



WARRIP

WESTERN AUSTRALIAN ROAD RESEARCH
AND INNOVATION PROGRAM

Low-Cost Urban Road Safety Treatments — Program Evaluation

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Summary

Main Roads Western Australia (MRWA) has identified local road intersections in urban areas as having significant opportunities for crashes with high severity outcomes. The analysis of crash data indicates that casualty crashes were reported at more than 4,500 intersections in the Perth Metropolitan area, including 3,500 local road intersections, many of which are generally not eligible for funding under existing road safety grant programs.

Recognising this, MRWA developed a Low-Cost Urban Road Safety Program (Low-Cost URSP) to target local road intersections that may be suitable for low-cost treatments to be installed in an area or the whole street, to enhance the safety of all road users. As part of the initial pilot project, low-cost treatments were implemented at 33 intersections in the following three local government areas:

- City of Stirling (Joondanna and Osborne Park area)
- City of Vincent (North Perth and Mount Lawley area)
- City of Rockingham (Waikiki and Cooloongup area)

The Australian Road and Research Board (ARRB) was engaged to evaluate the effectiveness of the treatments implemented under this program and to consult with the local councils to gauge community perception about the Low-Cost URSP.

ARRB commissioned traffic speed surveys, conducted traffic and crash data analysis, visited all project sites, and consulted with local government representatives as part of the evaluation process.

Either raised safety plateau or compact roundabout treatments were implemented at all 33 project sites. The design characteristics of similar treatment types were different across the jurisdictions; for example:

- Mini-roundabouts in the City of Vincent were semi-mountable, whereas compact (fully-mountable) roundabouts were constructed in the City of Stirling.
- Raised safety plateau line marking, signage, and treatment colour were different across all three local government areas.

The traffic data analysis indicates that the implemented treatments are effective in maintaining the 85th percentile speed below the default speed in all areas except Osborne Park. The treatments implemented in the Osborne Park area include a fully mountable compact roundabout with painted median islands and give way signs on all approaches.

During the project site visits in Osborne Park, it was observed that many vehicles were driving through the central island with minimal, if any, deflection and using the treated intersections more similar to a give way control. This suggests that fully-mountable central island and wide approach lanes are ineffective in requiring drivers to slow on approach, deflect their travel path at the roundabout, or use the intersection as a roundabout priority control. If such treatments are to be considered in future programs, it is suggested that MRWA collaborates with local governments to install additional low-cost treatments on the approaches to manage vehicle speeds.

The post-implementation crash data is not yet (at the time of writing) available; therefore, the evaluation of the impact of implemented treatments on crash trends was not able to be carried out. However, analysis of the crash data of all 33 project sites for the past five years (2017-2021) was undertaken, and this showed that the project sites in the Osborne Park area had the highest number of recorded crashes, i.e., 21 crashes at four intersections between 2017 and 2021, inclusive. All other project intersections recorded three or fewer crashes in the same five-year period.

It is suggested that the MRWA (in collaboration with City of Stirling) should commission a detailed crash analysis study for the Osborne Park area to identify the contributing factors to this high number of crashes. The findings of this would inform what additional treatments at the intersections may be required under the Low-Cost URSP.

Considering local governments are the key stakeholders in the Low-Cost URSP, ARRB carried out a three-phase consultation with local councils to seek feedback on the effectiveness of treatments, community reaction, and the URSP process. The consultation included:

- Preliminary discussions – to provide an overview of the study and elements on which feedback is sought.
- A survey questionnaire – to get feedback on the process and all treated intersections.
- Workshops – to discuss the received feedback and interactive discussion related to the program.

Council officers highlighted that the implemented treatments seem effective in reducing the area-wide speed, and there is generally a positive perception among residents and business owners. The officers mentioned that they had received no significant negative feedback or enquiry related to low-cost treatments.

The council officers suggested adopting a two-year staged approach for the Low-Cost URSP program, i.e., planning and design in the first year and on-ground delivery in the second. This would allow local councils to develop a more considered design and effectively consult with the community.

Council officers also expressed that evidence-based data is unavailable to demonstrate improvements in the safety of vulnerable road users. It was also noted from the consultation that local governments may have considered alternate or additional treatments if adequate time was available for planning and design.

It was observed during the consultation that the council officers are not fully across the Low-Cost URSP process described in the Strategy and Implementation Framework of Low-Cost URSP (MRWA document D22#24187). It is suggested that MRWA should consider hosting interactive sessions to increase awareness of the program, its process, and the role of local governments in a successful delivery. This will allow council officers to interact with the MRWA program manager, discuss local government challenges, and better understand the program's benefits and objectives.

The evaluation study recommends the following aspects for consideration in future rollouts to achieve maximum benefits from the Low-Cost URSP:

1. Develop a standard layout plan for common low-cost treatments to ensure uniform measures across different jurisdictions.
2. The demands and needs of vulnerable road users in each neighbourhood area should be considered in the selection of low-cost treatments.
3. Increase awareness of the Low-Cost URSP amongst local government practitioners.
4. Work in collaboration with local councils to develop practical planning and delivery timelines.
5. Develop pre and post-treatment data analysis plans for each neighbourhood area.
6. Consider using a combination of low-cost treatments where necessary to achieve desired safety objectives.
7. Commission Safe System assessments for all project sites in a neighbourhood area to evaluate different treatment options and optimise alignment with Safe System principles.

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1 Introduction

1.1 Background

Main Roads Western Australia (MRWA) has identified local road intersections and mid-blocks in urban areas as significant road safety concerns. The areas were identified as having numerous priority-controlled cross-intersections within a grid-style road network. This network style is problematic from a road safety perspective as the straight roads allow vehicles to build up speed between intersections. The priority-controlled cross-intersections present significant opportunities for crashes, noting the potential for severe right-angle crashes.

As per the five years (2015 – 2019) crash data, out of 51,000 metropolitan intersections, casualty crashes were recorded at more than 4,500 intersections. These included approximately 3,500 such road intersections under local government control and were not eligible for funding under existing road safety programs.

MRWA has developed a Low-Cost Urban Road Safety Program (Low-Cost URSP) to enhance the safety of all road users on local roads. During the initial phase, a series of intersection treatments across multiple urban areas were rolled out as part of the Low-Cost URSP. Low-cost intersection treatments in an area-wide or the whole street were implemented to maximise the safety benefits and value for money investment.

As a low cost program, the types of treatments chosen were to be installed within existing intersection footprints with minimal requirement of additional civil works. The area-wide approach was anticipated to provide a Local Area Traffic Management (LATM) style traffic calming benefit as well as site-specific benefits from individual intersection treatments, with the intention of providing outcomes greater than the sum of their parts.

MRWA engaged ARRB to evaluate the effectiveness of the implemented treatments and consult with local councils to gauge community perception about the Low-Cost URSP.

A total of 33 intersections (project sites) where low-cost treatments have been implemented are part of this study. The project sites are located in the three local governments (LGAs) of the City of Stirling, the City of Vincent, and the City of Rockingham.

These local government areas (LGAs) are the key stakeholders of Low-Cost URSP and have respective customer enquiry management systems to record resident feedback, complaints or general enquiries. Therefore, in addition to the site visit and traffic data collection, consultation with these LGAs was included in the scope of this study.

The consultation is intended to allow MRWA to gain feedback from LGAs on the effectiveness of treatments, community reaction and the overall Low-Cost URSP process. It is also intended to enable MRWA to develop greater confidence in the program and its alignment with local government needs.

1.2 Rationale

While anecdotal evidence and post-opening observations suggest the treatments have been successful, it is crucial to be able to accurately assess the performance of the treatment and understand:

- Do the treatments deliver their intended benefits?
- If not, how could they be modified to improve performance?
- Could they be enhanced to provide benefits over and above those initially anticipated?
- Have there been any unintended disbenefits of the treatments?
- If so, how can these treatments be modified to minimise/remove these disbenefits?
- Local government feedback on the Low-Cost URSP process and community response.

1.3 Objectives and Anticipated Benefits

The objective of the project was to assess the effectiveness of the existing program rollout to ensure:

- The project is realising its intended safety benefits.
- That no unintended adverse effects are being experienced.
- Identify any refinements that can be made to the implemented treatments for a safer road environment.
- Help inform the future program rollout to maximise safety benefits.
- Help build the body of knowledge of low-cost urban intersection treatments.

It is noted that learnings of this project not only help refine the existing treatments but also future rollouts of similar treatment programs. It is planned that the program will continue to be rolled out over the coming years, with 80-90 intersections treated per year. Accordingly, a process of continual review and assessment of the program is desired to ensure the program has its intended benefits and to allow for any identified refinements to be made that may benefit the continued rollout.

1.4 Scope

The overall scope of this study included:

- Collection of traffic data, including demand and speed profile in the vicinity of the implemented treatments.
- Consultation with LGAs to gauge feedback on overall Low-Cost URSP and implemented treatments.
- Visit all of the 33 project sites where treatments have been implemented.
- Evaluation of the effectiveness of implemented low-cost treatments at 33 intersections in the following areas of three local governments:
 - Osborne Park and Joondanna (City of Stirling)
 - North Perth and Mount Lawley (City of Vincent)
 - Waikiki and Coo롱gup (City of Rockingham)
- Providing recommendations to improve the effectiveness of implemented treatments and future rollouts under Low-Cost URSP.

1.5 Methodology

The adopted methodology for this study includes traffic data collection, consultation with local governments and site visits of all 33 project sites to evaluate the effectiveness of implemented treatments and gauge community reaction.

Table 1.1 summarises the adopted methodology for this study.

Table 1.1: Study Methodology

Project inception	<ul style="list-style-type: none"> • Meeting with the MRWA project manager • Discuss project scope, opportunities and constraints
Economic benefit preliminary analysis	<ul style="list-style-type: none"> • Undertake preliminary economic benefit analysis based on available information and data
Preparation of assessment method	<ul style="list-style-type: none"> • High-level analysis of the provided data by MRWA • Develop assessment methodology to evaluate project sites
Traffic data collection	<ul style="list-style-type: none"> • Traffic surveys around all project sites to collect traffic demand and speed environment
Data analysis	<ul style="list-style-type: none"> • Undertake analysis of the survey results including traffic trends and 85th percentile speed limit
Site visits	<ul style="list-style-type: none"> • Visit all 33 project sites located in three local government areas.
Consultation with local governments	<ul style="list-style-type: none"> • Carryout consultation, including preliminary discussion and workshop with all three local governments.
Evaluation of implemented treatments	<ul style="list-style-type: none"> • Based on collected data, site visits and feedback from local governments, evaluate effectiveness of all 33 project sites.
Project report	<ul style="list-style-type: none"> • Prepare a project documenting evaluation of implemented treatments in each area
Project presentation	<ul style="list-style-type: none"> • Deliver presentation to the MRWA project manager and other stakeholders to discuss findings of the evaluation and recommendations

1.6 Report Structure

This project report comprises seven chapters, with the first three chapters documenting the rationale of the Low-Cost URSP and treatments implemented as part of the pilot project. The last four chapters document the adopted assessment method, evaluation findings, lessons learnt and recommendations.

The following are the headings with links to all seven chapters:

- Chapter 1 Introduction
- Chapter 2 Low-Cost Urban Road Safety Program (URSP)
- Chapter 3 Low-Cost URSP Pilot Project
- Chapter 4 Assessment Methods
- Chapter 5 Consultation with Local Government
- Chapter 6 Assessment of Low-Cost URSP Pilot Project
- Chapter 7 Lessons Learnt and Recommendations.

2 Low-Cost Urban Road Safety Program (URSP)

2.1 What is the Low-Cost URSP

The Low-Cost URSP is a fully funded program that aims to improve road safety on local roads and intersections, managed by Local Governments.

The program is managed by MRWA and is supported by the Minister for Transport and the Minister for Road Safety through a \$16 million commitment via the Road Trauma Trust Account.

LGAs are not required to apply for the grant under this program. Instead, MRWA identifies the potential areas for treatments and works with local councils to design and deliver the project.

2.2 Low-Cost URSP Purpose and Objectives

The purpose of the Low-Cost URSP is *'to implement low-cost road safety treatments on an area-wide or whole-of-street.'*

The program's primary objective is reducing the likelihood of fatal and serious injury crashes on local roads and creating a safer road environment for vulnerable users.

The broader objective is to target areas and corridors for road safety improvements that are not generally eligible under other road safety grants.

2.3 Low-Cost URSP Principles

The key principle of the Low-Cost URSP is to address road safety issues by implementing low-cost treatments which, when combined with appropriate travel speeds, will reduce the likelihood of occurrence and severity of crashes.

The Low-Cost URSP Strategy and Implementation Framework states that *'....The Low-Cost URSP focuses on applying Safe System road design principles, which aim to prevent all road users from being seriously injured or killed in any crash. Safe System thinking recognises that all road users make mistakes and, accordingly, all elements of the road system should be designed to be forgiving when mistakes happen.'*

For local roads, proactively reducing impact speeds to below 30 kilometres per hour (km/h) ensures the safety of vulnerable road users, such as people who walk, cycle, ride motorcycles and occupants of vehicles. Achieving these lower speeds at intersections can improve safety outcomes for all road users.'

MRWA has identified a range of low-cost road safety treatments that can be implemented on local roads and intersections without requiring significant change in the existing road layout.

The treatments are intended to be applied on high-risk locations with a history of crashes and other sites having similar characteristics and the likelihood of crashes. The potential areas to be considered in the Low-Cost URSP include:

- Residential areas having long, straight local roads in grid street networks allow drivers to travel at high speed
- Commercial areas with vulnerable road user activities and conflicting road user demands
- Industrial areas with frequent interactions between trucks, light goods vehicles and passenger cars.

2.4 Low-Cost URSP Treatment Options

MRWA has identified the following treatments for consideration as part of the initial rollouts of the Low-Cost URSP:

- mini-roundabouts
- compact roundabouts
- uncontrolled pedestrian crossing facilities (wombat crossings)
- raised safety platforms
- slow points
- entry statements
- other minor road features and amendments.

MRWA coordinate and work with respective councils to finalise the treatment type based on site constraints, community expectations and local knowledge of the council officers.

2.5 Low-Cost URSP Process

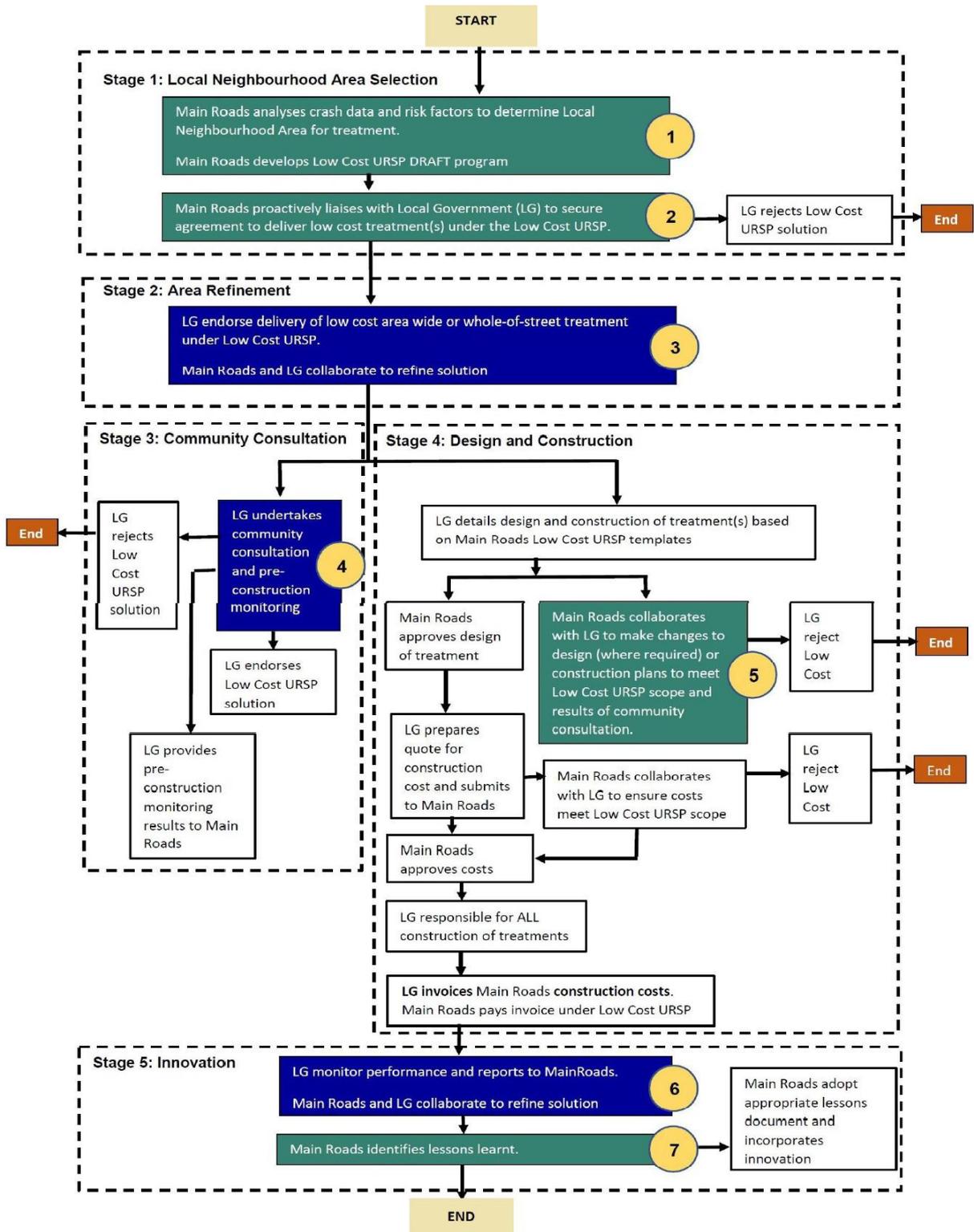
As per the Strategy and Implementation Framework, the process of the Low-Cost URSP includes the following five stages:

- **Stage 1** Local Neighbourhood (LN) Area Selection
- **Stage 2** Area Refinement
- **Stage 3** Community Consultation and Pre-construction Monitoring Data
- **Stage 4** Design, Cost Estimations and Construction
- **Stage 5** Innovation and Post-construction Monitoring Data.

Figure 2.1 illustrates the process of the Low-Cost URSP and the key steps included in all five stages.

For more details, please refer to the Low-Cost URSP framework. ([link](#))

Figure 2.1 Low-Cost URSP Process



Source: Low-Cost URSP Strategy and Implementation Framework

3 Low-Cost URSP Pilot Project

As part of the pilot project under the Low-Cost URSP, MRWA implemented low-cost safety treatments at 33 intersections in three metropolitan LGAs. The treatments included:

- raised safety plateaus
- semi-mountable compact roundabouts
- fully-mountable compact roundabouts.

The following sections describe the location and type of treatments implemented in the three LGAs.

3.1 Low-Cost Treatments in City of Rockingham

Under the Low-Cost URSP, raised safety plateau treatment was implemented at six intersections in the Waikiki and Cooloongup areas of the City of Rockingham.

Figure 3.1 illustrates the locations of the treated intersections in the City of Rockingham.

Figure 3.1 Treated Intersections in City of Rockingham

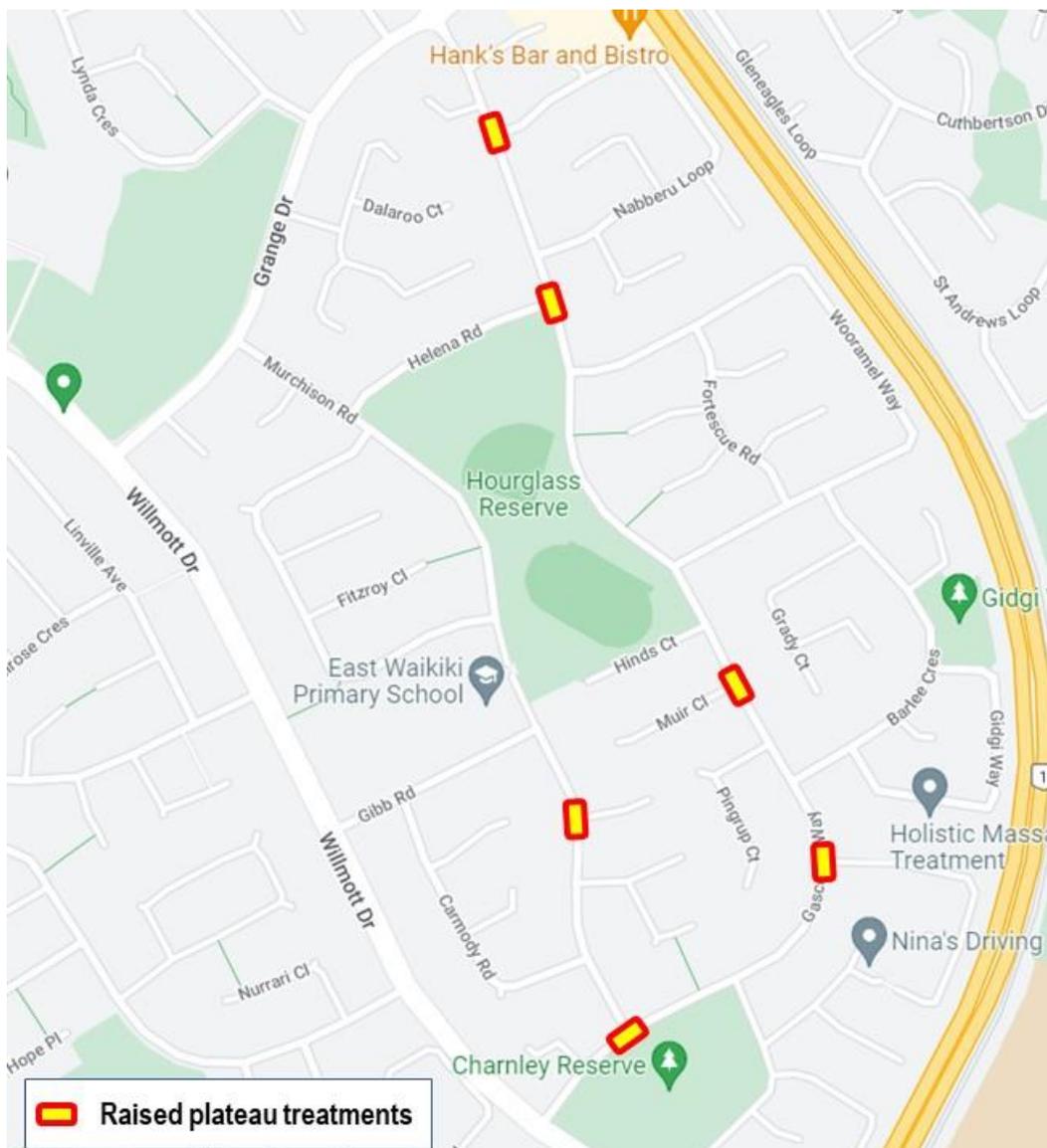


Figure 3.2 shows the raised safety plateau treatment (constructed in black asphalt) implemented at the intersection of Gascoyne Way and Murchison Road. The same type of treatment is applied at the other five intersections.

Figure 3.2 Raised Plateau Treatment at Gascoyne Way and Murchison Road Intersection



Warning signs with an advisory speed of 20 km/h; raised profile road marking are provided on all approaches. The same pattern was observed on all six treated intersections in the City of Rockingham.

3.2 Low-Cost Treatments in City of Vincent

Low-cost safety treatments were implemented at 17 intersections in the jurisdiction of the City of Vincent. The treatments included raised safety plateaus and semi-mountable mini-roundabouts.

As illustrated in **Figure 3.3**, the raised safety plateau treatment was applied at eight intersections in the North Perth area, and mini-roundabout treatment was implemented at nine intersections in North Perth and Mount Lawley areas.

Figure 3.4 shows examples of the raised safety plateau (constructed in red asphalt) and mini-roundabout treatments implemented in the City of Vincent. The road marking on the raised safety plateau treatments only included stop lines in the past; however, shark teeth marking have been installed on each approach with no warning signs. The central island of the mini-roundabout treatments is semi-mountable with warning signs and painted median islands.

Figure 3.3 Treated Intersections in City of Vincent

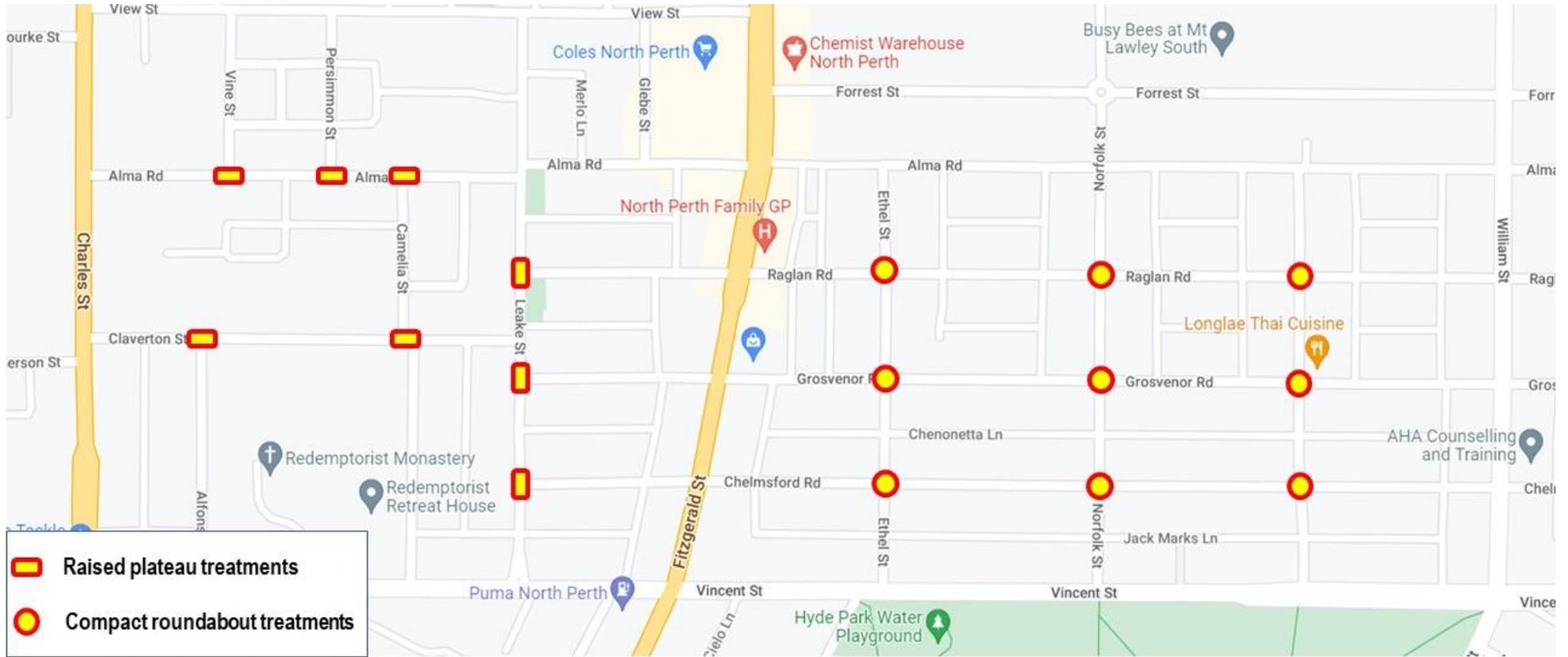


Figure 3.4 Treatment Types in City of Vincent



3.3 Low-Cost Treatments in City of Stirling

Low-cost safety treatments were implemented at ten intersections in the jurisdiction of the City of Stirling. The treatments included raised safety plateaus and fully-mountable compact roundabouts.

Figure 3.5 shows where the raised safety plateau treatment (constructed in red asphalt) was applied at six intersections in the Joondanna area, and compact roundabout treatment (constructed in red asphalt) was implemented at four intersections in the Osborne Park area.

Figure 3.5 Treated Intersections in City of Stirling

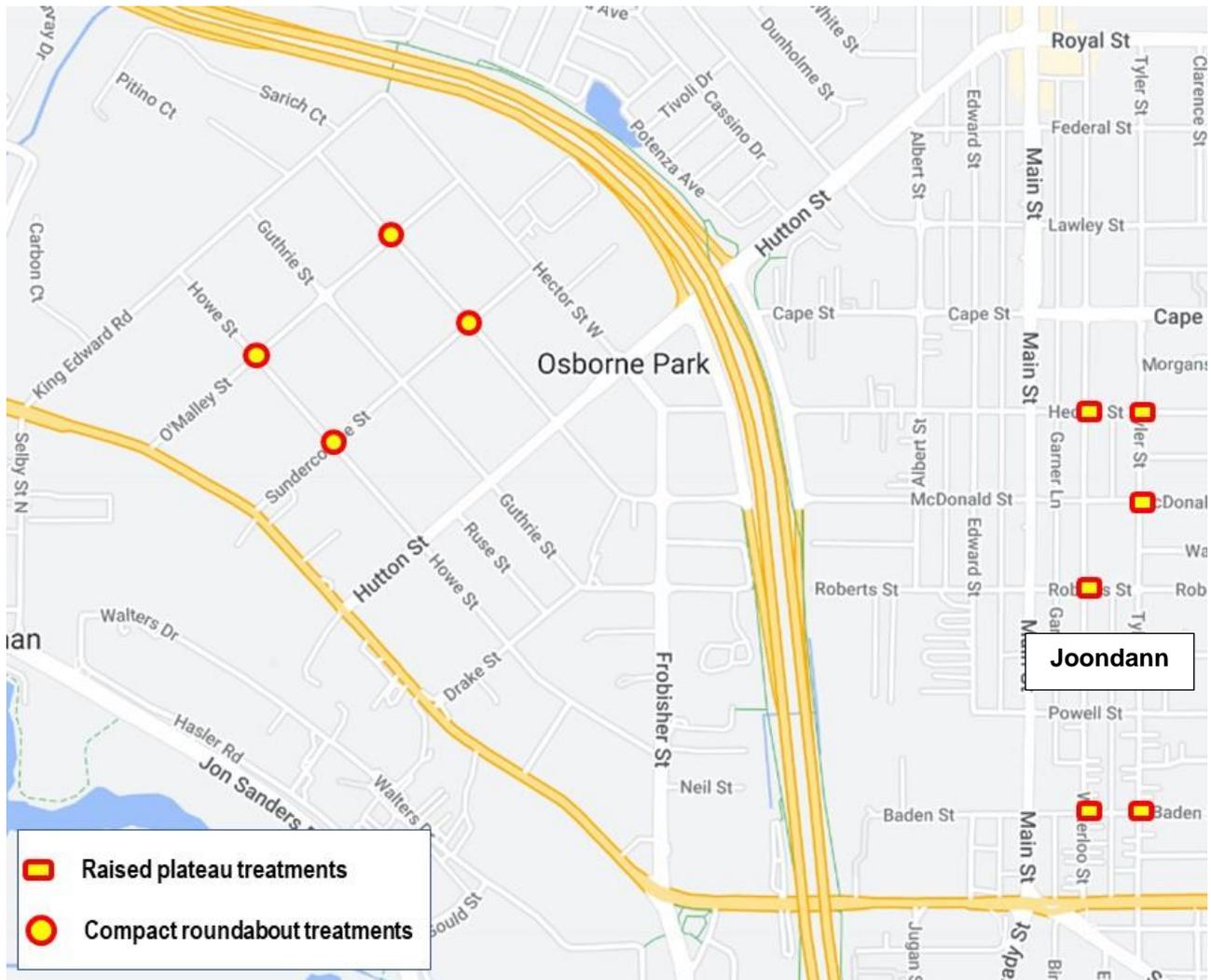


Figure 3.6 shows the raised safety plateau and compact roundabout treatments constructed in the City of Stirling. The road marking on the raised safety plateau treatments includes raised profile road marking on all approaches and give way line marking on minor approaches of the intersections. The central island of the compact roundabout treatments is fully-mountable with warning signs and painted median islands.

Figure 3.6 Treatment Types in City of Stirling



4 Assessment Methods

4.1 Desktop Review

ARRB carried out a desktop review of each study intersection using Nearmap and other online tools. The desktop review focused on the following key aspects:

- Previous intersection control and Implemented treatment
- Surrounding land use
- Pedestrian provisions
- Cyclists' provisions
- Consideration for heavy/service/delivery vehicles
- Line of travel
- Other site-specific points

4.2 Site Visits

ARRB conducted a site visit of all study intersections to observe the actual traffic pattern and to confirm points noted as part of the desktop review.

The aim was to visit the study intersection in either morning or evening peak hours. It will provide an opportunity to experience traffic behaviour and potential safety risks during peak periods.

ARRB took pictures and recorded videos at study intersections for recording and documenting in the project report.

4.3 Traffic Survey Data Analysis

Considering the location of implemented treatments at 33 study intersections, ARRB commissioned tube count surveys at 48 locations.

The survey assessed the speed environment in the vicinity of the implemented treatments. The data provided an opportunity to evaluate the effectiveness of URSP in creating a slow-speed road environment.

Tube count surveys were carried out for seven days at 48 locations and were commissioned out of school and public holidays.

Figure 6.1 to Figure 6.7 show the proposed survey plan for each area. The figures highlight the study intersections in the following areas and the location of tube count surveys:

- Waikiki / Coo loongup
- North Perth
- Mount Lawley
- Joondanna
- Osborne Park

4.4 Crash Data Analysis

ARRB carried out the analysis of the crash statistics of all study intersections. The data was provided by MRWA for a five-year period from 2017 to 2021. The crashes are classified as:

- Fatal
- Hospital
- Medical
- Major property damage only (PDO)
- Minor PDO

The post-implementation crash data is not yet (at the time of writing) available; therefore, the evaluation of implemented treatments' impact on the crash trends was not able to be carried out.

4.5 Consultation with Local Government Administrations (LGAs)

ARRB held a preliminary discussion and a workshop session with the following three LGAs, separately:

- City of Rockingham
- City of Vincent
- City of Stirling

ARRB coordinated with all three LGAs before the workshop to provide the background and purpose of this WARRIP project. ARRB also developed an online feedback form for every study intersection to be completed by the LGAs. This provided an opportunity to LGAs to gather all the required information and have internal discussions before the workshop.

ARRB arranged an online workshop to:

- Gauge community support/reaction
- Perception of effectiveness level
- LGAs feedback on the process

The workshops focused on the following aspects:

- Community enquiries or feedback received related to the proposed treatments
- Has the implemented treatment created a slow-speed environment
- Adequate time to consult with the community
- Impact on public transport and waste collection vehicles
- Potential maintenance issues
- At what stage should LGAs be involved in the process
- Would LGA consider additional or different treatments at study intersections
- Feedback from LGAs to improve the process

4.6 Evaluation Matrix

ARRB developed an evaluation matrix for each of the 33 study intersections. The evaluation matrix is shown below in **Table 4.1**.

Table 4.1: Evaluation Matrix

Intersection name	
Previous intersection control	
Implemented treatment	
Surrounding land use	
Pedestrian provisions	
Cyclist provisions	
Consideration for heavy/service/delivery vehicles	
Line of travel	
Other site-specific issues	
Advantage	
Disadvantage	

ARRB also collated the evaluation results to provide summary results for each area (North Perth, Osborne Park, Joondanna, Waikiki, and Coo롱gup) and treatment type (compact roundabouts, raised platforms etc.).

5 Consultation with Local Government Administrations (LGAs)

The primary purpose of the Low-Cost URSP is to enhance the safety of all road users on local roads managed and controlled by LGAs.

Therefore, LGAs are the key stakeholders in the Low-Cost URSP with a critical role in delivering effective, low-cost safety treatments in collaboration with MRWA.

LGAs are responsible for the following key tasks under the Low-Cost URSP:

- design of the preferred low-cost treatment
- consultation with community
- construction
- performance monitoring
- future maintenance
- responding to relevant enquiries from residents, visitors, and businesses.

5.1 Project Sites and LGAs

As described in **Section 3**, MRWA has included 33 intersections (project sites) as part of this study. The low-cost safety treatments have been implemented at all project sites located in the following three LGAs:

- City of Rockingham (see **Figure 3.1** for details)
- City of Vincent (see **Figure 3.3** for details)
- City of Stirling (see **Figure 3.5** for details)

5.2 Consultation Process

ARRB adopted a process comprising the following phases for consultation with LGAs:

- Preliminary discussions – separate half-hour session with all three LGAs
- A survey questionnaire
- Workshops – separate one and a half-hour sessions with all three LGAs.

5.2.1 Preliminary Discussion

The purpose of the preliminary discussion phase was to provide LGAs with an overview of the study that MRWA has commissioned to evaluate the effectiveness of the implemented low-cost road safety treatments.

ARRB held separate preliminary discussions with all three LGAs and shared the study's rationale, objectives, and scope. The attendees were also briefed on the importance of the feedback and how it can make future Low-Cost URSP rollouts more effective.

Table 5.1 shows the details of the preliminary discussions, including the date, time and attendees' names.

Table 5.1: Preliminary Discussion with LGAs

LGA	Date	Time (AWST)	Attendees from LGA
City of Rockingham	Wednesday, 28 September 2022	10:30 AM	Ryan Gibson and Manoj Barua
City of Stirling	Thursday, 29 September 2022	1:00 PM	Russell Jackson
City of Vincent	Friday, 30 September 2022	8:30 AM	Luke McGuirk

5.2.2 Survey Questionnaire

ARRB developed a survey questionnaire to uniformly gauge LGA feedback on the overall process of the Low-Cost URSP program, the effectiveness of implemented treatments and the community perception.

The survey questionnaire comprised three parts, as described in **Table 5.2**.

Table 5.2: Survey Questionnaire for LGAs

Survey Questionnaire Parts		Description
1	Information of the survey respondent	This part gathered information on the LGA officer responding to the survey questionnaire
2	Feedback on Low-Cost URSP	This part sought feedback on the process and effectiveness of the overall Low-Cost URSP. The LGAs were requested to provide feedback on the following aspects: <ul style="list-style-type: none"> Implemented treatments created a slow-speed environment Community feedback or enquiries were positive or negative Impact on public transport or waste collection vehicles Potential maintenance issues Comments on the overall process of Low-Cost URSP Time to consult with the community Any additional comment
3	Feedback on individual intersections	This part sought feedback on all project sites where low-cost treatments are implemented. The LGAs were requested to provide feedback on the following aspects for each project site: <ul style="list-style-type: none"> In general, is the community happy with the implemented treatment? Has the implemented treatment improved safety for pedestrians? Has the implemented treatment improved safety for cyclists? Has the implemented treatment impacted heavy vehicles, public transport or service vehicles? Has the implemented treatment created a slow-speed environment? Would LGA consider additional or different treatment at this intersection?

The survey questionnaire was shared on 30 September 2022, and the feedback from all LGAs was received by 21 October 2022.

5.2.3 Workshops

The purpose of the workshops was to have an interactive discussion with all LGAs and to discuss in detail the provided feedback. It was also an opportunity for LGAs to suggest improvements in the Low-Cost URSP process to enhance its effectiveness from an LGA perspective.

After analysis of the feedback, ARRB held separate one and a half hour workshops with all three LGAs.

Table 5.3 shows the details of the workshops, including the date, time and attendees' names.

Table 5.3: Workshop with LGAs

LGA	Date	Time (AWST)	Attendees from LGA
City of Vincent	Monday, 31 October 2022	11:00 AM-12:30 PM	Luke McGuirk and Hannah Ellwood
City of Rockingham	Wednesday, 2 November 2022	9:30 AM-11:00 AM	Ryan Gibson and Manoj Barua
City of Stirling	Thursday, 3 November 2022	10:00 AM-11:30 AM	Russell Jackson

5.3 Feedback from LGAs

The responding officers from all three LGAs were involved in delivering the Low-Cost URSP in their respective jurisdictions. They, therefore, had first-hand experience with challenges and improvement potential in the program.

The responding officers were part of the entire consultation process and provided feedback on the overall Low-Cost URSP (as a program) and individual intersections.

5.3.1 Feedback on the Low-Cost URSP (as a program)

The analysis of survey responses and workshop discussions with all three LGAs show positive feedback on the overall Low-Cost URSP.

The LGAs reported no significant negative feedback from the community, indicating a generally positive perception among residents of the areas where low-cost treatments are implemented.

Table 5.4 summarises the feedback received from LGAs on the overall program, with key comments from council officers provided below:

- Council officers suggested involving LGAs in Stage 1 of the Low-Cost URSP, i.e., determining areas for treatments and program development.
- LGAs should be allowed adequate time to design, plan and deliver the project effectively.
- For effective integration with LGAs' capital works program, there is a need to have early information on upcoming Low-Cost URSP projects.
- There is a lack of clarity on the MRWA's preferred criteria for consulting with the community.
- There is a need for a more apparent funding structure, including progress payments and document requirements.
- MRWA should provide a template for evaluation to report before and after observations, including speed compliance, resident enquiries and lessons learnt.

Table 5.4: Feedback on Low-Cost URSP (as a program)

Survey Questions	Questionnaire Response from LGAs			Workshop Discussion
	Stirling	Vincent	Rockingham	
Created a slow-speed environment	Unsure	Yes	Yes	All three LGAs believed that the early trends show that the implemented low-cost treatments have created a slow environment. However, the council officers highlighted the need for before and after traffic data collection to assess the effectiveness of creating a slow-speed environment. Council officers suggested that the Low-Cost URSP scope should include collecting area-wide before and after traffic data for projects.
Community feedback or enquiries	Positive	Mixed	Mixed	Based on the survey responses and workshop discussion, the overall community feedback regarding the implemented treatments was positive. All three LGAs have not received significant negative feedback or enquiry about the implemented treatment. A few residents raised concerns regarding access to the properties in the pre-construction consultation phase. However, the overall opinion of the residents is positive.
Impact on public transport and waste collection vehicles	No	No	Yes	All three LGAs have not received any enquiry or complaint reporting impact on waste collection and public transport services. The City of Rockingham highlighted that the bus operator raised concerns regarding increased journey time associated with the implemented treatments in Waikiki and Cooloongup. However, the implemented treatments are not too aggressive to cause a significant increase in bus journey time.
Potential maintenance issues	No	No	No	All three LGAs expressed that the implemented treatments would be easy to maintain as part of the existing road maintenance programs.
Supportive of the overall process of the Low-Cost URSP	Yes	Yes	Yes	In general, all three LGAs were happy with the process of Low-Cost URSP. The council officers made the following suggestions to make the program more effective from an LGA perspective: <ul style="list-style-type: none"> • Considering the local knowledge and understanding of community enquiries, LGAs should be involved in selecting potential areas for low-cost treatments and developing a program of treatments. • LGAs should be allowed adequate time to develop a practical design, arrange resources and effectively schedule work. • The project under Low-Cost URSP should be delivered in two phases, i.e. year 1 for scoping and design and year 2 for delivery.
Adequate time to consult with the community	Yes	No	No	A mixed response from LGAs was observed on the adequacy of time to consult with the community. Council officers from two LGAs highlighted that the project timelines did not allow an effective consultation with the community. Council officers also expressed ambiguity on MRWA's preferred community consultation criteria, i.e., information only or consultation as per LGA's consultation policy.

5.3.2 Feedback on Individual Treatments

Feedback from the City of Rockingham

As described in **Section 3.1**, the low-cost treatment of a raised safety plateau was installed at six intersections in the Waikiki and Coo loongup areas of the City of Rockingham.

Figure 5.1 illustrates one of the treatments implemented at the intersection of Gascoyne Way and Murchison Road in the City of Rockingham. Similar treatments have been implemented at the other four intersections on Gascoyne Way and one intersection on Murchison Road.

Figure 5.1 Raised Plateau Treatment in the City of Rockingham



The City of Rockingham provided the same feedback for all six intersections where low-cost treatments are implemented. This is likely due to the same treatment type at all six intersections and similar area demographics.

The overall feedback on the implemented treatments in the City of Rockingham was positive. The feedback highlighted that the community is happy with the treatments, with early data indicating a slow-speed environment being created along Gascoyne Way.

The council officers were unsure if the treatments have enhanced pedestrian and cyclist safety due to insignificant active travel demand in the area.

The feedback indicated that the LGA would not consider additional treatments at these six intersections unless safety concerns are reported or observed.

During the workshop discussion, the council officers suggested that MRWA should consider developing a low-cost treatment matrix based on dominant road users, speed reduction targets, road user needs, land use and other related factors.

Feedback from the City of Vincent

As described in **Section 3.2**, the following two types of low-cost treatments have been implemented at 17 intersections in the jurisdiction of the City of Vincent:

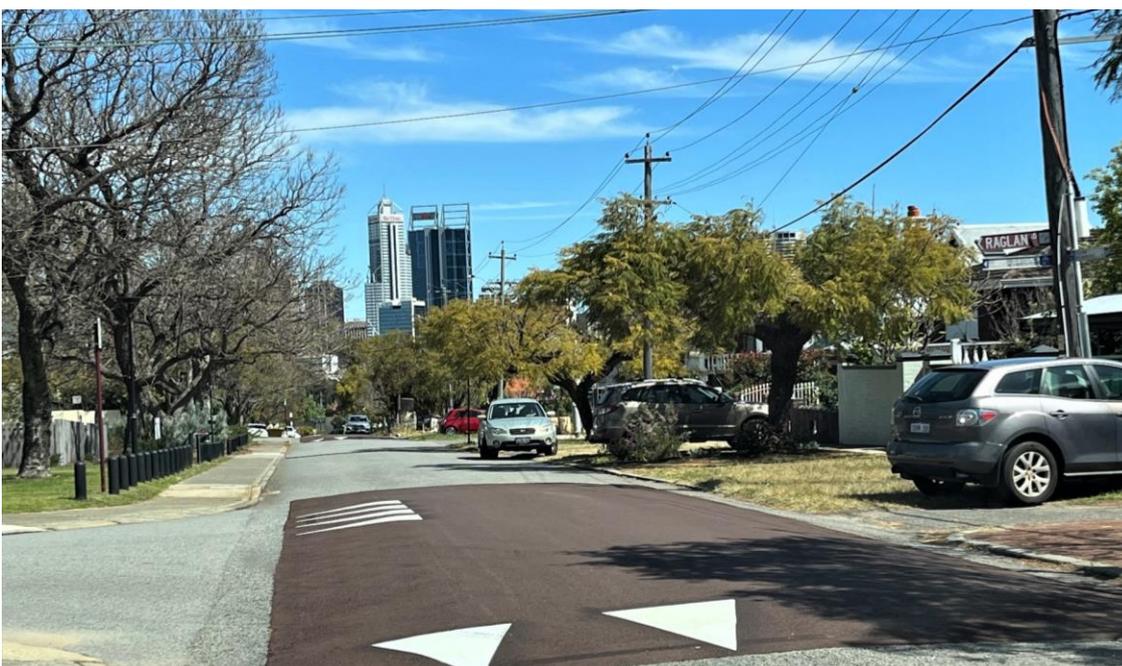
- Semi-mountable mini-roundabout at nine intersections
- Raised safety plateau at eight intersections

Figure 5.2 and **Figure 5.3** show the compact roundabout and raised safety plateau treatment, respectively, that are implemented in the City of Vincent.

Figure 5.2 Mini Roundabout Treatment at Norfolk Street and Grosvenor Road Intersection



Figure 5.3 Raised Plateau Treatment at Leake Street and Raglan Road Intersection



Considering the similar types of treatments, the response from the City of Vincent for all 17 treated intersections was identical. However, as part of the workshop discussion, ARRB discussed key aspects and questionnaire responses to understand the provided feedback better.

In general, the City of Vincent provided positive feedback on all 17 treated intersections, with early signs of reduction in the overall speed trends and fewer heavy vehicles in the area.

The feedback indicated a positive community perception of the implemented treatments, with no negative feedback or enquiry received from the residents or visitors. The council officers highlighted a lack of evidence/data demonstrating whether the treatments improved safety for pedestrians and cyclists.

The council officers suggested that post-project community consultation should be funded as part of the Low-Cost URSP. This will allow LGAs to gauge community reaction and the effectiveness of implemented treatments.

The workshop discussion indicates that the City of Vincent may have considered alternate or additional treatments if adequate time was allowed for planning and design.

Feedback from the City of Stirling

As described in **Section 3.3** and **Section 3.4**, the following two types of low-cost treatments have been implemented at ten intersections in the jurisdiction of the City of Stirling:

- Mountable compact roundabout at four intersections in Osborne Park
- Raised plateau at six intersections in Joondanna

Figure 5.4 and **Figure 5.5** show the compact roundabout and raised safety plateau treatments implemented in the City of Stirling.

Figure 5.4 Mini Roundabout Treatment at Sundercombe Street and Howe Street Intersection



Figure 5.5 Raised Plateau Treatment at Waterloo Street and Baden Street Intersection



The City of Stirling provided the same feedback for all ten intersections where low-cost treatments are implemented. This is likely due to the treatments' similar nature and area demographics.

ARRB discussed key aspects and questionnaire responses during the workshop discussions. This provided an opportunity to understand the feedback and suggestions better.

The feedback from the City of Stirling was generally positive about all ten treated intersections, with a reduction in speeding trends in some streets. As per council officers, the LGA has not received any negative feedback related to the implemented treatment, which indicates a generally positive perception among residents and business owners.

Like the other two LGAs, the City of Stirling also highlighted a lack of evidence/data demonstrating whether the treatments improved safety for pedestrians and cyclists.

The workshop discussions indicated that the implemented treatments had no impact on the operation of waste collection and public transport services.

5.4 Consultation Wrap-up

The consultation process has identified the following common themes across all three LGAs involved in this process:

- None of the LGAs has carried out their own assessment to evaluate the effectiveness of the implemented low-cost treatments in their jurisdictions.
- Council officers suggested involving LGAs in the identification of areas for treatment and program development.
- There is a lack of evidence-based data to inform whether the treatments improved safety for pedestrians and cyclists.
- No significant negative feedback from the community or businesses was received related to the implemented treatments.
- There is the suggestion of having adequate time to develop a practical design and consult with the community.

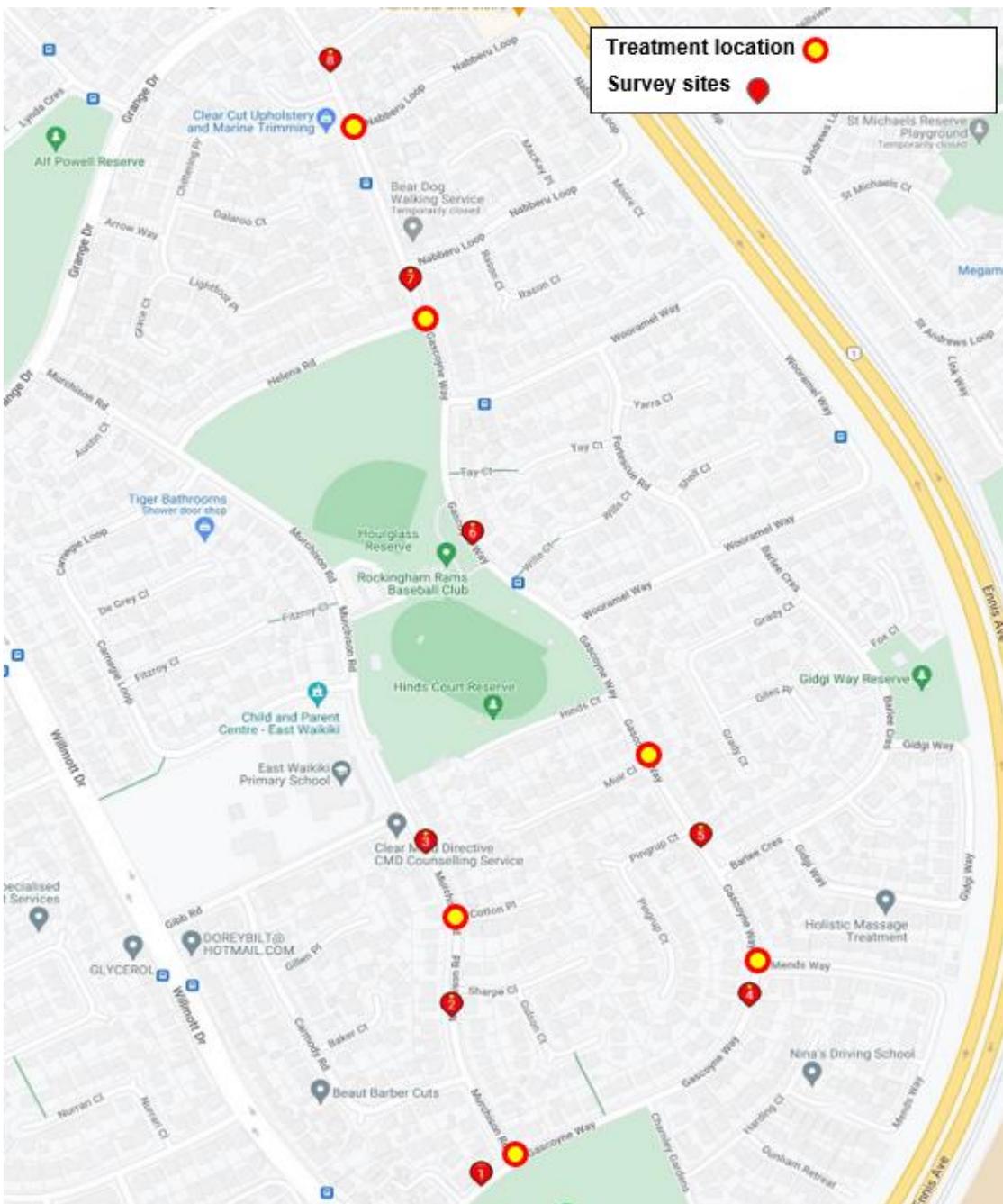
6 Assessment of Low-Cost URSP Pilot Project

6.1 Assessment of Low-Cost Treatments in Waikiki and Coo롱ungup

6.1.1 Traffic Data Analysis

A full-week tube count survey was commissioned at eight (8) locations in Waikiki and Coo롱ungup areas, in the jurisdiction of the City of Rockingham. The default speed limit in both areas is 50 km/h.

Figure 6.1 Traffic Survey Sites - Waikiki and Coo롱ungup



The survey results indicate that the average 85th percentile speed in the area was approximately 47 km/h, lower than the default speed limit.

As shown in **Table 6.1**, the following two survey locations on Gascoyne Way reported an 85th percentile speed greater than the default speed of 50 km/h:

- Gascoyne Way (the section between Barlee Crescent and Pingrup Court)
- Gascoyne Way (near Hourglass Reserve parking area)

Table 6.1: Survey Result Summary - Waikiki and Coo롱gup

Survey ID	Average Weekday Traffic	Average Weekend Traffic	85 th Percentile Speed (Full week)
1	2,499	2,207	43.7 km/h
2	475	307	50.2 km/h
3	328	181	43.6 km/h
4	1,803	1,559	39.8 km/h
5	1,482	1,349	54.5 km/h
6	1,739	1,518	54.7 km/h
7	2,200	1,907	43.6 km/h
8	2,627	2,365	48.8 km/h

6.1.2 Crash Data Analysis

MRWA has shared crash statistics for all project sites for a five-year period from 2017 to 2021. The crashes are classified as:

- Fatal
- Hospital
- Medical
- Major property damage only (PDO)
- Minor PDO.

Table 6.2 summarises the crashes reported in the five-year (2017-2021) period at six intersections in the Waikiki and Coo롱gup areas of the City of Rockingham. A raised safety plateau treatment was implemented at all six intersections as part of the Low-Cost URSP.

It is evident that a total of three crashes were reported, including one hospital and two minor PDO crashes. The hospital crash and one minor PDO crash occurred on Gascoyne Way.

Table 6.2: Crash Data Analysis - Waikiki and Coo롱gup

Intersection	Fatal	Hospital	Medical	Major PDO	Minor PDO	Total
Gascoyne Way and Muir Close					1	1
Gascoyne Way and Nabberu Loop						0
Gascoyne Way and Helena Road		1				1
Gascoyne Way and Murchison Road						0
Murchison Road and Cotton Place					1	1
Gascoyne Way and Mends Way						0
Total	0	1	0	0	2	3

6.1.3 Site Visit Assessment

ARRB carried out a detailed desktop review of the previous and existing intersection control before visiting all six project sites in the Waikiki and Cooloongup areas of the City of Rockingham. The sites were visited in the first week of October 2022 to observe traffic behaviour and potential safety risks.

The following key points were identified:

- The Waikiki and Cooloongup areas are predominantly residential.
- In the past, there was no line marking or signage at the six project sites to indicate priority.
- The implemented treatment at all six project intersections includes raised safety plateau with warning signs and raised profile road markings on all approaches.
- No additional provisions for pedestrians have been provided.
- At a few intersections, marks showing vehicle grounding were observed.

Figure 6.8 shows pictures taken during the visit to the project sites in the Waikiki and Cooloongup areas. Site assessment report for individual sites is provided in **appendix C.1**.

Figure 6.2 Site Assessment Pictures - Waikiki and Cooloongup



6.1.4 Findings and Discussion

The raised safety plateau treatment was implemented at all six project intersections in the City of Rockingham under the Low-Cost URSP. The treatments were constructed using asphalt with raised profile road marking on all approaches. Warning signs with an advisory speed of 20 km/h were also provided at the approaches to each of the treatments.

The raised safety plateau is a slightly raised area across an intersection with the purpose to promote slower travel speed and reduce the likelihood and severity of intersection crashes.

The pre-treatment traffic data is not available to analyse the impact of implemented treatments on speed. However, the post-treatment survey results indicate a good level of compliance and lower vehicle speeds in the area.

Analysis of speed survey data shows the 85th percentile speed is 47 km/h, recorded at eight survey sites. This suggests the treatments support speed compliance and potentially lower driving speed behaviour.

At two locations along Gascoyne Way, the recorded 85th percentile speed was greater than the default speed. A review of the route indicates that possible factors for this higher speed profile include the spacing between the two treatments on Gascoyne Way and the likely increase in vehicle speed between traffic calming treatments or intersections.

It is suggested that the council consider installing low-cost midblock road safety treatment/s on Gascoyne Way, preferably between the two access points to the parking area of Hour Glass Reserve. This will likely reduce speed of traffic approaching intersections of Wooramel Way with Gascoyne Way and improve safety for pedestrians crossing the road as well.

The post-implementation crash data is not yet (at the time of writing) available; therefore, the evaluation of the impact of these treatments on crash trends was not able to be carried out. The analysis of crashes that occurred in the past five years (2017-2021) indicates a low crash rate, with only three reported crashes at the six project intersections.

Traffic speed surveys found that overall the raised safety plateau treatments support vehicle speeds below the default speed of 50 km/h where appropriately spaced. Council officers expressed that the community feedback about the implemented treatments is generally positive.

The council officers highlighted insignificant pedestrian and cyclist movement in the area. The raised safety plateau treatments are not designed as pedestrian and cyclist facilities and therefore, do not directly enhance safety for vulnerable road user groups. However, as indicated by the traffic speed surveys, average 85th percentile speed is below the default speed limit and therefore they do generally contribute to a safer road environment for vulnerable road users.

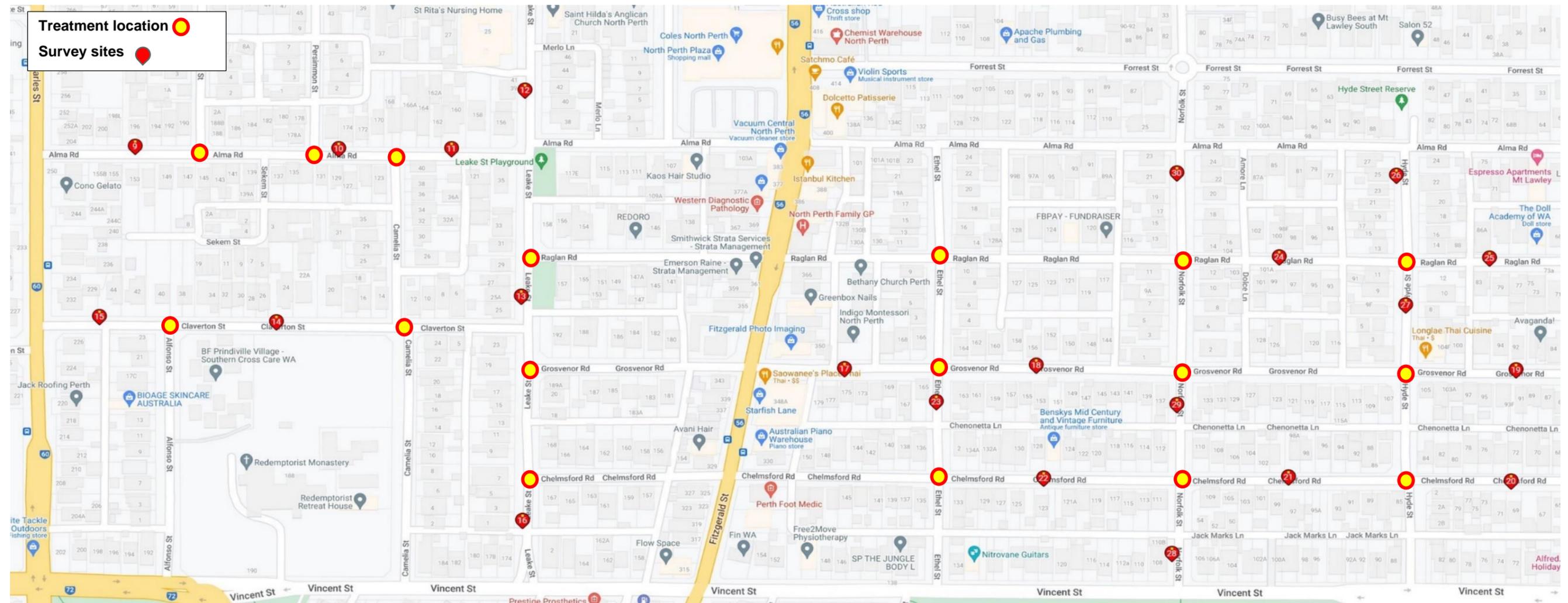
6.2 Assessment of Low-Cost Treatments in North Perth

6.2.1 Traffic Data Analysis

A full-week tube count survey was commissioned at 22 locations in North Perth, in the jurisdiction of the City of Vincent. The default speed in the area is 50 km/h.

Figure 6.3 shows the location of the implemented treatments and survey sites, with survey results summarised in **Table 6.3**.

Figure 6.3 Traffic Survey Sites - North Perth



The survey results indicate that the average 85th percentile speed in the area was 41 km/h, well below the default speed.

One survey site on the Calverton Street section between Alfonso Street and Camelia Street reported an 85th percentile speed greater than the default speed of 50 km/h. It is noted there are fewer properties and crossovers on the southern side of that section of Calverton Street compared to other survey sites in the vicinity.

Table 6.3: Survey Result Summary - North Perth

Survey ID	Average Weekday Traffic	Average Weekend Traffic	Post-treatment 85 th Percentile Speed
9	1,084	1,033	40.5 km/h
10	1,191	926	33.3 km/h
11	1,067	948	39.2 km/h
12	1,098	725	45.5 km/h
13	1,241	856	37.6 km/h
14	924	637	50.5 km/h
15	898	818	31.5 km/h
16	628	455	38.9 km/h
17	683	498	45.4 km/h
18	587	477	47.2 km/h
19	398	447	45.4 km/h
20	263	268	44.5 km/h
21	224	226	41.6 km/h
22	374	313	43.0 km/h
23	348	248	33.5 km/h
24	565	514	48.1 km/h
25	591	538	43.7 km/h
26	107	100	33.7 km/h
27	161	152	38.2 km/h
28	996	815	32.9 km/h
29	1,174	861	42.1 km/h
30	1,666	1,240	49.7 km/h

Pre and Post Treatment Speed Comparison

MRWA provided ARRB with the pre and post treatment speed comparison data of some roads east of Fitzgerald Road. The comparison was carried out by the City of Vincent and included:

- Pre-treatment speed survey results were recorded either in 2019, 2020 or 2021.
- Post-treatment speed survey results were recorded in either March or April 2022.

The data collected by the City of Vincent only shows the road name and section between the two roads where data was collected. The information regarding the location where the data was collected is unavailable, which is a limitation to assessing speed impacts in the middle of two treatments.

Table 6.4 summarises the pre and post treatment speed comparison analysis. It is evident that speed reduction was observed on all roads, and the post-treatment data collected by LGA and ARRB show similar speed trends. The analysis also indicates a sustained change in speed after the implementation of treatments which is a positive sign.

Table 6.4: Pre and Post Survey Data Comparison

Road Name	Section	Pre-treatment 85 th Percentile Speed (km/h) (LGA Data, 2019/2020/2021)	Post-treatment 85 th Percentile Speed (km/h) (LGA Data, Mar/Apr-22)		Post-treatment 85 th Percentile Speed (km/h) (ARRB Data, Oct-22)	
			Speed	Difference	Speed	Difference
Grosvenor Road	Ethel-Fitzgerald	47.7	44.1	-3.6	45.4	-2.3
Grosvenor Road	Ethel- Norfolk	50	48.4	-1.6	47.2	-2.8
Grosvenor Road	Hyde-William	44.9	43.9	-1	45.4	0.5
Chelmsford Road	Hyde- William	48.2	43.5	-4.7	44.5	-3.7
Chelmsford Road	Hyde- Norfolk	46.8	40.1	-6.7	41.6	-5.2
Chelmsford Road	Ethel- Norfolk	47.7	42.7	-5	43.0	-4.7
Ethel Street	Chelmsford- Grosvenor	40.3	38.9	-1.4	33.5	-6.8
Raglan Road	Hyde- Norfolk	49	46.1	-2.9	48.1	-0.9
Raglan Road	Hyde- William	45.9	47.2	1.3	43.7	-2.2
Hyde Street	Grosvenor-Raglan	37.6	37.3	-0.3	38.2	0.6
Norfolk Street	Chelmsford-Vincent	43	38.2	-4.8	32.9	-10.1
Norfolk Street	Chelmsford- Grosvenor	49.9	41.8	-8.1	42.1	-7.8
Norfolk Street	Alma -Raglan	52.6	47	-5.6	49.7	-2.9

6.2.2 Crash Data Analysis

MRWA has shared crash statistics for all project sites for a five-year period from 2017 to 2021. The crashes are classified as:

- Fatal
- Hospital
- Medical
- Major property damage only (PDO)
- Minor PDO

Table 6.5 summarises the crashes reported in the five-year (2017-2021) period at 17 intersections in the North Perth and Mount Lawley areas of the City of Vincent. Raised plateaus and semi-mountable compact roundabouts treatments were implemented at all 17 intersections as part of the Low-Cost URSP.

A total of eight crashes were reported, including one hospital, two medical, three major PDO and one minor PDA crash.

Table 6.5: Crash Data Analysis - North Perth

Intersection	Fatal	Hospital	Medical	Major PDO	Minor PDO	Total
Persimmon Street and Alma Road						0
Grosvenor Road and Ethel Street				1		1
Raglan Road and Hyde Street						0
Vine Street and Alma Road						0
Camelia Street and Alma Road						0
Raglan Road and Norfolk Street						0
Chelmsford Road and Hyde Street						0
Raglan Road and Ethel Street						0
Chelmsford Road and Norfolk Street		1		1	1	3
Leake Street and Grosvenor Road						0
Grosvenor Road and Norfolk Street			2		1	3
Grosvenor Road and Hyde Street						0
Chelmsford Road and Ethel Street				1		1

Intersection	Fatal	Hospital	Medical	Major PDO	Minor PDO	Total
Leake Street and Chelmsford Road						0
Leake Street and raglan Road						0
Claverton Street and Camelia Street						0
Claverton Street and Alfonso Street						0
Total	0	1	2	3	2	8

6.2.3 Site Visit Assessment

ARRB conducted a detailed desktop review of the previous and existing intersection controls before visiting all North Perth and Mount Lawley project sites. The sites were visited in the first week of October 2022 to observe traffic behaviour and assess potential safety risks.

The following key points were observed:

- Low-cost safety treatments were implemented at 17 intersections in North Perth and Mount Lawley, predominately residential areas.

Project sites west of Fitzgerald Road

- In the past, eight project sites west of Fitzgerald Road had no road signage or line marking to indicate intersection priority.
- Raised safety plateau treatments were implemented at these eight sites.
- The road marking on the raised safety plateau treatments only included stop lines in the past however, sharks teeth marking have been installed on each approach with no warning signs.
- The implemented treatments do not include any changes to the past pedestrian provisions, including pram ramps.
- Parking was not restricted on the raised safety plateau at two intersections on Alma Road.

Project sites east of Fitzgerald Road

- In the past, nine project sites east of Fitzgerald Road had either Giveway or Stop sign controlled intersections.
- Compact roundabout treatments having a semi-mountable central island with warning signs and painted median islands were implemented at all nine project sites.
- Many vehicles were observed not slowing down at the approach to the roundabouts.
- The vehicles were observed driving in a straight line without requiring to deflect at compact roundabouts.
- Traffic signs were obstructed by vegetation at Hyde Street and Raglan Road intersection, and Hyde Street and Chelmsford Road intersection.
- Traffic sign was missing on the eastern Leg of Ethel Street and Chelmsford Road intersection and the western leg of Norfolk Street and Chelmsford Road intersection.

Figure 6.8 shows the arrangements during the visit to the project sites in the North Perth area. Site assessment report for individual sites is provided in **appendix C.4**.

Figure 6.4 Site Assessment Pictures - North Perth



6.2.4 Findings and Discussion

Low-cost safety treatments were implemented at 17 intersections in the City of Vincent, including eight raised safety plateaus and nine compact roundabouts.

The raised safety plateau treatments were implemented at eight project sites west of Fitzgerald Road in North Perth. In contrast to the implemented treatments in Waikiki and Cooloongup areas, the road marking on the raised safety plateau treatments only included stop lines in the past; however, shark teeth marking have been installed on each approach with no warning signs.

The mini-roundabout treatments were implemented at nine project sites east of Fitzgerald Road in North Perth and Mount Lawley. The central island of the mini-roundabout is semi-mountable, with warning signs on each approach and painted median islands.

As per the Low-Cost URSP framework, mini-roundabout *'requires the vehicle driver to moderate their speed on approach to and through the intersection. As all vehicles approaching the intersection have to do so with caution, giving way to any road user already in the roundabout, mini roundabouts discourage vehicles from traveling in a straight line, which can reduce speed and crash severity by 78.9%'*.

The post-treatment traffic survey data collected by ARRB indicates that the implemented treatments support a slow-speed environment in the area. The average 85th percentile speed of 41 km/h was recorded at 22 survey sites.

MRWA also provided pre and post treatment speed comparisons carried out by the City of Vincent. The LGA's post-treatment speed survey results in March/April 2022 are similar to ARRB's data recorded in October 2022. The analysis indicates some variability in vehicle speeds on a site-by-site basis but it does suggest a sustained reduction in speed after the implementation of treatments which is a positive sign.

The post-implementation crash data is not yet (at the time of writing) available; therefore, the evaluation of the impact of implemented treatments on the crash trends was not able to be carried out. The analysis of crashes that occurred in the past five years (2017-2021) shows eight reported crashes at 17 project intersections.

The analysis also indicates that all eight crashes occurred on Grosvenor Road and Chelmsford Road, including six at Norfolk Street and two at Ethel Street. This is likely due to the high traffic demand on Norfolk Street and the presence of vulnerable road users in the area.

It was observed that the give way signs on approaches was obstructed at some compact roundabouts. Generally, the compact roundabout design does not include splitter islands on approaches and the only option is to install give way signs on the road verge. As a result, it is important to ensure signs are clearly visible to approaching drivers so they can adjust their speed to and through the intersection.

Overall, the raised safety plateau and mini-roundabout treatments show encouraging results in maintaining the area-wide speed below the default speed of 50 km/h. However, it was observed during the site visits that some vehicles were travelling in a straight line without requiring to deflect at the roundabout. This is due to the small footprint of the central island and painted median island.

The council officers provided positive feedback on all 17 treated intersections, with early signs of reduction in the overall speed trends, fewer heavy vehicles in the area, and no negative community feedback received.

The council officers highlighted the absence of evidence-based data to evaluate improvement in the safety of vulnerable road users. It was also noted from the consultation with the City of Vincent that they might have considered alternate or additional treatments if adequate time was available for planning and design.

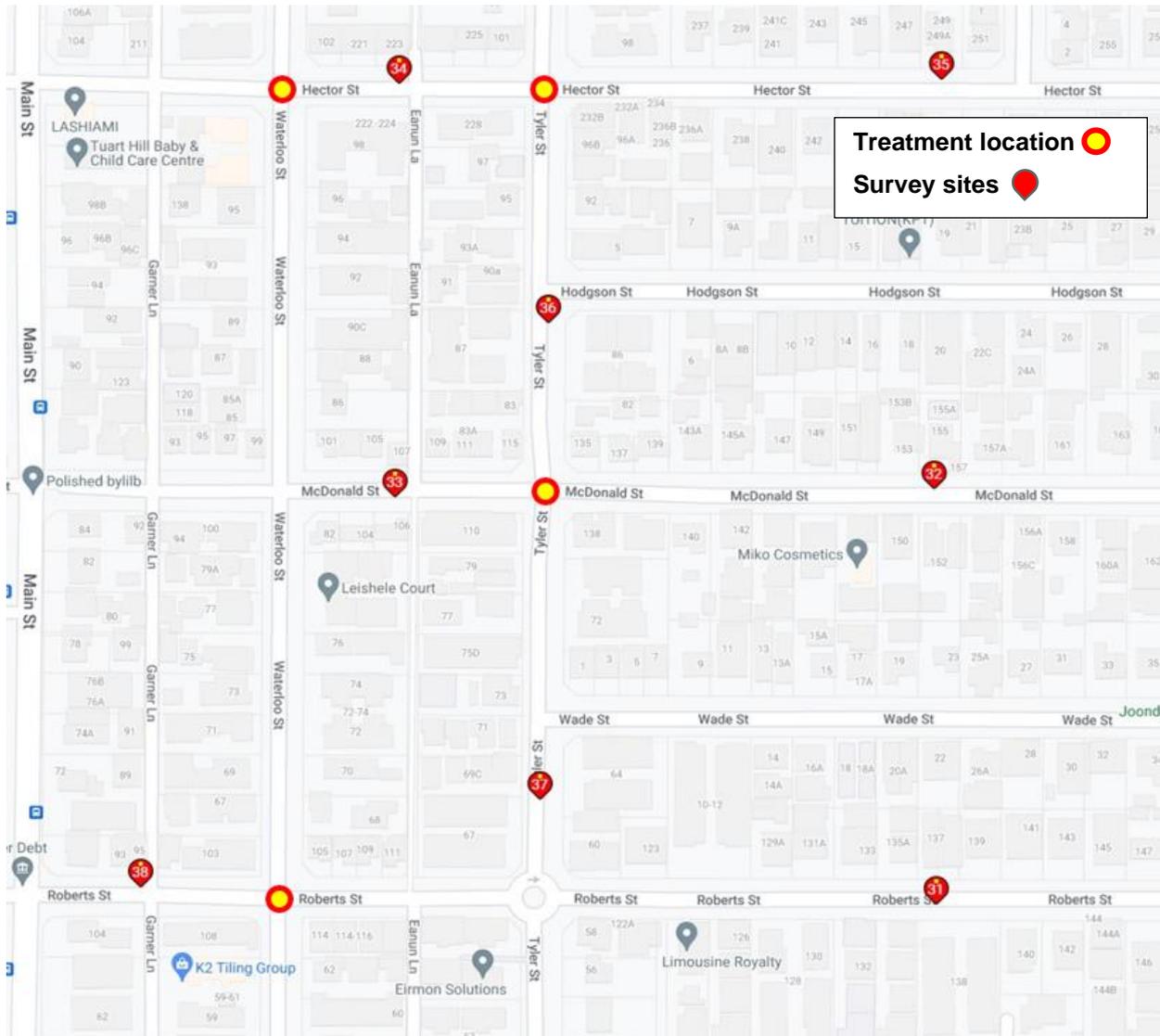
6.3 Assessment of Low-Cost Treatments in Joondanna

6.3.1 Traffic Data Analysis

A full-week tube count survey was commissioned at eight (8) locations in Joondanna, in the jurisdiction of the City of Stirling. The default speed in the area is 50 km/h.

Figure 6.5 shows the location of the implemented treatments and survey sites, with survey results summarised in Table 6.6.

Figure 6.5 Traffic Survey Sites - Joondanna



The survey results indicate that the average 85th percentile speed in the area was approximately 47 km/h, which is lower than the default speed.

As shown in Table 6.6, the following two survey sites reported an 85th percentile speed greater than the default speed of 50 km/h:

- Robert Street (the section between Tyler Street and Stoneham Street)
- Tyler Street (the section between Hodgson Street and McDonald Street)

Table 6.6: Survey Result Summary - Joondanna

Survey ID	Average Weekday Traffic	Average Weekend Traffic	85 th Percentile Speed (Full week)
31	1,735	1,429	53.3 km/h
32	457	408	49.0 km/h
33	284	223	39.1 km/h
34	1,137	574	44.3 km/h
35	513	348	50.0 km/h
36	1,072	797	52.4 km/h
37	1,230	1,031	43.0 km/h
38	2,621	2,276	46.8 km/h

6.3.2 Crash Data Analysis

MRWA has shared crash statistics for all project sites for a five-year period from 2017 to 2021. The crashes are classified as:

- Fatal
- Hospital
- Medical
- Major property damage only (PDO)
- Minor PDO

Table 6.7 summarises the crashes reported in the five-year (2017-2021) period at six intersections in the Joondanna area of the City of Stirling. A raised safety plateau treatment was implemented at all six intersections as part of the Low-Cost URSP.

It is evident that a total of seven crashes were reported, including three medical and four major PDO crashes.

Table 6.7: Crash Data Analysis - Joondanna

Intersection	Fatal	Hospital	Medical	Major PDO	Minor PDO	Total
Roberts Street and Waterloo Street			1			1
Baden Street and Tyler Street						0
Tyler Street and Hector Street			2			2
Waterloo Street and Hector Street				3		3
Baden Street and Waterloo Street						0
Tyler Street and Mcdonald Street				1		1
Total	0	0	3	4	0	7

6.3.3 Site Visit Assessment

ARRB carried out a detailed desktop review of the previous and existing intersection control before visiting all project sites in the Joondanna area. The sites were visited in the first week of October 2022 to experience traffic behaviour and potential safety risks.

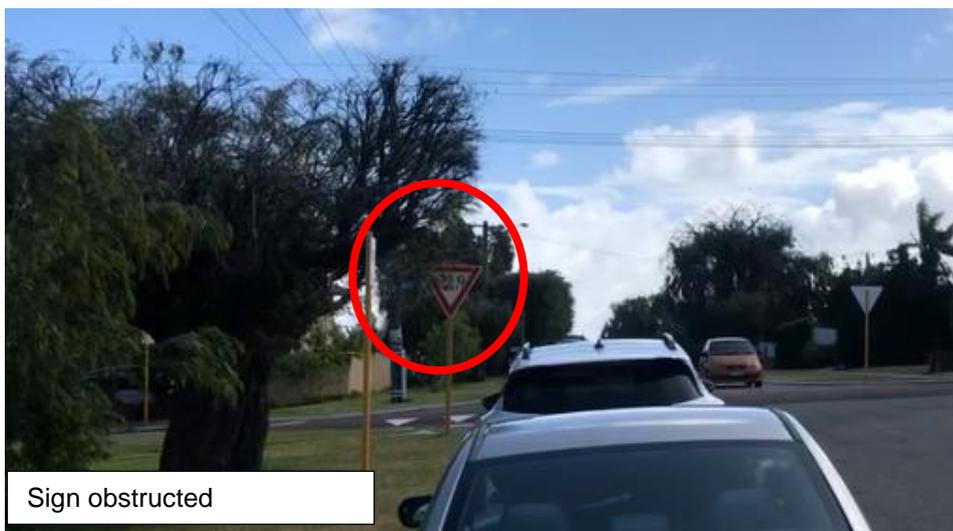
The following key points were observed:

- In the past, all six project sites had Stop sign controlled intersections with line marking and signage.
- The implemented treatment at all six project intersections includes raised safety plateau having raised profile road marking on all approaches and give way line marking on minor approaches of the intersections.
- The surrounding land use is residential.

- No additional provisions for vulnerable road users were provided.
- Traffic signs were obstructed at Waterloo Street and Hector Street intersection, and Waterloo Street and Baden Street intersection.

Figure 6.6 shows a few pictures taken during the visit to the project sites in the Osborne Park area. Site assessment reports for individual sites are provided in **Appendix C.3**.

Figure 6.6 Site Assessment Pictures - Joondanna



6.3.4 Findings and Discussion

A raised safety plateau treatment was implemented at all six project intersections in the Joondanna area of the City of Stirling. The treatments were constructed using coloured asphalt with raised profile road markings and give way markings on minor approaches.

The pre-treatment traffic data is not available to analyse the impact of implemented treatments on speed. However, the post-treatment survey data of eight locations indicate that the implemented treatments support a slow-speed environment in the area.

The average 85th percentile speed of 47 km/h was recorded at eight survey sites. At two locations on Robert Street and Tyler Street, the recorded 85th percentile speed was more than the default speed. The possible factors for the higher speeds include the high traffic demand, priority to Tyler Street traffic and spacing between controlled intersections.

The post-implementation crash data is not yet (at the time of writing) available; therefore, the evaluation of the impact of implemented treatments on the crash trends was not able to be carried out. The analysis of crashes that occurred in the past five years (2017-2021) shows a total of seven reported crashes at six project intersections.

The analysis also indicates that all seven crashes occurred at intersections on either Tyler Street or Waterloo Street. This is likely due to the high traffic demand, low gap acceptance, and site-specific issues.

Overall, the traffic data indicates that the raised safety plateaus treatments effectively maintain the speed below the default speed of 50 km/h where appropriately spaced. The council officers have not received any negative feedback about the implemented treatment, indicating a generally positive perception among residents and business owners.

The council officers highlighted the unavailability of evidence-based data to demonstrate whether the treatments have improved safety for pedestrians and cyclists.

6.4 Assessment of Low-Cost Treatments in Osborne Park

6.4.1 Traffic Data Analysis – Osborne Park

A full-week tube count survey was commissioned at 10 locations in Osborne Park, in the jurisdiction of the City of Stirling. The default speed in the area is 50 km/h.

The survey results indicate that the average 85th percentile speed in the area was approximately 53 km/h, above the default speed. This speed profile in the area is similar to the past speed survey results provided by MRWA.

Table 6.8 summarises the survey results recorded at all 10 locations. The 85th percentile speed was less than the default speed at only one out of the total 10 locations.

Figure 6.7 Traffic Survey Sites - Osborne Park

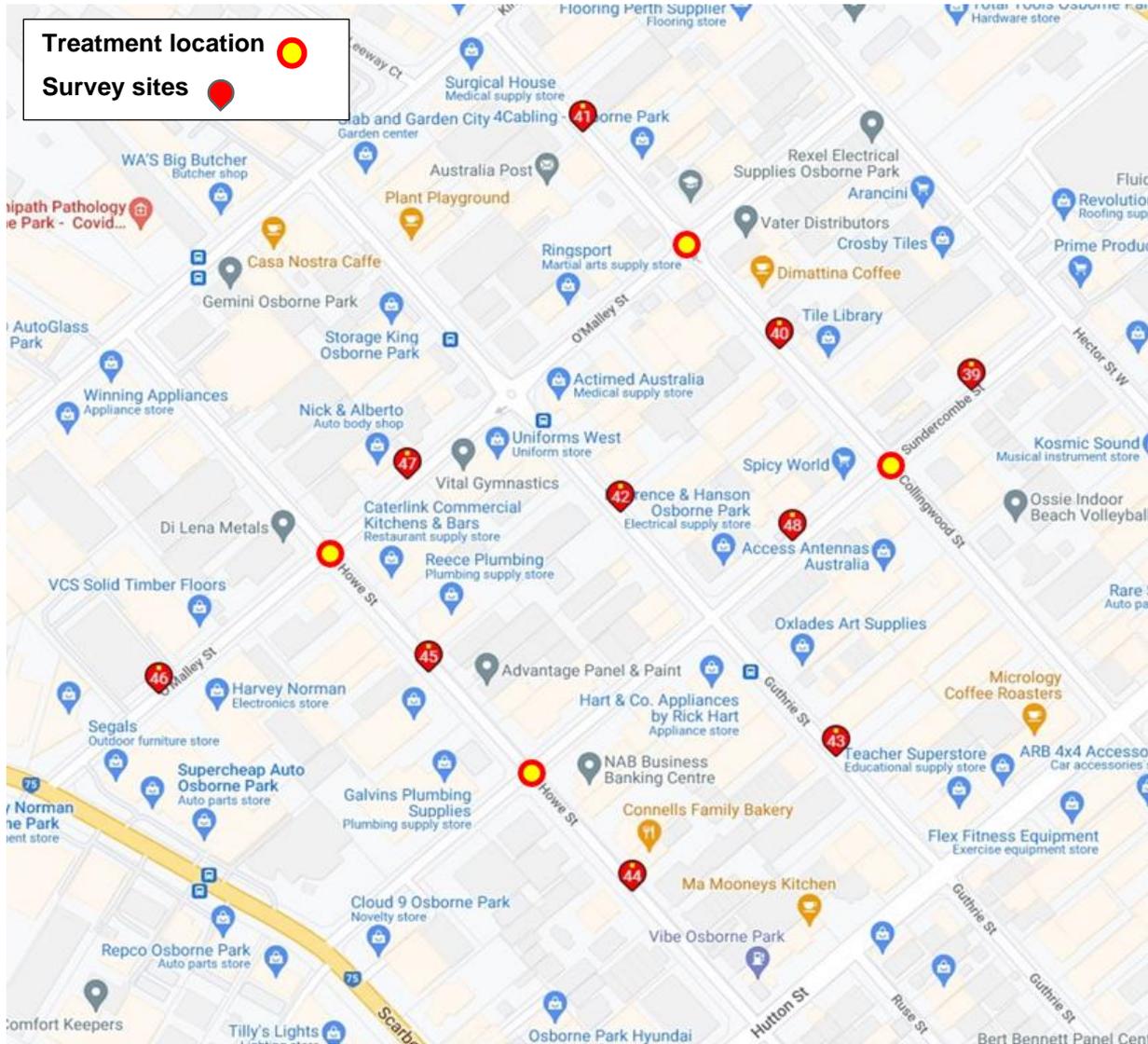


Table 6.8: Survey Result Summary - Osborne Park

Survey ID	Average Weekday Traffic	Average Weekend Traffic	85 th Percentile Speed (Full week)
39	1,302	344	51.3 km/h
40	2,968	752	53.1 km/h
41	1,975	492	56.2 km/h
42	3,409	841	54.9 km/h
43	4,229	1,031	54.4 km/h
44	4,013	751	53.6 km/h
45	3,215	655	53.1 km/h
46	1,639	636	55.3 km/h
47	1,743	539	51.3 km/h
48	1,725	376	44.1 km/h

6.4.2 Crash Data Analysis

MRWA has shared crash statistics for all project sites for a five-year period from 2017 to 2021. The crashes are classified as:

- Fatal
- Hospital
- Medical
- Major property damage only (PDO)
- Minor PDO

Table 6.9 summarises the crashes reported in the five-year (2017-2021) period at four intersections in the Osborne Park area of the City of Stirling. The compact roundabout treatment was implemented at all four intersections as part of the Low-Cost URSP.

It is evident that 21 crashes were reported in the Osborne Park area, including three hospitals, four medical, 13 major PDO and one minor PDO crash.

Osborne Park area has only four project sites but has the highest reported number of crashes, and a crash was reported at all project sites in this area.

Table 6.9: Crash Data Analysis - Osborne Park

Intersection	Fatal	Hospital	Medical	Major PDO	Minor PDO	Total
Howe Street and Sundercombe Street		1		3		4
Howe Street and O'Malley Street		1	4	5		10
Collingwood Street and Sundercombe Street				1		1
O'Malley Street and Collingwood Street		1		4	1	6
Total	0	3	4	13	1	21

6.4.3 Site Visit Assessment

ARRB carried out a detailed desktop review of the previous and existing intersection control before visiting all project sites in the Osborne Park area. The sites were visited in the first week of October 2022 to experience traffic behaviour and potential safety risks.

The following key points were observed:

- Osborne Park is a light-industrial area having higher heavy vehicle traffic than other sites in this study.
- There are minimum provisions for vulnerable road users.
- In the past, all four project sites either had Give Way or Stop sign controlled intersections with raised median and line markings.
- The implemented treatment at all four project intersections includes a fully mountable compact roundabout with warning signs and painted median islands.
- Many vehicles were observed not slowing down at the approach to the roundabouts.
- Vehicles were observed driving over the central island and using the intersections as a Give Way operation.
- Traffic signs were obstructed by vegetation at Sundercombe Street and Howe Street intersection, and O'Malley Street and Collingwood Street intersection.
- Past treatment line marking and water pooling were observed at O'Malley Street and Howe Street intersection.

Figure 6.8 shows a few pictures taken during the visit to the project sites in the Osborne Park area. Site assessment report for individual sites is provided in **appendix C.4**.

Figure 6.8 Site Assessment Pictures - Osborne Park



6.4.4 Findings and Discussion

Compact roundabouts were constructed at four intersections in the Osborne Park area as part of the Low-Cost URSP.

The implemented treatments were constructed using coloured asphalt with warning signs and painted median islands on all approaches. Considering the industrial area and high proportion of heavy vehicles, the central island at each site is fully mountable.

As per the Low-Cost URSP framework, the compact roundabouts discourage straight-line movement that can reduce speed and crash severity by 78.9%.

MRWA provided pre and post treatment speed comparisons at 14 locations in the Osborne Park area. The comparison was carried out by the City of Stirling and included:

- Pre-treatment speed survey results recorded either in April 2019 or April 2021.
- Post-treatment speed survey results recorded in September 2021.

The provided comparison indicates that out of 14 survey locations, speed reduction was observed at six locations, and speed remained the same or increased at eight locations. The comparison highlights that the treatments implemented have had a minimal impact on the speed trends in the area. (See **Appendix A.1**)

ARRB also commissioned post-treatment traffic surveys at 10 locations of interest to analyse the impact of the compact roundabouts on the area-wide speed. At nine out of 10 sites, the recorded speed was more than the default speed, and an average 85th percentile speed of 53 km/h was recorded at all ten survey sites.

The data indicate that the treatments implemented are ineffective in maintaining the area-wide speed below the default speed of 50 km/h.

The post-implementation crash data is not yet (at the time of writing) available; therefore, the evaluation of the impact of the implemented treatments on the crash trends was not able to be carried out. The analysis of crashes that occurred in the past five years (2017-2021) indicates a high crash rate in the area.

Twenty-one crashes were recorded at four project intersections, including three hospitals, four medical and 14 property damage. The number of reported crashes is significantly higher compared to other areas where low-cost treatments have been implemented. Considering the high crash rate, it is critical to keep monitoring the crash trends in Osborne Park and plan necessary safety interventions.

During the site visits, many vehicles were using the treated intersections as a Give Way control and driving through the central island in a straight line. This shows that fully-mountable central island and wide approach lanes are not effective in forcing drivers to slow down at the approaches or use the intersection as a roundabout priority. This factor may also increase the crash likelihood associated with poor driving behaviour and false expectations from other road users.

The community feedback is generally positive, as indicated by the council officers. They also highlighted that evidence-based data is not available to demonstrate whether the treatments have improved safety for pedestrians and cyclists.

Overall, the fully-mountable compact roundabout treatments do not show encouraging results in maintaining the area-wide speed below the default speed. It is suggested that MRWA should work with the City of Stirling to plan for additional treatments (e.g., speed cushions on minor approaches etc.) and regular monitoring of speed and crash trends in the area.

7 Lessons Learnt and Recommendations

MRWA has supported the implementation of safety treatments at 33 intersections in three local government jurisdictions under the Low-Cost Urban Road Safety Program. ARRB has been engaged to evaluate the effectiveness of the implemented treatments and consult with local councils to gauge community perception about the program.

As part of the evaluation, ARRB conducted traffic and crash data analysis, site visits of all project sites, and consultation with local governments. The following sections highlight the lessons learnt and recommendations for future rollouts under the URSP:

7.1 Uniform Treatments

It is noted from the evaluation that raised safety plateau treatments implemented in three local government areas do not have uniform characteristics.

Table 7.1 summarises the varying characteristics of the raised safety plateau treatments implemented as part of the Low-Cost URSP. The following points describe these key differences:

- Raised safety plateaus were constructed using typical black asphalt in the City of Rockingham, and coloured asphalt was used in the other two LGAs.
- At the time of site visit, raised profile markings were not installed in the North Perth area of the City of Vincent; instead, stop line markings were installed. However, MRWA has advised that sharks teeth mark is now installed at all road safety platforms in North Perth area.
- Give Way markings and signs on minor approaches were only installed in the Joondanna area of the City of Stirling.
- Raised profile warning signs with an advisory speed of 20 km/h were only installed in the City of Rockingham.

Table 7.1: Varying Characteristics - Raised Plateau Treatments

Raised Plateau Features	City of Rockingham	City of Vincent	City of Stirling	Comments
Asphalt construction	✓	✓	✓	Different colour asphalt
Raised profile marking	✓		✓	On all sides of the raised safety plateaus
Give Way marking			✓	Only on minor approaches
Stop line marking		✓		Stop line markings were installed at the treatment and not on the approaches to the intersection
Give Way signs			✓	Only on minor approaches
Raised Intersection warning signs	✓			On all approaches
Advisory speed	✓			On all approaches

Different treatment characteristics could impact the effectiveness level in different areas. It is suggested that MRWA consider developing standard layouts, including required signs, markings and overall scheme for

different low-cost treatments to achieve maximum benefits. This would assist LGAs to take the standard layouts as a base and make changes in the design based on site-specific constraints and it should aid cost efficiencies for implementing the program.

7.2 Consideration of Vulnerable Road Users

The evaluation of all 33 project intersections indicates that the implemented low-cost treatments have not directly considered or enhanced the safety of vulnerable road users, since the treatments primarily focus on slowing vehicles at the intersections. While lower speed environments are safer for pedestrians and other vulnerable road users, the implementation of the treatments showed no overt consideration for how vulnerable road users will have a safer road environment.

During the consultation with LGAs, council officers expressed uncertainty if the treatment aims to add to the safety of vulnerable road users significantly. Council officers also highlighted the absence of evidence-based data to demonstrate whether the treatments have improved safety for pedestrians and cyclists.

It is suggested that site-specific and area-wide vulnerable road user demands and needs are considered in the planning phase. The selection of treatment(s) should include elements that support the safer movement of vulnerable road users. For example:

- Use of sharrow marking will show the shared lane environment and enhance the safety of cyclists.
- Ensuring pram ramps are appropriately located and aligned and constructed to be suitable for people with special needs.
- Providing unobstructed sightlines for both drivers and pedestrians to improve detection to reduce the likelihood of a collision.
- Ensuring a reduction in vehicle speeds, rather than compliance with the default speed limit, particularly in residential areas, so crash severity is better aligned with established severity risk curves and adopted Safe System speeds.

7.3 Awareness of URSP

The council officers interviewed for this report lack awareness regarding the overall process of the Low-Cost URSP and how LGAs can play a role in implementing effective treatments. However, it is noted that MRWA held discussion in the past with participating LGAs to explain the program and its process.

Some council officers expressed ambiguity on MRWA's preferred community consultation criteria, i.e., information only or consultation as per LGA's consultation policy. The officers were also uncertain at what stage of the program they could provide inputs and if they could suggest local neighbourhood areas for consideration.

MRWA has published the Strategy and Implementation Framework of the Low-Cost URSP that provide detailed guidance on the overall process and consultation needs. However, it seems that council officers are not entirely across the framework resulting in a lack of understanding.

It is suggested that MRWA hold formal sessions for council officers to increase awareness of the program, its process and the role of local governments, and make these sessions widely known amongst councils. This will allow council officers to interact with the MRWA program manager and better understand the program's benefits and objectives.

7.4 Planning and Delivery Timeline

During the consultation with LGAs, some council officers highlighted that the project timeline was tight and did not allow consideration of alternate or additional treatments.

Council officers expressed that they would have planned, designed and delivered the treatments more effectively if more adequate time was available. They also suggested that MRWA should adopt a staged approach for the Low-Cost URSP, i.e. planning and design in the first year and delivery in the second year (a common theme amongst local government practitioners in other jurisdictions). This will allow LGAs to arrange resources, integrate delivery with other planned road works and have effective community consultation.

As suggested previously, MRWA sessions with LGAs provide an interactive discussion regarding the program timeline and expectations and would assist both stakeholders in discussing the challenges and constraints of LGAs and the expectations of Low-Cost URSP.

7.5 Pre and Post Treatment Analysis

It is important to analyse the impact of treatments on area-wide traffic demand, speed trends and crash reductions – potential and actual.

The Low-Cost URSP framework states that *'Pre and post-construction monitoring data will need to be provided, and funded, by Local Government. This will be the primary source of evidence for Main Roads to measure the safety performance of treatments'*.

However, it was noted from the evaluation study that none of the LGAs has carried out their own thorough assessment to evaluate the effectiveness of the implemented low-cost treatments in their jurisdictions. This is likely due to the recent construction of treatment and LGAs' perception that there may be no significant changes in the area-wide trends.

It is suggested that MRWA specify the evaluation process for every local neighbourhood area in the initial phases of the project. This will allow LGAs to record data required to be captured before the construction of treatments and provide more rigorous evaluation afterwards.

The evaluation process should include:

- Crash data to be analysed, e.g., three years prior and three years after the treatments are constructed.
- Location of interest where traffic data is to be recorded before and after the treatments are implemented. The locations should be selected to capture area-wide speed trends.
- Type of data to be collected, e.g., only speed and overall traffic demand or vehicle classification as well.
- Options for alternative data collection methods, e.g. Here/Google/Tom Tom traffic data for volume and speed, etc.

7.6 Combination of Treatment

Standalone treatments were constructed at all 33 project intersections as part of the pilot project of Low-Cost URSP indicates that. The data analysis, consultation with LGAs and site assessment indicates that Individual treatments may be effective at some intersection, however to achieve maximum road safety benefits combination of treatments should be considered. For example, compact roundabouts with painted median islands on approaches will provide drivers with a wider lane without requiring them to deflect from a straight-line movement. This type of treatment, if used in isolation, may not be effective in achieving desired safety objectives, as suggested via early analysis in this review.

It is suggested that MRWA consider the following additional low-cost treatments that are expected to enhance safety benefits for all road users:

- Speed cushions
- Kerb outstands
- Lane narrowing
- Sharrow marking
- Pram ramp upgrades

- Non-mountable median islands
- Other low-cost treatments

Over time, the establishment of appropriate before/after monitoring and analysis will permit MRWA to develop crash reduction factors (CRFs) for specific and combination/area wide treat programs. This will provide confidence in the direction to improving road safety in these types of areas and the value of return on the investment being made, via local government, to treat local roads and the risk posed to users.

7.7 Safe System Assessment – Treatment Options

Overall, the treatments implemented at 33 project intersections have supported and, in many instances, appear to have maintained the area-wide 85th percentile speed below the default in all areas except Osborne Park. However, available data and site assessment indicate that treatment designs at some locations may not significantly impact the speed, and at this time, the post-treatment crash data is not available to analyse the effect on crashes.

The council officers interviewed for this review also expressed ambiguity if the implemented treatments have enhanced the safety of vulnerable road users.

To achieve maximum benefits from the program, it is recommended that MRWA require a Safe System assessment for all project sites/treatments on a neighbourhood area basis. This will assist in ensuring that the proposed treatments are aligned with the Safe System principles (or as close as reasonably possible given the low-cost nature of the program treatments targeted) and, importantly, consider the need of all road users and identify site-specific issues that need to be addressed.

References

Main Roads Western Australia, *Strategy and Implementation Framework Low-Cost Urban Road Safety Program*, DD#24187, MRWA, Perth, WA.

Appendix A Data Provided to ARRB

A.1 Traffic Survey Data

Figure 7.1 Traffic Data - Osborne Park (provided by MRWA)

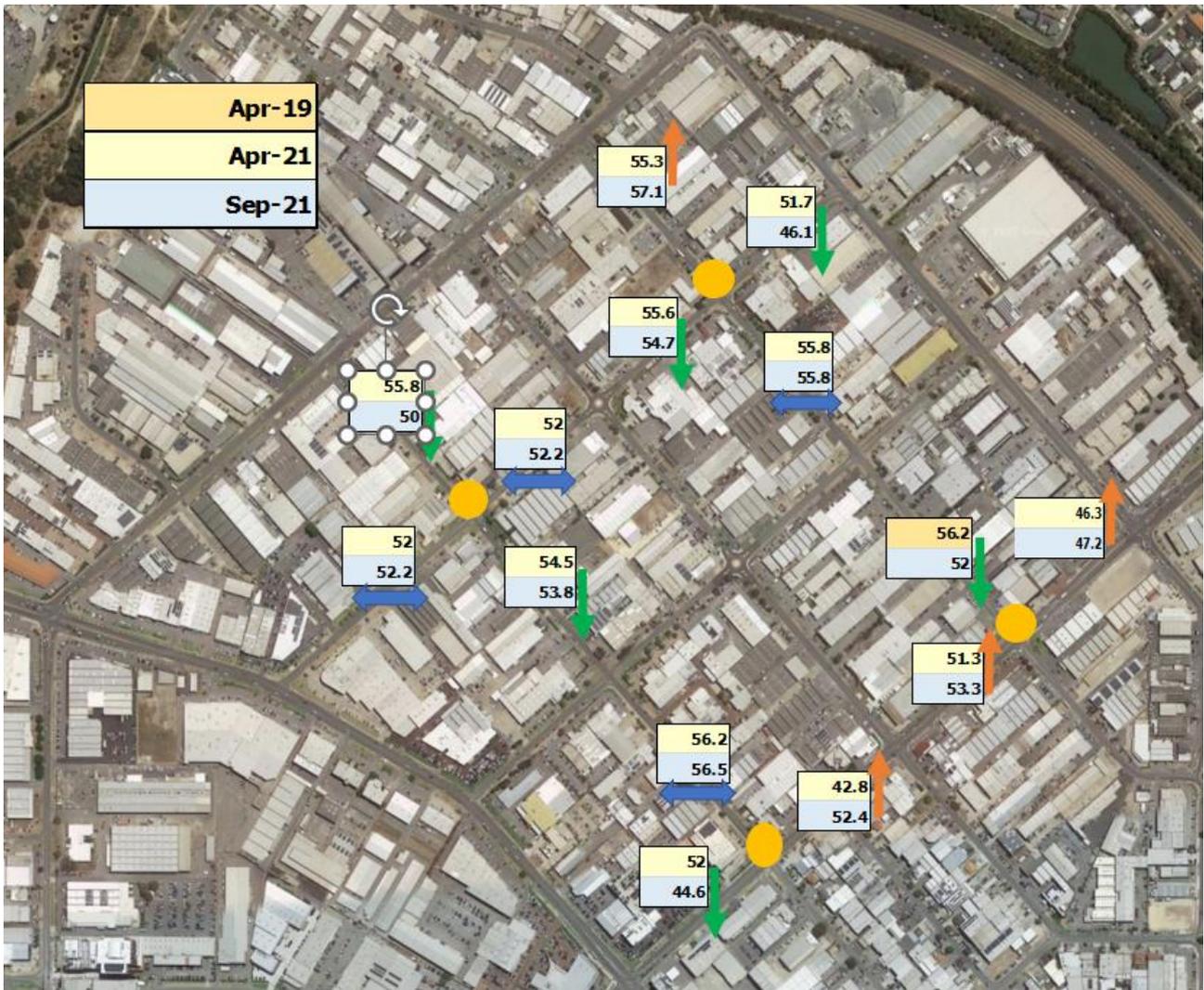
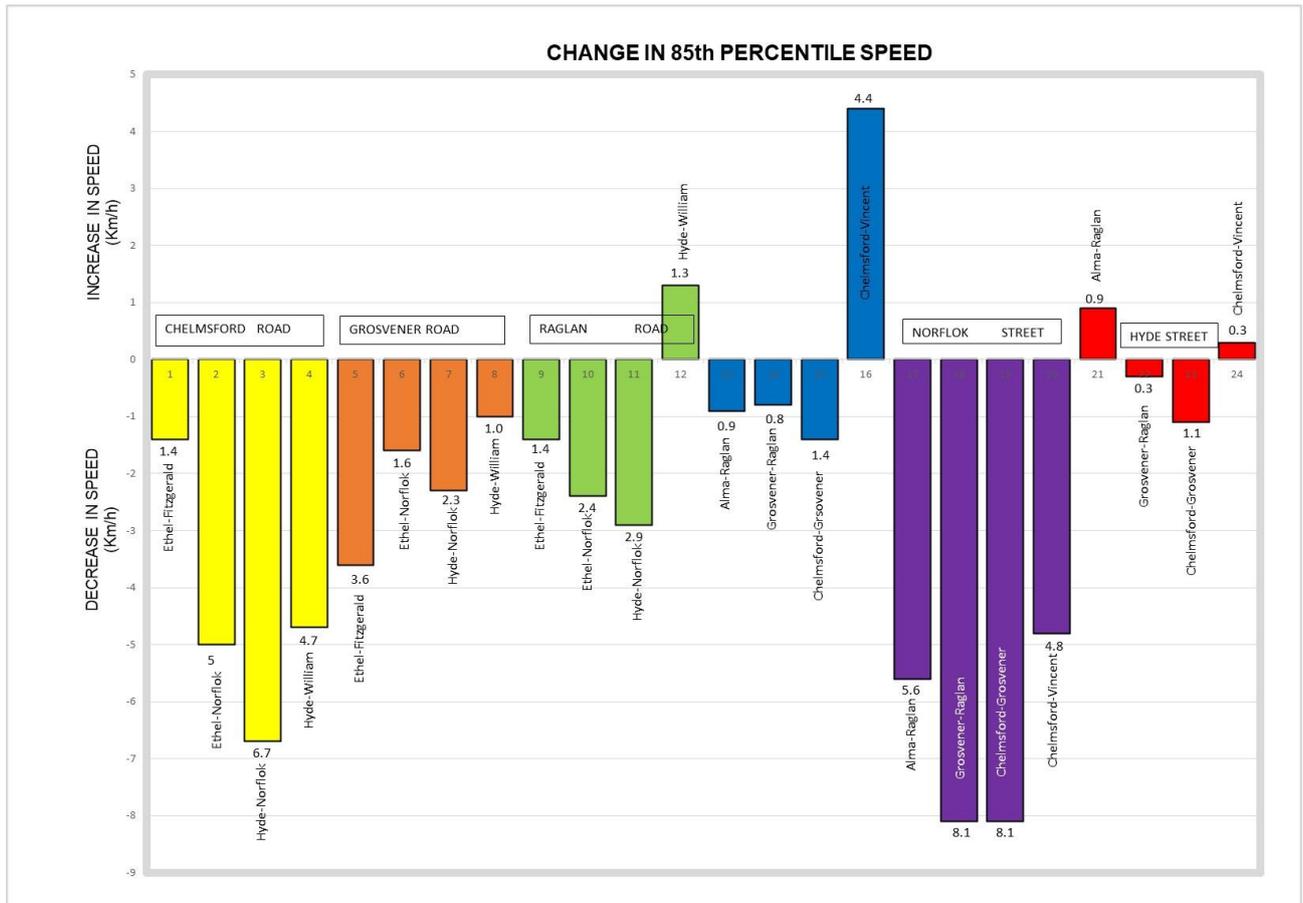


Figure 7.2 Traffic Data - North Perth (provided by MRWA)



Appendix B Traffic Survey Results

Figure 7.3 Traffic survey results - Waikiki and Cooloongup, City of Rockingham

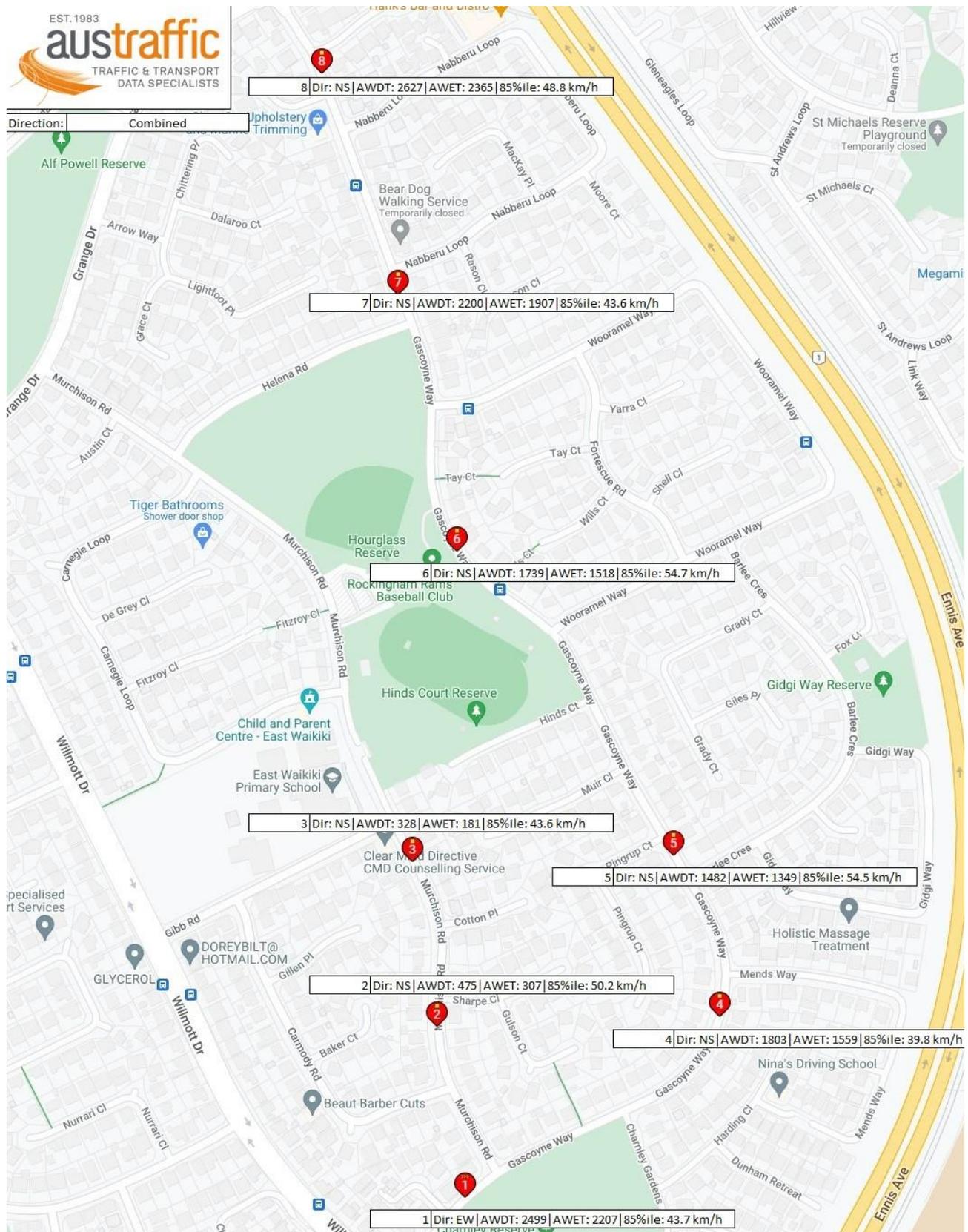


Figure 7.5 Traffic survey results - Osborne Park, City of Stirling



Figure 7.6 Traffic survey results - North Perth, City of Vincent



Appendix C Site Assessments

C.1 Site Assessment – Waikiki and Coo loongup Areas

C.2 Site Assessment – North Perth and Mount Lawley Areas

C.3 Site Assessment – Joondanna Area

C.4 Site Assessment – Osborne Park Area

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