



Evaluation and Implementation of Shared Spaces in NSW

Stage 2a – Empirical analysis of Shared Road Infrastructure in NSW: Collation of shared road infrastructure perspectives and local examples

Final Report

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Transport Research Centre (TRC), School of Civil and Environmental Engineering,
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Table of Contents

List of Figures	4
List of Tables.....	4
Executive Summary	6
1 Introduction	8
1.1 UTS Shared Spaces Research Program.....	11
1.2 Outcomes of Stage 1: Examination of existing shared space knowledge	12
1.3 Stage 2a Objectives	12
1.4 Report Structure	13
2 Stakeholder Workshop Development and Implementation.....	14
2.1 Workshop Structure.....	14
2.1.1 Workshop Activity Design.....	15
2.1.2 Initial Workshop Structure: Leveraging Lego Serious Play®.....	17
2.1.3 Pilot Testing.....	19
2.1.4 Final Workshop Structure.....	24
2.2 Recruitment	26
2.3 Implementation and Participation	26
2.4 Workshop Outcomes	26
2.4.1 Workshop 1	30
2.4.2 Workshop 2	32
2.4.3 Workshop 3	34
2.4.4 Workshop 4	36
2.4.5 Aggregated analysis of all four workshop outcomes	38
2.4.6 Summary of Key Findings	45
3 Shared Road Infrastructure Database	46
3.1 Database Development	46
3.1.1 Key Variables	46
3.2 Method of Site Identification	47
3.3 Collation of City of Sydney Data	48
3.3.1 Preliminary Analysis of City of Sydney Data	48
3.4 Summary of the Shared Road Infrastructure Database development.....	50
4 Limitations and Future Work.....	51
5 Concluding Remarks	52
6 References	56

APPENDICES.....	58
Appendix A1: Workshop 1 Notes.....	59
Appendix A2: Workshop 2 Notes.....	68
Appendix A3: Workshop 3 Notes.....	77
Appendix A4: Workshop 4 Notes.....	86
Appendix B: User guide for the Shared Road Infrastructure Database.....	95

List of Figures

Figure 1: Before and After - Fort Street, Auckland, New Zealand.	8
Figure 2: Built Environment Indicator themes (NSW Government, 2022).	9
Figure 3: Research program structure.	11
Figure 4: Report Structure and Logic.....	13
Figure 5: Connections between prioritised metrics.	17
Figure 6: Example of a "Street Experience" built by an individual participant.....	20
Figure 7: Group model identifying the relationship between key aspects identified by individuals.	21
Figure 8: Metric development and connection definition.....	21
Figure 9: Metric connection and prioritisation.	22
Figure 10: Workshop 3 group model presenting zone-based approach to shared space implementation.....	27
Figure 11: Existing shared space infrastructure in the City of Sydney LGA.	48
Figure 12: Contrast of two different shared space treatments (Google Maps, 2021a, 2021b).	50
Figure 13: Comparison of shared space definition and consolidated perspectives.	53
Figure 14: Staged Research Program (Highlighting Stage 2).....	54

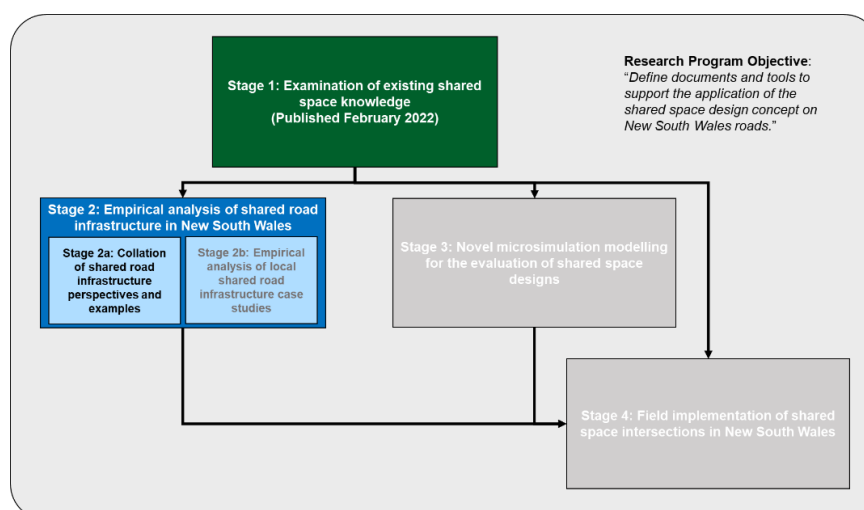
List of Tables

Table 1: Possible Workshop Activity Options.	15
Table 2: Initial Workshop Structure.....	18
Table 3: Strategies to improve the structure of the workshop.....	22
Table 4: Alternative Workshop Structure.	23
Table 5: Finalised Workshop Structure.....	25
Table 6: Aspect categorisation (Extracted from (CIHT, 2018)).	28
Table 7: Metric categorisation using BEI themes (Using (NSW Government, 2022)).....	29
Table 8: Summary of Workshop 1 Outcomes.	31
Table 9: Summary of Workshop 2 Outcomes.	33
Table 10: Summary of Workshop 3 Outcomes.	35
Table 11: Summary of Workshop 4 Outcomes.....	37
Table 12: References to shared space design in workshop aspect identification process. ...	38
Table 13: Consolidation of group model descriptions across all four workshops (green highlight indicates relationship with the shared space definition).....	39
Table 14: Grouping of primary aspects across all 4 workshops.	40

Table 15: Categorisation of key aspects across all 4 workshops.	41
Table 16: Classification of metrics across the 4 workshops.	42
Table 17: Identified metrics that are similar to BEI metrics.	42
Table 18: Metrics classified as "Other".	43
Table 19: Number of unique identifications of specific metrics across the 4 workshops.	44
Table 20: Collation of must have metrics across the 4 workshops.	44
Table 21: Variables collected in Shared Road Infrastructure database.	47
Table 22: Geographic analysis of the distribution of collated shared spaces across the City of Sydney LGA.	49
Table 23: Zoning classification of collated shared spaces across the City of Sydney LGA. .	49

Executive Summary

Shared spaces, in the context of road infrastructure, are locations that minimise the separation of road users to reduce and slow vehicle traffic and enhance place characteristics. In New South Wales (NSW), shared spaces have traditionally been associated with shared zones; streets with legislative speed limit requirements of 10km/h where vehicles must give way to pedestrians and cyclists. Alternative shared space solutions do not have detailed guidance or standards. Accordingly, the Transport Research Centre, within the School of Civil and Environmental Engineering at the University of Technology Sydney (UTS), was commissioned by Transport for New South Wales (TfNSW) and supported by the iMOVE CRC to **collate industry perspectives and examples of shared road infrastructure to provide greater clarity for the development of more comprehensive shared space guidance**. The following report details the findings from Stage 2a of the *UTS Shared Spaces Research Program* and refers to and reflects upon Stage 1, a comprehensive literature review. This Research Program aims to **establish the definition and understanding of shared space designs to provide transport practitioners additional options and guidance to define successful places**.



Stage 2a included two work packages, (1) stakeholder workshops to gather experiences, feedback, and future directions from practitioners and (2) development of a database identifying locations and attributes of shared space instances within the Sydney Metropolitan area. High level critical findings of Stage 2a include:

- Stakeholder consultation workshops revealed that **shared spaces were seen as a valuable tool** in balancing movement and place for street and road designs.
- Workshop participants identified safety, enhanced priority for active and public transport modes, lower speed environments and establishment of place using nature and other social infrastructure as the core aspects necessary for an ideal user experience.
- **“Vehicle Speed”, “Diversity of users” within the space/street and “Mode split”** were the most highly cited metrics to assess shared spaces by workshop participants.
- Metrics of most importance tended to focus on social interaction and liveability with the **presence of “nature/vegetation” being identified as important for evaluation of success**.
- A database of shared road infrastructure was developed and has been used to collate sites within the City of Sydney.

A brief summary of the key contributions categorised by section include:

- **Section 2: Stakeholder Workshop Development and Implementation**

- Practitioner perspectives of the shared space concept were explored through stakeholder workshops employing the Lego® Serious Play (LSP) methodology.
- The LSP methodology uses Lego® building blocks to enhance engagement within a workshop environment and ensure even participation leading to an inclusive outcome.
- Four workshops (two for each street context of Civic Spaces and Local Streets) were held across March, April, and May 2023, where a total of 27 transport professionals with diverse backgrounds from the private and public sector and exposure to street design and implementation, participated.
- Most participants suggested “**strategic use of shared road infrastructure**” where separated infrastructure was present to support vulnerable road users which bounds shared space designs (“zone-based approach” of shared space application).
- Using the responses from the workshop, and consistent with definition of shared spaces established in Stage 1, the following consolidated perspective to achieve an ideal shared road infrastructure experience was formed:

*“In order to achieve an effective shared space that can create an ideal experience for the community, **people must be prioritised ahead of vehicles. Lower speed environments** that promote accessibility and safety for all users in terms of mobility and, access to amenities and services **can enable changes in driver behaviour.** The **natural environment (vegetation and tree canopy) and zone-based applications of shared space designs should be leveraged** to transition from movement-oriented infrastructure to a place-oriented space. This strategic direction can cultivate an **inclusive shared space that fosters a sense of community while maintaining mobility.**”*

- **Section 3: Shared Road Infrastructure Database**

- Accordingly, a database of share space facilities was developed to initiate the data collection related to shared spaces. This addresses the lack of documentation of existing shared space sites, a gap identified in Stage 1.
- A Microsoft Power BI dashboard underpinned by a spreadsheet was used to collate the location, spatial dimensions, and other key features of shared space sites in Sydney Metropolitan area.
- The database has been constructed to collate data for sites across NSW, and as a pilot, all sites within the City of Sydney have been included.

Stage 2a revealed the significance of shared space solutions in achieving streets that strike a safe balance between movement and place, aligning with various street classifications defined by TfNSW. In addition, the database development highlighted a sample of the existing sites present on the network. However, there is limited guidance for practitioners seeking to implement the shared spaces, potentially complicating future applications. **Continued research will address this gap and comprehensively understand the impacts of shared spaces. This can ultimately lead to evidence-based frameworks and guidelines that facilitate appropriate implementation and evaluation of these solutions.**

1 Introduction

A place is an identifiable geographic area that consists of a physical form, has meaning and offers an opportunity for the community to participate in activities (NSW Government, 2020). “Place”, in the context of road infrastructure, is critical to develop sustainable, active, and productive communities. Historically, the design and operation of roads have focussed on servicing the safe and efficient movement of vehicles, which has contributed to car dependency, emergence of vehicular road traffic congestion and the detachment from the concept of community (Newman et al., 2016). As a result, over the last two decades, the objectives have shifted to designing and operating roads for people, instead of vehicles, and defining places across the road network. Strategic locations have been re-developed entirely to aid access to adjacent land uses, encourage walking and social interaction, and regain the concept of community, creating a sense of place. Furthermore, practitioners have focussed on the movement of people by enhancing accessibility to public and active transport modes. This has been achieved through design options such as the inclusion of bicycle infrastructure, wider footpaths, and shelters for public transport stops.

The Transport Research Centre (of the School of Civil and Environmental Engineering, Faculty of Engineering and IT) at the University of Technology Sydney (UTS) was commissioned by TfNSW to investigate further opportunities to enhance place in the context of road infrastructure. To address this need, UTS have developed a staged research program that examines **shared spaces** and the design principles supporting it. **Shared space solutions minimise separation of travel modes and equalise priority across the travel modes to reduce the dominance of private vehicles, encourage active modes of transport, and support a greater usage of urban spaces by people and communities.** Figure 1 presents an example of a shared space transformation in Auckland (New Zealand) where the introduction of vegetation, seating and alternative pavement design has been effective in establishing a place tailored to the local context. This example has led to reduced vehicular traffic and speeds and importantly is valued and used by the community (Wijayarathna et al., 2022).

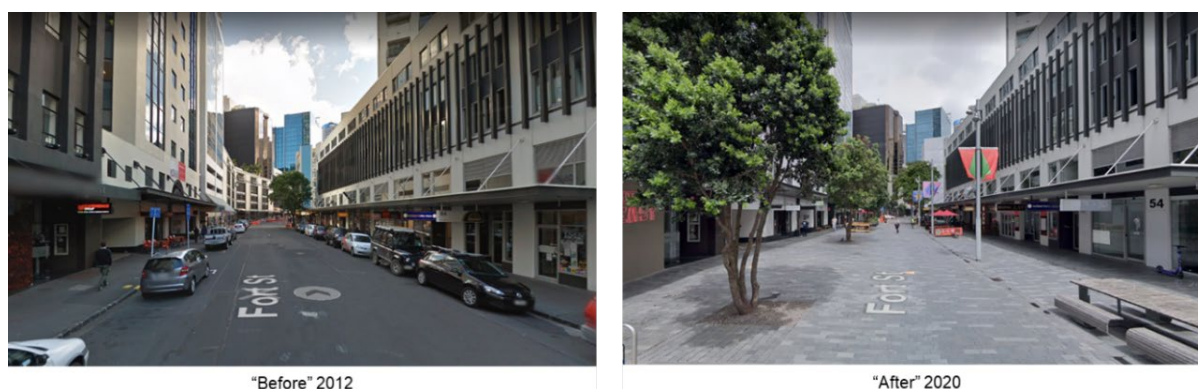


Figure 1: Before and After - Fort Street, Auckland, New Zealand.

This research project aligns with several recent developments concerning the planning and design of road infrastructure in NSW. A core vision of the NSW *Future Transport Strategy* is to “create vibrant, productive, liveable and sustainable places that support community health, safety and wellbeing” (TfNSW, 2021). Over the last decade, NSW Government has developed the “NSW Movement and Place Framework” (NSW Government, 2020) for the planning,

design, and operational management of road infrastructure. This framework advocates the establishment of “places” and provides practitioner guidance through a series of publications including: *The Practitioner’s Guide to Movement and Place* (2020) and *Movement and Place Evaluator’s Guide* (2020). These have been supplemented by tools and practitioner guidance that encourage active transport modes such as the “*Walking Space Guide: Towards Pedestrian Comfort and Safety*”, and the “*Cycleway Design Toolbox: Design Toolbox*”.

During December 2021, NSW Government released the “*NSW Movement and Place*” website, which collates the above documentation and presents a singular portal of information for the industry. The content of the website clearly articulates the need to systematically incorporate social, environmental, and economic aspects into roads and street design and operations. Furthermore, it formally presents 36 Built Environment Indicators (BEIs), separated into themes as shown in Figure 2, to establish a common language and quantification approach for road infrastructure evaluation across industry and government. The BEIs encompass the overall urban landscape, thus transcending traditional vehicular focused mobility and transport infrastructure evaluation methodologies.

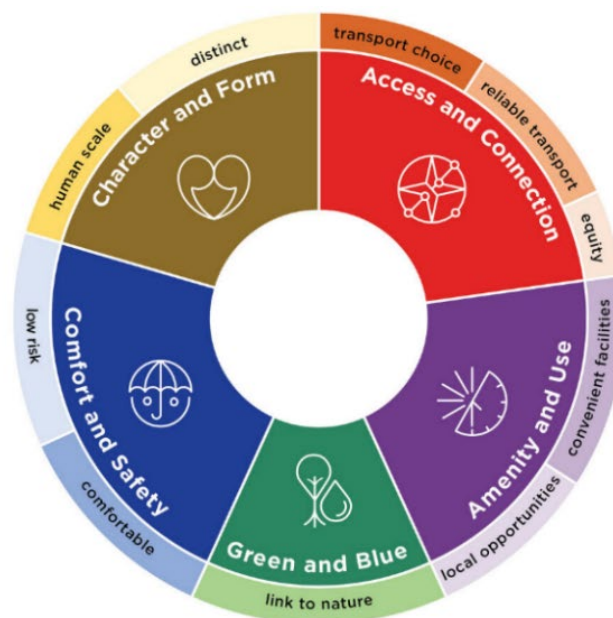


Figure 2: Built Environment Indicator themes (NSW Government, 2022).

The “*NSW Movement and Place Framework*” encourages the use of BEIs to classify street environments and support the design of roads for the community. The combination of ‘place intensity’ and ‘movement functions’ result in the classifications of civic spaces, local streets, main streets, main roads, and motorways within the road network. **Shared spaces offer an additional conceptualisation for greater place intensity to be achieved as it creates environments that remove mode hierarchy and enhance social interaction through the implementation of unique design features.**

Late in 2022, TfNSW released the “*Design of Road and Streets Guide*” as another resource of the *NSW Movement and Place Framework*. This document consolidates the available metrics, guidelines, and standards to provide practitioner guidance for the design of roads and streets in a variety of mobility contexts. The guide describes 21 street types for urban contexts and presents a variety of examples of best practice. Shared road infrastructure options are

highlighted, however **the guide does not explicitly document impacts of design solutions, prioritisation of options in different contexts or an evaluation framework to assess performance of implemented solutions.**

The NSW Government also referenced the “*Healthy Streets Design Check for Australia*” (Healthy Streets) tool in 2021 providing planning guidance for the design of road segments. This tool provides a further 19 indicators that are consistent with the BEIs offering practitioners the ability to prioritise street design elements in the context of a variety of social, environmental, and economic factors. Department of Planning and Environment (DPIE) have also supported the adoption of novel street and road designs through the “*Streets for Shared Spaces*” program launched in 2020. The program provides grant funding for Councils “*to deliver trials that test permanent changes that strengthen the amenity, accessibility and economic vitality of a high street and surrounding area, taking a place-based approach*”. **Though shared space design principles are central to these initiatives, there is limited guidance regarding design and implementation, making it challenging for practitioners to develop innovative solutions to establish safe places within urban landscapes and road networks.**

In addition to frameworks and guidance, it is also important to take into consideration standards and legislation. NSW Legislation (Road Rules 2014) contribute to the definition of roads and streets and place outcomes across the road network by establishing mode hierarchy across the spectrum of infrastructure and placing restrictions on user movements. Shared zone design and implementation must satisfy the NSW Government Technical Direction (TTS 2016/01) which is underpinned by Road Rule 24 which stipulates a maximum speed limit of 10km/h. Though a shared zone is a form of shared space, broader applications of the design approach may use speed limits between 10km/h and 30km/h (Wijayaratna et al., 2022). **Currently, there are no road rules associated with the design or implementation of the broader application of shared spaces, constraining practitioner design options to shared zone applications.** However, NSW Government recently released (July 2023) the NSW Speed Zoning Standard – TS 03631:1.0 (NSW Government, 2023b), which details the determination of speed zones on roads and streets in NSW. Section 10.2 of TS 03621:1.0 describes the requirements for accounting for high pedestrian activity and stipulates the use of 20, 30 or 40km/h speed limits to ensure a safe environment for all road users. The standard also requires “supporting infrastructure” to be installed to ensure that the road environment is suitable for lower speeds but does not provide a detailed discussion of specific options or the range of contexts practitioners could use. **Thus, guidance and standards for shared space designs can support the speed zoning standard, streamlining the implementation of safe road infrastructure.**

TfNSW have recognised the gap as an opportunity to gain a deeper evidence-based understanding of shared space applications to improve practice within Australia. limitations Thus, TfNSW have invested in UTS’s research program “*Evaluation and Implementation of Shared Spaces in NSW*” as a means of **advancing the NSW Movement and Place Framework and providing a clear evidence base and guidance for the future adoption of shared space designs.**

1.1 UTS Shared Spaces Research Program

The research program, “*Evaluation and Implementation of Shared Spaces in NSW*”, presented in Figure 3, investigates the potential application of shared spaces in NSW and intends to form an evidence base and guidance for practitioners for future implementation.

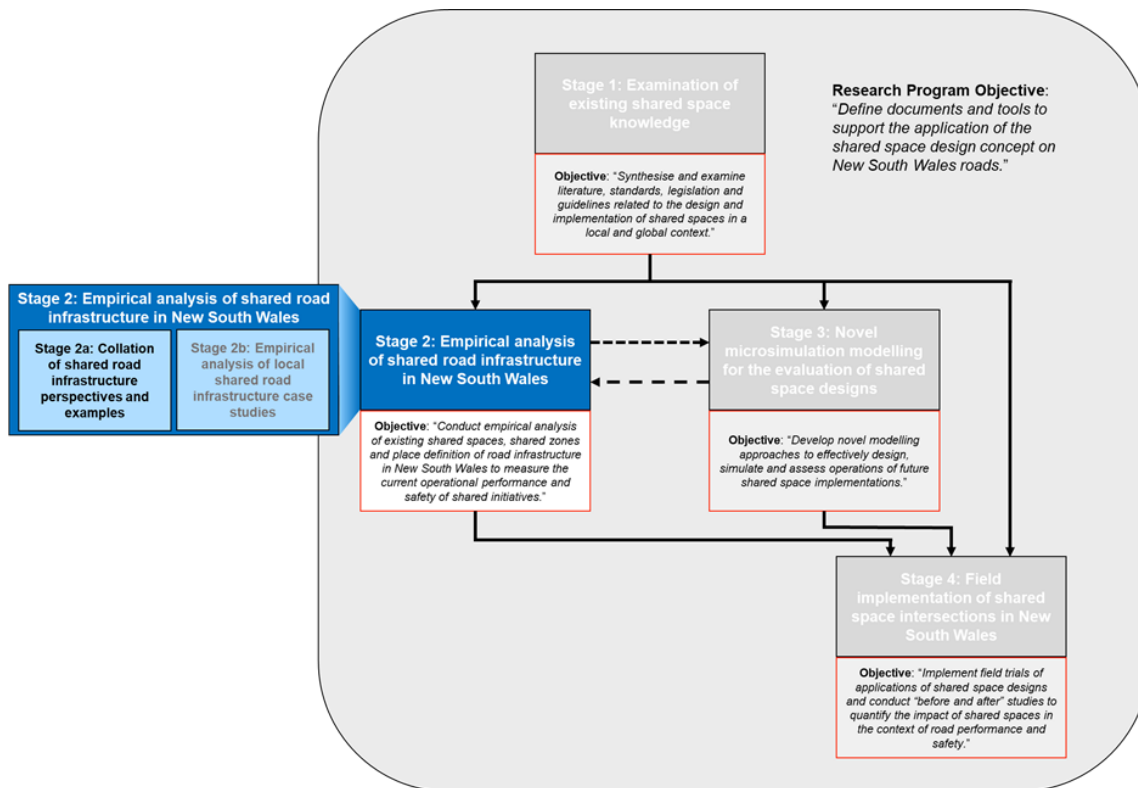


Figure 3: Research program structure.

Each stage of the research program consists of specific objectives and the program fulfils an overarching principal objective:

- **Review of Literature (Stage 1):** Synthesise and examine literature, standards, legislation, and guidelines related to the design and implementation of shared spaces in a local and global context.
- **Measure current performance (Stage 2):** Conduct empirical analysis of existing shared spaces, shared zones and placemaking road infrastructure in NSW to measure the current operational performance and safety of shared initiatives.
- **Contextualise design approach and scenario testing (Stage 3):** Develop novel microsimulation modelling approaches to effectively design, simulate, and assess operations of future shared space implementations.
- **Measure design effectiveness (Stage 4):** Implement share space intersections in field trials and conduct “before and after” studies to quantify the impact of shared spaces in the context of road performance and safety.
- **Establish Guidance (Accumulation of all Stages – Principal Objective):** Define documents and tools for the design and implementation of shared spaces on NSW roads.

1.2 Outcomes of Stage 1: Examination of existing shared space knowledge

Stage 1 of the research program delivered a [comprehensive review of literature](#) concerning the design principles and guidance for implementation of shared spaces. The research investigated the history and evolution of shared space design principles and also identified and analysed global and local application case studies. In collaboration with a TfNSW Working Group, this information was then synthesised to discuss the potential for application of shared spaces in NSW, highlighting current best practice as well as barriers and opportunities. The key outcomes of Stage 1 can be summarised as follows:

- **Shared space designs are useful** to create successful places.
- **A spectrum of intervention and design options are available** for practitioners within the shared space concept.
- Defining **relationships between design parameters or attributes and metrics are key** for creating successful shared space implementations.
- **Current guidelines, standards and practical processes limit the application of novel solutions** as well as other traditional solutions that value place over movement.

Building upon findings of Stage 1, the following report details the delivery and findings of the next step of the research program, “**Stage 2a: Empirical analysis of shared road infrastructure in NSW - Collation of shared road infrastructure perspectives and examples**”.

1.3 Stage 2a Objectives

Stage 2 in its entirety, distils and consolidates the findings from Stage 1 through additional guidance from transport practitioners, members of the community, and existing and collated data, so that real world shared spaces can be evaluated for their performance and effectiveness. Given the complexity of Stage 2, it has been separated into sub-stages:

- *Stage 2a: Collation of shared road infrastructure perspectives and examples*
- *Stage 2b: Empirical analysis of local shared road infrastructure*

The review of literature, conducted in the previous phase of the project revealed inconsistencies in the definitions and implementations of shared road infrastructure. Furthermore, given the importance of shared spaces to current planning practices, there is a lack of data available about the location and performance of existing sites. Thus, Stage 2a aims to gain clarity about shared road infrastructure design and implementation by gathering practitioner perspectives and initiate the identification and documentation of existing shared road infrastructure in a local setting. **The findings presented in this report will support the justification of site selection and data analysis techniques that will be used in Stage 2b.** The objectives of Stage 2a are as follows:

- **Clarify** definitions, objectives, design options and limitations of shared space applications in NSW.
- **Establish a database** of shared road infrastructure throughout the Sydney Metropolitan (focus on City of Sydney).

The collation of perspectives presented in this study does not take into consideration community perspectives, given the scope and resourcing that was available for the project. Consistency and clarity across practitioners are key to define guidance but equally important is gathering community views, especially vulnerable road users, to ensure that shared space infrastructure is usable and accessible. Accordingly, community perspectives will be gathered through a survey methodology in future research and will be compared with the findings of the study presented in this report.

1.4 Report Structure

In line with the project objectives, Stage 2a included two work packages:

1. **Stakeholder workshops** to gather experiences, feedback, and future directions from practitioners.
2. **Development of a database** identifying locations and attributes of shared spaces within the Sydney Metropolitan area.

The report is separated into two broad sections as presented in Figure 4. **Section 2** will detail the stakeholder workshop development and implementation. This section describes the formulation of workshop activities, piloting, recruitment, implementation, and outcomes from the activity. This section addresses the first primary objective of clarifying definitions and direction of the future application of shared space designs. **Section 3** addresses the second objective by explaining the establishment of the shared road infrastructure database for the Sydney Metropolitan. Finally, **Section 4**, concludes the report, summarising the key findings of the research and defining the next steps of the research program.

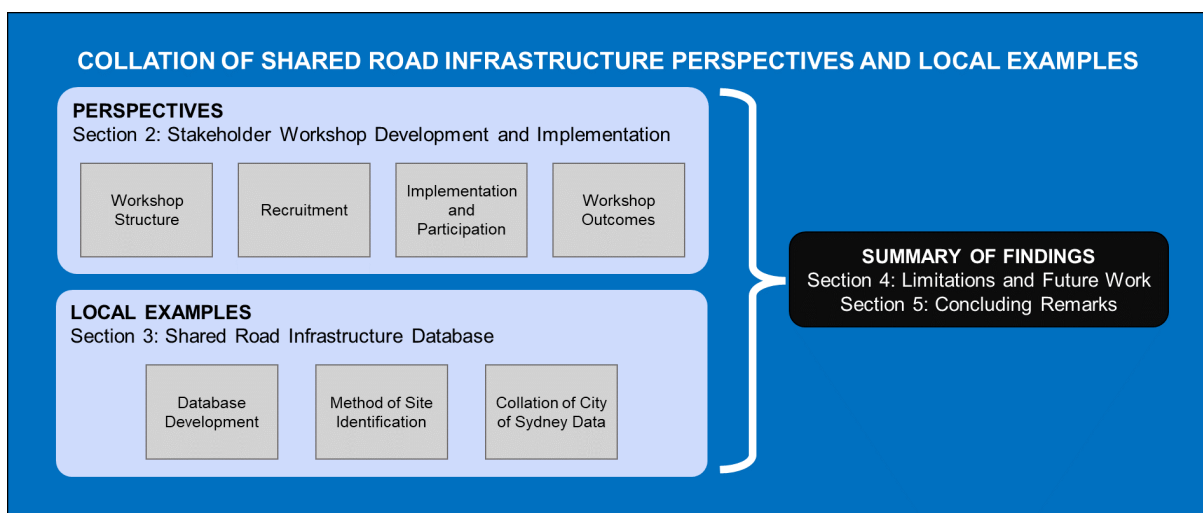


Figure 4: Report Structure and Logic.

2 Stakeholder Workshop Development and Implementation

Wijayaratna et al. (2022) presented a detailed review of literature concerning shared space implementation, evaluation, and guidance. This was delivered by analysing available documentation and global case studies, especially capturing the experiences throughout Europe and New Zealand. The primary findings from the study indicated that shared spaces involve a spectrum of design solutions that lead to positive impacts that enhance places. However, the process to implement a shared space design is complicated and there is limited guidance or scientific literature that correlate design aspects with key performance indicators that describe places on a road network. The lack of an evidence base establishing impacts in combination with instances of safety incidents within these designs led to criticism of the design approach in the United Kingdom as detailed by Imrie (2012), Imrie (2013) and Holmes (2015). Since this period, guidance and consensus regarding the application has not been achieved. Accordingly, to progress shared space applications within NSW, it is key to define a common understanding across stakeholders regarding the shared space design concept. Therefore, the development and implementation of stakeholder consultation was necessary to gather the perspectives of shared space designs from transport practitioners.

Several stakeholder consultation methods can be used such as: focus groups, surveys and questionnaires, interviews, workshops, town hall meetings, roundtable discussions, site visits, expert panels, and seminars. Focus groups, town hall meetings and round table discussions are tailored towards determining group solutions and sometimes can limit the ability for individual participants to identify specific attributes of a topic (Harrell & Bradley, 2009). On the other hand, surveys and questionnaires, interviews, expert panels, and seminars tend to focus on individual perspectives rather than group views (Knekta et al., 2019). Workshops are designed to create an environment for individuals to present ideas whilst also allowing for collaborative brainstorming, problem-solving and scenario planning exercises, and thus was the selected method. This allowed perspectives at both individual and group levels regarding key aspects and metrics of shared spaces to be gathered. In addition, it enabled patterns and consistency of the views related to shared road infrastructure design, implementation, and evaluation to be gauged.

2.1 Workshop Structure

Effective stakeholder consultation with members of an industry is core to developing standards and guidance (Cerè et al., 2019; Fraussen et al., 2020). The workshop included a variety of professionals involved in the planning, design and implementation of shared road infrastructure:

- Transport Planning
- Transport Design/Engineering
- Urban Planning
- Landscape Design/Architecture
- Pedestrian/Cyclist Design and Implementation
- Road Safety/Vulnerable Road User Providers

(Cerè et al., 2019; Fraussen et al., 2020) In addition, representation was necessary from the different sectors across the industry: State Government, Local Government, Developers and Consultants, which all contribute to the delivery of shared road infrastructure. Accordingly, the

design of the workshop was inclusive of the diversity in knowledge but also tailored to a participant list that had knowledge and experience in terms of road and street design and implementation.

The overarching objective of the stakeholder consultation workshops was to understand the variety of perspectives and gain clarity for the planning, design, implementation, and evaluation of shared road infrastructure. More specifically, it aimed to identify aspects that create an ideal experience in a street that safely balances place and movement as well as relevant metrics to measuring these aspects. Given the conjecture surrounding the terminology of “shared spaces”, care was taken to frame and structure the workshop. The term “*shared space*” was removed to assess whether the term would be used by participants to describe design options and define metrics within the workshop. The following sub-section details the activities carried out to deliver the workshop.

2.1.1 Workshop Activity Design

Workshop activities for stakeholder consultation aim to gather input, ideas, and feedback from stakeholders in a structured and interactive setting (Dowling et al., 2011; Hilson & Murck, 2000). Different formats for the workshop were considered such as brainstorming session, SWOT analysis, world café, dot voting, etc (Table 1).

Table 1: Possible Workshop Activity Options.

Activity	Description	Value for Shared Spaces Stakeholder Consultation Process
Brainstorming Sessions	Conduct brainstorming activities to encourage stakeholders to generate ideas, solutions, or suggestions related to the project. Provide a safe and non-judgmental environment for participants to share their thoughts freely.	Important to leverage as the overarching goal is to define a unified vision.
SWOT Analysis	Facilitate a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis to identify internal and external factors that may impact the project.	Not essential as detailed analysis of strengths and weaknesses of the topic aren't the focus of the workshop.
World Café	Organise a World Café-style activity where participants rotate through small groups, discussing specific questions or topics related to the project. This setup fosters diverse perspectives and allows for cross-pollination of ideas.	Not suitable for this context given the expected number of participants, time available and detail required.
Role-Play or Simulation	Use role-playing or simulation exercises to explore potential challenges or scenarios related to the project. This approach allows stakeholders to experience and understand different perspectives and dynamics.	Important to gather a variety of perspectives related to benefits and challenges of developing shared road infrastructure.
Dot Voting	Provide stakeholders with a limited number of dots or stickers and allow them to vote on priorities, preferences, or options. This simple voting technique helps identify the most favoured ideas or solutions.	Important to prioritise identified aspects and metrics.
Fishbowl Discussions	Conduct fishbowl discussions where a small group of stakeholders actively participates in the discussion while others observe. This setup can lead to more focused and insightful conversations.	Not suitable for this context given the expected number of participants, time available and detail required.

Activity	Description	Value for Shared Spaces Stakeholder Consultation Process
Idea Cards or Post-it Note Activities	Distribute idea cards or post-it notes to participants, asking them to write down their thoughts, concerns, or suggestions. Collect and display the cards to facilitate further discussion and analysis.	Important to share ideas related to aspects, metrics, and the overall vision.
Visual Mapping	Use visual mapping techniques like mind maps or concept maps to visualise relationships between different ideas, concepts, or stakeholder perspectives.	Important to connect aspects and metrics to support the definition of the vision.
Collaborative Workgroups	Set up collaborative workgroups with mixed stakeholders to work on specific tasks, challenges, or projects. This approach fosters teamwork and allows stakeholders to work together on shared goals.	Important to gather group perspectives and discuss costs and benefits of shared road infrastructure in collaboration.

Highlighted rows identify approaches that were suitable for the objective of the workshop.

To deliver a holistic and integrated visual and tactile structure of **metrics** associated to key **aspects** (or objectives) related to shared spaces that safely balance place and movement, the Lego Serious Play® (LSP) technique was chosen. Besides achieving a model using the Lego® bricks that visually represents and summarises the group response to a brief (an example is shown in Figure 5), LSP has a number of other advantages. LSP is a problem-solving and facilitation technique that relies on the creation of a model using Lego® bricks and the metaphor/meaning given by its builder (i.e., workshop participant) to the different parts of the model. This creates psychological safety and levels the playing field since participants bring their own perspective by presenting and discussing their model (Wheeler et al., 2020), thus being inclusive of different personality types. This is crucial for a truly successful stakeholder engagement in which everyone’s perspective is elicited, valued, and incorporated in the discussion. The fact that the final model created by the group has physical Lego® bricks of the models individually created by each participant (and its associated metaphor/meaning) is further evidence of the collaborative and inclusive nature of the technique.

The 100% engagement (namely, everyone is actively participating during the whole duration of the workshop) provides a major advantage of LSP compared to more traditional techniques, in which often 20% of people make 80% of the inputs/contributions (Rasmussen Consulting, 2022). LSP creates a change from “lean backward meetings” to “lean forward meetings” by using the Lego® pieces (LEGO Group, 2019), which make the session fun and engaging, prompting attendees to actively participate (Figure 5). These positive outcomes have been reported in prior applications of LSP and were also observed by the research team in the four workshops carried out as part of this project. LSP does not entail “filling a blank page” or verbal jousting that can occur in stakeholder consultation workshops, but instead explores the careful selection of Lego® bricks and the unique process where “people think through their fingers” (Rasmussen Consulting, 2022). Besides the psychological safety and the levelled playing field, the ludic aspect of Lego® ensures the attention and active participation of all the people attending the session. This means a diversity of ideas is captured and that everyone influences and has an impact on the group vision created (Grienitz & Schmidt, 2012; Lear et al., 2020; Primus & Sonnenburg, 2018). This was particularly relevant for this research considering the diversity of roles and professional backgrounds participating in the workshops. Capturing the

spectrum of perspectives was imperative to ensure a holistic and comprehensive understanding of shared spaces.

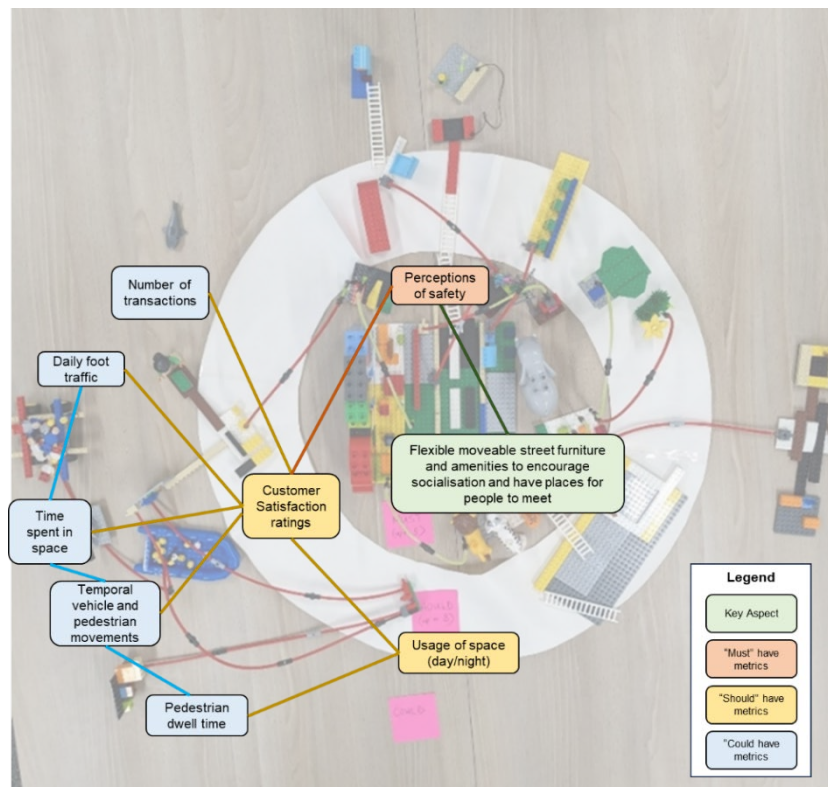


Figure 5: Connections between prioritised metrics.

2.1.2 Initial Workshop Structure: Leveraging Lego Serious Play®

The workshop was organised into four main parts mirroring the four core steps of the LSP process (Rasmussen Consulting, 2022): (1) the facilitator poses a question; (2) participants (individually or in groups) build a model in response to the question, having an internal mental process of constructing a story/assigning meaning to the bricks; (3) participants (individually or in groups) share the model's meaning or story to the rest of the group; and (4) the facilitator and participants reflect and crystallise key insights, prompting clarifying and explorative questions about the models.

In addition, the fundamental structure for a LSP workshop was also followed in line with Rasmussen Consulting (2022). This entails a skill building block (one hour duration) prior to the applications of one or more of the seven potential techniques (*building individual models, building shared models, creating a landscape, making connections, building a system, playing emergence and decisions, and extracting simple guiding principles*). This initial block (comprised of four exercises) establishes the correct starting conditions for the workshop, enables participants to become confident in using the bricks, and provides them with a hands-on experience of LSP four core steps. For this application, *building individual models* (Technique 1) was used for the individual street experience (Part I) and metrics development (Part III) whereas *building group models* (Technique 2) was used for group street experience (Part II) and metrics prioritisation (Part IV), as shown in Table 2. This structure entailed a scaffolded approach, which ensured individual models (and associated meaning/stories) were being incorporated into the final group vision and model (i.e. aspects that enable place and movement in a road or street and their associated metrics).

Table 2: Initial Workshop Structure.

Activities	Duration (mins)	Challenge questions & Instructions
Introduction	10	Welcome and purpose of the workshop
Skills building	60	<ol style="list-style-type: none"> 1. Build the tallest possible tower (5 minutes) 2. Build a model from the catalogue (Select from models 1 to 4) 3. Modify the catalogue model (2) to represent one of your key strengths as a professional. 4. Build a model of how you feel when doing your favourite outdoor activity.
Individual Street Experience – Part I	45	<ol style="list-style-type: none"> 5. Build an individual model that describes an ideal experience in a street that is a place for people while also allowing for movement and travel. Place a red brick on the 2 most important aspects of this experience.
BREAK	10	Break for all participants and facilitators.
Group Street Experience – Part II	45	<ol style="list-style-type: none"> 6. Build a group model that describes an ideal experience in a street that is a place for people while also allowing for movement and travel.
Metric Development – Part III	45	<ol style="list-style-type: none"> 7. Build a model representing one metric that could be used to measure the success of a street that enables both place and movement. 8. Now build models for as many metrics that you can think of and build one model for each metric.
Metric Prioritisation – Part IV	45	<ol style="list-style-type: none"> 9. Connect the metrics to the aspect(s) of the group model they refer to considering the three zones (“Must”, “Should”, “Could”). Each metric must have one connection to the group model.
Total Time	260	

The initial workshop structure is presented in Table 2. The total expected duration was 260 minutes (4 hours and 20 minutes) which included a 10-minute break after 115 minutes (1 hour and 55 minutes), to ensure participants were not fatigued. Following a brief introduction, all participants experience a skill building session to create a comfortable environment where participants could use Lego® to express their ideas and perspectives. Participants build a quick model to overcome lack of confidence in using Lego® bricks (tallest tower), showcase the ability to follow instructions (catalogue build) and then build creatively to describe a feeling or perspective through a build (i.e. using metaphors and representation to convey meaning). In addition to familiarisation of Lego®, the warm-up activity serves as a series of icebreakers for participants to get to know one another.

The “*street experience*” activity required participants to describe the key aspects necessary to achieve the ideal experience in a street/road that safely balances both movement and place objectives. Participants individually developed the street experiences and then as a group formed a group model that collated the two most important aspects of their individual design. In addition, the participants had to interrelate the key aspects to define a cohesive vision for the ideal experience that catered for movement and place.

The “*metric development*” activity required participants to reflect on the ideal experience defined earlier and develop metrics to measure the aspects of the initial task. Like the “street experience” activity, participants developed metrics individually and then as a group prioritised the importance of all derived metrics. As a group, participants had to categorise the metrics into “must have” (up to five metrics), “should have” (up to eight metrics) and “could have” whilst

also connecting the metric to the key theme/aspect present in the group model built in the previous exercise.

The “street experience” activity would yield aspect identification and prioritisation while the “metric development” activity would result in metric identification and relationships with aspects and themes defined in the street experience, thus combining to provide a comprehensive practitioner perspective.

2.1.3 Pilot Testing

The initial structure of the workshop was refined through pilot testing. Two pilots were conducted during January and February of 2023 to verify the workshop structure and establish logistics. This was particularly important in the context of the project as the LSP methodology involves constructing and deconstructing Lego® which requires the collection and clearing of Lego® bricks when transitioning between tasks. TfNSW professionals (outside of the Working Group supporting the project) participated in the pilot workshop and provided feedback to the research team. In addition to delivering the workshop structure, the following protocols were applied to ensure participants were in a focussed but comfortable environment.

- **Consent and data collection awareness:** Participants were notified that they could, at any time, leave the workshop if they desired to do so. They were also informed all data collected would be confidential and de-identified. Participants were notified of all note-takers present and that the note-takers would be taking photographs to document the builds and analyse results.
- **High-level agenda presenting the titles of the activities and the timing of each activity:** It is important for participants to focus on building models and storytelling during the activities. Therefore, all instructions are presented as the activities occur, to avoid premeditation and distraction. Also written prompts were limited to brief descriptions of the activity and instructions were delivered verbally and repeated during each build.
- **No food or drink to be consumed while engaging in a Lego® Activity:** To minimise the risk of accidents that could cause delays (e.g., knocking over a coffee cup over Lego® bricks or models), food and drink could only be consumed away from the Lego® building areas.
- **Use of music during Lego® builds:** Models building (step 2 of LPS core process) occupied between 3 and 20 minutes, soft background music was played to create a pleasant, relaxed and safe ambience to focus on the activities (reduce the feeling that the activities were an exam an encourage future discussion in group activities).

2.1.3.1 Pilot 1 Outcomes

The first pilot was conducted on January 19, 2023, at the offices of TfNSW. Five transport professionals from TfNSW participated in the exercise including people with Engineering and Planning backgrounds. Overall, the feedback was positive with participants enjoying the exercises. They believed it was an engaging methodology to gain feedback from stakeholders.

The notetaking and data collection process was also effective in identifying key aspects and metrics that result from individual and group builds. Figure 6 presents an example of a street experience built by a participant. The labels in red text are the key aspects identified by the participant while the labels in black text are the remaining aspects as part of the build.

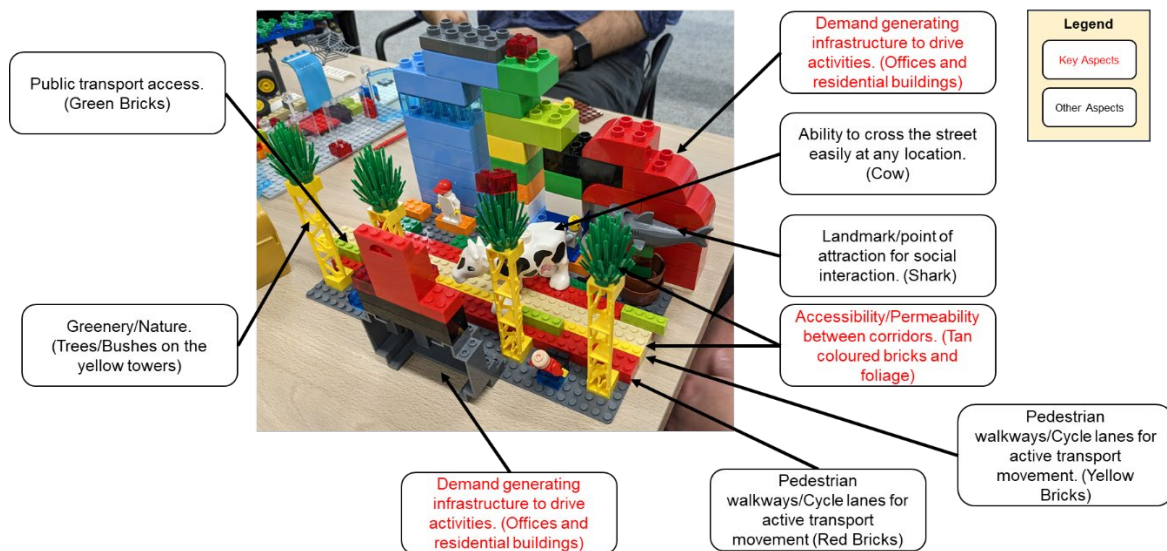


Figure 6: Example of a "Street Experience" built by an individual participant.

Figure 7 presents the final model of group defined street experience. Participants effectively negotiated the connectivity and prioritisation of key aspects and were able to detail a cohesive description of an ideal street experience as follows:

"In order to achieve an ideal street experience that balances movement and place, the land use should have a key attractor to encourage social interaction, and this is supplemented with other demand generating infrastructure that drive productivity and activity in the road space. To ensure the environment is safe but accessible, it is key to have barriers/delineation of speed environments but permeability between zones to allow for mode transfers (between active and public transport. The implemented solution should be resilient accounting for changes in environmental conditions and having adequate utilities provisions and serviceability requirements."

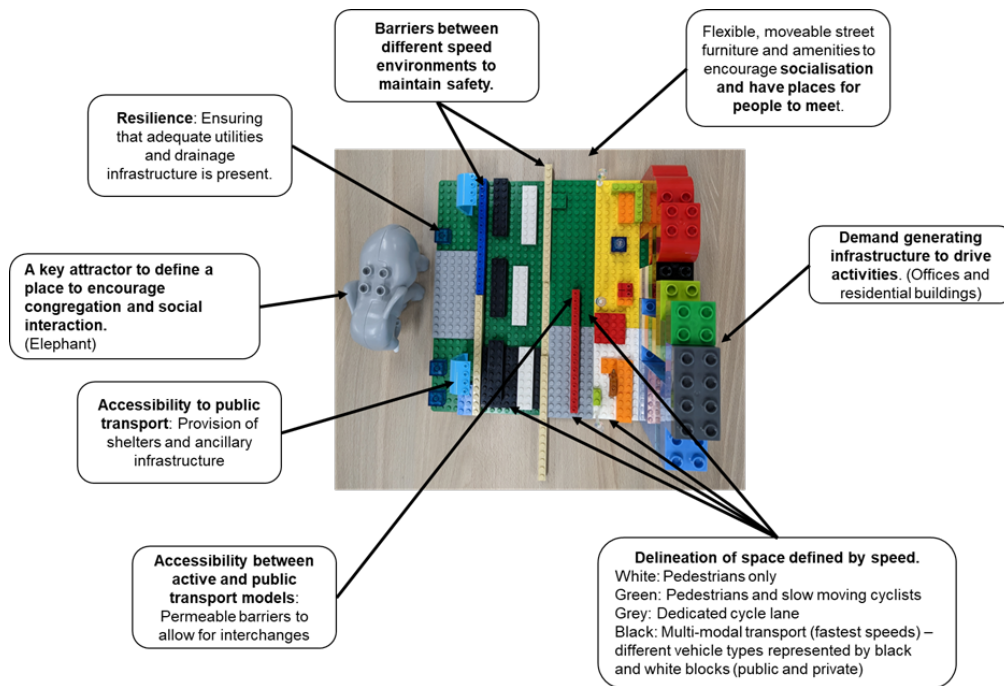


Figure 7: Group model identifying the relationship between key aspects identified by individuals.

Figure 8 presents metrics that were developed and the connections between the metrics as defined by the participants. The photograph on the right of Figure 8 connects 3 metrics related to safety, while the photograph on the right outlines movement related metrics.

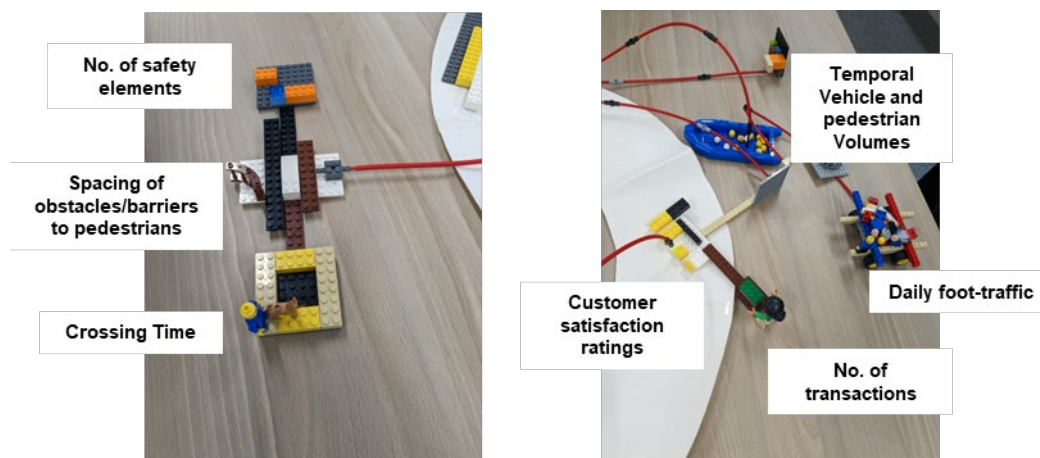
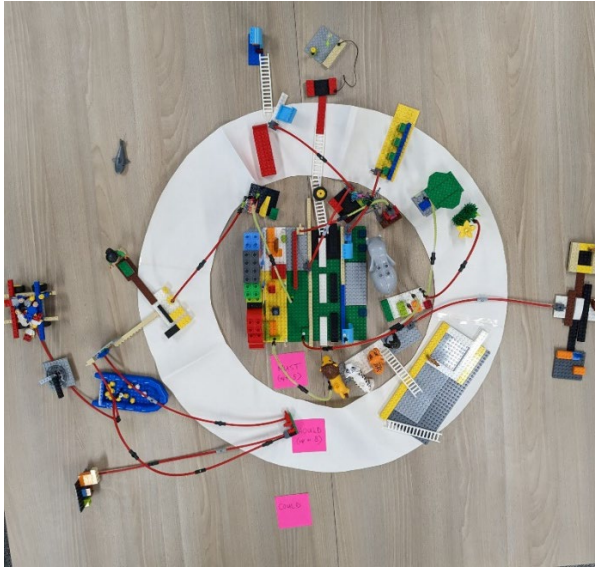


Figure 8: Metric development and connection definition.

Figure 9 presents the final group model where participants have connected the defined metrics to the aspects of the group model and prioritised metrics based on importance in the evaluation of a street or road design. Participants found connecting metrics to aspects complex as there are some overarching metrics that connect to multiple aspects. For example, customer satisfaction ratings could be used to measure the accessibility, resilience and the quality of demand generating infrastructure. Prioritisation of metrics was easier upon discussion with the other participants in the group.



Must have:

- Inclusivity (using accessibility metrics)
- Temperature (related to shade, green spaces)
- Connectivity of networks
- Perception of safety
- Speed

Should have:

- Permeability (no. of intersections)
- Green elements (square metres)
- No. of tree pits/ amount of canopy coverage
- Frequency of public transport
- No. of public transport stops
- Customer satisfaction ratings
- Usage of space (day/night)

Could have:

- No. of transactions
- Temporal vehicle and pedestrian volumes
- Time spent in the space
- Quality of public transport infrastructure
- Spacing of obstacles/barriers to pedestrians
- Daily foot traffic
- Pedestrian dwell time
- No. of safety elements, e.g. lighting, CCTV
- Average waiting time to cross

Figure 9: Metric connection and prioritisation.

The areas of improvement and related strategies are presented in Table 3. The strategies were formulated using feedback from participants of the pilot, discussion with the TfNSW Working Group and support from experienced LSP facilitators.

Table 3: Strategies to improve the structure of the workshop.

Areas of Improvement	Improvement strategy
Though the pilot was delivered within the stipulated duration, the schedule felt rushed for participants especially transitioning from the skills building to the main activities.	Change the final skills building task (favourite outdoor activity) to a task that is related to road and street design.
Participants requested additional time for the break or the inclusion of refreshments.	Increase break length to 20 minutes.
Participants identified aspects and metrics from a design perspective rather than from a 'user experience' lens.	Change the wording of the "street experience" activities to instruct participants to directly represent goals and objectives to deliver streets that enable both movement and place, instead of generally referring to "ideal user experience".
No account for different road contexts in the definition of objectives and metrics (different contexts could have different objectives)	Leverage the "Design of roads and streets" guide (NSW Government, 2023a) to define context for the application of shared road infrastructure: Local Streets and Civic Spaces
The process of note-taking for the final activity (metric connection with group model aspects and prioritisation) was challenging especially with multiple connections between metrics and aspects.	Take additional photographs and focus notetaking on prioritisation to ensure that at least the prioritisation (must have metrics) is gathered in detail.

Table 4 presents a modified workshop structure (changes highlighted in red text) incorporating the strategies defined in Table 3. The alternative workshop changes the final skills building task to a task that questions participants to build a model that reflects the pain points of using road infrastructure that safely balances movement and place. This was completed to improve the transition to the core topic of the workshop. Phrasing of the street experience tasks were changed to guide participants to directly model goals and objectives to reduce the focus on streetscape design whilst increasing the connection to user experience. However, a separate streetscape design activity was introduced as a last activity to cover this aspect (Table 4). Finally, the overall context for the workshop focussed on “Local Streets” to determine if context impacts the outcomes of the unified vision from the participants. The time for each activity (outside of skills building) was reduced given there is more direct instruction for participants and the break time increased, the total expected duration was 220 minutes (3 hours and 40 minutes).

Table 4: Alternative Workshop Structure.

Activities	Duration (mins)	Challenge questions & Instructions
Introduction	10	Welcome and purpose of the workshop
Skills building	60	<ol style="list-style-type: none"> 1. Build the tallest possible tower (5 minutes) 2. Build a model from the catalogue (Select from models 1 to 4) 3. Modify the catalogue model (2) to represent one of your key strengths as a professional. 4. Think about your experience when using streets, what is the biggest pain point for people to use streets that enable both place and movement?
Individual Street Experience – Part I	30	<ol style="list-style-type: none"> 5. Now considering all users, use Lego® to represent the two most important goals/objectives (excluding safety) we must achieve to deliver streets that successfully enable both place and movement. This time think about the different people using the space (kids, adults, teenagers, elderly) and the distinct travel modes (walking, biking, driving, using public transport).
BREAK	20	Break for all participants and facilitators.
Group Street Experience – Part II	25	<ol style="list-style-type: none"> 6. Now build a group model connecting these goals/objectives.
Metric Development – Part III	20	<ol style="list-style-type: none"> 7. Build a model representing one metric that could be used to measure the success of a street that enables both place and movement. 8. Now build models for as many metrics that you can think of and build one model for each metric.
Metric Prioritisation – Part IV	35	<ol style="list-style-type: none"> 9. Connect the metrics to the aspect(s) of the group model they refer to considering the three zones (“Must”, “Should”, “Could”). Each metric must have one connection to the group model.
Streetscape Design	20	<ol style="list-style-type: none"> 10. Now build a streetscape in which these goals/objectives are met.
Total Time	220	

2.1.3.2 Pilot 2 Outcomes

The second pilot was conducted on February 27, 2023, at the offices of TfNSW. Like the first pilot, five transport professionals from TfNSW participated in the exercise including people with Engineering and Planning backgrounds. Road context was considered in this workshop and participants considered a Local Street scenario. As with the first pilot, overall feedback was positive with all participants enjoying the exercises.

In general, the changes to the workshop structure yielded positive outcomes:

- “Pain point” skills building activity enabled participants to begin thinking about the context of the workshop more quickly (ability to build to convey user experience), better supporting the main activities. However, as the context may place the participants in a negative mindset (as it refers to pain point), there could be an unintentional bias which needs to be addressed.
- The shift towards an “objective” focussed exercise (differing from the “ideal experience”) resulted in less streetscape design-oriented builds leading to clearer objective/aspect definition. However, metrics definition was more challenging for participants and as such the 2nd pilot had less innovation in the suggested metrics.
- Providing the contextual background of “local streets” yielded similar aspects, metrics, and overall vision to that of the first pilot.
- The additional break time did not enhance the workshop; however, participants benefited from refreshments.

The results from Pilot 1 and Pilot 2 were used to form the final workshop structure.

2.1.4 Final Workshop Structure

Table 5 presents the final structure of the workshop. Listed below are the modifications following the second Pilot.

- The total expected duration was set to 235 minutes (3 hours and 55 minutes minutes) which included a 10-minute break after 115 minutes (1 hour and 55 minutes). The break was reduced to 10 minutes (increased if the workshop was to run ahead of schedule) but included refreshments.
- Task 4 (within Skills Building) was modified in two ways. First, to further promote building in the context of “user experiences”, participants had to select from a list of prepared “personas” which included: an elderly going to buy newspaper in the local tabaco agency; a person commuting to work using public transport; a person driving their kids to the local school; a food delivery person that is conveying a pizza to a local resident; a teenager walking their dog; a person biking to their local gym; a person with a baby stroller buying fruit at the local grocery; a person with a physical impairment crossing the road; children playing tag; friends having coffee on an outdoor area of a restaurant; and two work colleagues walking down the street and chatting. Once a persona was selected, a participant had to build a model that would define a positive or negative experience for the selected persona on road infrastructure that balances place and movement functionalities. The choice of positive or negative experience was used to mitigate any potential for a person to approach the following tasks with a negative mindset.

- The “Street Experience” activity reverted to the version delivered in Pilot 1, where participants had to individually, and in a group setting, describe the ideal experience on road infrastructure that balances movement and place. This was completed to ensure that metrics obtained in the following task were as rigorous as possible.
- The road context (Local Streets and Civic Spaces) was maintained which resulted in the need for multiple workshops to effectively assess the impact of context in the aspect, metric and vision definition.
- The “Streetscape Design” activity from Pilot 2 was removed as this would be covered in the “Street Experience” activities. Instead, at the conclusion of the workshop participants were asked to provide examples of street/road designs that they would consider as best practice in the context of delivering streets that balanced movement and place (“Street Examples”).

Table 5: Finalised Workshop Structure.

Activities	Duration (mins)	Challenge questions & Instructions
Introduction	10	Welcome and purpose of the workshop
Skills building	60	<ol style="list-style-type: none"> 1. Build the tallest possible tower (5 minutes) 2. Build a model from the catalogue (Select from models 1 to 4) 3. Modify the catalogue model (2) to represent one of your key strengths as a professional. 4. Select a persona, now build a model of a positive or a negative experience for that persona in using a street that enables both place and movement.
Individual Street Experience – Part I	45	<ol style="list-style-type: none"> 5. Now considering all users engaging in a Local Street/Civic Space, build a model of the ideal experience in a street that enables both place and movement. Select the 2 key aspects/ objectives of the model (place and movement) which you will use in the group model.
BREAK	10	Break for all participants and facilitators.
Group Street Experience – Part II	40	<ol style="list-style-type: none"> 6. Now build a group model of an ideal experience considering all user in a street that enables both place and movement (considering Local Street/Civic Space context)
Metric Development – Part III	25	<ol style="list-style-type: none"> 7. Build a model representing one metric that could be used to measure the success of a street that enables both place and movement (considering Local Street/Civic Space context). 8. Now build models for as many metrics that you can think of and build one model for each metric (considering Local Street/Civic Space context).
Metric Prioritisation – Part IV	40	<ol style="list-style-type: none"> 9. Connect the metrics to the aspect(s) of the group model they refer to considering the three zones (“Must”, “Should”, “Could”). Each metric must have one connection to the group model.
Street Examples	5	<ol style="list-style-type: none"> 10. Can you think of any examples of streets in Sydney or anywhere else that provide a safe and comfortable space for people to dwell and move.
Total Time	235	

Four workshops utilising the structure detailed in Table 5 were delivered¹ to have an increased sample size as well as ensuring both contexts of street design (local and civic spaces, 2 of each) were discussed.

¹ Ethics approval to conduct the workshops was obtained from the University of Technology Sydney (Application ID: ETH22-7714)

2.2 Recruitment

Recruiting stakeholders for workshops is crucial to achieve an effective workshop and gather diverse perspectives. The recruitment method applied in this project was to define a stakeholder database leveraging the networks of the research team and TfNSW Working Group. This database then served as the foundation to send direct invitations (emailed invitations) to prospective participants. The database was formed with the following constraints:

- Participants must have 3 to 5 years plus experience in the transport domain.
- Preference to include participants with experience in shared road infrastructure planning, design, implementation, or evaluation in Australia.

2.3 Implementation and Participation

The workshops were implemented as follows:

- Four workshops (30 March 2023, 13 April 2023, 19 April 2023, 2 May 2023) were held from 9am to 1pm (all executed within the expected duration).
- Two of the workshops considered the “Local Street” context, while the remaining two considered the “Civic Space” context.
- Workshops were held at the University of Technology Sydney within a room that could accommodate up-to 12 participants.
- LSP technique requires a minimum of 2 and but no more than 12 participants per workshop (Rasmussen Consulting, 2022)
- All workshops had between 6 and 10 professionals enrolled, and the attendance varied between 75% and 100% (each workshop had 6 or 7 participants).

A total of 27 practitioners participated across the 4 workshops, which to the authors’ best knowledge, is one of the largest in-depth stakeholder engagement exercises involving practitioners within the transport landscape (focused on road and street design). Local government involvement was identified as a critical component of the stakeholder workshop design because these professionals interact with the strategic guidance provided by state government/researchers, must address community needs and implement designs in practice. Accordingly, 12 of the participants were Local government professionals, representing 11 Local Government Areas in the Greater Sydney region. In addition, the participants included 6 State Government professionals and 9 professional who were Engineering/Planning or Landscape Architecture technical professionals providing consultation and advice to implement street and road designs.

2.4 Workshop Outcomes

Participation across the workshops was consistent. All attendees were able to contribute to the exercises and was involved in the development of each group activity, a testament to the novel LSP approach as well as the enthusiasm of the participants. The workshops also generated professional connections and insights allowing for an appreciation of diverse perspectives. All workshops were delivered within the stipulated duration and according to finalised workshop structure (Table 5).

Participants displayed different ideologies related to the planning, design, and delivery of streets. Considering that the focus of the workshop was to design streets that balance movement and place, most discussion surrounded the need to separate modes by providing

infrastructure, which is directly related to shared space design and implementation. In general, participants could be categorised as either practitioners who believed in: (i) “separated” infrastructure or (ii) “shared” infrastructure to deliver outcomes. The practitioners who preferred separated environments described streets with dedicated cycleways, separated footpaths and areas for movement separated from places where people dwell. On the other hand, the professionals who were in favour of “shared” infrastructure held the belief that to define a place, it is critical to leverage level surfaces, integrated design and spaces that are common by multiple users. Thus, there was debate and negotiation considering the appropriate direction to achieve an ideal experience in a street that safely balances movement and place.

Practitioners who believed in “separated” infrastructure were generally concerned that shared road infrastructure would create uncertainty among users which can compromise road safety. The concern is heightened in the context of vulnerable road users, consistent with the discussion presented in Imrie (2012) and Holmes (2015). However, as each workshop progressed a clear consensus was achieved regarding the debate. The practitioners who advocated for a “shared” approach acknowledged the risks highlighted by the practitioners of the “separated” approach and **the two groups compromised to propose solutions that contain “zones” of shared infrastructure and separated infrastructure.** This compromise between the two ideologies is captured across all the group models but is particularly evident in the group model prepared by the participants of Workshop 3, as presented in Figure 10. In this workshop, the participants presented a transition of infrastructure for a street, where closer to major attractors, shared space designs were considered optimal. However, for the section of the street focussed on movement, separated infrastructure was deemed necessary given the possibility of interactions in higher speed environments. Thus, there would be designated "zones" of shared space within a controlled low-speed environment. Alongside this, there would be separate infrastructure available to prioritise the safety of vulnerable road users, thereby avoiding neglect of their needs. This consistent with past literature (Auckland Council, 2017; Elliot et al., 2017) and was considered a best practice outcome from the research completed during Stage 1 (Wijayarathna et al., 2022).

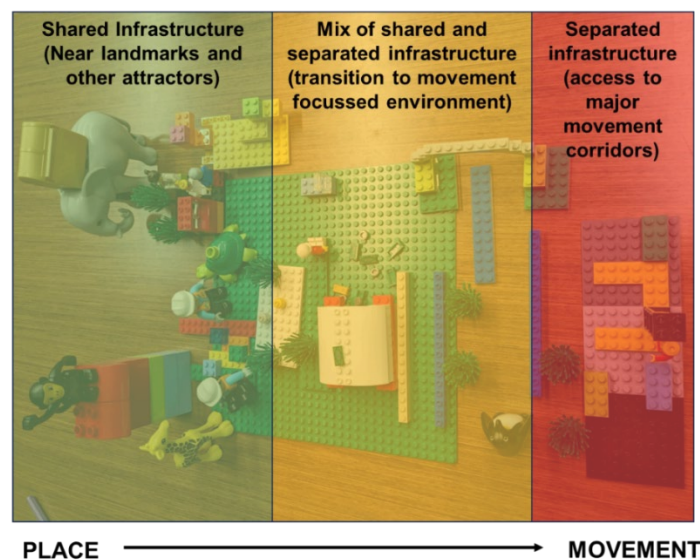


Figure 10: Workshop 3 group model presenting zone-based approach to shared space implementation.

More detailed outcomes of each workshop are presented in the following sections of the report. Aligned with the structure of the workshop and the primary objectives of the research, the workshop outcomes presented are focussed on the following:

- **Establish key aspects** of street design that enable a balance between movement and place.
- **Identify and prioritise metrics** that can be used to measure the performance of and evaluate streets that enable a balance between movement and place.

The following sub sections of the report summarise the outcomes of the workshop centred around aspect and metric identification and prioritisation. Individual responses as well as group responses across the four workshops presented several suggestions, some of which were unique, while others were repeated (for example, “road safety” as a key aspect and “vehicle speed” as a metric). Thus, it was important to categorise and compare responses to determine if a unified vision could be achieved. To be consistent with existing literature, categorisation of aspects was based on the “*Creating better streets*” report by the Chartered Institution of Highways and Transportation, which presents five aspects/objectives for any street improvement scheme (CIHT, 2018) as shown in Table 6.

Table 6: Aspect categorisation (Extracted from (CIHT, 2018)).

Objective	Description
Inclusive Environment (IE)	Accounting and catering for all users (especially vulnerable) in the operation of the road infrastructure. Aspects would be related to equity, accessibility, and perceptions of safety by the entire community.
Ease of Movement (EM)	This objective focuses on mobility and accessibility in the context of navigating across the road infrastructure. Aspects would be related to mode movement and network connectivity.
Safety and Public Health (SPH)	The overarching objective of all road infrastructure is to ensure it is safe and doesn't negatively impact public health. Aspects that belong to this category are related to road and place safety and health-oriented objectives (for example maintaining a minimum level of air quality).
Quality of Place (QP)	Shared spaces aim to maintain movement through the infrastructure but also enhance quality of place. Thus, a core objective is to measure and evaluate the quality of place. Aspects in this category are related to the definition of place quality.
Economic Benefit (EB)	This objective focusses on the potential for the infrastructure to generate economic or financial benefits for the community. Aspects in this category would concern productivity and economic viability.

Similarly, the metrics were categorised using the BEI themes (Table 7), developed by TfNSW (NSW Government, 2022). As detailed in Section 1.1, the BEI indicators are categorised based on five overarching themes that can be correlated with the objectives identified by CIHT (2018). The consistency between the documents indicates that the categorisation of both aspects and metrics are robust. However, it is important to correlate objectives and aspects using CIHT separate from the metric categorisation based on the BEI themes, this is because the BEI themes are not explicitly objectives of street design and can be correlated to multiple objectives.

Table 7: Metric categorisation using BEI themes (Using (NSW Government, 2022)).

BEI Theme	Description	Related CIHT (2018) Objective
Access and Connection	Includes indicators that measure user outcomes of mode choice, reliable transport, and equity (of access). The metrics focus on how well connected a place is and how equitable the transport network is.	Inclusive environment/ Ease of movement
Amenity and Use	Captures the mix of local opportunities and convenient facilities. Metrics focus on the presence of quality of public space, infrastructure availability and the characteristics of the population that reside and use the infrastructure.	Inclusive environment/ Economic benefit/ Quality of place
Green and Blue	Environmental indicators that measure the presence and quality of natural environments (vegetation and waterways) and supporting infrastructure.	Quality of place/ Safety and public health/ Economic benefit
Comfort and Safety	Explores whether roads and streets are sensitive to place that aligns with the surrounding context. Metrics concern road safety aspects but also place safety/personal safety/ public health components (environmental indicators)	Safety and public health
Character and Form	Examines whether a place is “human-scaled” and contains distinct features. Metrics concern the density and permeability of infrastructure and presence of landmarks.	Quality of place

Categorisation was based on key words identified in the descriptions by participants. If aspects or metrics could not be categorised, they were grouped as “Other”. The ability to categorise aspects and metrics with the established categorisations frameworks would indicate that practitioners are suggesting a form of shared space as a solution or at the very least taking into consideration key built environment indicators that support the development of place.

The following sub-sections summarise the outcomes of each workshop. It is important to note that each participant is identified by alphanumeric code “PX” where X represents an identification number of the participant, for example “P1” would be “Participant 1”.

2.4.1 Workshop 1

Table 8 presents a summary of the outcome of Workshop 1 (30 March 2023). A total of seven participants attended the workshop (out of 9 professionals who enrolled). The workshop contained 3 participants from Local Councils, 3 participants who were consultants (2 landscape architects) and a representative from State Government. The “Civic Spaces” context was considered for this workshop. Detailed notes from the workshop are presented in **Appendix A1**.

All participants completed the skills building tasks and provided valuable insights in describing positive and/or negative experiences of streets for each persona. Part 1 of the workshop revealed 14 prioritised aspects necessary to deliver streets and roads that balance movement and place. As shown in Table 8, most of the aspects were categorised as “Quality of Place” (QP) or “Inclusive Environment” (IE) objectives. This suggests that there is a greater priority placed on achieving place outcomes when achieving a balance between movement and place on a street. This is an intuitive outcome given traditionally, in Australia, streets and roads have been designed from a private vehicle and movement context. P3 highlighted the “Ease of Movement” (EM) as key aspects, highlighting the importance of public transport accessibility and pedestrian movements within the core of a town as the most important to capture. However, the participant reflected on the task from a strategic road network context and thus considered the design in the context of the wider road network.

The aspects highlighted in Part I were consolidated into 5 primary aspects:

1. Changing driver behaviour
2. Equity across all user classes
3. Transition “movement oriented” design to “place oriented” design
4. Use nature to create places within streets
5. Strategic regional accessibility.

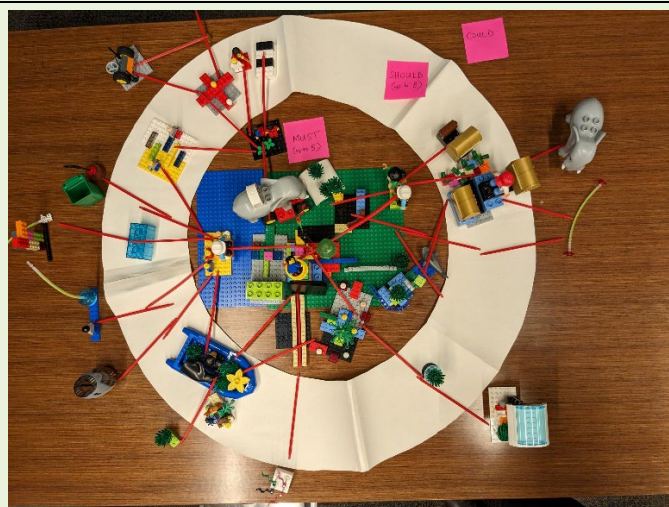
The group model was described by participants as follows: *“In order to achieve an ideal street experience, it is important to provide the necessary road infrastructure (and enforcement/legislation – especially within low-speed contexts) to **create an environment that changes driver behaviour to be aware of and reprioritise these streets in favour of vulnerable road users**. This will result in greater equity across the user classes from a movement perspective creating a better place for people. The design of the street should be supported by High Occupancy Vehicle (HOV) accessibility at the peripheries and the street should relate to the core of the town centre (pedestrian prioritised). Furthermore, the ideal experience will contain design elements that are **less focussed about movement and more focussed on providing community services and leveraging nature**. The street is to become an extension of people’s dwellings and memorable moments should be delivered within the final streetscape.”*

The metric identification and prioritisation exercises (Part III and Part IV) yielded 35 unique metrics (38 metrics in total with duplication of Pedestrian Dwell Time, Vehicle Speed and Pedestrian Counts). The metrics covered a range of movement and place measures, and there were 5 metrics similar in nature to BEI metrics (mode share, number of fatalities, number of crossings, vehicle speed, urban heat island effect). The “must have” metrics were related to comfort, safety, and the environment, further emphasising the importance of measuring place in the delivery of a street that balances movement and place.

Table 8: Summary of Workshop 1 Outcomes.

Date: 30 March 2023 Number of participants: 7		CIHT Cat.
Aspect Identification (2 key aspects)		CIHT Cat.
P1	<ul style="list-style-type: none"> Street becomes an extension of people's homes Moments within the landscape (landmarks and experiences) 	QP QP
P2	<ul style="list-style-type: none"> Equity of all users (prioritisation of vulnerable road users) Changes in driver behaviour to appropriately account for vulnerable users 	IE IE
P3	<ul style="list-style-type: none"> Core of town to create pedestrian priority HOV accessibility to support regional transport to the street/core of the town 	EM EM
P4	<ul style="list-style-type: none"> Safe and accessible infrastructure Redefinition of the interaction between place and movement (place for all users where pedestrians are prioritised over motorists) 	SPH QP
P5	<ul style="list-style-type: none"> Fluidity between movement and place Nature to provide a place for people to enjoy 	QP QP
P6	<ul style="list-style-type: none"> Consideration of motorists within the environment Accounting for vulnerable road users by providing safe infrastructure and accessibility to land uses 	IE IE
P7	<ul style="list-style-type: none"> Deconstructing the idea of streets being solely movement oriented Equal access to transport facilities and services (accessibility) 	QP IE

Group Model



Metric Identification and Prioritisation (5 “Must” have metrics)

- Number of people dwelling in the space
- Satisfaction/perception rating of the space
- Number of children using the space
- Water quality
- Heat Island Effect

2.4.2 Workshop 2

Table 9 presents a summary of the outcome of Workshop 2 (13 April 2023). A total of six participants attended the workshop (out of 7 professionals who enrolled). The workshop contained 2 participants from Local Councils, 2 participants who were consultants and 2 representatives from State Government. The “Local Street” context was considered for this workshop. Detailed notes from the workshop are presented in **Appendix A2**.

As per Workshop 1, all participants completed the skills building tasks and provided valuable insights in describing positive and/or negative experiences of streets for each persona. Part 1 of the workshop revealed 12 prioritised aspects necessary to deliver streets and roads that balance movement and place. Unlike Workshop 1, most of the aspects fit the “Ease of Movement” (EM) category with “Safety and Public Health” and “Quality of Place” also featuring multiple times. The participants in the workshop had a core belief that the provision of infrastructure that creates mobility in a balanced movement and place context would educate users into appreciating the benefits of low-speed environments. In short, the design of efficient, safe and place-oriented infrastructure will form a balanced street.

The aspects highlighted in Part I were consolidated into 5 primary aspects:

1. Pedestrian prioritisation
2. Accessibility for all users, amenities, and services
3. Interface between spaces for multiple users while creating cross-corridor connectivity
4. Street activation to create social spaces
5. Road safety

The group model was described by participants as follows: *“In order to achieve an ideal street experience, it is key to design safe infrastructure that prioritises pedestrians and encourages active transport. The **space should leverage adaptable design features (movable furniture, dynamic parking) to transition from a traditional movement-oriented environment to a lower speed environment that will enhance place.** Building infrastructure, lighting and street activation areas can be used as an interface between spaces while also creating connectivity. Finally, the design should feature access for all users to necessary amenities and services.”* The adaptable design features were suggested so that streets could serve different purposes at different times of the day, for example the street could provide more movement functionality during peak periods of travel.

The metric identification and prioritisation exercises (Part III and Part IV) yielded 34 unique metrics (37 metrics in total with duplication of Vehicle Speed, Number of streetlights and Tree Canopy cover). As with Workshop 1, the metrics covered a range of movement and place measures, and there were 9 metrics similar in nature to BEI metrics (vehicle speed, footpath width, number of crossings, noise level, air pollution level, number of streetlights, tree canopy cover, number of crashes, urban heat island effect). The “must have” metrics were related to access and connection, the environment and safety and aligns with the focus that network-wide strategic design is fundamental to achieving a balance between movement and place.

Table 9: Summary of Workshop 2 Outcomes.

Date: 13 April 2023 Number of participants: 6		
Aspect Identification (2 key aspects)		CIHT Cat.
P8	<ul style="list-style-type: none"> • Accessibility of all road users. • Street Lighting (safe utilisation across the day) 	IE SPH
P9	<ul style="list-style-type: none"> • Pedestrian prioritisation • Cross-corridor connectivity 	EM EM
P10	<ul style="list-style-type: none"> • Accessibility to amenities/services • Road safety 	EM SPH
P11	<ul style="list-style-type: none"> • Sustainable living - pedestrian prioritisation • Narrow streets to encourage a low-speed environment 	QP SPH
P12	<ul style="list-style-type: none"> • Interface between spaces for multiple users • Adaptability of movement features of a space 	QP EM
P13	<ul style="list-style-type: none"> • Street activation to create social spaces • Access for service vehicles 	QP EM

Group Model



Metric Identification and Prioritisation (5 “Must” have metrics)

- Missing footpath links (Connectivity)
- Pedestrian cross-connections/accessibility
- Journey time reliability of public transport
- Tree canopy cover (area of coverage)
- Number of crashes (crash statistics)

2.4.3 Workshop 3

Table 10 presents a summary of the outcome of Workshop 3 (19 April 2023). A total of seven participants attended the workshop (out of 8 professionals who enrolled). The workshop contained 4 participants from Local Councils, 2 participants who were consultants and a representative from State Government. The “Civic Spaces” context was considered for this workshop. Detailed notes from the workshop are presented in **Appendix A3**.

Like Workshop 1 and 2, all participants successfully completed the skills building component. Part 1 of the workshop revealed 14 prioritised aspects necessary to deliver streets and roads that balance movement and place. As shown in Table 10 and similar to the outcome of Workshop 2, most of the aspects were categorised as “Ease of Movement” (EM) objectives. Unlike the first two workshops, a key aspect related to the “Economic Benefit” category was also identified, deemed important in the context of a Civic Space. The outcomes of this workshop align closely with creating an environment that form attractions for people, synonymous to the definition of Civic Space (NSW Government, 2023a).

The aspects highlighted in Part I were consolidated into 4 primary aspects:

1. Prioritisation of pedestrians and other active transport users.
2. Quality and appropriateness of the built form to frame key attractions.
3. Business and diversity in the civic centre.
4. Safety achieved through lower speed environments accounting for vulnerable users.

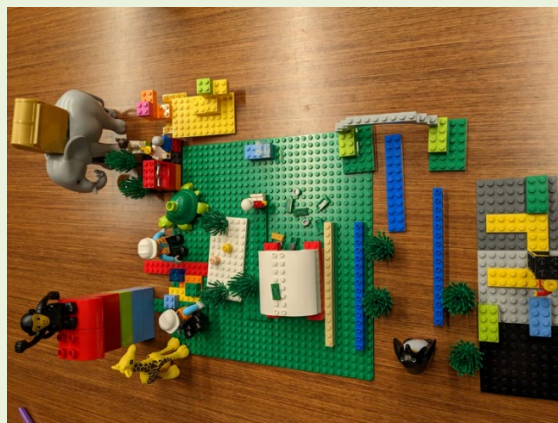
The group model was similar in structure and presentation to that of Workshop 3 was described by participants as follows: *“In order to achieve an ideal street experience, it is **key to create a “hierarchy” as we transition from a movement corridor to a place that is shared by the community.** Maintaining efficiency of the surrounding road and public transport network is **key to ensure access to a Civic Space environment, thus the design and inclusion of entry treatments is critical** (use of vegetation barriers, pavement alterations). By providing effective access, the Civic Space can have equitable access resulting in diversity and growing business within the space. The space itself will transition from vehicular modes of transport to active modes, with **areas around key landmarks and attractors prioritising pedestrians.** Finally, a Civic Space’s success is driven by the quality and appropriateness of the built form that is relevant to the purpose of a Civic Space.”*

The metric identification and prioritisation exercises (Part III and Part IV) yielded 36 unique metrics (38 metrics in total with duplication of Diversity of users within the space/street, Vehicle Speed and Pedestrian Counts). Workshop 3 contained a greater overlap with BEI metrics, where participants identified 11 metrics similar to what is available within the BEI framework (urban heat island effect, density of people within the space/street (crowding), number of crossings, tree canopy cover, number of crashes, pollution (air particulates), vehicle speed, proximity to green/blue land uses, mode split, number of intersections (legibility), safety satisfaction ratings). The “must have” metrics identified in this Workshop contained metrics outside of the BEI themes (classified as “Other”). “Lifecycle cost of infrastructure” would gauge the productivity of the infrastructure within the space, important as a Civic Space context have objectives related to economic benefits for the local area. The other metric identified that could not be categorised was “Level of Service of all infrastructure”, this is a high-level all-encompassing metric and would be important for any street design and implementation.

Table 10: Summary of Workshop 3 Outcomes.

Date: 19 April 2023 Number of participants: 7		
Aspect Identification (2 key aspects)		CIHT Cat.
P14	<ul style="list-style-type: none"> Quality and appropriateness of the built form Accounting for the slowest and most vulnerable users 	QP IE
P15	<ul style="list-style-type: none"> Anchor the space with a public transport corridor (light rail) Place activation through temporary pop-up solutions 	EM QP
P16	<ul style="list-style-type: none"> Pedestrian prioritisation (spaces should contain pedestrian only areas) Consideration of the management of main-roads and signalised intersections 	EM EM
P17	<ul style="list-style-type: none"> Sustainable transport modes Space for people to interact and socialise 	EM QP
P18	<ul style="list-style-type: none"> Prioritisation of active transport Movement around water bodies/supporting the destination 	EM EM
P19	<ul style="list-style-type: none"> Business and diversity in the civic centres Cycleways and accessibility 	EB EM
P20	<ul style="list-style-type: none"> Buildings and development that frame places Safer and quieter streets 	QP SPH

Group Model



Metric Identification and Prioritisation (5 “Must” have metrics)

- Lifecycle cost of infrastructure
- Tree canopy cover (area of coverage)
- Level of Service (of all infrastructure components)
- Satisfaction ratings (How safe do you feel?)
- Diversity of users within the space/street

2.4.4 Workshop 4

Table 11 presents a summary of the outcome of Workshop 4 (2 May 2023). A total of seven participants attended the workshop (out of 8 professionals who enrolled). The workshop contained 3 participants from Local Councils, 2 participants who were consultants and 2 representatives from State Government. The “Local Streets” context was considered for this workshop. Detailed notes from the workshop are presented in **Appendix A4**.

Like the first 3 Workshops, all participants successfully completed the skills building component. Part 1 of the workshop revealed 14 prioritised aspects necessary to deliver streets and roads that balance movement and place. “Safety and Public Health” (SPH) oriented aspects and “Quality of Place” (QP) aspects dominated the priority list. Given the residential context of a “Local Street” environment, where there would be a large proportion of vulnerable road users, the importance of safety is a justifiable outcome.

The aspects highlighted in Part I were consolidated into 4 primary aspects:

1. Safe infrastructure with impediment free (well connected) and equitable access for all users
2. Acknowledgement of high pedestrian (active transport) activity
3. Design for uncertainty associated with local community activities
4. Space should be connected with nature catering for users to linger outside of dwellings

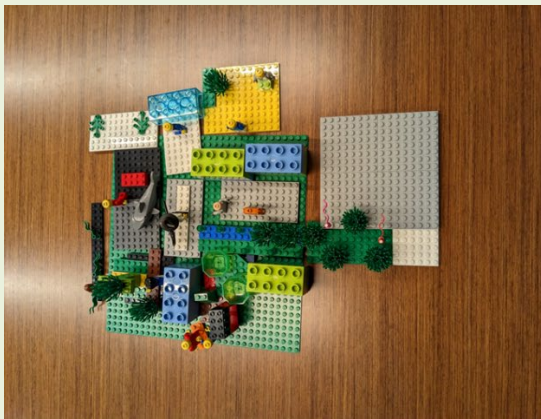
And the group model, which was similar in structure and definition as Workshop 2 and 3, was described by participants as follows: *“In order to achieve an ideal street experience, **safety is paramount to transition from movement oriented arterial road infrastructure to place and community focussed local streets. A connected network with crossing infrastructure, tailored to cater for a high-pedestrian environment that can hold outdoor community activities** that may have uncertain user behaviour is core in the design and management of streets that balance movement and place. It is important that all types of users, vulnerable and disabled, are accounted for in the design (consideration of tactiles, ramps etc.)”*

The metric identification and prioritisation exercises (Part III and Part IV) yielded 37 unique metrics (40 metrics in total with duplication of Diversity of users within the space/street, mode split, number of doorways/windows facing the street (active frontage)). Participants identified 6 metrics similar to what is available within the BEI framework (mode split, tree canopy cover (area of coverage), number of pedestrian crossings per kilometre, vehicle speed, number of crashes, length of cycleways). The “must have” metrics identified in Workshop 4 were more traditional metrics that are expected of an appraisal of a street. Three of the measures were focussed on comfort and safety, where vehicle speed was deemed as a must, along with pedestrian dwell time and air pollution. The other two metrics covered the link to nature (tree canopy cover) and society (diversity of users), core to delivering a residential environment. The key metrics identified align with the group model developed and the “Local Street” context of the workshop.

Table 11: Summary of Workshop 4 Outcomes.

Date: 2 May 2023 Number of participants: 7		CIHT Cat.
Aspect Identification (2 key aspects)		CIHT Cat.
P21	<ul style="list-style-type: none"> Vegetation (presence of tall trees for shade) Providing level crossings and enhanced crossing infrastructure 	SPH SPH
P22	<ul style="list-style-type: none"> Liveable space for a diversity of users Safe and balanced access for all users 	IE SPH
P23	<ul style="list-style-type: none"> Ensuring users can "stop and linger" Impediment free access for all modes and users 	QP EM
P24	<ul style="list-style-type: none"> Slower speeds to ensure safety Acknowledge and design for the presence of unpredictable/spontaneous activities 	SPH IE
P25	<ul style="list-style-type: none"> Balanced safe access (prioritisation of active transport modes) Accounting for high pedestrian trip generation 	SPH EM
P26	<ul style="list-style-type: none"> Leverage vegetation for self-exploring streets Ensuring users can "stop and linger" 	QP QP
P27	<ul style="list-style-type: none"> Walkable connected streets (people centric street design) Connecting nature and active frontages 	EM QP

Group Model



Metric Identification and Prioritisation (5 "Must" have metrics)

- Tree canopy cover (area of coverage)
- Vehicle Speed
- Pollution (air-particulates)
- Pedestrian dwell time
- Diversity of users within the space/street

2.4.5 Aggregated analysis of all four workshop outcomes

An aggregate analysis can be conducted in the context of the project objectives and the workshop structure. Initially, the primary objective of the project will be discussed whether participants converged to shared spaces as a potential solution to achieving a street that balances place and movement. Furthermore, could participants define a unified vision for this type of street and is there alignment with the core objectives of a shared spaces. The workshop outcomes can then also be analysed from an “aspect identification” and “metric identification” lens, following the structure of the workshop.

2.4.5.1 Consolidation of perspectives

Wijayaratna et al. (2022) proposed a tailored definition of shared spaces for a NSW context: **“A public street or intersection that is intended and designed to be used by all modes of transport equally in a consistently low-speed environment. Shared space designs aim to reduce vehicle dominance and prioritise active mobility modes. Designs can utilise treatments that remove separation between users in order to create a sense of place and facilitate multi-functions.”** The underlined sections of the definition have been universally and consistently discussed by workshop participants as showcased in Section 2.4.1 to Section 2.4.4 (and within the associated appendices A1 to A4). The most significant outcome of the individual street experience activity (Part 1) was the unprompted reference to components of the shared space design or the shared space-built form. Table 12 presents 6 of the 54 key aspects identified by participants that explicitly have a relationship with shared space designs. In addition to these aspects that have direct relationships, there were instances where participants highlighted key aspects that indirectly referred to shared spaces, like “pedestrian prioritisation” which was noted 7 times. However, the way these 7 aspects were defined by participants did not explicitly state a redefinition of interaction or specific details of the prioritisation.

Table 12: References to shared space design in workshop aspect identification process.

Key aspect	Connection with Shared Space Design Concept
Street becomes an extension of people's homes.	This aspect is related to the following part of the shared space definition: “remove separation between users to create a sense of place and facilitate multi-functions”.
Redefinition of the interaction between place and movement (place for all users where pedestrians are prioritised over motorists).	This aspect is related to the aim of shared spaces to “reduce vehicle dominance and prioritise active mobility modes”.
Deconstructing the idea of streets being solely movement oriented.	Shared spaces aim to change user behaviour by equalising mode priority.
Interface between spaces for multiple users.	The interface between users can be achieved through treatments that remove separation (pavement entry treatments, decluttering)
Adaptability of movement features of a space.	Adaptability of movement features in a space result in a low-speed environment, a key aspect of a shared space.
Buildings and development that frame places.	Shared space designs are intended to create a sense of place which can only be achieved with infrastructure that frames the place.

Further to the individual prioritisation of the aspects in Part I of the workshops, the descriptions of the group model in Part II all note design features or components of the shared space definition, as highlighted in green within Table 13. Each description refers to prioritisation of pedestrians, reduced priority for movement, development of low-speed environments (or environments that favour vulnerable road users) and emphasise connecting community and generating a place for people. Workshop 3 in fact uses the phrase, “transition from a movement corridor to a place that is shared by the community”, where the term shared is used in a context that aligns with one of the objectives of shared space. It is important to also note that there are differences in the description when comparing the Civic Space context and the Local Street context. Respondents in the Civic Space context generally suggested a need for a key attractor of landmark that was a focal point for the space, as well as highlighting economic objectives, two aspects that were not discussed in the Local Street context. However, as highlighted, it should be noted that there are aspects that are important across both contexts, indicating the need for both strategic and context specific guidance for shared space design and implementation possibly leveraging a categorical approach, consistent with the findings of past literature (Al-Mashaykhi & Hammam, 2020; CIHT, 2018; Wijayarathna et al., 2022).

Table 13: Consolidation of group model descriptions across all four workshops (green highlight indicates relationship with the shared space definition).

Workshop Number	Group Model Description
1 (Civic Space Context)	In order to achieve an ideal street experience, it is important to provide the necessary road infrastructure (and enforcement/legislation – especially within low-speed contexts) to create an environment that changes driver behaviour to be aware of and reprioritise these streets in favour of vulnerable road users . This will result greater equity across the user classes from a movement perspective creating a better place for people. The design of the street should be supported by HOV accessibility at the peripheries and the street should relate to the core of the town centre (pedestrian prioritised). Furthermore, the ideal experience will contain design elements that are less focussed about movement and more focussed on providing community services and leveraging nature . The street is to become an extension of people’s dwellings and memorable moments should be delivered within the final streetscape.
2 (Local Street Context)	In order to achieve an ideal street experience, it is key to design safe infrastructure that prioritises pedestrians and encourages active transport . The space should leverage adaptable design features (movable furniture, dynamic parking) to transition from a traditional movement-oriented environment to a lower speed environment that will enhance place . Building infrastructure, lighting and street activation areas can be used as an interface between spaces while also creating connectivity. Finally, the design should feature access to for all users to necessary amenities and services .
3 (Civic Space Context)	In order to achieve an ideal street experience, it is key to create a “hierarchy” as we transition from a movement corridor to a place that is shared by the community . Maintaining efficiency of the surrounding road and public transport network is key to ensure access to a Civic Space environment, thus the design and inclusion of entry treatments is critical (use of vegetation barriers, pavement alterations). By providing effective access, the Civic Space can have equitable access resulting in diversity and growing business within the space. The space itself will transition from vehicular modes of transport to active modes, with areas around key landmarks and attractors prioritising pedestrians . Finally, a Civic Space’s success is driven by the quality and appropriateness of the built form that is relevant to the purpose of a Civic Space.
4 (Local Street Context)	In order to achieve an ideal street experience, safety is paramount to transition from movement oriented arterial road infrastructure to place and community focussed local streets. A connected network with crossing infrastructure, tailored to cater for a high-pedestrian environment that can hold outdoor community activities that may have uncertain user behaviour is core in the design and management of streets that balance movement and place . It is important that all types of users, vulnerable and disabled, are accounted for in the design (consideration of tactiles, ramps, etc.)

The comparison also reveals the possibility to form a consolidated perspective of an ideal street experience on infrastructure that balances movement and place, i.e., a shared space. Table 14 presents an aggregation of the primary aspects collectively identified across all Workshops. These primary aspects are grouped again based on similarities (highlighted by colour). **The additional aggregation yielded 5 overall aspects:**

1. Prioritisation of pedestrians and other active transport users by changing driver behaviour. (Orange)
2. Safety achieved through lower speed and accessible environments. (Pink)
3. Accessibility for all users in terms of mobility and access to amenities and services. (Blue)
4. Appreciating and utilising nature to define place. (Green)
5. Designs that include interfaces allowing for seamless transition from a “movement oriented” space to a “place oriented” space. (Purple)

Using these aspects, a consolidated perspective of shared space implementation was formed:

“In order to achieve an effective shared space that can create an ideal experience for the community, people must be prioritised ahead of vehicles. Lower speed environments that promote accessibility and safety for all users in terms of mobility and, access to amenities and services can enable changes in driver behaviour. The natural environment (vegetation and tree canopy) and zone-based applications of shared space designs should be leveraged to transition from movement-oriented infrastructure to a place-oriented space. This strategic direction can cultivate an inclusive shared space that fosters a sense of community while maintaining mobility.”

Table 14: Grouping of primary aspects across all 4 workshops.

Workshop Number	Primary Aspects	Overall Aggregation
1 (Civic Space Context)	Changing driver behaviour	Prioritisation of pedestrians and other active transport users by changing driver behaviour.
	Equity across all user classes	
	Transition “movement oriented” design to “place oriented” design	
	Use nature to create places within streets	
	Strategic regional accessibility.	
2 (Local Street Context)	Pedestrian prioritisation	Safety achieved through lower speed and accessible environments.
	Accessibility for all users, amenities, and services	
	Interface between spaces for multiple users while creating cross-corridor connectivity	
	Street activation to create social spaces	Accessibility for all users in terms of mobility and access to amenities and services.
	Road Safety	
3 (Civic Space Context)	Prioritisation of pedestrians and other active transport users	Appreciating and utilising nature to define place.
	Quality and appropriateness of the built form to frame key attractors	
	Business and diversity in the civic centre	
	Safety achieved through lower speed environments accounting for vulnerable users	
	Safe infrastructure with impediment free (well connected) and equitable access for all users	
4 (Local Street Context)	Acknowledgement of high pedestrian (active transport) activity	Designs that include interfaces allowing for seamless transition from a “movement oriented” space to “place oriented” space.
	Design for uncertainty associated with local community activities	
	Space should be connected with nature catering for users to linger outside of dwellings	

2.4.5.2 Aspect Identification

During Part I and Part II, the terminology of “shared space” was introduced by participants across all the workshops. It was referred to as a design feature which could be used to achieve a balance between movement and place for a street or road. Notably, as mentioned earlier, collectively participants suggested “strategic use of shared road infrastructure”, indicating zone-based approaches (Elliot et al., 2017) are beneficial where protected or separated design attributes are used alongside shared spaces. The aspects defined in the workshop are consistent with objectives of the shared space design concept.

Table 15 presents a categorisation of the key aspects highlighted by the participants across the 4 workshops. As there were 27 participants a total of 54 key aspects were identified and thus could be categorised to gauge patterns within the responses. As mentioned at the beginning of Section 2.4, the categorisation utilised the established shared space objectives framework presented in CIHT (2018). The categories of “Ease of Movement” (EM) and “Quality of Place” (QP) contained the highest aspect count. This is an intuitive result as the EM objective relates to achieving movement and QP objective concerns the definition of place, both aspects were core to instructions provided to participants in the workshop. The “Inclusive Environment” (IE) and “Safety and Public Health” (SPH) also contained 9 or more aspects with each workshop containing at least one aspect related to these two objectives. In general, IE and SPH are universal objectives of all road and street design, and perhaps all civil infrastructure design as it is essential to construct and maintain inclusive and safe environments. Only one of the key aspects identified satisfied the “Economic Benefit” (EB) category, this occurred during Workshop 3, which was based on the Civic Space context. Participants across all workshops did flag other aspects related to the EB objective, but were not prioritised, indicating that achieving a balance of movement and place is more about achieving a mobility goal rather than an economic goal. It is clear from Table 15, that active transport prioritisation, accessibility and safety are paramount to the design of street that attempts to define a place, consistent with a number of past studies (Archer, 2014; CIHT, 2018; Wijayaratra et al., 2022).

Table 15: Categorisation of key aspects across all 4 workshops.

CIHT Categories	Count
Inclusive Environment (IE)	9
Ease of Movement (EM)	17
Quality of Place (QP)	17
Safety and Public Health (SPH)	10
Economic Benefit (EB)	1

2.4.5.3 Metric Identification

The workshops resulted in the identification of 153 metrics (113 unique metrics) to evaluate the performance of street and road designs that balance movement and place. However, a significant challenge was present in the activity as participants identified metrics could not be measured through field data collection and at times referred to methodologies rather than metrics (for example, assessment of Cost Benefit Ratio or the Quadruple Bottom Line). Facilitators acknowledged these suggestions, but made attempts to gain clarity on specific metrics, for example Quadruple Bottom Line was refined to “benchmarking against lifecycle costs”. A finding across the workshops was that many practitioners required an example to

comprehend the definition of a metric in the context of the activity, perhaps indicating the complexity of metric definition within the transport profession. As documented earlier, in Section 2.4, metrics were classified based on the BEI framework and the classification of all 153 metrics is presented in Table 16. Almost one-third of the metrics identified satisfied the category of “Comfort and Safety”, with an even distribution of metrics associated with the other 4 themes of the BEI framework. This result is consistent with the general approach to shared space design. There will be a change in infrastructure, leading to a change in travel behaviour, which in turn requires an assessment of both comfort and safety, thus requiring relevant metrics. Furthermore, this is synonymous across all forms of infrastructure and indicates that practitioners are following a safe systems approach to design and implementation practices.

Table 16: Classification of metrics across the 4 workshops.

BEI Themes	Number of Metrics
Access and Connection	25
Amenity and Use	21
Character and Form	16
Comfort and Safety	49
Green and Blue	21
Other	21

Table 17 presents metrics that are similar to or identical to metrics identified in BEI framework, which constituted 20 out of the 113 unique metrics. Many of the matching metrics are related environmental assessment (Green and Blue theme) and safety (Comfort and Safety theme).

Table 17: Identified metrics that are similar to BEI metrics.

Metric similar to BEI metric	Count
Density of people within the space/street	1
Footpath width	1
Length of cycleways	1
Mode split	4
Noise (Decibel)	1
Number of crashes (Crash Statistics)	3
Number of crossings	3
Number of fatalities (Crash Statistics)	1
Number of intersections (legibility)	1
Number of pedestrian crossings per kilometre	1
Number of street lights	2
Pollution (Air-Particulates)	2
Proximity to green/blue land uses	1
Satisfaction Ratings (How safe do you feel?)	1
Tree canopy cover (area of coverage - Private)	1
Tree canopy cover (area of coverage - Public)	1
Tree canopy cover (area of coverage)	4
Tree canopy cover (percentage of coverage)	1
Urban heat island effect	3
Vehicle Speed	7

An interesting finding was the different measurement approaches used for tree canopy cover proposed by the participants. Many respondents suggested simply measuring the area of coverage, however the standardised approach (percentage of coverage), presented in the BEI framework, is better for comparison between sites.

There were 18 unique metrics that could not be classified across any of the BEI themes which is shown in Table 18. Most of these metrics are “mode demand” metrics and are related to counts of vehicles, pedestrians, and cyclists. Data collected to measure these metrics are common for most evaluations of transport infrastructure and would be considered for the assessment of a shared space design to understand demand for the infrastructure. This would be particularly important in before and after case studies as a means of valuing the benefits of any change to infrastructure. The other category did contain some unusual metrics that may require refinement and clarification to become a metric that can be measured easily. For example, “measuring ‘waste’ in project delivery” would need clarification to assess what features constitute project delivery and the benchmarking necessary to determine what is wasteful and what is necessary.

Table 18: Metrics classified as "Other".

Metrics that were assigned into the “Other” category	Count
Benchmarking against lifecycle expenses	1
Cost of construction of any redevelopment	1
Level of Service (of all infrastructure components)	1
Lifecycle cost of infrastructure	1
Measuring "waste" in project delivery	1
Number of Awards/Recognition	1
Number of kerbs and gutters	1
Number of people crossing a street	1
Number of people using active transport (counts)	1
Number of successful audits of project completion	1
Number of vulnerable users	1
Pedestrian Counts	3
Pedestrian delays at crossings	1
Pedestrian road capacity	1
Pedestrian trajectories	1
Perception of safety on waterways	1
Vehicle Counts	2
Volume of patrons (exiting/entering) - quality of active frontage	1

Further analysis of the metrics identified are presented in Table 19 and Table 20. Table 19 presents an ordered list of the number of instances a specific metric was identified across the four workshops. As metric identification occurs in 2 rounds, metrics identified in round 1 are not re-identified in round 2 as participants share the model builds thus minimising duplication. Vehicle speed was mentioned 7 times and was normally identified in the first round of metric development, emphasising the importance of obtaining speed measurements. In addition to speed, the diversity of using a space/street and the mode split statistics are both also repeatedly identified by participants as key indicators that can be measured to evaluate a street design.

Table 19: Number of unique identifications of specific metrics across the 4 workshops.

Metric	Number of Unique Identifications
Vehicle Speed	7
Diversity of users within the space/street	5
Mode split	4
Tree canopy cover (area of coverage)	4
Economic Growth	3
Number of Crashes (Crash Statistics)	3
Number of crossings	3
Number of people dwelling in the space	3
Pedestrian Counts	3
Pedestrian Dwell Time	3
Pollution (Air-Particulates)	3

Table 20 displays the 5 “must have” metrics in the performance assessment of a shared space, as defined by each group across the 5 workshops.

Table 20: Collation of must have metrics across the 4 workshops.

Workshop Number	MUST have metrics for Assessment
1 (Civic Space Context)	Water quality
	Number of people dwelling in the space
	Satisfaction/perception rating of the space
	Number of children using the space
	Urban Heat Island Effect
2 (Local Street Context)	Missing footpath links (Connectivity)
	Pedestrian cross-connections/accessibility
	Journey time reliability of public transport
	Tree canopy cover (area of coverage)
	Number of Crashes (Crash Statistics)
3 (Civic Space Context)	Lifecycle cost of infrastructure
	Tree canopy cover (area of coverage)
	Level of Service (of all infrastructure components)
	Satisfaction Ratings (How safe do you feel?)
	Diversity of users within the space/street
4 (Local Street Context)	Tree canopy cover (area of coverage)
	Vehicle Speed
	Pollution (Air-Particulates)
	Pedestrian Dwell Time
	Diversity of users within the space/street

In short, all participants within each workshop considered these metrics essential in measuring performance. Consistent with the identification of environment/place-oriented metrics in the individual exercise, the top 5 metrics tend to also be related to the environment or place. The most significant trend is the presence of “**Tree Canopy Cover (area of coverage)**” (highlighted in green) and the “**Diversity of users within the shared space/street**” (highlighted in orange) **being a top 5 metric in more than one workshop**. These metrics are traditionally not captured in evaluations of transport infrastructure, especially road

infrastructure, thus further stressing the importance of measuring the link to nature as well as the place that is defined by the infrastructure.

2.4.6 Summary of Key Findings

The outcomes of the stakeholder workshops, based on the analysis of the data, can be summarised as follows:

- All participants were engaged with the material (offering valuable insights) and enjoyed the unique nature of the workshop.
- The workshops generated professional connections and insights allowing for an appreciation of diverse perspectives.
- **All workshops yielded discussions concerning themes that could be related to existing objectives of shared space designs.**
- Though there was a **consensus in aspect definition** regarding safety, enhanced priority for active and public transport modes, lower speed environments and establishment of a place using nature and other social infrastructure, there were differences between the Civic Space context workshops and Local Street context workshops.
 - Respondents in the Civic Space context generally suggested a need for a focal point attractor within the space as well as acknowledging the need to achieve economic success, two aspects that were not discussed in the Local Street context.
- Given the consistency of responses across the workshops, **a consolidated perspective to achieve an ideal shared road infrastructure experience was formed.**
- **The terminology of “shared spaces” was used in every workshop, indicating that it is a core component of achieving both movement and place within a design.** Furthermore, all aspects highlighted by participants aligned with the high-level objectives identified in CIHT (2018) which confirms that shared space designs are a potential solution to achieve streets that have a balance between movement and place.
- Collectively, participants suggested **“strategic use of shared road infrastructure”** indicating zone-based approaches are beneficial where protected/separated design attributes are present alongside shared spaces.
- 153 metrics (113 unique) were identified by participants with most metrics focussed on measuring the comfort and safety of users.
- 20 out of 113 unique metrics identified were similar or identical to BEI metrics, constituting approximately 18% of the responses. Thus, there are several additional considerations when appraising shared spaces.
- **“Vehicle speed”, “diversity of users” within the space/street, “Mode split” and “tree canopy cover”** were the most highly cited metrics by workshop participants. These are the most logical metrics to use to evaluate whether a location has lower speeds, greater socialisation or community engagement or increased walking and cycling.
- Metrics of importance tended to focus on social interaction and liveability with the **presence of “nature/vegetation” being identified as key for evaluation.**

3 Shared Road Infrastructure Database

In parallel to the stakeholder consultation presented in Section 2, another gap the Stage 1 of the research program identified is the lack of documentation of existing sites that could be classified as a shared space. Understanding the location and attributes of existing locations can provide practitioners a foundation in designing, implementing, and evaluating future shared spaces. Accordingly, the second core objective of the project was to collate key information of existing shared road infrastructure across the NSW road network. The following sections of the report detail the development of a shared road infrastructure database. In addition, data was collated for the City of Sydney local government area as a demonstration of the development of the database and preliminary analysis is presented to showcase the potential of the database in supporting future practitioner tasks concerning shared space implementation.

3.1 Database Development

The Microsoft Power BI platform was used as the primary medium for cataloguing and representing shared zones. Power BI is a powerful data visualisation platform, that is used by TfNSW. Power BI, like some features of Geospatial Information Systems (GIS) software, is able to represent data with a spatial component. Unlike GIS, Power BI is interactive platform that is designed to be intuitive, not requiring prior experience for users to navigate and operate. Furthermore, it is augmented with sorting and filtering functions such that specific data attributes can be selected and analysed by users.

Latitudinal (*lat*) and longitudinal (*long*) data for each shared space was used to spatially locate and represent length and geometry of the infrastructure. Each shared space was given a unique 'ID' number to differentiate it, with a particular shared space also containing an added attribute of a 'Segment Number'. This was used to capture geometry such as curves along the road alignment by having unique *lat* and *long* for each segment as well as the start and end points of a particular site. Furthermore, splitting each site into segments allowed for the identification of nuances in features along the length of a shared space.

3.1.1 Key Variables

Consideration was given to determine the key variables that would be collected for each shared space. The variables that were used align to TfNSW's BEI framework and is augmented with physical design features and spatial information. The variables used are outlined in Table 21. In addition to the primary variable of "Geographic Location", variables such as the type of infrastructure (Intersection Site) and adjacent land use provide indication of the street context (Main Street, High Street, Civic Space or Local Street). The "Shared Zone/Space Signage" variable was collected to determine the formalisation of the shared road infrastructure. The database has been designed to capture formalised shared spaces with signage but also allows practitioners to note prospective or proposed sites that currently do not have signage but have features of shared road infrastructure. The preliminary analysis presented in Section 3.3.1 refers to defined sites in the City of Sydney. The remaining variables collected describe features of each site such as speed limit, presence of vegetation, pavement types, barriers, street furniture and others.

Table 21: Variables collected in Shared Road Infrastructure database.

Variable	Purpose
Geographic Location	Latitude/Longitude, Street Name, Adjacent Street Names, Suburb and LGA are all documented to gauge spatial positioning and relationships of sites.
Adjacent Land Use	Allows to draw relationships between land use and shared road infrastructure.
Intersection Site	To signify the type of road infrastructure being transformed, is it isolated to an intersection or is it a road section/network treatment.
Speed Limit	Critical to collate as a means of maintaining safety in shared environments. Also, necessary to conduct compliance studies when speed data is collected.
Shared Zone/Space Signage	Is the location an existing shared space (clear definition using “shared” signage) or a potential site (no clear definition/signage but operates as a shared space)? – allows for differentiation between formal/informal sites.
Street Furniture	Place oriented variable common to shared space applications globally. Can be used as an independent variable in assessing impacts.
Foliage/ Greenery/ Tree Canopy	Place oriented variable common to shared space applications globally and integrated within the BEI. Can be used as an independent variable in assessing impacts.
Pavement Type	Place oriented variable common to shared space applications globally. Can be used as an independent variable in assessing impacts.
Kerb/ Guttering	Place oriented variable common to shared space applications globally. Can be used as an independent variable in assessing impacts.
Safety Barriers	Provides an indication to the degree of separation within the shared space. Can support the development of the categorisation shared road infrastructure.
Traffic Signals	Traditional shared space definitions/implementations remove signalisation. This variable can provide insights into local applications which may require an adjustment for the Australian/Local context.
Signalised Crossings	Traditional shared space definitions/implementations remove signalised crossings. This variable can provide insights into local applications which may require an adjustment for the Australian/Local context.
Marked Unsignalised Crossings	Traditional shared space definitions/implementations removes marked crossings. This variable can provide insights into local applications which may require an adjustment for the Australian/Local context.
Other Informal Crossings	Pavement colouring, raised pavements, road cushions and other traffic management devices maybe perceived as an informal crossing by pedestrians.

3.2 Method of Site Identification

The population of the database involved leveraging several data sources to verify the presence of shared road infrastructure sites. The method involved examining the following resources:

- **Geographical Information System (GIS) Maps:** GIS maps of the Sydney Road network was used to initially identify sites that had sign-posted speed limits of 30km/hr or less (with a particular focus on sites that were 10km/hr as this is the required limit for a shared zone)
- **Aerial Maps:** Nearmap© and Google Maps© were used to gather visual cues of sites that had shared space features. Traffic calming entry treatments, coloured pavements, bollards, and street furniture supported in the identification of both defined and potential shared road infrastructure sites.
- **Google Street View© and Site Investigation:** Street views and site investigations were conducted to confirm design features and spatial information.

3.3 Collation of City of Sydney Data

The City of Sydney does not currently catalogue its shared road infrastructure and there is no formal definition of shared spaces across NSW, only shared zones (a sub-category of shared spaces). NSW road classification data was used to identify existing as well as potential shared road infrastructure within the City of Sydney Local Government Area (LGA). This LGA contains the most detailed publicly accessible road infrastructure data easing the process of identification of defined shared road infrastructure. However, it was found to not document planned or shared road infrastructure projects under construction such as the Little Eveleigh Street shared zone which commenced construction in 2022. Furthermore, upon analysing the dataset, it was found to not record shared road infrastructure on private roadways.

A total of 71 formally defined shared spaces (specifically shared zones) were identified within the City of Sydney as shown in Figure 11, the highest of all local government areas within NSW.



Figure 11: Existing shared space infrastructure in the City of Sydney LGA.

3.3.1 Preliminary Analysis of City of Sydney Data

Shared zones were predominantly located within the inner-city suburbs of Surry Hills and Redfern as well as the Sydney Central Business district as shown in Table 22. All the shared zones were found to be road segment treatments and not localised to a single intersection. All the shared zones analysed began at an intersection and ran the length of the street until intersecting with a secondary street. This is not the case with all shared zones in NSW, as some identified by the research group outside of the City of Sydney LGA were implemented along a segment of road where pedestrian volumes were high, or a vulnerable user group was present. Data analysis suggests that planning considerations impact the implementation of shared zone treatments. Table 23 presents that many shared zones were in General Residential and Mixed-Use zones. These align with shared space objectives located in areas of high pedestrian movement. The average population per square kilometre for all the shared zones analysed had a maximum value of 13,614 and a median value of 12,512 (NSW Government, 2023c) This indicates shared zones are being implemented in predominantly dense urban areas.

Table 22: Geographic analysis of the distribution of collated shared spaces across the City of Sydney LGA.

Suburb	Proportion of shared zones within City of Sydney (%)
Surry Hills	26
Sydney	24
Redfern	15
Darlington	10
Ultimo	7
Glebe	6
Paddington	5
Camperdown	4
Waterloo	3

Table 23: Zoning classification of collated shared spaces across the City of Sydney LGA.

Shared space land zoning	Proportion of shared zones with City of Sydney (%)
R1 – General Residential	57
B4 – Mixed Use	22
B2 – Local Centre	7
B8 – Metropolitan Centre	5
B1 – Neighbourhood Centre	4
RE1 – Public Recreation	4
B6 - Enterprise Corridor	2

The physical design variables as part of the database showed that the average carriageway width of the shared zones was approximately 4.2m. Footpath sizes were highly variable with largest value being 6.3m, typically when a shared zone adjoined with a pedestrian precinct. Along the length of the shared zone (i.e., parallel to its direction of travel) the most common footpath width was zero as highlighted in Figure 12. Kensington Street from Figure 12 could be considered a purposeful shared space treatment, where no footpath has been provided to align with shared space design principles. This however may not be indicative of typical shared space treatments implemented with the intention of equal mode share, but the retrofitting of existing service lanes or other low volume/speed streets as shared zones. In these street environments property boundaries typically front right up to the carriageway with no space allocated for footpaths. Standard pavement and asphaltting were found to be the most common surface type along the carriageway at 51% of shared zones, followed by pavers at 42% and coloured pavement at only 7% of sites. Approximately 17% of shared zones had physical barriers separating vehicles and pedestrians (for example bollards and other devices that separate vehicles and pedestrians). These were mostly located at new shared zone treatments that had implementation of more typical features of shared space design as opposed to the aforementioned retrofitted streets. Only four shared zones analysed did not have kerbs or guttering present along their length.



(a) Wilson Lane, Darlington
(No footpath provided)



(b) Kensington Street, Chippendale
(Footpath provided)

Figure 12: Contrast of two different shared space treatments (Google Maps, 2021a, 2021b).

All the shared zones analysed did not have any form of signalisation with only one site containing a formal/informal crossing point along its length. This was located adjacent to the entrance of a local primary school. All the defined shared zones had a posted speed limit of 10 km/h, consistent with TfNSW guidelines and NSW legislation. Over 90% of the identified sites within the City of Sydney had foliage, greenery, or tree canopy coverage at some point along their length.

3.4 Summary of the Shared Road Infrastructure Database development

Section 3.3 demonstrates the collation of data and the possible analysis that can be carried out for shared road infrastructure at different spatial scales. It is intended that with collation of all sites across NSW, the analysis can be considerably more detailed comparing regions and allowing for the strategic prioritisation of “place” generating initiatives. For example, the findings of the preliminary analysis of the City of Sydney sites highlighted that the most common adjacent land use to shared zones was “general residential” (Table 23), which indicate that the solution may not have been explored or implemented in more commercial settings, such as Civic Spaces. The database can provide an evidence base to investigate such spatial and design trends and patterns and potentially provide guidance for future projects.

It is important to note that the database is underpinned by a simple spreadsheet format allowing it to be an evolving crowdsourced resource. The intention is for practitioners to easily contribute to the database so that industry can use the resource to guide future designs, planning and implementation of shared road infrastructure. Practitioners can use analysis procedures described in Section 3.3.1 and simple filtering features and spatial clustering to gather further insights to support future work. The next steps of the development of the database are to collate further sites across NSW and explore further data analysis techniques.

4 Limitations and Future Work

The tasks completed in the research study contain limitations that must be acknowledged and could be addressed in future work. The stakeholder consultation workshops involved gathering perspectives from a sample of professional practitioners. Though the executed methodology involved gathering diverse perspectives across a spectrum of professionals (Engineers, Planners, Developers etc.) maximising the likelihood of capturing every dimension of shared space planning, design, and application, it is still a sample of views. However, the Workshops provided clear evidence that shared space designs present as a part of the solution to delivering streets that balance movement and place, from a practitioner perspective, as described in Section 2.4. Therefore, this offered the opportunity to consolidate perspectives regarding shared space design and implementation, as highlighted in Section 2.4.6 which signified the achievement of the first primary objective. **To remedy the sampling associated with the methodology and confirm the proposed vision, it is essential to gather community feedback through a large-scale survey.** The survey could involve online interactive mapping tool where respondents identify, rate and critique roads and streets that contain shared infrastructure that they use, enabling a collection of mass subjective data from the public. In addition, the survey can involve an open-ended questionnaire for general suggestions regarding the planning of streets that aim to balance movement and place.

Stage 1 findings indicated that data regarding the presence and performance of shared spaces in NSW is disparate (Wijayaratna et al., 2022). The Shared Road Infrastructure Database has defined a foundation to systematically account for shared space locations and attributes. The project documented sites from only the City of Sydney Local Government area, thus limiting the analysis. **The next stage of development would be to collect information across other LGAs in NSW to capture regional and state-wide data.** In addition, the variables that have been collected are only related to physical and spatial information. There is scope to expand the database to include performance reports (past studies) and traffic characteristics (for example average speed, peak flow etc.) to be included once made accessible. Critically, the development of **the database will guide the site selection process necessary to conduct empirical analysis of local case studies and before and after analysis** of newly developed shared road infrastructure.

5 Concluding Remarks

This research project continues the research concerning the implementation and evaluation of shared space designs within the NSW road network. Advancing the comprehensive literature conducted within Stage 1 of the *UTS Shared Spaces Research program*, this report presented the outcomes of Stage 2a. This stage of work has delivered a collation of shared road infrastructure perspectives from practitioners and formed a database that has begun to document existing shared road infrastructure sites across NSW (initial data collected focuses on City of Sydney LGA).

Practitioner perspectives of the shared space concept were investigated using stakeholder consultation workshops. Given the conjecture surrounding the terminology of “shared spaces”, a novel workshop structure, based on the LSP technique, was designed to investigate the perspectives of practitioners concerning street and road designs that equalised the priority of both movement and place attributes. The term “shared space” was removed from the workshop instructions, and the activities gauged whether the term would be used to describe design options and define metrics within the workshop. Thus, the goal of the workshop was to *“identify key aspects for an ideal experience in a street that balances place and movement and determine metrics that measure these aspects”*, covering both the design and evaluation of shared spaces.

Iterations and pilot testing of versions of the workshop activities led to the final workshop structure. The workshop included a skill building component and two overarching sections: street experience tasks to identify key aspects and metric identification and prioritisation tasks. In addition, two versions of the workshop were delivered to cater for the different street contexts in which shared spaces designs would generally be adopted within: Civic Spaces and Local Streets. Four workshops (two for each street context) were held across March, April and May 2023, where 27 transport professionals with diverse backgrounds from the private and public sector and exposure to street design, implementation and evaluation, participated. All participants were engaged with the material (offering valuable insights) and enjoyed the unique nature of the workshop. In addition, the workshops generated professional connections and insights allowing for an appreciation of diverse perspectives. The key outcomes from the workshops can be summarised as follows:

- **The terminology of “shared spaces” was used by participants in every workshop, indicating that it is a core component of achieving both movement and place within a design.**
- Most participants suggested **“strategic use of shared road infrastructure”** indicating zone-based approaches are beneficial where protected/separated design attributes are present alongside shared spaces.
- 153 metrics (113 unique) were identified by participants with most metrics focussed on measuring the comfort and safety of users.
- **“Vehicle speed”, “diversity of users” within the space/street, “mode split” and “tree canopy cover”** were the most highly cited metrics by workshop participants. These are the most logical to measure when attempting to assess if a location has lower speeds, greater socialisation or community engagement or increased walking and cycling.
- Metrics of importance tended to focus on social interaction and liveability with the **presence of “nature/vegetation” being identified as key for evaluation.**
- There was **a consensus in the importance of safety**, enhanced priority for active and

public transport modes, lower speed environments and establishment of a place using nature and other social infrastructure. Thus, allowing for the **formation of a consolidated perspective regarding the implementation of shared spaces.**

Using the responses from the workshop, the blue box in Figure 13 presents the consolidated perspectives of workshop respondents to achieve an ideal shared space experience. Figure 13 also presents the shared space definition established during Stage 1 of the research program. The sections of text highlighted in yellow indicate the consistency between the definition and the practitioner perspectives, thus establishing congruence in definition and expectations for future application.

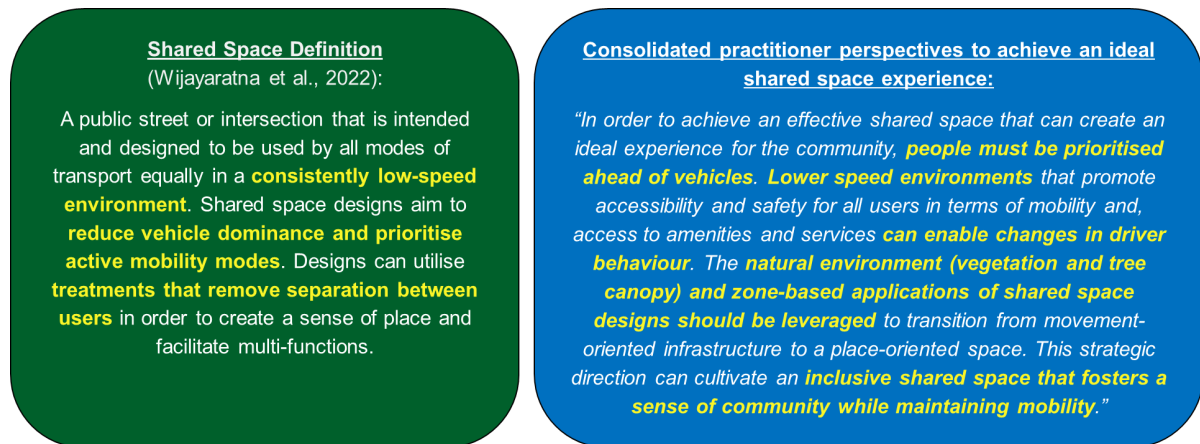


Figure 13: Comparison of shared space definition and consolidated perspectives.

In parallel to understanding and consolidating practitioner views of shared space design and implementation, Stage 2a involved the collation of existing shared road infrastructure information within a database. The database serves as a resource for practitioners to identify the presence and features of existing shared road infrastructure and use this for the planning and implementation of future shared road infrastructure solutions. A Microsoft Power BI dashboard was developed, underpinned by a spreadsheet database collating the location, spatial dimensions, and other key features of shared spaces. The database infrastructure was constructed to collate data for sites across NSW, and as a pilot, sites within the City of Sydney have been included in the current version of the database. Collecting this information, even at a preliminary level has allowed for spatial analysis, indicating key relationships between shared road infrastructure and other variables. For example, within the City of Sydney, more than half of the shared space locations were in a "General Residential" land use category.

The practitioner perspectives clearly indicate that shared space solutions are fundamental to achieving streets that safely balance movement and place, which are important to delivering several street classifications described by TfNSW, such as Civic Spaces and Local Streets (NSW Government, 2023a). In addition, there are currently numerous shared road infrastructure sites present across the City of Sydney locality and many more sites are present across NSW. However, as documented in Section 1, there is no formal guidance for practitioners regarding the implementation and evaluation of shared spaces which can complicate future applications. **Therefore, continuing the research effort to understand the impacts of shared spaces would offer an opportunity to develop guidance for appropriate implementation and evaluation.**

5.1 Future opportunities

The finding presented in this report could be used to deliver Stage 2b of the UTS Shared Spaces Research Program, “*Empirical analysis of local shared road infrastructure*” (recast as Figure 14). **Specifically, the outcomes would support the site selection (database can be used to identify a list of sites), data collection (metric identification and prioritisation will optimise the collection minimising resource consumption) and data analysis (practitioner descriptions from the workshop will provide the context for analysis).**

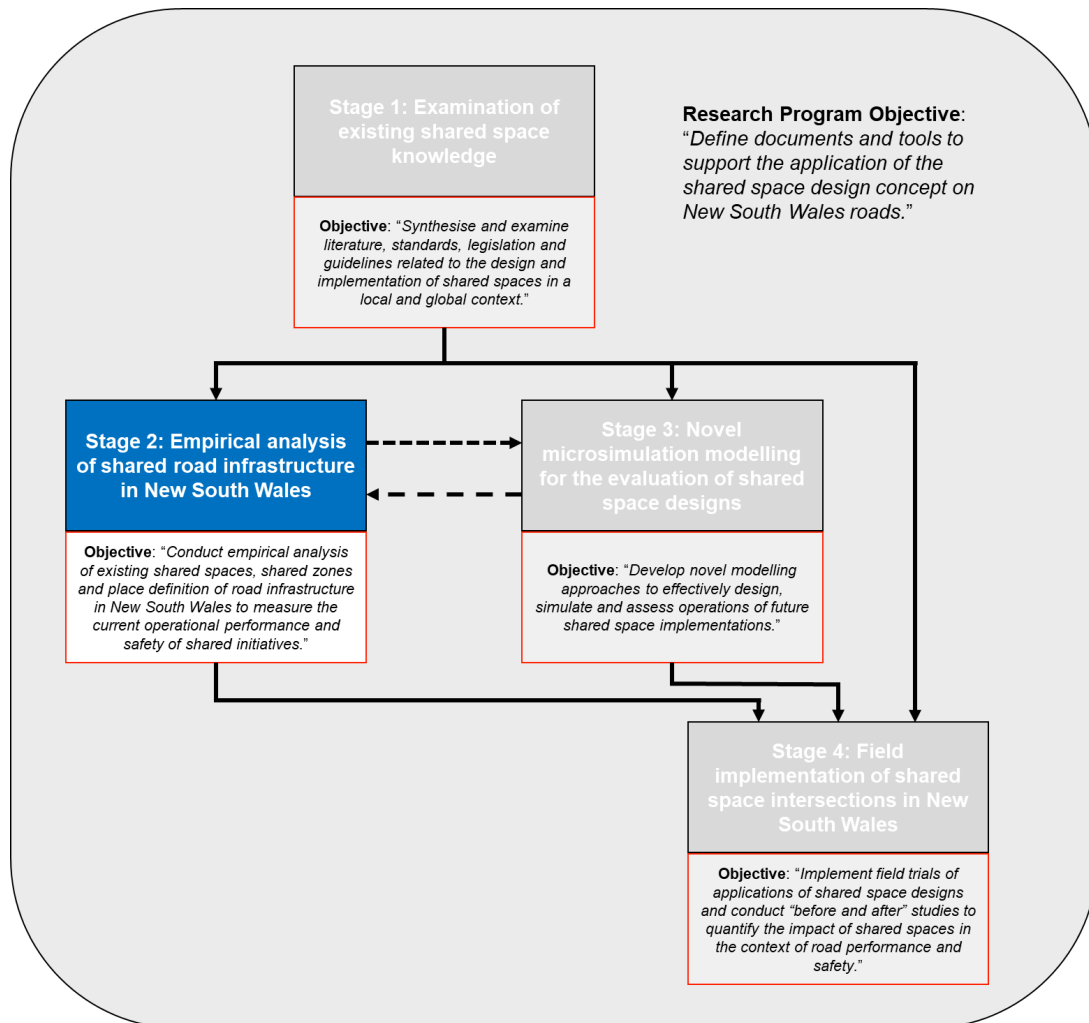


Figure 14: Staged Research Program (Highlighting Stage 2).

Moreover, the limited number of "before and after" empirical studies that offer comprehensive quantitative and qualitative analyses of shared space implementations is further compounded by the scarcity of empirical research on interventions that focus on enhancing "place," such as widening footpaths, changing pavement types, or integrating furniture and greenery near road infrastructure. The absence of a robust, scientifically driven evidence base makes it challenging for practitioners to implement innovative solutions confidently. **Therefore, there is value to model potential infrastructure scenarios considering interactions within a shared space (Stage 3) and subsequently assess impacts through rigorous "before" and "after" studies.**

This initiative spans the long term and could be accomplished through the staged program described above. The outcomes of such research would form the groundwork for establishing clear guidelines and developing standards that professionals can efficiently utilise to implement successful solutions, including shared space solutions, that create well-defined and thriving places.

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APPENDICES

Appendix A1: Workshop 1 Notes

Date (Time): 30 March 2023 (9:00AM – 1:00PM)

Location: UTS Building 11, Level 12, Room 113

Street Context: Civic Space

Overall Notes

- 7 participants (9 participants were invited, 2 apologised due to unavoidable circumstances)
 - Participant 1 (P1) – Landscape Architect
 - Participant 2 (P2) – Transport Planner
 - Participant 3 (P3) – Traffic Engineer
 - Participant 4 (P4) – Traffic Engineer
 - Participant 5 (P5) – Road Safety Officer
 - Participant 6 (P6) – Transport Planner
 - Participant 7 (P7) – Landscape Architect
- All participants engaged with each activity and provided clear explanations and feedback. Participants debated during group exercises with everyone providing inputs.
- Identification and explanation of “experiences” throughout the workshop was clear and metaphors were used throughout (successful application of LSP).
- Clear objectives, design features and metrics were identified throughout the process.
- The workshop began 10 minutes late. Finished approximately 3 minutes late (1:03PM).

Skills Building – “Build a model of a positive or a negative experience for the persona you have selected in using a street that enables both place and movement”.

- P1 – Biking to local gym
 - Positive experience – described as a “Happy Person”.
 - Involved nature (trees and vegetation) sharing of space to accommodate and make the cyclist feel safe.
- P2 – User has a physical impairment
 - Positive experience – described as “the person is seen - is not invisible”.
 - The build involved highlighting the individual as a large pink set of bricks that had greater priority and attention as compared with other users in a multi-modal environment.
- P3 – Person driving kids to school
 - Negative experience – described as “distractions in a cluttered environment is dangerous for interactions between users”.
 - The build highlighted obstacles (resulting from vegetation and other infrastructure) that prevented line of sight for users potentially creating a distracted environment resulting in a lack of safety.
- P4 – Teenager walking a dog
 - Negative experience – described as “clutter preventing access to a comfortable journey - frustration”.
 - Person walking the dog is facing a cluttered environment with barriers on the footpath not allowing for easy movement.

- P5 – A person pushing baby stroller – neither a positive or negative experience described just highlighting infrastructure requirements (need for pram ramps and sight lines)
- P6 – Couple sitting on a bench
 - Positive experience – separation of movement and place to offer a time to interact.
 - Green buffer/barrier to separate busy movement corridor with the place where people are sitting.
- P7 – Public transport commuter
 - Both positive and negative experiences highlighted.
 - Negative experience: A complex model with a lack of clarity making the user feel overwhelmed when using the transport service (confusing information/layout of stations/infrastructure).
 - Positive experience: “Clear lines of sight, different textures to highlight different types of infrastructure” – Move through the system and keep in touch with nature.

Individual Model Notes

“Build an individual model of an ideal experience in a street that is a place for people while also allowing for movement and travel.”

P1 – The ideal experience should cater for a variety of travel speeds but all speeds should be moderated (achieved through infrastructure/barriers) and the street should become an extension of the home to make it truly a place.

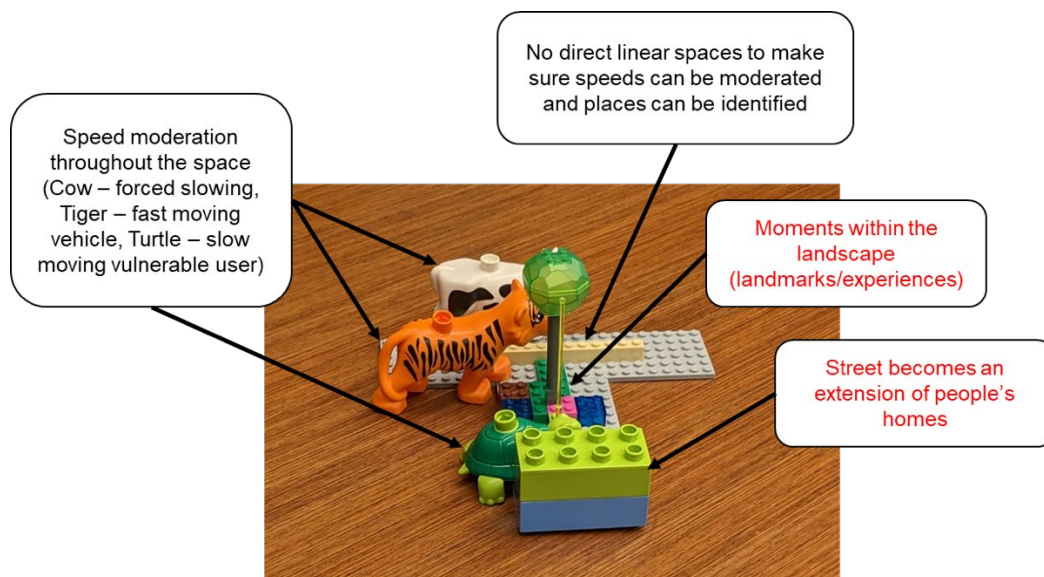


Figure A1 - 1: Individual model by P1 (red text: aspects selected by the participant for the group model)

P2 – The ideal experience in a street should be equitable where vulnerable users are prioritised and driver behaviour changes (cultural shift) to appropriately acknowledge the change in priority. Children should feel safe and have more opportunity to interact with the street independently and we should be leveraging nature to create a place for people to dwell.

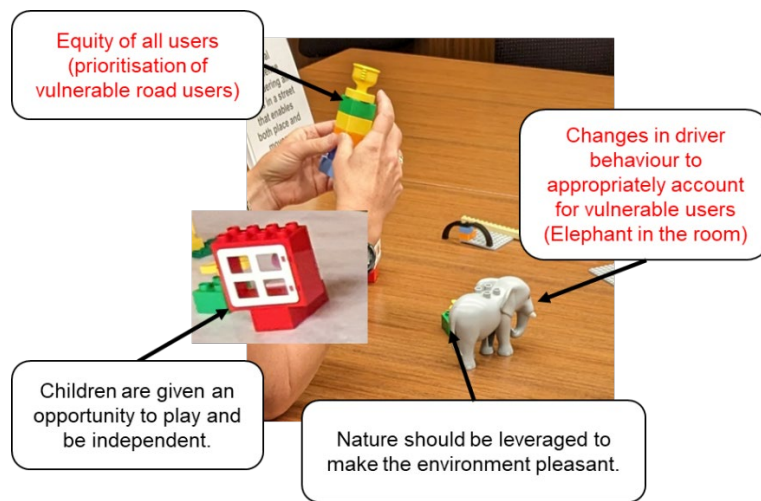


Figure A1 - 2: Individual model by P2 (red text: aspects selected by the participant for the group model)

P3 – The ideal experience should cater for multiple modes in separated infrastructure to ensure safety whilst also being supported by vegetation/greenery to highlight a place. The street should feed into a pedestrian prioritised core town centre and be also connected to High Occupancy Vehicle (trains/buses etc) infrastructure to provide regional access.

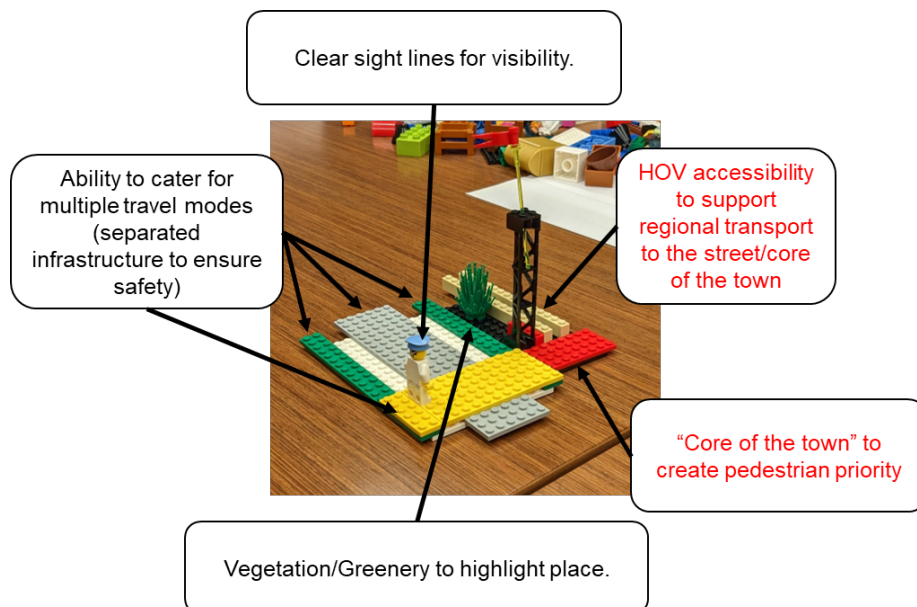


Figure A1 - 3: Individual model by P3 (red text: aspects selected by the participant for the group model)

P4 – The ideal experience should be within a low speed environment and leverage infrastructure to connect movement and place functionalities that results in a safe and accessible system for all users. The interaction between the functionalities should be redefined to prioritise pedestrians and vulnerable users ahead of motorists.

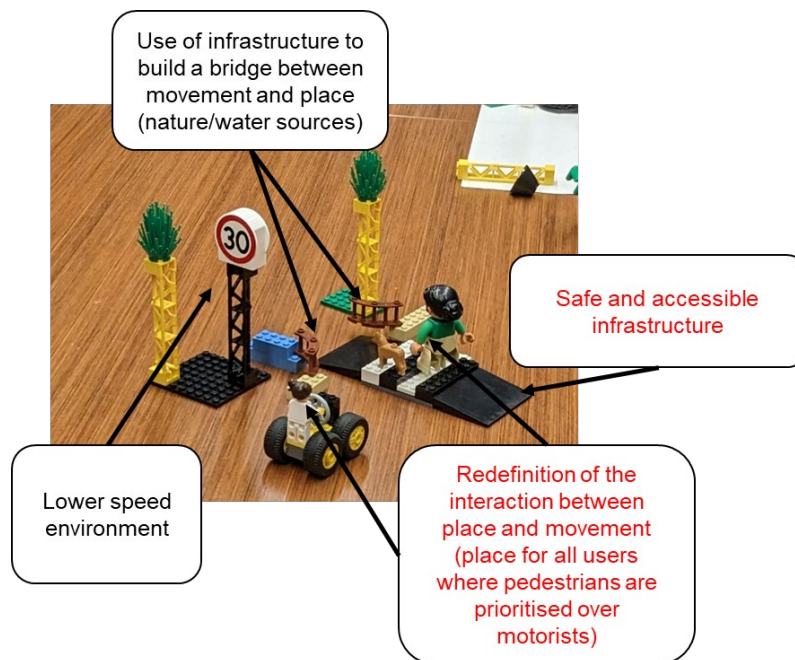


Figure A1 - 4: Individual model by P4 (red text: aspects selected by the participant for the group model)

P5 – The model presents the current state of streets and not the ideal experience where there are some areas of the network (“Haves”) where there is a balance between movement and place whereas there are other regions (“Have nots”) that do not have a balance. In order to achieve the ideal experience, there must be a fluidity between movement and place and nature is the key link for this to occur.

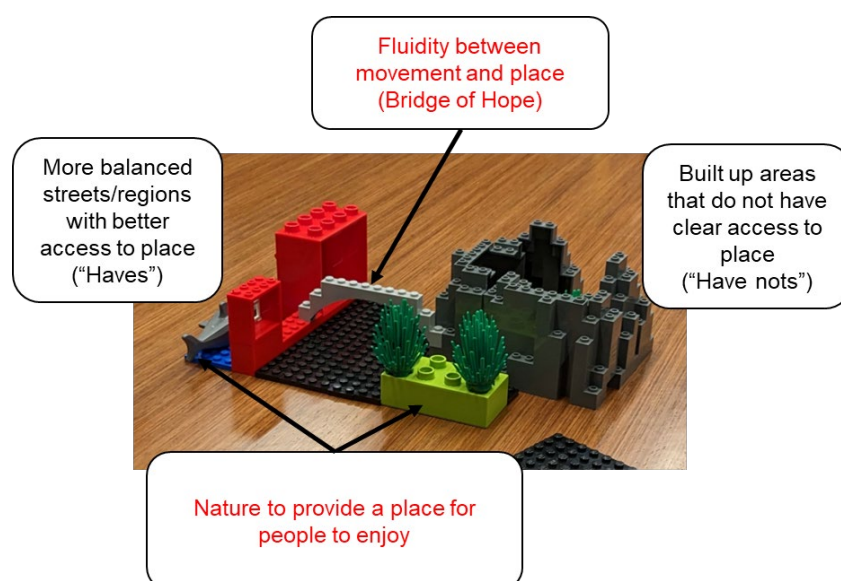


Figure A1 - 5: Individual model by P5 (red text: aspects selected by the participant for the group model)

P6 – The ideal experience within a street accounts for vulnerable road users by providing safe infrastructure but also takes into consideration the needs of motorists to traverse and access the study area. In order to maintain the balance between both movement and place, there needs to be effective monitoring of speed and the strategic inclusion of aspects of nature.

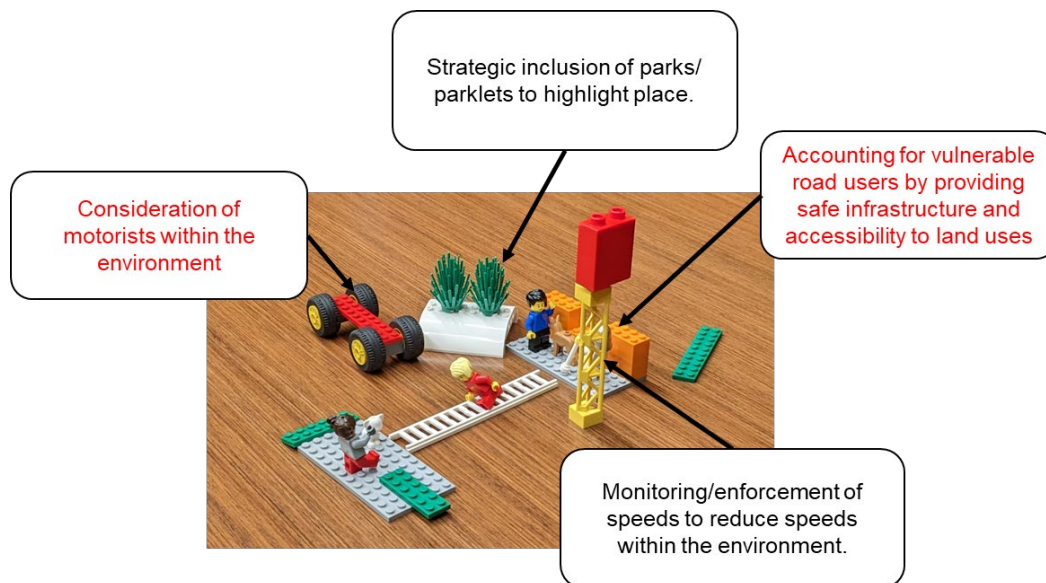


Figure A1 - 6: Individual model by P6 (red text: aspects selected by the participant for the group model)

P7 – The ideal experience within a street should make sure all users feel safe and comfortable. There needs to be a deconstruction of the idea that streets serve movement first, connectivity and places, defined by nature, should be interspersed along the transport corridors. The experience should have equal access and cater to diverse population.

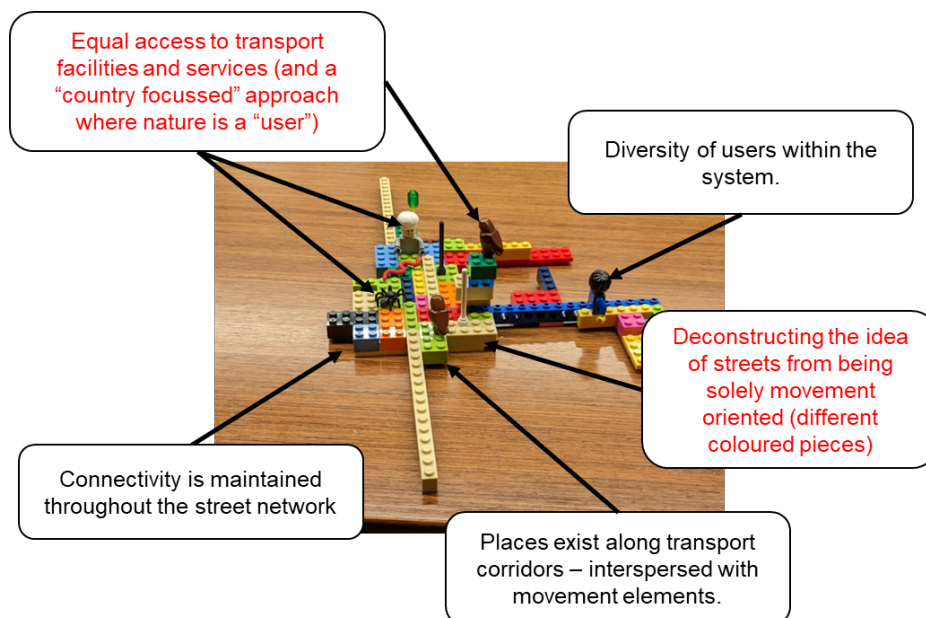


Figure A1 - 7: Individual model by P7 (red text: aspects selected by the participant for the group model)

Group Model Notes

The two most important objectives/aspects of an ideal experience highlighted by each participant are as follows:

ID	Description	CIHT Cat. 2
P1	<ul style="list-style-type: none"> Streets become an extension of people's homes. Creation of moments within the streetscape. 	QP QP
P2	<ul style="list-style-type: none"> Equity of all users (prioritisation of vulnerable road users) Changes in driver behaviour to appropriately account for vulnerable users. 	IE IE
P3	<ul style="list-style-type: none"> HOV accessibility to support regional transport to the street/core of town centre. Pedestrian prioritised core town centre streets. 	EM EM
P4	<ul style="list-style-type: none"> Safe and accessible infrastructure Redefinition of the interaction between place and movement (place for all users where pedestrians are prioritised over motorists). 	SPH QP
P5	<ul style="list-style-type: none"> Nature to provide a place for people to enjoy. Fluidity between movement and place. 	QP QP
P6	<ul style="list-style-type: none"> Consideration of motorists within the environment Accounting for vulnerable road users by providing safe infrastructure and accessibility to land uses. 	IE IE
P7	<ul style="list-style-type: none"> Deconstructing the idea of streets from being solely movement oriented. Equal access to transport facilities and services. 	QP IE

- Prioritisation of pedestrians/vulnerable road users is a common theme across all participants.
- The need to be aware of and include natural aspects (flora/fauna) as interspersed aspects within a street environment is also key to an ideal experience.
- The infrastructure should be connected and safe for all users.

² CIHT Categorisations: Inclusive Environment (IE), Ease of Movement (EM), Safety and Public Health (SPH), Quality of Place (QP), Economic Benefit (EB)

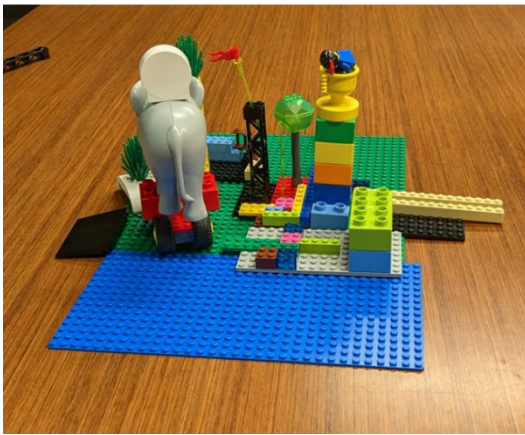
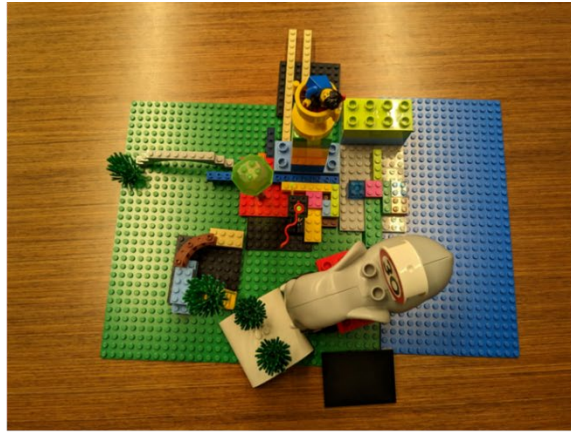


Figure A1 - 8: Group Model

The Group Model Story:

- The aspects highlighted by individuals were grouped and connected into 5 primary aspects:
 - Changing Driver Behaviour
 - Equity across all user classes
 - Transition “movement oriented” design to “place oriented” design.
 - Use nature to create places within streets
 - Strategic regional accessibility
- *In order to achieve an ideal street experience, it is important to provide the necessary road infrastructure (and enforcement/legislation – especially within low speed contexts) to create an environment that changes driver behaviour to be aware of and reprioritise these streets in favour of vulnerable road users. This will result greater equity across the user classes from a movement perspective creating a better place for people. The design of the street should be supported by HOV accessibility at the peripheries and the street should be connected with the core of the town centre (pedestrian prioritised). Furthermore, the ideal experience will contain design elements that are less focussed about movement and more focussed on providing community services and leveraging nature. The street is to become an extension of people’s dwellings and memorable moments should be delivered within the final streetscape.*

Metrics

ID	Metric	Is it a BEI Metric?	BEI Category	BEI Sub-Category	Must have Metrics
P1	Mode split	Yes	Access and Connection	Transport choice	
P1	Water quality		Green and Blue	Link to nature	MUST
P1	Economic Benefit (Trading Hours)		Amenity and Use	Local opportunities	
P1	Pedestrian Dwell Time		Amenity and Use	Convenient Facilities	
P1	Number of community events		Amenity and Use	Local opportunities	
P1	Number of art works/landmarks		Character and Form	Distinct	
P2	Number of Fatalities (Crash Statistics)	Yes	Comfort and Safety	Low Risk	
P2	Number of crossings	Yes	Character and Form	Human Scale	
P2	Vehicle Speed	Yes	Comfort and Safety	Low Risk	
P2	Area of green space		Green and Blue	Link to nature	
P2	Number of people dwelling in the space		Comfort and Safety	Comfort	MUST
P3	Sight distance measurements		Comfort and Safety	Low Risk	
P3	Vegetation Growth		Green and Blue	Link to nature	
P3	Pedestrian Counts		Other	Other	
P3	Vehicle Speed	Yes	Comfort and Safety	Low Risk	
P4	Satisfaction/perception rating of the space		Comfort and Safety	Transport choice	MUST
P4	Presence of Flora and Fauna		Green and Blue	Link to nature	
P4	Pedestrian Dwell Time		Amenity and Use	Convenient Facilities	
P4	Economic Benefit (Business Profits)		Amenity and Use	Local opportunities	
P4	Volume of garbage collected (Cleanliness)		Amenity and Use	Convenient Facilities	
P5	Number of raised crossings		Comfort and Safety	Low Risk	
P5	Number of pram ramps		Comfort and Safety	Low Risk	
P5	Number of flora and fauna species		Green and Blue	Transport choice	
P5	Pedestrian Counts		Other	Other	
P5	Number of safety features (overall)		Comfort and Safety	Transport choice	
P5	Vehicle Counts		Other	Other	
P6	Number of shelters/shaded areas		Character and Form	Human Scale	
P6	Number of water features		Character and Form	Distinct	
P6	Number of children using the space		Comfort and Safety	Low Risk	MUST
P6	Presence of digital technologies to support experiences		Character and Form	Distinct	
P6	Presence of public art		Character and Form	Distinct	
P6	Perception of cleanliness		Comfort and Safety	Comfort	
P6	Colour accessibility measurements		Character and Form	Distinct	
P7	Heat Island Effect	Yes	Comfort and Safety	Comfort	MUST

ID	Metric	Is it a BEI Metric?	BEI Category	BEI Sub-Category	Must have Metrics
P7	Water Retention		Green and Blue	Link to nature	
P7	Economic Growth		Amenity and Use	Local opportunities	
P7	Biodiversity (Number of species of animals)		Green and Blue	Link to nature	
P7	Standardised Crash Statistics accounting for demand		Comfort and Safety	Low Risk	

Metric and Objective Relationship Identification



Figure A1 - 9: Group Model with Metric Prioritisation

Appendix A2: Workshop 2 Notes

Date (Time): 13 April 2023 (9:00AM – 1:00PM)

Location: UTS Building 11, Level 12, Room 113

Street Context: Local Street

Overall Notes

- 6 participants (8 participants were invited, 2 apologised due to unavoidable circumstances) – Note that Workshop 1 contained 7 participants.
 - Participant 8 (P8) – Traffic Engineer
 - Participant 9 (P9) – Transport Planner
 - Participant 10 (P10) – Traffic Engineer
 - Participant 11 (P11) – Traffic Engineer
 - Participant 12 (P12) – Transport Planner
 - Participant 13 (P13) – Urban Designer
- All participants engaged with each activity and provided clear explanations and feedback. Participants debated during group exercises with everyone providing inputs.
- Identification and explanation of “experiences” throughout the workshop was clear and metaphors were used throughout (successful application of LSP).
- Clear objectives, design features and metrics were identified throughout the process.
- The workshop began 20 minutes late. Finished approximately 10 minutes late (1:03PM)

Skills Building – “Build a model of a positive or a negative experience for the persona you have selected in using a street that enables both place and movement”.

- P8 – Biking to local gym
 - Positive transitioning to Negative experience of “obstructed”. The build presented a scene where a bicycle lane ends limiting the connectivity between origin and destination of a user. Cycleway is not wide enough and has uneven surfaces.
- P9 – A person commuting to work
 - Negative experience depicting confusion in managing a location that has poor signage and separation devices that confound experiences. Different coloured bricks represented “origin/destination” (red), “transport modes” (blue/grey), “Road infrastructure” (beige).
- P10 – Children playing tag
 - Positive experience of “safe and accessible”. Build showed a local road, separation of pedestrian/cycling/play area as well as regions of shared space to connect between zones.
- P11 – User has a physical impairment
 - Both positive and negative experience, model described a foot path with (positive) and without raised crossings (negative).

- P12 – Teenager walking a dog
 - Positive “safe” experience. Build included barriers to separate footpaths and road space where there was adjacent green areas for the dog to play. Good lighting (represented by light bricks) and indication of the sense of a balanced space.
- P13 – Elderly person going to buy a newspaper
 - Positive experience where the elderly are “elevated” and “seen” as vulnerable road users and members of the community. Build had a platform to show the importance of the elderly and used translucent pieces to describe visibility.

Individual Model Notes

“Build an individual model of an ideal experience in a street that is a place for people while also allowing for movement and travel.”

P8 – The ideal experience should create a safe and accessible environment for all users of the space. Street lighting is fundamental to ensure that amenity and use is possible across the entire day.

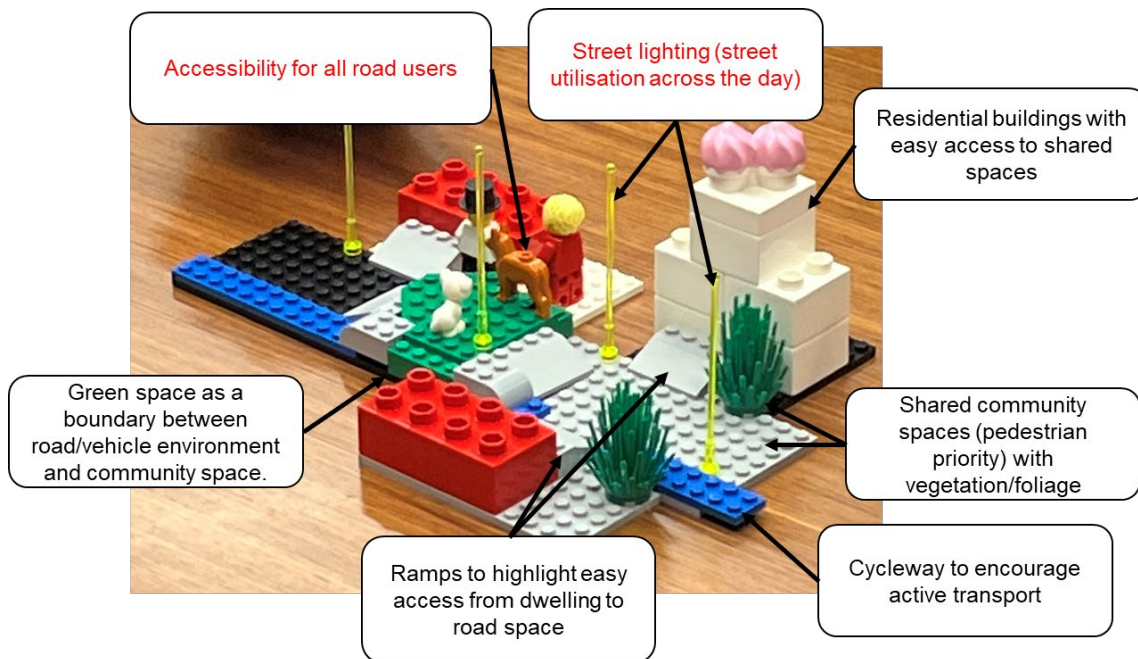


Figure A2 - 1: Individual model by P8 (red text: aspects selected by the participant for the group model)

P9 – The ideal experience should contain accessible infrastructure (especially schools) and public transport (to commute to work from the residential zone). The street should prioritise pedestrians and leverage parking as a means of traffic calming (reduce speeds by narrowing the street dimension). Street lighting and vegetation are key to defining a place that connects with nature.

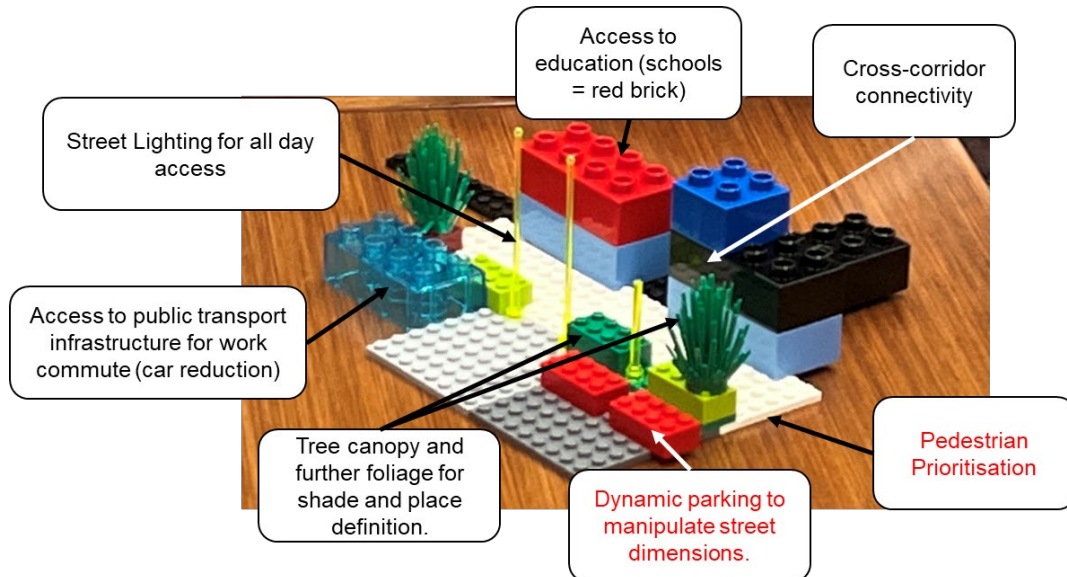


Figure A2 - 2: Individual model by P9 (red text: aspects selected by the participant for the group model)

P10 – The ideal experience can only be defined if road safety is at the centre of the design. Defined zones should be used for movement, active transport mobility (shared environment) and place. Accessibility to amenity and services is crucial across the zones. Green space and parks should be used so that people can dwell and engage socially.

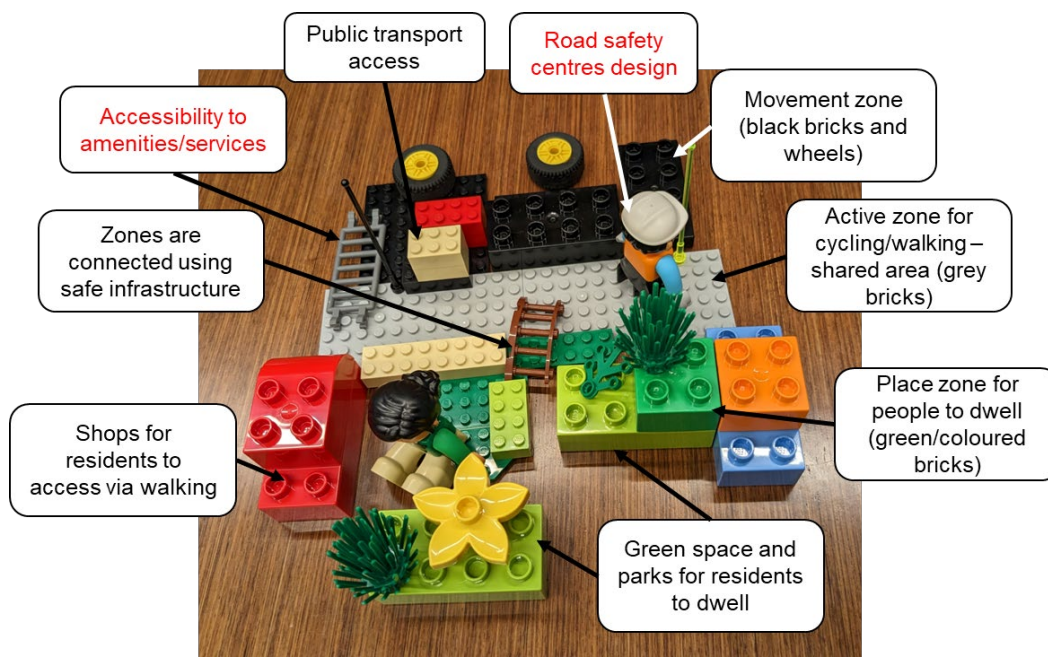


Figure A2 - 3: Individual model by P10 (red text: aspects selected by the participant for the group model)

P11 – The ideal experience should be within a low speed environment that can be created by narrowing streets and prioritising pedestrians. Residences are on the periphery of the network and there are internal areas for mobility and social interaction. These areas should be connected with nature by leveraging green space and parks for residents.

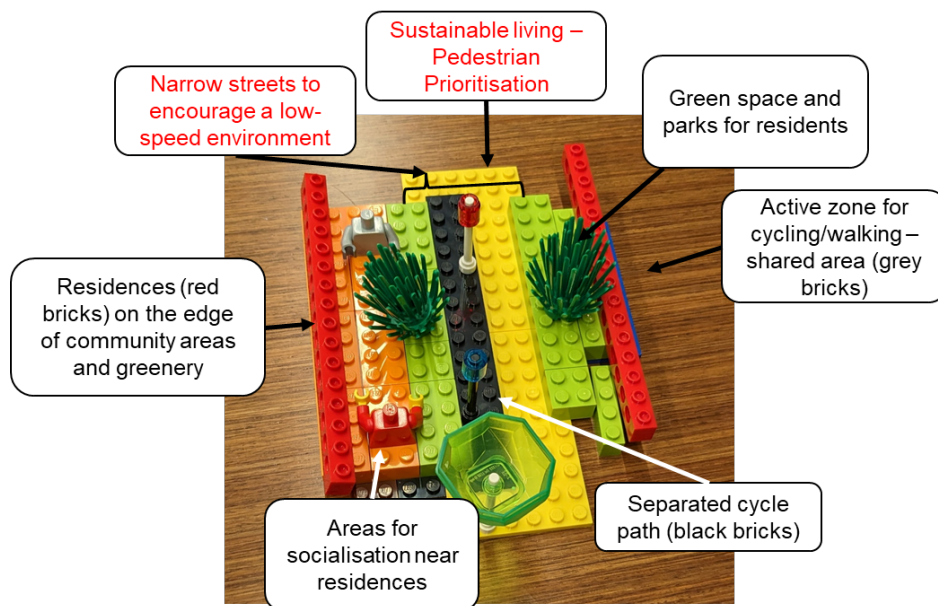


Figure A2 - 4: Individual model by P11 (red text: aspects selected by the participant for the group model)

P12 – The ideal experience in a street should contain adaptable infrastructure to change the level of movement/place depending on community needs and have an interface between areas with greater levels of movement of areas that are more focussed on place. There should be an active zone for the mobility of pedestrians and cyclists but also a shared area for people to dwell and socialise.

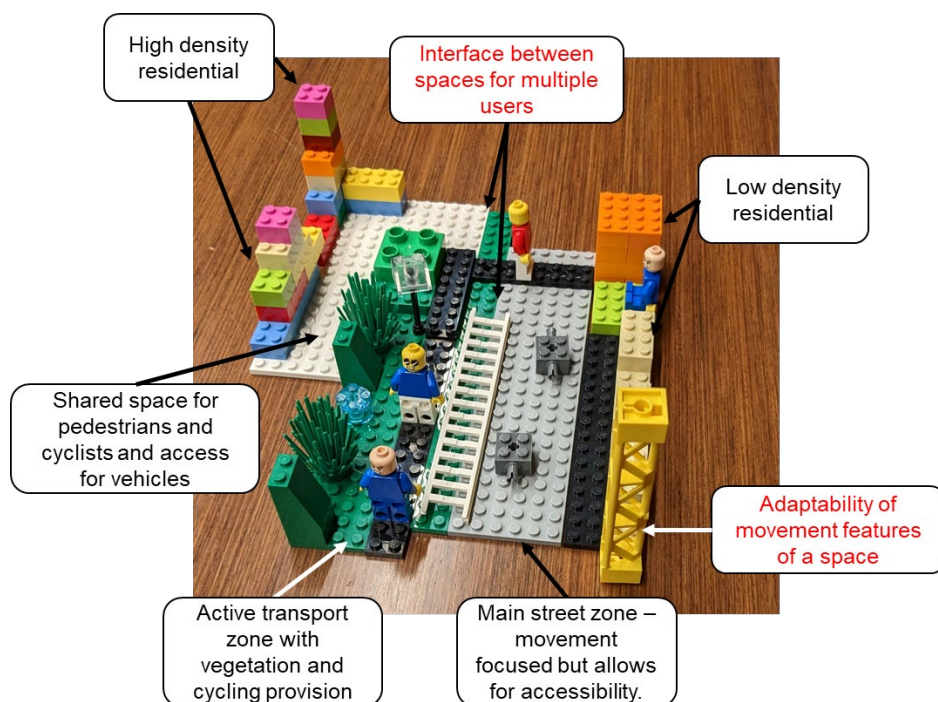


Figure A2 - 5: Individual model by P12 (red text: aspects selected by the participant for the group model)

P13 – The ideal experience within a street is centred around a non-linear shared space that has appropriate entry treatments to slow cars/private vehicles. There is a need for accessible infrastructure (ramps), a mix between low and high density residential area, public transport access and cycling. To ensure functionality, service vehicle access must be accounted for and a space for street activation is necessary to create a social space.

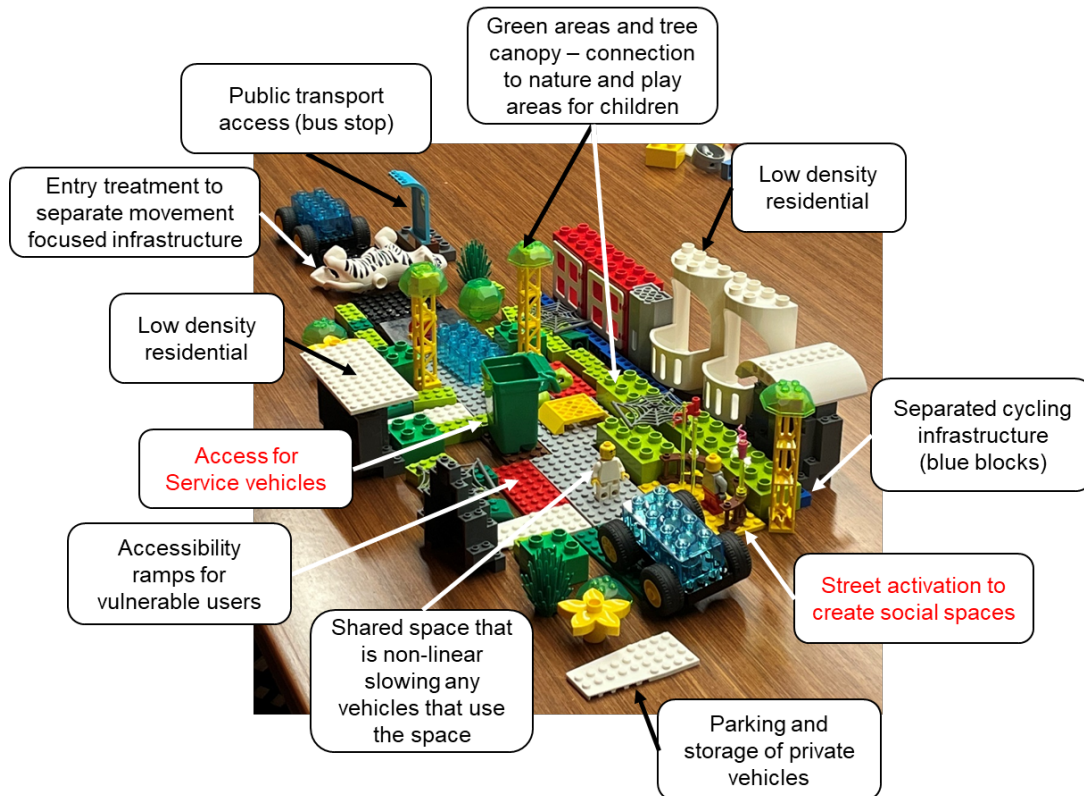


Figure A2 - 6: Individual model by P13 (red text: aspects selected by the participant for the group model)

- Use of zones to transition from movement focussed to a movement and place street.
- Prioritisation of pedestrians/vulnerable road users is a common theme across all participants.
- Connection with greenery and nature is key to achieving place.

Group Model Notes

The two most important objectives/aspects of an ideal experience highlighted by each participant are as follows:

ID	Description	CIHT Cat. ³
P8	<ul style="list-style-type: none"> Accessibility of all road users. Street Lighting (safe utilisation across the day) 	IE SPH
P9	<ul style="list-style-type: none"> Pedestrian Prioritisation Dynamic parking to manipulate street dimensions. 	EM EM
P10	<ul style="list-style-type: none"> Accessibility to amenities/services Road safety centre design 	EM SPH
P11	<ul style="list-style-type: none"> Sustainable living - Pedestrian Prioritisation Narrow streets to encourage a low-speed environment 	QP SPH
P12	<ul style="list-style-type: none"> Interface between spaces for multiple users Adaptability of movement features of a space 	QP EM
P13	<ul style="list-style-type: none"> Street activation to create social spaces Access for service vehicles 	QP EM

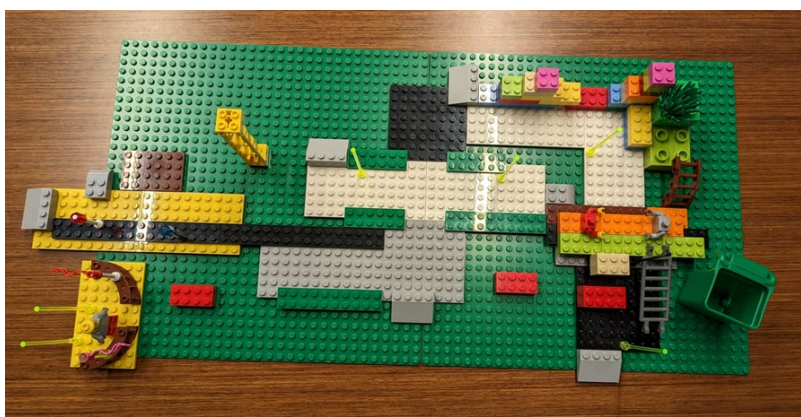


Figure A2 - 7: Group Model

³ CIHT Categorisations: Inclusive Environment (IE), Ease of Movement (EM), Safety and Public Health (SPH), Quality of Place (QP), Economic Benefit (EB)

The Group Model Story:

- The objectives/aspects highlighted by individuals were grouped and connected into 5 primary objectives:
 - Pedestrian prioritisation
 - Accessibility for all users, amenities, and services
 - Interface between spaces for multiple users while creating cross-corridor connectivity
 - Street activation to create social spaces
 - Road safety
- *In order to achieve an ideal street experience, it is key to design safe infrastructure that prioritises pedestrians and encourages active transport. The space should leverage adaptable design features (movable furniture, dynamic parking) to transition from a traditional movement-oriented environment to a lower speed environment that will enhance place. Building infrastructure, lighting and street activation areas can be used as an interface between spaces while also creating connectivity. Finally, the design should feature access to for all users to necessary amenities and services.*

Metrics

ID	Metric	Is it a BEI Metric?	BEI Category	BEI Sub-Category	Must have Metrics
P8	Number of people dwelling in the space		Comfort and Safety	Comfort	
P8	Vehicle Speed	Yes	Comfort and Safety	Low Risk	
P8	Cost of construction of any redevelopment		Other	Other	
P8	Missing footpath links (Connectivity)		Access and Connection	Transport choice	MUST
P8	Presence of Greenery/Vegetation		Green and Blue	Link to nature	
P9	Footpath width	Yes	Access and Connection	Transport choice	
P9	Pedestrian road capacity		Other	Other	
P9	Pedestrian cross-connections/ accessibility		Access and Connection	Transport choice	MUST
P9	Pedestrian Counts		Other	Other	
P10	Number of crossings	Yes	Access and Connection	Equity	
P10	Noise (Decibel)	Yes	Comfort and Safety	Comfort	
P10	Pollution (Air-Particulates)	Yes	Comfort and Safety	Comfort	
P10	Pedestrian delays at crossings		Comfort and Safety	Low Risk	
P10	Perception of women cycling		Character and Form	Low Risk	
P10	Journey time reliability of public transport		Access and Connection	Reliable transport	MUST
P10	Density of passengers on public transport		Access and Connection	Transport choice	
P11	Pedestrian Counts (Unaccompanied Children)		Comfort and Safety	Low Risk	
P11	Vehicle Speed	Yes	Comfort and Safety	Low Risk	
P11	Number of trees		Green and Blue	Link to nature	
P11	Number of street lights	Yes	Comfort and Safety	Low Risk	

ID	Metric	Is it a BEI Metric?	BEI Category	BEI Sub-Category	Must have Metrics
P12	Tree canopy cover (area of coverage)	Yes	Green and Blue	Link to nature	
P12	Number of street lights	Yes	Comfort and Safety	Low Risk	
P12	Number of places (distinct landmarks)		Character and Form	Distinct	
P12	Expenditure of Businesses		Amenity and Use	Local opportunities	
P12	Number of potential activities		Amenity and Use	Local opportunities	
P13	Satisfaction/perception rating of the space		Comfort and Safety	Comfort	
P13	Water infiltration area (soil health)		Green and Blue	Link to nature	
P13	Tree canopy cover (area of coverage)	Yes	Green and Blue	Link to nature	MUST
P13	Number of Crashes (Crash Statistics)	Yes	Comfort and Safety	Low Risk	MUST
P13	Number of Near Misses (Crash Statistics)		Comfort and Safety	Low Risk	
P13	Rainfall water quality		Green and Blue	Link to nature	
P13	Number of insect species		Green and Blue	Link to nature	
P13	Urban heat	Yes	Comfort and Safety	Comfort	
P13	Number of street frontages		Character and Form	Human Scale	
P13	Presence of clutter		Character and Form	Human Scale	
P13	Number of kerbs and gutters		Other	Other	
P13	Number of community events		Amenity and Use	Local opportunities	

Metric and Objective Relationship Identification



Figure A2 - 8: Group Model with Metric Prioritisation

Suggestions for example sites

Participants provided feedback regarding the sites that provide a safe and comfortable space for people to dwell and move in Sydney (Local Street Context):

- Norton Street, Leichhardt
- Buckland Street, Alexandria
- Bourke Street, Surry Hills
- Meta Street, Croydon
- “Jordan Springs” – streets within the new development.

Appendix A3: Workshop 3 Notes

Date (Time): 19 April 2023 (9:00AM – 1:00PM)

Location: UTS Building 11, Level 12, Room 113

Street Context: Civic Space

Overall Notes

- 7 participants (all invited participants attended)
 - Participant 14 (P14) – Landscape Architect
 - Participant 15 (P15) – Transport Engineer
 - Participant 16 (P16) – Transport Engineer
 - Participant 17 (P17) – Transport Planner
 - Participant 18 (P18) – Transport Engineer
 - Participant 19 (P19) – Transport Planner
 - Participant 20 (P20) – Transport Planner
- All participants engaged with each activity and provided clear explanations and feedback. Participants debated during group exercises with everyone providing inputs.
- Identification and explanation of “experiences” throughout the workshop was clear and metaphors were used throughout (successful application of LSP).
- Clear objectives, design features and metrics were identified throughout the process.
- Workshop began and completed on-time.

Skills Building – “Build a model of a positive or a negative experience for the persona you have selected in using a street that enables both place and movement”.

- P14 – Children playing tag
 - Negative experience – described as “Confusing and present with conflict”.
 - Model presented a scenario where children were not allowed space and were being looked down upon (conflict) with other road users. Limited periphery.
- P15 – Baby stroller and mum
 - Both positive and negative experience – described as “infrastructure guiding experience”.
 - Two scenarios presented – use of overpasses/kerb ramps allowing for accessibility (positive) versus clutter and unseen surface issues (negative).
- P16 – Elderly person going to buy a newspaper
 - Negative experience – described as “invisibility of the elderly”.
 - Lack of trees/shade for resting, obstacles preventing movement, level issues, lack of lighting, pushy drivers.
- P17 – Friends having coffee
 - Positive experience – described as “relaxed and positive”.
 - Side street, people interacting in a low speed environment with places to dwell.
- P18 – Food delivery person
 - Negative experience – described as “inconvenience and frustrated”.
 - Unable to park the vehicle, inaccessibility to residences, switch from driving to cycling.

- P19 – User has a physical impairment
 - Negative Experience – pedestrian bridge that is difficult to access for a person in a wheelchair.
- P20 – Two colleagues walking (one walking and the other in a wheelchair)
 - Positive Experience – post transformation experience where there is improved foot path width, smart lighting, raised crossings – “equality to converse” .

Individual Model Notes

“Build an individual model of an ideal experience in a street that is a place for people while also allowing for movement and travel.”

P14 – The ideal experience should ensure that there is appropriate and quality built form (that can engage the public) and the focus should be to account for the slowest and most vulnerable users. Separated infrastructure should be used throughout where each user has a dedicated space, this will avoid conflicts with predatory/hostile motorists.

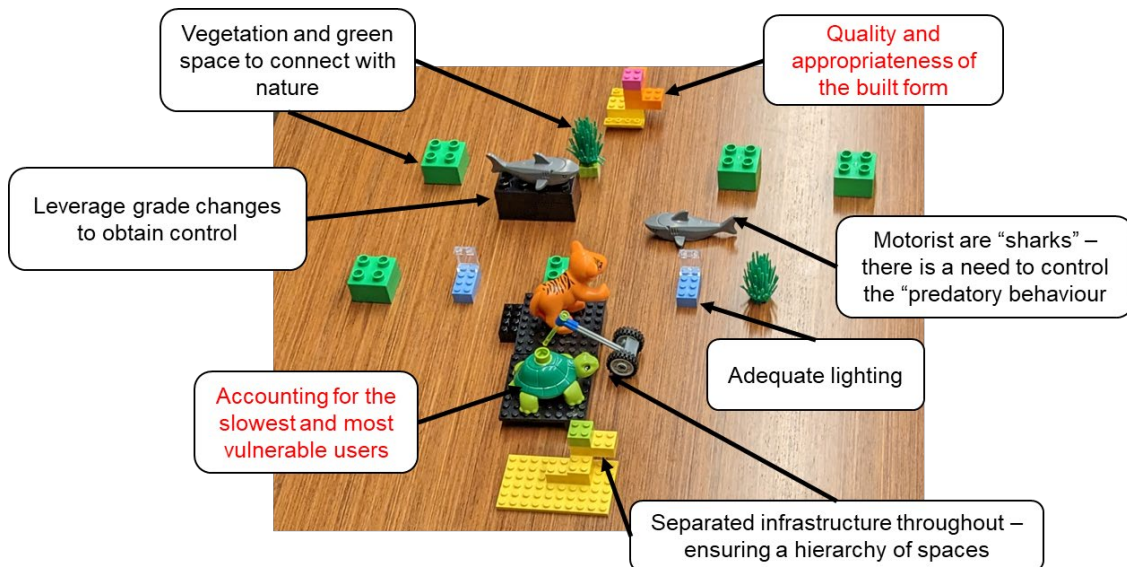


Figure A3 - 1: Individual model by P14 (red text: aspects selected by the participant for the group model)

P15 – The ideal experience should be anchored by a public transport corridor that provides access to the street for people within and external to the local area. Place activation through temporary pop-up solutions creates excitement and variety to the space, generating demand. Movement and place solutions do not need have vehicles but need to provide access for service needs. The presence of public art/landmarks and vegetation are important in creating a place that attracts people.

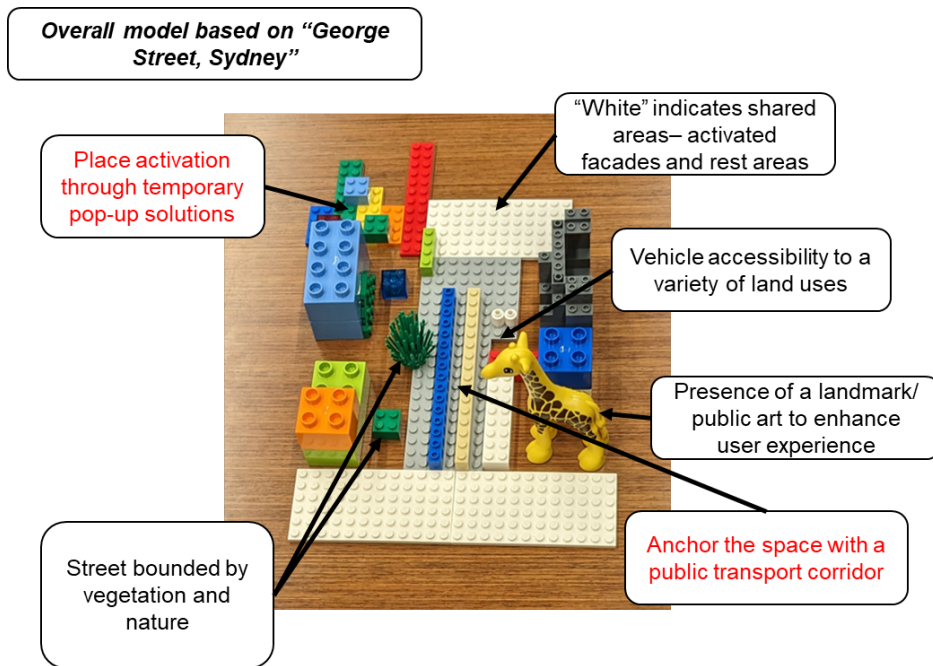


Figure A3 - 2: Individual model by P15 (red text: aspects selected by the participant for the group model)

P16 – The ideal experience should cater for the transition of fast moving vehicles to slow moving pedestrians through a series of traffic calming devices (signalisation, vertical deflection devices and entry treatments. Separating infrastructure should be used to demarcate areas of priority with locations closest to attractors having shared infrastructure solutions.

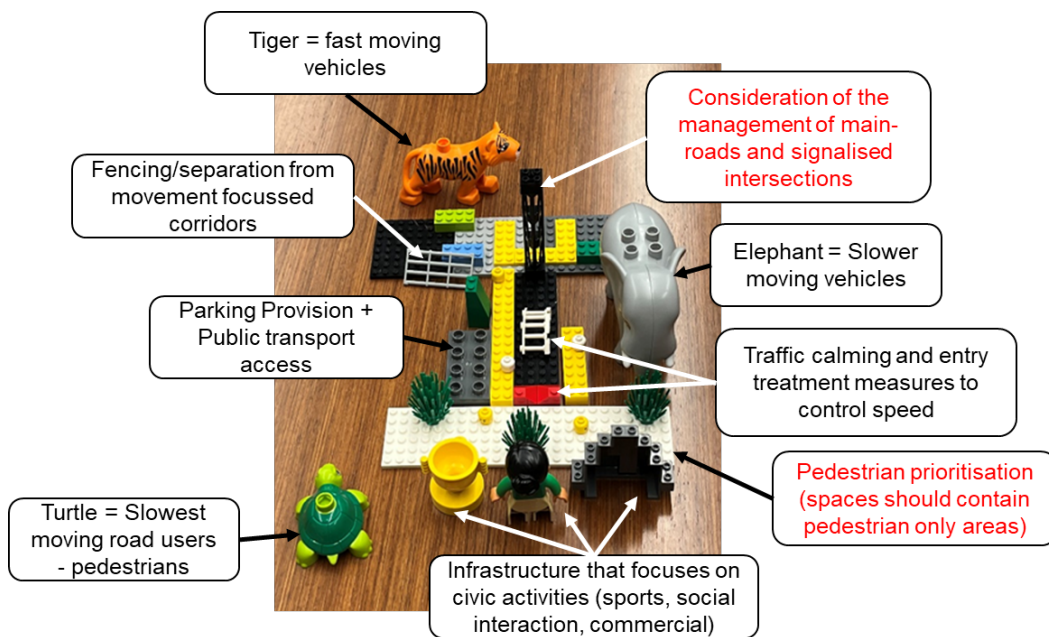


Figure A3 - 3: Individual model by P16 (red text: aspects selected by the participant for the group model)

P17 – The ideal experience should contain access to all sustainable transport modes (public and active) and a space for people to interact and socialise. This can be supported with playgrounds, access to amenities and link to vegetation and nature.

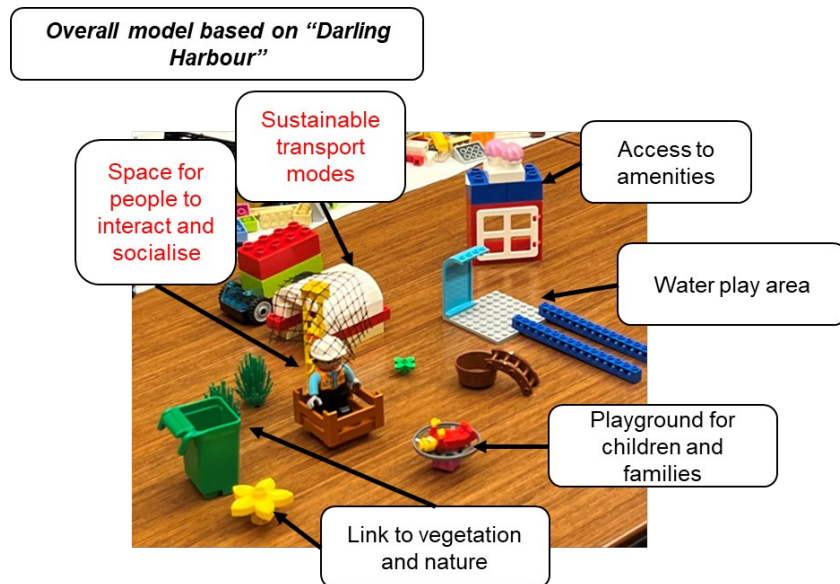


Figure A3 - 4: Individual model by P17 (red text: aspects selected by the participant for the group model)

P18 – The ideal experience should prioritise for active transport modes with traffic calming infrastructure and overhead structures utilised to create an accessible and low speed environment. Another important aspect is to have a connection with water (important in Australia given most cities have a water landmark/feature), this can be a focal point within a Civic Space.

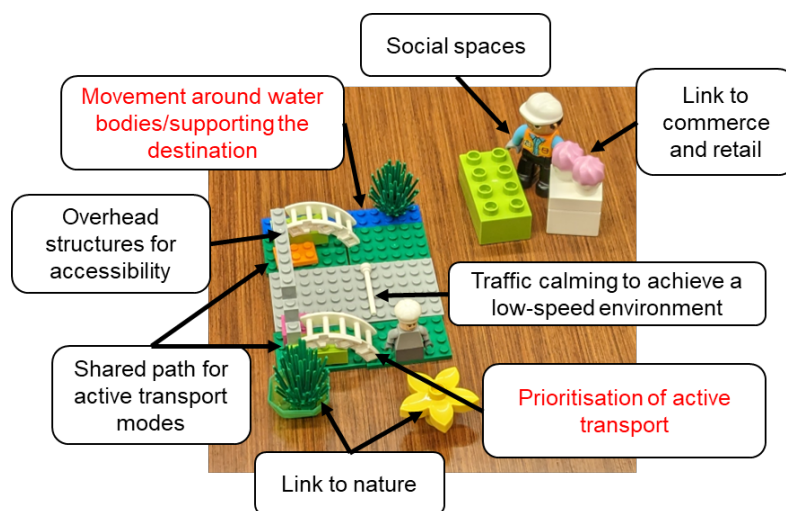


Figure A3 - 5: Individual model by P18 (red text: aspects selected by the participant for the group model)

P19 – The ideal street experience should ensure that businesses thrive within a diverse civic centre. Cycleways should be a primary mode of transport and infrastructure should be designed to ensure adequate accessibility. It is also key to provide support for vulnerable road users while also being aware of nature. The space can be connected with a shared low-speed environment and supported by freight and motorists to maintain business activity.

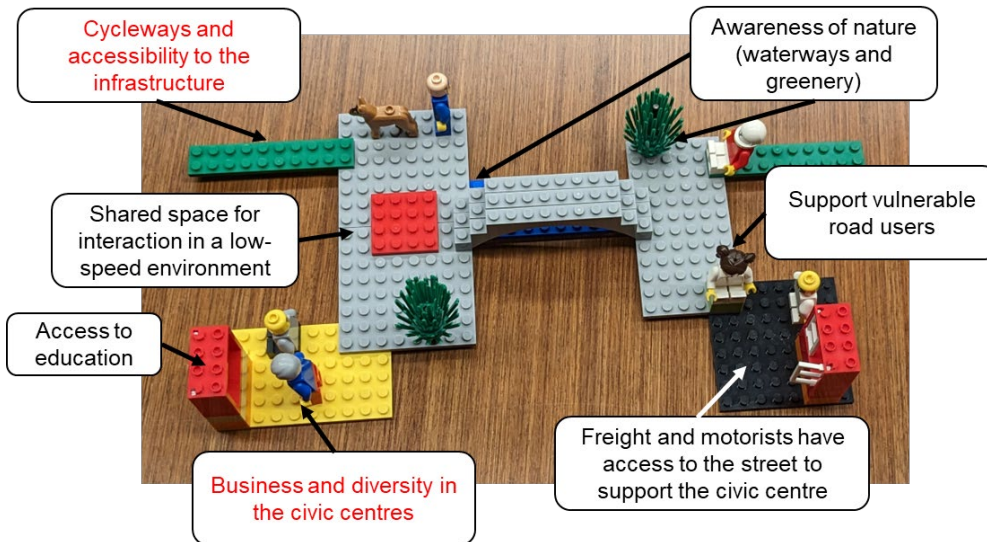


Figure A3 - 6: Individual model by P19 (red text: aspects selected by the participant for the group model)

P20 – The ideal street experience should have buildings and infrastructure that frame places and the street itself should be safe and quiet. Streets contain a mix of vehicle types and there should be permeable boundaries that transition to pedestrian prioritised zones which can contain shared road infrastructure. Passive surveillance could be used by communities to ensure standards are maintained and the community is protected.

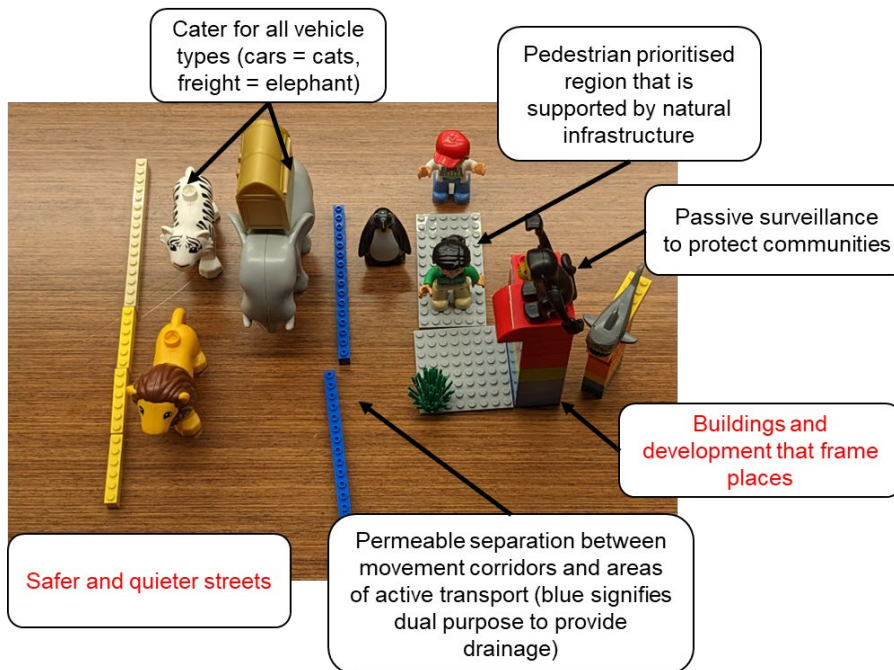


Figure A3 - 7: Individual model by P20 (red text: aspects selected by the participant for the group model)

- Zones and barriers used to separate more movement-oriented sections of a street with more place-oriented sections.
- Priority of pedestrians and a focal point of businesses and landmarks.
- Examples of George Street and Darling Harbour used as a discussion platform.

Group Model Notes

The two most important objectives/aspects of an ideal experience highlighted by each participant are as follows:

ID	Description	CIHT Cat. ⁴
P14	<ul style="list-style-type: none"> Quality and appropriateness of the built form Accounting for the slowest and most vulnerable users 	QP IE
P15	<ul style="list-style-type: none"> Anchor the space with a public transport corridor (light rail) Place activation through temporary pop-up solutions 	EM QP
P16	<ul style="list-style-type: none"> Pedestrian prioritisation (spaces should contain pedestrian only areas) Consideration of the management of main-roads and signalised intersections 	EM EM
P17	<ul style="list-style-type: none"> Sustainable transport modes Space for people to interact and socialise 	EM QP
P18	<ul style="list-style-type: none"> Prioritisation of active transport Movement around water bodies/supporting the destination 	EM EM
P19	<ul style="list-style-type: none"> Business and diversity in the civic centres Cycleways and accessibility 	EB EM
P20	<ul style="list-style-type: none"> Buildings and development that frame places Safer and quieter streets 	QP SPH

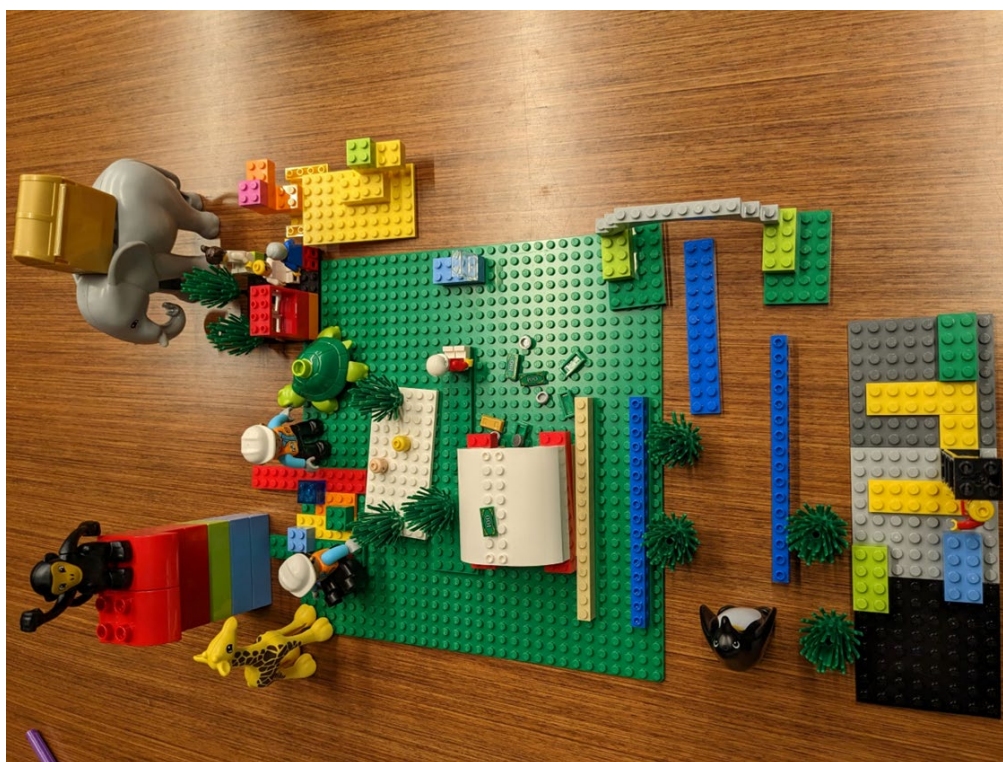


Figure A3 - 8: Group Model

⁴ CIHT Categorisations: Inclusive Environment (IE), Ease of Movement (EM), Safety and Public Health (SPH), Quality of Place (QP), Economic Benefit (EB)

The Group Model Story:

- The objectives/aspects highlighted by individuals were grouped and connected into 5 primary objectives:
 - Prioritisation of pedestrians and other active transport users
 - Quality and appropriateness of the built form to frame key attractors
 - Business and diversity in the civic centre
 - Safety achieved through lower speed environments accounting for vulnerable users
- *In order to achieve an ideal street experience, it is key to create a “hierarchy” as we transition from a movement corridor to a place that is shared by the community. Maintaining efficiency of the surrounding road and public transport network is key to ensure access to a Civic Space environment, thus the design and inclusion of entry treatments is critical (use of vegetation barriers, pavement alterations). By providing effective access, the Civic Space can have equitable access resulting in diversity and growing business within the space. The space itself will transition from vehicular modes of transport to active modes, with areas around key landmarks and attractors prioritising pedestrians. Finally, a Civic Space’s success is driven by the quality and appropriateness of the built form that is relevant to the purpose of a Civic Space.*

Metrics

ID	Metric	Is it a BEI Metric?	BEI Category	BEI Sub-Category	Must have Metrics
P14	Lifecycle cost of infrastructure		Other	Other	MUST
P14	Urban heat	Yes	Comfort and Safety	Comfort	
P14	Number of successful audits of project completion		Other	Other	
P14	Benchmarking against lifecycle expenses		Other	Other	
P14	Measuring "waste" in project delivery		Other	Other	
P15	Density of people within the space/street	Yes	Comfort and Safety	Low Risk	
P15	Number of crossings	Yes	Access and Connection	Equity	
P15	Pedestrian delays at crossings		Other	Other	
P15	Distance between crossings		Amenity and Use	Convenient Facilities	
P15	Diversity of users within the space/street		Access and Connection	Equity	
P15	Tree canopy cover (area of coverage)	Yes	Green and Blue	Link to nature	MUST
P16	Number of people dwelling in the space		Comfort and Safety	Comfort	
P16	Economic Benefit (Business Profits)		Amenity and Use	Local opportunities	
P16	Level of Service (of all infrastructure components)		Other	Other	MUST
P16	Number of Crashes (Crash Statistics)	Yes	Comfort and Safety	Low Risk	
P16	Number of Awards/Recognition		Other	Other	

ID	Metric	Is it a BEI Metric?	BEI Category	BEI Sub-Category	Must have Metrics
P16	Property price/rental values		Amenity and Use	Local opportunities	
P17	Number of people using the space		Comfort and Safety	Comfort	
P17	Pollution (Air-Particulates)	Yes	Comfort and Safety	Comfort	
P17	Vehicle Speed	Yes	Comfort and Safety	Low Risk	
P17	Proximity to green/blue land uses	Yes	Green and Blue	Link to nature	
P17	Number of places to dwell		Comfort and Safety	Comfort	
P17	Proximity to diversity of services		Access and Connection	Equity	
P17	Mode split	Yes	Access and Connection	Transport choice	
P17	Number of intersections (legibility)	Yes	Character and Form	Distinct	
P18	Satisfaction Ratings (How safe do you feel?)	Yes	Comfort and Safety	Low Risk	MUST
P18	Missing footpath links (Connectivity)		Access and Connection	Transport choice	
P18	Separation of infrastructure (Presence of barriers)		Access and Connection	Transport choice	
P18	Perception of safety on waterways		Other	Other	
P19	Diversity of users on different modes		Access and Connection	Equity	
P19	Diversity of users within the space/street		Access and Connection	Equity	MUST
P19	Happiness Index		Comfort and Safety	Comfort	
P19	Space allocation of land uses		Amenity and Use	Convenient Facilities	
P19	Economic Growth		Amenity and Use	Local opportunities	
P20	Number of people crossing a street		Other	Other	
P20	Vehicle Speed	Yes	Comfort and Safety	Low Risk	
P20	Tree canopy cover (percentage of coverage)	Yes	Green and Blue	Link to nature	
P20	Area of shade		Comfort and Safety	Comfort	

Metric and Objective Relationship Identification



Figure A3 - 9: Group Model with Metric Prioritisation

Suggestions for example sites

Participants provided feedback regarding the sites that provide a safe and comfortable space for people to dwell and move in Sydney (Local Street Context):

- Promenade – Dee Why (The Strand)
- “Manly” – Corso area
- Crown Street, Darlinghurst
- George Street, Sydney
- Darling Harbour, Sydney
- “Cabramatta Pedestrian Plaza” – John Street

Appendix A4: Workshop 4 Notes

Date (Time): 2 May 2023 (9:00AM – 1:00PM)

Location: UTS Building 11, Level 12, Room 113

Street Context: Local Street

Overall Notes

- 7 participants (All participants invited attended)
 - Participant 1 (P21) – Transport Planner
 - Participant 2 (P22) – Traffic Engineer
 - Participant 3 (P23) – Strategic Planner
 - Participant 4 (P24) – Transport Planner
 - Participant 5 (P25) – Transport Planner
 - Participant 6 (P26) – Traffic Engineer
 - Participant 7 (P27) – Transport Planner
- All participants engaged with each activity and provided clear explanations and feedback. Participants debated during group exercises with everyone providing inputs.
- Identification and explanation of “experiences” throughout the workshop was clear and metaphors were used throughout (successful application of LSP).
- Clear objectives, design features and metrics were identified throughout the process.
- The workshop began and finished on time.

Skills Building – “Build a model of a positive or a negative experience for the persona you have selected in using a street that enables both place and movement”.

- P21 – User has a physical impairment
 - Negative Experience – described as an “Uncertainty”.
 - Stochastic driver behaviour (untrustworthy) and uneven environments.
- P22 – Baby stroller and mum
 - Negative experience – described as “A lack of space”.
 - Narrow footpaths, street infrastructure encroaching on the footpath.
- P23 – Children playing tag
 - Positive experience – described as “Freedom”.
 - Separated environment for children to play with passive surveillance/landmarks.
- P24 – Couple sitting on a street bench
 - Positive experience – described as “Sitting and enjoying the view”.
 - Accessible location with interesting landmarks/natural views .
- P25 – Two colleagues walking
 - Negative experience – described as “Uncomfortable”.
 - Narrow streets/footpath, noisy and delays at crossings (single occupancy vehicles).
- P26 – Elderly person going to buy a newspaper
 - Negative experience – described as “lack of visibility of vulnerable users”.
 - Lack of road width and unsafe for vulnerable users.

- P27 – Person driving kids to school
 - Positive experience – described as “No rush and stress free”.
 - Pedestrian priority street where vehicles can easily access the school in a separated environment.

Individual Model Notes

“Build an individual model of an ideal experience in a street that is a place for people while also allowing for movement and travel.”

P21 – The ideal experience should prioritise pedestrians through enhanced crossing infrastructure and vegetation that supports shading so the community can enjoy the outdoors. Movement on the street should prioritise active and public transport and areas of shared road space can service interactions between people.

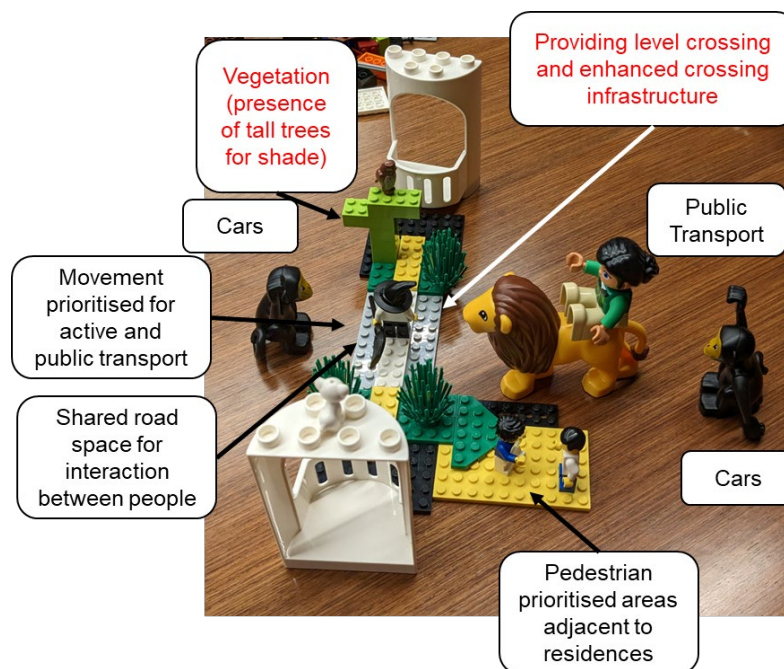


Figure A4 - 10: Individual model by P21 (red text: aspects selected by the participant for the group model)

P22 – The ideal street experience should be a safe, accessible and liveable space for a diversity of users. The environment can be shared by leveraging different pavement infrastructure, raised pavements, road narrowing and vegetation.

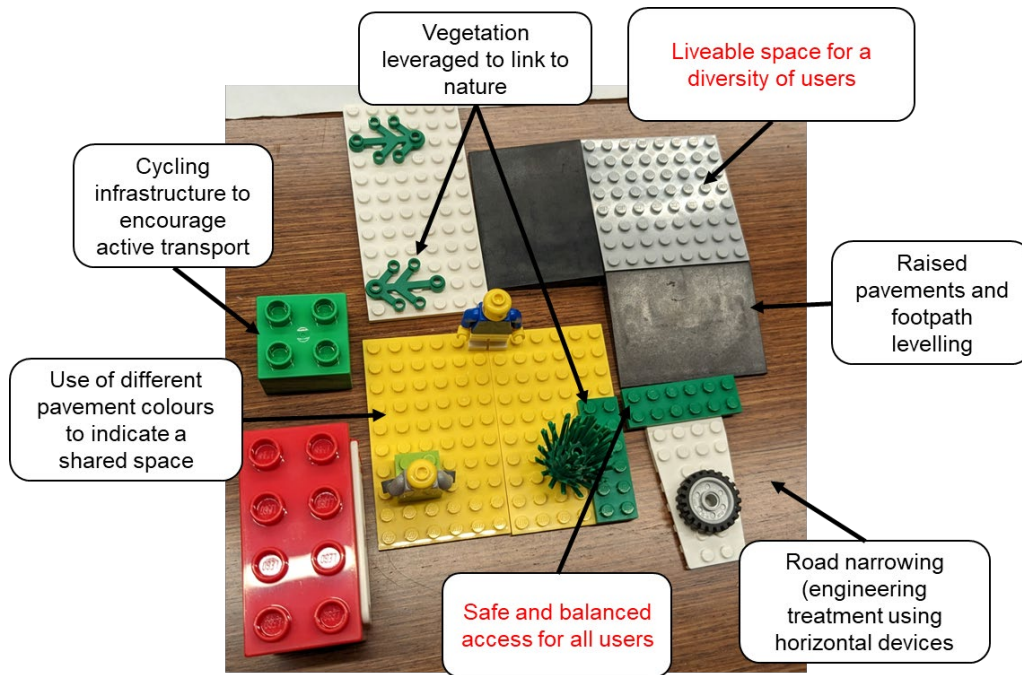


Figure A4 - 11: Individual model by P22 (red text: aspects selected by the participant for the group model)

P23 – The ideal experience should ensure users can “stop and linger” by leveraging areas for shared use and street art as a landmark. The street should also have impediment free access for all modes and users.

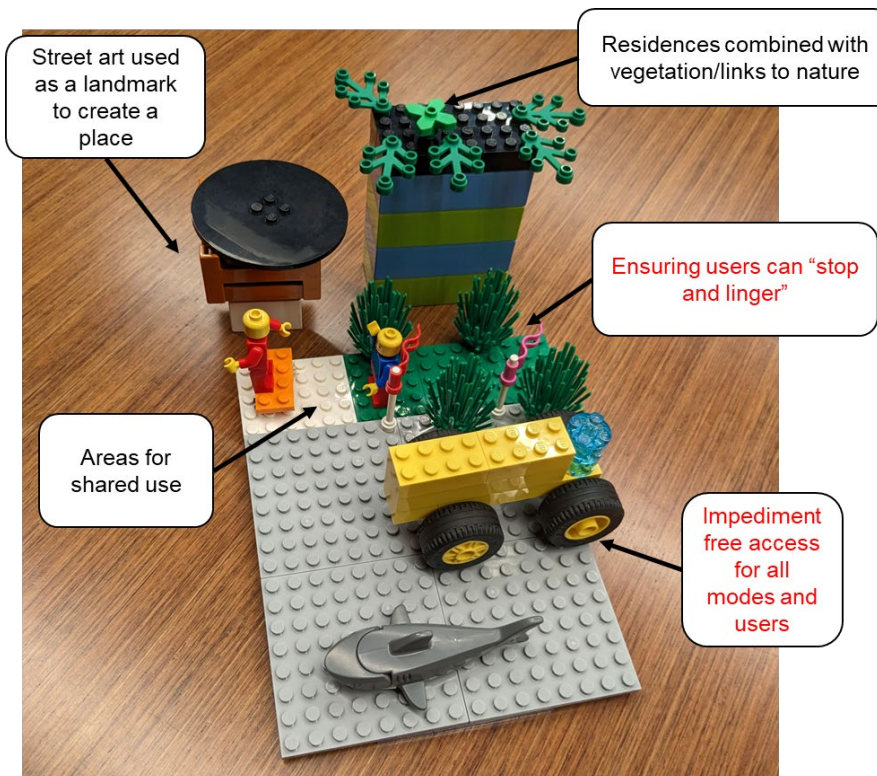


Figure A4 - 12: Individual model by P23 (red text: aspects selected by the participant for the group model)

P24 – The ideal experience should contain slower speeds that ensure safety. It is important to design the space that acknowledges the possibility of unpredictable behaviour/activities by active transport modes. The space should be able have people interacting of all ages.

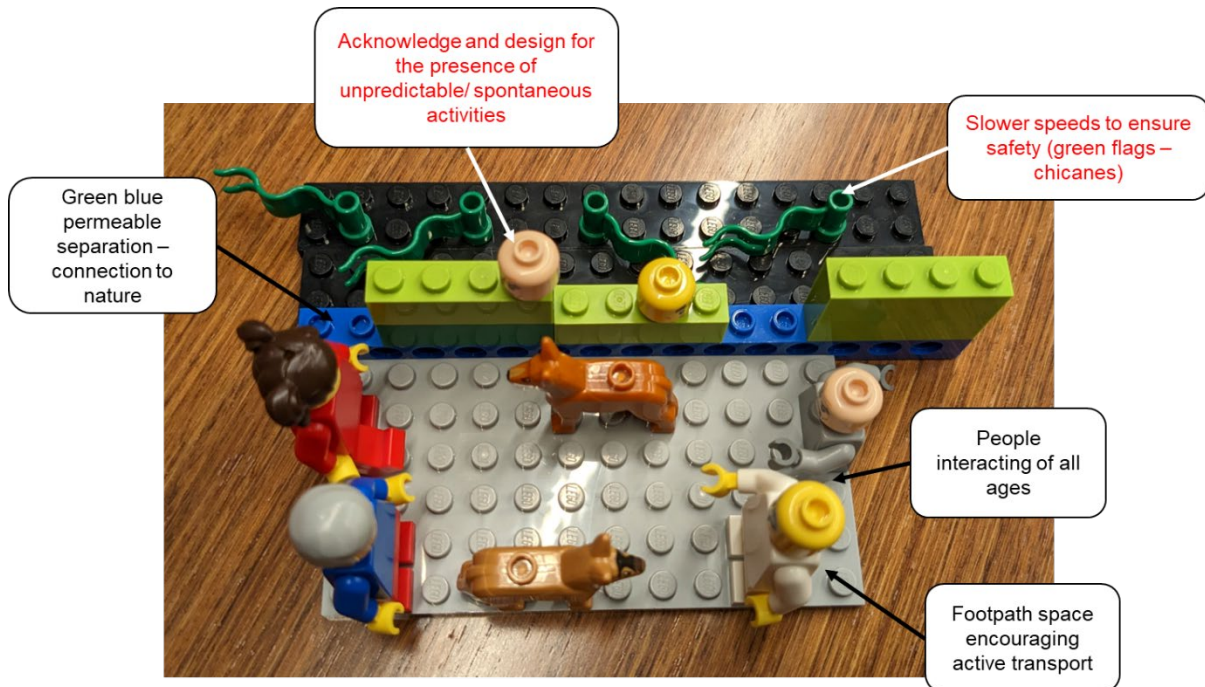


Figure A4 - 13: Individual model by P24 (red text: aspects selected by the participant for the group model)

P25 – The ideal street experience should provide balanced safe access prioritising active transport modes. The local street should be able to account for high pedestrian trip generation from higher density mixed use developments. There should be provision for cycleways and traffic calming/entry treatments for access to the local street.

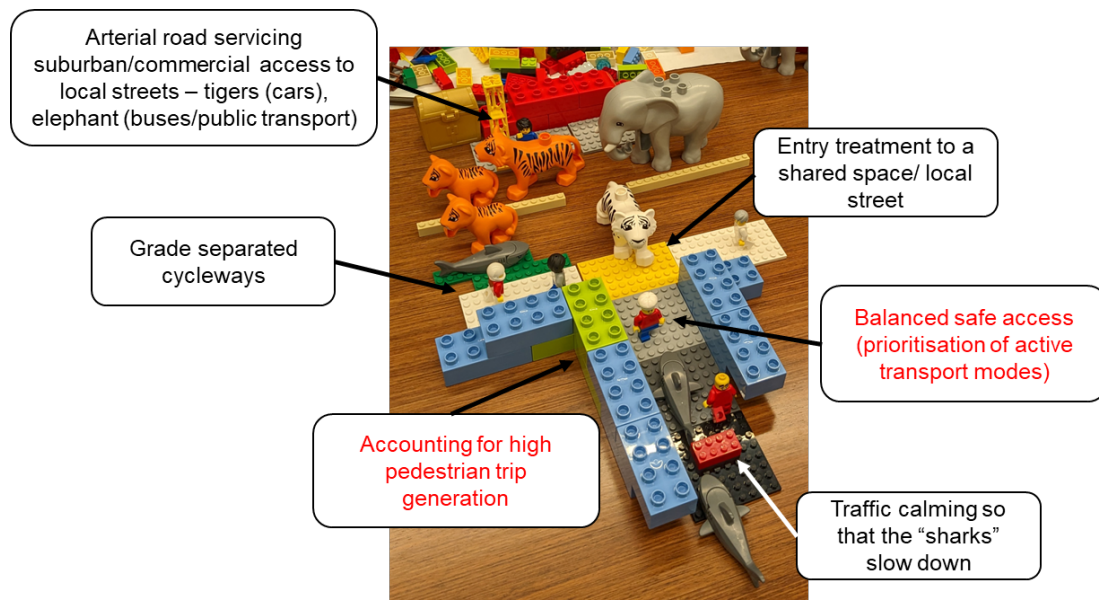


Figure A4 - 14: Individual model by P25 (red text: aspects selected by the participant for the group model)

P26 – The model presents the ideal cross-section of a local street that can provide the best possible experience for all road users. The cross-section should have areas of pedestrian priority that ensures users can “stop and linger” while also having a cycleway to encourage active transport. The street can leverage vegetation for self-exploring streets and can influence a low-speed road environment.

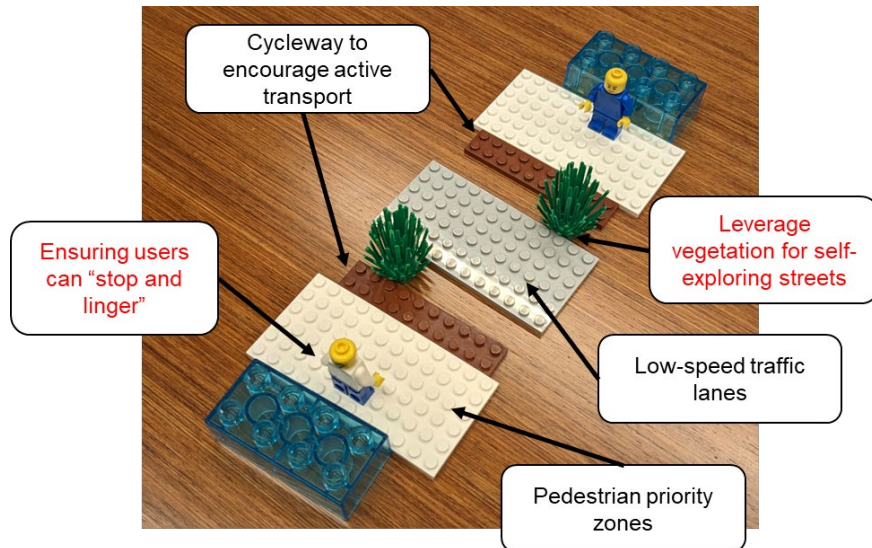


Figure A4 - 15: Individual model by P26 (red text: aspects selected by the participant for the group model)

P27 – The ideal experience within a street should connect the existing nature with active frontages. The street should be walkable and connected to the rest of the neighbourhood. Streets should be designed based on a “blue and green” design principle to ensure sustainability where tall trees are key to providing shade for people who dwell on the street. The street can also have a landmark/place of attraction for local community interaction and green spaces for families to interact.

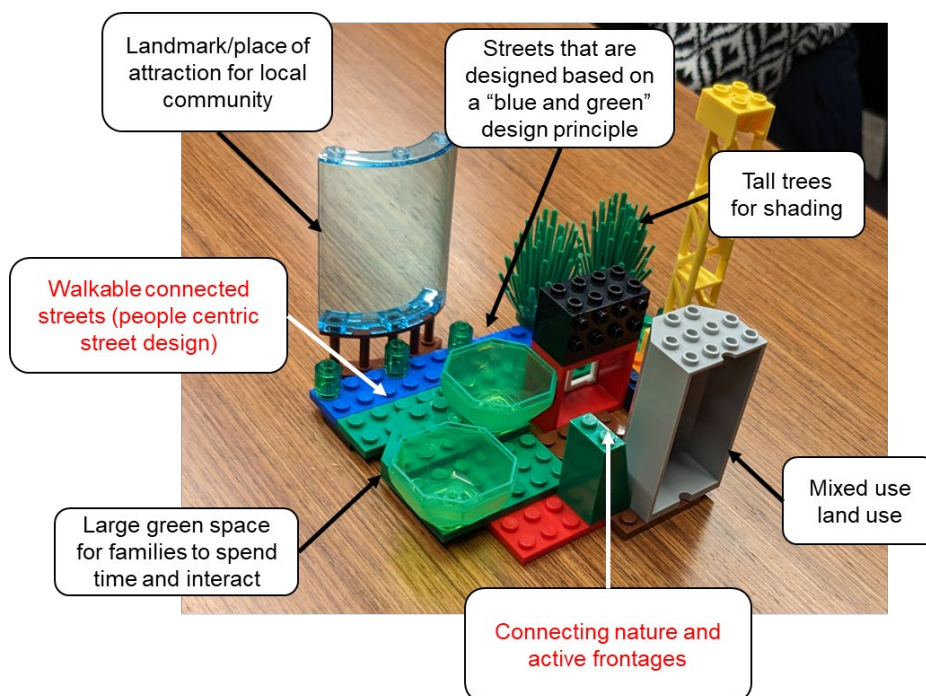


Figure A4 - 16: Individual model by P27 (red text: aspects selected by the participant for the group model)

- Ensure that users can “stop and linger” and there are spaces for community interaction.
- A connected network is important for active transport to be prioritised.
- Traffic calming should be used to ensure slow speed environments.

Group Model Notes

The two most important objectives/aspects of an ideal experience highlighted by each participant are as follows:

ID	Description	CIHT Cat. ⁵
P21	<ul style="list-style-type: none"> • Vegetation (presence of tall trees for shade) • Providing level crossings and enhanced crossing infrastructure 	SPH SPH
P22	<ul style="list-style-type: none"> • Liveable space for a diversity of users • Safe and balanced access for all users 	IE SPH
P23	<ul style="list-style-type: none"> • Ensuring users can "stop and linger" • Impediment free access for all modes and users 	QP EM
P24	<ul style="list-style-type: none"> • Slower speeds to ensure safety • Acknowledge and design for the presence of unpredictable/spontaneous activities 	SPH IE
P25	<ul style="list-style-type: none"> • Balanced safe access (prioritisation of active transport modes) • Accounting for high pedestrian trip generation 	SPH EM
P26	<ul style="list-style-type: none"> • Leverage vegetation for self-exploring streets • Ensuring users can "stop and linger" 	QP QP
P27	<ul style="list-style-type: none"> • Walkable connected streets (people centric street design) • Connecting nature and active frontages 	EM QP



Figure A4 - 17: Group Model

⁵ CIHT Categorisations: Inclusive Environment (IE), Ease of Movement (EM), Safety and Public Health (SPH), Quality of Place (QP), Economic Benefit (EB)

The Group Model Story:

- The objectives/aspects highlighted by individuals were grouped and connected into 5 primary objectives:
 - Safe infrastructure with impediment free (well connected) and equitable access for all users
 - Acknowledgement of high pedestrian (active transport) activity
 - Design for uncertainty associated with local community activities
 - Space should be connected with nature catering for users to linger outside of dwellings
- *In order to achieve an ideal street experience, safety is paramount to transition from movement oriented arterial road infrastructure to place and community focussed local streets. A connected network with crossing infrastructure, tailored to cater for a high-pedestrian environment that can hold outdoor community activities that may have uncertain user behaviour is core in the design and management of streets that balance movement and place. It is important that all types of users, vulnerable and disabled, are accounted for in the design (consideration of tactiles, ramps etc.)*

Metrics

ID	Metric	Is it a BEI Metric?	BEI Category	BEI Sub-Category	Must have Metrics
P21	Tree canopy cover (area of coverage)	Yes	Green and Blue	Link to nature	MUST
P21	Volume of patrons (exiting/entering) - quality of active frontage		Other	Other	
P21	Number of pedestrian crossings per kilometre	Yes	Character and Form	Human Scale	
P22	Vehicle Speed	Yes	Comfort and Safety	Low Risk	MUST
P22	Number of Fatal/Serious/Injury Crashes (Crash Statistics)		Comfort and Safety	Low Risk	
P22	Mode split	Yes	Access and Connection	Transport choice	
P22	Pedestrian Trajectories		Other	Other	
P23	Diversity of users within the space/street		Access and Connection	Equity	
P23	Pollution (Air-Particulates)		Comfort and Safety	Comfort	MUST
P23	Business Turnover		Amenity and Use	Local opportunities	
P23	Pedestrian and Vehicle near misses		Comfort and Safety	Low Risk	
P24	Number of community complaints		Comfort and Safety	Comfort	
P24	Mode split	Yes	Access and Connection	Transport choice	
P24	Number of separation infrastructure		Access and Connection	Transport choice	
P24	Number of doorways/windows facing the street (Active Frontage)		Character and Form	Human Scale	
P24	Diversity of users within the space/street		Access and Connection	Equity	
P24	Diversity of vegetation		Green and Blue	Link to nature	

ID	Metric	Is it a BEI Metric?	BEI Category	BEI Sub-Category	Must have Metrics
P25	Number of people using active transport (counts)		Other	Other	
P25	Vehicle Counts		Other	Other	
P25	Number of vulnerable users		Other	Other	
P25	Satisfaction Ratings (How safe do you feel?)		Comfort and Safety	Comfort	
P25	Economic Growth		Amenity and Use	Local opportunities	
P26	Pedestrian Dwell Time		Comfort and Safety	Low Risk	MUST
P26	Vehicle Speed (Compliance)		Comfort and Safety	Low Risk	
P26	Number of Crashes (Crash Statistics)	Yes	Comfort and Safety	Low Risk	
P26	Length of footpath		Access and Connection	Transport choice	
P26	Length of cycleways	Yes	Access and Connection	Transport choice	
P26	Number of benches		Amenity and Use	Convenient Facilities	
P26	Area of shade		Comfort and Safety	Comfort	
P27	Density of street furniture		Amenity and Use	Convenient Facilities	
P27	Speeds of all users (relative speed)		Comfort and Safety	Low Risk	
P27	Number of types of crossing infrastructure		Character and Form	Human Scale	
P27	Number of street furniture infrastructure		Amenity and Use	Convenient Facilities	
P27	Zoning of land use		Amenity and Use	Local opportunities	
P27	Presence of dedicated cycleways		Access and Connection	Transport choice	
P27	Number of doorways/windows facing the street (Active Frontage)		Character and Form	Human Scale	
P27	Diversity of users within the space/street		Access and Connection	Equity	MUST
P27	Area of open space		Character and Form	Distinct	
P27	Tree canopy cover (area of coverage - Public)	Yes	Green and Blue	Link to nature	
P27	Tree canopy cover (area of coverage - Private)	Yes	Green and Blue	Link to nature	

Metric and Objective Relationship Identification



Figure A3 - 18: Group Model with Metric Prioritisation

Suggestions for example sites

Participants provided feedback regarding the sites that provide a safe and comfortable space for people to dwell and move in Sydney (Local Street Context):

- Glebe Point Road, Glebe
- Sergeant Street, Edmondson Park
- Henderson Road, Edmondson Park (Poor Example)

Appendix B: User guide for the Shared Road Infrastructure Database

The Shared Road Infrastructure Database is formed using a Microsoft Excel Spreadsheet database that is connected to a Microsoft Power BI dashboard that allows for visualisation and transformation of the data that is gathered.

The connection between the spreadsheet and the Power BI dashboard can be summarised as follows:

1. **Launch Power BI Desktop:** Open Microsoft Power BI Desktop, which is the application used for creating reports and dashboards.
2. **Get Data:** In the Home tab of Power BI Desktop, click on the "Get Data" button. This will open a dropdown menu with various data source options.
3. **Select Excel Workbook:** From the list of data source options, choose "Excel" under the "File" category. This will open the "Excel" data connection window.
4. **Connect to Excel Workbook:** In the "Excel" data connection window, navigate to the location where your Excel spreadsheet is stored. Select the Excel file (.xlsx) that you want to connect to.
5. **Navigator:** After selecting the Excel file, Power BI will open the "Navigator" window. This window displays the sheets and tables available in the Excel workbook.
6. **Select Data to Import:** In the "Navigator" window, you can preview the sheets and tables in your Excel workbook. Select the checkboxes next to the sheets or tables you want to import into Power BI. You can also perform data transformations at this stage if needed by clicking on the "Edit" button.
7. **Load Data:** Once the desired sheets or tables have been selected, click the "Load" button to initiate the data import process. Power BI will import the selected data and create a data model based on your selections.
8. **Data View:** After loading the data, Power BI will open the "Data" view, which displays the data tables and fields that have been imported. Here, the structure of the data is presented allowing for a variety of data visualisation options.
9. **Create Reports and Visualisations:** With the imported/ transformed data, it is possible to switch to the "Report" view by clicking on the "Report" tab. Here, fields can be dragged and dropped onto the canvas to create visualisations such as charts, tables, and graphs.
10. **Save and Publish (Optional):** Once the desired reports and visualisations have been organised, the Power BI Desktop file (.pbix) can be saved and share with other stakeholder. Additionally, the report can be uploaded to the Power BI Service for online sharing and collaboration.

Note: Currently, the Shared Road Infrastructure Database has a defined dashboard developed by the UTS Research Team and can be made publicly available upon the request of Transport for New South Wales.

The remainder of the Appendix provides guidance for managing the spreadsheet that underlies the Power BI dashboard.

Inputting to the database

- The shared space database uses Microsoft Excel linked to the Power BI platform to store and categorise shared space infrastructure.
- To Input to the database, use the Excel file '**Shared Space Database Spreadsheet.xlsm**'.
 - A Microsoft Office License with access to Microsoft Power BI and Microsoft Excel is required to edit and input the database.
- Open the Excel file and navigate to the '**Database**' sheet on the bottom left – this is where shared space data is input.
- There are 31 columns that contain the unique attributes of each shared space.
 - Before inputting into the database, it is highly advised to click on the '*Definitions-Purposes*' tab and become familiarised with each variable.

Geographical Location

- Starting with the '*ID*' column, input a unique ID number sequentially from the previous shared space in the database.
- Each shared space must have its own individual ID number. In the '*LGA*' column, input the Local Government Area that the shared space is administered by i.e. City of Sydney.
 - This will trigger the '*State*' and '*Country*' columns to update to New South Wales and Australia respectively. If the shared space is not in New South Wales, input the state name manually in the '*State*' column.
 - Input the '*Latitude*' and '*Longitude*' points where the shared space starts and input '1' in the '*Segment*' column.
- The '*Segment*' column is used to capture the geometry (i.e. start points, end points or curves).
 - At a minimum, a shared space must have at least two segments that correspond to its start point and end point. *This is represented as two rows with segment '1' and '2' with the same ID (given that it is the same shared space) and the latitude and longitude coordinates for each start and end point respectively.*
- Under the '*Street Name*' column input the street name which the shared space is located.
 - If a shared space treatment has been applied to multiple intersecting streets, it is advised to split them into different shared spaces in the databases.
 - Enter the streets the shared space is bound between in the '*Shared Space/Zone Between Street Name 1*' and '*Shared Space/Zone Between Street Name 2*' columns. If the shared space is on a no-through road leave the '*Shared Space/Zone Between Street Name 2*' column empty.
 - It is advised to start a new segment row with the latitude and longitudinal location where any of the shared space variables are noted as changing from the previous segment location along the length of a shared space (i.e. carriageway width, footpath width, zoning, pavement type or the presence of barriers change at various locations along the street).
- Enter the suburb and postcode location in the '*Suburb*' and '*Postcode*' tabs.

Shared Space Variables

- If a particular street has a formal and defined piece of shared space infrastructure (i.e. a shared zone) input 'Defined' in the '*Defined or Potential*' column. If a particular street has characteristics appropriate for a shared space treatment, input 'Potential'. Input the posted speed limit in the '*Speed Limit (km/h)*' column.
- Input the population density where the shared space is located.
 - This information can be accessed at:
<https://www.movementandplace.nsw.gov.au/place-and-network/built-environment-indicators/population-density>
- Input the land uses adjacent to the street based on the drop-down options. Input the zoning code and description relevant to the segment of the street. This information can be accessed at:
 - <https://www.planningportal.nsw.gov.au/spatialviewer>

Shared Space Physical Characteristic Variables

- Input the carriageway width into the '*Carriageway Width (m)*' column for a particular segment of the shared space. If parking is permitted, it is advised to measure the width from the edge of the allocated parking zone.
 - If footpaths are present adjacent or parallel to the carriageway input into the '*Footpath Width (m)*'.
 - If there is no footpath present, input zero.
- If an existing shared space or potential site is located at an intersection and is purely an intersection treatment, select 'yes', otherwise select 'no' from the drop-down menu in the '*Is the Shared Zone/Space located at an intersection?*' column.
 - If there is signage indicating to users that they are entering or exiting from shared space infrastructure (i.e. shared zone signage), select 'yes' from the drop down menu. Otherwise, select 'no'.
- If the segment of the street under analysis has street furniture present, selected 'yes' under the '*Presence of Street Furniture*' column. If street furniture is not present along a particular segment of the street, select 'no'.
- For a particular latitude and longitude location select the pavement type from the dropdown in the '*Pavement Type*' column.
 - If pavement type changes along the street length, create a new segment inputting the latitude and longitude location where the pavement type has changed and the new pavement type from the dropdown menu.
- If Kerbs or guttering are present along a segment of the street, select 'yes' under the '*Presence of Kerb/Guttering*' for that segment. Otherwise select 'no'.
- If safety barriers such as bollards are present along a particular segment of the street, select 'yes' under the '*Presence of Safety Barriers*' column for that segment. Otherwise select 'no'.
- If traffic signals are present along a segment of the street, select 'yes' under the '*Presence of Traffic Signals*' column for that segment. Otherwise select 'no'.
- If a signalised crossing is present along a segment of the street, select 'yes' under the '*Presence of Signalised Crossings*' column for that segment. Otherwise select 'no'.
- If a marked unsignalised crossing is present along a segment of the street, select 'yes' under the '*Presence of Marked Unsignalised Crossings*' column for that segment. Otherwise select 'no'.

- If an informal marked crossing point is present along a segment of the street, select 'yes' under the '*Presence of Informal Marked Crossings*' column for that segment. Otherwise select 'no'.
- If Foliage, greenery, or tree canopy coverage is present along a segment of the street, select 'yes' under the '*Presence of Foliage/Greenery OR % Tree Canopy Cover*' column for that segment. Otherwise select 'no'.

The spreadsheet containing the database of information is connected to the Power BI dashboard (provided file name and column names remain unchanged). Therefore, any change to the database will automatically appear on the Power BI dashboard.