking sensor network to deliver real-time occupancy information; linking with existing parking app developments, to create a more complete picture of parking use and trends.

2.3.5 NSW Public Spaces Charter

Launched in December 2021, the NSW Public Spaces Charter is a principles-based document that supports the creation and improvement of high-quality public spaces. The Charter supports creating successful places for communities and enhancing economic activity. It promotes neighbourhood walkability, streets as shared spaces and safe routes to walk and cycle, amongst a number of other key characteristics.

Application:
The NSW Public Spaces Charter identifies 10 principles for quality public spaces. Where applicable to a development application, these principles should be considered in the planning of a development. The principles are:

- Open and welcoming
- Community focused
- Culture and creativity
- Local character and identity
- Green and resilient
- Healthy and active
- Local business and economies
- Safe and secure
- Designed for place
- Well-managed

2.4 Technical standards and guidelines

Appendix A of the Guide provides a summary of the relevant technical standards and guidelines which are related to transport matters. An overview of the key organisations providing standards and guidelines for assessing transport impacts are listed below.

2.4.1 Australian Standards

Standards Australia is an independent organisation recognised by the Australian Government as the peak non-government Standards body, providing mandatory requirements in the design and planning of transport facilities.

2.4.2 Australian guidance

Austroads is the peak organisation of Australasian road transport and traffic agencies, including TfNSW and the Australian Local Government Association. It publishes a range of guides that cover the design, construction, maintenance and operation of road networks in Australia and New Zealand.

2.4.3 State government guidance

Guidance on transport impacts and planning is provided by TfNSW and other state agencies such as Department of Planning and Environment and the Government Architect NSW. TfNSW produces standards that are required for managing different life cycle phases of a NSW transport asset or specific transport mode. Should any developments interface with the operation and/or the physical state of a NSW transport asset, the relevant TfNSW standards must be considered when assessing the DA.

2.4.4 Local council guidance

Councils prepare DCPs that provide greater detail on local policy and built outcomes for development. Detail in DCPs often include matters relating to traffic and transport matters.

It is important for a DA to appropriately consider the intent of any relevant DCP including during the preparation of supporting documentation such as a TIA.

In addition, councils maintain a broader suite of other strategies and plans that might affect transport related matters such as local transport strategies, bike network plans, design codes, development contributions plans, etc. DA applicants should also consider this information when preparing a TIA.

Chapter

3 Undertaking a Transport Impact Assessment

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3.1 Overview

3.1.1 Purpose

A Transport Impact Assessment evaluates how a development would affect all modes of transport. This chapter provides NSW specific guidance on how to undertake a TIA or a Transport Impact Statement (TIS) to support a Development Application (DA), which is an application for consent under Part 4 of the EP&A Act. Activities undertaken by Public Authorities under Division 5.1 of the EP&A Act may also affect the transport system, requiring thorough evaluation and mitigation measures. Section 2.122 of the T&I SEPP elaborates on these specific situations.

Guidance provided in this chapter builds on the Austroads Guide to Traffic Management, Part 12: Integrated Transport Assessments for Developments.

This chapter examines the purpose of TIAs and the circumstances under which assessments might be undertaken. It also covers a range of issues that might be considered under different conditions, and the levels of detail for assessments and documentation.

3.1.2 Structure

This chapter is structured as follows:

- Section 3.2 describes a TIA and when it is required
- Section 3.3 discusses the methodology involved in developing a TIA
- Section 3.4 provides a summary of other TIA considerations.

The table below provides an overview of the steps to undertaking a TIA and the chapters relevant to each step. More detailed guidance can be found in Chapters 4–8.

Table 3.1. **Overview of the steps to undertaking a TIA**

Transport Impact Assessment process

Given the multifaceted nature of TIAs, it is not possible to have sequential chapters. Chapter 3 covers the overarching methodology for TIAs, and Chapters 4–8 cover more in depth guidance.

Phase		Relevant chapter						
		Legislation, strategic direction and standards	Undertaking a Transport Impact Assessment	Travel demand management (TDM)	Land use trip generation	Multimodal network impacts	Site access and design	Parking provision and design
		C2	C3	C4	C5	C6	C7	C8
Scoping and background conditions	**Step 1** – Document proposed development location, scale and access arrangements for all modes	●	●				●	
	Step 2 – Identify the area of influence and surrounding transport networks	●	●			●		
	Step 3 – Understand the existing and future baseline transport network conditions (for all modes in the area of influence)	●	●			●		
Proposed development analysis	**Step 4** – Identify and select travel demand management measures	●	●	●				
	Step 5 – Estimate trip generation to/from the development	●	●		●			
Impact assessment and mitigation	**Step 6** – Assess the development impacts on the transport network (across all modes in the area of influence)	●	●			●		
	Step 7 – Determine parking provision (including bicycle parking)	●	●					●
	Step 8 – Review and refine development design and site access points (incorporating findings of assessment, parking requirements and TDM)	●	●	●	●	●	●	●
	Step 9 – Impact mitigation (refined design, update TDM measures, upgrade infrastructure)	●	●	●	●	●	●	●
Documentation	**Step 10** – Document findings and recommendations	●	●	●				

3.2 Development transport impacts

3.2.1 Why assess trip generating developments?

Local councils and TfNSW are responsible for the safe and efficient management of transport networks. Land use developments generate trips as people, goods and services move to, from, through or within a development. Assessing transport impacts of a development seeks to ensure that the travel demand can be managed safely and efficiently, while attempting to mitigate potential issues before construction and occupation. Without adequate mitigation and design consideration, issues may arise including localised congestion around development access points and safety issues affecting developers, occupants, and the surrounding community. Therefore, impacts on all modes of transport should be considered.

3.2.2 What is a TIA?

A TIA is an objective appraisal of the implications of a particular development on the surrounding transport networks. This includes impacts to pedestrians, cyclists, motorists and passengers, public transport users, and freight and servicing vehicles. A TIA is undertaken by qualified professionals on behalf of the proponent of a development and is documented in a report format. The TIA:

- Provides an understanding of issues and quantifies the impacts related to a proposed development on different transport modes.
- Demonstrates the acceptability of those impacts subject to the implementation of recommended mitigation measures or actions in association with the proposed development.

The TIA findings may be used by consent authorities and other relevant public authorities in:

- Assessing Development Applications (DAs)
- Preparing a Development Control Plan (DCP)
- Planning and funding the provision of transport infrastructure and services
- Determining appropriate on-site car, bicycle, freight and servicing parking provisions
- Optimising the safe and efficient operation of the transport system
- Ensuring sustainable land use and transport development outcomes, such as minimising community reliance on single occupant private car use and encouraging active transport.

3.2.3 When is a TIA required?

A TIA is a key element that should be addressed in the DA often forming part of the Statement of Environmental Effects or an annexure to it. A TIA may also be required as part of the Environmental Impact Statement required for State Significant Development (SSD) or State Significant Infrastructure (SSI). A TIA is used by consent authorities, and other relevant public authorities, in their assessment and determination of a DA.

In general, a minor development such as building a new house or installing ventilation in a commercial building may not require a TIA, provided it meets the standards set out in the legislation, planning instruments, and related design guides.

For developments that impact on transport network operations, a TIA may be required.

Referral to TfNSW

The preparation of a TIA is required to accompany land use proposals referred for consideration under Schedule 3 of the State Environmental Planning Policy (Transport and Infrastructure) 2021, the Roads Act 1993, and other Environmental Planning Instruments (EPIs) or regulations. Refer to Chapter 2 for more information.

A TIA is required for a DA which, due to its location and/or scale, require TfNSW referral or concurrence. Key concerns relevant to TfNSW are the safety, efficiency and ongoing operation of transport infrastructure, networks and services. These include those under:

- Section 2.97 of the State Environmental Planning Policy (Transport and Infrastructure) 2021
- Section 2.122 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 specifically for development identified in Schedule 3 of the State Environmental Planning Policy (Transport and Infrastructure) 2021
- Section 2.22 of the State Environmental Planning Policy (Resources and Energy) 2021.

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3.2.4 What is contained in a TIA?

Depending on the context and scale of the proposed development, the requirements will vary. In general, the following are included in a TIA:

- Background on the location and details of the development, demonstrating consistency with relevant State or local government planning instruments or policy.
- Baseline for existing and future transport network conditions to inform the assessment of impacts. This may include maps, illustrations and/or description of land uses and transport networks surrounding and within the development site. It should detail both existing and committed improvements to transport systems, identification of nearby transport facilities and evaluation of accessibility of the development by all transport modes, as well as existing road safety performance.
- The estimated trips generated by the development and mode share.
- Analysis of the impact of transport scenarios on the safety and operational efficiency for transport users of all types.
- Recommendations to address issues and reasonably manage potential impacts of trips generated by the proposed development on the surrounding transport network (including a Travel Plan).
- The safety and functionality of the development's proposed multimodal access arrangements and internal road layout, including service and parking areas for all user groups (e.g. freight and servicing, general traffic, visitor parking, disabled parking, car share and car charging), and pedestrians and cyclists.

Within the context of the above requirements, preparers and reviewers should ensure that (adapted from Austroads Part 12):

- A TIA is undertaken in a uniform manner leading to consistent treatment of similar developments.
- The analysis of impact assessment is appropriate for the level of potential impacts, with larger impacts requiring more effort.
- Both 'soft' interventions (e.g. behaviour change) and 'hard' interventions (e.g. changes to infrastructure) are considered when mitigating impacts.
- The needs of all road users are considered and, where necessary, appropriate facilities (e.g. separated cycleways, footpaths, bus lanes, pedestrians crossings, intersection widening or upgraded intersection controls) are provided.
- A development should be considered within its physical and strategic context and not in isolation from nearby developments, including buildings already constructed, under construction or approved developments in the area of influence. Nearby features such as intersections, footpaths and other driveways, as well as active transport facilities should also be considered.
- Road safety is treated as a priority in the planning process.
- Environmental impacts (both natural and built) are given consideration.

3.2.5 Level of detail

Developments may vary from small establishments that generate relatively low numbers of trips generated to large mixed use, retail, commercial, industrial, or residential developments that generate high volumes of trips. The extent of assessment for a smaller development will be less detailed than for a major development. The level of assessment is proportional to the level of impact expected by the proposed development based on the site location and context.

Table 3.2. **Impact Assessment level**

Type of report	Description
Transport Impact Assessment (TIA)	A TIA is to be used for developments for which size or capacity and their site access(es) to adjoining road meet or exceed the thresholds as defined in Columns 2 and 3 of Schedule 3 in the State Environmental Planning Policy (Transport and Infrastructure) 2021, or as a requirement of another EPI.
Transport Impact Statement (TIS)	A TIS can be used for a development that is expected to have relatively low trip generation and impact to the surrounding transport networks. It is suggested that consultation should be made with the consent authority to confirm the methodology, prior to preparation of a TIS. The statement is intended to collect information about the proposed development such as site location and context, development scale, access arrangements, trip generation and distribution.

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Determination of the level of assessment should reflect the nature and scale of the development proposed and should account for the cumulative impact of components of the development. Where other issues are significant, the discretion and professional judgement of the consent authority may be exercised to request more details in support of the assessment (e.g. request for a TIA instead of a TIS. There may also be instances where a specific assessment is required to support a TIS, such as proximity to rail corridors/bus lanes or additional trips generated by a development using a railway level crossing.

Note that the need for a TIA can be influenced by many factors apart from trip generation. Factors which may influence the level of assessment required include (adapted from Austroads Guide to Traffic Management Part 12):

- Existing or potential safety or transport issues near the proposed development, such as crash history and/or geometric minima.
- Situations where there is a significant impact on public transport services or where existing public transport services and infrastructure are unable to support growth.
- Situations where traffic from other existing or proposed abutting developments is likely to compound traffic impacts (e.g. challenges with traffic demands due to the locations of proposed driveways/intersections).
- Situations where there is a significant impact on public transport services or where existing public transport services and infrastructure, or active transport corridors are unable to support growth.
- Areas that will have their environmental capacity adversely affected (e.g. traffic volume, speed or noise in residential areas, sensitive natural environment near the development).
- Situations where development peak trip generation coincides with peak recreational flows on the surrounding networks. In these instances, data should be sourced for both normal weekday situations as well as recreational peak periods.
- Developments that will generate high volumes of heavy vehicle traffic (including buses and freight) or introducing usage of new vehicle types (for example, buses from new subdivision) that may require geometric improvements or upgrades to an existing pavement (e.g. heavy vehicles, buses etc.). Refer to the relevant sections in Austroads Guide to Traffic Management Part 12 on how to undertake road pavement impact assessment.

Transport Impact Statement

A TIS satisfies the requirement for an assessment of transport impacts, but is not as comprehensive as a TIA. A TIS generally includes:

- A brief description of the development in terms of proposed land use, development scale and trips generated, staging development plan (if applicable), proposed development completion and operation timeframe.
- A brief description of the existing operational conditions of the transport networks for all relevant modes in the immediate vicinity of the development.
- An analysis of the operation of the multimodal accesses to the development and parking arrangements.
- An analysis of the operation of intersections, on either side of the accesses.
- A conceptual geometric layout of the access arrangements, including any nearby driveways and intersections.
- Observations and mitigations for safety issues, if any, in relation to the access arrangements.
- Professional opinion about the expected transport impacts based on a site observation during the expected critical peak hour and the analysis conducted.

The TIS format is not fixed but is typically presented in the form of a short report by an experienced transport practitioner.

A checklist of typical steps is available in Appendix E.

The guidance contained within Section 3.3 TIA methodology and Chapters 4–8 will also assist with preparing elements of a TIS.

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3.3 TIA methodology

In general, all TIAs follow the same core methodology adapted to different developments, as outlined below in Table 3.3.

This section presents a summary of key tasks through the TIA methodology which reflects best practice, including guidance adapted from the Austroads Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments.

Table 3.3. **Steps to developing a TIA**

Phase	Steps for undertaking TIAs
Scoping and background conditions	**Step 1** – Document proposed development location, scale and access arrangements for all modes
	Step 2 – Identify the area of influence and surrounding transport networks
	Step 3 – Understand the existing and future baseline transport network conditions (for all modes in the area of influence)
Proposed development analysis	**Step 4** – Identify and select travel demand management measures
	Step 5 – Estimate trip generation to/from the development
Impact assessment and mitigation	**Step 6** – Assess the development impacts on the transport network (across all modes in the area of influence)
	Step 7 – Determine parking provision (including bicycle parking)
	Step 8 – Review and refine development design and site access points (incorporating findings of assessment, parking requirements and TDM)
	Step 9 – Impact mitigation (refine design, update TDM measures, upgrade infrastructure)
Documentation	**Step 10** – Document findings and recommendations

Notes

This section does not provide prescriptive task definitions and the methodology should be adapted to suit the development proposal's context and consent authority requirements.

3.3.1 Scoping and background conditions

Prior to conducting any development assessment, it is necessary to establish the minimum technical responsibilities and analyses that will be performed. It is the applicant's responsibility to ensure that the proposed methods follow the techniques and practices accepted by consent authorities and any other relevant public authorities.

Step 1 – Document proposed development location, scale and access arrangements

This step involves compiling details about the site location, the proposed development and its scale. The proposed development site characteristics will identify the location of the proposed development, site boundaries and other site related characteristics. Information that may need to be provided includes:

- Site plan that clearly indicates the location of proposed development and, if applicable, internal road layout and its connection with the adjoining transport network.
- Review of Council's documents, such as development control plan, that are relevant or applicable to the development site.
- Proposed land use with details of the scale, density, and classification.
- Site development timeframe including staging plan (if applicable), development completion year and anticipated full operation year.
- Access arrangement for all transport modes including pedestrians, cyclists and freight and servicing vehicles. Other information should also include any proposed traffic signals, median openings, major driveway access locations serving the site and any restrictions such as Controlled Access Roads.
- Determination whether a TIA or TIS is more appropriate based on this information.

Step 2 – Identify the area of influence and surrounding transport networks

Once the development details and the need for a TIA is determined, an initial review of the surrounding transport networks can be undertaken.

The transport networks surrounding the proposed development should be identified including public transport, bicycle, pedestrian, road and freight networks. The segments likely to be affected by the proposed development should also be identified and form the area of influence (see Section 6.2.2 Assessment considerations). The interface between the transport network and the proposed development should be considered, along with existing parking facilities both on and off street. The existing conditions information may be presented with labelled figure maps and text.

A description of the site's current transport context is required, at regional and local levels. The site location in relation to other major trip generators and attractors is significant in determining the trip distribution in Step 7. This will inform the identification of the TIA area of influence boundaries, which can be presented in the diagram.

Scoping/pre-lodgement meetings

For large or uncommon developments, the development applicant should consult with relevant consent authorities and any other relevant public authorities and stakeholders, such as TfNSW. This allows for greater clarity on the TIA scope recommended for the proposed development.

> Early consultation before undertaking the TIA is an optional, although an encouraged step to set clear expectations up-front and potentially eliminate the need for rework upon submission. The consultation may also be useful for larger developments by engaging with specialists within the relevant agencies to obtain strategic advice/direction and local knowledge to improve the proposed development outcomes.

This scoping prior to commencing a TIA may take the form of:

- **Informal conversation** – a phone call to the relevant consent authorities (e.g. local council) to obtain advice, information and clarification of assessment requirements. A follow-up email to confirm the requirements in writing is recommended.
- **Formal meeting** – a meeting with relevant agencies (e.g. local council and TfNSW) for complex development proposals. This is recommended for high impact or large scale developments.

During scoping discussions, the following will typically be explored (based on desktop investigations):

- Discussion of proposed development, the development process and desktop investigations
- Assessment requirements in the context of the proposed development
- Confirmation of the geographical extent (area of influence) and, if required, the need for transport modelling
- Discussion and agreement on the TIA scope/methodology
- Scope of any works in public roads or transport corridors.

The methodology should include identifying the proposed development impacts on the transport network, as well as the potential improvements necessary to mitigate the development's capacity, operation, and safety impacts.

Discussion outcomes should be documented and confirmed in writing. Based on this agreed scope and extent, the TIA can be undertaken. It is understood that there may be a change in scope as a TIA is undertaken. Significant changes should be made in consultation with the relevant consent authorities.

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Step 3 – Understand the existing and future baseline transport network conditions

A thorough understanding of the existing and future baseline transport network condition allows for the robust transport impact assessment of a proposed development.

Existing conditions

Information which may be reviewed and documented as part of existing conditions includes:

- **Roads, streets and intersections** in the area of influence including the number of lanes, speed limits, types of traffic controls/configuration, road classification (state, regional or local), current freight access, movement and place function (and impact on movement and place function as a result of the development) and any traffic management schemes (such as bus lanes).
- **Public transport** infrastructure and services including routes and frequencies within the vicinity of the proposed development.
- **Pedestrian and bicycle paths**, routes and facilities both on and off road.
- **Travel volumes and capacity** on existing networks, based on usage, patronage data, peak periods, or as otherwise agreed.
- **Responsible agencies** for facilities and operations within the area of influence.
- **Safety** issues and risks for all modes.
- **Parking facilities** available in the vicinity of the site, including loading for freight and servicing, both off-street and on-street with detailed restrictions.

Future conditions

Design year volumes are estimated to establish a base case scenario. The base case is a representation of the future transport network without the proposed development, incorporating any planned and anticipated growth and infrastructure upgrades.

In considering design year conditions, travel demand growth information should be identified. The nature and size of the proposed development will govern the sources and processes used to determine design volumes. For smaller proposals, analysis of the current year or completion year may be sufficient, whilst major developments such as major residential subdivisions or regional shopping centres require a more comprehensive approach that may include future design years.

Sources of design year, or base case, volumes:

- Strategic models, which are based on current travel behaviour and future population and employment forecasts. In highly congested locations, the forecasted growth may not be accommodated, and adjustments may be required.
- Growth rates, in line with best practice and based on historical data or derived from the Census or Journey To Work data.

Apart from the impact of the proposed development, other changes that may be required in the base case include:

- Committed infrastructure investments and programmed improvements on transport facilities and upgrades in the area of influence.
- Changes to existing and provision of new public transport services and routes.
- Planned land use changes, including rezoning or the introduction of a major development or precinct plan.
- Any other changes that will impact the transport network within the area of influence.

To account for the uncertainty over the magnitude of estimated volumes, it is recommended to undertake a sensitivity test using a range of volumes.

Refer to Section 3.4.1 for guidance on establishing assessment year determination.

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Strategic context for the development

It is essential to consider the alignment of a development with relevant transport strategies, plans and planning controls. This involves consideration of:

- Relevant planning strategies, policies and controls affecting the site and its sub-region, such as:
  - State level and regional strategies.
  - Statutory plans such as State Environmental Planning Policies (SEPPs).
  - State Significant Development (SSD) and State Significant Infrastructure (SSI).
  - Local government planning instruments such as Local Environment Plans (LEPs), as well as Development Control Plans (DCPs), and other Council policies.
  - Site specific plans or other relevant legislation.
  - Refer to Chapter 2: Legislation, strategic direction and standards for more information.
- Key transport and related issues, constraints, opportunities and requirements for the site and its sub-region, relating them to the above identified plans.
- Any conflicts between State or local plans and the development.
- Key existing and planned land uses in the region and their transport relationships to the site, including employment areas, other major trip generators and significant special use sites e.g. hospitals and education facilities.
- Key existing and proposed infrastructure in the region and their relationship to the site, including transport, utilities and human services.
- Significant features of the proposed site, including existing or previous land use, population, employment and resulting transport demand.
- Extent of significant technological advancements which may have implications on inputs and assumptions and require sensitivity testing – this is more relevant to larger developments.

How TIAs adopt a Vision and Validate planning approach

Development should support the vision for an area, as outlined in relevant local or state transport policies, strategies, and plans. This should be considered in the design of the development. A TIA adopts evidence based approaches such as benchmarking to demonstrate how development manages the transport impacts and supports elements of those strategies and plans.

Data collection and analysis

The data requirements for existing transport information should be carefully planned and considered by an experienced practitioner. Data may include crash reports, intersection counts, mid-block tube counts, pedestrian counts, cyclist counts, and SCATS data for signal phasing during peak periods (e.g. if transport modelling for signalised intersections is required). Consultation is encouraged prior to data collection if the TIA will be referred to TfNSW.

Analysis of collected data will help establish a basis for comparison of the development impacts. The basic analysis should consist of assessing the existing operational performance of the transport system using an appropriate methodology. An appropriate analysis period should be identified and agreed upon based on assessment requirements and local network context (e.g. peak hour vs all day).

Where suitable data is not publicly available, the applicant is responsible for collecting data. In general, observational counts are preferred and should be reflective of typical conditions. Data collection should consider variations such as demands across the week, seasonality, and weather conditions. Periods of lower demand should be avoided, such as school holidays. Data sourced during significant transport network changes or coinciding with major development openings should also be noted and potentially excluded if they could distort the observations. The data collected should cover the critical demands in line with the analysis period.

While passively generated big data sources are not preferrable due to unreliable application in transport impact assessments, big data sources may supplement observational counts and provide insights in cases where the sample size is less important (e.g. travel times) or where a relative result is required (e.g. before/after studies, route choice, origin-destination). Place-based data guidance includes examples of other smart technologies that may be used where appropriate.

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3.3.2 Proposed development analysis

Step 4 – Identify and select travel demand management measures

Travel demand management (TDM) is an effective way of reducing private vehicle travel demand from a development site once completed and occupied. However, identifying TDM measures early allows an opportunity to incorporate hard measures into the design of a development to improve the potential of a Travel Plan.

At this stage, it is beneficial to identify TDM measures suitable for the development, including design optimisations of the development to prioritise non-car modes. Refer to Chapter 4 – Travel demand management for more information.

Step 5 – Estimate trip generation to/from the development

Trip generation

Trip generation is the estimation process used to determine the number of trips made to and from the proposed development by each mode of transport. The travel demand will depend on the proposed specific land use(s), as well as the development's context. Trip generation estimates are a critical element of TIAs, and when coupled with data on existing and future travel demands, are the basis for analysing transport impacts on the wider network.

Mode share

Mode share is the proportion of trips taken by different transport modes. Its estimation enables an understanding of the impacts of trips generated on each transport network. Mode choice can be impacted by various factors, with the largest influences related to travel time, cost and access to public transport.

Mode share is highly dependent on the site characteristics and network context, and so the estimation method must be site and land use specific. The data for determining realistic modal shares can come from Census information, transport surveys or transport studies. More directly, mode use and parking surveys for similar developments in areas with similar characteristics can serve as useful reference points.

Trip distribution and network assignment

Trip distribution is the process used to determine where trips will travel to and from the proposed development. Depending on the size of the area of influence, a specific origin and destination may be identified for each trip, or the general area of travel may be determined.

The direction taken to and from the proposed development site should be identified and justified. All assumptions and the methodology used to establish the trip distribution is to be documented in the TIA report. The assessment should be based on the critical peak periods where the combination of background and local trips is at a maximum.

Adjustments to trip estimates

Adjustments may be applied to account for factors that have not been captured through the previous steps. This includes TDM strategies, reductions to reflect existing, linked or internal trips, or changing travel trends. Any adjustments must be reasonable, genuine, and supported by a robust evidence base.

Refer to Chapter 5 – Land use trip generation which details key principles, terms and definitions, estimation approaches and survey data summaries.

3.3.3 Impact assessment and mitigation

Step 6 – Assess the development impacts on the transport network

It is important to establish the ability of the surrounding transport network to accommodate any increases in demand associated with a development. This is particularly important in urban settings with well used and space constrained networks. The ability for one network to accommodate demand in place of another can also influence Travel Plan objectives, as well as public transport infrastructure enhancements where appropriate.

Safety issues

As part of the TIA, an assessment should be conducted to identify and address all potential safety issues (e.g. Road Safety Audit) on-site and on the surrounding transport networks. Detailed considerations are included in Chapter 7 – Site access and design.

Depending on the context of the development, a formal road safety audit may also be advised by local council or TfNSW. A road safety audit is an independent examination of a development's road safety from the perspective of all road users. In NSW, road safety audits are conducted by certified road safety auditors, who help identify deficiencies and areas of risk in design.

Further guidance on road safety audits is available in the TfNSW Guidelines for Road Safety Audit Practices and the Austroads Guide to Road Safety Part 6: Road Safety Audit.

Performance assessment

Generally, the level of acceptable performance resulting from a development should be maintained to the level of performance that would have otherwise occurred in the area of influence in regard to network capacity, performance and safety of all users. If exceeded, appropriate mitigation should be proposed and documented in the TIA for consideration by the consent authority and relevant agencies.

Performance criteria are measures that assist in this assessment and define the level of service provided by the transport network to the users. Specific performance criteria are discussed in Section 6.2.3.

When any component of the transport system is significantly and adversely impacted, this should be identified in the TIA. Transport modelling can be used to estimate the potential impacts of the development. Refer to Section 6.3 for more information.

Step 7 – Determine parking provision

Determine how much bicycle and car parking is needed for the proposed development. Other considerations for this step include:

- Parking for people with disabilities
- Motorcycle parking
- Bicycle and micromobility parking including end of trip facilities
- Delivery and servicing vehicles including loading dock provision.

Refer to Chapter 8 – Parking provision and design for more information.

Step 8 – Review and refine development concept and site access points

Assess the development's ability to accommodate the estimated level of trip generation internally and at the proposed access points. Essentially all vehicle traffic, walking and cycling movements within the development and at all access points, must be undertaken in a safe and efficient manner. Design should enable safe and comfortable walking and cycling access. Also consider site design providing internal site layout to facilitate coherent and logical circulation and accessibility to local public transport infrastructure in the vicinity of the development site. Identify any initial problems or issues with the development design which may need to be addressed.

Review and refinement of the development design and site access points is valuable following the completion of Steps 1–7. The review should focus on optimising the design to maximise the likelihood of success for TDM measures, freight/servicing vehicles addressing safety and prioritising development access for walking and cycling and enabling access to nearby public transport.

Refer to Chapter 7 – Site access and design for more information.

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Step 9 – Impact mitigation

Recommended measures to mitigate the impacts of the proposed development on the transport network should be documented. These measures:

- May include infrastructure, services or strategic solutions to address identified issues.
- Must be practical, implementable and consistent with local council and NSW government requirements.
- Must include consideration of funding requirements and timing for implementation.
- For infrastructure measures, a concept design should be prepared, which should inform the environmental assessment, cost estimates and funding requirements.

Any mitigation measures identified in a TIA will become part of the DA and assessed by the consent authority as part of the overall assessment process. Note that some mitigation measures may require subsequent approvals under other legislation (e.g. Roads Act approvals) and in principal agreement should be sought from the relevant agency such as TfNSW as part of the DA process.

In all cases, the proposed measures should focus on maximising sustainable and safe accessibility to the development. Travel Plans are a useful approach to mitigate development impacts. Measures which encourage a reduction in single occupant vehicle usage and peak spreading have the potential to reduce the severity of projected impacts. The level of mitigation should be justified based on a solid evidence base, reasonable targets and a completed Travel Plan. Refer to Chapter 4 – Travel demand management.

Where improvement to transport infrastructure and facilities are required and agreed, developers should be made aware of the need to contribute to the cost of such improvement. The TIA should examine the proportion of the impact that results from trips added by the proposed development and by growth in background traffic, which would assist in informing the level of contribution needed for the improvement works which are a direct result of the proposed development. Refer to Section 6.4 for more information.

3.3.4 Documentation

Step 10 – Document findings and recommendations

The final step is preparing a consolidated TIA report that documents the methodology steps with respective findings and recommendations. Generally it is advisable to provide a concise write up including the use of bullet points, tables and figures to assist with presenting complex results with enhanced readability.

Some submission elements include:

- An executive summary outlining the proposed development, impact assessment results and recommendations.
- A version control table in the front of the report, identifying authors, preparation, reviews and dates.
- A strategic design of the proposed development, in line with TfNSW's Strategic design requirements for DAs, 2022.
- TIA methodology and any outcomes of scoping/pre-lodgement consultation (if applicable).
- Technical assessment assumptions should be clearly stated in the report.
- Proposed development characteristics and existing context.
- Safety assessment, e.g. Road Safety Audit with suggested mitigation measures for consideration, noting the appropriate hierarchy of control.
- Trip generation, distribution, mode share and assignment methods and results.
- Assessments of development impacts and mitigation measures for roads, public transport, pedestrian and cycle connectivity and facilities, etc.

Where transport modelling is required, results should be provided for all relevant scenarios and modes. Models developed as part of the TIA may need to be submitted electronically if requested by the consent authority, TfNSW or any other relevant public authority.

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3.4 Other TIA considerations

3.4.1 Assessment year determination

Forecast years should be selected to best indicate the stages of development and the transport demand upon maturity. Major sites with complex staging may require additional sensitivity testing including additional forecast years, and/or scenario testing involving differing forecast periods. A range of forecast years should be tested to identify sensitivities as well as potential risks.

For smaller scale developments, analysis of the current year and year of completion may be sufficient. However, for major developments (such as large residential subdivisions or large shopping centres) two forecast years may be appropriate. For example, a short term forecast about five years after development completion, and a longer term forecast at approximately 10 years after opening especially if more costly infrastructure investment is required to mitigate impacts. Councils or TfNSW may have specific requirements with regards to the design years which should be verified. The TIA needs to provide sufficient detail to enable impacts of the development to be quantified for each mode at effective opening and at agreed future years. The nature of the development, whether primarily residential, commercial, educational or a mixed-use development, will determine the specific mode information required.

3.4.2 Technical assumptions

Key assumptions are made in any assessment, from desktop analysis to four-step models and can affect the reliability and validity of the TIA. Such assumptions need to be discussed and clearly stated in the TIA report. They include:

- Network provision
- Land use and density
- Staging and timing of development
- Trip generation rates and trip distribution for all modes of transport
- Comparable sites
- Mode share

Critical assumptions should be challenged by sensitivity and/or scenario testing.

3.4.3 Sensitivity testing

TIA sensitivity testing is important to ensure that technical assumptions do not distort the findings. Sensitivity testing may consider the following:

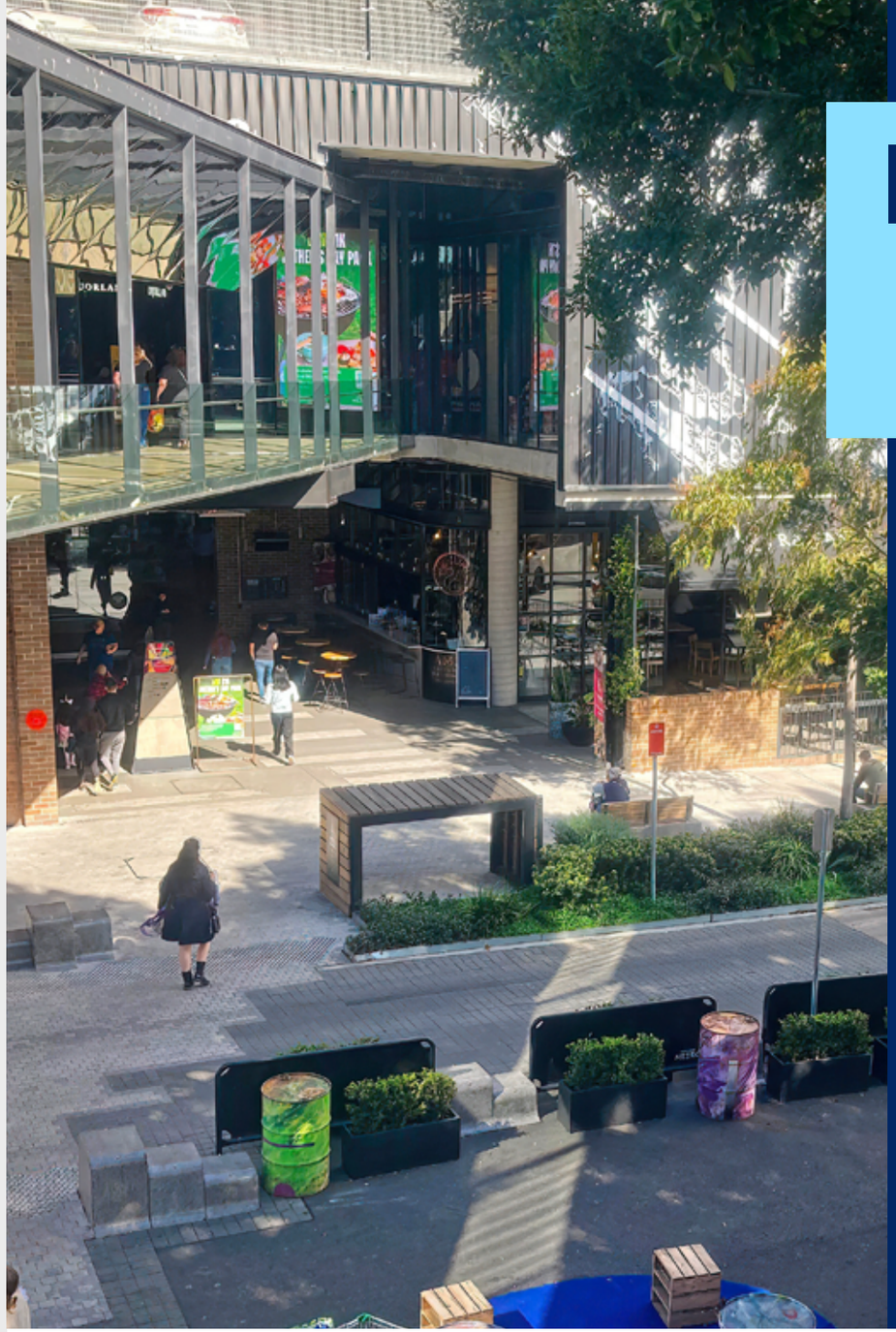
- Proposed land uses, densities and staging
- Demographic changes including household size and socio-economic group, car ownership and use levels
- Trip generation rates for various land uses
- Trip purposes and selected modes
- Forecast years, regional development and population changes
- Provision of remote and/or independent transport infrastructure that may influence travel behaviour
- Variations in travel cost.

A reasonable amount of budget and effort may need to be allocated for sensitivity testing (particularly in large scale developments), as the results would contribute to the assessment of impacts, proposal modification, needs identification, and funding apportionment. Sensitivity testing needs to be designed to enable robust comparisons to be made amongst scenarios. The scenarios tested should be consistent with other assessments which may be required as part of a DA (e.g. consistency with forecasted demographic changes). Scenarios tested may be discussed with the consent authority.

3.4.4 Construction traffic and pedestrian impacts

A Construction Traffic (or Transport) Management Plan (CTMP) examines the impacts of development construction works on the local transport network and mitigation measures. It may be conditioned by the consent authority and prepared separately from a TIA. Refer to the relevant consent authority or local council for further information on applicable requirements. A large or complex development may benefit by having a preliminary CTMP prepared as part of the TIA.

While a CTMP may not be required, in all developments, it is valuable to consider the construction requirements and associated measures to manage potential interruptions to regular pedestrian and vehicular traffic routes (e.g. road/footpath closures, access closures, parking areas for construction staff and impacts, haulage routes, construction generated traffic etc.). Where possible, pedestrian and cyclist access connecting the development should be maintained throughout the construction period to support safety and sustainable mode share and alleviate construction impacts.



Chapter

4 Travel demand management

4.1 Overview

4.1.1 Purpose

Travel demand management (TDM) for developments involves undertaking deliberate planning and design to promote more sustainable travel behaviour of future occupants and visitors.

TDM measures are focused on influencing travel behaviour by remoding, retiming, rerouting and/or reducing journeys.

 **Remode**	Shifting journeys from one transport mode to another.	 **Retime**	Shifting journeys from peak to off-peak periods.
 **Reroute**	Shifting journeys from congested to less congested routes.	 **Reduce**	Reducing the number of journeys using the transport network.

This chapter also provides guidance and tools for developing Travel Plans to support a DA.

4.1.2 Structure

This chapter is structured as follows:

- Section 4.2 describes TDM principles, strategies and how these can be applied in phases of development
- Section 4.3 describes Travel Plans, key benefits and provides guidance for when Travel Plans are recommended
- Section 4.4 provides guidance to assist transport practitioners with preparing, implementing, monitoring and evaluating Travel Plans.

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4.2 Travel demand management

4.2.1 Key principles

TDM strategies identify a point(s) of pressure on a transport network, identify the cause and design interventions to achieve a more desirable behavioural outcome.

TDM strategies are most effective when a context-based, people focussed, multipronged approach is used, including a combination of hard and soft interventions and behaviour change campaigns.

'Hard' interventions are generally either infrastructure-based or financial instruments. Examples include:

- Supporting infrastructure such as end-of-trip facilities and bicycle parking.
- Improvements to the 'last mile' pedestrian and cycle access: direct routes, clear signage, suitable lighting, accessible to all users, clear of obstructions, safe and secure.
- Car parking management such as parking pricing and encouraging multiple occupancy vehicles.
- Provision and/or access of on-site facilities such as child care or gym facilities.
- Use of shuttle buses from key origins to the development.

'Soft' interventions encourage and support voluntary behaviour change, focus on changing policies and practices, and include communicating the mutual benefit of travelling in a particular way. Examples include:

- Information about travel choices (e.g. providing a travel access guide see section 4.4.4).
- Workplace policies (e.g. offering flexible working arrangements).
- Incentives (e.g. bike share memberships).
- Social/behavioural marketing campaigns (e.g. removing perceived barriers through messaging and encouraging travel behaviour change).
- Understanding the audience (e.g. focus on target population, viable travel alternatives, information accessibility).

These interventions are enablers to changing travel behaviour and should complement the desired outcome(s) of the TDM approach. The interventions should consider barriers to changing travel behaviour including:

- Beliefs, attitudes, and social norms (e.g. perceived prestige associated with car ownership).
- Personal habits.
- Convenience, speed, and flexibility of preferred mode, compared to alternative options.
- Personal safety concerns (e.g. time of travel).
- Socio-demographic factors (e.g. age, income, number of dependents).
- Journey complexity (e.g. a series of activities between trip origin and destination).
- Lack of public transport accessibility at the trip origin and/or destination.

TDM strategies can lead to various outcomes that benefit individuals and communities, including:

- Increase efficient use of the transport network.
- Improve active and public transport infrastructure and services.
- Provide and promote sustainable travel choices.
- Increase productivity through efficient urban freight and servicing.
- Manage the impacts of planned/unplanned transport interruptions.

4.2.2 TDM through design

The design of a development provides an opportunity to apply TDM strategies to mitigate the transport impacts generated and to support more desirable transport outcomes.

A site layout design that provides safe, effective and convenient access, connections and facilities, supports TDM strategies by influencing desired travel behaviour for a development. Some examples include positioning pedestrian access points for easy access to nearby amenities and public transport stops/stations, considering desire line of movements for active transport users and reducing the conflicts with car mode at access points. Refer to Chapter 7 – Site access and design for more information.

A Travel Plan may be required as part of a DA and provides the opportunity to apply a holistic package with measures integrated into the site's design, construction and occupation rather than 'retrofitted' once the development is complete. Refer to Section 4.3 – Travel Plans for more information.

A Travel Plan can be used to identify and achieve mode share targets and, if effective, may reduce the development's private vehicle trip generation. It is important that any adjustments proposed to the trip generation rates are based on robust evidence. Refer to Section 5.5.6 for more information.

Managing parking supply for a development is a common hard intervention that can be used with other TDM measures to change travel behaviour and support outcomes associated with managing vehicle usage and encouraging alternative transport. Professional car share is another example of a valuable TDM tool.

The management of parking demand is essential to reducing parking supply. The degree of reduction in parking demand depends on the TDM measures used to alter travel behaviour leading to a reduction in private vehicle usage. Parking management approaches can also drive desired travel behaviour, such as charging a parking fee and using the proceeds toward providing incentives for employees who elect to travel by public or active transport; or for sites with limited public and active transport, encouraging workers to carpool, as well as detached, decoupled and shared parking. Refer to Chapter 8 – Parking provision and design for more information.

TDM strategies can be used for managing urban freight and servicing activity coming to, from and within a development. Refer to Freight and Servicing Last Mile Toolkit (TfNSW, 2021) which includes guidance on how to plan and manage off-street freight and servicing activity.

TDM strategies implemented during the development's design and construction that support sustainable transport outcomes can be recognised through rating systems such as Green Building Council of Australia.

4.2.3 TDM through construction

During construction of a development, transport impacts are generated which may require mitigation measures.

A Construction Traffic (or Transport) Management Plan (CTMP) may be required as part of a DA to assess the impact of the development's construction activities on the local transport network. Refer to Section 3.4.4 for more information.

TDM strategies can alter trip making behaviour created or affected by construction activities to support more desirable transport outcomes.

This can include retiming and/or rerouting construction vehicle movements and remoding, rerouting and reducing journeys to, from and/or through the development including journey to work for construction workers and traffic management plans for disruption events.

A common TDM practice in CTMPs includes bringing tools and materials on site into holding areas, to enable workers to travel into a worksite by public transport, or by a shuttle bus service, without requiring a work vehicle on site at all times.

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4.3 Travel Plans

A Travel Plan is a management strategy for delivering behavioural change and sustainable travel patterns across a development. It is used to influence travel behaviour associated with the ongoing use and occupation of the development site.

A Travel Plan is unique, evidence-based and tailored to the development's specific circumstances. It is not a one-size-fits-all approach and should be tailored to the site context and the future occupants. A Travel Plan is a living document that needs to be continually updated to effectively influence travel behaviour and respond to the needs of the development's occupants and visitors, as well as changing transport conditions and travel options.

TfNSW has developed a toolkit to assist in developing, implementing and monitoring a Travel Plan by people or groups. The toolkit provides various templates, resources and examples. There are also toolkits tailored to hospital precincts, as well as higher education institutes and large shopping centres.

Consent authorities may require a Travel Plan to be prepared and submitted with DAs or require a Travel Plan to be prepared as a condition of development consent before a construction or occupation certificate is issued. A Travel Plan may be required when there is a significant impact on the road or transport network due to the level of trip generation including all State Significant Development (SSD) and State Significant Infrastructure (SSI) projects. The relevant consent authority will set the specific requirements which will usually include identifying likely travel patterns associated with the development, propose strategies to manage or mitigate them, provide associated supporting infrastructure to enable them, and identify a mechanism for its implementation, monitoring and review.

Generally, a Travel Plan is recommended for consideration for any development where there is a positive cost-benefit from implementing the Travel Plan to achieve sustainable transport outcomes, such as enabling and encouraging a mode shift in trip generation to alternative transport options. These developments are likely to be serviced by public transport and have well connected active transport facilities. Developments which are most likely to benefit from a Travel Plan include:

- High density developments including commercial, residential and mixed-use.
- Significant trip generating developments including large shopping centres, employment centres, entertainment centres.

Many developers and organisations prepare Travel Plans voluntarily to capitalise on the benefits that they provide to their businesses, staff and occupants.

Table 4.1. **Potential Travel Plan benefits**

Developer benefits	• Reduces need for capital investment, such as costs related to
	  · transport network capacity improvements (e.g. road and intersection improvements).
	  · provision of car parking.
	  · development impact mitigation.
	• Reduces localised vehicular congestion through good planning and design, and the provision and promotion of sustainable transport options.
	• Enhances attractiveness and value of the development and the surrounding precinct.

Occupant benefits	• Enhances transport connectivity of the site and surrounding precinct. • Improves the amenity, attractiveness and efficient use of building. • Increases awareness of travel options. • Improves access to work opportunities through improved access to public transport. • Improves health benefits through improved access to active transport. • Reduces travel time and car operation costs through improvements in congestion. • Enables flexible working arrangements.

Organisational benefits	• Reduces organisational costs, including:
	  · Reduced travel times due to less congestion.
	  · Reduced car park and loading dock congestion.
	  · Better employee health and wellbeing outcomes.
	  · Decreased absenteeism.
	  · More efficient use of space.
	• Improves attraction, retention and wellbeing of staff and visitors, from larger catchments and demographics.
	• Enables flexible working arrangements.
	• Enhances corporate, social and environmental responsibility.

4.4 Travel Plan process

The development of a Travel Plan follows a basic methodology that can be scaled and adapted depending on the development's context. This section outlines the six-phase process for Travel Plan preparation, delivery, monitoring and evaluation.

The approach for a development site with unknown occupants differs slightly. A Framework Travel Plan is prepared until the occupants are known, and a baseline travel survey can be undertaken.

A successful Travel Plan typically depends on a number of key principles including:

- Collaboration between the developer and tenant in the preparation, review and handover of the Travel Plan.
- Senior/executive organisation support/endorsement.
- Clearly assigned roles and responsibilities for the implementation and management of the Travel Plan.
- Commitment to undertake and repeat consistent site audits and travel surveys to establish baseline conditions and monitor change.
- Selection of effective and appropriate action plan measures.
- Committed resources to implement the Travel Plan actions.
- Implementing a thorough communication strategy to raise awareness of the Travel Plan.
- Robust evaluation of the Travel Plan to ensure the measures effectively deliver progress towards meeting and maintaining the objectives and targets.

4.4.1 Phase 1 – Scope the Travel Plan

The first phase involves developing high-level objectives for the Travel Plan and then assigning roles and responsibilities for planning, delivery, managing, monitoring and evaluation.

A committee or steering group should be established to oversee the plan's preparation, delivery and evaluation. A selected committee member should serve as a champion or Travel Plan coordinator to lead the Travel Plan's ongoing development, delivery, review and ongoing implementation and refinement.

A resource commitment should be determined to enable travel investigations and the development of a robust Travel Plan.

The high-level objectives can then be refined following data collection and analysis in Phase 3.

Figure 4.1. **Travel Plan process**

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Framework Travel Plan

For developments where the future occupant is unknown, or in order to respond to a requirement for a Travel Plan to address the planning phases of a development, a Framework Travel Plan may be prepared. In these instances collection of data should be based on the assumed trip generation rates/mode split within the TIA which may include available travel data from similar sites by type, location and transport accessibility. The Framework Travel Plan follows the outlined methodology with the developer serving as the Travel Plan coordinator to oversee the preparation of a Framework Travel Plan based on assumptions of how the site will be used. This ensures that necessary design features to support future travel demand are included during the planning phase and that demand generation associated with the site's end use is appropriately catered for.

Once the occupants of the development site are known, the Framework Travel Plan should be reviewed and updated with a baseline travel survey of the occupants to ensure the action plan is appropriate. The developer should hand over responsibilities for delivery and ongoing management of the Travel Plan, including planning consent authority conditions within an agreed timeframe. It is recommended that an initial travel survey be conducted within six months of full occupation; planning consent authorities may require this after stage completion, depending on the size and scale of development.

4.4.2 Phase 2 – Collect and analyse travel data

This phase involves the collection and analysis of travel data to provide insights into travel behaviour and the surrounding transport network. The identification of the development's occupants or visitors, potential enablers and barriers to changing travel behaviour and any points of pressure on the transport network, will inform the objectives and targets (Phase 3) and action plan (Phase 4).

Data sources

Travel pattern analysis from the TIA, including Journey to Work (JTW) and Household Travel Survey (HTS) data, should be incorporated into the travel data for the Travel Plan. Refer to Section 5.5.2 for more information.

Site audit

A site audit should be carried out to understand the development's transport connectivity and the quality of infrastructure and services for each mode. The assessment will identify deficiencies in the provision and potential underutilisation of transport services and infrastructure. This may include observations of parking and end of trip facilities, wayfinding signage, footpath grade and public transport service frequencies in the local area. The site audit results should influence the design of the development to address any potential issues and ensure the development has adequate high quality travel options as part of the overall design. A site audit checklist can be found here.

Travel survey

An initial or baseline or comparable travel survey would typically be undertaken with the residents and/or workers at a similar existing development to understand existing travel behaviour. The survey should focus on actual behaviour on the day and not on what usually happens, as this will average results and not provide a clear understanding of the range and nature of travel behaviour. Additional attitudinal questions can be used to understand barriers and usual or preferred behaviour. Advice and information on travel surveys can be found on the Travel Demand Management website.

Travel data analysis

The available data should be analysed to gain a quantitative measure of indicators such as:

- baseline trip generation by the time of day
- primary origin and destination locations for travel to and from the site
- existing mode split for the development or similar existing developments
- car parking and bicycle parking utilisation and peak demands.

In addition, survey findings may provide qualitative insights into travel behaviour, including potential enablers or barriers to transport modes. The analysis results can be used to inform the development of objectives, targets and potential measures in Phase 3.

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4.4.3 Phase 3 – Set objectives and targets

This phase involves setting objectives and targets based on analysed travel data and Travel Plan scope.

The objectives are a statement of the intended outcome of implementing the Travel Plan. While some objectives may be generic, there may be objectives that are only relevant to the specific site. Travel plan objectives may include:

- reducing mode split of single occupant vehicles
- encouraging sustainable journeys to and from the site
- minimising the impact of the development on the transport network
- reducing localised congestion around the site.

Targets for existing developments are typically defined based on the existing mode split, as obtained by the baseline survey data. For new developments, targets should be based on a combination of the predicted trip generation and any demonstrable shift in travel behaviour that can be reasonably expected to occur if the proposed actions are implemented. Targets should be aligned with the objectives and include interim targets to validate the pathway towards achieving the objectives. Targets may be guided by case studies of similar or nearby sites and/or applicable Government targets, which would serve as benchmarks. Targets should be S.M.A.R.T. (specific, measurable, achievable, relevant, and time-bound) and set over the life span of the Travel Plan.

4.4.4 Phase 4 – Prepare an action plan

This phase involves identifying and selecting measures and preparing an action plan to implement the selected measures.

A list of potential measures should be identified to influence site occupant and visitor travel behaviours to achieve the objectives and targets. The potential measures should include both 'hard' and 'soft' interventions and short, medium and long-term timeframes. An anticipated resource requirement can be estimated for each measure to allow appropriate allocation and to gauge the relative value for money of individual actions. The potential measures should be assessed based on criteria such as cost, influence, and deliverability and selected measures are prioritised based on the Travel Plan's objectives and targets. If possible, engagement with key stakeholders during the selection of site-appropriate measures will assist to measure the potential influence of each measure and raise awareness of the Travel Plan.

The action plan contains the proposed program of measures and outlines:

- identification of tasks
- who is responsible
- any resource requirements
- implementation timeline.

It is recommended that a high-level risk assessment is undertaken for each measure to provide mitigation strategies for implementation. This may include risks to timeframes, budget, etc.

The Travel Plan document can then be prepared to use the baseline travel data analysis, objectives, targets and proposed program of measures (action plan). A monitoring/review plan will accompany the Travel Plan - see Section 4.4.6. Depending on the context and audience, the Travel Plan may be presented as a detailed report (for a consent authority) or a brief one-page infographic (for employees and residents).

Travel Access Guide (TAG)

A TAG is a concise representation of all travel options to a building or precinct, highlighting key information about the most effective ways of accessing a location by sustainable modes of transport (public transport, walking or cycling).

It is essential for helping occupants and visitors plan their journeys to the development or site. It shows the full range of available transport options within a short walking distance and can help people make well informed travel choices.

A TAG may also provide information about bicycle parking, car parking, end of trip facilities and freight and servicing arrangements, depending on individual business requirements.

TfNSW provides a comprehensive "how to" kit for organisations seeking to prepare a TAG for their building or workforce. It is available on the Travel Demand Management website, with a TAG Checklist and a Sample TAG.

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4.4.5 Phase 5 – Implement and raise awareness

This phase involves implementing the selected measures through the action plan and raising awareness of the Travel Plan.

It is important to ensure clear and effective governance for implementing and promoting the Travel Plan. For existing developments, the Travel Plan coordinator is responsible for implementing the measures on time and within budget.

For new developments, the implementation of hard measures may be undertaken by the developer in conjunction with the design and construction process, while soft measures may be the site occupant's responsibility.

A communications strategy should be developed to raise awareness of the Travel Plan and should identify:

- the key messages
- the target audience
- communication channels
- timings and frequency for communication.

Key messages may be delivered through various communication channels and should be tailored to the target audience(s), informing communication timings and frequency to optimise engagement.

4.4.6 Phase 6 – Manage, monitor and evaluate

This phase involves the ongoing management, monitoring and evaluation of the Travel Plan.

Monitoring and evaluation should be conducted periodically throughout the life span of the Travel Plan. The monitoring/review plan should establish:

- when monitoring and evaluation will occur
- what information will be collected
- what evaluation criteria will be used
- who is responsible
- how the review will be documented/reported.

Travel surveys can be undertaken periodically to assess the development's progress relative to the baseline survey data (Phase 2), modal targets and efficacy of measures. It is recommended that repeat surveys are undertaken periodically throughout the life span of the Travel Plan (e.g. annually for a period of five years, or for the period required by the consent authority).

In addition to the periodic travel surveys, smaller sample spot counts or spot surveys may be beneficial in capturing seasonal variations in travel behaviour or monitoring a specific objective, measure or issue. One such way could be the use of camera technology. The data should be analysed to assess the trends in travel behaviour and adapt any related actions. Survey and/or questionnaire methodology should be kept consistent to ensure comparable data and validity of data to monitor trends in travel behaviour.

The Travel Plan evaluation criteria should assess the objectives, targets and measures within the action plan. If the Travel Plan falls below expectations, the measures may need to be revised or new measures proposed to reach the targets and objectives. Targets and objectives should also be reviewed to ensure they are realistic, achievable, and aligned with the needs of consent authorities and the expectations of the development's occupants.

The evaluation findings should be documented and could be reported back to the occupants of the development. Documentation can be in the form of a report outlining the Travel Plan performance over the evaluation period, and the proposed revisions for the following period. Reporting the evaluation findings reinforces the positive changes that have been made, as well as highlighting the areas where further work may be required.

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Chapter

5 Land use trip generation

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5.1 Overview

5.1.1 Purpose

Trip generation is an estimation process used to determine the number of trips made to and from the proposed development by each mode of transport. It is a critical element of TIAs to support DAs and planning proposals.

An estimate of trip generation from a proposed development requires an understanding of the intricate relationship between travel demand, transport supply and land uses.

This chapter provides guidance on land use trip generation for transport planning and engineering practitioners and consent authorities.

5.1.2 Structure

This chapter is structured as follows:

- Section 5.2 describes key principles and requirements for trip generation
- Section 5.3 outlines trip generation definitions and time periods for data collection
- Section 5.4 describes factors influencing trip generation
- Section 5.5 provides guidance for trip generation estimates using TfNSW rates, benchmarking and First Principles approaches
- Section 5.6 provides a summary of trip generation rates for land uses surveyed by TfNSW with guidance for their purpose.

Note, the full TfNSW survey data tables and analysis reports for each land use are available for download. Links are also provided in Table 5.2.

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5.2 Principles and requirements

Land use, urban form and transport planning are interlinked components of the overall development process. Land use and urban form influence the demand for travel and mode choice and ultimately guides the provision and operation of transport infrastructure and services.

Travel demands depend on the proposed specific land use(s), as well as the development's context. Trip generation estimates, coupled with data on existing and future traffic volumes and public transport patronage, are the basis for analysing transport impacts on the wider network.

5.2.1 Key principles

The following key principles will need to be considered to determine appropriate trip generation estimates:

- Trip generation rates vary by site based on a number of factors. These factors can explain why identical developments in different locations can generate a different number of trips, travel profiles and mode shares.
- Site characteristics, urban context and transport network factors influence trip rates, such as land use mix, urban morphology, built form, accessibility, and development density (as discussed in Section 5.4).
- Trip purpose, such as the split of education, work, shopping, recreation and cultural trips in the area.
- Socio-demographic characteristics, such as income, household structure, vehicle ownership and use, affect the demand for travel and trip generation rates.
- Freight, servicing and commercial trips are based on the productivity and operating hours of the land use, as well as the derived demand for last-mile trips to destinations.

Trip generation for a proposed development is an 'estimate', not an 'actual' or 'exact' measurement. Practitioners should note that it is not practicable or the intent of trip generation to accurately measure and determine the 'actual' rate of trip generation for a proposed development.

For the purposes of assessment, transport impacts will depend on an evidence-based estimation of trip generation (as discussed in Section 5.5).

There is no one-size-fits-all estimation approach for trip generation. Depending on the proposed land use, development scale and data available, the chosen trip generation approach may vary.

For example, for a small residential development of eight dwellings, the average trip generation method may be sufficient to form an estimate; whereas for a large scale precinct development, a First Principles approach to trip generation may be more suitable.

5.2.2 Requirements

Transparency of trip generation estimation methodologies is imperative to ensure robustness of the analysis and future replicability. The following should be documented when estimating trip generation rates as part of any TIA:

- Provide findings from detailed site context analysis, including the key factors influencing travel behaviour.
- A clear methodology for calculation of estimates for trip generation rates with justification.
- Chosen time periods for trip generation estimation justified with evidence.
- Provide all relevant data and assumptions that have influenced the trip generation estimate, justified with evidence, and highlighting the key factors considered:
  - Trip generation surveys used.
  - Characteristics of survey sites considered.
  - Anticipated mode shares (e.g. walking, cycling, public transport, private vehicles) and vehicle occupancy by mode (e.g. buses, private vehicles).
  - Freight and servicing trips.
  - If applicable, trip adjustment factors applied, including any TDM strategies proposed and anticipated impacts.
  - If applicable, alignment of assumptions with strategic policies and place-based visions and objectives.

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5.3 Basic terms and definitions

This section provides definitions for common technical terms used in relation to trip generation with a discussion of relevant issues.

5.3.1 Trip generation

Trip generation is the first step in the conventional four step transport planning and modelling process.

Trips are defined as one way movements of people, goods and services from one point (origin) to another (destination) by any mode of transport.

Person trips refer to a one way movement by one person by any mode of transport. Person trip generation refers to the number of movements of people (person trips) to and from a land use.

Vehicle trips represent a one-way movement by a single vehicle such as a car, van, truck, motorcycle etc. Vehicle trip generation refers the number of vehicles movements to and from a land use.

Trip rates can be converted between person and vehicle trips with an appropriate mode share and vehicle occupancy assumption, as shown opposite.

Converting between person trips and vehicle trips

A single vehicle trip may account for multiple person trips. For example, if there are four people travelling in one car there would be four person trips and one vehicle trip. Therefore to calculate vehicle trips using person trip data:

$$\text{Vehicle trips} = \frac{\text{Person trips} \times \text{car mode share (\%)}}{\text{Estimated vehicle occupancy (persons/vehicle)}}$$

Example: If there are 1,000 person trips with a car mode share of 70% and vehicle occupancy of 1.4 persons/vehicle, the result would be a total of 500 vehicle trips.

Similarly, to calculate person trips from vehicle trips data:

$$\text{Person trips} = \frac{\text{Vehicle trips} \times \text{Estimated vehicle occupancy (persons/vehicle)}}{\text{car mode share (\%)}}$$

The number of trips made on other modes of transport can simply be calculated by multiplying by estimated mode share. For example, if the mode shares from the total of 1,000 person trips were 35% rail, 8% bus, 6% cycling and 2% walking, this would equate to 350, 80, 60 and 20 trips respectively.

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5.3.2 Types of trips

New developments generate additional trips that may be either completely new or changed existing trips. This is particularly relevant for specific land uses such as commercial, retail or educational.

For example, commuters may divert their trip to and from work to complete a secondary trip to a new commercial centre to purchase goods. Consider accounting for this behaviour to accurately depict the impact of new developments.

Trips can be broadly categorised as:

- **Linked trips:** Journeys where there are multiple destinations from origin to the ultimate destination. For example, a trip from work to home with a stop at a shopping centre and fast food outlet would comprise three linked trips.
- **Unlinked trips:** Direct journeys from an origin to destination with no intermediate stops. For example, a trip from home to work at an office development with no stops.

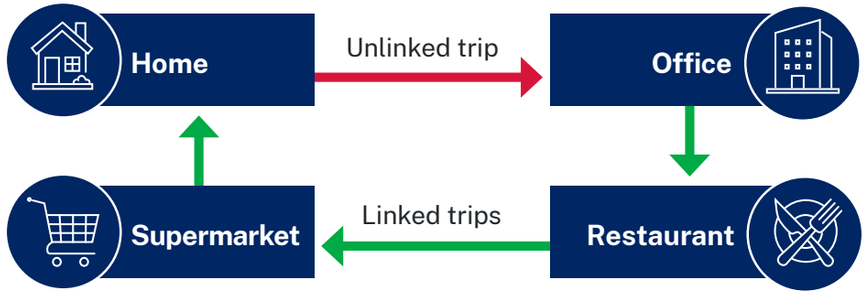

Figure 5.1. **Linked and unlinked trips**

In the context of impact assessments and new or changed developments, these trips can be further split into these categories:

- **New trips:** Generally refer to unlinked trips that are attracted to the development, which would not have been made without the new development. For example, a new supermarket located close to an office may result in new trips by office staff throughout the day.
- **Transferred trips:** Refer to trips already present and accessing similar sites close to a proposed development, which would now transfer their destination to the new development. These trips may be either linked or unlinked. For example, a new supermarket located closer to a residential area is likely to have a large number of transferred trips.

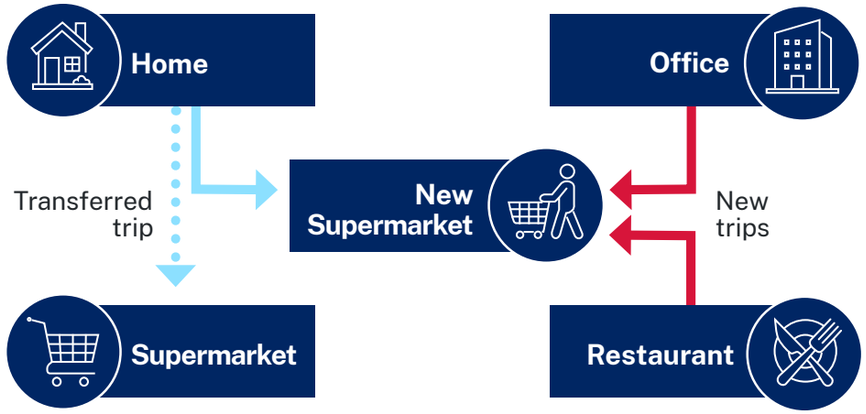

Figure 5.2. **New and transferred trips**

- **Diverted drop-in trips:** Refer to linked trips from an origin to a destination that have made a significant diversion to use the new development. For example, trips currently not passing by the access to the site, with a diverted path to enter the development, returning to the original route to reach the final destination.

- **Undiverted drop-in/Pass-by trips:** Refer to linked trips from an origin to a destination that previously passed the development site. These trips are common for sites such as service stations, which may be considered to be already part of the existing travel path, typically on roads.

  For example, trips currently passing adjacent to the point of access to the site, which would enter the development.

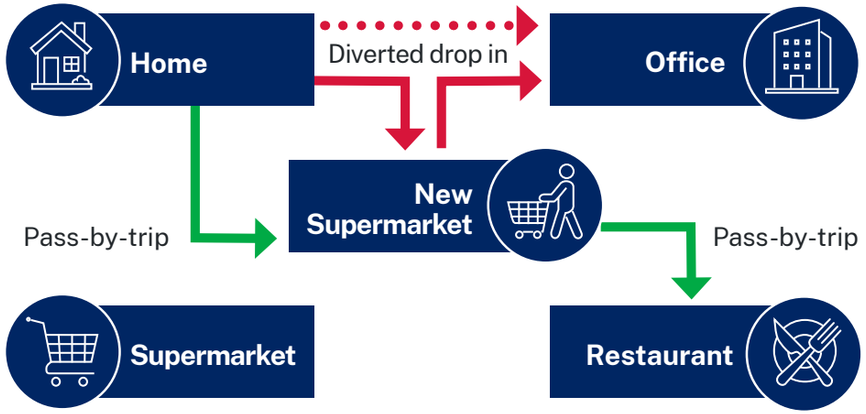

Figure 5.3. **Diverted and pass-by trips**

For the purposes of impact assessments, all trips should be categorised into:

- **Internal trips** that occur wholly within the development site and do not use the external transport network. These trips occur between different areas within the same development, such as trips between residential and retail land use, or as linked trips between different retailers in a retail centre.
- **External trips** that occur outside the development, and as such utilise and impact the external transport network.

5.3.3 Time period

Peak periods

In the context of trip generation, peak periods are defined as the time of the day where demand for travel to, from or around a development is at its highest. Typically trip generation rates are estimated for the following time periods:

- **The peak activity times of the transport network** – traffic volume and public transport patronage data can be used to determine peak transport network use, typically in the AM and PM periods. These peak periods are used to assess the development's impact on the transport system, and, where appliable, inform any adjustments required to accommodate new trips on the system.
- **The peak activity time of the proposed development** – this time period is particularly relevant for developments that generate trips as a result of activity undertaken on site. For example, peak activity periods for freight and delivery companies will differ as compared to commercial and retail centres. In this context, the peak activity time should be used as a basis for reviewing transport network impacts as well as access to the proposed development site and design requirements.

Appropriate assessment periods should be considered and justified depending on the context of the proposed land use development. For example, a proposed retail centre would consider assessing both the weekday AM and PM peak period and the weekend peak period, while a development with mixed or multiple uses may consider several time periods.

Assessment should also identify peak periods during the week and over the year as appropriate. For example, an office might expect higher attendance occurring mid-week due to flexible working policies and lower in-office attendance on Mondays and Fridays. Similarly, a regional destination may experience the greatest seasonal demand during summer and holiday periods.

Arrival/departure profiles

The expected arrival and departure profile of a new development is useful in understanding how travel will impact on transport network performance throughout the day. Analysis of the profile may assist with identification of the peak activity time for the proposed development and assist with the estimation of trip generation. For example, arrivals to schools are typically spread out over an hour at the start of the day, while departures are consolidated over a shorter period at the end of the school day.

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5.4 Factors influencing trip generation

Transport systems are critical to the economic, social and environmental prosperity of a community. In NSW, people of all ages and abilities and businesses rely on an efficient, convenient and safe transport system for their personal travel needs as well as importing and exporting goods and services.

Understanding travel behaviour and how it is evolving will ensure more robust trip generation estimates. Practitioners need to consider the key factors which influence travel mode choice, journey experience, distances and destinations. A selection of these factors are outlined in this section, acknowledging the variability in different contexts. Factors only need to be evaluated if relevant and significant to the impact of the proposed development.

5.4.1 Segmentation analysis

Travel demand is derived by the composition of people, households, businesses and organisations within the community, in essence creating a travel market.

Segmentation analysis sets the basis for carrying out demand estimation for different attributes by breaking down the total travel market into components. The analysis considers divisions by:

- Type of land use generator, particularly in developments with multiple and different components.
- Trip purposes (e.g. discretionary vs. non-discretionary).
- Journey length, which influences the attractiveness of particular modes.
- Trip destinations and/or directions.
- Time of day and/or time of year (seasonality).
- Linked vs. unlinked trips, particularly as this relates to the most attractive modes for customers.

Segmentation analysis should be undertaken for mixed use developments, which often exhibit multiple distinct markets. All analysis should be evidence based, with reasonable and clear assumptions.

5.4.2 Proximity to centres and employment

Longer distances to employment opportunities mean that customers choose different modes to reach their end destination. It also changes the travel budget. For example, customers close to retail land uses may choose to travel more frequently than those further away.

It is important to consider that there is not a hard line separating regional and metropolitan areas, with some areas sharing similar proximity to centres/employment. For example, a proposed regional town centre may have similar characteristics to an outer metropolitan town centre.

5.4.3 Transport options

Mode choice is an individual decision and differs for each person based on their perceived relative utility (satisfaction or benefit) for each of the transport options available. Mode choice is influenced by:

- the trip maker (income, age, car ownership)
- the trip purpose e.g. movement of bulky goods would limit transport options
- the travel mode (travel time, fares, availability, accessibility, frequency, reliability, vehicle operating costs, parking availability and cost, tolls and environmental impact).

Proximity of a site to public transport stops and facilities, and the quality and frequency of services, is a predictor of public transport use. Developments that are distant from public transport facilities are likely to have greater private vehicle mode share, while closer developments are likely to have higher public transport mode share. It is important to consider not just the proximity, but also the safety and amenity of the walking and cycling routes to the site and whether it lies within the respective catchment.

Customers in different locations will have different capacity and willingness to walk to public transport facilities. Consider how long typical walk lengths are to transit in the location of the development. People are willing to walk longer distances to public transport stops if they have the requisite mobility and the quality, frequency and directness of the service is attractive and competitive. It is critical to consider the service coverage (including both geographic coverage and frequency) of public transport compared with the primary locations to which people are forecast to travel.

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5.4.4 Site characteristics and network context

Typical land uses such as office blocks or commercial centres have relatively fixed hours of operation and consistent travel patterns, while special land uses (such as stadiums and community centres) may have distinct hours and travel patterns defined by scheduled events and activities. Accordingly, it is important to understand the site characteristics in the context of the type of development.

Site characteristics which can influence travel behaviour include:

- location (e.g. metropolitan, regional)
- topography and urban form (e.g. grades of footpaths and roads, permeability, tree canopy cover)
- total land area and land division
- proposed land use and density mix (e.g. number of units, Gross Floor Area)
- market share or commercial success anticipated
- capacity (e.g. estimated employees, residents, students)
- availability of parking spaces both on-site and off-site.

In addition to site attributes, the transport network and urban context can also influence travel behaviour. Network considerations include:

- distance to rail stations, light rail stops, bus stops and ferry wharves
- distance to and quality of surrounding active transport networks
- distance to other destinations, such as schools, retail, government services, healthcare
- co-location of destinations into walkable precincts
- frequency of services for each mode within walking distance
- level of transport infrastructure development
- demand and capacity of the surrounding transport network
- type of road access and road network connectivity
- mode share estimates.

These characteristics and contexts may increase or decrease the total number of trips generated, or result in more trips by certain modes. Professional judgement is required to determine which attributes may have a significant impact on travel behaviour and therefore should be accounted for in the trip estimation process (see Section 5.5).

5.4.5 Socioeconomic and demographic characteristics

Travel behaviour affects the demand for trips and is dependent on the socio-economic and demographic attributes of a region. It is important to consider and account for factors such as:

- income level (low/middle/high)
- expected age and gender profile (including incoming population)
- level of education
- vehicle ownership and ability to use vehicle (car, motorcycle, bike)
- household size and structure

These types of data can be obtained from Census statistics and can be correlated with overall Journey To Work data also gathered from the Census (Australian Bureau of Statistics).

5.5 Estimating trip generation

The estimated trip generation rates are fundamental to assessing transport impacts of a proposed development.

All transport modes play an important role in moving people to and from developments, and given the increasing need to reduce car dependency and support healthy, sustainable lifestyles, it is essential to consider trip generation for all modes. These insights will assist local councils and State government authorities in better understanding holistic infrastructure and service requirements.

This section summarises the overall approach, as well as giving more detail about methods that can be used to estimate trip generation, and adjustment factors that may apply in specific cases. This section does not prescribe these methods or provide an exhaustive list of potential evidence-based estimation methods.

5.5.1 Process overview

Once the design of the proposed development is understood, the following process may be applied to estimate the number of generated trips.

Step 1. Detailed site context analysis, including key factors influencing travel behaviour, as outlined in Section 5.4.

Step 2. Review of network performance, and selection of peak assessment period(s) (see Section 5.3.3). Assessments should focus on the most critical time periods, which may be the time of peak site generation, during network peaks, and on weekdays and/or weekends.

Step 3. Determine the total person trips using an appropriate estimation method. Trips can typically be estimated from person trip rates or, if person trip data is not available, from vehicle trips and assumed mode shares of the surveyed sites used. Three estimation methods are outlined in Section 5.5.3.

Step 4. Determine freight and servicing trips based on available models or data (the three estimation methods outlined in Section 5.5.3 may be applied). Depending on the data used in Step 3, freight and servicing trips may be a proportion of the total trips, or be in addition to the total trips calculated in Step 3.

Step 5. Determine the number of trips that will go in and out of the development, during the assessment period/s. This may also be referred to as the in/out split of total trips, and should be based on the observed splits found in the data used in Step 3 and 4.

Step 6. Determine the anticipated mode share and vehicle occupancy for the development. The estimation methods in Section 5.5.3 may be applied if survey data is available.

Step 7. Determine the trips for all modes based on the trips calculated at Step 3 and Step 4, the in/out split assumed in Step 5, and the vehicle occupancy and mode share assumed in Step 6. This will enable an assessment of impact to the transport network.

Step 8. Where applicable, apply adjustments with supporting justification. Adjustments may be made to the assumed mode share, vehicle occupancy or final trip figures. Types of acceptable adjustments are outlined in Section 5.5.4.

The final output should include person trips by mode, with and without adjustments, for the assessment peak period(s). Calculation of trip generation may also be an iterative process as the design of the proposed development is reviewed and refined.

One final step to prepare the trip generation estimate for the transport network impact assessment is to determine the origin and destination of these trips (trip distribution) and which footpaths, cycleways, roads, and public transport services these trips will use (network assignment). This step is outlined in Section 5.5.6.

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5.5.2 Data sources

Practitioners are encouraged to source and use the most recent, relevant and best available data to develop trip generation estimates, supplemented with new surveys where possible. Some of the potential data sources which could be used to inform trip generation estimates are described below.

TfNSW surveys

TfNSW periodically conduct trip generation surveys for sites throughout NSW. The survey data may be used as a data source to inform the estimation of an appropriate trip generation rate for a development. Section 5.6 presents a summary of TfNSW trip generation data and links to full survey data and analysis reports for each land use. The trip rates provide the total trips entering (in) and exiting (out) the site.

TfNSW Urban Freight Forecasting Model

The Urban Freight Forecasting Model (UFFM) is based on freight surveys undertaken for Sydney metropolitan sites between 2017 and 2022. Given a set of building information characteristics, the model can provide an estimate of freight and servicing trips generated for commercial, residential, hotel and retail land use types. This can be used in combination with other trip generation data, such as TfNSW survey data which generally provides the total trips generated inclusive of freight and servicing trips.

With an emphasis on providing insights and useability, the UFFM provides detailed freight and servicing vehicle information including:

- total number and profile of vehicles likely to arrive by hour of the day
- the number and mix of dock spaces required
- the small, medium, large mix of vehicles, their purpose and expected dwell time
- “what if” testing of different loading dock space provisions
- reports on the performance of the proposed loading dock.

Access to the model can be requested via email.

Independent trip generation surveys

Applicants may carry out or commission independent trip generation surveys for developments. An appropriate survey methodology should be followed, preferably agreed to during a scoping discussion, and applicants are encouraged to share the data with TfNSW. Submissions should include both the unprocessed data tables as well as a summary. Survey data may be emailed to GTIA@tranpsort.nsw.gov.au.

Survey contributions are encouraged for collective industry benefit. As surveys are added to the TfNSW database, and a sufficiently large number of surveys are made available, TfNSW will test implementation of the database as a source of survey data for applicants when estimating trip generation.

NSW Household Travel Survey

The Household Travel Survey (HTS) is a major source of information used to develop a set of models for estimating travel behaviour. The NSW HTS is undertaken each year with a sample of over 5,000 households chosen at random to participate in a detailed survey of their travel patterns. The survey aims to collect all data relating to trips (and their characteristics) as well as data related to the household’s characteristics. The information gained from HTS summaries provides useful insights into trip generation and shifts in mode share.

Australian Bureau of Statistics data

Journey to Work (JTW) data is derived from the five-yearly Census of Population and Housing conducted by the Australian Bureau of Statistics (ABS). It offers employment by industry and occupation data, and method of travel to work at a fine geographical level known as the travel zone. This information is a valuable resource for the analysis and forecasting of employment, commuting patterns mode shares and land use changes.

It is worth noting that the 2021 Census occurred during strict COVID-19 lockdown restrictions in NSW and is not representative of typical travel patterns.

Emerging data sources

Passively generated big data sources such as global positioning systems (GPS), cellular network and geo-coded phone application records are an emerging data source for transportation planning. Given their relatively new development, these datasets are not standardised and face several challenges, including missing data (data gaps, data privacy limits, market share), interpretation difficulty (e.g. activity duration, mode of travel, vehicle occupancy) and absence of personal or socio-economic data. Assumptions and approximations are usually required to produce useable data, with limited data available for validation. As such, use of emerging data sets must be treated with caution and are at this time only recommended as a supplementary data source to surveys.

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5.5.3 Trip generation methods

Method selection

Depending on the context and resources of a proposed development, the estimation method may vary. The table below provides an indication of which method may be appropriate. Discretion and professional judgement is advised when referring to the table below.

Table 5.1. **Estimation method selection**

Estimation methods	When could this approach be useful?
Average method	Indicative estimate of an average trip generation based on TfNSW surveys. Allows for a rapid estimate of trips generated and may be preferred for smaller developments, but is not as accurate as the other methods.
Benchmarking method	Involves developing an understanding of proposed development characteristics and benchmarking the site with similar surveyed sites to determine an average rate.
First Principles method	Useful to supplement benchmarking approach or for land uses with a lack of survey data or comparable land uses, such as uncommon or special land use developments.

Overestimates and underestimates

If there is uncertainty, applicants are encouraged to confirm which trip generation method and data sources are appropriate with the consent authority during scoping/pre-lodgement.

Investment where it is needed elsewhere, and may induce further demand, creating congestion in other parts of the surrounding network. This may also encourage private vehicle use where otherwise more sustainable modes could be adopted. Infrastructure overprovision also increases development costs with impacts to housing affordability and project viability.

However, an underestimate could lead to a lack of transport infrastructure and services being provided to cater for the integration of the new development, resulting in reduced efficiency and safety issues.

In order to reduce the likelihood of overestimating or underestimating trip generation rates, it is preferrable to use robust, evidence-based and context-specific methods to calculate appropriate trip generation estimates.

Average method

This trip generation estimation method involves the use of the average trip generation rates from TfNSW Surveys, as presented in Section 5.6, to gain an indicative estimate of trip generation.

This rate is most suitable for smaller developments, as it does not reflect the varying trip generation rates that occur site to site due to development-specific characteristics and contexts. A degree of caution is required for larger developments where transport impacts should be assessed more accurately, as this method is likely to overestimate or underestimate the trips generated.

An exception to this is for developments over larger areas such as structure plans in greenfield areas. The cumulative impact of trip generated over larger areas will tend to average out, as it is not probable that all developments within an area generate only at the lower or upper end of trip rates.

For some land uses, a regression formula is provided. It is important to note that regression formulae are only valid over the range of independent variables observed (e.g. gross floor area, number of dwellings etc.) and cannot be used for sites that have characteristics outside of this range. In such cases, an alternative method should be used. Multi-variable formulae are also only valid when used in their entirety, and relationships cannot necessarily be drawn between the trips generated and each independent variable.

The average rate requires a degree of caution as it is compiled across different geographical locations, does not capture individual site characteristics and other sources of variations, and the sample of survey sites for each land use is small, limiting the precision of trip generation estimates. It is only recommended for small developments where the impact of any overestimation or underestimation is limited.

Larger developments with significant impacts are encouraged to apply either the Benchmarking or First Principles method. The consent authority may request these methods for larger developments to enable a more accurate assessment of transport impacts.

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Benchmarking method

This method involves comparing the proposed development with existing developments which have similar characteristics and transport context. The trip generation survey information from those selected 'benchmark' sites is then applied to the proposed development and the average is taken as the estimated rate. The data may be sourced from both TfNSW surveys and independent surveys, but the benchmark sites must be appropriate. The main steps are outlined below.

Step 1 – Determine development characteristics and transport network context

The proposed development's characteristics and context will govern the selection of trip generation rates for a DA. Professional judgement is required to determine which characteristics (see Section 5.4) may have a significant impact on travel behaviour and should be accounted for in the trip estimation process.

In general, some key characteristics to consider include:

- location
- size and density of development
- existing and anticipated mode shares.

Step 2 – Characteristics and context for DAs vs. planning proposals

For a TIA supporting a DA, the site characteristics are based on the proposed development. However, in the context of a planning proposal for land rezoning, the site characteristics should be based on a maximum practicable yield scenario for the proposed zone and not the planned development. This will enable a robust transport network analysis of any potential development if the site were to be rezoned.

The site characteristics and transport network context for the proposed development is compared with available survey data to identify relevant locations for use in estimating the trip generation rates. Professional judgement is required in determining and demonstrating the applicability of a given survey to a specific development. In general, a minimum of three comparable sites is preferred and should be used.

Step 3 – Estimate trip generation rate and justify process/any assumptions

Available data sourced from similar site(s) are used to estimate a trip generation rate. Consideration should also be given to the potential differences arising from different characteristics and the subsequent implication of this i.e. whether trip generation can be expected to be higher or lower.

With an appropriate mode share assumption (e.g. JTW data) and car occupancy, person and vehicle trip generation can be estimated, including delivery and servicing movements. The process used for estimation of the trip generation rate is based on similar sites used and any relevant assumptions must be documented (e.g. average rate of selected sites or regression analysis).

First Principles method

This method involves making evidence-based assumptions about the development, its users and their behaviour to inform trip generation assumptions. It is used particularly in the absence of information such as TfNSW trip generation survey data. An example would be an uncommon or special land use developments (e.g. stadiums, airports, distribution centres etc.), where there is a need to consider the available information as the basis for a trip generation estimate.

The approach may vary depending on the development's context, site characteristics and planned daily operations. Assumptions that may be required include:

- number of employees/staff/visitors
- respective arrival and departure profiles for employees/staff/visitors/deliveries etc.
- mode share for the site or by grouping.

These assumptions can be used to estimate the level of trip generation throughout the day and week and allow practitioners to project the site peak periods and travel patterns.

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Worked example: First Principles method for a distribution centre

The proposed development is for a warehouse and distribution facility. It will store and distribute a range of goods, which will be brought to the site in bulk and distributed to customers throughout NSW. Prior to a prospective occupier of the facility being known, trip generation rates are used to estimate traffic generation. These rates are based on a number of factors including Gross Floor Area, number of employees, recent surveys and comparisons with similar existing developments.

Once the prospective occupier of the facility is known, trip generation can be estimated from First Principles by considering operational information provided by the occupier, such as the freight task and types of heavy vehicles, the number of staff, customers/visitors and service vehicles that are likely to travel to the proposed development.

In the example below, based on current operational traffic data provided by the prospective occupier, the following daily operational assumptions have been adopted for the proposed development:

- Inbound movements with goods to be processed at the facility before being reloaded for distribution to customers:
  - 30 x courier vans
  - 14 x 3-tonne trucks
  - 30 x 10-tonne rigid trucks
  - 20 x semi-trailers and B-Double trucks.
  - Outbound movements that depart with goods for customers:
  - 162 x courier vans
  - 6 x semi-trailers
  - 4 x 10-tonne rigid trucks.
- Staff: 150 warehouse team members over two shifts (morning/afternoon shift – 60 staff, late afternoon/night shift – 90 staff), and 15 office-based workers (standard office hours; 8.30am–5.30pm).

Based on operational data provided, the projected daily traffic volumes generated by the proposed development are:

- Operations – 266 movements per day (approximately 74 heavy vehicle movements)
- Staff – 330 movements per day.

In total, there would be 596 trips per day. Anticipated mode shares for operations and staff movements may then be applied to determine the number of trips by mode.

5.5.4 Mode split methods

Mode split is the proportion of trips taken by different transport modes. Its estimation enables an understanding of the impacts of trips generated on each transport network. Mode choice can be impacted by various factors, with the largest influences related to travel time, cost and public transport access.

Mode split is highly dependent on the site's characteristics and network context, so this estimation method must be site and land use specific. Data for determining realistic modal splits can come from Census information, transport surveys or transport studies. More directly, mode use and parking surveys for similar developments in areas with similar characteristics can serve as useful sources. TfNSW provides mode share data within trip generation surveys (Refer to Section 5.6 for more information).

Different site locations can have different transport characteristics, which can affect modal split and should be considered where applicable. This includes:

- maturity, coverage, accessibility and frequency of public transport services
- amenity of pedestrian and cyclist facilities
- site density (development density and intensity), diversity (type of housing, mixture of land uses) and distance to transport interchanges
- the nature of the business (e.g. hardware/bulky goods, shopping mall, motel)
- transport strategies and TDM initiatives which may increase or decrease the attractiveness of one mode over another (refer to the Austroads Guide to Traffic Management Part 4 and Part 7)
- parking restrictions
- initiatives and incentives for active and public transport use
- car-pooling
- telecommuting
- alternative working hours
- out-of-hours delivery.

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5.5.5 Trip distribution and network assignment

The final step in estimating the trips generated for impact assessment is to identify the routes that these trips will take to and from the development.

A tabled estimate of origins and destinations can be developed based on existing or anticipated travel patterns justified through data, such as:

- existing surveys of travel in the area
- journey to work (Census, ABS)
- household travel survey (HTS, TfNSW)
- market analysis of demand sources (e.g. shopping centre, sports complex, school)
- local knowledge of travel patterns.

It is important that any adjustments for existing trips, linked trips and internal trips are reflected in the trip distribution step. The subsequent step of assigning these trips to the transport networks should generally consider the shortest path of travel and cost of travel, alongside any other factors that may impact the routes chosen.

For significant developments, an assignment model may be developed and used. The level of detail required will depend on the magnitude and geographical extent of impact anticipated. Trip distribution tables may need to be detailed for the local area or on the wider transport networks as appropriate. This should be completed for all modes of travel.

5.5.6 Adjustments to trip estimates

Transport conditions and challenges that affect travel behaviour can vary and change over time. Following the methods outlined in the previous sections, an adjustment may be made as a last step of the estimation process to account for factors that have not been captured. This includes improvements as a result of future TDM strategies, a reduction to reflect the proportion of existing, linked, or internal trips, or differences as a result of changing travel trends. Any reductions and increases, as well as associated implications, must be reasonable, genuine and supported by a robust evidence base.

Travel demand management adjustments

TDM can alter the trip making behaviour of a development by redistributing journeys to other modes, times, routes, or by removing the journey altogether. Current trip generation datasets may not include the effects of TDM, and so adjustments may be made to reflect the anticipated reduction in travel, changed modes, and/or changed travel times.

It is important that any proposed adjustments to the trip generation rates are genuine and based on robust evidence. Reasonable justification should be provided and may be based on observed relationships e.g. an appropriate reduction in parking provision can lead to lower trips as identified in the regression formula for high density residential dwellings in low accessibility areas (Table 5.8, Section 5.6). Consent authorities may request further information in determining if adjustments are reasonable.

Existing trips

For cases where the proposed development will replace an existing land use, a discount may be applied to transport volumes on the existing network, or to the estimated trips generated in the previous steps. This will depend on the type of existing and proposed land use, and how similar the impact of any future trips are when compared to current trips.

For example, the peak time of travel and distribution of travel on the wider transport network would be significantly different between an industrial estate and commercial premises. A discount may be applied to existing transport network volumes in the impact assessment to reflect the removal of those trips when the new development is completed. Conversely, a higher density residential dwelling may have similar trip behaviour to an existing lower density residential dwelling, in which case, trips generated by the new development can be directly discounted to reflect this.

Existing trips should be sourced from surveys of the existing development, in preference of applying trip generation rates. If surveys cannot be completed, use of trip generation rates should be adequately justified.

Linked trips

For certain land uses, linked trips represent a significant proportion of the trips generated into and out of the development. As these trips will have already existed on the network without the development, a discount may be applied to account for this in the impact assessment. A typical example is service stations.

The total estimated trips should be categorised as either new trips, transferred trips, diverted trips and/or undiverted trips (see Section 5.3.2 for definitions). These proportions should be estimated based on studies of similar land uses. Certain linked trips may not be present, depending on the proposed development type.

Subsequent network impact assessment should treat these trips in accordance with their definitions. At a local level, all trips will need to be considered in the operation of the immediate transport network.

At a network level, undiverted trips may be discounted for the purposes of assessment, while new trips are added to the network flows. Transferred and diverted trips (e.g. relevant for some land uses such as shopping centres or service stations) may increase travel demand closer to the development, while reducing trips in other areas of the transport network. This may be accounted for by re-orienting background travel demands where relevant and justified, such as through market analysis.

Internal trips

In larger developments, mixed-use developments or subdivisions, there may be a number of internal trips that occur without a need to travel externally to the development site. For example, a residential apartment tower may generate trips to the ground floor retail area of the same tower, or a bulky goods complex with multiple retailers may generate linked trips as customers visit one retailer to the next. In a larger subdivision, there may be trips via internal roads between residential dwellings and commercial or retail centres. These internal trips can be estimated by applying an internal trip capture rate and can subsequently be subtracted from the total trips generated. This will determine the number of external trips, which can then be used to inform the impact assessment for the surrounding transport network.

The internal trip capture rate should be estimated on a case-by-case basis, considering the size, mix and type of land use proposed, the surrounding land uses and proximity to competing destinations, the expected trip purposes from occupants, and existing travel patterns from other similar developments. The analysis should also consider if the trip generation rates already include internal trips, for example through the design of the survey.

Additionally, it is important to demonstrate through the application that the internal transport network has been designed to support the number of anticipated internal trips. A well designed internal transport network may increase the number of internal trips, while a poorly designed one may reduce them.

Changing travel trends

Trip generation surveys can be undertaken periodically to ensure rates remain relevant and reflective of current travel trends. At other times, travel trends may change temporarily as a result of specific circumstances or events. As developments are permanent, they must be designed accordingly. Any changes to rates with the intent of reflecting recent or future travel trends must be prudent and supported with evidence.

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5.6 Trip generation survey data summaries

Since 1978, trip generation surveys have been conducted by TfNSW (and its predecessors) for several land use types within Sydney and NSW regional centres. It also provides summaries of trip generation survey contributions received from industry. This section provides brief summaries of the trip generation surveys. The trip rates include both trips entering (in) and exiting (out) the site.

The average rates presented in the Guide have been compiled across different geographical locations and do not capture individual site characteristics and other sources of variations. The rates are also based on a small sample of survey sites for each land use. Consideration should be given to the applicability of the rates before they are used. For larger developments, a benchmarking approach is preferred and may be requested by the consent authority. More guidance is available in Section 5.5.3.

5.6.1 TfNSW Data and Analysis Reports

Revised surveys undertaken after 2008

Full data and analysis reports are available for TfNSW land use surveys completed after 2008, with links provided in Table 5.2. Data and analysis notes are available for trip generation survey contributions from industry. These may be examined to estimate an appropriate trip generation rate by the approaches described in Section 5.5.

Surveys undertaken prior to 2002

Some land uses have not yet been re-surveyed since the release of the GTGD in 2002 and are also listed in Table 5.2.

Care and professional judgement should be exercised in reviewing data from these older trip generation surveys, as travel behaviour and the nature of the land use (e.g. development standards, household characteristics and industry operations) may have changed significantly since the survey period.

Table 5.2. **Trip Generation Survey Data**

Land use	Survey year	Links to available full reports
5.6.2 Residential		
Low density	2022 2010	Data | Analysis Data | Analysis
Medium density	2013	Data | Analysis
High density (low public transport accessibility)	2017	Data | Analysis
High density (high public transport accessibility)	2013	Data | Analysis
High density (freight and servicing trips)	2017–2021	Data + Analysis (combined)
Boarding houses	2022	Data | Analysis
Housing for seniors	2009	Data | Analysis
5.6.3 Casual accommodation		
Motels	1979	Data + Analysis (combined)
Hotels	1980	Data + Analysis (combined)
5.6.4 Commercial and industrial		
Office blocks	2010	Data | Analysis
Large format warehousing	2024 2012	Data + Analysis (combined) Data | Analysis
Business parks	2012 1994	Data | Analysis Data + Analysis (combined)
5.6.5 Retail		
Shopping centres	2011	Data | Analysis
Small suburban shopping centres	2018	Data | Analysis
Bulky goods/hardware stores	2009	Data | Analysis
Service stations	2013	Data | Analysis
Plant nurseries	1994	Data + Analysis (combined)
Car wash and cafes	2019	Data | Analysis
Car tyre outlets	1980	Data + Analysis (combined)
Car showrooms	1980	Data + Analysis (combined)

Table 5.2 continued. **Trip Generation Survey Data**

Land use	Survey year	Links to available full reports
5.6.6 Food service establishments		
Fast food outlets	2016	Data | Analysis
Drive through coffee outlets	2015	Data + Analysis (combined)
Restaurants	1981	Data + Analysis (combined)
5.6.7 Recreational and tourist facilities		
Fitness centres	2014	Data + Analysis (combined)
Golf courses	2022	Data | Analysis
Marinas	2020	Data | Analysis
Recreation (squash and tennis courts)	1980	Data + Analysis (combined)
5.6.8 Health, education and community facilities		
Child care centres	2015	Data | Analysis
Schools	2014	Data | Analysis
Hospitals	2013	Data + Analysis (combined)
Medical centres	2015	Data | Analysis

5.6.2 Residential

It should be noted that the rates provided in this section only reflect trips made to destinations and from origins external to the subdivision. When reviewing the impact of the traffic generated on arterial roads, some adjustment may be necessary, depending on the location of shops, schools and recreational facilities.

Low density residential dwellings (2022)

Low density residential areas are defined as areas where the majority of dwellings are on separate lots. On larger lots, the provision of large duplexes has also been assumed to be low density generating dwellings. Public transport accessibility in such areas is often limited.

Surveys of low density residential developments were undertaken in 2022, as summarised in Table 5.3 (weekday) and Table 5.4 (weekend). Twenty four sites were surveyed in total, including 16 in metropolitan Sydney and eight in regional NSW.

Table 5.3. **Low density residential sample summary (weekday)**

Weekday rates	Sydney	Regional
Person trips (person trips/dwelling)		
AM peak hour	1.09	1.20
PM peak hour	1.14	1.11
Vehicle trips (vehicle trips/dwelling)		
AM peak hour	0.68	0.83
PM peak hour	0.77	0.84
Daily	8.12	7.53

Table 5.4. **Low density residential sample summary (weekend)**

Weekend rates	Sydney	Regional
Person trips (person trips/dwelling)		
Peak hour	1.21	1.23
Vehicle trips (vehicle trips/dwelling)		
Peak hour	0.68	0.83
Daily	5.28	4.88

Notes

- These figures do not include trips internal to the subdivision, involving local social visits and where appropriate trips to local shops, schools, child care centres and recreational facilities such as parks and sports clubs. Therefore, consultants should not discount internal capture from these surveys.
- AM and PM peak hours refer to the road network peak one-hour period.
- Person trip data was limited to the AM and PM three hour peak. Daily rates may be estimated considering previous surveys from 2010, which included data over a 13-hour period between 6am and 7pm.
- Weekend peak hour person trips has been estimated based on the product of average weekday peak occupancy and weekend peak vehicle trips.

Mode share

The predominant mode of travel was car for most sites, with variability in mode share similar across the metropolitan and regional sites. Mode shares were found to vary across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.5. **Mode share summary for low density residential**

Mode	Sydney Average and Range	Regional Average and Range
Car	91% (84% to 98%)	94% (88% to 97%)
Walk	7% (2% to 16%)	4% (3% to 6%)
Public Transport	1% (0% to 4%)	2% (0% to 5%)
Cycle	1% (0% to 3%)	1% (0% to 1%)

Notes

- Mode share has been calculated based on the person trips observed on weekdays between 6am and 9am and 3:30pm-and 6:30pm.
- The survey method does not capture trips made on other modes not observable from the survey sites, such as travel by train.

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Medium density residential dwellings (2013)

Surveys of medium density residential developments were undertaken in 2013. Medium density residential sites have been defined as having between 30 and 60 dwellings per hectare (net) and include dwelling types such as villas, townhouses, flats and low rise apartments that were located within larger area developments, multi-storey developments and precincts.

Seventeen sites were surveyed in total, including nine in metropolitan Sydney, three in Wollongong, two in the Central Coast and three in Newcastle.

Table 5.6. **Medium density residential sample summary**

Weekday rates	Sydney	Regional
Person trips (person trips/dwelling)		
AM peak hour	1.05	0.93
PM peak hour	0.98	1.21
Daily	6.76	7.04
Vehicle trips (vehicle trips/dwelling)		
AM peak hour	0.39	0.41
PM peak hour	0.37	0.60
Daily	2.72	3.67

Notes

- AM and PM peak hours refer to the road network peak one-hour period.
- The daily rate is based on the 13-hour survey period 6am-7pm and would be a higher rate over a 24-hour period.

Mode share

The dominant mode of transport for medium density residential dwellings was walking and private vehicles, although pedestrian numbers would also include other modes such as public transport.

Mode shares were found to vary widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.7. **Mode share summary for medium density residential dwellings**

Mode	Sydney Average and Range	Regional Average and Range
Car	51% (19% to 74%)	68% (42% to 87%)
Walk	44% (10% to 63%)	30% (12% to 58%)
Cycle	6% (1% to 20%)	2% (0% to 7%)

Notes

- Mode share has been calculated based on the person trips observed on weekdays between 6am and 7pm.
- The survey method does not capture trips made on other modes not observable from the survey sites, such as travel by train.

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High density residential dwellings

Low public transport accessibility (2017)

Surveys of high-density residential dwellings with low public transport accessibility were undertaken in 2017. All developments were comprised of residential buildings of six storeys or more and had limited accessibility to major public transport hubs and corridors.

Twenty-eight sites were surveyed, including eight metropolitan Sydney sites, nine Sub-Metropolitan sites and 11 regional site. Metropolitan sites were defined as those within built-up areas approximately 8km from the Sydney Central Business District (CBD). Sites outside this area but within the defined Sydney metropolitan area were defined as sub-metropolitan while the remaining sites across NSW and the Gold Coast, Queensland were defined as Regional.

Table 5.8. **Car based high density residential sample summary (weekday)**

Weekday rates	Person trips	Vehicle trips
Metropolitan		
AM Peak	0.2P + 4.67 (where P>92)	0.134P + 4.9 (where P>147)
PM Peak	0.26P	0.20P
Daily	Not available	1.37P
Sub-Metropolitan		
AM Peak	Not available	0.19P + 1.79
PM Peak	0.35P + 3.65 (where P>43)	Not available
Daily	5.09U	1.62P
Regional		
AM Peak	Not available	0.14B + 1.92 (where B>55) or 0.39U – 3.06 (where U>47)
PM Peak	Not available	0.17B or 0.475U-6.66 (where U>85)
Daily	Not available	1.41B-12.44 (where B>53)

Variables

- (P): number of off-street parking spaces
- (U): number of units
- (B): number of bedrooms.

Table 5.9. **Car based high density residential sample summary (weekend)**

Weekend rates	Person trips	Vehicle trips
Metropolitan		
Peak	0.26P + 2.36 (where P>36)	0.145P + 5.6 (where P>156)
Daily	Not available	1.37P
Sub-Metropolitan		
Peak	Not available	0.34U – 1.49 (where U>27)
Daily	Not available	2.74U – 34 (where U>74)
Regional		
Peak	Not available	0.17B + 1.74 (where B>42) or 0.46U-3.67 (where U>47)
Daily	Not available	13.2B – 22.56 (where B>104)

Variables

- (P): number of off-street parking spaces
- (U): number of units
- (B): number of bedrooms.

Notes

- AM and PM peak hours refer to the road network peak one-hour period.
- Daily rate is based on the 13-hour survey period between 6am and 7pm and would be higher over a 24-hour period.
- The regression formulae are only valid over the range of trips independent variables observed, and only valid when used in their entirety.
- Model estimates of total vehicle trips may increase by approximately 10% at Metropolitan sites and 20% at Sub-Metropolitan sites considering the sites proximity and availability of long term/overnight on-street parking. Not enough data is available to estimate implications for Regional sites.

Mode share

Of the sites surveyed, walking and car were the dominant travel modes. Mode shares were found to vary widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.10. **Mode share summary for car based high density residential**

Mode	Weekday Average and Range	Weekend Average and Range
Metropolitan		
Car	79% (50% to 100%)	70% (40% to 100%)
Walk	7% (0% to 23%)	17% (0% to 55%)
Cycle	0.2% (0% to 1%)	0.3% (0% to 2%)
Public Transport	11% (0% to 29%)	11% (0% to 43%)
Sub-Metropolitan		
Car	47% (25% to 100%)	53% (25% to 99%)
Walk	37% (0% to 73%)	35% (25% to 99%)
Cycle	0% (0% to 0%)	0.4% (0% to 2%)
Public Transport	14% (0% to 30%)	10% (0% to 23%)
Regional		
Car	53% (15% to 100%)	50% (14% to 100%)
Walk	46% (0% to 85%)	50% (0% to 86%)
Cycle	0.4% (0% to 3%)	0.5% (0% to 4%)
Public Transport	0.2% (0% to 2%)	0% (0% to 0%)

Notes

- Mode share has been calculated based on the person trips observed between 6am and 7pm, and pedestrian intercept surveys between 7am and 9am.
- On-street parking was not included in person trips captured and a proportion of walking trips may instead represent car trips. Car mode share is expected to be underestimated more at Sub-Metropolitan and Regional sites compared with Metropolitan sites.
- Only a small sample of pedestrian intercept surveys were available, and were not available at all sites. The actual mode split between walking and public transport trips may vary from the table.

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High public transport accessibility (2012)

Surveys of high density residential developments were undertaken in 2012. All developments were composed of residential buildings of six storeys or more and did not contain significant uses other than residential activity. Eight surveyed developments were within Sydney and two others were located in regional cities.

Surveyed sites were close to public transport nodes providing high levels of transport service.

Table 5.11. **High density residential sample summary**

	Sydney	Regional
Weekday rates	**Average**	**Average**
Person trips (person trips/dwelling)		
AM peak hour	0.66	0.71
PM peak hour	0.56	0.88
Daily	4.49	7.35
Vehicle trips (vehicle trips/dwelling)		
AM peak hour	0.19	0.53
PM peak hour	0.15	0.32
Daily	1.52	4.57

Notes

- AM and PM peak hours refer to the road network peak one-hour period.
- Daily rate is based on the 13-hour survey period 6AM to 7PM, and would be a higher over a 24-hour period.
- Sydney average rates are not recommended for use, unless the proposed development is within 800 metres of a major transport interchange or multiple public transport services with acceptable capacity to accommodate proposed development person trips.

Mode share

Walking was the dominant mode for most of the surveyed sites in Sydney, while private vehicles was the dominant mode in the regions. Mode shares were found to vary widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.12. **Mode share summary for high density residential**

Mode	Weekday Average and Range	Weekend Average and Range
Sydney		
Car	37% (27% to 56%)	37% (22% to 59%)
Commercial vehicle	1% (0% to 2%)	1% (0% to 5%)
Walk	62% (43% to 73%)	62% (41% to 78%)
Regional		
Car	50% (33% to 68%)	46% (37% to 55%)
Commercial vehicle	25% (0% to 50%)	13% (3% to 22%)
Walk	25% (18% to 32%)	41% (40% to 42%)

Notes

- Mode share has been calculated based on the person trips observed between 8am and 6pm.
- The survey method does not capture trips made on other modes not observable from the survey sites, such as travel by train.
- A high number of commercial vehicle trips were observed at the regional sites surveyed, reflecting the mixed-use nature of the developments.

Freight and servicing trips to high density residential (2017–2021)

Surveys of 10 residential sites were undertaken between 2017 and 2021 for freight and servicing trips to high density residential centres. All sites were predominantly residential but with some mixed-used, located in metropolitan Sydney, and had between 120 to 300 dwellings.

Table 5.13. **Average freight and servicing trip rates for high density residential in Sydney**

Year	Vehicle trips (per dwelling per day)		
	All vehicles	Bicycles only	All vehicles excluding bikes
Average			
2020	0.254	0.055	0.199
Medium term (2026)	0.281	0.061	0.220
Longer term (2036)	0.334	0.073	0.261
Neighbourhood centre[1]			
2020	0.287	0.063	0.225
Medium term (2026)	0.317	0.069	0.248
Longer term (2036)	0.377	0.082	0.295
Regional centre[2]			
2020	0.242	0.053	0.189
Medium term (2026)	0.267	0.058	0.209
Longer term (2036)	0.317	0.069	0.248

Notes

- 2020 rates are based on driveway counts of commercial vehicles at 10 residential developments.
- 2026 and 2036 trip rates are based on forecast growth of (parcel) deliveries, and only consider deliveries influenced by changing consumer trends.
- Trip rates for apartments within close proximity to a regional shopping centre were observed. The average rate is further segmented into two sub-categories which may be applied:
  - [1] Neighbourhood centres with significant amounts of high-density development, including locations like Zetland, Crows Nest, North Strathfield, Gordon, Ashfield, Pymble, West Ryde
  - [2] Regional centres with significant amounts of high-density development and a regional shopping centre, including locations like Bankstown, Hurstville, Chatswood, Burwood, Liverpool, Bondi Junction, Miranda and Eastgardens
- Each residential building surveyed featured a similar arrival profile with peak activity occurring in the mid-late morning period, however evening deliveries are more prevalent than other land uses.

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Boarding houses (2022)

A boarding house is a residential building with individual units, which may have shared amenities, such as communal kitchens, bathrooms and laundry rooms. Surveys for boarding houses were undertaken in 2022, with 11 sites surveyed, including eight in metropolitan Sydney and three in regional NSW.

Table 5.14. **Housing for boarding houses sample summary**

Average weekday rates	**Person trips** (person trips/ boarding house room)	**Vehicle trips** (vehicle trips/boarding room)
Person trips (person trips/boarding room)		
Site AM peak hour	0.52	0.30
Site PM peak hour	0.57	0.35
AM peak hour	0.13	0.09
PM peak hour	0.23	0.13
Daily	3.02	1.71

Notes

- Site peak hours refers to the one-hour peak period of the boarding houses, while AM and PM peak hours refer to the road network peak one-hour period .
- Daily rate is based on the 13-hour survey period between 7am and 8pm, and would be higher over a 24-hour period.

Mode share

Walking/cycling and car were the dominant modes for the surveyed sites, with public transport also accounting for a significant share in metropolitan Sydney. Mode shares were found to vary widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.15. **Mode share summary for boarding houses**

Mode	**Sydney** Average and Range	**Regional** Average and Range
Sydney		
Car	44% (8% to 82%)	67% (10% to 100%)
Walk/cycle	39% (0% to 92%)	30% (0% to 80%)
Public Transport	15% (0% to 50%)	4% (0% to 10%)
Taxi/ride share	2% (0% to 6%)	0% (0% to 1%)

Notes

- Mode share has been calculated based on 532 interviews conducted on weekdays across the sites.

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Housing for seniors (2009)

Surveys of housing for seniors developments were undertaken in 2009. Ten sites were surveyed, including five in metropolitan Sydney and five in regional locations. All Sydney sites provided both self-contained accommodation and "low-care" hostel accommodation; two sites included "high-care" accommodation. Of the five regional sites, four provided self-contained accommodation only; one provided both self-contained accommodation and "low-care" accommodation.

Table 5.16. **Housing for seniors sample summary (weekday)**

Weekday rates	Sydney	Regional
Person trips (person trips/dwelling)		
Site peak hour	0.46	0.64
PM peak hour	0.26	0.35
Daily	2.79	3.62
Vehicle trips (vehicle trips/dwelling)		
Site peak hour	0.30	0.44
PM peak hour	0.17	0.23
Daily	1.80	2.39

Table 5.17. **Housing for seniors sample summary (weekend)**

Weekend rates	Sydney	Regional
Person trips (person trips/dwelling)		
Site peak hour	0.34	0.54
Daily	1.90	2.21
Vehicle trips (vehicle trips/dwelling)		
Site peak hour	0.20	0.33
Daily	1.17	1.31

Notes

- Peak travel generally does not coincide with the morning network peak, although there is a closer correlation between evening site peaks and network peaks
- Daily rate is based on the 10-hour survey period between 10am to 8pm

Mode share

The predominant mode of travel was car, and variability in mode share was similar across the metropolitan and regional sites. Mode shares were found to vary across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.18. **Mode share for seniors**

Mode	Weekday Average and Range	Weekend Average and Range
Car	91% (80% to 98%)	90% (74% to 99%)
Walk - visitor	3% (0% to 9%)	2% (0% to 8%)
Walk- resident	6% (0% to 14%)	8% (0% to 26%)

Notes

- Mode share has been calculated based on the person trips observed between 10am and 8pm
- The survey method does not capture trips made on other modes not observable from the survey sites, such as travel by train.

5.6.3 Casual accommodation

Motels (1979)

Surveys of motels undertaken in 1979 recommended the following rates:

- Daily vehicle trips = 3 per unit
- Evening peak hour vehicle trips = 0.4 per unit.

While these rates are provided as a reference point, care and professional judgement should be exercised in applying older data as travel behaviour and the nature of the land use may have changed significantly since the survey period.

Notes

The above rates assume 100% occupancy of units. When comparing similar developments and unit occupancy where data is available, rates based on 85% occupancy on the peak day of the week may be appropriate. When a restaurant within a motel attracts a large number of non-resident patrons, vehicle trip generation and parking demand is higher.

Hotels (1980)

Original research undertaken in 1980 indicated a large variance in the vehicle trip generation rates of hotels. This variation is due to such factors as the building's location and age, its internal design, the provision of live music and other facilities.

Since these surveys were undertaken, there have been significant changes in the use of hotels, including the introduction of random breath testing, gambling facilities, less live music, better food and less emphasis on accommodation. Therefore, it is recommended that the analysis of proposed hotel developments be based on surveys of similar existing hotels.

Where hotels are to be located in or near residential areas, an assessment of vehicle trip generation in the late evening period must be undertaken in order to determine the noise impact.

5.6.4 Commercial and industrial

Office blocks (2010)

Surveys of office blocks were undertaken in 2010. Eight surveys were conducted within the Sydney urban area and one each in the regional centres of Newcastle and Wollongong.

Table 5.19. **Office blocks sample summary**

Weekday rates	Sydney	Regional
Person trips (person trips/100m² Gross Floor Area)		
AM peak hour	2.49	1.32
PM peak hour	1.84	1.28
Daily	17.87	13.24
Vehicle trips (vehicle trips/100m² Gross Floor Area)		
AM peak hour	1.69	0.99
PM peak hour	1.20	0.96
Daily	11.29	9.87

Notes

- The Sydney sites provided a range of locations with two inner ring sites (0-10km from Sydney CBD), four middle ring sites (10-20km from Sydney CBD) and two outer ring sites (20km from Sydney CBD).
- AM and PM peak hours refer to the site peak one-hour periods.
- Daily rate is based on the 11.5-hour survey period between 7am and 6.30pm and would likely be a higher rate over a 24-hour period.

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Mode share

The predominant mode of travel was car for most sites, while public transport was the dominant mode for some metropolitan sites. Mode shares were found to vary widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.20. **Mode share summary for office blocks**

Mode	Sydney Average and range	Regional Average and range
Car	65% (17% to 97%)	85% (83% to 86%)
Walk	4% (0% to 10%)	5% (4% to 5%)
Cycle	1% (0% to 6%)	2% (0% to 4%)
Public transport	28% (2% to 72%)	7% (6% to 8%)
Taxi/ride share	0% (0% to 1%)	0% (0% to 0%)
Motorcycle	1% (0% to 8%)	0% (0% to 0%)

Notes

- Mode share was determined from weekday interview surveys.

Large format warehousing (2024 and 2012)

Large format warehousing typically covers warehousing, storage, distribution and logistics activities, generally accommodated in tenancies providing greater than 5,000 m² of Gross Floor Area. Office components within these facilities are usually minimal and serve only a supportive, ancillary role.

The industrial and warehouse market has evolved with a distinction between large format warehousing and traditional business parks or smaller manufacturing developments. Large format warehouses are driven by the rise of e-commerce and the integration of automation, requiring significantly more space to accommodate logistics systems and automated material handling equipment. These facilities are designed emphasising efficiency through automation and scalability, in contrast to the smaller, more localised focus of business parks and manufacturing spaces.

Surveys of large format warehousing estates were undertaken in 2024. A total of 11 sites were surveyed in metropolitan Sydney. A further two sites were surveyed previously as industrial estates in 2012. Larger estates comprised of multiple warehouses and tenancies, whereas smaller sites surveyed comprised of only one or two units.

A wide range of values were observed for estates with GFA less than 100,000m² and the average rate is not recommended, but has been provided for indicative purposes below.

Table 5.21. **Large format warehousing summary (2024 and 2012)**

	Estate Gross Floor Area		
Weekend rates	**0 – 10,000m² GFA**	**10,000m² - 100,000m² GFA**	**> 100,000m² GFA**
Vehicle trips (vehicle trips/100m² GFA)			
Site AM peak hour	0.5	0.26	0.17
Site PM peak hour	Not available	0.23	0.15
Network AM peak	Not available	0.17	0.14
Network AM peak	Not available	0.21	0.14
Daily	4	2.83	1.94

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Notes

- Trip generation rates vary substantially depending on the tenants, type of goods being warehoused and the nature of the facilities. A benchmarking approach is recommended where details of tenants and proposed activities are known.
- The site AM and PM peak hours are based on the peak traffic generating hour calculated for each study area between 6am to 10am and 3pm to 7pm for the AM and PM periods, respectively.
- The recommended rates are based on large estates, rather than individual warehouses. However, individual warehouses within a larger estate may apply a rate based on the size of the total estate for the purposes of any off-site cumulative assessment in Greater Sydney, where the proposed use is for large format warehousing. At this time, rates for other parts of NSW are not available.
- It is suggested that for development applications that involve a single large format warehouse, benchmarking be undertaken or a sensitivity test be undertaken using 0.5 vehicle trips/100m² GFA for the purposes of estimating the impact of any critical issues (for example such as road safety implications or increased demand for unprotected right turn movements).
- The rates presented account for all areas of the estates surveyed, including a small portion of non-warehousing uses.
- Site peak periods varied widely from 6am-9:30am and 3pm-7pm. Network peak periods varied widely between 7am-9am and 2pm-6pm. The network peak should only be used in conjunction with local traffic data and reference to surveys of an appropriate benchmarked site. Analysis should consider if trip generation during the site peak will result in a larger impact than trip generation in the network peak.
- Average rates have been calculated using the aggregated average method, which divides the total number of trips for the selected sites by the total GFA.
- Due to limited samples, trip rates for warehouses with GFA between 0 to 10,000m² have been retained from the 2002 Guide to Traffic Generating Developments.
- Particular care should be taken:
  - For large estates with few warehouses, large hardstand areas and many loading docks.
  - In assessing industrial unit developments where a high proportion of warehouse uses are proposed. These developments can also suit small factory operations such as electronics / computer assembly and repairs. Uses such as these can substantially increase trip generation.

Vehicle classifications

The 2024 survey classified vehicles according to the AUSTROADS vehicle classification system. A summary of the vehicle classes observed inbound (entry) and outbound (exit) are included in Table 5.22.

Table 5.22. **Vehicle classification by direction summary for large format warehousing**

	Sydney				
Classification (entry : exit)	**All vehicles Class 1-11**	**Light Class 1**	**Medium Class 2-5**	**Long Class 6-9**	**Double Combo Class 10-11**
Site peak hour	100% (58% : 42%)	77% (44% : 33%)	15.5% (9.5% : 6%)	6% (3.5% : 2.5%)	1.5% (1% : 0.5%)
Site AM peak hour	100% (62% : 38%)	69% (49% : 20%)	21.5% (7.5% : 14%)	7.5% (4% : 3.5%)	2% (1.5% : 0.5%)
Site PM peak hour	100% (34.5% : 66.5%)	72.5% (17.5% : 55%)	20% (13% : 7%)	5.5% (3% : 2.5%)	2% (1% : 1%)
Network AM peak hour	100% (70% : 30%)	68% (53.5% : 14.5%)	20.5% (11% : 9.5%)	9.5% (4.5% : 5%)	2% (1% : 1%)
Network PM peak hour	100% (34% : 66%)	70% (16.5% : 53.5%)	21% (13% : 8%)	7% (3.5% : 3.5%)	2% (1% : 1%)
Daily	100% (50% : 50%)	68% (34% : 34%)	20% (10% : 10%)	9% (4.5% : 4.5%)	3% (1.5% : 1.5%)

Source: Ason Group, 2024

Notes

- No surveys recorded any triple combination road trains (class 12) which are generally restricted east of Newell Highway.
- A portion of the Class 1 traffic was observed to be of a 'commercial' nature, rather than staff movements.
- Vehicle classification should be identified for a development based on the supply chain process it intends to serve.
  - First-mile rely on trucks for long-distance, bulk transport from production sites to distribution centres.
  - Middle-mile handle moderate to long-distance transport between distribution hubs, often focused on capacity and efficiency.
  - Last-mile rely on smaller, more manoeuvrable vehicles suited for short-distance, frequent deliveries to final destinations, focusing on accessibility and speed.
  - Warehousing in Sydney would generally be last-mile, middle-mile or a combination of last and middle mile.

Mode share

Car and commercial vehicles (rigid and articulated) were the dominant transport modes for the two 2012 surveyed sites.

Table 5.23. **Mode share summary for large format warehousing in metropolitan Sydney (2012)**

Mode	Average and range
Car	71% (71% to 72%)
Commercial vehicle	27% (26% to 28%)
Walk/Ccycle	0.2% (0.1% to 0.2%)
Public transport	1% (0% to 2%)
Cycle	0.2% (0.1% to 0.3%)

Notes

- Mode share has been calculated based on the person trips observed on weekdays between 7am and 7pm, using data from the 2012 surveys.

Business parks (2012 and 1994)

Business parks refers to developments that permit a range of land uses in an integrated complex. The developments generally incorporate a mix of office, retail and wholesale stores, warehousing, workshops, manufacturing, light industrial, showrooms and scientific research establishments.

Surveys of business parks were undertaken in 2012 across nine sites comprising individual units of up to 3,000m² in GFA. Two sites were located in metropolitan Sydney and seven in regional centres. Surveys of a further 11 metropolitan Sydney sites were previously undertaken in 1994 and have been aggregated with the survey results from 2012 to form a larger sample for metropolitan Sydney. While these rates are provided as a reference point, care and professional judgement should be exercised in applying older data as travel behaviour and the nature of the land use may have changed since the survey period.

Table 5.24. **Business parks sample summary (2012 & 1994)**

Weekend rates	Sydney	Regional
Person trips (person trips/100m² GFA)		
AM site peak	1.57	0.82
PM site peak	1.37	0.98
Vehicle trips (vehicle trips/100m² GFA)		
AM site peak	1.11	0.69
PM site peak	1.00	0.78

Notes

- Trips generated vary substantially depending on the types of uses incorporated in the business park, particularly office and retail use which generally result in higher trips.

Mode share

Car and commercial vehicles (rigid and articulated) were the dominant transport modes for the surveyed sites.

Table 5.25. **Mode share summary for business parks (2012)**

Mode	Sydney Average and range	Average Average and range
Car	86% (81% to 90%)	86% (77% to 94%)
Commercial vehicle	8% (14% to 13%)	11% (4% to 22%)
Walk/cycle	6% (6% to 6%)	1% (0% to 1%)
Public transport	0.3% (81% to 90%)	1% (0% to 3%)
Cycle	0.1% (0% to 0%)	1% (0% to 1%)

Notes

- Mode share has been calculated based on the person trips observed on weekdays between 7am and 7pm, using data from the 2012 surveys.

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5.6.5 Retail

Shopping centres (2011)

Trip generation surveys of shopping centres were undertaken in 2009 and 2010. Ten sites were surveyed, with seven in Sydney and three in regional centres (Newcastle and Wollongong). The tables below show average rates for the surveyed shopping centres on a Thursday, Friday and Saturday.

Table 5.26. **Shopping centres sample summary (Thursday)**

Thursday rates	Sydney	Regional	Combined
Person trips (person trips/100m² GLFA)			
Site peak hour	8.37	7.91	8.23
Network AM peak hour	3.58	4.78	3.94
Network PM peak hour	7.46	7.44	7.45
Daily	87.59	80.85	85.57
Vehicle trips (vehicle trips/100m² GLFA)			
Site peak hour	4.08	4.98	4.35
Network AM peak hour	1.78	3.34	2.25
Network PM peak hour	3.71	4.67	4.00
Daily	43.37	51.53	45.81

Table 5.27. **Shopping centres sample summary (Friday)**

Friday rates	Sydney	Regional	Combined
Person trips (person trips/100m² GLFA)			
Site peak hour	8.30	8.20	8.27
Network AM peak hour	3.25	4.17	3.52
Network PM peak hour	6.66	7.90	7.03
Daily	63.20	66.48	64.18
Vehicle trips (vehicle trips/100m² GLFA)			
Site peak hour	4.06	5.33	4.44
Network AM peak hour	1.55	3.00	1.99
Network PM peak hour	3.30	5.05	3.83
Daily	32.49	44.53	36.10

Table 5.28. **Shopping centres sample summary (Saturday)**

Saturday rates	Sydney	Regional	Combined
Person trips (person trips/100m² GLFA)			
Site peak hour	10.75	11.38	10.94
Network peak hour	9.88	10.76	10.15
Daily	77.36	77.91	77.52
Vehicle trips (vehicle trips/100m² GLFA)			
Site peak hour	4.86	6.12	5.24
Network peak hour	4.61	5.88	4.99
Daily	36.03	43.03	38.13

Notes

- Daily rate is based on the 11.5-hour survey period between 7am and 6.30pm and would likely be a higher rate over a 24-hour period.
- Trip generation rates generally declines with increasing centre size. This is likely to be as a result of a higher proportion of multi-purpose trips.
- It is preferable to base a trip generation estimate for a shopping centre on a development which is similar in terms of size and public transport accessibility.
- The analysis noted higher daily peak hour vehicle trip rates for the regional centres when compared with Sydney shopping centres.

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Seasonal factors

Trip generation rates also have seasonal variations. The monthly variation in daily traffic flows based on the recently surveyed sites is provided below:

Table 5.29. **Seasonal shopping centre variation factors by month**

Month	Variation (Compared with average)	Month	Variation (Compared with average)
January	1.03	July	1.05
February	0.91	August	0.96
March	0.77	September	1.01
April	0.97	October	1.02
May	0.98	November	1.02
June	0.95	December	1.33

Notes

- Care should be exercised in using this data as it is based on a small sample.

Peak generation model for large shopping centres

The following model can be used to calculate the approximate peak period traffic generation for medium and larger centres (15,000 to 100,000+ m² GLFA).

Table 5.30. **Peak hour trip generation model for large shopping centres**

Rates	Vehicle trips (vehicle trips/hour)
Metropolitan	
Thursday	= 0.017 (S) + 0.003 (F) + 0.137 (SM) + 0.032 (SS) + 0.164 (OM) – 0.011 (C)
Friday	= 0.031 (S) + 0.032 (F) + 0.134 (SM) + 0.016 (SS) + 0.158 (OM) – 0.033 (C)
Saturday	= 0.023 (S) + 0.01 (F) + 0.017 (SM) + 0.031 (SS) + 0.201 (OM) – 0.019 (C)
Sunday	= 0.013 (S) + 0.034 (F) + 0.16 (SM) + 0.027 (SS) – 0.002 (C)

Variables

- (S): Slow Trade Gross Leasable Floor Area (GLFA) includes major department stores, furniture, electrical and whitegoods stores
- (F): Faster Trade GLFA includes discount department stores and larger specialist stores.
- (SM): Supermarket GLFA includes both supermarket stores and large green grocery markets.
- (SS): Specialty shops, secondary retail, automobile services GLFA includes smaller retail outlets e.g. clothing and jewellery. These stores are grouped as they tend to not be primary attractors to the centre.
- (OM): Office, medical, child care GLFA includes medical centres and general business offices.
- (C): Cinemas.

Notes

- Care should be exercised when using these formulae, as they only relate to the 10 shopping centres surveyed in the 2011 study. They should not be used for proposals having a dissimilar mix of retail floor space categories, or for developments well outside of the size range of those surveyed.
- For Thursdays and Fridays, the models are for the vehicle trips in the evening peak hour where this period has been taken as between 4.30pm and 5.30pm.
- For Saturday morning, the peak vehicle hour has been used. This is typically between 11.00am and 12.00pm. Localised variations in these peak hours can occur.
- Caution should be exercised when using multiple regression formulae with negative coefficients to ensure robust estimates.
- The regression formulae are only valid over the range of independent variables observed, and only valid when used in their entirety.

Mode share

The car was the most predominant mode of travel for most sites. Nevertheless, mode shares were found to vary widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.31. **Mode share summary for shopping centres**

Mode	Sydney Average and range	Regional Average and range
Thursday		
Car	79% (51% to 89%)	90% (86% to 92%)
Public transport	12% (6% to 33%)	7% (1% to 14%)
Walk	8% (1% to 16%)	4% (0% to 8%)
Friday		
Car	80% (56% to 95%)	90% (87% to 94%)
Public transport	15% (3% to 33%)	6% (4% to 7%)
Walk	5% (1% to 10%)	4% (1% to 7%)
Saturday		
Car	81% (67% to 92%)	93% (91% to 96%)
Public transport	12% (2% to 22%)	3% (1% to 6%)
Walk	7% (2% to 14%)	4% (2% to 8%)
Sunday		
Car	85% (77% to 92%)	96% (93% to 98%)
Public transport	7% (1% to 13%)	1% (1% to 2%)
Walk	8% (5% to 12%)	3% (0% to 4%)

Notes

- Mode share has been calculated based on interview surveys conducted during store opening hours
- Cycling contributed between 0% to 2% of all trips across the sites.

Small suburban shopping centres (2018)

Trip generation surveys of small suburban shopping centres were undertaken in 2018. Twenty sites were surveyed, with 11 in Sydney and nine in regional centres. The tables below show aggregated averages for the surveyed shopping centres on a Wednesday/Thursday, Friday and weekends.

Table 5.32. **Small shopping centres sample summary (Wednesday/Thursday)**

Wednesday/Thursday rates	0 – 1,000m² GLFA	1,000 – 6,000m² GLFA	6,000 – 10,000m² GLFA
Person trips (person trips/m² GLFA)			
Site AM peak hour	0.251A	0.086A + 164	0.209A – 571
Site PM peak hour	0.367A	0.126A + 241	0.108A + 105
Daily	2.831A	0.973A + 1,858	1.033A + 1,477
Vehicle trips (vehicle trips/m² GLFA)			
Site AM peak hour	0.192A	0.066A + 126	0.076MT + 0.075OT
Site PM peak hour	0.259A	0.089A + 170	0.216A – 591
Daily	2.022A	0.695A + 1,327	1.684A – 4,608

Variables

- (A): GLFA
- (MT): Major Tenants' GLFA
- (OT): Other Tenants' Total GLFA

Table 5.33. **Small shopping centres sample summary (Friday)**

Friday rates	0 – 1,000m² GLFA	1,000 – 6,000m² GLFA	6,000 – 10,000m² GLFA
Person trips (person trips/m² GLFA)			
Network AM peak hour	0.254A	0.087A + 166	0.108A + 105
Network PM peak hour	0.383A	0.132A + 252	0.319A – 874
Daily	2.51A	0.863A + 1,647	0.91A + 1,299
Vehicle trips (vehicle trips/m² GLFA)			
Network AM peak hour	0.196A	0.196A	0.196A
Network PM peak hour	Not available	Not available	Not available
Daily	1.856A	0.638A + 1,218	1.546A – 4,229

Variables

- (A): GLFA
- (MT): Major Tenants' GLFA
- (OT): Other Tenants' Total GLFA

Table 5.34. **Small shopping centres sample summary (weekend)**

Weekend rates	0 – 1,000m² GLFA	1,000 – 6,000m² GLFA	6,000 – 10,000m² GLFA
Person trips (person trips/m² GLFA)			
Peak hour	0.428A	0.147A + 281	0.357A – 976
Daily	2.849A	0.979A + 1,870	1.229MT + 1.308OT
Vehicle trips (vehicle trips/m² GLFA)			
Peak hour	0.283A	0.097A + 186	0.236A – 646
Daily	1.894A	0.651A + 1,243	1.577A – 4,316

Variables

- (A): GLFA
- (MT): Major Tenants' GLFA
- (OT): Other Tenants' Total GLFA

Notes

- Detailed regression analysis found that it was appropriate to apply three sub-classes based on the GLFA size ranges of:
  a. 0 –1,000 square metres GLFA
  b. 1,000–6,000 square metres GLFA, and
  c. 6,000–10,000 square metres GLFA.
- On average, the highest percentage of linked trips for all surveyed sites occurs on a Friday (approximately 30 per cent) with Wednesday Thursday, Saturday and Sunday survey results showing similar proportions of linked trips (approximately 24 per cent).

Mode share

The car was the predominant mode of travel for most sites, with variability in mode share similar across metropolitan and regional sites. Mode shares were found to vary widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.35. **Mode share summary for small shopping centres**

Mode	Thursday Average and range	Friday Average and range	Saturday Average and range
Car	89% (54% to 99%)	89% (53% to 99%)	92% (57% to 99%)
Walk	9% (1% to 43%)	10% (1% to 45%)	7% (0% to 38%)
Public transport	1% (0% to 5%)	0% (0% to 2%)	1% (0% to 5%)
Taxi	0% (0% to 2%)	0% (0% to 3%)	0% (0% to 1%)
Cycle	0% (0% to 1%)	0% (0% to 1%)	0% (0% to 1%)

Notes

- Mode share has been calculated based on interview surveys conducted during store opening hours.
- Sunday survey results were available only for a subset of sites but showed similar trends to Saturday.

Hardware and bulky goods stores (2009)

Bulky goods retailers include categories such as furniture, white goods, electrical equipment, bedding and manchester, lighting, automotive parts, camping and outdoor equipment, tools, building materials and large hardware warehouses specialised in a variety of hand, paint, garden, domestic, outdoor furniture, timber and building products.

Surveys of hardware and bulky goods stores were undertaken in 2009. For hardware, five locations in the Sydney metropolitan area were surveyed and four in regional centres. For bulky goods, surveys were undertaken at three Sydney metropolitan locations and three locations in regional centres. Large hardware warehouses have been reported separately from other bulky goods retailers due to their different characteristics.

Table 5.36. **Hardware stores sample summary (weekday)**

Weekday rates	Sydney	Regional	Combined
Person trips (person trips/100m² GLFA)			
Site peak hour	5.06	5.49	5.25
AM peak hour	No reliable relationship, Benchmarking Method recommended		
PM peak hour	3.50	3.78	3.63
Daily	42.42	38.34	40.61
Vehicle trips (vehicle trips/100m² GLFA)			
Site peak hour	4.03	4.41	4.20
AM peak hour	1.68	2.50	2.05
PM peak hour	2.70	3.03	2.85
Daily	32.99	31.79	32.46

Table 5.37. **Hardware stores sample summary (weekend)**

Weekend rates	Sydney	Regional	Combined
Person trips (person trips/100m² GLFA)			
Site peak hour	9.11	8.11	8.66
Network peak hour	8.59	7.53	8.12
Daily	59.25	44.66	52.76
Vehicle trips (vehicle trips/100m² GLFA)			
Site peak hour	5.91	5.28	5.63
Network peak hour	5.33	4.92	5.15
Daily	38.94	30.81	35.33

Notes

- Peak travel to/from the sites generally does not coincide with the morning network peak, although there is a closer correlation between evening site peaks and network peaks.
- Higher trip rates were observed in PM network peaks than AM network peaks.
- Both daily trip generation and site peak hour trip generation are higher during weekend days than weekdays.
- The majority of trips are specific trips with a small proportion of pass-by and multi-purpose trips. On weekends there is a higher element of pass-by trips.
- Trips rates during weekdays were similar across Bunnings and Mitre10, but Mitre10 had lower trip rates than Bunnings on weekends.
- The trip rate across weekdays and weekends was relatively consistent over the week at Mitre10, due to a higher proportion of tradesmen, while trip rates for Bunnings were much higher on weekends than weekdays.

Table 5.38. **Bulky goods stores sample summary (weekday)**

Weekday rates	Sydney	Regional	Combined
Person trips (person trips/100m² GLFA)			
Site peak hour	4.33	4.69	4.51
PM peak hour	1.68	2.99	2.46
Daily	24.52	30.38	27.45
Vehicle trips (vehicle trips/100m² GLFA)			
Site peak hour	2.44	2.92	2.68
PM peak hour	1.01	1.51	1.31
Daily	15.76	18.08	16.92

Table 5.39. **Bulky goods stores sample summary (weekend)**

Weekend rates	Sydney	Regional	Combined
Person trips (person trips/100m² GLFA)			
Site peak hour	7.90	8.67	8.28
Network peak hour	4.36	5.49	4.92
Daily	33.72	42.37	38.05
Vehicle trips (vehicle trips/100m² GLFA)			
Site peak hour	3.75	3.94	3.85
Network peak hour	2.24	2.72	2.48
Daily	16.16	21.02	18.59

Notes

- All bulky goods sites opened after the accepted AM peak so the impact on the AM peak traffic from these sites should be minimal.
- Both daily trip generation and site peak hour trip generation are higher during weekend days than weekdays.
- Most trips are specific trips with a small proportion of pass-by and multi-purpose trips. On weekends there is a higher element of pass-by trips.

Mode share

The dominant travel mode was private vehicles, due largely to factors such as location and the nature of the business. Many hardware store customers came to the site by utility vehicles (i.e. utes), vans or trucks, while no cyclists were observed at any of the sites.

A mode share summary based on the surveyed trips is shown. Variability in mode share was similar across metropolitan and regional sites. Mode shares were found to vary across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.40. **Mode share summary for hardware and bulky goods stores**

Mode	Hardware Average and range	Bulky Goods Average and Range
Weekdays		
Car	66% (38% to 78%)	81% (74% to 91%)
Ute/van/truck	32% (20% to 62%)	8% (1% to 16%)
Walk	2% (0% to 7%)	14% (5% to 20%)
Weekends		
Car	73% (45% to 86%)	81% (66% to 92%)
Ute/van/truck	23% (13% to 55%)	7% (1% to 21%)
Walk	3% (0% to 10%)	12% (2% to 31%)

Notes

- Mode share has been calculated based on person trips observed on weekdays during opening hours.

Service stations (2013)

Surveys of service stations were undertaken in 2013. Nine Sydney metropolitan sites and one site outside the Sydney metropolitan area were chosen.

The following equations may be used to estimate the daily and peak vehicle trips, where (N) refers to the number of service channels at the service station and (S) refers to the total site area in square metres.

Table 5.41. **Service stations trip generation equations**

Time period	Vehicle trip generation equation (vehicle trips/hour)
Daily rate (D)	(D) = 29.042(N)2 + 222.58(N) + 1668.3 (R2 = 0.87)
Site peak one hour rate (P)	(P) = 0.0819(D) + 46.302 (R2 = 0.91)
AM peak hour (AM)	(AM) = 0.2815(N)2 + 14.047(N) + 16.715 (R2 = 0.80)
PM peak hour (PM)	(PM) = 0.0205(S) + 88.52 (R2 = 0.84)

Notes

- Analysis showed a wide spread in trip generation rates in the sample, which means average rates could not be used for planning purposes.
- Linear and non-linear relationships were established between the number of total daily and AM and PM peak trips and two independent variables: the total site area and the number of service channels.
- Peak one-hour vehicle trips were found to be reliably estimated from the total daily trips.
- The regression formulae are only valid over the range of independent variables observed, and only valid when used in their entirety.

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Plant nurseries (1994)

A plant nursery is any place where horticultural stock is propagated for the purpose of sale. Horticultural stock is defined as tree, vine, plant, shrub or other vegetation.

Surveys of plant nurseries were undertaken in 1994. While these rates are provided as a reference point, care and professional judgement should be exercised in applying older data as travel behaviour and the nature of the land use may have changed significantly since the survey period. Most notably, plant nurseries have grown in scale and services offered since 1994, with some similar to large hardware supercentres.

Plant nurseries had a peak vehicle trip generation during the weekend with peak generation occurring during the Sunday midday period.

Table 5.42. **Plant nurseries vehicle trip generation equation**

Time period	Vehicle trips
Two-way peak hour vehicle trips	57 + 0.7 per 100m² of site area

Notes

- Variables include staff, delivery, service and on-street movements such as taxis and pick-up/set-down.
- The variables also include the vehicle generation of supplementary services such as refreshment, gift and landscaping facilities but not that of auxiliary facilities such as retail, hardware, fruit market etc. Refer to the appropriate guideline for vehicle generation rates of auxiliary facilities with appropriate allowance for multiple trips.

Car wash and cafes (2019)

Surveys of car washes with on-site seated café areas were undertaken in 2019 for 15 locations, with 11 in the Sydney metropolitan area, two in Newcastle and two in Wollongong. Trip generation rates were found to vary widely. As such, the trip generation of proposed car washes with cafes should be determined from surveys of similar car washes, noting such factors as the number of wash bays, occupancy, transport mode, catchment of resources and the distributions of arrivals and departures.

Mode share

Private vehicles were the dominant mode of transport, with walking trips attributabed to demand generated by the cafes.

A summary of mode share based on the surveyed trips is shown. Variability in mode share was similar across metropolitan and regional sites. Mode shares were found to widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.43. **Mode share summary for car wash and cafes**

Mode	Friday (Average and range)	Saturday (Average and range)	Sunday (Average and range)
Car	93% (84% to 100%)	90% (79% to 100%)	92% (73% to 100%)
Walk	7% (0% to 16%)	9% (0% to 21%)	8% (0% to 27%)
Cycle	0.2% (0% to 2%)	0.4% (0% to 3%)	0.1% (0% to 1%)

Notes

- Mode share has been calculated based on the car, pedestrian, and cyclist trips observed during opening hours, which ranged from 6am to 7pm on weekdays and weekends.
- Vehicle occupancy was only recorded at the Muswellbrook site and averaged between 1.3 (Friday) and 1.4 (weekend).

Car tyre outlets (1980)

Trip generation rates for car tyre outlets are based on surveys undertaken in 1980. While these rates are provided as a reference point, care and professional judgement should be exercised in applying older data as travel behaviour and the nature of the land use may have changed significantly since the survey period.

Table 5.44. **Car tyre outlets vehicle trip generation**

Time period	Vehicle trips/100m ² site area
Daily	10
Evening peak hour	1

Car showrooms (1980)

Trip generation rates for car showrooms (vehicle sales premises) vary widely. While these rates are provided as a reference point, care and professional judgement should be exercised in applying older data as travel behaviour and the nature of the land use may have changed significantly since the survey period. The rate below was based generally on showrooms with both new and used car sales as well as servicing facilities.

Table 5.45. **Car showroom vehicle trip generation**

Time period	Vehicle trips/100m ² site area
Evening peak hour	0.7

5.6.6 Food service establishments

Fast food outlets (2016)

Surveys of fast food outlets were undertaken in 2016 at a total of 26 outlets, with 14 sites within Sydney and 12 sites in regional areas. The following tables present average rates for the top fast food brands with drive-through facilities in NSW, namely McDonalds (40 per cent), KFC (27 per cent), and Hungry Jacks (18 per cent).

Table 5.46. **Fast food sample summary – McDonalds**

	Sydney	Regional	Combined
Weekday Vehicle trips (vehicle trips/outlet)			
Site AM Peak hour	137	206	192
Network AM Peak	119	188	173
Site PM Peak hour	188	201	214
Network PM Peak	138	183	179
Daily	1,032	1,261	1,272
Weekend Vehicle trips (vehicle trips/outlet)			
Site Peak hour	267	225	269
Daily	1,209	1,164	1,303

Table 5.47. **Fast food sample summary – KFC**

	Sydney	Regional	Combined
Weekday vehicle trips (vehicle trips/outlet)			
Site AM peak hour	Outside of opening hours		
Network AM peak			
Site PM peak hour	106	135	118
Network PM peak	78	67	73
Daily	468	615	531
Weekend vehicle trips (vehicle trips/outlet)			
Site peak hour	112	121	116
Daily	522	693	595

Notes

- The study noted that for Oporto (2 outlets surveyed) and Red Rooster (3 outlets surveyed), there was limited data to draw significant conclusions.
- However, analysis recommended baseline vehicle trip generation rates for PM network peak hour and proportions of pass-by trips in each type of fast food outlet surveyed:
  - McDonalds – 183 trips | 51 per cent pass-by trips
  - KFC – 73 trips | 43 per cent pass-by trips
  - Hungry Jacks – 61 trips | 54 per cent pass-by trips
  - Oporto – 41 trips | insufficient data
  - Red Rooster – 35 trips | 51 per cent pass-by trips.

Table 5.48. **Fast food sample summary – Hungry Jacks**

	Sydney	Regional	Combined
Weekday vehicle trips (vehicle trips/outlet)			
Site AM Peak hour	42	66	54
Network AM Peak	18	45	31
Site PM Peak hour	105	113	109
Network PM Peak	72	63	68
Daily	606	668	637
Weekend vehicle trips (vehicle trips/outlet)			
Site Peak hour	114	110	112
Daily	717	626	672

Notes

- It is recommended that due to the diversity of characteristics in fast food outlets, when estimating the trip generation rate, consideration should be given to the following:
  - indoor/outdoor seating capacity
  - drive through capacity
  - exposure to frontage road traffic
  - visible exposure to passing traffic
  - ease of site access/egress.

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Drive through coffee outlets (2015)

Surveys of drive through coffee outlets were undertaken in 2015. Of the 10 sites surveyed, seven were located in NSW, and four interstate (Queensland or Victoria). The table below shows average rates.

Table 5.49. **Drive through coffee outlets sample summary**

Weekday rates	Sydney	Regional
Person trips (person trips/outlet)		
Site AM peak	102	151
Network AM peak	107	130
Site PM peak	38	34
Network PM peak	33	31
Daily	298	398
Vehicle trips (vehicle trips/outlet)		
Site AM peak	91	128
Network AM peak	86	110
Site PM peak	28	23
Network PM peak	23	17
Daily	246	326

Notes

- It is recommended that when assessing proposed developments, selection of an appropriate traffic generation rate should consider the following:
  - drive through capacity
  - number of staff
  - reputation/quality of beverages, food and service
  - visible exposure to passing traffic
  - ease of site access/egress.
- It is recommended that 83 per cent be adopted as the proportion of passing trade in calculations of impacts to the surrounding road network.

Restaurants (1981)

The trip generation of restaurants varies widely, depending on restaurant characteristics including type and location. The trip generation of proposed restaurants should be determined from surveys of similar restaurants, noting such factors as the number of seats, occupancy, transport mode, catchment of resources and the distributions of arrivals and departures.

In recent years, food delivery services have become more accessible for restaurants, and have resulted in increased trip generation and short-stay parking requirements.

Average rates based on the sites surveyed are provided as reference points but should be treated cautiously. Care and professional judgement should be exercised in applying older data as travel behaviour and the nature of the land use may have changed significantly since the survey period.

Table 5.50. **Restaurant trip generation**

Time period	Vehicle trips/100m ^{2} site area
Evening peak hour	5
Daily	60

Notes

- The average rates given are based on the restaurant's GFA. The ideal method of calculation bases the assessment of traffic generation on the number of seats. The number of staff also can be relevant in assessing the peak parking demand. At DA stage, some idea of seating and staffing is known, although both may be subject to change. The surveys indicate that the mean GFA/seat was 2.1 square metres, whilst the mean dining floor space/seat was 1.5 square metres. The mean staffing ratio was 9.7 seats/staff.
- These rates reflect a high car usage, with a mean mode split for cars of 85 per cent and a mean car occupancy of 2.2
- Total daily vehicle trips will be substantially greater if the restaurant also serves lunch
- When assessing peak traffic generation, it is preferable to assume 85 per cent occupancy rather than 100 per cent occupancy. Of the restaurants surveyed in 1981, the mean peak seat occupancy was 91 per cent, varying from 63 per cent to 133 per cent where figures over 100 per cent may indicate the use of separate bar areas or of take-away facilities.
- If located in or near a residential area, a restaurant might have noise impacts on residents in the evenings. Estimates of late evening traffic generation would assist in the assessment of traffic/vehicle noise generation potential.

5.6.7 Recreational and tourist facilities

Recreational and tourist facilities are site and type specific in their operation and trip generation, often with seasonal variations in usage. Ideally, analysis of proposed developments should be based on surveys of similar developments. If this is not possible, a First Principles approach is required.

An indication of trip generation is provided for fitness centres, squash courts, tennis courts and marinas.

Fitness centres (2014)

Surveys of fitness centres were commissioned in 2014 at five sites in metropolitan Sydney. Trip generation rates were found to vary significantly and the average rate is not recommended, but has been provided for indicative purposes below.

Table 5.51. **Fitness centres weekday and weekend sample summary**

Rates	Weekday	Weekend
Person trips (person trips/100m² GFA)		
Site peak hour	8.5	6.7
Daily	37.7	22.8
Vehicle trips (vehicle trips/100m² GFA)		
Site peak hour	3.6	2.9
Daily	16.9	10.4

Notes

- Trip rates were found to vary significantly. This may be due to factors such as promotional effort, season / day to day demand, trendiness, popularity of instructors and weather.
- Surveys did not include 24/7 gyms or gyms less than 900m² in GLFA.

Mode share

The dominant mode of transport for fitness centres was walking and private vehicles. Mode shares were found to vary widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.52. **Mode share summary for fitness centres**

Mode	Weekday Average and range	Weekend Average and range
Car	67% (13% to 95%)	70% (18% to 95%)
Walk	24% (4% to 71%)	25% (4% to 77%)
Cycle	1% (0% to 3%)	1% (0% to 4%)
Public transport	5% (0% to 14%)	3% (0% to 13%)
Motorbike/taxi	2% (0% to 7%)	1% (0% to 4%)

Notes

- Mode share has been calculated based on the person trips observed for limited time periods on weekdays (generally six hours between 6am and 8pm and weekends (generally five hours between 7am and 12pm), and interview surveys.
- Mode shares are based on trips into the sites only.
- Public transport use was higher at sites closer to multiple public transport stops.

Golf courses (2022)

Surveys of golf courses in NSW were undertaken in 2022 at eight sites in metropolitan Sydney and seven sites in regional NSW.

Table 5.53. **Golf courses weekday and weekend sample summary**

Rates	Sydney	Regional
Person trips (person trips/hole) (In only)		
Weekday AM peak	2.9	1.2
Weekday PM peak	2.6	0.8
Weekday Daily	19.0	5.7
Saturday Peak	5.6	2.0
Saturday Daily	31.4	8.4
Sunday Peak	5.1	1.0
Sunday Daily	28.2	5.4
Vehicle trips (vehicle trips/hole)		
Weekday AM peak	4.2	3.0
Weekday PM peak	4.8	3.0
Weekday Daily	34.0	20.7
Saturday Peak	5.9	3.8
Saturday Daily	42.3	22.8
Sunday Peak	5.4	2.5
Sunday Daily	36.9	14.6

Notes

- Analysis did not identify a correlation between trip rates and the number of holes played but the rates are considered adequate, providing strong consideration is given to additional influencing factors, such as ancillary uses, weather, special events, public or private courses, and demographics.
- The peak hours for the sites did not often coincide with the network peak. There were typically three peak periods: a peak when most visitors arrived, a midday peak when morning golfers left and afternoon golfers arrived, and an evening peak near closing time.
- Vehicle occupancy and pedestrian surveys were not available across all sites, and only conducted for trips entering the golf courses.
  - Vehicle occupancy where available was observed to be between one and two people per vehicle.
  - Care should be taken when interpreting person trips, which only include trips entering the sites. For instance, these rates will be significantly lower than the total persons trips during the PM peak when most trips are leaving.
- Factors that were not considered but may influence trip generation include the cost to play, golf course quality or reputation, and proximity to other golf courses.

Mode share

The dominant mode of transport for golf courses was private vehicles, and variability in mode share was similar across metropolitan and regional sites.

Table 5.54. **Mode share summary for golf courses**

Mode	Weekday Average and range	Weekend Average and range
Car	97% (91% to 100%)	96% (87% to 100%)
Walk	1% (0% to 3%)	3% (0% to 12%)
Cycle	1% (0% to 3%)	1% (0% to 3%)
Public transport	0.1% (0% to 2%)	1% (0% to 11%)

Notes

- Mode share has been calculated based on the person trips observed between 6am and 7pm and interview surveys.
- Mode shares are based on trips into the sites only.
- Public transport use was higher at sites closer to multiple public transport stops.

Marinas (2020)

Surveys of marinas in NSW were undertaken in 2020. The study included surveys at 12 sites, with eight sites in metropolitan Sydney and four sites in regional NSW.

Table 5.55. **Marinas weekday and weekend sample summary**

Rates	Sydney	Regional
Person trips (person trips/10,000m²)		
Weekday AM peak	19.62	34.82
Weekday PM peak	21.87	29.82
Weekday daily	103.2	191.5
Saturday peak	35.15	29.02
Saturday daily	138.0	172.4
Sunday peak	23.28	28.99
Sunday daily	105.7	151.5
Vehicle trips (vehicle trips/10,000m²)		
Weekday AM peak	7.75	11.45
Weekday PM peak	9.18	8.86
Weekday daily	46.08	59.32
Saturday peak	7.35	11.09
Saturday daily	32.28	64.04
Sunday peak	6.28	11.73
Sunday daily	30.16	64.69

Notes

- The surveyed marina sites have areas ranging from 4,216 square metres to 125,600 square metres, and vessel capacities (swing moorings + wet berths) ranging from 50 to 369 vessels
- The regional sites generally had higher trip generation rates than Sydney metropolitan sites.

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Mode share

A mode share summary is included below.

Table 5.56. **Mode share summary for marinas**

Mode	Weekday (Average and range)	Saturday (Average and range)	Sunday (Average and range)
Car	85% (34% to 100%)	87% (35% to 100%)	84% (0% to 100%)
Public Transport	13% (0% to 52%)	11% (0% to 57%)	14% (0% to 92%)
Walk/Cycle	1% (0% to 9%)	0.3% (0% to 3%)	2% (0% to 8%)
Taxi/Ride Share	1% (0% to 5%)	2% (0% to 9%)	0.4% (0% to 3%)

Notes

- Mode share has been determined based on 2,273 site observations of person trips across the 12 survey sites.
- The dominant mode of transport for marinas was private vehicles, with the exception of the Double Bay Marina, where the majority of trips were observed to be via public transport. This may be due to a lack of on-site parking and time restricted on-street parking.

Squash courts (1980)

Surveys of squash courts were undertaken in 1980. While these rates are provided as a reference point, care and professional judgement should be exercised in applying older data as travel behaviour and the nature of the land use may have changed significantly since the survey period.

Table 5.57. **Squash courts vehicle trip generation**

Rates	Vehicle trips (vehicle trips/court)
Weekday peak hour	3
Total evening	20

Notes

- Where regular competitions are held trip generation rates may be higher.

Tennis courts (1980)

Surveys of tennis courts were undertaken in 1980. While these rates are provided as a reference point, care and professional judgement should be exercised in applying older data as travel behaviour and the nature of the land use may have changed significantly since the survey period.

Table 5.58. **Tennis courts vehicle trip generation**

Rates	Vehicle trips (vehicle trips/court)
Weekday peak hour	4
Total evening	45

Notes

- Regular competitions, night tennis, and lights during winter were noted as factors that influence traffic generation rates

5.6.8 Education facilities

Child care centres (2015)

Surveys of child care centres in NSW were undertaken in 2015. The study included surveys at four different types of child care centres: long day care centre (four), pre-school (three), occasional care (three), and outside school hours care (four). Traffic activity was found to vary with the differing operating hours of the child care centres. The person and vehicle trip generation rates given below are the average rates.

As the sample sizes were small, and a wide range of values were observed, the average rate is not recommended but has been provided for indicative purposes below. A benchmarking or first principles approach is recommended.

Table 5.59. **Child care centre sample summary**

	Long day care centre	Pre-school	Occasional care	Outside school hours care (OSHC)	All (excl. OSHC)
Weekday rates	**Avg**	**Avg**	**Avg**	**Avg**	**Avg**
Person trips (person trips/licensed child places)					
Site AM peak hour	0.85	1.08	0.77	0.47	0.89
Site PM peak hour	0.83	1.03	0.84	0.49	0.89
Network AM peak hour	0.66	1.09	0.73	0.08	0.81
Network PM peak hour	0.39	0.60	0.06	0.28	0.36
Daily	3.07	2.50	1.83	1.51	2.52
Vehicle trips (vehicle trips/licensed child places)					
Site AM peak hour	0.81	0.86	0.63	0.38	0.77
Site PM peak hour	0.80	0.76	0.78	0.43	0.78
Network AM peak hour	0.64	0.83	0.63	0.07	0.69
Network PM peak hour	0.39	0.51	0.06	0.23	0.33
Daily	2.97	1.96	1.65	1.30	2.27

Notes

- The centres surveyed had 45 to 90 children in long day-care, 20 to 40 children attending pre-schools, 25 to 36 attending occasional care, and 70 to 105 children in OSHC care.
- OSHC operate very differently to the other centre types. Some differences include having separate intakes before and after school with different children in attendance, no mandated staff to children ratio requirements, and significantly more licensed child places than are typically in actual demand.
- The number of children delivered or picked up in one trip averaged 1.3 across all sites.

Mode share

The dominant mode of transport for child care centres was private vehicles, and mode shares were generally consistent in the AM period (between 6:30am and 9.30am) and PM period (between 2:30pm and 6pm).

Mode shares were found to vary widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context. For these reasons, a benchmarking approach is recommended.

Table 5.60. **Mode share summary for child care centres**

Mode	Sydney Average and range	Regional Average and range
Car	87% (46% to 99%)	89% (84% to 93%)
Non-car	13% (1% to 54%)	11% (7% to 16%)

Notes

- Mode share has been calculated based on the car and non-car trips observed between 6:30am and 9.30am and 2.30pm and 6pm.
- Non-car trips for staff and other business visitors were not recorded.

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Schools (2014)

Surveys of primary and secondary schools were undertaken in 2014 at a total of 22 sites, with 14 locations in the Sydney urban area and eight in regional areas. Excluding one combined primary and secondary school, the following tables summarise the average rates across eight primary schools and 13 secondary schools.

Table 5.61. **Primary school sample summary**

	Sydney	Regional	Combined
Person trips (person trips/student)			
AM peak hour	1.6	1.6	1.6
PM peak hour	1.8	1.5	1.7
Daily	4.2	3.7	4.0
Vehicle trips (vehicle trips/student)			
AM peak hour	0.7	1.2	0.9
PM peak hour	0.5	1.0	0.7
Daily	1.6	2.6	2.0

Table 5.62. **Secondary school sample summary**

	Sydney	Regional	Combined
Person trips (person trips/student)			
AM peak hour	1.1	1.1	1.1
PM peak hour	1.0	1.2	1.0
Daily	2.3	2.7	2.5
Vehicle trips (vehicle trips/student)			
AM peak hour	0.5	0.4	0.5
PM peak hour	0.3	0.3	0.3
Daily	1.1	0.8	0.9

Notes

- Trip generation rates have been determined based on one-way trips per student enrolled. For example, a parent dropping off a child by car generates two one-way vehicle trips (one inbound and one outbound) OR three one-way person trips (two inbound and one outbound).
- Peak hour refers to the site AM and PM peak periods (i.e. around school start and finish times).
- Three schools had five-day surveys to assess traffic variation over the school week. Trip generation was found to be consistent over the week, except on days where other events were identified as impacting trip generation.

Mode share

The mode shares varied widely between the school sites and reflects factors such as the level of public transport access, availability of safe and well-connected walking access and the age of school students. Mode shares were found to vary widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context. For these reasons, a benchmarking approach is recommended.

Table 5.63. **Mode share summary for primary schools**

	Sydney		Regional	
Mode	**AM period** Average and range	**PM period** Average and range	**AM period** Average and range	**PM period** Average and range
Car	49% (23% to 66%)	39% (14% to 78%)	66% (44% to 84%)	60% (40% to 74%)
Walk	48% (34% to 62%)	58% (22% to 75%)	28% (8% to 43%)	35% (14% to 60%)
Bus	3% (0% to 16%)	2% (0% to 11%)	7% (0% to 13%)	5% (0% to 12%)

Table 5.64. **Mode share summary for secondary schools**

	Sydney		Regional	
Mode	**AM period** Average and range	**PM period** Average and range	**AM period** Average and range	**PM period** Average and range
Car	45% (14% to 83%)	38% (10% to 52%)	47% (16% to 65%)	24% (9% to 38%)
Walk	32% (4% to 67%)	34% (8% to 73%)	20% (1% to 51%)	22% (3% to 43%)
Bus	23% (0% to 46%)	29% (0% to 48%)	33% (20% to 52%)	54% (31% to 78%)

Notes

- Mode share has been calculated based on the person trips observed in the AM and PM survey periods, which varied between 6:15am to 9.30am and 1:45pm and 6:15pm.
- Observations were conducted from survey points at the school sites and do not capture trips such as remote drop offs.
- Car is the predominant transport mode in the AM period, while walking is the predominant mode in the PM period. This indicates trip types where children are dropped off as part of a multi-purpose trip in the AM period while some are left to walk home in the PM period.
- Car mode share was greater for primary schools than secondary schools, and greater for regional schools than metropolitan ones.
- Bus mode share was greater in secondary schools compared to primary schools, indicating an increase in independent travel to and from school in older children.

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5.6.9 Health facilities

Hospitals (2013)

Surveys of hospitals were undertaken between 2007 and 2011. The trip rates and information presented is a summary from studying 21 hospitals in Sydney.

Table 5.65. **Hospital sample summary**

Hospital type	AM and PM peak trip rate (vehicle trips/ staff/hour)	Peak hour trip rate (vehicle trips/ bed/hour)
Metropolitan hospitals with high transport accessibility (eight sites)	0.3-0.5	1.1-2.7
Metropolitan and regional hospitals with lower accessibility (13 sites)	0.4-0.9	0.8-2.3

Notes

- These trip rates reflect trip rates for all hospital users. Staff have a lower trip rate.
- Most trip generation rates for hospitals rely on the number of beds and the number of staff during a shift period. In practice, it is often difficult to ascertain the number of staff in different categories such as nursing, medical, domestic, admin and technical due to administration and staff allocation of departments. Furthermore, the trip generation of hospitals differs significantly based on their location, size and types of activities. For example, urban hospitals have a lower rate of vehicle trips and parking generation when compared with regional hospitals or hospitals located where there is limited public transport accessibility. Therefore, it is more appropriate to categorise hospitals in terms of their locations and accessibility (particularly by public transport) and then to assess their trip and parking generation rates.
- A review of the data in 2013 indicated that trip generation rates and transport requirements of the hospitals are more related to their function than the number of beds. For example, in hospitals with high outpatient services, the trip generation rates are likely to be higher. Professional judgement is required in interpreting and applying the available data.

Peak generation model

The following models provide a means for calculating the approximate peak period traffic generation for hospitals when both the number of staff and beds are known. The models should be used within the range of estimation.

Table 5.66. **Peak hour trip generation model for hospitals**

Hospital type	Trips (veh/h)
High accessibility	AM Peak = 0.34 (S) + 0.32 (B) PM Peak = 0.39 (S) + 0.33(B)
Low accessibility	AM Peak = 0.41 (S) + 0.62 (B) PM Peak = 0.59 (S) + 0.05 (B)

Variables

- (S): Number of staff during the main day shift at the hospital
- (B): Number of beds

Medical centres (2015)

Surveys of medical centres were undertaken in 2015 at a total of 20 sites, with 14 Sydney metropolitan sites and six regional sites. The following tables present the average rates for the surveyed medical centres.

Table 5.67. **Medical centre weekday and weekend sample summary**

	Weekday	Weekend
Rates	**Average**	**Average**
Person trips (person trips/centre)		
Site peak hour	74	47
AM peak hour	42	25
PM peak hour	47	28
Daily	472	291
Vehicle trips (vehicle trips/centre)		
Site peak hour	32	22
Daily	130	81

Notes

- The surveys were undertaken at medical centres with floor space varying from 210 square metres to 1,361 square metres and with the number of consulting rooms varying from five rooms to 23 rooms
- The operational parameters of the surveys sites may be used to estimate the operational parameters of a development when only the floor space is known.
- GFA per consulting room ranged from 17 square metres to 87 square metres and averaged 46 square metres.
- Number of doctors per consulting room ranged from 0.4 to 1.2 and averaged 0.8.
- Number of staff members per consulting room ranged from 0.5 to 2.2 and averaged 1.25.

Peak generation model

The following models provide a means for calculating the approximate weekday peak period traffic generation for medical centres. The models should be used within the range of estimation.

Table 5.68. **Peak hour trip generation model for medical centres**

Rates	**Person trips** (person trips/hour)
Peak 1-hour (in + out)	= 0.0314 (R2) + 6.1122 (R) + 8.0607
Total daily	= 0.1544 (R2) + 38.456 (R) + 8.6803

Variables

- (R): Number of consulting rooms

Mode share

The dominant mode of transport for medical centres was private vehicles. Mode shares were found to vary widely across the sites surveyed, and any mode share estimate should be site specific, considering the site characteristics and network context.

Table 5.69. **Mode share summary for medical centres**

Mode	**Sydney** Average and range	**Regional** Average and range
Car	83% (43% to 100%)	90% (74% to 96%)
Walk	11% (0% to 33%)	4% (0% to 11%)
Public transport	5% (0% to 26%)	5% (0% to 11%)
Other	1% (0% to 3%)	1% (0% to 5%)

Notes

- Mode share has been calculated based on the person trips observed, generally between 7am and 7pm on weekdays.

Chapter

6 Multimodal network impacts

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6.1 Overview

6.1.1 Purpose

Developments may result in additional travel demand and/or changed travel patterns, which impacts the transport network. These impacts are unique to the geographic, transport and demographic context of the proposed development.

Managing development impact is vital to maintain operational standards and reasonable service levels for all transport network users. This process also serves as a foundation for consent authorities, TfNSW, government agencies, and stakeholders (including end-users, neighbouring land uses, and communities) to engage in discussion and reach agreement on the impact and mitigation measures. The mitigation approach should be directly relevant to the development (not for the purpose of rectifying pre-existing problems), considerate (and reasonable) with respect to its scope, feasible and practical, all with the aim of achieving the necessary community outcomes when the development is executed.

This chapter provides guidance on how to assess a development's impacts on the transport network and how to mitigate those impacts. The chapter also gives an overview of transport modelling methods used to undertake the assessment including any developer contributions, works-in-kind agreements and works deeds arising from impact mitigation.

6.1.2 Structure

This chapter is structured as follows:

- Section 6.2 explains the multimodal network assessment approach for a development
- Section 6.3 presents transport modelling guidance to the support multimodal network assessment for a development
- Section 6.4 outlines the approach to mitigation of significant development impacts
- Section 6.5 provides an overview of development contribution, agreement and deed in support of infrastructure improvements required for a development.

Any lists of considerations presented in the chapter are provided as guidance that should be evaluated where relevant. Practitioners must use professional judgement and determine the relevance of the list of considerations to the planning and design of a given development.

Note

The recommendations contained in this chapter are supplementary to the relevant content in the Austroads Guide to Traffic Management including:

- Part 2: Traffic Theory Concepts
- Part 3: Transport Study and Analysis Methods
- Part 6: Intersections, Interchanges and Crossings Management
- Part 7: Activity Centre Transport Management
- Part 8: Local Street Management
- Part 10: Transport Control – Types of Devices
- Part 11: Parking Management Techniques
- Part 12: Integrated Transport Assessments for Developments
- Part 13: Safe System Approach to Transport Management

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6.2 Multimodal network assessment

This section gives an overview of the approaches to multimodal network assessment for a development for all users within a defined geographical area.

Transport networks support the movement of people and goods through multiple modes, including:

- Public transport networks (road buses, on-demand and demand responsive services, ferry, light rail, passenger rail and regional air)
- Road networks (State, regional and local roads and streets)
- Freight road and rail networks, including port and aviation links
- Walking networks
- Cycling networks
- Point-to-point transport services, such as taxis and ride share services.

These networks comprise of:

- Road-based facilities (traffic lanes, footpaths, bus lanes, light rail lines and on-road bicycle lanes)
- Off-road facilities (off-road bicycle paths, pedestrian paths, waterways, light rail lines and rail lines).

6.2.1 Purpose of the network assessment

Developments generate trips with a mix of modes and purposes which impact the transport network. The purpose of the multimodal network assessment is to test the impacts of the development on existing transport networks and to determine whether mitigation measures are necessary. Generally, the level of acceptable performance resulting from a development should be maintained to the level of performance that would have otherwise occurred in the study area. Assessment therefore considers performance both with (Future Project Case) and without (Future Base Case) the development. Performance is measured through performance criteria, which define the level of service provided by the transport network to its users.

6.2.2 Assessment considerations

The development may impact the immediate surrounding transport network, as well as the adjoining transport network. This area of influence needs to be defined to capture impacts with a nexus to the development. Furthermore, the area can differ between modal networks (e.g. a development that is expected to generate a large number of vehicle trips, but few pedestrian trips). Assessments only need to consider the area of influence relevant to the development context for each applicable mode.

When undertaking a multimodal network assessment, the following items should also be considered:

- Current and forecasted trip generation for all modes, during construction and operations, including how these trips will be distributed onto the network (Refer to Chapter 5 – Land use trip generation).
- Staged subdivisions/incremental developments should be examined as a whole, incorporating the original development. Any existing or prior contributions or similar agreements for the existing development should be taken into account when assessing the overall transport impact.
- Place and transport outcomes
  - What is the precinct/structure plan, Environmental Planning Instruments (EPIs) or Development Control Plan (DCP), local government strategies, plans and codes that are applicable to the development's location?
  - Are there any known transport network improvements committed or in delivery that would support the proposed development?
  - How would the trip pattern changes affect the desired place and transport outcomes in the development's surroundings?
- What is the transport network performance for the movement of people and goods?
  - What is the transport network's current performance within the area of influence/impact of the development?
  - Where do limitations occur in the current transport networks?
  - Will the demand generated by the development adversely impact the safety and efficiency of the surrounding transport networks?
  - Can travel demand management (TDM) measures be implemented at the design stage as well as post occupancy stage to mitigate the impacts?
  - Are there any impacts on the strategic freight network and on roads connecting the development to the freight network?

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Site consolidation

The benefit of a mixed land use development is that it encourages people to walk and interact with the environment and reduces their need to travel by motorised vehicle. Site consolidation design can also offer the benefits of road safety and traffic operation by allowing existing accesses to major arterial roads to be eliminated with all access to be provided via an alternative frontage (e.g. a local road).

Corridor preservation

Corridor identification, preservation and management is a key function of TfNSW from a strategic transport planning perspective. The early identification of corridors is key to later land use developments. TIAs must consider transport corridors as gazetted in relevant EPIs.

6.2.3 Assessment approach

Performance indicators by mode

The following table outlines primary and supporting performance indicators that may be used to assess each modal network. Depending on the development's complexity and networks, additional indicators or considerations may be necessary to provide a comprehensive assessment.

Conversely, there may be cases where there is low impact in one or more modes, and an assessment using these indicators would be excessive. The assessment effort and relevant performance indicators and considerations should be determined on a case-by-case basis using professional judgement.

Table 6.1. **Performance criteria and considerations by mode for network impact assessment**

Mode	Primary indicator(s)	Supporting indicator(s)
Walking	• Walking Space Level of Service within site and at site frontage (Walking Space Guide, TfNSW) • Safety review of footpaths and crossings (e.g. nearest safe crossing opportunity) within site and at site frontage	• Comparison with minimum target walking space (Walking Space Guide, TfNSW)
Cycling	**Subdivision DAs:** • Bicycle Level of Traffic Stress within site (Cycleway Design Toolbox, TfNSW) **All DAs:** • Sufficiency of bicycle parking and end of trip facilities (refer to DCP or other EPIs, if applicable)	**Subdivision DAs:** • Level of Service (Cycleway Design Toolbox, TfNSW Appendix A.5) **All DAs:** • Safety review of cycleway within site and at site frontage, if applicable
Public transport	**Subdivision DAs:** • 400m walk catchment to nearest bus stops and 800m walk catchment to light rail stops/ heavy rail stations **All DAs:** • Capacity (e.g. waiting space) and safety of facilities at the nearest service stop(s) and opportunities for improving services	• Ease of pedestrian access to and from the nearest public transport nodes (such as locations where buses board and alight passengers)
Road	• Levels of Service for intersection (refer to Appendix F) • Safety implications of queuing/merging/ weaving, etc. (e.g. motorway operations, turn bay overspill, back of queue, other side of curves or crests)	• Degree of saturation
Freight and servicing	• Provision of loading bays should refer to DCP or other EPIs if applicable (the adequacy of such provision could be assessed or justified using relevant technical guidance, such asTfNSW's Freight and Servicing Last Mile Toolkit, Urban Freight Forecast Tool, and other available available methods such as Erlang Loss or queue theory)	• Safe connectivity to and from the strategic freight network

Note: When determining the assessment time periods for the above modal network, reference should be made to the commentary provided in Section 5.3.3. The appropriate time periods of assessment should be considered and justified depending on the context of the development and its activities.

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Walking

Safe, direct, convenient and comfortable walking facilities are essential given that all development users are pedestrians for some part of their journey, and should be assessed in a TIA report.

A development should be planned, designed and built to guide pedestrians to safe and efficient paths and road crossings on the network and demonstrate convenient and connected pedestrian access to nearby transport interchanges. Pedestrian delays should be minimised as this can lead to higher levels of non-compliance with pedestrian signals and raise safety concerns.

Depending on the proposed development and planned land use, pedestrian flows can be significant on surrounding footpaths. Levels of service may be applied to evaluate the adequacy of pedestrian facilities, determined primarily in terms of space, flow rates and speeds.

The process for a detailed pedestrian assessment should follow the five steps outlined in the Walking Space Guide (TfNSW, 2020), for both the Future Base Case and Future Project Case.

More detailed guidance is also available in:

- Guide to Road Design Part 6A: Paths for Walking and Cycling (Austroads, 2021) which provides design guidance for safe and efficient walking and cycling paths.
- Guide Information for Pedestrian Facilities (Austroads, 2013) which provides a review of best practice for pedestrian facilities.
- Local strategies and plans such as Pedestrian Access and Mobility Plan (PAMP), Cycling Strategy and Action Plan, Active Transport Action Plan, and Sustainable Urban Mobility Plan (SUMP).

Cycling

Direct, convenient and attractive access should be provided to the development to encourage cycling and reduce the demand on other networks. The development should also demonstrate safe and convenient cyclist access to nearby transport interchanges.

Cycle paths may be required as part of the development to provide connectivity to the broader cycle network, as well as to cycle parking and end of trip facilities proposed within the site. Cyclists may access the development from the adjacent road system or from dedicated off-road bicycle routes.

The cycling network assessment involves:

- Reviewing cycling routes that connect the development site to the wider cycleway network, which are generally designated by councils. The network can include bicycle paths, shared paths, shared zones, and quietways (refer to Cycleway Design Toolbox, TfNSW).
- Undertaking a review of cyclist movements in the area of influence. This may include sourcing existing cycling surveys from local council or conducting surveys at the proposed development site where no data is available.
- Estimating Future Base Case cyclist movements from the development to the wider cycleway network using realistic growth factors, such as a percentage based on historic or predicted trends.
- Determining the Future Base Case cycling network performance. This may be through assessing Level of Service or Level of Traffic Stress, or a qualitative assessment of the adequacy of the connections.
- Using the person trips generated by the development (as determined in Chapter 5 – Land use trip generation), and applying the same methodology as for the Future Base Case, assess the Future Project Case cycling network performance.

It is recommended to refer to the following for more detailed guidance:

- Cycleway Design Toolbox (TfNSW, 2020) which assists practitioners to design and construct high quality bicycle facilities.
- Cycling Aspects of Austroads Guides (Austroads, 2017) which outlines key information relating to planning, design and management of cycling facilities.
- Local strategies and plans such as Pedestrian Access and Mobility Plan (PAMP) and Sustainable Urban Mobility Plan (SUMP).

Public transport

A key consideration of any TIA is how development users will access the public transport network. Developers should consider the transport modes that residents/employees will need to use to travel between the development and the nearest transport interchange. This will help to determine the infrastructure impact and changes required to improve movement between the development and interchanges to encourage public transport use.

Developments should encourage the use of available public transport facilities near the development. Network impacts should be considered when assessing public transport, and may interface with the road network, such as in the case of buses and light rail.

Assessing public transport impacts should be tailored to the location, the nearby public transport network, and the type and the scale of development. Professional judgement should be used to determine whether an assessment of public transport capacity, bus stop access or bus priority is necessary. If an assessment is considered necessary, council and TfNSW may be contacted to discuss the scope of assessment required. In developments expected to produce a high public transport trip volume, the following process for public transport network assessment may be considered:

- Reviewing the public transport network in the area of influence to identify relevant modes likely to be impacted.
- Reviewing timetables for nearby services to determine frequency, travel times and interchange requirements to access major destinations.
- Sourcing passenger volumes through TfNSW's Open Data Hub for impacted services:
  - Buses – Bus Opal Assignment Model (BOAM)
  - Light rail – Light Rail Opal Assignment Model (LOAM)
  - Train and Metro – Rail Opal Assignment Model (ROAM)
- Estimating Future Base Case passenger volumes using realistic growth factors, such as a percentage based on historic or predicted trends.
- Determining Future Base Case volume/capacity ratios for impacted services. Level of Service for public transport stations or interchanges should also be calculated if significant crowding is expected. Consideration should also be given to the availability and suitability of commuter parking facilities and end-of-trip facilities, spaces and distance to and from stations.
- Based on the public transport person trips generated by the development (as determined during Chapter 5 – Land use trip generation) and applying the same methodology as for the Future Base Case, assess the Future Project Case for public transport network performance.

It is recommended to refer to the following for more detailed guidance:

- Integrated Public Transport Service Planning Guidelines (TfNSW, 2013) which details public transport service principles and service capacities
- Guidelines for Public Transport Capable Infrastructure in Greenfield Sites (TfNSW, 2018) which provides guidance to planners and developers to support good road design in greenfield sites so that public transport can be successfully delivered now and into the future.

Road network

Multimodal network impact assessments need to consider the function of roads within the movement and place framework. Safety is a priority for all road users.

An example of assessing vehicle traffic impacts on the road transport network may include:

- Undertaking a review of the surrounding road network in the area of influence to identify the existing traffic demand and travel patterns. This will generally be sourced from surveys.
- Estimating future base case traffic volumes using realistic growth factors, such as a percentage based on historic or predicted trends.
- Determining the Level of Service, including average delay, and queue lengths. Transport modelling frameworks as outlined in Section 6.3 are integral in testing the impacts of development trip generation on the road network.
- Based on vehicle trips generated by the development (as determined in Chapter 5 – Land use trip generation) and applying the same modelling framework for the Future Base Case, the road performance for the Future Project Case can be determined. Note that mitigation measures may be incorporated in this assessment.

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The movement of people and goods is typically the primary concern for major roads with a high movement function, while place outcomes and amenity are the primary concern of minor roads or local streets. This involves considering traffic efficiency for cars, freight and buses or comfortable movement of large volumes of pedestrians or cyclists. From a movement and place perspective, the following should be considered:

- The relative priorities of the movement of people and goods to their destinations for all road-based modes.
- The strategic significance of the roads (for pedestrians, cyclists and vehicles) and the proposed land use adjacent to/interacting with these roads.
- For developments involving a new road network, apply the movement and place supporting tools relevant to the development scale e.g. precinct/neighbourhood/street for identifying the role of each internal road through its movement and place function, and consider how the internal road network adjoins with the surrounding network. Consideration should also be given to DCPs, where changes of road functions may have been identified in the future. For example, roads that might have an interim function serving as collector roads and would be closed off or repurposed to local roads in the longer term.
- For all DAs, an understanding of the movement and place role of the adjoining road is essential to guide how the road should be managed and impacts mitigated when additional trips are generated.

Road authorities, in most cases being the local council, are encouraged to prepare movement and place road network classifications within their jurisdiction and include these in documents such as DCPs so that practitioners can reference them when preparing TIAs.

It is recommended to refer to the following for more detailed guidance:

- Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments (Austroads, 2020) which provides guidance on the process to identify and assess potential impacts of developments through integrated transport assessments.
- Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management (Austroads, 2020) which provides guidance on how to manage intersections, interchanges and crossings.
- Guide to Traffic Management Part 3: Transport Study and Analysis Methods of which relevant sections provide guidance on how to assess mid-block capacities on different road types.
- Movement and Place Framework, Design of Roads and Streets and supporting guides (TfNSW, 2023)

Freight and servicing

Consent authorities and developers must assess the traffic generated by buildings and precincts. All developments generate freight and servicing tasks, including waste collection, which require a comprehensive approach to planning. Considerations for freight and servicing impacts include:

- Identifying the haul routes and heavy vehicle types likely to be used during the development's construction and operation phases.
- Consideration of cumulative freight traffic impacts at key intersections using an appropriate modelling framework. Based on the freight and servicing trips generated by the development (as determined in Chapter 5 – Land use trip generation), create freight and servicing plans to accommodate on-site loading/unloading, servicing and waste collection vehicles to avoid queuing in the local network during construction and operation.
- For high density residential developments, the design of the developments should consider how Council's standard waste collection vehicles could be serviced to avoid impacting the adjacent public roads when waste collection is carried out.
- Swept path diagrams showing the largest expected freight and servicing vehicles entering and exiting the development without adversely affecting the adjoining road network and safety of road users.
- If modelling is required to assess the impact, it should consider both route and access constraints applicable to freight and service vehicles. For large vehicles, information can be found in the Performance Based Standards Map. For smaller vehicles, the constraints are usually associated with accessibility and parking provision.

It is recommended to refer to the following information for more detailed guidance:

- Freight and Servicing Last Mile Toolkit (TfNSW, 2021) for how to plan and manage off-street freight and servicing activity.
- Metropolitan Road Freight Hierarchy on the State Road Network (TfNSW, 2011) which sets out the road freight hierarchy on the State road network in the Greater Metropolitan Area. Also refer to Performance Based Standards Map for details about the different classifications for State heavy vehicle networks, including over-height vehicles.

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Safety

A network assessment, regardless of scope, should always consider any potential road safety issues. This includes:

- Any existing or potential safety issues that may be exacerbated by the development or the need for geometric improvements (such as to accommodate heavy vehicle movements).
- Conflicting movements on the likely routes for patrons (including pedestrians, motorcyclists, cyclists, children of younger age, elderly and users of mobility devices) to public transport interchanges, links to the pedestrian and cycleway network, and movements occurring at intersections and at traffic control devices.
- Increases in traffic flows at a level crossing as a result of development will need a site specific safety assessment. An Australian Level Crossing Assessment Model (ALCAM) assessment may be required, subject to consultation with the relevant Rail Authority as defined in the Transport & Infrastructure State Environmental Planning Policy (SEPP). Note that creation of new level crossings in NSW is only supported in exceptional circumstances.
- Evaluating recent typical crash rates to assist in determining if new road infrastructure is required for safety reasons. Statistics for local government areas across NSW are provided on the TfNSW websites and more detailed data can be can be viewed at the NSW Centre for Road Safety's website.
- Impact during construction, especially in terms of heavy vehicle movements, and also at the end state of the development.
- Any roadside advertising signage associated with the development should comply with the Transport Corridor Outdoor Advertising and Signage Guidelines.
- The road safety contents presented in the Austroads Guide to Traffic Management, Part 12: Integrated Transport Assessment for Developments and Austroads Guide to Road Safety, Part 6: Road Safety Audit as well as other sections of the Austroads Guide to Road Safety that are applicable to identifying new and increased crash risk as a result of the development.
- For school developments, the above points should be considered together with a school's designated catchment area.

In addition to the considerations listed above, developments with significant risks to the public should also conduct an independent road safety audit and/or peer review assessment. Examples of significant risk include a proposal for a development located near an existing hazard which cannot be designed for or treated. In these instances, it is recommended that the relevant road authority is consulted prior to lodgement to obtain Approval-in-Principle (AIP).

6.2.4 Development specific assessment items

For certain development types or locations, additional performance criteria and considerations may need to be assessed to evaluate the level of development impact on the transport network and appropriate mitigations. For example, a function centre or large sport venue may generate a large influx and outflow of visitors over a short time period requiring a more thorough pedestrian assessment to ensure nearby footpaths and crossings can safely manage the trips generated.

Similarly, a tourist development that generates its peak trip volumes during weekends may cause a level of impact different from the commuting peak hours in the surrounding local network. Refer to Chapter 3 - Undertaking a Transport Impact Assessment for more information.

Some examples of development-specific assessment considerations include:

- Existing or potential safety issues that may be exacerbated by the development or the need for geometric improvements (such as accommodating heavy vehicle movements).
- Noise and vibration impact and/or vandalism for a development adjacent to rail lines (including light rail), arterial roads or motorways. Refer to Development near Rail Corridors and Busy Roads – Interim Guideline (NSW Department of Planning, 2008) for more information.
- For larger scale developments (e.g. subdivision DA), identifying the role of each internal road through its movement and place function and considering how different modes are catered for and how the internal road network adjoins with the surrounding network.
- For a DA that involves a street network within its site, site permeability with seamless interface to access local networks to support safety, convenience and comfort for pedestrians and cyclists by allowing them to select more direct routes. The Movement and Place supporting tools relevant to the development scale could be applied to evaluate the suitability of the streets and roads within the internal network.

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6.3 Transport modelling

Transport modelling can be used to support TIA preparation. Modelling tools work through a system of complex mathematical equations and behavioral assumptions to forecast changes in performance metrics caused by changes in infrastructure (supply) or travel (demand). For example, a forecast based on historical data or validating a preferred scenario based on a suite of assumptions. Transport models can be useful in estimating the impacts of a development and identifying or progressing transport planning and mitigation measures, including TDM, to address these impacts.

TfNSW uses a suite of transport modelling tools to forecast and assess the performance of the transport system at different levels of detail and scope. The need for modelling and the level of modelling required for a TIA should be discussed at the scoping consultation meeting with the consent authority and relevant agencies, giving due regard to the size, scale, potential transport impact and geographical extents of the development.

6.3.1 Modelling frameworks

Transport models are calibrated to reflect observed travel choice behaviour at a specific point in time. The calibrated models can then be used to forecast future travel patterns in response to a change in travel demand, infrastructure, policy, or behaviour.

Referring to the multimodal network assessment process in Section 6.2, transport modelling should be used to validate the effect/outcome of the change in travel patterns and travel choice behaviour as a result of the proposed TDM measures if the model is capable of reflecting the demand to the proposed TDM measures. In instances where the model is not capable of reflecting the demand response to the proposed TDM, demand responses should be calculated using an alternative approach, with transport modelling being used to validate the impact of the demand response.

In assessing developments, three scenarios should be modelled:

- Existing Case: existing development + existing condition
- Future Base Case: existing development (e.g., brownfield site) + future background growth + other committed/planned land use and infrastructure changes in the area of influence
- Project Case: Future Base Case – existing development + proposed development with trip adjustment resulting from the anticipated effects of proposed TDM measures.

The impact of the development is defined as the difference in performance metrics between the Base Case and the Project Case. The use of modelling to either draw a comparison between scenarios or to obtain absolute value results depend on the scale and nature of the modelling, and the quality of its calibration. Large area strategic models are typically well-suited to providing comparative results between scenarios, whereas an operational model may be suited to providing absolute results.

Identifying a framework

While modelling frameworks differ for different development scales and contexts, a modelling framework should:

- Include an appropriate level of detail to assess the demand and impacts of a development at a reasonable level of confidence
- Clearly set out all significant assumptions with justifications
- Apply models with consideration of the strengths and limitations of tools used
- Consider city-wide or State-wide trends where these will have a measurable impact on the planning and designing of the development
- Consider current planned and committed transport investments and changes within the area of influence of the development
- Include appropriate time horizons to assess the full impact of the development
- Agree with the consent authority and relevant transport agencies.

The tools selected for a development assessment should be reflective of the expected potential impact, time and resources available to undertake an assessment, and other comparable constraints. The request for additional framework components should be balanced against the longer delivery and calibration times required.

The selected modelling framework must be used for its intended purpose and not be presumed to be appropriate for different developments within a study area or for subsequent more detailed work for the same development.

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6.3.2 TfNSW modelling guidelines

TfNSW Traffic Modelling Guidelines

The TfNSW Traffic Modelling Guidelines provide guidance to ensure consistency of traffic modelling practice are adopted in the industry.

It presents the various levels of traffic modelling, outlines appropriate usage and provides a framework for model selection. It also outlines the model process and describes general model requirements.

The guidelines explain different levels of modelling such as Strategic modelling, Demand modelling, Highway Assignment modelling, Microsimulation modelling, SCATSIM modelling, Corridor modelling and Single intersection modelling. There is also guidance for modelling practitioners about appropriate modelling standards and fitness for purpose descriptions.

Note

TfNSW is currently reviewing and preparing an updated suite of Transport Modelling (Technical) Guidelines to provide consistency to the development, review, use, transfer and storage of transport models in NSW. It is expected that this suite of guidelines will include a guide for practitioners covering key issues around model selection and application including:

- When and why transport modelling is required
- How the TfNSW's standard models are best used through the project lifecycle
- How project requirements, development stage (within the project lifecycle) and approval processes drive the selection and use of models
- What are the appropriate models that should be used based on the project profile
  - Identification of what projects need from strategic vs. operational models as they progress, including interfaces between the various modelling types
  - An indication of the types of information/data/inputs required by modellers
  - What are the known model limitations, risks, challenges, and issues
  - How the critical elements of time, cost and quality affect the choice of models used in projects.

A link to the new guidelines will be provided once it is officially published.

Other Technical Directions published by TfNSW

In addition to the above guidelines, the following Technical Directions should be complied with when transport modelling is undertaken as part of a TIA:

- TS 05442 -Operational modelling reporting structure
- TS 05445 -Traffic Signals in Microsimulation Modelling.

Please note that the upcoming Transport Modelling Guidelines are expected to supersede many of these guidelines and should be the first point of reference for transport modelling once released.

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6.3.3 Typical modelling tools

TfNSW has a variety of tools and models that are typically used in combination to meet one or multiple components of the four-stage modelling approach. These range from strategic models, which are used to calculate demand at an area/city-wide level, to single intersection models or spreadsheets and First Principles tools. Generally, there is a trade-off between the complexity and the size of a model. Specific models may be of benefit or greater use than others for a particular transport assessment, such as those with significant impacts on travel market segments like freight.

Table 6.2. **Typical transport modelling tools used in NSW**

Model class	Analysis offered	Related TfNSW models
Strategic models: Cover large areas with limited details. Multimodal typically examining broad transport demands. Best used for broad network evaluation and demand forecasting.	Trip generation, distribution, mode choice and trip assignment, link level performance metrics, capacity constraints.	Sydney Strategic Travel Model (STM), Public Transport Project Model (PTPM), Enhanced Train Crowding Model (ETCM), Sydney Freight Movement Model (FMM), Regional Freight Model (RFM), Regional Travel Model (RTM).
Highway assignment models: Macro-level strategic models – similar to those used in strategic modelling, but, are used when only vehicle flows are required to be assessed. Meso-level strategic models – cover large areas and include intersection details to more accurately reflect intersection delays.	Combines elements of microsimulation and strategic models for analysis at an aggregate level.	Sydney Traffic Forecasting Model (STFM), Strategic Motorway Planning Model (SMPM), Mesoscopic Dynamic Traffic Assignment (DTA) Foundation Model.
Microsimulation models: Adopted where complex traffic operations are required to be assessed. These models simulate the movement of individual vehicles based on a number of algorithms. Also can be used for the analysis of corridor assignment and intersection performance.	Assignment. Corridor and intersection performance metrics.	-
Pedestrian models: Usually tailored to the need of the project, generally localised to a platform, station or event precinct.	Planning and designing spaces where pedestrians congregate, particularly where there is a potential safety concern.	-
Multi-intersection models: Used for the analysis and optimisation of a corridor or small network.	Corridor and intersection performance metrics.	-
Single intersection models: Used at isolated intersections or where the effects of coordination are not required to be modelled explicitly.	Intersection performance metrics.	-
Spreadsheet model	Manual demand, distribution, mode choice and assignment. Variety of performance metrics, Static and Semi-Dynamic pedestrian modelling.	-

For more information about the different model classes, refer to Austroads (AP-R647-21) Management of Traffic Modelling Processes and Applications.

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6.4 Network impact mitigation

6.4.1 Mitigating development impacts

The final element of the multimodal network assessment process is to mitigate development impacts that degrade transport network performance or safety.

Considerations include:

- Impact of development infrastructure on the surrounding transport networks of vehicle and non-vehicle modes of transport such as walking and cycling.
- Increased vehicle trips on the road network.
- Increased patronage on bus routes, ferry routes, light rail lines or train lines, and associated interchanges.
- Increased delay on a modal network as a resulting impact from another transport mode (e.g. more vehicles on the road network will impact bus and light rail travel times, delays to pedestrians and cyclists, impacts on active transport amenity and reduced safety to pedestrians and cyclists, etc.).
- Adequacy of addressing infrastructure requirements (e.g. Disability Discrimination Act and National Construction Code compliance, elevators, parking provisions).
- Encroachment on strategic road and rail freight.

TDM measures are identified upfront to promote better use of public and active transport modes through development planning and design (refer to Chapter 4 – Travel demand management). TDM measures could be used to manage travel demand resulting from a development and alleviate its impact to the transport network. In the instance where mitigation additional to TDM is required to alleviate the impact, upgrades of network infrastructure or facilities (e.g. intersections, footpaths, traffic signals etc.) should be considered to maintain the safety and efficiency of the transport network.

Examples of mitigation measures include:

- Upgraded facilities such as bus shelters near the development.
- Improving the safety and equitable access of walking and cycling to education, employment, recreation, services and other public spaces.

Another form of mitigation is adjusting the development design to improve the interface with the transport network (e.g. optimising pedestrian or cycling access points and safety to the development). Refer to Chapter 7 – Site access and design for more information.

6.4.2 Transport network improvements required for developments

The following considerations are relevant in determining network improvements for developments:

- Developer contingent works.
- Development contributions (as per Part 7 Infrastructure contributions and finance) under the EP&A Act.

Developer contingent works

Based on the result of a TIA, the consent authority and/or TfNSW may consider that a development impact is significant enough to require some forms of mitigation. These measures should be assessed within the TIA and agreed with the relevant authorities and considered as part of the environmental impact assessment (ie SEE or EIS).

In order to facilitate development assessment timeframes, it would be beneficial for all parties to discuss and agree any transport impact mitigation measures included in the TIA prior to DA lodgement. This potentially avoids requests for further information during the formal assessment process.

Where a TIA indicates that transport improvements are needed (e.g. as an impact resulting from the development), that requirement generally constitutes a condition of consent for development approval, or it may form part of a planning agreement or dealt with some other way in accordance with any Ministerial directions and associated guidance dealing with the Housing & Productivity Contributions levy.

The developer will be required to fund works that are considered essential to the ongoing safe operation of the development, its users, and the surrounding transport network.

The TIA should, to the extent possible, mitigate impacts identified at the end state of any multi-staged development. Note mitigation measures may also need to be staged in accordance with the impacts identified at each stage so it is imperative that the TIA presents a clear statement of the impacts at each development stage.

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Part 7 of the EP&A Act 1979

This outlines the provisions relating to developer contributions for local and regional infrastructure that are applicable to development.

Further details about how local and regional contributions are applied to a development can be found on the NSW Planning website. Note the details the Housing Productivity Contribution (HPC) is subject to Ministerial Order that will also be published on the NSW Planning website.

6.4.3 Environmental Impact Assessment of works within road reserve

An Environmental Impact Statement (EIS) or Statement of Environmental Effects (SEE) will generally outline the likely environmental impacts of a development and must be submitted with all DAs.

Developments often propose or require works external to the site, and on some occasions within a road reserve for which environmental impacts must also be considered. For example, a DA for a new dwelling may include a new driveway construction which requires the removal of a tree. The environmental impacts of the new driveway need to be considered and managed.

Similarly, a larger development may need traffic control signals with related traffic control measures such as restrictions on turning movements and "no stopping" areas resulting in a loss of on-street parking and causing potential impacts to network access for nearby residents etc. Refer to Section 138 of the Roads Act, as quoted in section 4.46 of the EP&A Act, for the part of the legislative framework that deals with works within the road reserve.

6.4.4 Consultation on mitigation approaches

Practitioners should consult with the relevant consent authorities and transport agencies e.g. TfNSW, Sydney Trains, Sydney Metro, etc., to discuss mitigation measures to alleviate the impact on the transport networks resulting from the development. This consultation will also allow TfNSW to better plan and service development as the development is completed and occupied. Some matters that are of interest to TfNSW are listed below.

For public transport services and infrastructure:

- Need for addition and/or increasing service frequencies
- Rationalising bus services to service higher density areas
- Provision or upgrade of interchange/station/stop upgrades
- New infrastructure including bus and light rail priority at intersections
- Infrastructure provision within and/or nearby sites (particularly relevant for hospitals, schools and larger sites)
- Improvement to rail and ferry services as well as infrastructure.

For the road-based network:

- Desired performance levels and relevant measures (e.g. Volume/Capacity ratio, average delay, safety etc.) should be agreed with the consent authorities and will depend on the transport context where the development is located (e.g. central business district, suburban, regional, etc.). If a classified road network is impacted, consultation with TfNSW is required.
- Consult the consent authority (and TfNSW if relevant) regarding the indicative cost, responsible delivery organisations and timeline for all proposed improvement measures.

For freight and servicing:

- At urban locations where freight and servicing are concerned, consider the guiding principles and design and management solutions as recommended in the TfNSW Last Mile Toolkit and the guidance to Delivery Service Plans.
- Refer to NSW Freight and Ports Plan 2018-2023, which sets the State Government's priorities for the sector, key objectives, and details the land use and infrastructure planning that needs to be considered for freight and ports.
- Refer to Austroads Guidelines for Planning and Assessment of Road Freight Access in Industrial Areas, NSW Heavy Vehicle Policy Framework and TfNSW Last Mile Toolkit and AS2890.2 Off-street Commercial Vehicle Facilities for guidance relating to freight planning and design and for guidance relating to the planning and design of freight and services for a development.

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6.5 Developer contributions, agreement and deeds

6.5.1 Funding improvements

Where improvements to the transport infrastructure and services are needed, that requirement should be included as part of the environmental assessment. In this situation, developers should be aware of the following:

- Developers should contribute to the cost of improvements to transport infrastructure and facilities that arise from the development.
- The level of contribution is proportional to the need for improvements which are a direct result of the development.
- The minimum level of contribution is assessed on the basis of maintaining the performance level (e.g. average delay) in future year on the adjacent road network which would have otherwise occurred without the development.

Where a program of planned road improvement works align with a development, a proportional monetary contribution may be made by the developer towards such works and advance the works schedule to coincide with development completion.

Mechanisms for funding by developers

Part 7 Division 7.1 of the EP&A Act 1979 sets out a number of ways for State and local governments to secure contributions from developers to fund transport network upgrades as a result of a development proposal:

- Planning agreements (Subdivision 2, Sections 7.4 to 7.10)
- Local infrastructure contributions (Subdivision 3, Sections 7.11 to 7.21)
- Housing and productivity contributions (Subdivison 4, Section 7.22 to 7.31)

In June 2023, the Environmental Planning and Assessment Amendment (Housing and Productivity Contributions) Bill 2023 was passed by the NSW Parliament and now applies to DAs submitted on or after 1 October 2023 (including complying development and SSD). The amendments aim to provide funding to support the delivery of essential regional infrastructure such as major roads, public transport infrastructure, schools and hospitals etc., and is separate to the contributions that developers pay to councils for local infrastructure.

Planning agreements

The EP&A Act establishes a statutory framework for planning agreements as a means for planning authorities to obtain contributions for a public purpose. This includes the provision of (or recouping of the cost of providing) public amenities and services, such as transport infrastructure.

Recent practice has been that planning agreements, which contain contributions toward infrastructure and services provided by State government agencies, would normally be initiated and coordinated by the Department of Planning, Housing and Infrastructure (DPHI).

A planning agreement may include a developer dedicating land, paying a monetary contribution, or providing any other material public benefit, or any combination of these. Planning agreements can be entered into at either the planning proposal or DA stage.

Once entered into, a registered planning agreement becomes a statutory obligation and is binding and enforceable. A breach of a planning agreement will be a breach of the EP&A Act.

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Local infrastructure contributions

Section 7.11 of the EP&A Act is the principal method of enabling councils to levy contributions for public amenities and services required as a consequence of developments.

Section 7.11 can only be applied to capital funding of facilities including civic improvements, open space, car parking and community facilities in accordance with a contributions plan.

Where a TIA identifies potential upgrades to the surrounding local road network due to the development, councils as the consent authority can seek contributions from the proponent of the development towards the identified road upgrades in accordance with the 7.11 plan.

Note that upgrades on the classified road network can be included in the 7.11 plan. However, this only applies to upgrades solely required to service growth identified in the precinct which is the subject of the 7.11 plan.

Housing and Productivity Contributions

Part 7 subdivision 4 of the EP&A Act provides for the levying of contributions for the provision of Regional Infrastructure including regional or State Roads and other transport infrastructure. This applies to development within the area defined in the Ministerial Order. Please refer to the Department of Planning, Housing and Infrastructure for further information about the HPC.

Developers may have been able to discharge their obligations under the previous SIC through Works-In-Kind or through the provision of land. In these instances, a legal agreement, such as a planning agreement or a Works-In-Kind agreement may be entered into with the Minister for Planning. A Works-In-Kind agreement executed before the introduction of the HPC will continue to operate.

Similar to the SIC regions, Works-in-Kind agreements are still available to be used but will be subject to a competitive assessment process administered by DPHI and Treasury. Guidance for Works-in-Kind is currently being developed by the DPHI.

If the Works-In-Kind involve classified roads or other measures where TfNSW has a statutory function (e.g. installation of traffic control signals), the work process is managed by TfNSW through the provisions of a Works Authorisation Deed (WAD) as further explained in Section 6.5.2. If the developer funds these works, the fund administrator would need to agree to both the application and costs of the proposed works-in-kind.

For clarification, and as noted earlier, some works will be developer contingent works and would therefore not be part of the HPC levy.

Note this advice will be updated as the Department's Guidelines related to the operation of the HPC and Works-In-Kind operations is published.

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6.5.2 Works Authorisation Deeds (WAD)

Where TfNSW has a statutory involvement as part of the DA process under the EP&A Act, TfNSW generally provides its approval or concurrence under the Roads Act 1993 in writing to the consent authority.

If works were required on a classified road or on any other road where TfNSW has a statutory interest, regardless it is an outcome of a condition of development consent issued by a consent authority or works that are nominated by the proponent as part of a planning agreement (made under Section 7.4 of the EP&A Act), TfNSW generally advises the consent authority that the developer will be required to enter into a WAD with TfNSW to enable these works to be undertaken to the satisfaction of TfNSW. By entering into a WAD, TfNSW issues the necessary Roads Act concurrences and approvals.

The developer should discuss with TfNSW its processes, costs and time required to progress the design and construction of the required works.

A WAD is intended to enable developers (private and public authority) and their contractors to:

- Satisfy the legal requirements for TfNSW to authorise implementation of certain road works and other works e,g. in relation to sections 64, 87 and 138 of Roads Act 1993.
- Provide TfNSW with a means of managing risks associated with the quality, financing and timely implementation of works.
- Meet TfNSW's design, construction and maintenance requirements (see TfNSW Find a Standard for details).
- Satisfy road safety, network efficiency, Work Health & Safety (WHS), property, asset and environmental requirements during construction.
- Provide a means of controlling road occupancies.

The WAD requirements and conditions include the process for road occupancy, geometric road design and pavement design approval, construction specifications, project management arrangements, insurances, occupational health and safety and environmental management during construction.

In some cases, further environmental assessment of road works may be required beyond that carried out in the development assessment stage as part of the WAD process.

Execution of a WAD is subject to a financial guarantee being provided in favour of TfNSW, and must be executed and entered into before any road related works can commence. Pro-forma of both the major and minor WADs is available from TfNSW.

Refer to the TfNSW's website for more information regarding WAD and other third party works.

Chapter

7 Site access and design

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7.1 Overview

7.1.1 Purpose

Early consideration of site access facilities and layout design is critical to driving positive outcomes for a development's occupants and affected road users. This chapter presents guidance on how developments can provide safe and efficient site access for various transport modes. It also covers design considerations for individual developments and subdivisions, with an overview of principles, technical standards and guidelines for practitioners to consider when developing TIAs.

Safety is a key consideration when planning and designing a development or subdivision layout. Other factors may depend on the development's local context or subdivision location, urban design and placemaking. In some occasions, councils maintain a broader suite of local strategies, plans and design codes that might be relevant for consideration in preparing development applications. It is important to design practical and convenient site access for all users of different transport modes to ensure safety at all times. In this context, comprehensive planning and design of transport facilities/ development layout is vital for safety by reducing potential conflicts between competing transport modes and prioritising pedestrian and cyclist movements.

This includes consideration of:

- pedestrian, bicycle, micromobility and access for people with disabilities
- access to surrounding public transport networks (i.e. through bus stands, rail stations, light rail stops and ferry wharves)
- access driveways
- access to other key nodes such as schools, shops, and other community facilities
- internal road networks
- delivery and servicing vehicle facilities.

Any lists of considerations in this chapter are provided as guidance and may not be relevant to all developments. Transport planning and engineering practitioners must use professional judgement and work in consultation with built environment practitioners to determine the appropriateness of considerations to the planning and design context of a development.

7.1.2 Structure

This chapter is structured as follows:

- Section 7.2 details key design considerations, including relevant standards and guidelines to site access and parking design, as well as typical road safety considerations
- Section 7.3 outlines requirements and guidelines for site access design, including planning for transport access facilities, requirements for various modes and different purposes and internal road network elements
- Section 7.4 outlines the key considerations for the planning of access and internal road network for a subdivision.

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7.2 Key design considerations

Site layout design should be informed by thorough context and site analysis performed by qualified professionals considering the multiple scales of the district, precinct and street. Some of the key aspects that should be considered in a site layout design, include detailed design and evaluation of:

- Access points between the site and the surrounding transport network for active transport, public transport, freight and servicing (including waste collection), emergency services, and light motor vehicles.
- Access points between the site and the surrounding transport network for active transport, public transport, freight and servicing (including waste collection), emergency services, and light motor vehicles.
- Internal road network including elements like speed limits, on-street facilities for use by pedestrian and cyclists, etc. Consider using the supporting tools of the Movement and Place Framework where applicable.
- Pedestrian, end of trip facilities for cyclist and micromobility users.
- Car parking areas, commercial vehicle access and parking including freight and servicing as well as waste collection.
- Public transport facilities in collaboration with transport authorities, if applicable.
- Built form, facades and frontages in relation to the site context, neighbouring properties and surrounding streets, as it relates to access by all modes, parking, and movements.
- Compliance with Disability Discrimination Act 1992 (DDA) requirements.

In addition to the above, a site layout design should also consider:

- Road safety and alignment with safe system principles, such as reductions in potential conflicts between different transport modes.
- Consideration of the design excellence clause of Local Environmental Plans when designing development layout.

7.2.1 Modal considerations and trade-offs

The Road User Space Allocation (RUSA) Policy seeks to ensure the allocation of road user space considers the place, function and movement requirements of roads to support efficient movement and enhance the amenity of places. This is a TfNSW corporate policy document that applies to TfNSW staff who are involved in the planning, design, scheme approval, building, management or operation of roads in NSW.

The policy principles are beneficial to developers and transport practitioners and may be taken into account when designing and planning for site access and layout where reasonably practicable and feasible.

Application

The RUSA Policy seeks to balance the needs of road users based on network and local context, while maximising the potential for walking, cycling and public transport to shift to more sustainable travel modes.

Work undertaken should also consider the development's characteristics and context. For example, an employment precinct involving freight and servicing vehicles needs suitable design solutions to allow freight movement and ensure safety by minimising conflicts between freight and other transport modes.

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7.2.2 Safety in development design

Safety is a crucial consideration in any development and this outcome can be most influenced early in the concept design phase as well as throughout the design development phase. To ensure the safety of those accessing and passing a development, a TIA must consider the impacts on all road users. This includes pedestrians, people with disabilities, cyclists and micromobility users, as well drivers and passengers of public transport, light vehicles (cars and vans), and heavy vehicles.

The assessment must focus on the four pillars of the Safe System Approach: Safe Roads, Safe People, Safe Speed and Safe Vehicles, and how these can be used to mitigate the risk, particularly of avoidable road user trauma. Mitigation must consider exposure, likelihood and severity issues. This approach supports the Towards Zero commitment to achieve zero trauma on NSW roads by 2050.

For guidance for assessing development road and traffic safety, please refer to the Austroads Guide to Traffic Management, Part 12: Integrated Transport Assessments for Developments and Austroads Guide to Road Safety, Part 6: Road Safety Audit.

Road safety assessment

The scale and nature of road safety assessment depend on a number of factors, such as:

- The type of frontage roads surrounding the development (road classification, traffic volumes, posted speed limit, pedestrian and cyclist volumes etc.).
- Existing road safety issues within frontage roads surrounding the development.
- The development's size, complexity and trip generation (type of land use, turnover of parking, types of road users etc.).
- Potential conflicts between different types of road users.
- Alignment of the road speed limit and other design features with the movement and place function of the surrounding road network and land uses.
- Freight and servicing vehicles parking on-site or nearby.

Typical road safety issues

The purpose of a road safety assessment or road safety audit is to ensure that all potential road safety issues on-site and on the public road network impacted by the development have been identified and addressed. Safety impacts can often extend beyond the development site's immediate vicinity, and consideration should be taken to ensure that safety impacts across the broader road network are addressed.

Depending on the type and scale of the development, the range of matters to be considered varies and includes:

- Pedestrians (including those with vision and mobility constraints) bicycle and micromobility users, and vehicle site access, including:
  - Driveway locations and shape
  - New turning lanes
  - Frontage road impacts at the driveway access point
  - Swept paths of large vehicles
  - Safety impacts of waste collection services
  - Footpath locations near traffic
  - Proposed site activities at the site frontage, e.g. outdoor dining.
- Speeds and visibility within the site and at access/conflict points.
- Pedestrian/cyclist/vehicle conflicts on-site and close to the site and adequate warning signage for all users and sightlines.
- Management and delineation of priority for pedestrians, where road vehicle access to and within the site crosses the pedestrian footpath.
- Road vehicle queues across pedestrian and cycle paths which should be minimised or eliminated.
- Appropriate parking management to avoid parking overflow onto nearby roads.
- Consideration of space required for parking, boarding and alighting of wheelchair accessible vehicles.

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- Ensuring the safety of all users through design principles that prioritise the needs of pedestrians, cyclists and public transport users at all hours.
- Safe provision for public transport (including access to and from public transport).
- Changes to the road environment due to generation of pedestrian and cyclist movements along frontage roads.
- Safety impact of peak period congestion, including changes to turning movements and the use of nearby streets.
- Safety impacts of turn bays overspilling into through traffic lanes caused by additional development related traffic.
- Signal phasing and timing that may not account for appropriate pedestrian phases or adequate crossing times.
- Integration with the existing road environment and function.
- Where possible, the road safety assessment should be undertaken in conjunction with other safety assessments (e.g. Crime Prevention Through Environmental Design (CPTED) assessments for certain types of development as identified by councils) to ensure a consistent and comprehensive approach.

7.3 Site access and facilities design

Consideration should be given to the access demand needed by each transport mode to and from the proposed development, and to ensure requirements of all users are met. Effective provision of access facilities could result in:

- Well-designed walking and cycling access with facilities well integrated with the adjoining road/street
- Efficient vehicle access facilities taking into account different vehicle types, sizes and access requirements (e.g. customers, residents, freight and servicing, waste collection etc.)
- Mitigated impacts on through traffic flows on the road network close to the proposed development.

For large scale subdivision development applications, the subdivision layout should establish a network of street types, public spaces, lots and destinations that balances the movement and place functions.

The layout should have the appropriate road or street types related to the development's trip generation, lot access, on-street parking and verge requirements.

The site access and facilities design should enable safe and efficient pedestrian, cyclist and motor vehicle traffic movements within the development.

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7.3.1 Elements to be considered

When planning the development's access facilities the following elements should be considered:

- Public safety – the access location must not compromise safety for users of the surrounding area.
- Opportunities to prioritise walking, cycling and the use of public transport.
- Impact to surrounding amenity and public domain.
- Origin and destinations of users.

Access facilities should be planned for all transport modes. The following sections provide an overview of the factors that generally influence the location of access facilities. Section 4.3 of Austroads Guide to Traffic Management Part 12 provides guidance on how access facilities of a development should be planned.

Transport modes serviced

The transport mode serviced by the proposed access facility must be considered in detail to ensure accessibility, safety and convenience for users. For example, alignment of on-site footpaths and pedestrian access points, such as entry gates, should consider pedestrian sight lines and desire lines between the site, fronting footpaths, bus stops and nearby facilities such as shops and rail stations. Separation between access facilities of different transport modes, including freight and servicing, should be considered to reduce potential conflicts.

Type of frontage road

A key consideration when planning development site access is the movement and place functions of the frontage roads. The NSW Practitioner's Guide for Movement and Place identifies different street environments within the transport network.

TfNSW general access management practices for classified roads seek to limit the number of vehicular conflict points (access points) on the classified road network. This maintains the ongoing operational performance and safety of the road network post development and is supported by A Framework for Arterial Road Access Management.

In accordance with the policy position outlined in Section 2.119 of State Environmental Planning Policy (Transport and Infrastructure) 2021), access for development should not be provided from a classified road where there is a practical alternative via a lower order road. Lower order roads usually have a greater place context and a slower speed limit with the function of these roads more compatible with the development's vehicle access. Depending on the nature of the site and surrounding roads, access for pedestrian and cyclists would also be appropriate from the lower order road.

Where access to a classified road is required, early consultation with TfNSW should be undertaken to ensure safe outcomes are optimised. Opportunities for consolidation via shared access arrangements should be explored where possible. Direct access to motorways and freeways, and other controlled access roads are generally not permitted. Access to other high-speed roads should be determined in consultation with the relevant road authority.

Auxiliary lanes (deceleration and acceleration lanes) may need to be provided to minimise conflicts between entering/leaving traffic and fast moving through traffic. In many cases, right turn movements into a site may need to be banned, unless an exclusive right turn bay is provided.

Right turn bays for vehicle movement into the proposed development should be provided on major roads, where conflicts between right turn traffic and any opposing major road traffic may cause a substantial delay or safety concern. In a rural context, rural turn lane warrants should be checked for site accesses to the appropriate layout. Refer to the relevant guidance stated in the Austroads Guide to Road Design Part 4A and TfNSW's TS 02642:1.0 Supplement to Austroads Guide to Road Design.

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Sight distance

Driveway access should be positioned where the maximum sight distance can be achieved. It is essential that any vehicle entering or leaving the driveway is visible to approaching vehicles, cyclists, micromobility users and pedestrians.

Consideration should be made for the position of fire hydrants, electric transformers and any other structures within the front setback of a development, ensuring sight distance is not obstructed.

Refer to Austroads Guide to Road Design Part 4A and Section 3.2.4 of AU/NZS 2890.1: Parking facilities, Part 1: Off-street car parking for information regarding Stopping Sight Distance, Minimum Gap Sight Distance, and Safe Intersection Sight Distance for various combinations of frontage road speed, reaction time or gap time.

Intersections

Refer to AS/NZS 2890.1: Parking facilities, Part 1: Off-street car parking and Part 2: Off-street commercial vehicle facilities for requirements on the positioning of driveways from intersections and TfNSW Supplement for Australian Standard 2890 – Parking Facilities for matters relating to road signs. The use of traffic signs should be confirmed with the NSW Traffic Signs Register.

Potential conflicts

Potential conflicts associated with driveways are often proportional to the trip generating potential of the development which they serve.

To minimise conflicts between different transport modes the following should be considered:

- Providing separate access facilities for the different transport modes that access the development (pedestrians, cyclists, motorbikes, cars and services vehicles).
- Establishing safe, clear and convenient pedestrian and micromobility accesses within car park areas with priority being given to them. These accesses should minimise the number of points that cross vehicle paths and be marked to heighten driver awareness (e.g. painting, use of contrasting materials, lighting, speed limit and warning signage).
- Avoiding the following locations when positioning driveways with high traffic and pedestrian volumes:
  - On major roads
  - Close to intersections
  - Opposite other developments generating a large amount of traffic (unless separated by a median)
  - Where there is a heavy pedestrian movement along the footpath, such as main street shops
  - Where there is a bicycle path or other facilities along the frontage street
  - Where right turning traffic entering the facility may obstruct through traffic
  - Where traffic using the driveways interferes with or blocks the operations of bus stops, traffic signals, light rail, taxi ranks, loading zones or pedestrian crossings.

Consideration must also be given to freight, waste collection and other servicing tasks that support the development. Informed planning for urban freight and servicing offers benefits for the surrounding road network and service providers. Consideration should be given to how trade and service vehicle movements vary in size and function on a site, kerbside, precinct and network.

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7.3.2 Planning and design of transport access facilities

When planning and designing transport access facilities for a development, the following design principles should be considered:

- Understanding physical and behavioural aspects of the context to design a holistic solution for all users of the development.
- Enabling safe and equitable access for future residents, workers, visitors and customers, taking into account that some of them will access the development by means other than private car.
- Separating or co-locating access for different transport modes that service the development, depending on the site layout, volumes of traffic and context, without compromising user safety.
- Positioning pedestrian and bicycle access points as close as possible to facilities on the frontage road, such as a pedestrian crossing or bus stop, under cover bicycle parking, and considering pedestrian desire lines to and from the development to nearby amenities and rail stations.
- In consultation with the road authority, providing links to nearby public pedestrian and bicycle facilities considering access needs, and links to cycle routes and public transport.
- Site access should be located at the furthest possible distance from the nearest road intersection on the kerbside lane adjacent to the site.
- Avoiding reversing movements into or out of public streets (except in the case of individual dwelling houses).
- Avoiding arrangements which may result in on-street queuing by providing adequate storage space for vehicles entering the site, particularly for school access or emergency vehicles.
- Positioning each driveway so that it is clear of all obstructions, e.g. poles and trees, fire hydrants and electric transformers, which may prevent adequate sight distance for drivers.
- Sign posting access driveways in larger car parks or developments with appropriate entry, exit and keep left signs if appropriate and applicable.
- Relocating or installing new bus stops adjacent to the main pedestrian entrance(s) of major developments such as shopping centres, health, educational or recreational development or other major institutions.

Vehicle access design should enable vehicles turning into the kerbside lane from the development driveway and vice versa, particularly for classified roads, subject to road safety requirements. Where vehicle access is located on a single carriageway, it should be designed to enable all vehicle turning manoeuvres without crossing the road centre line. Particular care should be taken to minimise and manage conflict between vehicles entering and exiting a development that cross the path of accessing pedestrian or cycle facilities.

The choice of turnout radius for a kerb return driveway design depends on the type of vehicle being accommodated. The design vehicle swept paths should be referred to Austroads Design Vehicles and Turning Path Templates. While planning access facilities for service vehicles, the longest service vehicle that will service the development should be used as the design vehicle and ensuring the safety of other road users such as pedestrians and cyclists. However, consideration should be given to other vehicles that require access such as buses or emergency vehicles, as well as “general access” vehicles as defined in the NSW Heavy Vehicle Access Policy Framework, while also taking into account any limitations on the adjacent roads.

Pedestrian, cyclist and micromobility access

The safety of pedestrians, cyclists, motor vehicle micromobility users (including for people with disabilities) is a critical aspect in the planning and design of access facilities. Site layout should ensure that access facilities are designed to minimise conflicts points between all users. Another critical aspect to consider includes designing access paths that are legible, direct, sheltered and well-lit at night, as well as aligning with pedestrian and cyclist desire lines to encourage usage.

Consideration should be given to the site permeability and the ability for pedestrians, cyclists and micromobility users to travel through a development site where appropriate. The design of signage and pavement markings must consider the relevant standards and be correctly installed. Suitable footpath/walkway access to those with disabilities under the Disability Discrimination Act (1992) and adequate access for all users with mobility constraints to all areas within the development including car parks, must be provided. Guidance on continuous accessible paths of travel should be referenced to the relevant sections in AS1428 Design for access and mobility.

Where a footpath, shared path or cycleway meets a trafficked area, consideration must be given to safety, and whether users can see each other in sufficient time to avoid a collision. Delineation and signage to indicate priority for pedestrians and/or cyclists must be considered. Where practicable, pedestrian links should be provided under cover and be appropriately lit. The principles presented in the Crime Prevention through Environmental Design (CPTED) Guideline must be considered in the design process.

Public transport access

Public transport is integral to realising the 30-minute city concept for Greater Sydney and outer metropolitan regions, and to enhancing access and mobility across regional NSW.

With walking and cycling often providing the last-mile connection between a development and public transport, developments should prioritise pedestrian and cyclist paths, facilities, and crossings. This enables access for users to and from public transport facilities such as bus stops, railway stations and ferry wharves.

All developments should consider the following aspects when assessing the accessibility of a development to and from public transport:

- The role of public transport in any local and regional Travel Demand Management strategy.
- The proximity of the development to existing transport infrastructure and services (such as rail stations and bus facilities).
- The provision of safe, direct, controlled (where possible) and well-lit pedestrian routes to and from bus stops, railway stations and ferry wharves.
- Strategies to encourage the use of public transport as part of a Travel Plan, such as reduced on-site parking.
- Requirements for improved or new public transport infrastructure and services, including access to these facilities (see Section 6.5 for further details about developer's contributions).

Applicants of larger developments should contact TfNSW for advice on current and future public transport services in the vicinity of the development. The relevant consent authority should also be contacted, and community consultation be undertaken as part of the approval of new stops, stations or ferry wharves.

Freight and servicing vehicle access and facilities

The planning and design of all freight (including deliveries) and servicing vehicle access facilities must consider AS 2890.2:2018 Parking facilities, Part 2: Off-street commercial vehicle facilities and TfNSW Supplement for Australian Standard 2890 – Parking facilities. Practitioners should also consider Austroads Guidelines for Planning and Assessment of Road Freight Access in Industrial Areas, Austroads Guide to Road Design, Austroads Guide to Road Safety, Austroads Guide to Traffic Management and TS 05384.12 Supplement to AS 1742 - Manual of Uniform Traffic Control Devices - Part 12 Bus, transit, tram and truck lanes. This may include bulk freight vehicles, delivery vehicles, coaches, couriers, waste collection trucks and other service vehicles.

In general, all delivery and servicing should occur within the site unless agreed by the consent authority or advised otherwise by Local Environment Plans (LEPs). Delivery and service vehicle trips to and from the development should be managed to reduce the potential impacts on the frontage roads to ensure efficient use of loading and service areas.

With respect to vehicle size, the internal site layout, location and design of service access facilities should consider the following:

- Consulting with the roads authorities of the frontage roads to ensure that they meet traffic management requirements, such as moving mobile plants and vehicles during construction or any special events/activities.
- The ability of freight and service vehicles to safely enter and exit the site in a forward direction, as well as safely maneuver within the site, and travel between internal access points.
- Adequate off-street loading facilities are provided to meet the demands of the development and not rely on the local road network and kerb space.
- A plan for the safe management of delivery, service and waste collection vehicles.
- With respect to vehicle size, the internal site layout, location and design of service access facilities should consider:
  - Number and type of loading and servicing spaces and their location.
  - Place context of the frontage roads.
  - Access requirements to the loading and servicing space.
- Sufficient provision on-site for standing, loading, unloading and turning of all traffic likely to be generated, including adequate storage for vehicles queuing at security gates and considering an adequate rest area for truck drivers in the case of industrial estates.

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- Sufficient hard stand areas for at-gate security checking and loading and unloading of vehicles within the site without impeding traffic movements.
- The needs of the largest vehicles likely to regularly access the site (e.g. removalists trucks and overhead loading waste collection vehicles. In some developments large vehicles such as 26 metre B-doubles and 19 metre semi-trailers may also need to be accommodated, etc.).
- Waste and recycling collection as an essential service for a development. Consideration should be given to the waste servicing strategy, proposed collection methodology, waste collection vehicle size, frequency of collection and waste management controls as stated in DCPs and relevant guidelines if applicable, including Council's standard waste vehicle for residential waste collection and use of standard or non-standard vehicles for non-residential waste collection around waste storage and proximity to loading bays.
- Avoidance of reversing maneuvers within sites and where it is not possible, consider systems and infrastructure to assist with safe servicing.
- Food delivery servicing strategy, including need for refrigerated storage close to loading dock.
- Multimodal servicing strategy, including cyclists or walk up deliveries servicing from off-site parking spaces.
- Whether separate accesses for service and light vehicles are required to reduce conflicts and improve safety.
- Additional mitigation measures in high-demand pedestrian and cyclist environments, such as traffic controllers or heavy vehicle safety features, to increase the safety interactions with pedestrians and cyclists.

If the proposed land use change is industrial in nature, the State Environmental Planning Policy (Resilience and Hazards) 2021 must be referred.

TfNSW has developed a Last Mile Toolkit, which can assist in identifying the loading dock space requirements for an urban site, based on land use type, total development size, number of tenancies and the nature of the business. This toolkit should be referred to when planning and designing service vehicle facilities for any new, extended or upgraded developments. The Urban Freight Forecasting Model (UFFM) can be used to estimate the number and mix of dock space required for a development. Refer to Section 5.5.2 for more information.

Emergency service vehicle access

Site layout design should consider emergency vehicles access, such as fire service vehicles, ambulances and police vehicles. Other emergency services, such as access to the water or gas systems within the development in case of emergency repair, should also be considered in the site layout design.

Land uses such as aged care homes, medical clinics and hospitals also have specific considerations for unobstructed ambulance access and parking.

Site access and design should consider the design guidance set out in the Fire Safety Guidelines – Access for fire brigade vehicles and firefighters. For building in a bush fire prone area, reference should be made to Planning for bush fire protection.

Internal road network in development

The development's internal road network provides access between the access points (from the adjoining road network) and on-site parking areas and loading docks. The internal road network should be designed to prioritise the safety and movement of active transport users. It should also satisfy the last mile freight access and any applicable road based public transport services (for example on-demand buses) in accordance with an approved concept masterplan in the event of a staged DA or development proposal being lodged.

Internal road networks may include circulation roadways and ramps within car parks. The internal site layout should ensure there is sufficient queuing area at each access point and should be resilient to incidents such as vehicle breakdowns or failure of parking ticket machines. This may include alternate routes through the site, alternate access points or ensuring that the circulation roadways and ramps allow for the largest design vehicle to pass where required. A queuing analysis might be required to justify any short queuing areas behind access gates, car lifts, turntables or controlled signals internal to site are provided proximate to the external road network.

The design of circulation roadways and ramps in a development should consider Australian Standards 2890 – Parking facilities, and should also reference Austroads Guide to Traffic Management, Austroads Design Vehicles and Turning Path Templates and Austroads Guide to Road Design, and Supplements to Austroads published by TfNSW.

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7.4 Access and road network for subdivisions

A DA for a subdivision requires different treatments and considerations, such as creating new public roads, catering for general traffic and addressing broader safety concerns.

In the context of subdivision of land, the development's internal road network layout, location of parking and service accesses can significantly impact the transport planning outcomes. The planning and design of site layout and parking facilities should also consider road safety and the place impact of the development on the surrounding area and public domain.

7.4.1 Planning and design principles

The Network Planning in Precincts Guide provides best practice principles, tools, examples and case studies that demonstrate efficient movement as well as desired place, safety and environmental outcomes.

Transport network planning is generally undertaken for a broader area scale, such as for a Local Government Area (LGA) or a precinct. Some of the Network Planning in Precincts Guide principles that could be considered in subdivisions, include:

- Developing an urban structure that supports successful places and encourages walking, cycling and public transport journeys.
- Creating a permeable network with a grid-like structure, short block lengths and high intersection density, with the use of well-designed roundabouts to moderate vehicle speeds and resolve intersection conflicts.
- Planning public transport infrastructure, services and technology concurrently.
- Accommodating the movement of goods, freight, waste collection and other urban services based on the desired place outcomes.
- Designing street environments following the NSW Movement and Place Framework.
- Consider and preserve connections with adjacent future developments to minimise the need for creating additional access onto the classified road network.

7.4.2 Traffic speed, traffic volume and carriageway width

For traffic management in a large scale subdivision development, particularly a residential environment, the planning and management of road space should consider reducing traffic volumes and speeds in local streets to improve safety and access for residents (for example pedestrians and cyclists). Refer to Austroads Guide to Traffic Management Part 8: Local Street Management and TS 05394.8 Austroads Supplement for Guide to Traffic Management Part 8 Local Area Traffic Management and Design of Roads and Streets Guide for guidance on the selection, design, and application of traffic control measures for a systematic approach to traffic management in local areas.

For a local street network that requires bus services, the design principles and requirements provided in the Guidelines for Public Transport Capable Infrastructure in Greenfield Sites must be considered to allow for efficient and reliable public transport service that can be integrated into the broader transport network. Local streets should also be designed to accommodate Council's standard waste collection vehicles.

7.4.3 Pedestrians

Where there is likely to be a high pedestrian demand, traffic details of the area must be examined carefully for pedestrian safety. Visibility is a significant factor which must also be considered in assessing these situations. Pedestrian networks should be planned to promote continuous connection that creates walkable neighbourhoods which focus on centres and public transport nodes. Walking should be considered a movement system, rather than just space on the side of vehicle roads. The pedestrian network should have more connectivity and permeability than the vehicle laneways.

Footpaths

Subdivisions should provide safe and comfortable environments with sufficient space to encourage people to walk. Provision of footpaths on both sides of a carriageway should be provided.

Generally, Council DCPs, codes and guidelines provide the necessary guidance on the planning and design of footpaths/shared paths. In the absence of local guidance or if supplementary guidance, is required, the TfNSW's Walking Space Guide provides planning principles for footpaths serving different

types of street contexts and should be considered as best practice from a pedestrian usage perspective. The Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling provides guidance on the design criteria for different types of paths including pedestrian paths and shared paths, which could be referenced in the absence of local guidance.

Pedestrian crossing

Pedestrian desire lines should be taken into account when planning crossing points within the wider pedestrian network to ensure safety, accessibility and continuous connectivity. The appropriate type of facility at each location depends on the expected demands, available road space and safety considerations. A key consideration associated with the design of pedestrian crossings is to minimise the crossing distance for pedestrians as much as practicable.

In a subdivision development involving a network of internal streets, pedestrian crossings should be located at places where traffic speed is suitably reduced. Refer to Austroads Guide to Traffic Management Part 8: Local Street Management and TS 05394.8 Austroads Supplement for Guide to Traffic Management Part 8 Local Area Traffic Management and AS 1742 Manual of Uniform Traffic Control Devices for guidance on the selection, design, and application of traffic calming measures.

A fundamental objective for pedestrian links in a subdivision is to allow pedestrians to cross streets without undue delay. The delay factor varies according to traffic flow, the carriageway width and the degree to which parked cars cause difficulties for pedestrians wanting to cross the road. Sufficient sight distance at pedestrian crossing points is essential to ensure safety. Refer to Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections for sight distance calculations for pedestrian visibility.

One way to make it easier to cross a wide and busy road is to separate the carriageway so that the crossing can be made in two attempts. While it is not necessary that all parts of a residential street accommodate cross pedestrian movements, pedestrians should be appropriately catered for at intersections.

TS 00043 Pedestrian Crossing Guideline, Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management and Austroads Supplement for Guide to Traffic Management Part 6 Intersections, Interchanges and Crossings provide further details relating to the planning and design guidance for pedestrian crossing.

Pedestrian access and facilities for schools

Large subdivisions may include community facilities, such as schools. When evaluating and planning school pedestrian facilities, the following should be considered:

- The nature of the walking environments within the school catchment area.
- Pedestrians generally take the shortest route between two points irrespective of potential road danger.
- The most direct route from the school entrance to any street in the development is the most preferred route, unless specific measures are taken to divert the journey to a safer route.
- When crossing arterial and other busy roads, the majority of children use traffic signals, pedestrian crossings, children's crossings and marked foot crossings. However, random crossing movements on all road types is still a matter of concern so the design needs to accommodate these movements to ensure safety is adequately addressed.
- Evaluate the adequacy and safety of existing pedestrian facilities along the pedestrian desire lines between school and the surrounding residential developments where students are not eligible for free school travel pass under the School Student Travel Scheme.
- When planning the school entrance locations, consideration should be given to the interface between pick-up, set-down or overspill parking and the adjoining roads and streets, to ensure road safety is adequately addressed.
- As the school entrance area is used by children enroute to home and to parents' cars, it is important that the most popular routes are traced, and appropriate safety measures are added.
- Provision must be made for buses (including a set-down area).
- Lower speed limits with associated infrastructure to make lower speeds self-enforcing.

It should be noted that some of the above points could also be applied to community facilities which require similar consideration for their planning and design.

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7.4.4 Cycling facilities

Cycling movements must be safely and efficiently accommodated by developments through local roads, shared paths or dedicated cycleways. An integrated approach to planning accounts for the movement and place functions of the location, its associated infrastructure and local context.

A safe system approach for cycling requires the appropriate selection of infrastructure type based on travel demand and speeds, as well as appropriate design and location of the cycling network. It incorporates aspects like adequate lighting, line markings, minimising the use of curves and steep gradients, and a smooth road surface. Ultimately, the objective is to support a transport system that is safe for all road users.

When planning a cycle/shared path in residential streets, consideration should be given to the location of potential conflicts where two or more transport modes interface. Consideration should also be given to waste collection on residential streets where waste collection vehicles using side loader arm might be used and reach over an on-street cycle path to collect bins. The cycle path design on a commuter route should carefully consider the speed limit in relation to the surrounding environment and safety of other road users who might interface with the route.

In existing networks, the general traffic flow (combined with the implementation of traffic control measures) may create pinch points which hinder cyclists. These types of pinch points should be avoided by fit for purpose design in new subdivisions. Bicycle lanes should be provided to accommodate cyclists ensuring safety and encourage the use of active transport modes.

The Cycling Aspects of Austroads Guides and Austroads Guide to Road Design Part 6A: Path for Walking and Cycling provide further details on the planning and design of cycling path and associated facilities.

Emerging micromobility considerations

The NSW Government is working closely with NSW councils to enable trials of shared e-scooters. TfNSW has been enabling local councils to run e-scooter trials across NSW since 2022. In June 2024, an improved application process has been put in place to make it easier and faster for councils to participate in this trial. Refer to the NSW Shared E-scooter Trial Program for more information.

7.4.5 Bus route provision

Streets to accommodate future bus routes must be identified in subdivisions, based on the routes approved by TfNSW, so that appropriate planning measures can be undertaken to provide practical direct route paths, integrating land use and connecting pedestrian networks to bus stops and local centres.

Relatively direct street alignments enabling bus routes to run through subdivisions past local centres and connecting with neighbouring estates are important factors for efficient bus operation. Attractive public transport services capable of competing with the private car depend on quick, direct and efficient bus routes with stops easily accessible by foot from residences and other land uses in the vicinity. There is also the opportunity to facilitate bicycle-bus multimodal trips by providing bicycle parking and supporting infrastructure around key bus stops and transport nodes. The location of schools, shops, and other community facilities in local centres or along bus routes makes these activities easier to access by public transport.

TfNSW bus service guidelines aim to bring bus services to within 400m of most residences and this is usually achieved by running buses along Collector Roads and Sub-Arterial Roads in subdivisions. At times it may be necessary to operate buses on narrower local access streets to ensure service coverage. The long-term success of bus routes and public transport usage depends on walking connectivity to bus stops on routes that are relatively direct linking to centres and railway stations.

Bus-Only links providing bus short-cuts between adjoining estates and suburbs can facilitate more direct and faster public transport without generating traffic “rat-runs” in residential areas. These links can also accommodate pedestrian and cycle paths.

The TfNSW Guidelines for Bus Capable Infrastructure in Greenfield Sites provides design principles and requirements for bus infrastructure in new subdivisions including traffic lane widths and bus stop requirements.

Discussions with TfNSW should be undertaken to ensure that proposed bus infrastructure is aligned with wider public transport network planning in the area, and to ensure that bus stops are appropriately located to meet current and future user needs. Detailed road design and any works or structures within the road corridor (including road reserve) require the approval of the relevant road authority under section 138 of the Roads Act 1993, regardless of the planning approval pathway selected.

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7.4.6 Access for emergency services

In subdivision design, emergency service vehicle access should be considered, for example fire service vehicles, ambulances and police vehicles.

These vehicles should be able to travel from a Collector Road to the most remote lot in a reasonable time. This should be considered in the overall street layout of the subdivision.

For developments in bush fire prone land, subdivision development design should refer to the requirements set out in the Planning for Bush Fire Protection Guide as well as the Fire Safety Guidelines – Access for fire brigade vehicles and firefighters which is applicable to access design of all subdivision developments.

7.4.7 Detailed geometric design

A balanced approach should be adopted for the geometric design of local access streets and laneways in subdivisions.

Design should ensure safety, operational efficiency and adequate space for users of all transport modes, while creating safe and attractive walking and cycling environments. Refer to Austroads Guide to Road Design Part 3: Geometric Design and TS 02642.3 Supplements to Austroads Guides – Road Design Part 3 and any relevant design guidelines published by councils.

The consent authority, usually the local council, must assess the practicality of the overall design to ensure the desired traffic speed and traffic volume objectives can be achieved.

Chapter

8 Parking provision and design

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8.1 Overview

8.1.1 Purpose

Parking is an essential component of the transport system, enabling the safe storage of vehicles while not in use at a given location. Off-street parking is the preferred option for the storage of vehicles, with on-street parking mainly used in urban centres to service road users with the need for high levels of access, including people with disabilities and emergency services.

This chapter outlines guidance about off-street parking provisions, design of parking areas for various modes and provides TfNSW reference rates for specific land uses. The principles and parking rates presented in this chapter should be considered as guidance and is intended to serve as supplementary information to local Council parking controls.

8.1.2 Structure

This chapter is structured as follows:

- Section 8.2 describes parking principles and car parking management approaches
- Section 8.3 outlines how to determine and adjust off-street car parking provision and estimate car parking demand
- Section 8.4 provides guidance for the design and provision of parking for various modes
- Section 8.5 provides TfNSW reference car parking rates and guidance for specific land uses.

8.2 Principles of parking management

8.2.1 Parking principles

This section provides definitions of key parking principles which describe the nature of parking and offers a base understanding of parking operations.

Parking supply and demand

Parking supply for a development refers to the total number of off-street parking spaces or facilities available. Parking demand is the amount of parking that is needed to accommodate vehicles at a specific time and place. An imbalance in parking supply and demand can lead to either insufficient or excessive parking.

Parking occupancy or utilisation

Parking occupancy or utilisation describes the percentage of parking spaces that are occupied at a given time in relation to the total available parking spaces. It measures how efficiently parking resources are being used and reflects the relationship between parking supply and parking demand.

Parking duration and turnover

Parking duration refers to the length of time a vehicle occupies a parking space. Parking turnover describes how frequently a parking space becomes available over a defined period of time. The two interrelated concepts are typically inversely related and are used to identify the number of opportunities for vehicles to occupy a parking space, with more opportunities indicated by a short parking duration and high parking turnover.

8.2.2 Car parking management approaches

These approaches are strategies and techniques used to effectively design and control the use of car parking resources. They aim to balance supply and demand, promote efficient land use and support mode shift where alternative transport options are viable. This section summarises key parking management approaches that a development may consider based on the proposed land use context and nature of the expected parking demand.

Restricting parking provision can reduce development construction costs, maximise productive floor space, increase parking utilisation and increase affordability of housing options. It requires effective on-street parking controls to avoid parking spill over onto local streets. Appropriate restrictions in parking provision can encourage a mode shift to alternative transport options.

Shared parking arrangements allow multiple land uses or businesses within a development to share parking spaces based on varying peak demand. These land uses take advantage of different demand profiles and demand peaks between individual land uses to increasing parking utilisation and reducing the provision of parking. An example of complementary mixed use is night-time entertainment with day-time employment uses.

Parking pricing strategies such as ticketed parking or pay-per-use systems, allows users to pay for their actual parking time while enabling operators to monitor and regulate parking activity. These strategies encourage parking turnover and increase parking utilisation. Pricing can be adjusted based on factors like time of day, duration of stay or demand.

Travel Demand Management (TDM) measures encourage mode shifts in travel behaviour which can reduce requirements for car parking provision. Examples include offering incentives like subsidised public transport passes, carpooling programs, and preferential parking for carpool users. TDM measures must be suited to the proposed development and implemented to ensure outcomes are achieved.

Unbundled parking refers to the practice of separating the parking cost from the cost of housing or other amenities. In this arrangement, residents or users of a development are charged separately for parking, meaning they pay for parking spaces only if they want them. This can improve affordability and increase parking utilisation.

Decoupled parking refers to separating the provision of parking from the use of a particular property. It can encompass various scenarios, including the provision of off-site parking or shared parking facilities for multiple developments. This provides opportunities to improve urban design outcomes by not requiring on-site parking, and can reduce the development construction cost and help maximise productive floor space.

8.3 Car parking provision

The estimated car parking demand of a development is useful in determining the appropriate car parking provision for a development. In general, determining car parking provision involves:

1. Understanding local requirements as described in Section 8.3.1.
2. If there are no requirements present, practitioners can estimate the parking demand of the proposed development. This may be through a parking study and understanding the factors that influence parking demand. The TfNSW reference rates or First Principles may help in estimating parking demand where no prevailing requirements are available. See Section 8.3.2.
3. Based on parking demand analysis, adjustments to car parking requirements may be proposed. Any proposed change should consider estimated parking demand and site-specific conditions that may warrant adjustments. A consent authority may consider adjustment based on other provisions such as TDM measures, bicycle parking, car share parking, and public transport accessibility.

8.3.1 Parking controls

Parking for a development should satisfy requirements for cars, bicycles, delivery and servicing vehicles, as provided in relevant planning instruments. These requirements are typically outlined in Environmental Planning Instruments (EPIs) such as Local Environment Plans (LEPs) as well as Development Control Plans (DCPs). In some circumstances, off-street parking requirements for specific land uses are specified in State Environmental Planning Policies (SEPPs) such as:

- Affordable housing and diverse housing as specified in the State Environmental Planning Policy (Housing) 2021.
- Residential apartment development as specified in State Environmental Planning Policy (Housing) 2021 and the Apartment Design Guide (ADG).
- Dwelling houses and attached development as specified in the SEPP (Exempt and Complying Development Codes) 2008 (Codes SEPP) and the Low Rise Housing Diversity Design Guide.

Note

The ADG notes that the minimum parking requirement for residents and visitors is the lower of the rates set out in Guide to Traffic Generating Developments (GTGD), or the car parking requirements prescribed by the relevant council.

Noting GTIA supersedes GTGD, any references to GTGD in the ADG refer to GTIA.

Application

The parking controls specified in LEPs and/or DCPs take precedence over the parking rates set out in this Guide to the extent of any inconsistency. The exception to this are circumstances, as stated in Section 8.3.1, where other EPIs prevail.

If there are no prevailing requirements, the TfNSW reference rates for specific land uses as presented in Section 8.5 may be considered for the development.

In the absence of specific requirements, independent surveys or First Principles analysis should be undertaken to estimate parking demand and determine parking provision for a development.

Car parking rates can be defined as:

Maximum parking rates specify the "upper limit" or maximum number of parking spaces that a development is to provide for a given land use. These rates are intended to control the provision of parking spaces, typically in inner metropolitan areas where there is high accessibility to alternative transport options.

Minimum parking rates specify the "lower limit" or minimum number of parking spaces that a development is to provide for a given land use. These rates are intended to ensure that there is an adequate supply of parking to meet the estimated demand.

Target or reference parking rates typically specify a reference point for the number of parking spaces that a development may provide for a given land use. These rates are not intended as minimum or maximum parking rates. The parking provision may be above or below this rate based on the development proposed and the local context.

This Guide shifts away from minimum rates contained in the GTGD and provides reference rates. Although minimum parking rates have been widely applied across NSW, maximum parking rates or reference parking rates are increasingly being adopted. Maximum rates are common in areas of high levels of access to public transport and in areas where a wide range of services and amenities are available. Local councils are encouraged to review their parking controls and rates to suit their local context and desired outcomes.

Parking strategies

A parking strategy is a comprehensive plan that outlines a local council's approach to managing parking within its local government area to meet their transport and planning objectives and community needs. These strategies can include proposed pay or permit parking schemes, supported by parking studies and community consultation.

One of the main objectives of pay parking is to optimise access to parking spaces by increasing parking turnover. There may also be higher transport objectives such as management of travel demand or influencing travel mode choices through pricing mechanisms. Parking permits help to improve amenity for road users in locations where there is insufficient off-street parking and where on-street parking is restricted. Permit parking also helps to balance the needs of the local community in areas of high demand.

The provision of parking within a development should be considered in the context of the parking strategy adopted by local councils. Generally, developments with on-street parking conditions such as metered, short-duration regulated parking or residential parking schemes are less likely to cause overflow parking impacts. This may provide opportunities to increase utilisation of off-street parking facilities or reduce parking provision off-street without adversely affecting the surrounding road network.

Payment in lieu

Some local councils may have a scheme in place, such as a Section 7.11 contribution plan, which enables developers to pay a contribution to council for the provision of off-site parking facilities in lieu of developers providing vehicle parking on-site. Such arrangements can be useful for small developments where providing off-street parking spaces may not be practical, or situations where councils wish to consolidate parking facilities away from a particular area.

Car parking credits for existing developments

In certain cases, developments may have been established without, or with only a proportion of, the off-street parking required under a current DCP. In some instances, a local council may allow lower parking provision based on the historic deficiency, however it is critical to check with the relevant council and its planning regulations and policies.

8.3.2 Estimating car parking demand

Estimating car parking demand associated with a development assists in determining the appropriate provision of parking and to optimise parking utilisation. The car parking demand will depend on the development characteristics and the surrounding transport network, including:

- Development type
- Development size
- Number of residents, visitors and/or employees
- Proximity to nearby centres and/or neighbourhood
- Accessibility to public transport infrastructure and facilities
- Car mode share
- Existing traffic and on-street parking conditions.

Factors influencing parking demand

Parking demand is an important consideration for a Transport Impact Assessment (TIA) as it influences the design, cost and access of a development. Parking demand is dynamic in nature and influenced by factors including:

Land use: Each land use has a unique parking demand profile based on the activities occurring on-site. Surrounding land uses can also influence parking demand for a given location where access to parking is shared.

Location: Different areas have unique characteristics including geography, population density, proximity to key destinations and economic activities. For example, an urban centre compared to a regional centre.

Time of day: Parking demand can fluctuate throughout the day, week and year depending on the type of development. Peak parking periods are defined as the time where parking demand for the development is at its highest for a given period of time. Peak periods may align with business hours, evenings, weekends, special events or seasonal holidays.

Transport options: Areas with access to a wide range of transport options as an alternative to private vehicle travel including public and active transport, car share and ride share services can reduce parking demand.

Private vehicle ownership: Areas that are well located near mass transit in high activity areas may encourage lower private vehicle ownership and can therefore influence the underlying demand for car parking. Locations with higher private vehicle ownership correlate with higher parking demand. The availability of free or inexpensive secure parking in close proximity to the intended destination also affects mode choice and parking demand.

Surrounding amenities: Neighbourhoods may contain homes, schools, shops, cafes, businesses, community services and green infrastructure as well as public transport stops and stations. When these neighbourhoods are in proximity, they encourage people to live, learn, work, shop and engage in recreational activities using alternative transport options to private vehicle travel which may lead to a reduction in the demand for car parking.

TfNSW reference rates

TfNSW reference rates for specific land uses are included in Section 8.5 and can be used if no prevailing requirements are available as stated in Section 8.3.1.

It is important to distinguish that these parking rates are not requirements and are provided to assist in determining a suitable number of parking spaces for the development considering its local context.

Parking demand could be higher or lower than the TfNSW reference rate depending on the context and site-specific factors. These may include:

- Proximity to a nearby centre
- Access to public transport and car mode share
- Suitable TDM measures
- Shared use with another development with different peak usage.

First Principles

This section provides guidance to estimate car parking demand for a development using First Principles as an alternative to the TfNSW reference rates.

Practitioners using First Principles should first consult with the consent authority to confirm the methodology before adopting a First Principles approach. This approach requires professional judgement in setting appropriate assumptions that best reflect the situation to be assessed.

Short Stay

Short-stay parking can be modelled as an Erlang Loss system. It assumes that cars arrive according to a Poisson process, and the time they spend in the carpark is exponentially distributed. If the car park is full when a car arrives, it will overspill because the system is full. The following equation is used to determine the number of parking spaces required to accommodate the parking demand with an acceptable threshold for the overspill of cars into the public domain. An Erlang Blocking Calculator (Erlang B) can be used online to apply the formula.

$$P_n = \frac{\left(\frac{\lambda}{\mu}\right)^n \frac{1}{n!}}{\sum_{k=0}^{n} \left(\frac{\lambda}{\mu}\right)^k \frac{1}{k!}}$$

Where:

P_n: the probability of overspill

n: the number of parking spaces

λ: average number of cars arriving per unit of time

μ: $\frac{1}{\text{average time spent in car park}}$

The number of visitors and estimated length of stay should be validated against trip generation rates, and as a sensitivity can be compared to average trip generation and peak parking accumulation rates. Professional judgment is required to determine if deviations in the length of stay are reasonable. A key element that requires reasonable judgement is the proportion of cars that overspill into the public domain is below an acceptable threshold. As a reference, an overflow of one per cent represents a "peak of peaks", such as several days a year, while five per cent may represent a few hours a month.

Example

A bulky goods store of 10,000m² Gross Leasable Floor Area (GLFA) is applying First Principles for the Sydney weekend site peak hour. An overspill rate of five per cent and duration of stay of 30 minutes is determined as appropriate given the local context and the average rate from Table 5.36 of 3.75 vehicle trips/100m² GLFA for site peak hour is applied. The Erlang can be calculated by multiplying 375 vehicles/hour by a stay duration of 0.5 hours, giving 187.5, while P_n (sometimes referred to as Grade of Service) is 0.05. Using an Erlang B calculator, the number of parking spaces (sometimes referred to as lines, capacity, or channels) required to accommodate the demand is determined as 190 car parking spaces or 1.90 car parking spaces/100m² GLFA.

As a reference, the "Hardware and bulky goods stores (2009)" survey found that peak parking accumulation was 1.57 car parking spaces/100m² GLFA".

Long Stay

Long-stay parking may be determined on a population basis and the typical mode share. For non-residential developments, estimating parking demand may involve the average number of workers and the typical Journey to Work (JTW) mode share. Consideration should be given to future change of use, such as an increase in the number of workers or changes in mode share.

For office development, the proportion of the Gross Floor Area (GFA) that is attributable to each work-point, then adjusting for typical work-point vacancy and average proportion of workers offsite/working from home, determines the number of workers per square metre of GFA. This can be calculated using the Gross Leasable Floor Area (GLFA) and an assumption about building efficiency (GLFA/GFA). Typically, an assumed building efficiency is 60 to 80 per cent where there are higher efficiencies for modular arrangements (e.g. offices, call centres) and lower efficiencies where circulation or break-out space is required (e.g. classrooms, labs, courtrooms). Adjustments for work-point vacancy and workers offsite/working from home can be informed by:

- NSW Common Planning Assumptions – Workspace Ratios
- Australian Government Office Occupancy Reports
- NSW Remote Working Insights.

Parking demand can be estimated by the local average JTW car mode share, the Movement and Place mode share webmap or Australian Bureau of Statistics, Place of work (POWP) data.

Example

An office development with a GLFA of 15m² per work-point and a building efficiency of 80%. This gives a rate of one work-point per 18.75m² of GFA. Adjusting for a work-point vacancy rate of 10% and an average proportion of workers offsite/working from home of 20%, the building occupancy can be estimated to be 70% and a rate of one worker per 26.8m² of GFA.

The local average JTW car mode share of 40 per cent is applied to estimate a parking demand of one worker per 67m² of GBA or 1.5 car parking spaces per 100m². As a reference, the car mode share is indicative of an office development in a Category 1 area and comparable to the TfNSW reference rate provided in Table 8.5.

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8.4 Design of parking areas

Designing parking areas involves creating functional and efficient spaces for vehicles to be parked conveniently and for people to walk safely from their vehicles into the development. Whether in urban areas, commercial centres, shopping centres, residential complexes, or other settings, the design of parking areas is essential to ensure safe traffic flow, maximise space utilisation, and enhance user experience. Parking areas are designed for various users, including people with disabilities, motorcycles, bicycles, pedestrians and delivery and servicing vehicles. LEPs or DCPs may contain requirements for off-street parking design and provision for various modes.

The following principles should be considered when designing parking areas:

- Using Crime Prevention Through Environmental Design (CPTED), such as positioning parking spaces which can be seen from nearby habitable areas and public spaces. Refer to NSW Car Park Guidelines for Crime Prevention for more information.
- All aisle widths and alignments are to be arranged to ensure safe and efficient access to parking areas/spaces (including turning path analysis).
- Provision of adequate lighting to ensure a feeling of security and safety for all users.
- Safety of pedestrians and cyclists to access and travel within the parking area.
- Reduction of potential conflicts between all users.
- Ability to undertake an adaptive re-use on above ground car park levels.

Guidance on the design of parking facilities can be sought from:

- AS/NZS 2890 Parts 1 to 6, parking standard series provides minimum requirements for the design and layout of off-street parking facilities, including multi-storey car parks for motor cars, light vans and motorcycles. It includes access and egress requirements for both public and private car parks, and car parking on domestic properties.
- Guide to Traffic Management Part 11: Parking Management Techniques provides guidance for planners and engineers to ensure that parking is provided in a safe and efficient manner and with due regard to considerations of access to and the impact on the wider road and transport system. Specifically, Section 8 addresses the location of off-street parking facilities and provisions for road users other than car drivers, special event parking and parking payment systems.

8.4.1 Parking for people with disabilities

The design of parking areas complying with the Disability Discrimination Act 1992 and provision of parking areas for people with disabilities is an important consideration in all developments. Going beyond the minimum requirements is encouraged where demand is present to ensure equitable access for users of the development. Guidance on the design and provision of parking for people with disabilities can be sought from:

- AS 1428.1:2021 Design for access and mobility, Part 1: General requirements for access — New building work specifies the design requirements for new building work to provide the minimum design requirements for new building work to enable access for people with disabilities.
- AS 2890.6:2022 Parking facilities, Part 6: Off-street parking for people with disabilities specifies minimum requirements for the provision of off-street parking facilities for people with disabilities.
- NCC 2022 Volume 1 Part D4 Access for people with a disability covers provision of accessible car parking spaces.

8.4.2 Bicycle and micromobility parking

Bicycle parking and routes to it should be clearly marked, located in a highly visible area, well-maintained, well-lit and integrated into the built environment. Providing bicycle parking and end of trip facilities should be accessible, convenient, secure, integrated and maintained. Bicycle parking should be located conveniently in relation to the surrounding transport network and typically be located on the ground floor, adjacent to pedestrian access to the building. Careful consideration should be given regarding duration of stay and type of parking facility e.g. short term visitor bicycle parking and longer-term secure bicycle parking.

LEPs or DCPs may contain requirements for the rates of provision and design of bicycle parking and other end-of-trip facilities. In the absence of such requirements, the Cycling Aspects of Austroads Guides AP-G88-17 (Austroads, 2017) includes rates of bicycle parking by land use as well as further guidance relating to planning, design and management of cycling facilities.

A higher rate of bicycle parking, supported by appropriate end-of-trip facilities is encouraged where uptake is likely and/or supports the local Council's plans and strategies.

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Further guidance on the design and provision of bicycle and micromobility parking facilities can be sought from:

- Cycleway Design Toolbox (TfNSW, 2020) assists practitioners to design and construct high quality bicycle and micromobility facilities.
- AS 2890.3:2015 Parking facilities, Part 3: Bicycle parking specifies a set of minimum requirements for the layout, design and security of bicycle parking facilities for planners and service providers.
- Bicycle Parking Facilities: Updating the Austroads Guide to Traffic Management AP-R528-16 (Austroads, 2016) guides the design of bicycle parking facilities and helps identify appropriate provisions of bicycle parking and end-of-trip facilities.
- Bicycle Parking Facilities: Guidelines for Design and Installation AP-R527-16 (Austroads, 2016) provides information to assist in the design and installation of bicycle parking and end-of-trip facilities that are fit for purpose.

8.4.3 Delivery and servicing vehicles

The minimum design requirements for commercial parking are set out in AS 2890.2:2018 Parking facilities, Part 2: Off-street commercial vehicle facilities. This standard provides minimum requirements and recommendations for the provision of off-street parking, loading and manoeuvring areas for seven representative commercial vehicles classified according to limiting dimension and minimum turning circles. Vehicles with more than two points of articulation will require specialist design.

Consideration should be given to the volume of commercial vehicle activity and how this will be managed to avoid internal circulation issues and parking on-street. With large numbers of commercial vehicles, there is a need to actively plan and manage servicing.

Potential service vehicle parking considerations include:

- An adequate number of loading docks for the development to prevent queueing or conflicts on the road network.
- Opportunities for centralised/shared loading dock facilities with adjacent developments should be investigated, particularly in large multi-use developments.
- Parking demand and servicing requirements to ensure that the on-site layout of the development does not cause adverse safety and traffic efficiency issues to the surrounding road network.
- Adequate space to handle waste and recyclables, including for truck-mounted bin/skip hoists.

TfNSW's Last Mile Toolkit and Delivery and Servicing Plan Guidance provide further guidance on urban freight planning for delivery and servicing vehicles.

8.4.4 Buses and coaches

Bus parking areas such as coach parking and layover areas should be designed to satisfy the specific needs of rigid and articulated buses. Bus parking may generally be treated in the same manner as truck parking. Large developments, such as shopping centres and hotels, may be able to accommodate parking on-site for regular passenger buses (and taxis), shopper-coaches, tourist coaches, etc. Parking for these vehicles at convenient places (usually at main entrance points) would provide good amenity for customers. However, in some instances, on-street waiting areas for public passenger vehicles (buses, coaches and taxis) may be the most appropriate and are subject to approval by the relevant authority.

8.4.5 Motorcycle parking

Motorcycle parking bays take up less space than cars and light vehicles and are typically located in areas that may not be adequate for other road users, such as where there is insufficient space for a car parking bay. Motorcycle parking bays in off-street locations are usually provided in groupings, in response to demand (e.g. near higher education institutions and shopping centres etc).

The design of motorcycle parking spaces should ensure users have easy access to parking facilities and the spaces should be visible, safe and accessible. Areas allocated to motorcycle parking should be firm and sufficiently level so that motorcycles are stable without toppling over, and sheltered parking facilities should be considered.

Consideration should also be given to providing quality end-of-trip storage facilities for helmets and clothing. These end-of-trip facilities may be combined with those for bicycle users.

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8.4.6 Electric vehicles

An electric vehicle (EV) is a type of vehicle that uses a battery and electric motor. Infrastructure that supports these vehicles includes EV supply equipment (EVSE) and dedicated EV parking spaces. The design and provision of EV charging infrastructure supports the increasing use of EVs. Charging infrastructure may be provided in locations such as public fast charging stations, retail and commercial car parks, kerbside, commuter car parks, motels, as well as private residential parking spaces.

The design of EV charging areas should consider:

- The number of EV parking spaces
- The charging level depending on the desired speed of charging and expected duration of vehicle stay
- The type of plug provided – standard plugs include: Type 2 (Mennekes) plug for alternate current (AC) charging, combined charging system (CCS2) for direct current (DC) charging and charge de move (CHAdeMO) for DC charging
- The maximum electricity demand and capacity of the electrical network in the area.

Provision of necessary wiring and electrical infrastructure during construction typically minimises the future installation cost of EV chargers. The NCC 2022 Volume 1 Part J9 Energy monitoring and on-site distributed energy resources covers provisions that facilitate the easy retrofit of EV charging equipment. Specifically, Part J9 D4 provides rates as a proportion of total car parking spaces by building class, for which electrical distribution boards must be sized to support the future installation of type 2 EV chargers.

Guidance on the design and provision for EVs may be sought from:

- SEPP (Transport and Infrastructure) 2021 Section 2.124 refers to development for the purposes of installing an EV charging unit.
- Australasian Fire and Emergency Service Authorities Council (2022) Electric Vehicles (EV) and EV charging equipment within the built environment also provides guidance relating to the installation of EV charging facilities.

8.4.7 Car share

Car share parking spaces are used by car share vehicles for the use of car share scheme members. These parking spaces may be beneficial for medium and large developments, particularly in inner urban areas where there is a demand for car share. Car share can have a role in facilitating on-demand car use, which provides a reasonable alternative where public transport, walking or cycling cannot substitute for private vehicle trips. Some LEPs and DCPs include car share requirements and may provide for local considerations. Individual providers may have additional design requirements for car share spaces. It is advisable to contact potential car share providers for more information on implementation at a development.

In general, car share spaces should be accessible 24 hours a day, seven days a week, located together and with convenient pedestrian access to all members including non-residents.

8.4.8 Pick-up/drop-off/point to point transport

Certain land uses have a high propensity for point to point or other passenger pick-up and drop-off activity (e.g. child care centres). Dwell time and turnover are primary considerations for pick-up and drop-off facilities.

Point to point transport is any service using a vehicle with 12 seats or less (including the driver) that can take customers on the route they choose, at the time that suits them, for a fare. This includes taxis, hire cars, tourist services and rideshare.

Off-street facilities should be considered as the preference, particularly for larger developments likely to generate demand for these services such as hotel or motel accommodation and high-density residential developments.

The design of taxi ranks should be treated like the design of on-street car parking bays. If designated taxi bays are provided, they should be located close to the entrance of the building or buildings which the taxi rank is servicing. They should be visible from the access driveway and/or frontage road.

8.4.9 Emergency vehicles

Parking designs should consider access for emergency vehicles, such as fire service vehicles, ambulances and police vehicles. The location of parking should be carefully considered to ensure access is unimpeded to emergency services such as fire appliances, or access to water and gas systems. Section 307 of the Road Rules Act relates to the stopping and parking exemption for police and emergency vehicles, if the driver is taking reasonable care, and it is reasonable that the restriction should not apply. Refer to Chapter 7 – Site access and design for more information on access considerations for emergency vehicles.

8.4.10 Caravans, trailers and recreational vehicles

Parking areas for caravans, trailers and recreational vehicles should be designed for the specific needs of their users, including clearance heights and design vehicle considerations. Guidance on the design of caravan, trailers and recreational vehicle parking can be sought from:

- AS 2890.2:2018 Parking facilities, Part 2: Off-street commercial vehicle facilities provides minimum requirements and recommendations for the provision of off-street parking, loading and manoeuvre areas for seven representative commercial vehicles according to limiting dimensions and minimum turning circles.
- AP-G34-23 Austroads Design Vehicles and Turning Path Templates provides design vehicle dimensions, including a passenger vehicle towing a trailer.

Generally, caravans, trailers and recreational vehicles may be treated similarly to a passenger vehicle towing a trailer regarding swept path templates, circulation roadways and access roadways.

8.4.11 Mechanical parking units

Mechanical parking units such as car stackers, use vertical space to increase parking capacity within a floorspace area. The use of these units should consider the safety and efficiency of how cars are moved in and out in relation to the type of users e.g. short stay, long stay, or reserved/designated parking spaces. Profiles of user arrivals and service time for these units should be considered to ensure sufficient queuing space and access points. Queuing of vehicles should be contained within the site to avoid adverse impacts to the surrounding road network.

LEPs or DCPs may contain requirements for the design and usage of mechanical parking units. Guidance can be sought from:

- AS/NZS 2890.1:2004 Parking facilities, Part 1: Off-street car parking This provides requirements and recommendations for the design and layout of off-street parking facilities, including access to mechanical parking installations.
- AS 5124:2017 Safety of machinery – Equipment for power driven parking of motor vehicles – Safety and electromagnetic compatibility EMC requirements for design, manufacturing, erection and commissioning stages provides requirements for the safe design, installation and servicing of car storage devices.

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8.4.12 Other specialised parking spaces

Specialised parking spaces are designed to meet the needs of certain user groups or activities including:

Car wash bays which may be required under a LEP or DCP, typically for residential developments and may form part of the visitor parking area. These bays should consider appropriate access arrangements, drainage systems and dimensions.

Carpool parking which is designed to encourage and support vehicles carrying multiple occupants, reducing potential trip generation by increasing vehicle occupancy. Consideration of carpool provision is encouraged in consultation with the relevant local council.

Parents-with-pram parking which provides convenience and safety for parents or caregivers with young children. These parking spaces are typically located in shopping centres, supermarkets, or other public places. The spaces are typically wider than standard parking spaces to accommodate prams or strollers and provide extra space for parents to load and unload children and baby equipment. These spaces are usually located close to entrances or facilities to make it easier for parents with young children to access the premises.

Visitor parking which may be required under a LEP or DCP and should include a proportion of parking for people with disabilities. Visitor parking should be suitably grouped, clearly marked and conveniently located to access points.

8.4.13 Urban design

Urban design considerations can minimise the impact of parking on the amenity and character of a street, area or development. Careful planning can soften the appearance of car parks against the surrounding environment, increase aesthetic appeal and integrate parking structures into the urban environment. This maintains pedestrian interest and activity, encouraging continuity and connectivity at a street level.

General design principles which should be considered as appropriate include:

- Encouraging mixed-use or sharing of parking areas.
- Applying water-sensitive urban design drainage and stormwater management principles wherever possible.
- Providing tree cover either by retaining existing trees or planting new trees which can provide shade for cars during the day, provide a more attractive facility and avoid large expanses of unshaded asphalt.
- Screening parking areas from the public and blending in with the urban form.
- Creating ground floor active frontages and avoiding blank walls or large gaps in streetscapes.
- Incorporating well-designed pedestrian and cyclist service elements inside parking structures and connectivity to adjacent land uses.
- Avoiding on-site car parking between the footpaths and the fronts of buildings in urban and suburban contexts. In other contexts, using landscaping for shade and streetscapes.
- Layout and form to be responsive to the site conditions and urban context such as the different types of street and lot frontages, contribution to the streetscape, location of driveways and effect of vehicle movements on local networks.

8.5 Car parking rates for specific land uses

Context-based reference rates have been provided for a number of selected land uses and require use of the categorisation map detailed in Section 8.5.1. The reference rates provided for the remaining land uses are sourced from past surveys and serve as historic provisions within Sydney and NSW regional centres. The definitions for each land use are generally sourced from Standard Instrument (Local Environmental Plans) Order 2006. Table 8.1 provides a summary of TfNSW reference rates and should only be used in conjunction with the information for each land use.

The parking controls specified in LEPs and/or DCPs are to be given precedence over the parking rates set out in this Guide. The exception to this are circumstances, as stated in Section 8.3.1, where other EPIs prevail. If no prevailing requirements are available in the relevant DCP or LEP, the TfNSW reference rates for specific land uses below may be considered.

Note

This Guide contains reference to parking rates based on historic minimum rates of provision from the 2002 Guide to Traffic Generating Developments (GTGD), that have not been substantially revised. In order to modernise this Guide, TfNSW has developed updated reference rates for some selected land uses, adopting a new context-based approach.

Development of future reference rates or new surveys will gradually supersede the historical provisions.

Table 8.1. **Summary of TfNSW reference rates and historic provisions**

Land use	TfNSW reference rate	Historic provisions
8.5.2 Residential		
Dwelling houses and dual occupancy	-	• 1-2 spaces per dwelling • 2 spaces if dual occupancy
Medium density residential dwellings	Refer to Table 8.3	
High density residential dwellings	Refer to Table 8.4	
Seniors housing		Independent living units (resident funded): • 2 spaces per 3 units (residents) plus. • 1 space per 5 units (visitors). Independent living units (subsidised): • 1 space per 10 units (residents) plus. • 1 space per 10 units (visitors). • hostels: • 1 space per 10 beds (visitors) plus. • 1 space per 2 on-duty employees plus. • 1 space per ambulance.
8.5.3 Casual accommodation		
Motels	-	• 1 space per unit • +1 space per 2 employees If restaurant included then add the greater of: • 15 spaces per 100m² GFA of restaurant/ function room or • 1 space per 3 seats
Hotels	-	Comparisons should be drawn with regard to similar developments
8.5.4 Commercial and industrial		
Office premises and business parks	Refer to Table 8.5	
Business premises		• 1 space per 40m² GFA
Highly-automated industrial	0.2 spaces per 100m² GFA	
General industry		• 1.3 spaces per 100m² GFA
Warehouse or distribution centre		• 1 space per 300m² GFA
8.5.5 Retail		
Shops		
Shopping centres	Refer to Table 8.6	
Hardware and building supplies		Comparisons should be drawn with regard to similar developments

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Land use	TfNSW reference rate	Historic provisions
Specialised retail premises		Comparisons should be drawn with regard to similar developments
Service stations and convenience stores		Additive recommendations of: • 6 spaces per work bay • 5 spaces per 100m² GFA of convenience store If restaurant present, then greater of: • 15 spaces per 100m² GFA, or • 1 space per 3 seats
Vehicle sales or hire premises		• 0.75 spaces per 100m² site area • + 6 spaces per work bay (for vehicle servicing facilities)
Car tyre retail outlets		Whichever is the greater of: • 3 spaces per 100m² GFA, or • 3 spaces per work bay
Roadside stalls		• 4 spaces
Markets		• 2.5 spaces per stall (customers only)
Plant nurseries		Whichever is greater of: • 15 spaces or • 0.5 spaces per 100m² of site area
8.5.6 Food and drink premises/registered clubs		
Drive-in take-away food outlets		**Developments with no on-site seating** • 12 spaces per 100m² GFA **Developments with on-site seating** • 12 spaces per 100m² GFA or greater of: • 1 space per 5 seats (internal and external), or • 1 space per 2 seats (internal) **Developments with on-site seating and drive through facilities** Whichever is the greater of: • 1 space per 2 seats (internal), or • 1 space per 3 seats (internal and external) plus queuing area for 5 to 12 cars
Restaurants		Whichever is greater of: • 15 spaces per 100m² GFA or • 1 space per 3 seats
Registered clubs		Comparisons should be drawn with regard to similar developments

Land use	TfNSW reference rate	Historic provisions
8.5.7 Recreational and tourist facilities		
Recreational facilities		• Squash courts: 3 spaces per court • Tennis courts: 3 spaces per court • Bowling alleys: 3 spaces per alley • Bowling greens: 30 spaces for first green and 15 spaces for each additional green
Gymnasiums		• 3 spaces per 100m² GFA
Golf courses		• Regional areas: 3 to 5.7 spaces per hole • Metropolitan areas: 8.7 to 10.5 spaces per hole
Caravan parks		1 space per caravan site
Marinas		If a survey of a similar existing development has not been undertaken, the following figures may serve as a general guide: • 0.6 spaces per wet berth • 0.2 spaces per dry storage berth • 0.2 spaces per swing mooring • 0.5 spaces per marina employee
8.5.8 Road transport facilities		
Road transport terminals		Comparisons should be drawn with regard to similar developments
Container depots		Comparisons should be drawn with regard to similar developments
Truck stops		Comparisons should be drawn with regard to similar developments
8.5.9 Health and community services		
Health consulting rooms		• 3 spaces per room/health care professional
Extended hours medical centres		• 4 spaces per 100m² GFA
Centre-based child care facility		• 1 space for every 4 children in attendance
Note: Parking spaces specified in this section, unless stipulated otherwise, are for cars. Depending on land use type, parking for bicycles, motorcycles and delivery and servicing vehicles, should also be provided.		

8.5.1 Car parking categorisation

The new context-based parking rates recognises that the demand for parking can be influenced by a range of factors outlined in this section. It requires the identification of the category where the development is located.

Across NSW, transport accessibility can vary significantly, reflecting the diverse geography, population distribution, infrastructure and economic activities throughout the state. Inner metropolitan areas, urban centres, suburban areas and regional areas present different transportation challenges and opportunities. A categorisation approach at a Statistical Level 2 (SA2) scale has been adopted to reflect this variability, based on key indicators that influence parking demand. These indicators are:

- Within 15 minute walk to a strategic centre
- Within 30 minutes public transport to a strategic, regional or metropolitan centre
- Car mode share (all trip purposes)
- Population density.

The generalised performance of each indicator for each category is presented in Table 8.2.

Table 8.2. **Summary of categorisation of NSW**

Indicator	Sub-Category 1A	Category 1	Category 2	Category 3
Within 15 minute walk to a strategic centre	Very high	Very high	High	Low
Within 30 minute public transport to a strategic, regional or metropolitan centre	Very high	Very high	Medium	Low
Car mode share (all trips)	Low	Medium	Medium	High
Density (people/km^2)	Very high	High	Medium	Low

Category 1: Typical of urban areas with high alternative transport options and low car mode share.

Within this category, **Sub-Category 1A:** is identified as areas with higher density and lower car mode share than typical urban areas. This sub-category is typical of inner metropolitan areas where local councils are trending to mandate lower parking provision compared to other areas within **Category 1**.

Category 2: Typical of outer urban areas or regional centres with more variability in alternative transport options and medium car mode share.

Category 3: Typical of regional areas or outer urban areas with low or limited alternative transport options, low population density and high car mode share.

Given the large zone structure for the categorisation, there may be highly accessible developments in a lower category zone and vice versa. Practitioners are encouraged to present and analyse technical evidence to understand the parking demand associated with the development. For example, reference rates could be considered in the following ways:

- If the development is well serviced by alternative transport options and has a low expected car mode share for trips entering and exiting the development, provide less parking than the reference rate of parking.
- If the development has limited alternative transport options, with a high expected car mode share for trips entering and exiting the development, provide parking at or above the reference rate.

The webmap containing the SA2 categorisation can be accessed via this link.

8.5.2 Residential

Dwelling houses and dual occupancy

A car parking provision of one to two spaces is the historic provision for dwelling houses. If there is dual occupancy on a residential lot, two parking spaces are recommended. Parking provision for low density residential dwellings can vary substantially between local government areas due to varying levels of public transport accessibility as well as geographic and socio-economic factors. These factors should be considered when determining the appropriate parking provision for the development.

Medium density residential dwellings

Medium density residential is a building containing at least two but less than 20 dwellings, with a typical net residential density of 30 to 60 dwellings per hectare and applies to residential components of:

- Attached dwellings
- Multi dwelling housing including terraces
- Manor houses
- Shop top housing, residential flat building and mixed use developments.

The parking reference rates adopt the SA2 categorisation approach outlined in Section 8.5.1. The web map to confirm the category relevant to the proposed development can be accessed here.

Table 8.3. **Medium density residential dwellings – TfNSW reference rates per dwelling**

Category	Studio/1 br	2 br	3 + br	Visitor
1	0.5	0.8	1.2	1 space per 5 dwellings
2	0.7	1.0	1.6	1 space per 5 dwellings
3	1.0	1.7	2.0	1 space per 5 dwellings

The comments made above in dwelling houses and dual occupancy are equally applicable to medium density residential dwellings. Consideration of the locality, and projected levels of parking demand are also particularly important for large developments.

High density residential dwellings

High density residential is a building containing more than 20 dwellings, 3 or more storeys (not including levels below ground level (existing) or levels that are less than 1.2 metres above ground level (existing) that provide for car parking) and applies to residential components of residential flat building, shop top housing and mixed use developments.

The parking reference rates adopt the SA2 categorisation approach outlined in Section 8.5.1. The web map to confirm the category relevant to the proposed development can be accessed here.

Table 8.4. **High density residential dwellings – TfNSW reference rates per dwelling**

Category	Studio/1 br	2 br	3 + br	Visitor
1	0.4	0.7	1.2	1 space per 7 dwellings
2	0.6	0.9	1.4	1 space per 5 dwellings
3	1.0	1.3	1.5	1 space per 5 dwellings

Provision for delivery and service vehicles should be determined in addition to these spaces. Refer to Section 5.6 on "Freight and servicing trips to high density residential (2017-2021)" and TfNSW's Last Mile Toolkit.

The parking provisions for commercial use within a high-density residential development should be separately established by referring to the relevant guidelines for those specific uses.

Seniors housing

Seniors housing means a building or place that is, or is intended to be, used permanently for seniors or people who have a disability, or people who live in the same household with seniors or people who have a disability, or staff employed to assist in the administration of the building or place or in the provision of services to persons living in the building or place. This can be a residential care facility, a hostel, independent living units, or a combination of these.

The Senior Housing Design Guide provides design principles for senior housing developments for different densities of development. Division 7 of Part 5 of the State Environmental Planning Policy (Housing) 2021 sets out non-discretionary development standards for seniors housing, including minimum parking provisions.

The appropriate provision of parking is dependent on the mobility of the residents at the facility and development context.

The TfNSW Housing for seniors (2009) report analysed independent living developments catering for active retirees and found the provision of parking spaces varied from 0.45 spaces per unit to 2.32 spaces per unit with an average of 1.07 spaces per unit.

Higher car ownership was found in non-metropolitan sites compared with the Sydney Metropolitan sites.

The historic parking rate for senior housing may also be considered:

Independent living units (resident funded):

- Two spaces per three units (residents)
- One space per five units (visitors).

Independent living units (subsidised):

- One space per ten units (residents)
- One space per ten units (visitors).

Hostels:

- One space per ten beds (visitors)
- One space per two on-duty employees
- One space per ambulance.

Resident funded developments tend to have a higher per unit cost and attract residents with higher financial resources. The car ownership levels of such residents are likely to be relatively high, as is the associated traffic generation and parking requirements of these residents.

Subsidised developments are usually associated with lower car ownership levels and consequently lower corresponding generation rates.

In assessing the parking demands for senior housing, consideration should be given to the funding arrangement proposed for the development.

Clarification from the developer may also be required in this matter. A lower parking provision can only be approved when it can be clearly demonstrated that low car ownership levels will prevail.

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8.5.3 Casual accommodation

Hotel or motel accommodation

Hotel or motel accommodation means a building or place (whether or not licensed premises under the Liquor Act 2007) that provides temporary or short-term accommodation on a commercial basis and that:

- Comprises rooms or self-contained suite
- May provide meals to guests or the general public and facilities for the parking of guests' vehicles, but does not include backpackers' accommodation, a boarding house, bed and breakfast accommodation or farm stay accommodation.

Motels

The historic provision of off-street car parking is one space for each motel unit, plus one space per two employees.

If a restaurant and/or function room is to be included as part of the development, then the amount of off-street parking may be reviewed and increased as necessary. If the restaurant mainly serves motel customers, then additional parking may not be required. However, the possibility of a future change in restaurant patronage should be considered. The total parking provision may be reduced if the peak parking demand will not coincide, considering factors such as the time of usage, and possible future usage.

The greater of the following historic rates of provision of parking may be considered for situations where the restaurant and/or function room operates entirely independently of the motel:

- 15 spaces per 100m² GFA of restaurant and/or function room facility
- One space per three seats.

Hotels

It is recommended that proposed hotel developments be compared to similar existing developments, with a similar local context. This includes local public transport access, the existing supply and demand for parking in the area, and the peak parking periods of individual facilities within the hotel.

When a proposed development includes a function room for live music performances (or a nightclub), particular attention should be made to parking requirements to meet peak demands.

Adequate parking provision should be made on-site for the type of vehicles most likely to service the development including coach parking if their use is anticipated. Tourist hotels, which are substantially used for tourist accommodation, should also include adequate pick-up and drop-off parking facilities.

8.5.4 Commercial and industrial

Office premises and business parks

Office premises means a building or place used for the purpose of administrative, clerical, technical, professional or similar activities that do not include dealing with members of the public at the building or place on a direct and regular basis, except where such dealing is a minor activity (by appointment) that is ancillary to the main purpose for which the building or place is used.

The term business park refers to developments that permit a range of land uses in an integrated complex. The developments generally incorporate a number of individual units of similar size. They typically include elements of industrial, manufacture, research, warehousing, office space, retail, commercial, refreshment and recreational activity. These developments are generally located in industrial areas and the uses within the park are generally to a scale appropriate for the anticipated workforce and zoning.

The appropriate provision of parking is largely dependent on the specific uses proposed. For example office uses located near a public transport node may require lower rates of parking provision, while a manufacturing hub may require higher rates of parking. Practitioners should carefully review the proposed use and local context when applying the reference rates.

The parking reference rates adopt the SA2 categorisation approach outlined in Section 8.5.1. The web map to confirm the category relevant to the proposed development can be accessed here.

Table 8.5. **Office premises and business parks – TfNSW reference rates**

Category	TfNSW reference rate
1	1.6 spaces per 100m² GFA
2	2.5 spaces per 100m² GFA
3	3.1 spaces per 100m² GFA

Business premises

Business premises means a building or place at or on which one of the following occurs:

- An occupation, profession or trade (other than an industry) is carried on for the provision of services directly to members of the public on a regular basis.
- A service is provided directly to members of the public on a regular basis, and includes funeral homes, goods repair and reuse premises and, without limitation, premises such as banks, post offices, hairdressers, dry cleaners, travel agencies, betting agencies.

The parking reference rate is one space per 40m² GFA for developments where parking demand is to be managed off-street. Adjustments may be considered given the business nature, trading hours, proximity to public transport stops, surrounding active transport connectivity and the local context of the development.

Highly-automated industrial

Highly-automated industrial means industrial land uses that typically involve operations that heavily rely on advanced automation, robotics and technology to perform tasks with minimal human involvement. These land uses generally have lower overall employment compared to traditional manufacturing or industrial land uses.

The parking reference rate is 0.2 spaces per 100m² GFA.

General industry

General industry means a building or place (other than a heavy industry or light industry) that is used to carry out an industrial activity.

Industrial activity means the manufacturing, production, assembling, altering, formulating, repairing, renovating, ornamenting, finishing, cleaning, washing, dismantling, transforming, processing, recycling, adapting or servicing of, or the research and development of, any goods, substances, food, products or articles for commercial purposes, and includes any storage or transportation associated with any such activity.

The parking reference rate is 1.3 spaces per 100m² GFA.

Warehouse or distribution centre

Warehouse or distribution centre means a building or place used mainly or exclusively for storing or handling items (whether goods or materials) pending their sale, but from which no retail sales are made, but does not include local distribution premises.

Local distribution premises means a building or place used for the storage or handling of items (whether goods or materials) pending their delivery to people and businesses in the local area, but from which no retail sales are made.

The parking reference rate is one car space per 300m² GFA.

Variations could be considered in the context of both current and potential users. While surveys might suggest less parking demand for a particular development, consideration might be given to future change of use.

8.5.5 Retail

Shopping centres

Shopping centre means a building or place used as a centralised location for various retail purposes and often includes supermarkets, entertainment facilities (e.g. cinema or theatre), food and drink premises (e.g. restaurant, café, take away) and specialised retail (e.g. household appliances, furniture, homewares).

The parking demand for shopping centres can vary significantly based on its unique characteristics, including size, location and the comprising mixed-uses of the development.

A neighbourhood shopping centre, with smaller retailers such as a fruit shop, newsagent and convenience stores will generally have a lower parking demand and a smaller catchment area as compared to a larger community shopping centre comprising of neighbourhood supermarkets and a mix of retail shops.

Consideration should be given to these characteristics when determining an appropriate reference rate. The inclusion of land uses that induce a higher parking demand will likely lead to applying a higher reference rate as the starting point for assessment, especially where supermarkets or specialised retail is proposed.

Table 8.6. **Shopping centres – TfNSW reference rates**

Gross leasable floor area (GLFA) m²	TfNSW reference rate
0-10,000	6.1 spaces per 100m² GLFA
10,000-20,000	5.6 spaces per 100m² GLFA
20,000-30,000	4.3 spaces per 100m² GLFA
Over 30,000	4.1 spaces per 100m² GLFA

Gross leasable floor area is preferred to gross floor area for this land use category, because it refers most specifically to the factor that generates/attracts trips.

The term gross leasable floor area means the sum of the areas at each floor of a building. In this instance, the area of each floor is taken to be the area within the internal faces of the walls, excluding stairs, amenities, lifts, corridors and other public areas, but including all stock storage areas. As a guide, about 75% of the gross floor area is deemed gross leasable floor area. However, this percentage can vary substantially between developments.

The above car parking provisions are based on unrestrained demand for parking, in isolation to adjacent developments.

When it can be demonstrated that the time of peak demand for parking associated with the proposed shopping centre and the adjacent land uses do not coincide, or where common usage reduces total demand, a lower level of parking provision may be acceptable. Provision of public transport may also reduce the demand for car parking spaces. If the proposed development is an extension of an existing retail development, additional parking demand could be less than proportional to the increase in floor area.

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Hardware and building supplies

Hardware and building supplies means a building or place the principal purpose of which is the sale or hire of goods or materials, such as household fixtures, timber, tools, paint, wallpaper, plumbing supplies and the like, that are used in the construction and maintenance of buildings and adjacent outdoor areas.

It is recommended that comparisons be drawn with similar developments. TfNSW Bulky Goods/Hardware Stores (2009) report found for hardware stores, the peak parking demand from the survey data varied from 0.78 to 2.81 spaces per 100m² GFA. Parking was higher on weekends than weekdays.

Specialised retail premises

Specialised retail premises means a building or place the principal purpose of which is the sale, hire or display of goods that are of a size, weight or quantity, that requires one of the following:

- A large area for handling, display or storage.
- Direct vehicular access to the site of the building or place by members of the public for the purpose of loading or unloading such goods into or from their vehicles after purchase or hire, but does not include a building or place used for the sale of foodstuffs or clothing unless their sale is ancillary to the sale, hire or display of other goods referred to in this definition.

Examples of goods that may be sold at specialised retail premises include automotive parts and accessories, household appliances and fittings, furniture, homewares, office equipment, outdoor and recreation equipment, pet supplies and party supplies.

It is recommended that comparisons be drawn with similar developments. The TfNSW Bulky Goods/Hardware Stores (2009) report found that for bulky goods, the peak parking demand from the survey data varied from 0.35 to 3.17 spaces per 100m² GFA.

Service stations and convenience stores

Service station means a building or place used for the sale by retail of fuels and lubricants for motor vehicles, whether or not the building or place is also used for any one or more of the following:

- The ancillary sale by retail of spare parts and accessories for motor vehicles.
- The cleaning of motor vehicles.
- Installation of accessories.
- Inspecting, repairing and servicing of motor vehicles (other than body building, panel beating, spray painting, or chassis restoration).
- The ancillary retail selling or hiring of general merchandise or services or both.

The term convenience store refers to a drive-in retail facility, usually established by the modification of existing service stations. This type of establishment usually combines the selling of petrol and other goods, with the hours of operation extending beyond normal retail hours.

Adequate off-street parking should be provided for employees and for vehicles being serviced. The historic parking rate of six spaces per work bay may be considered.

If a convenience store is provided on-site, additional parking at the rate of five spaces per 100m² GFA is recommended.

If a restaurant is provided, a historic rate of 15 spaces per 100m² GFA or one space per three seats, whichever is the greater, is recommended.

The above recommended facilities may be reduced where it is shown that peak demand times for the various facilities do not coincide. Parking should be provided to satisfy the development's peak cumulative parking requirements as a whole by superimposing the parking demand for each facility separately.

Vehicle sales or hire premises

Vehicle sales or hire premises means a building or place used for the display, sale or hire of motor vehicles, caravans, boats, trailers, agricultural machinery and the like, whether or not accessories are sold or displayed there.

The historic parking rate of 0.75 spaces per 100m² of site area may be considered.

Where vehicle servicing facilities are provided, additional off-street parking should be provided. The historic parking rate of six spaces per work bay may be considered.

Car tyre retail outlets

Car tyre retail outlet refers to a building or place used for the purpose of retailing and fitting tyres to motor vehicles or agricultural machinery.

The historic parking rate of the greater of three spaces per 100m² GFA or three spaces per work bay may be considered.

Roadside stalls

Roadside stall means a place or temporary structure used for the retail sale of agricultural produce or hand-crafted goods (or both) produced from the property on which the stall is situated or from an adjacent property.

The historic parking rate of four spaces per roadside stall may be considered.

Markets

Market means an open-air area, or an existing building, that is used for the purpose of selling, exposing or offering goods, merchandise or materials for sale by independent stall holders, and includes temporary structures and existing permanent structures used for that purpose on an intermittent or occasional basis.

The historic parking rate of 2.5 spaces per stall may be considered. These figures are based on unrestrained demand for parking and do not include stall holders' vehicles. Separate provision should be made for these vehicles. Where a market is located within an existing shopping centre, consideration should be given to multiple usage requirements of parking facilities. Parking requirements are usually determined by the number of participating stalls in the market place.

The provision of parking at the recommended level would not be necessary in all situations. If it can be demonstrated that peak times of parking demand associated with the proposed markets and those of the existing adjacent land uses do not coincide, or where common usage reduces total demand, a lower level of parking provision may be acceptable. If the proposed development is an extension of an existing retail development, additional parking demand could be less than proportional to the increase in site area.

Plant nurseries

Plant nursery means a building or place the principal purpose of which is the retail sale of plants that are grown or propagated on site or on an adjacent site. It may include the on-site sale of any such plants by wholesale and, if ancillary to the principal purpose for which the building or place is used, the sale of landscape and gardening supplies and equipment and the storage of these items.

The historic parking rate may be considered as the greater of:

- 0.5 spaces per 100m² of site area
- 15 spaces.

Parking provision for auxiliary facilities associated with a plant nursery are not included in these figures. Refer to appropriate guidelines for parking rates of auxiliary facilities with appropriate allowance for dual or complementary use. Provision should be made for car/trailer combinations at strategic locations.

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8.5.6 Food and drink premises/registered clubs

Drive-in take-away food outlets

The three types of drive-in take-away food outlets referred to in this section are:

- Developments where customers park their vehicles on-site and walk to the food outlet for takeaway service, with no seating for the on-site consumption of food.
- Developments where customers park their vehicles on-site and walk to the food outlet for takeaway service, with seating also for on-site food consumption.
- Developments with features of the above second category with the addition of a drive-through service for customers not wishing to consume the food on the premises.

The historic parking rate for drive-in take-away food outlets which may be considered:

- Developments with no on-site seating or no drive-through facilities: 12 spaces per 100m² GFA.
- Developments with on-site seating but no drive-through facilities: 12 spaces per 100m² GFA, or the greater of:
  - 1 space per five seats (both internal and external seating)
  - 1 space per two seats (internal seating)
- Developments with on-site seating and drive-through facilities greater of:
  - 1 space per two seats (internal)
  - 1 space per three seats (internal and external).

Drive through facility.
An exclusive area for queuing of cars for a drive-through facility should be considered to avoid unreasonably disrupting car parking operations or extending onto the street. A range of five to 12 car lengths from pick-up point may be considered dependant on turnover and four car lengths from ordering point may be considered as a guide.

Restaurants

Restaurant or cafe means a building or place the principal purpose of which is the preparation and serving, on a retail basis, of food and drink to people for consumption on the premises, whether or not liquor, take away meals and drinks or entertainment are also provided.

For developments with a GFA greater than 100m², the historic parking rate should be the greater of:

- 15 spaces per 100m² GFA
- One space per three seats.

For developments with a GFA less than 100m², the parking provision recommended above is desirable but should take into account car parking available in adjacent parking areas, including on-street, and its time of use.

An alternative method of assessing restaurant parking demand would be by a comparison with a similar restaurant, where the following model may be applied:

- Peak Parking Demand = No. of Seats x Design Occupancy x Modal Split for cars.

The design occupancy could be less than the seating capacity. If appropriate data is available, the 85th percentile peak demand could be used.

Consideration should be given to additional short stay parking requirements that will accommodate food delivery demands, which may require spaces for bicycles, motorbikes or cars.

Registered clubs

Registered club means a club that holds a club licence under the Liquor Act 2007.

The number of parking spaces should be based on the characteristics of the proposed development and comparisons should be drawn with similar clubs. The determination should consider the peak demand time of the various activities within the development. Parking should satisfy the development's peak cumulative parking requirements as a whole, by superimposing the parking demand for each activity.

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8.5.7 Recreational and tourist facilities

Recreational facilities

An indoor recreation facility means a building or place used predominantly for indoor recreation, whether or not operated for the purposes of gain, including a squash court, indoor swimming pool, gymnasium, table tennis centre, health studio, bowling alley, ice rink or any other building or place of a like character used for indoor recreation.

An outdoor recreation facility means a building or place (other than a recreation area) used predominantly for outdoor recreation, whether or not operated for the purposes of gain, including a golf course, golf driving range, minigolf centre, tennis court, paint-ball centre, lawn bowling green, outdoor swimming pool, equestrian centre, skate board ramp, go-kart track, rifle range, water-ski centre or any other building or place of a like character used for outdoor recreation (including any ancillary buildings).

The number of parking spaces is best determined by the nature of the proposed development and comparisons should be drawn from similar facilities.

If a survey is not conducted of similar developments, the following historic parking rates may be considered:

- Squash courts: three spaces per court
- Tennis courts: three spaces per court
- Bowling alleys: three spaces per alley
- Bowling greens: 30 spaces for first green and 15 spaces for each additional green.

Gymnasiums

A gymnasium is a building, room or a number of rooms, used for organised or instructed indoor exercise, typically including aerobics, weight training, circuit training, etc. Other facilities such as health care services, spa/sauna and a small apparel sales area are commonly provided within gymnasiums. Specialised facilities such as squash and tennis courts are auxiliary to the gymnasium usage.

If a gymnasium is located within a centre and is in close proximity to rail/bus services, the historic off-street parking rate is three spaces per 100 m² GFA.

The peak activity period for gymnasiums generally occurs weekdays between 5.30pm and 6.30pm. If a gymnasium is located within a commercial or retail complex, appropriate allowance should be made for complementary usage of the common off-street parking area.

Golf courses

It is recommended that comparisons be drawn with similar developments. TfNSW Golf Courses (2022) report found the peak parking demand from the survey data:

- Regional areas: 3.0 to 5.7 spaces per hole
- Metropolitan areas: 8.7 to 10.5 spaces per hole.

Generally, parking demand in metropolitan golf courses is much higher than the demand at regional golf courses and weekend demand is higher than weekday demand. If it can be shown that informal/overflow parking areas manage peak periods of parking demand, it is acceptable to reduce the parking provision.

Caravan parks

Caravan park means an area of land, with access to communal amenities, used for the installation or placement of caravans, or caravans and other moveable dwellings, but does not include farm stay accommodation.

For caravan parks, the historic parking rate is one parking space for each caravan site.

Marinas

Marina means a permanent boat storage facility (whether located wholly on land, wholly on a waterway or partly on land and partly on a waterway), and includes any of the following associated facilities:

- Any facility for the construction, repair, maintenance, storage, sale or hire of boats
- Any facility for providing fuelling, sewage pump-out or other services for boats
- Any facility for launching or landing boats, such as slipways or hoists
- Any car parking or commercial, tourist or recreational or club facility that is ancillary to the boat storage facility
- Any berthing or mooring facilities.

Parking demands at marinas vary substantially depending on the season, type of berth or mooring and type of boat. Ideally, surveys should be undertaken of similar developments, over summer weekends. Boats parked in wet marina berths are more accessible and therefore more likely to be used than boats in dry berths or on swing moorings. Use also varies with boating purpose. While a typical marina might have 30 per cent of boats used on a summer weekend, racing yachts are more highly used with an average of over 60 per cent at one club surveyed. The size of the boat affects the number of crew or passengers, while the location of the marina affects the crew's transport mode.

If a survey is not conducted of similar developments, the following are recommended:

- 0.6 spaces per wet berth
- 0.2 spaces per dry storage berth
- 0.2 spaces per swing mooring
- 0.5 spaces per marina employee.

AS 3962:2020 Marina design provide designers, manufacturers and operators of marina and vessel berthing facilities with requirements for recreational marinas and small commercial vessels up to 50 metres in length. Requirements are also given for on-shore facilities such as dry boat storage, boatlifts, boat ramps and associated parking facilities.

8.5.8 Road transport facilities

Road transport terminals

A road transport terminal means a facility used principally for the bulk handling of goods for transport by road including any facility for the loading and unloading of vehicles used to transport those goods and for the parking, holding, servicing or repair of those vehicles.

It is recommended that comparisons be drawn with similar developments. Off-street employee and visitor parking should be provided to satisfy the peak parking demand and truck parking provision should be provided to satisfy peak vehicle accumulation on the site. Consideration should be given to providing suitable on-site overnight truck parking.

Container depots

A container depot means a road transport terminal where one or more of the following operations are performed:

- Unloading of containers for the purposes of delivery to individual consignees
- Consolidation of goods from different consignors into full container loads for dispatch
- Repair, refitting and/or storage of containers.

It is recommended that comparisons be drawn with similar developments. Off-street employee and visitor parking should be provided to satisfy the peak parking demand with location of parking independent of the normal operations of the depot.

Consideration should be given to providing suitable on-site parking (overnight or unattended) for trucks.

Truck stops

A truck stop means a building or place located on or near a major road which is used for the principal purpose of providing support facilities for road transport vehicles. Such facilities may include the retailing of fuel, maintenance and repair facilities and overnight accommodation.

It is recommended that comparisons be drawn with similar developments. If overnight accommodation (motel) or a public restaurant is provided, the parking provisions should be separately established by referring to the relevant guidelines for those specific uses. Of these parking spaces, 50% should be truck parking spaces and a suitable maneuvering area should be provided.

8.5.9 Health and community services

Health consulting rooms

Health consulting rooms means premises comprising one or more rooms within (or within the curtilage of) a dwelling house used by no more than three health care professionals at any one time.

As a guide, three spaces per surgery may be considered. If it can be shown that not all surgeries will be in concurrent operation, it is acceptable to reduce the parking provision suggested above. Consideration could be given to reducing parking provision, if convenient on-street parking is available, providing that the use of such parking does not adversely affect the amenity of the adjacent area.

Extended hours medical centres

Medical centre means premises that are used for the purpose of providing health services (including preventative care, diagnosis, medical or surgical treatment, counselling or alternative therapies) to out-patients only, where such services are principally provided by health care professionals. It may include the ancillary provision of other health services.

The historic rate of provision of parking is four spaces per 100m² GFA.

Centre-based child care facility

Centre-based child care facility means a building or place used for the education and care of children that provides long day care, occasional child care, out-of-school-hours care (including vacation care) and/or pre-school care, or an approved family day care venue (within the meaning of the Children (Education and Care Services) National Law (NSW)).

The historic off-street parking rate is one space for every four children in attendance. Given the short length of stay, parking should be provided in a convenient location, allowing safe movement of children to and from the centre. Consideration could be given to reducing the parking required if located near quality public transport stops, quality walking and cycling facilities, or if convenient and safe on-street parking is available (e.g. indented parking bays).

The Child Care Planning Guidelines provides design principles and considerations for centre-based child care facilities including guidance on car parking provision and design.

Glossary

A

Access: Generally referred to as vehicular access to a public road but also applies to freight and servicing, active and public transport access.

Access management: How access is managed in relation to a public road. It may be permitted, restricted or denied. It could be in the form of a controlled or uncontrolled intersection or driveway.

Accessibility: The level of connectivity of a development to its surrounding transport network. Each transport mode has unique factors to consider including convenience, safety and efficiency of access, such as public transport frequency and reliability of services, or active transport infrastructure.

Active transport: Transport that requires individual physical effort to provide mobility. For personal travel, this includes walking, use of a wheelchair or mobility aid, cycling using a bicycle (without power assistance) and power-assisted micromobility. Active forms of transport for freight delivery include both pedal-powered and electric power-assisted cargo bikes.

Area of influence: The geographical or spatial extent over which a development is expected to have an impact on a transport network

Australian Standards (AS) or joint Australian/New Zealand Standards (AS/NZS): Standards developed by Standards Australia or accredited Standards Development Organisations are widely recognised as being authoritative documents. Standards set out requirements, recommendations, specifications and procedures designed to ensure products, services and systems are safe, reliable and consistently perform the way they were intended to. They establish a common language that defines quality and safety criteria. Standards have wide legislative acceptance in the States, Territories and Commonwealth.

C

Classified road: Any of the following – a main road, a highway, a freeway, a controlled access road, a secondary road, a tourist road, a tollway, a transitway, a State work. Each of these has the same meaning as it has in Part 5 of the Roads Act Complying development: is development for which provision is made as referred to in section 4.2(5) in the EP&A Act.

Complying development: Is a development for which provision is made as referred to insection 4.2(5) in the EP&A Act.

Concurrence: It is a term used in the EP&A Act to identify a requirement that an agreement be obtained (normally from a State agency) before a consent authority can decide to grant consent to a DA which may or may not be subject to any conditions of the concurrence.

Consent authority: Has the same meaning as it has in Division 4.2 of the EP&A Act.

Council: Council of a local government area. Has the same meaning as it has in the Local Government Act 1993 No 30.

D

Determining authority: Has the same meaning as it has in section 5.1 of the EP&A Act.

Development: Has the same meaning as it has in section 1.5 of the EP&A Act.

Development application (DA): An application for consent under Part 4 of the EP&A Act to carry out development but does not include an application for a complying development certificate.

Development consent (or Consent): Consent made under Part 4 of the EP&A Act to carry out development and includes, unless expressly excluded, a Complying Development Certificate.

Development Control Plan (DCP): A detailed guideline that illustrates the controls that apply to a particular type of development or in a particular area and is made under Division 3.6 of the EP&A Act.

Development proposal: A proposed land use development that is or may be the subject of a formal DA under Part 4 including State Significant Developments of the EP&A Act.

Dwelling: A room or suite of rooms occupied or used, or constructed or adapted so as to be capable of being occupied or used as a separate domicile.

Glossary (continued)

E

Environmental Impact Assessment (EIA): An assessment of the environmental, social and/or economic impacts of a project.

Environmental Impact Statement (EIS): An environmental impact statement prepared by or on behalf of the proponent to accompany a proposed activity under Part 5 of the EP&A Act when the activity is likely to have a significant effect on the environment.

Environmental Planning and Assessment Act 1979 (EP&A Act): The primary land use planning statute in NSW. It governs matters such as planning administration, planning instruments, development assessments, building certification, infrastructure finance, appeals and enforcement.

Environmental Planning Instrument (EPI): Legal documents that regulate land use and development in NSW. They include a SEPP or LEP made under Part 3 of the EP&A Act.

F

Footpath: Part of a road set aside or formed as a path or way for pedestrian traffic. It may also be used for bicycle traffic and/or personal mobility devices Gross Floor Area (GFA): Total floor area inside the building envelope, including the external walls.

G

Gross Leasable Floor Area (GLFA): Total floor space available to be leased, which typically excludes hallways, elevator shafts, stairways and other non-leasable space.

I

Integrated Development: Has the same meaning as it has in section 4.46 of the EP&A Act.

Interchange: A facility that allows for transfer from one mode of transport, or one transport service, to another. It may be a single bus stop or a major train station.

Intersection: The place at which two or more roads meet or cross.

L

Land use development: Land use plan and development assessment activities associated with the proposed use and development of land in NSW under the EP&A Act.

Land use plan: A generic term used to describe the range of planning documents in use in NSW, including a SEPP, LEP and a DCP.

Levels of Service (LoS): A qualitative stratification of the performance measure or measures representing quality of service.

Local Environmental Plan (LEP): An EPI and statutory plan used to guide planning decisions for LGAs through zoning and development controls.

Local Government Area (LGA): An administrative area for which a local council is responsible.

Local road: All public roads for which council is the roads authority, other than classified roads, or other public roads for which other authorities are responsible.

M

Micromobility devices: Small, lightweight, power-assisted vehicles operating at low speeds, to carry one person plus a child or other passenger, or a small load, for example, e-bikes and e-scooters.

Minister for Planning: Minister responsible for the Planning Portfolio.

Mode Share or Mode Split: The proportion or percentage of trips taken by users of different transport modes.

Modification application: An application for modification of a development consent under section 4.55 or section 4.56 of the EP&A Act.

Multimodal: A combination of two or more types of transport modes.

Glossary (continued)

P

Person trips: A one-way movement by one person by any mode of transport. i.e. a single car trip with two occupants would constitute two person trips.

Planning Panel: A decision-making body for which provision is made as referred to in section 4.6 and section 4.7 of the EP&A Act.

Private road: Any road that is not a public road.

Proponent: Has the same meaning as Part 5 of the EP&A Act.

Public authority: Has the same meaning as it has in the EP&A Act.

Public road: Any road that is opened or dedicated as a public road, whether under the Roads Act or any other Act or law, and any road that is declared to be a public road for the purposes of the Roads Act.

Public utility: Any water, sewerage, drainage, gas, electricity, telephone, telecommunication or other like utilities.

R

Regional roads: Has the same meaning as in the Schedule of Classified Roads and Unclassified Regional Roads, TfNSW.

Referral: Requests for consultation with a referral authority about a DA, as required by an EPI.

Referral authority: Entities (typically NSW Government agencies or private-public utilities) with authority to respond to requests for integrated development approval, concurrence, referrals for consultation or reason other than those listed above.

Roads Act 1993 No 33 (Roads Act): An Act to make provision with respect to the roads of New South Wales; to repeal the State Roads Act 1986 , the Crown and Other Roads Act 1990 and certain other enactments; and for other purposes.

Roads authority: A person or body that is, by or under the Roads Act, declared to be a roads authority and, in relation to a particular public road, means the roads authority for that road.

Road work: Any kind of work, building or structure (such as a roadway, footway, bridge, tunnel, road-ferry, rest area, transitway station or service centre) that is constructed or installed on or in the vicinity of a road for the purpose of facilitating the use of the road as a road, the regulation of traffic on the road or the carriage of utility services across the road, but does not include a traffic control facility. Carrying out road work includes carrying out any activities in connection with the construction, erection, installation, maintenance, repair, removal or replacement of a road work.

S

Standard Instrument (Local Environmental Plans) Order 2006: Prescribes the form and content of a principal local environmental plan for an area for the purposes of section 3.20 of the EP&A Act.

State Environmental Planning Policy (SEPP): An EPI for which provision is made as referred to in Division 3.3 of the EP&A Act.

Statement of Environmental Effects (SEE): A formal report, which describes the environmental impacts of a development proposal and explain how these impacts will be minimised, prepared by the applicant in support of a DA.

State roads: A category of roads agreed with Council for administrative purposes. They form the primary arterial network of classified roads in the State and some special purpose classified roads. They are the major routes for which TfNSW accepts the primary responsibility for funding, priorities and outcomes.

State Significant Development (SSD): Has the same meaning given by Division 4.7 of the EP&A Act.

State Significant Infrastructure (SSI): Has the same meaning given by Division 5.2 of the EP&A Act.

Sustainable transport: Modes of transport that are sustainable in terms of their social and environmental impacts. It refers to active and public transport.

Swept path: The area covered by the outermost and innermost points of the vehicle during a turning manoeuvre.

Glossary (continued)

T

Transport for NSW (TfNSW): Transport for NSW constituted under the Transport Administration Act 1988.

Transport Management and Accessibility Plan (TMAP): A comprehensive document which enhances the transport network by promoting accessibility, safety, multimodal integration, and sustainability. It provides a comprehensive framework for strategic transport planning that prioritises the needs of the community, encourages sustainable transport choices, and helps optimise the movement of people and goods. The main objective is to inform the desirable transport response to changes in travel demands associated with large scale development and growth.

Transport corridor: Land dedicated to use by a transport mode, including 'transport corridor land' and 'future infrastructure corridor' as defined in relevant EPIs.

Transport infrastructure: Has the same meaning as in the Transport Administration Act 1988.

Transport Impact Assessment (TIA): A comprehensive assessment of a development impacts by all modes of transport. This includes impacts to pedestrians, cyclists, car drivers and passengers, public transport users, and freight and servicing vehicles.

Transport Impact Statement (TIS): A TIS satisfies the requirement for an assessment of transport impacts, but is not as comprehensive as a TIA. It is a short report that is intended to collect factual information about a development such as site location and context, development scale, access arrangements, trip generation and distribution.

Transport services: Include railway services (including heavy rail and light rail services and metro passenger services), bus services and ferry services. Has the same meaning as in the Transport Administration Act 1988.

Transport system: The transport services and transport infrastructure of the State for all modes of transport. Has the same meaning as in the Transport Administration Act 1988.

Trip generation: Travel demand 'attracted' or 'produced' by a proposed development.

Trips: A one way movements of people, goods and services from one point (origin) to another (destination) by any mode of transport.

Travel Behaviour Change: TDM measures focused on influencing travel behaviour. by redistributing journeys to other modes, times, routes, or by removing the journey altogether

Travel demand management (TDM): Interventions that seeks to modify travel behaviour on a transport network so that more desirable transport, social, economic and/or environmental objectives can be achieved, and the adverse impacts of travel can be reduced.

Travel Plan: A management strategy for delivering behavioural change and sustainable travel patterns across a development, organisation or precinct.

U

Unclassified roads: Local roads under the care and control of local government and Regional roads that are not classified pursuant to the Roads Act.

V

Vehicle trips: A one-way movement by a single vehicle such as a car, van, truck, motorcycle etc.

Voluntary Planning Agreement (VPA): An agreement for which provision is made as referred to in section 7.4 of the EP&A Act.

W

Works Authorisation Deed (WAD): A common law agreement between TfNSW and an external party, typically a developer to enable works to be undertaken on the road network, in which TfNSW has some statutory interest, as an outcome of a condition of development consent issued by a development consent authority, or if works are nominated by the proponent as part of a planning agreement made under Section 7.4 of the EP&A Act.

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Appendices

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– Technical references

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Appendix A

– Technical references

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Appendix A – Technical references

Common technical standards and guidelines that may be relevant to a TIA are listed below. Documents are hosted online and the latest version of the document should be sourced as required.

Standards Australia	
AS 1428	Design for Access and Mobility Series
AS 1742	Manual of Uniform Traffic Control Devices Series
AS 1743	Road signs – Specifications
AS 2890	Parking Facilities Series
AS 3962	Marina Design
Standards relevant to railway and the Rail Industry Safety and Standards Board (RISSB)	

Austroads	
Guide to Traffic Management (Part 1 to 13)	
Guide to Road Safety (Part 1 to 7)	
Guide to Road Design (Part 1 to 7)	
AP-R488-15	Safe System in the Planning Process
AP-G88-17	Cycling Aspects to Austroads Guides
AP-R470-14	Guidelines for Planning and Assessment of Road Freight Access in Industrial Areas
AP-R629-20	Framework and Tools for Road Freight Access Decisions
AP-R228-03	Planning for Freight in Urban Areas
AP-R316-07	Guideline for Freight Routes in Urban and Rural Areas
AP-G34-23	Austroads Design Vehicles and Turning Path Templates
AP-R647-21	Management of Traffic Modelling Processes and Applications

Transport for NSW
Strategic Design Requirements for DAs
Guidelines for Road Safety Audit Practices
Freight and Servicing Last Mile Toolkit
Delivery and Servicing Plan Guidance
Heavy Vehicle Access Policy Framework
Towards Zero: 2026 Road Safety Action Plan
Integrated Public Transport Service Planning Guidelines – Sydney Metropolitan Area
Integrated Public Transport Service Planning Guidelines – Outer Metropolitan Area
Public Transport Service Planning Guidelines – Rural and Regional NSW
Metropolitan Road Freight Hierarchy on the State Road Network Practice Note
Guidelines for Public Transport Capable Infrastructure in Greenfield Sites
Schedule of Classified Roads and Unclassified Regional Roads
Austroads Supplement for Guide to Traffic Management (Part 1 to 13) – TS 05394.1, TS 05394.2, TS 05394.3, TS 05394.4, TS 05394.5, TS 05394.6, TS 05394.7, TS 05304.8, TS 05394.9, TS 05394.10, TS 05394.11, TS 05394.12, TS 05394.13
Supplement to AS1742 Manual if Uniform Traffic Control Devices – TS 05384.1, TS 05384.2, TS 05384.3, TS 05384.4, TS 05384.5, TS 05384.6, TS 05384.7, TS 05384.9, TS 05384.10, TS 05384.11, TS 05384.12, TS 05384.13, TS 05384.14, TS 05384.15

Appendix A – Technical references (continued)

Transport Standards Portal
TS 00043 Pedestrian Crossing Guideline
TS 01589 Walking Space Guide
TS 01590 Cycleway Design Toolbox
TS 02389 Active Transport Links on the Rail Corridor
TS 02642 Supplement to Austroads Guide to Road Design
TS 02391 Access Roads
TS 05392 Supplement to AS 2890 Road Sign – Parking Facilities Part 1-6
TS 05393 Supplement to AS 1743 Road Sign – Specification
TS 05435 Bus Layover Parking
TS 05442 Operational Modelling Reporting Structure
TS 05444 Guidelines for On-street Fixed Space Car Share Parking
TS 05461 Traffic Modelling Guidelines
TS 05485 Pay Parking Guidelines
TS 05487 Permit Parking Guidelines
TS 05493 Traffic Signal Operation
TS 05489 A Guide to the Delegation to Councils for the Regulation of Traffic

NSW Government
Practitioner's Guide to Movement and Place
Design of Road and Streets Guide
NSW Public Spaces Charter
NSW Public Spaces Charter Draft Practitioner's Guide
NSW Public Spaces Activation Guide
NSW Guide to Walkable Public Space
NSW Traffic Signs Register
Healthy Streets Design Check Tool
Travel Plan Toolkit - Hospital Precincts
Your Guide to the DA Process
Development near Rail Corridors and Busy Roads – Interim Guide
Better Placed: An Integrated Design Policy for the Built Environment of NSW
Evaluating Good Design
Implementing Good Design
Design Guide for Schools & Environmental Manual
Design Guide for Heritage
Urban Design for Regional NSW
NSW Car Park Guidelines for Crime Prevention
Crime Prevention Through Environmental Design
Other standards/guidelines
Australian Transport Assessment and Planning (ATAP) Guidelines
Disability Standards for Accessible Public Transport

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Appendix B

– List of Roads Act sections relevant to transport matters

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Appendix B – List of Roads Act sections relevant to transport matters

There are a number of sections of the Roads Act which are commonly relevant to TfNSW as outlined in the following table.

Part/Section	Description
Part 1	**Preliminary**
Section 5	Right of Passage Along Public Road by Members of Public
Section 6	Right of Access to Public Road by Owners of Adjoining Land
Part 3	**Road boundaries and road levels**
Section 26	No Constructions on Land Affected by Road Widening Order
Part 4	**Closing of public roads**
Section 37	Decision on Proposal
Part 5	**Classification of roads***
Section 61	Road Works on Certain Classified Roads
Section 64	TfNSW may exercise functions of roads authority with respect to certain roads
Section 70	Construction of access to freeways, transitways etc prohibited
Part 6	**Road work**
Section 75	Public authorities to notify TfNSW of proposal to carry out road work on classified roads
Section 87	Traffic control facilities
Part 7	**Protection of public roads and traffic**
Section 104	TfNSW may direct removal etc of traffic hazards
Part 8	**Regulation of traffic by roads authorities**
Section 116	Applications for consent
Part 9	**Regulation of works, structures and premises**
Section 125	Approval to use road for food or drink premises
Section 128	Roads authority may grant permit
Section 138	Works and structures
Section 144B	Roads authority not to obstruct light rail system
Section 144C	Consent for works and other action relating to light rail system
Part 12	**Acquisition of land**
Section 177	Power to acquire land generally
Section 178	Procedure for acquiring land

Note: * The schedule of roads classified under the Roads Act 1993, and State and regional roads, is available on the TfNSW website

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Appendix C

– List of State Environmental Planning Policies relevant to transport matters

Appendix C – List of State Environmental Planning Policies relevant to transport matters

There are a number of State Environmental Planning Policies (SEPPs) that may be relevant to a TIA. Selected SEPPs and relevant divisions or sections are outlined in the table below.

The latest version of the SEPPs mentioned in the table are available online and must be checked to ensure all the latest amendments are considered.

Name of SEPP/relevant divisions or sections	Description	TfNSW's Guidance
State Environmental Planning Policy (Transport and Infrastructure) 2021		
Chapter 2 Part 2.3 Development controls – Division 15 Railways		
Subdivision 1	Railways and rail infrastructure facilities	
Subdivision 2	Development in or adjacent to rail corridors and interim rail corridors	Some of the sections in this subdivision require concurrence be granted by the rail authority of the respective rail corridor. TfNSW is the rail authority of all rail corridors (including light rail) except for a rail corridor that is vested or owned by Australian Rail Track Corporation Ltd (ARTC).
Section 2.97	Development involving access via level crossings	Concurrence is required from the rail authority. The rail authority may require the applicant to undertake a safety assessment consistent with Australian Level Crossing Assessment Model (ALCAM) to demonstrate the rail safety or operational issues associated with the aspects of the development and the implications of the development for traffic safety are satisfied.
Section 2.98, 2.99, 2.101 and 2.102	Impacts (both construction and operational) of development that locates within or adjacent to rail corridors	Referral to the rail authority is required under Sections 2.98 and 2.99. For Section 2.101, concurrence from the relevant rail authority is required. For Section 2.102, a certificate issued by the Secretary of Department of Transport is required to certify whether or not there would be any adverse effect on the viability of the proposed metro corridor from the proposed development.
Section 2.103	Development near proposed metro stations	It requires a consent authority to take into consideration of whether the proposed development will encourage the increased use of public transport when granting or not granting consent to a development.
Chapter 2 Part 2.3 Development controls – Division 17 Roads and traffic		
Subdivision 1	Roads and road infrastructure facilities	
Subdivision 2	Development in or adjacent to road corridors and road reservations	
Section 2.118	Development on proposed classified roads	Consent authority must take into consideration of the safety, efficiency and ongoing operation of the classified road will not be adversely affected by the proposed development in the assessment of developments application.

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Appendix C – List of State Environmental Planning Policies relevant to transport matters (continued)

Name of SEPP/relevant divisions or sections	Description	TfNSW's Guidance
Section 2.119	Developments with frontage to classified roads	Consent authority must take into consideration that the safety, efficiency and ongoing operation of the classified road will not be adversely affected by the proposed development in the assessment of development's application.
Section 2.121	Excavation in or immediately adjacent to corridors	Referral for comment must be given to TfNSW by the consent authority.
Section 2.122	Traffic generating development	A detailed TIA should be prepared as part of the environmental impact assessment and referred to TfNSW for comment. Applicants should consult with TfNSW prior to the preparation of the TIA if the development has access to a classified road or a road that connects to a classified road.
Chapter 4 Major Infrastructure Corridors		
Section 4.7	Development in future infrastructure corridor for previously permitted uses of land	Concurrence is required from TfNSW prior to consent authority, determines a DA or an application for modification of a consent.
State Environmental Planning Policy (Resources and Energy) 2021		
Section 2.22	DAs for the purposes of mining or extractive industry that involves transportation of materials	Referral to each roads authority of the road and TfNSW (if it is not a roads authority of the road) is required; and The consent authority must consider any submissions that it receives from any road authority or TfNSW prior to determining the application.
State Environmental Planning Policy (Precincts - Eastern Harbour City) 2021		
Section 6.12	Development of land within the Cooks Cove site	Consent must not be granted without the approval of a comprehensive transport management plan after being satisfied TfNSW has agreed to the strategies of the management plan.
State Environmental Planning Policy (Precincts - Central River City) 2021		
Appendix 9 – Schofields Precinct Plan		
Section 6.10	Development of land within or adjacent to public transport corridor	Concurrence from TfNSW is required for consent of development in the area marked "H" on the Land Zoning Map.
Appendix 11 – Blacktown Growth Centres Precinct Plan		
Section 6.10	Development of land within or adjacent to public transport corridor	Concurrence from TfNSW is required for consent of development in the area marked "I" on the Land Zoning Map.
Appendix 13 – Marsden Park Industrial Precinct		

Appendix C – List of State Environmental Planning Policies relevant to transport matters (continued)

Name of SEPP/relevant divisions or sections	Description	TfNSW's Guidance
Section 6.6	Development of land within or adjacent to public transport corridor	Concurrence from TfNSW is required for consent of development in the area marked "I" on the Land Zoning Map.
State Environmental Planning Policy (Precincts - Western Parkland City) 2021		
Section 4.27	Transport corridors	Concurrence from TfNSW is required for development of certain capital investment value and at certain location as stipulated in sub-sections (1) (a) and (b). Consent must not be granted to a development of certain capital investment value and at certain location as stipulated in sub-sections (3), without consultation with Sydney Metro.
Section 7.15	Signage	Written notice to TfNSW is required and the consent authority is required to consider any comments provided by TfNSW in determining the application.
State Environmental Planning Policy (Industry and Employment) 2021		
Section 2.34	Development of land within or adjacent to transport investigation area	Concurrence from TfNSW is required for development of a certain capital investment value and at certain location as stipulated in sub-section (1).
Section 2.35	Development within Mamre Road Precinct	Concurrence from TfNSW is required for development of a certain capital investment value and at certain location as stipulated in sub-section (1).
Sections 3.13, 3.14, 3.15, 3.16 and 3.17	DAs relating to advertisement	Concurrence from TfNSW is required when consent is granted to the display of the advertisement in accordance with section 3.16.

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Appendix D

– TIA report structure outline

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Appendix D – TIA report structure outline

The following provides an outline of the reporting structure and table of contents for a detailed TIA and is not prescriptive for all TIAs.

Heading	Purpose
Executive summary	Summary of the TIA including: a description of the site area, proposed development, types of studies undertaken (impacts, signal warrant, site access, etc.), findings, conclusions and recommendations.
Table of contents, List of Figures, List of Tables, Glossary, Appendices	A multi-levelled table of contents, list of figures and list of tables. Include a glossary of key abbreviations and definitions of technical terms.
1.0 Introduction 1.1 Background 1.1.1 Policy context 1.1.2 Overarching principles 1.2 Proposed development 1.3 Scope of the study 1.3.1 Methodology 1.4 Report structure	Brief overview of the background of the TIA, list of documents reviewed, summary of the proposed development, the scope of the study (including study objectives).
2.0 Proposed development 2.1 Study area 2.2 Zoning 2.3 Land use and intensity 2.4 Future Corridor Protection Requirements 2.5 Site plan 2.6 Development timing	Details of the proposed development, describing the existing and proposed land uses for the site as well as the surrounding area. This section would also include the proposed site plan, construction/development timing, and area of influence.
3.0 Existing conditions 3.1 Existing travel behaviour 3.2 Active transport 3.2.1 Pedestrian 3.2.2 Cycling 3.3 Public transport 3.3.1 Rail 3.3.2 Bus 3.3.3 Light rail 3.3.4 Ferry 3.3.5 Taxi 3.4 Private transport 3.4.1 Road network 3.4.2 Traffic volumes and conditions 3.4.3 Existing network/ intersection performance 3.4.4 Parking facilities and demand Other as applicable (e.g. freight and service vehicles)	A review of the existing travel demand based on available data, such as the top origins and destinations for JTW trips and mode splits. Existing facilities, service frequencies and demand by mode. Deficiencies and issues should also be identified here. If applicable, a summary of the existing traffic modelling results.
4.0 Future context (without Proposal) 4.1 Overview 4.2 Committed upgrades and service improvements 4.2.1 Active transport 4.2.2 Public transport 4.2.3 Private transport 4.3 Background growth	This section will review the future context for the site and surrounding area, as well as an outline of background growth without the proposed development.

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Appendix D – TIA report structure outline (continued)

Heading	Purpose
5.0 Operational impacts (with Proposal) 5.1 Travel forecasts 5.1.1 Trip generation 5.1.2 Trip distribution 5.1.3 Forecasted mode split 5.1.4 Trip assignment 5.2 Active transport facilities 5.2.1 Pedestrian 5.2.2 Cycling 5.3 Public transport 5.3.1 Rail 5.3.2 Bus 5.3.3 Light rail 5.3.4 Ferry 5.3.5 Taxi 5.4 Private transport 5.4.1 Traffic volume forecasts 5.4.2 Capacity and Level of Service 5.4.3 Intersections and traffic signals 5.4.4 Parking facilities 5.4.5 Road safety review	This section will provide a detailed comparison of the site operational impacts with and without the proposed development to identify the impacts of the development on all modes.
6.0 Impact mitigation 6.1 Improvements to accommodate existing demand 6.2 Additional improvements to accommodate site trips 6.3 Summary of proposed improvements (including funding arrangements and status: Already Funded, Programmed or Planned) 6.4 Evaluation	This section will review the upgrades and measures put in place to accommodate the demand generated by the development for all modes, such as end of trip cycle facilities and intersection upgrades. A summary of committed and proposed projects and an evaluation of the effectiveness of the package of improvements in managing travel demand.

Heading	Purpose
7.0 Conclusion and recommendations 7.1 Key findings 7.1.1 Site accessibility 7.1.2 Transport impacts 7.1.3 Need for improvements 7.1.4 Compliance with applicable local codes 7.2 Recommendations 7.2.1 Site access/circulation plan 7.2.2 Active transport improvements 7.2.3 Public transport improvements 7.2.4 Road network improvements 7.2.5 Funding arrangements and developer contributions 7.3 Conclusion(s)	This section should serve as a summary for the reviewer to be able to understand the key transport impacts of the proposal, as well as the measures proposed to mitigate any associated issues for each mode.
Appendix A – Transport Modelling Report	Reporting of any transport modelling undertaken including methodology, calibration, validation and results. A summary should be provided within the body of the report.
Appendix B – Transport Data and Surveys B.1 Intersection count results B.2 Tube count results B.3 Pedestrian count results etc.	The collected input data should be provided to ensure the integrity of the assessment preparation.
Appendix C – Travel Plan	Developed in line with Chapter 4: Travel demand management.
Any other additional Appendices as required	

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Appendix E

– Scoping checklist

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Appendix E – Scoping checklist

The following table serves as a checklist of typical items that are considered or developed in TISs and TIAs. The final column also includes considerations for subdivision TIAs. This checklist is not prescriptive and aims to assist practitioners in optimising a TIA or TIS to focus on critical and impactful elements.

Y = Generally Required. **M** = May be Required depending on Development Circumstances.

Deliverables and Actions Checklist	GTIA Cross Reference	Conditions where this may be required	TIS	TIA	Subdivision
Scoping					
Determine suitable assessment: Transport Impact Statement (TIS)	Chapter 3, Section 3.2.5	Small impact developments, generally below the T&I SEPP Schedule 3 thresholds	Y	-	-
Determine suitable assessment: Transport Impact Assessment (TIA)	Chapter 3, Section 3.2.5	Medium to large impact developments, generally meet or above the T&I SEPP Schedule 3 thresholds	-	Y	Y
Proposed development					
Alignment with relevant transport strategies, plans and planning controls	Chapter 2, Section 2.3.1	Always	Y	Y	Y
Relevant site characteristics, including location and proposed land use mix	Chapter 2, Section 2.3.1	Always	Y	Y	Y
Plans showing layout of site and access arrangements for all modes	Chapter 7	Always	Y	Y	Y
Travel demand management measures	Chapter 4, Section 4.2	To reduce dependency on private vehicle travel when there is (or proposed to be) adequate accessibility to alternative transport modes	-	M	M
Travel Plan	Chapter 4, Section 4.3	At the consent authority's discretion, typically to mitigate significant impact	-	M	M
Parking provisions and facilities by mode and vehicle type, on-street and off-street	Chapter 8	Always	Y	Y	Y
Movement and place roles of internal roads	Chapter 7, Section 7.4	Subdivisions	-	-	Y
Freight and servicing plan	Chapter 6, Section 6.2.3	Significant and/or complex freight and servicing	M	Y	Y
Delivery and Servicing Plan (refer to TfNSW's Last Mile Toolkit)	Chapter 6, Section 6.4.4	At the consent authority's discretion, typically in urban centres	-	M	M

Appendix E – Scoping checklist (continued)

Y = Generally Required. **M** = May be Required depending on Development Circumstances.

Deliverables and Actions Checklist	GTIA Cross Reference	Conditions where this may be required	TIS	TIA	Subdivision
Existing Conditions					
Area of influence and peak periods identified by mode	Chapter 6, Section 6.2.2	Always	Y	Y	Y
Surrounding transport networks, and origins and destinations connected					
Walking network	Chapter 6, Section 6.2.3	Walking demand	M	Y	Y
Cycling network	Chapter 6, Section 6.2.3	Significant cycling demand and/or limited cycling capacity	M	Y	Y
Public transport network, including service frequencies	Chapter 6, Section 6.2.3	Significant public transport demand and/or limited public transport capacity	M	Y	Y
Road network, including movement and place roles	Chapter 6, Section 6.2.3	Significant road network demand and/or limited road capacity	M	Y	Y
Existing and future baseline transport network conditions					
Walking space analysis	Chapter 6, Section 6.2.3	Walking demand	M	Y	Y
Cycling connections analysis	Chapter 6, Section 6.2.3	Significant cycling demand and/or limited cycling capacity	M	Y	Y
Public transport capacity and accessibility analysis	Chapter 6, Section 6.2.3	Significant public transport demand and/or limited public transport capacity	M	Y	Y
Road performance analysis	Chapter 6, Section 6.2.3	Significant road network demand and/or limited road capacity	M	Y	Y
Road safety assessment	Chapter 6, Section 6.2.3	Road user demand	M	Y	Y

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Appendix E – Scoping checklist (continued)

Y = Generally Required. **M** = May be Required depending on Development Circumstances.

Deliverables and Actions Checklist	GTIA Cross Reference	Conditions where this may be required	TIS	TIA	Subdivision
Development Impacts					
Trips generated to/from the development by mode	Chapter 5, Section 5.5	Always	Y	Y	Y
Trip distribution and network assignment at an appropriate scale	Chapter 5, Section 5.5.5	Always	Y	Y	Y
Development impacts on the surrounding transport network in peak periods					
Walking space analysis to key points of interest	Chapter 6, Section 6.2.3	Significant walking demand	M	M	Y
Cycling connections analysis	Chapter 6, Section 6.2.3	Significant cycling demand	M	Y	Y
Public transport capacity and accessibility analysis	Chapter 6, Section 6.2.3	Significant public transport demand	M	Y	Y
Public transport interchange capacity and safety analysis	Chapter 6, Section 6.2.3	Significant pedestrian demand at station precincts or interchanges	M	M	M
Road performance analysis	Chapter 6, Section 6.2.3	Significant road demand	M	Y	Y
Road signal warrant and turn lane warrant analysis	Chapter 6, Section 6.2.3	Significant road demand	M	Y	Y
Road safety assessment (see Transport's Road Safety Assessment Methods)	Chapter 6, Section 6.2.3	Always	M	Y	Y
Road safety audit (see Transport's Guidelines for Road Safety Audit Practices)	Chapter 6, Section 6.2.3	Significant road safety risk	M	M	M
On-site transport movements and parking analysis, including swept path diagrams	Chapter 7, Chapter 8	Vehicle movements on-site	M	Y	-
Construction impacts on the surrounding transport network					
Haul routes and the type of heavy vehicles used	Chapter 3, Section 3.4.4	Significant construction impacts on road network	-	M	M
Public transport access, service or route disruptions	Chapter 3, Section 3.4.4	Construction impacts on public transport network/services	-	M	M
Pedestrian and cyclist access	Chapter 3, Section 3.4.4	Construction impacts on active transport network	-	M	M

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Appendix E – Scoping checklist (continued)

Y = Generally Required. **M** = May be Required depending on Development Circumstances.

Deliverables and Actions Checklist	GTIA Cross Reference	Conditions where this may be required	TIS	TIA	Subdivision
Mitigations					
Improvements, such as design changes and infrastructure upgrades	Chapter 6, Section 6.4	If mitigations are necessary for the final design	M	M	M
Construction impact mitigations	Chapter 6, Section 6.4	If mitigations are necessary during construction	M	M	M
Funding arrangements and developer contributions	Chapter 6, Section 6.5	If mitigations are necessary	M	M	M
Issue specific considerations					
Signage complies with the Transport Corridor Outdoor Advertising and Signage Guidelines	Chapter 6, Section 6.2.3	Roadside signage or advertising	M	M	M
Strategic design complying with Transport's Strategic Design requirements for DAs	Chapter 3, Section 3.3.4	Works on State roads and traffic signals on any road	M	M	M
Development near rail corridors and busy roads, as per Transport and Infrastructure SEPP	Chapter 6, Section 6.2.4	Development near rail or busy road corridors	M	M	M
Development involving access via level crossings, as per Transport and Infrastructure SEPP	Chapter 6, Section 6.2.3	Development involving access via level crossings	M	M	M
Site permeability and access to local networks	Chapter 6, Section 6.2.4	Design proposes an internal street network	M	M	Y
Traffic analysis using modelling software	Chapter 6, Section 6.3	Significant road network demand and/or limited road capacity	M	M	M
Pedestrian analysis using modelling software	Chapter 6, Section 6.3	Significant pedestrian demands	M	M	M
Impact of freight traffic on road safety and capacity, including at key intersections	Chapter 6, Section 6.2.3	Significant and/or complex freight	M	M	M
Heavy vehicle driver facilities, including truck and trailer parking and rest facilities	Chapter 6, Section 6.2.3	Significant freight	M	M	M

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Appendix F

– Levels of service for intersections

Appendix F – Levels of service for intersections

Levels of service

It is important to assess the impact of a development proposal on the efficiency of the road network. Level of service is a performance indicator for this purpose. This is a qualitative assessment of the quantitative effect of factors such as speed, volume of traffic, geometric features, traffic interruptions, delays and freedom to manoeuvre.

The effect of differing levels of traffic flow on the operating performance of intersections is assessed by considering the intersection volume/capacity ratios (referred to as Y values), and intersection degrees of saturation (referred to as X values). The X value eliminates the variability caused by lost time within an intersection. It does not however always adequately describe operating conditions, such as when minimum phase times are determined by pedestrian facilities.

While computer based intersection assessment programs are commonly used nowadays, and could provide an effective way of carrying out an assessment, it must be noted that these programs require accurate input data and interpretation of the output by a skilled transport planning/engineering practitioner.

Level of service	Average delay per vehicles (secs/veh)
A	<14
B	15 to 28
C	29 to 42
D	43 to 56
E	57 to 70

The figures as shown in the table above are intended as a guide only. Any particular assessment should take into account site-specific factors including maximum queue lengths (and their effect on lane blocking), the influence of nearby intersections and the sensitivity of the locations to delays. In many situations, a comparison of the existing and future average delay provides a better appreciation of the impact of a development proposal, and not simply the change in the level of service.

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