

NELSON ROAD – PEDESTRIAN AND CYCLIST SAFETY INVESTIGATION

TAC ANALYSIS GRANT

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NELSON ROAD– PEDESTRIAN AND CYCLIST SAFETY INVESTIGATION

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CONTENTS

1	INTRODUCTION	4
2	DATA COLLECTION	18
3	CONSULTATION	21
4	SAFE SYSTEM PRINCIPLES FOR PEDESTRIANS AND CYCLISTS	22
5	IDENTIFICATION OF POTENTIAL SOLUTIONS	26
6	REVIEW, REFINEMENT AND DEVELOPMENT OF CONCEPT DESIGNS	35
7	PERFORMANCE EVALUATION FRAMEWORK	43
8	CONCLUSIONS AND RECOMMENDATIONS	45
APPENDIX A: CRASH DATA & ANALYSIS		46
APPENDIX B: WORKSHOP SUMMARIES		54
APPENDIX C: PRELIMINARY DESIGN OPTIONS EVALUATION FRAMEWORK		69
APPENDIX D: CONCEPT LAYOUTS		73
APPENDIX E: ROAD SAFTY AUDIT		90
APPENDIX F: TREATMENT PRIORITISATION		116

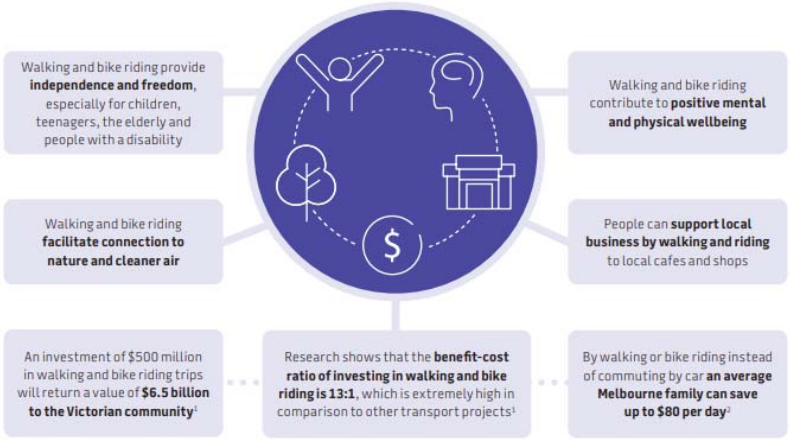
1 INTRODUCTION

Walking is a crucial form of transport, whether on its own, or as part of a longer journey that integrates other modes (public transport, bicycle or motor vehicle). In Melbourne, 'almost two-thirds of total transport trips under 1 km are walked. However, people will commonly walk more than a kilometre, with almost one third of all trips between 1 and 2 km in length walked'[1].

Enabling people to walk and ride as a part of their daily lives builds the communities people want to live in, where places are more welcoming, and people feel connected and safe.[2]

Similarly, in Whitehorse over 60% of people walk as part of their trip under 1 km, and over 25% walk as part of their trip between 1 – 2 km. Around 2% of people choose to cycle as part of their trip between 1 – 2 km and also between 3 – 4 km, while around 1% of people choose to cycle as part of their trip for longer distances[3].

In addition to community health and vibrancy benefits, it is observed that "walking and cycling are essential to the success of revitalisation strategies". Further, it is suggested that "a well-designed, quality street environment that promotes walking, cycling and public transport is good for business", the local economy and also supports increased property values, and that "high quality pedestrian and cycling conditions are absolutely integral to retail and business success in Activity Centres"[4]. It is also recognised that 'the importance of enhancing the safety and convenience of walking for older pedestrians will grow as the older population in Victoria continues to increase'[5].



SOURCE: AMY GILLETT FOUNDATION ET AL. *STREETS ARE FOR EVERYONE, A CONSENSUS STATEMENT TO SUPPORT MORE WALKING AND BIKE RIDING FOR VICTORIANS*

FIGURE 1: BENEFITS OF WALKING AND BIKE RIDING

[1] Eady, J and Burtt, D 2019, *Walking and transport in Melbourne Suburbs*, Victoria Walks, Melbourne.
[2] Amy Gillett Foundation, Bicycle Network, Cycling and Walking Australia and New Zealand, IPAN - Deakin University, Heart Foundation, Monash University – School of Public Health and Preventive Medicine, Municipal Association of Victoria, ORIMA research, Parents' Voice, Royal Automobile Club of Victoria (RACV), VicHealth, Victoria Walks, We Ride Australia, 2021, *Streets are for everyone, A consensus statement to support more walking and bike riding for Victorians*.
[3] Department of Transport 2019, *Victorian Integrated Survey of Travel & Activity (VISTA)*, <https://public.tableau.com/profile/vista#!>.
[4] Tolley R, 2011, *Good for Busine$$, The benefits of making streets more walking and cycling friendly*, National Heart Foundation of Australia.
[5] Mantilla, J. and Burtt, D, 2016, *Safer Road Design for Older Pedestrians*, Victoria Walks, Melbourne, Version 1.1.

1.1 PROJECT OBJECTIVE AND APPROACH

This Analysis Project investigated pedestrian and cyclist safety along Nelson Road between Whitehorse Road and Severn Street (Figure 2), and identified potential improvements along the corridor to address and support vulnerable road user safety.

The project approach involved:

- Data collection and analysis
  - Review of background materials
  - Feature survey
  - Analysis of casualty crash data
  - Consultation with the Project Working Group
- Development of preliminary concepts
- Development of an evaluation framework for comparing preliminary concepts
- Development of concept design plans (including Road Safety Audit)
- Development of a prioritisation framework.
- Development of a performance evaluation framework.

1.2 BACKGROUND AND STUDY AREA

Nelson Road provides connection and access within the Box Hill Metropolitan Activity Centre (MAC) to:

- the medical precinct, including Box Hill Hospital and Epworth Eastern Hospital
- key education sites of Box Hill Institute
- Box Hill Gardens
- residential and hotel developments.

Box Hill train station, Box Hill Central shopping centre, and the Box Hill Central Neighbourhood (Precinct 1 in the draft MAC draft Structure Plan[6]) are located just south of the study area, while Hagenauer Reserve is located to the north-west of the study area with Hagenauer Walkway providing a pedestrian and cyclist connection to Nelson Road north of Severn Street.

The Whitehorse City Council Integrated Transport Strategy, Cycling Strategy, and Box Hill Structure Plan all recognise and identify the importance of active transport, as well as community safety, accessibility and amenity.



BASE IMAGE SOURCE: NEARMAP (REPRODUCED WITH PERMISSION)

FIGURE 2: STUDY AREA SITE & KEY NEARBY NEIGHBOURHOOD LOCATIONS

[6] MGS Architects, *Box Hill Metropolitan Activity Centre to 2036 Draft Structure Plan*, May 2020.

The Box Hill MAC Integrated Transport Strategy [7] recognises Nelson Road as a key walking and cycling route. Nelson Road 'forms part of one of Council's Easy Ride (low stress) Cycling Routes through the municipality', is part of the Principal Bicycle Network, and is identified as a Strategic Cycling Corridor.

1.3 CONTEXT

1.3.1 Australia's National Road Safety Strategy

Australia's *National Road Safety Strategy 2021–2030 (NRSS)*[8] represents Australian governments at all levels 'commitment to deliver significant reductions in road trauma, putting Australia on a path to achieve 'Vision Zero' or zero deaths and serious injuries on our roads by 2050'. The Strategy aims to halve road deaths and reduce serious injuries by at least 30% by 2030. It 'continues the commitment to the Safe System approach and strengthening all elements of our road transport system under three key themes: Safe roads, Safe vehicles and Safe road use'.

The Strategy recognises the importance of supporting local government road safety. It is noted that one of the actions under the Infrastructure planning and investment priority is to 'deliver measurable improvements in safety through infrastructure funding at all government levels and support local governments to embed and deliver road safety into their business as usual'.

Note, the National Road Safety Action Plan for 2021 – 2025 'will set out actions all governments will take to address the priorities of the National Road Safety Strategy 2021-30 during the first five years. It is anticipated the action plan will include safety performance indicators to benchmark progress and ensure that interventions are working'.

The previous *National Road Safety Action Plan 2018-2020* outlined priority national actions and other critical actions. For local government, this included (with key actions relevant for this project circled):

- Priority Action 1: Review speed limits on high risk regional and remote roads, in consultations with the community
- Priority Action 2: Target infrastructure funding towards safety-focused initiatives to reduce trauma on regional roads
- Priority Action 3: Implement safety treatments to reduce trauma from crashes at urban intersections
- Priority Action 6: Reduce speed limits to 40 km/h or lower in pedestrian and cyclist places
- Critical Action A: Set safety plans for high risk corridors within the network to direct investment to reduce fatal and serious injury risk
- Critical Action B: Apply Safe System principles and treatments to all road infrastructure investment programs
- Critical Action J: Remote road safety – identify and implement key interventions.

[7] City of Whitehorse, *Box Hill MAC Integrated Transport Strategy*, October 2020.
[8] Commonwealth of Australia 2021, *National road safety strategy 2021-2030*, Department of Infrastructure, Transport, Regional Development and Communications, Canberra, ACT

1.3.2 Victorian Road Safety Strategy

The *Victorian Road Safety Strategy 2021–2030*[9] 'commits to the ambitious target of eliminating death from our roads by 2050, with the first step of halving road deaths by 2030'. The Strategy 'also seeks to reduce the incidence of serious injury resulting from road crashes'. The Strategy focuses on:

- *supporting and enforcing safer driver behaviour*
- *removing unsafe vehicles from our roads*
- *vulnerable and unprotected road users*
- *improving safety on high speed roads and at intersections and reducing the underlying risk*
- *increasing safety for those using the road for work or at work*
- *recognising the importance of post-crash care.*

1.3.3 Victorian Cycling Strategy

Victoria's Cycling Strategy[10] 2018-2028 aims to *increase the number, frequency and diversity of Victorians cycling for transport by:*

- *Investing in safer, lower stress, better-connected network, prioritising strategic corridors*
- *Making cycling a more inclusive experience.*

The Victorian strategy prioritises strategic cycling corridors but recognises that neighbourhood cycling connections are essential to provide safe access to local destinations.

1.3.4 Plan Melbourne

Plan Melbourne[11] is Melbourne's metropolitan planning strategy that defines the future shape of the city and suburbs to 2050 by integrating long-term land use, infrastructure and transport planning in order to meet Melbourne's future environmental, population, housing and employment needs. It outlines:

If 20-minute neighbourhoods existed across Melbourne, it could reduce travel by nine million passenger kilometres and cut Melbourne's daily greenhouse gas emissions by more than 370,000 tonnes

- 9 principles – to guide policies and actions
- 7 outcomes – to state the ambitions of the plan
- 32 directions – to outline how the outcomes will be achieved
- 90 policies – to detail how directions will be turned into actions

Policies that relate to walking and cycling include:

- Policy 3.1.6 Support cycling for commuting
- Policy 3.3.1 Create pedestrian-friendly neighbourhoods

[9] State of Victoria Department of Transport, *Victorian Road Safety Strategy 2021–2030*
[10] Transport for Victoria 2017, *Victorian Cycling Strategy 2018-28, Increasing cycling for transport*
[11] State of Victoria Department of Environment, Land, Water and Planning 2017, *Plan Melbourne 2017-2050*

- Policy 3.3.2 Create a network of cycling links for local trips
- Policy 3.3.3 Improve local transport choices
- Policy 3.3.4 Locate schools and other regional facilities near existing public transport and provide safe walking and cycling routes and drop-off zones
- Policy 4.1.2 Integrate place-making practices into road-space management
- Policy 5.1.1 Create mixed-use neighbourhoods at varying densities
- Policy 5.1.2 Support a network of vibrant neighbourhood activity centres
- Policy 5.2.1 Improve neighbourhoods to enable walking and cycling as a part of daily life

Plan Melbourne identifies the need for safe and walkable neighbourhoods and suburbs in order to support strong and healthy communities (Principle 7 and Direction 5.2). It also identifies creation of 20-minute neighbourhoods (Direction 5.1) in order to support reduced dependence on car travel, increase opportunities for people to engage in active travel, provide opportunities for local jobs, social interaction and community participation. Plan Melbourne identifies Box Hill as a 'Metropolitan activity centre'.



SOURCE: DEPARTMENT OF ENVIRONMENT, LAND, WATER AND PLANNING 2019, *20-MINUTE NEIGHBOURHOODS, CREATING A MORE LIVEABLE MELBOURNE*

FIGURE 3: FEATURES OF A 20-MINUTE NEIGHBOURHOOD

1.3.5 Whitehorse City Council strategic documents

Key Whitehorse City Council strategic documents, including the Integrated Transport Strategy, Cycling Strategy, and Structure Plan all recognise and identify the importance of active transport, as well as community safety, accessibility and amenity.

Council Vision and Plan

The Whitehorse *Council Vision 2013-2023*[12] describes community aspirations, and outlines five strategic directions that guide the long-term planning and delivery within the municipality, based on these aspirations. The directions are:

1. Support a healthy, vibrant, inclusive and diverse community.
2. Maintain and enhance our built environment to ensure a liveable and sustainable city.
3. Protect and enhance our open spaces and natural environments.
4. Strategic leadership and open and accessible government.
5. Support a healthy local economy.

These directions underpin a series of goals and approaches (strategies) for achieving those goals in the *Council Plan 2017-2021*[13].

Draft Structure Plan

The Box Hill Draft Structure Plan[14] outlines the *Vision for Box Hill*, 'and proposes a suite of objectives, strategies, land use and development controls by which this vision will be achieved'.

Box Hill Metropolitan Activity Centre (BHMAC) is the largest Metropolitan Activity Centre (MAC) in Melbourne's eastern region. Box Hill is forecast to experience considerable growth in population, jobs and housing.

The Plan articulates a series of neighborhoods in order to support decision making and development across the municipality. Nelson Road forms the boundary of the Health and education neighborhood (Precinct 2) and the Garden neighborhood (Precinct 4) with the south-eastern extent of the corridor transitioning to the Central neighborhood (Precinct 1) (see Figure 4).

Vision for Box Hill

Box Hill is the pre-eminent urban centre for Melbourne's east. The centre supports a regionally significant focus for health, education and employment serviced by a major public transport hub. It provides a diverse and growing range of business, retail, entertainment, community and living opportunities.

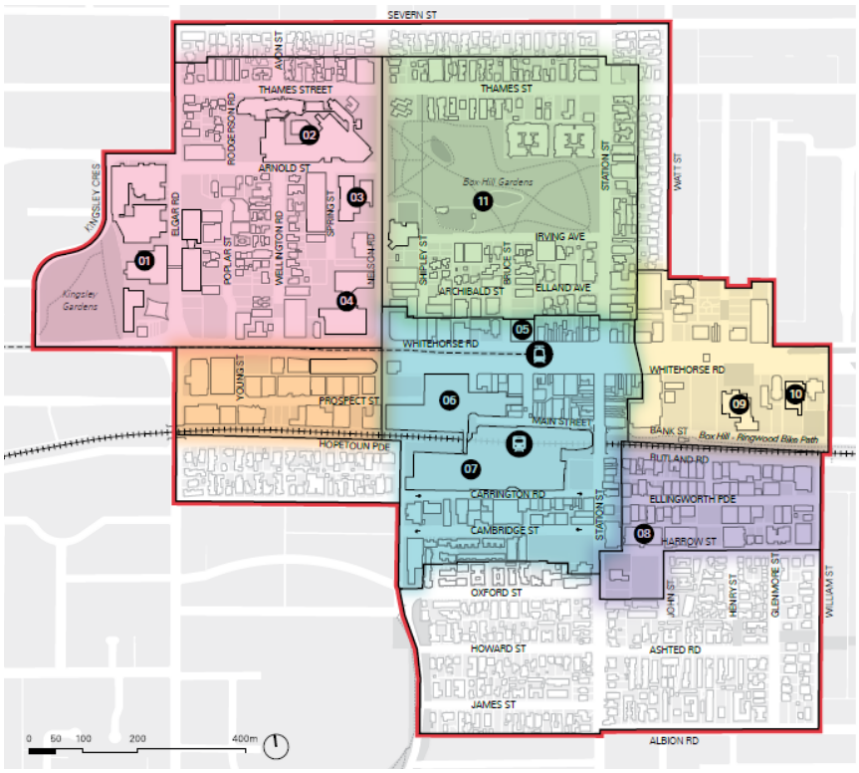
An interconnected network of complementary and distinctive, accessible and vibrant neighbourhoods respond to the diverse community's desire for sustainable, engaging, safe, caring and healthy places. Future change in Box Hill will deliver a people-friendly environment with open and welcoming public spaces for all.

- Box Hill Metropolitan Activity Centre to 2036 Draft Structure Plan

[12] City of Whitehorse, *Council Vision 2013–2023* <https://www.whitehorse.vic.gov.au/about-council/what-we-do/publications/corporate-documents/council-vision>
[13] City of Whitehorse, *Council Plan 2017–2021, Year Four* <https://www.whitehorse.vic.gov.au/about-council/what-we-do/publications/corporate-documents/council-plan>
[14] MGS Architects, May 2020, *Box Hill Metropolitan Activity Centre to 2036 Draft Structure Plan*.

In the Development Framework (Chapter 5), Nelson Road:

- is a primary pedestrian axis and bicycle route, with other primary and local pedestrian routes connecting along the corridor length (*Land use and development framework* and *Transport and movement framework*)
- features institutional mid-rise on the western side, while the eastern side features intensified (higher-rise), diversified (low- to mid-rise) and residential (low-rise) transition (*Built form and design framework*)
- features increased tree canopy cover to support 'climate change resilience and provide comfort for the community along key pedestrian routes' (Public realm and open space framework).



SOURCE: MGS ARCHITECTS, MAY 2020, *BOX HILL METROPOLITAN ACTIVITY CENTRE TO 2036 DRAFT STRUCTURE PLAN*

FIGURE 4: DISTINCTIVE NEIGHBOURHOODS OF BOX HILL

The Precinct Plans (Chapter 6) identify Nelson Road as (1) a preferred future bicycle route and (2) an existing primary walking link. The Precinct Plans outline 'objectives and guidelines towards achieving the vision for each of Box Hill's neighbourhoods'. Precinct guidelines relating to Nelson Road include (drawn from the guidelines for Central, Health and Education, and Garden neighbourhoods):

- Support the establishment of Nelson Road as a primary bike and pedestrian connection, noting that development 'should provide active street frontages and prioritise pedestrian and cyclist movement over vehicle access along those street frontages' (i.e., crossovers are strongly discouraged)
- Integrate proposed shared path (or separate bicycle lane)

- Provide adequate spaces for formal pedestrian crossings
- Introduce additional planting to increase environmental comfort for pedestrians and cyclists.



SOURCE: MGS ARCHITECTS, MAY 2020, *BOX HILL METROPOLITAN ACTIVITY CENTRE TO 2036 DRAFT STRUCTURE PLAN*, COMBINED PRECINCT MAPS (CENTRAL, HEALTH & EDUCATION AND GARDEN)

FIGURE 5: PRECINCT MAP (ALONG NELSON ROAD)

Integrated Transport Strategy

Box Hill MAC Transport Vision

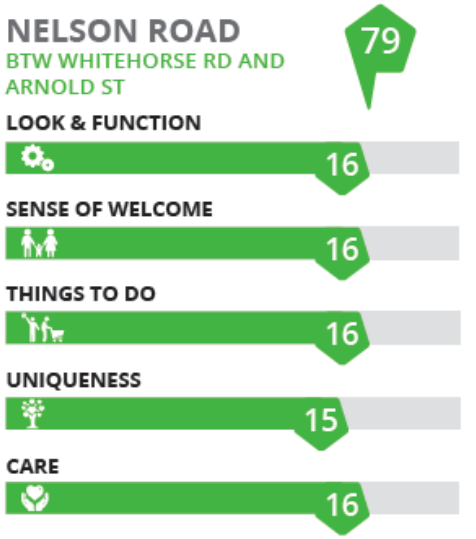
An integrated, safe and accessible transport system, providing a range of sustainable and efficient ways for people and goods to move around, allowing and promoting Box Hill to thrive as the pre-eminent urban centre for Melbourne's east.

- Box Hill MAC Integrated Transport Strategy

The Box Hill MAC Integrated Transport Strategy[15]' key outcomes include supporting walking, cycling and public transport journeys, and it identifies Nelson Road as a 'primary walking and cycling north-south route'.

The *Issues & Opportunities Report*[16] noted the following in relation to the Nelson Road corridor:

- There is poor pedestrian and cycling connectivity over the railway line along the Nelson Road and Thurston Street-Surrey Drive corridor
- a high number of crashes occur at the Nelson Rd/Thames St and Nelson Rd/Whitehorse Rd intersections
- Pedestrian and cyclist casualty crashes are a concern along Nelson Road
- Movement and Place assessment found 'most of the issues that need to be addressed with the MAC are pedestrian related', which was also the case for the Nelson Road corridor
- high pedestrian volumes 'surrounding the activity centre core, including Box Hill Mall and Nelson Road medical and education precinct'
- a lack of safe cycling infrastructure may be contributing to cyclist crashes and a low journey to work cycling mode share.



SOURCE: PLACESCORE 2019, *BOX HILL METROPOLITAN ACTIVITY CENTRE TOWN CENTRE COMMUNITY INSIGHTS REPORT*

FIGURE 6: NELSON ROAD PLACE ATTRIBUTES

Community engagement undertaken during the preparation of the Integrated Transport Strategy looked at 'Which place attributes are most important to you in your ideal town centre' and also 'How is each place attribute impacting your personal enjoyment of this place?'

[15] City of Whitehorse, October 2020, *Box Hill MAC Integrated Transport Strategy*.
[16] AECOM, October 2019, *Box Hill Integrated Transport Strategy Issues and Opportunities Report*.

In relation to Nelson Road, the research found that improvements should focus on (Figure 8):

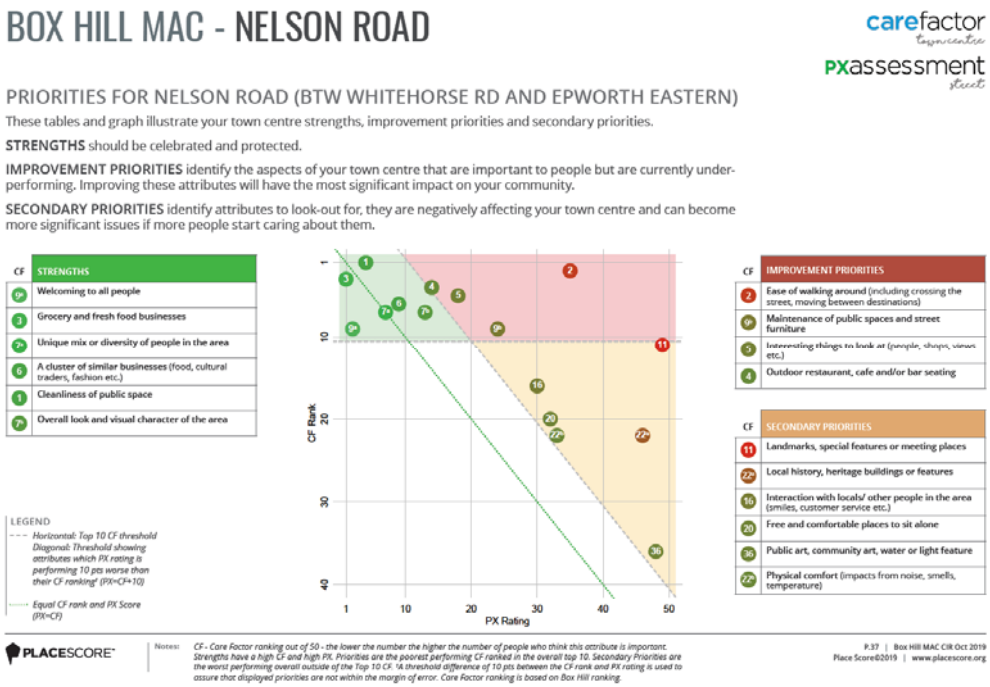
- Priority 1 – Ease of walking around (including crossing the street, moving between destinations)
- Priority 2 – Maintenance of public spaces and street furniture
- Priority 3 – Interesting things to look at (people, shops, views etc.)

The ITS outlines primary walking corridors, cycling corridors, and opportunities for improved road crossings for pedestrians. Those in the vicinity of the Nelson Road project corridor are shown in Figure 7.



SOURCE: FIGURES 11, 14 & 20 COMBINED FROM CITY OF WHITEHORSE, OCTOBER 2020, *BOX HILL MAC INTEGRATED TRANSPORT STRATEGY*

FIGURE 7: WALKING ROUTES, CYCLING ROUTES AND OPPORTUNITIES FOR IMPROVED ROAD CROSSINGS



SOURCE: PLACESCORE 2019, *BOX HILL METROPOLITAN ACTIVITY CENTRE TOWN CENTRE COMMUNITY INSIGHTS REPORT*

FIGURE 8: NELSON ROAD PRIORITIES

Cycling Strategy and Easy Ride Routes

The *Whitehorse Cycling Strategy*[17] "has a vision of increasing cycling through creating a connected network of attractive, safe and inviting low stress streets and paths which are accessible to all and respects the needs of all users".

The Strategy identified Nelson Road as LTS3, which accommodates 'Enthused and confident' and 'Strong and fearless' rider types.

Nelson Road is part of the Principal Bicycle Network, and is identified as a Primary Route (C1) Strategic Cycling Corridor (SCC). Nelson Road forms part of one of Council's Easy Ride (low stress) Cycling Routes through the municipality (Easy Ride Route 'North South 2'[18]).

Community Road Safety Strategy

The *Community Road Safety Strategy*[19] identifies road safety priorities for Whitehorse, including:

1. Pre-school and school aged children
2. Youth (road users aged 16-25 years)
3. Vulnerable road users, such as cyclists, pedestrians and motorcyclists
4. Road users with limited mobility, such as the elderly and disabled
5. Safe vehicles
6. Risky behaviour, such as speeding, drink and drug driving, and fatigue
7. Safe roads, footpaths and off-road paths.

Walking and cycling improvements along the Nelson Road corridor align with a number of actions outlined in the strategy, including:

- Action 3.8: *Continue to carry out works throughout the Box Hill Central Activities Area to improve the safety and accessibility of pedestrians and cyclists*
- Action 7.3: *Encourage walking as a safe, healthy and sustainable mode of transport by improving infrastructure in high pedestrian areas*
- Action 7.4: *Prioritise actions within Council's key strategic planning documents … to improve the safety and accessibility of pedestrians and cyclists*
- Action 7.5: *Ensure road and path infrastructure meets the needs of senior pedestrians and those with limited mobility*.

Parking Strategy (2014) and Review (2018)

The 2014 *Parking Strategy*[20] identified a range of issues relating to parking, and 38 Strategy Recommendations to improve parking within the Box Hill MAC and surrounds. High parking demand was noted along Nelson Road and the surrounding network. Strategy recommendations along the Nelson Road corridor included short-term fee parking along both sides of Nelson Road between Whitehorse Road and Thames Street.

[17] City of Whitehorse, *Whitehorse Cycling Strategy 2016*
[18] Ride with GPS 2022, *Easy Ride Route North South 2* <www.ridewithgps.com/routes/34279226>
[19] City of Whitehorse, *Whitehorse Community Road Safety Strategy 2013*
[20] GTA Consultants June 2014, *Box Hill Central Activities Area, Car Parking Strategy*

The 2018 *Box Hill Car Parking Strategy Implementation*[21] reviewed of number of the 2014 recommendations, including those along the Nelson Road corridor. The 2018 review supported the previous recommendation of implementing short-term (2-hour) parking.

1.3.6 Safe System

A safe road network is critical for all road users. The Safe System approach to road safety management recognises that humans make errors, that crashes will continue to occur and that humans have a limited tolerance to impact forces[22]. Safe System principles have been acknowledged in successive national road safety strategies and action plans since 2003 as the guiding principles for road safety programs in Australia.

> The Safe System approach recognises that people make mistakes, that crashes will continue to occur and that humans have a limited tolerance to impact forces. The approach seeks to eliminate the potential for fatal and serious injury crashes

A Safe System approach seeks to eliminate the potential for fatal and serious injury (FSI) crashes, and where this is not possible treatments that seek to minimise the incidence and/or severity of crashes are considered. The Safe System Assessment Framework outlines a Safe System-based hierarchy of solutions for run-off-road, head-on, intersection and 'other' vehicle type crashes, as well as treatments for pedestrian and cyclist crashes.

Very low speed limits/speed environments are required to protect vulnerable road users in accordance with Safe System principles. An impact speed of 30 km/h is recognised as the Safe System speed for vulnerable or unprotected road users (pedestrians, cyclists, motorcyclists). 'A Safe System speed is defined as the maximum survivable speed upon impact where the chance of death is less than 10%'[23].

> *Implementation of Safe System involves first consideration of solutions which eliminate occurrence of fatal and serious injuries (primary solutions). In some situations, such options will not be feasible due to project constraints dictated by budget, site, conflicting road user needs, or the environment. If so, the next safest project-feasible solution needs to be identified (supporting solutions). This process requires a clear Safe System-based hierarchy of solutions*[2].

The *Safe System Assessment Framework* outlines a Safe System-based hierarchy of solutions for run-off-road, head-on, intersection and 'other' vehicle type crashes, as well as treatments for pedestrian and cyclist crashes (See Section 4).

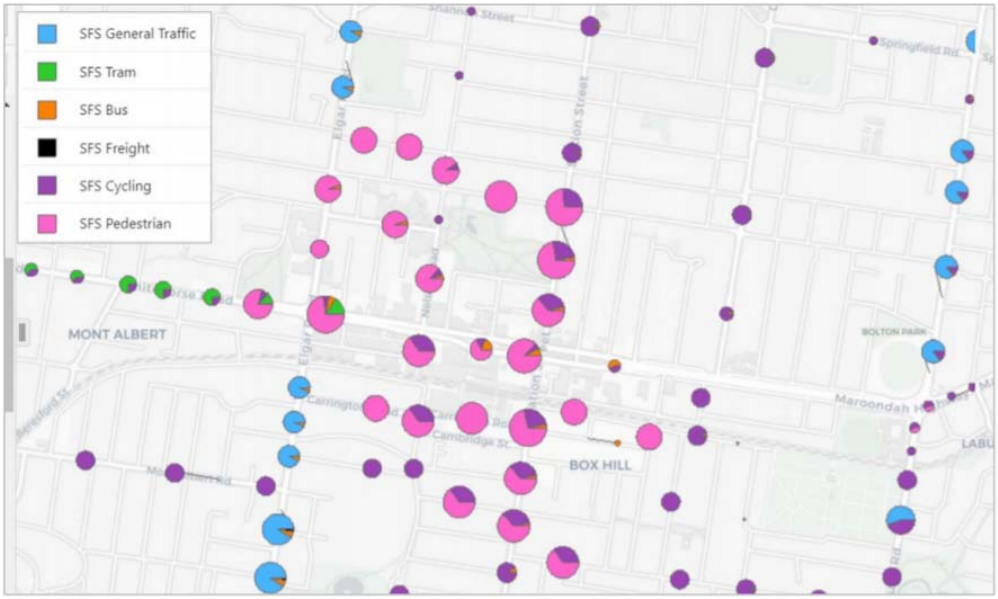
1.3.7 Movement and Place

It is important to consider the function of the road within the surrounding road network and how it performs its function to meet the community's, as well as users' needs.

[21] O'Brien Traffic July 2018, *Box Hill Car Parking Strategy Implementation*
[22] Safe System principles have been acknowledged in successive national road safety strategies and action plans since 2003 as the guiding principles for road safety programs in Australia. The Safe System framework is key to the National Road Safety Strategy 2011–2020 (Australian Transport Council 2011) as well as Austroads guides.
[23] Austroads 2016, *Safe System Assessment Framework*, AP-R509-16, Austroads, Sydney, NSW

The movement and place framework helps to manage priorities relating to 'facilitating the movement of people and goods' and 'acting as places for people'[24]. *Movement and Place in Victoria*[25] provides a framework for assessing Movement and Place. Various movement and place strategies may be implemented to improve aspects such as road safety, vehicle travel time, connectivity for pedestrians and cyclists, etc. In the context of the Nelson Road corridor project, the focus would be to balance the community's needs through supporting active and public transport, supporting the movement of motorised traffic, and support safety, health and well-being and environmental sustainability.

Whitehorse City Council participated in a VicRoads Movement and Place Trial in 2018, during which draft Strategic Focus Scores (SFS) for movement aspects were established[26]. The results of this analysis found that 'most of the issues that need to be addressed with the MAC are pedestrian related', which was also the case for the Nelson Road corridor.



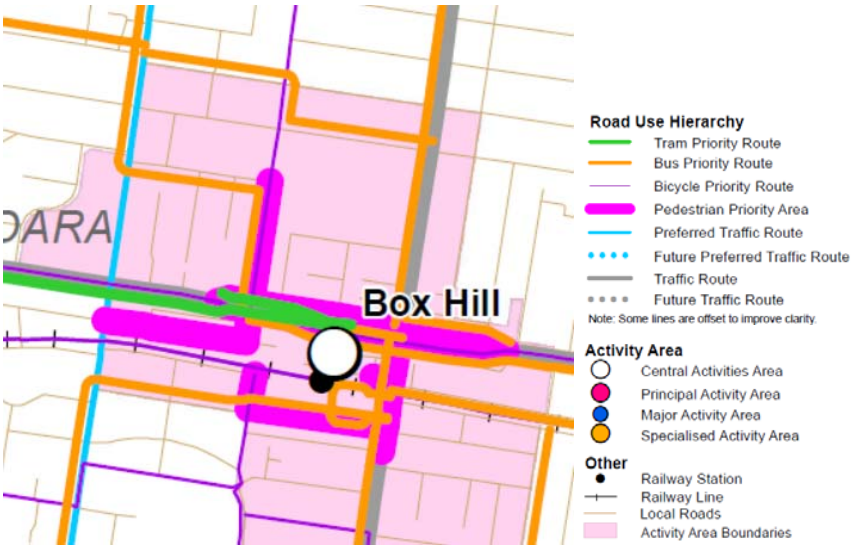
SOURCE: AECOM 2019, *BOX HILL INTEGRATED TRANSPORT STRATEGY ISSUES AND OPPORTUNITIES REPORT*

FIGURE 9: DRAFT STRATEGIC FOCUS SCORE FOR MOVEMENT WITHIN BOX HILL

[24] Austroads 2016, *Guide to Traffic Management Part 4: Network Management*, AGTM04-16, Austroads, Sydney, NSW.
[25] State of Victoria Department of Transport 2019, *Movement and Place in Victoria*, Department of Transport, Melbourne
[26] AECOM 2019, *Box Hill Integrated Transport Strategy Issues and Opportunities Report*

1.3.8 SmartRoads

SmartRoads provides a framework that integrates road, transport and surrounding land use management. The SmartRoads priority map for the City of Whitehorse[27] identified Box Hill as a Central Activity Centre and Nelson Road as a pedestrian priority area, bicycle priority route and bus priority route.



SOURCE: VICROADS 2012, SMARTROADS PRIORITY MAP: CITY OF WHITEHORSE

FIGURE 10: BOX HILL SMARTROADS PRIORITY MAP

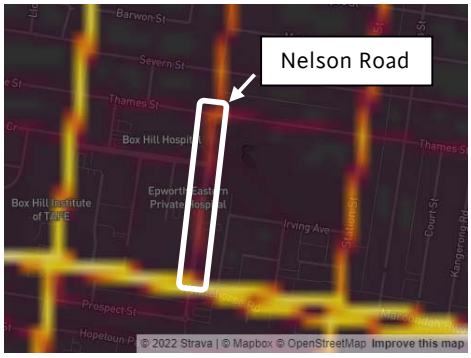
1.3.9 Walking and cycling demand

An indicative level of walking and cycling demand may be inferred by Strava heatmaps[28]. A view of the walking and cycling heatmap showing Nelson Road is provided in Figure 11. Sections of higher usage are brighter in colour.



WALKING HEATMAP

SOURCE: STRAVA 2022



CYCLING HEATMAP

FIGURE 11: STRAVA WALKING AND CYCLING HEATMAPS

[27] VicRoads 2012, SmartRoads Priority Map: City of Whitehorse

[28] Strava is a social network and training tool for cyclists, runners and swimmers. Users record their physical activity using a dedicated GPS device or utilise the mobile app, and upload the file to their profile. Strava anonymised this information and makes it available through their "Global Heatmap" tool, showing aggregated all public activities over the last year.

2 DATA COLLECTION

2.1 ROAD NETWORK

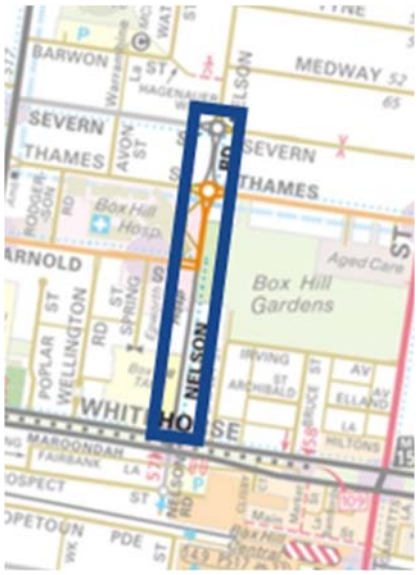
Nelson Road is managed under the care and maintenance of Council (**Figure 12**). It is a *Collector Road* along most of the project length, and a *Major Road* for the section between Arnold and Thames Street. It is typically subject to 50 km/h speed limit.

Elgar Road and Station Street are adjacent north-south arterial roads corridors subject to a 60 km/h limit.

Nelson Road experiences a relatively high volume of traffic associated with:

- People travelling to medical, education, recreational or other nearby facilities
- People seeking car parking in the area
- Local traffic
- Drivers 'rat-running' through the area.

A walking tour of the study corridor provided an opportunity for the project team (*O'Brien Traffic* and *Active City)* to identify key issues, consider major destinations and pedestrian and cyclist desire lines.



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FIGURE 12: STUDY AREA ROAD HIERARCHY

2.2 PUBLIC TRANSPORT

Nelson Road carries four bus routes between Whitehorse Road and Arnold Street, and one bus route between Thames Street and Severn Street with peak period frequencies of <20 minutes for some services. Box Hill railway station is located, approximately 400m walk south-east of the Whitehorse Road/Nelson Road intersection. Tram route 109 operates along Whitehorse Road with peak period frequencies of <10 minutes.

2.3 FEATURE SURVEY

A feature survey (property boundary to property boundary) of the corridor was undertaken as part of preparation of the background information and to inform decision making throughout the project. This information was supplemented with survey data provided by Council within the park.

2.4 PEDESTRIAN AND CYCLIST DATA

No pedestrian count data were available from Council for this project. Recommendations included in this report are based on community consultation, review of relevant strategic documents as well as observations by the project team.

Pedestrian survey data collected during development of the *Box Hill Integrated Transport Strategy* found high levels of pedestrian activity 'surrounding the activity centre core, including Box Hill Mall and Nelson Road medical and education precinct'[29].

[29] AECOM 2019, *Box Hill Integrated Transport Strategy Issues and Opportunities Report*

2.5 CASUALTY CRASH HISTORY

A review of the Victorian Department of Transport crash data indicates that 17 casualty crashes were recorded within / near to the study area for the five-year period 2015 – 2019 (refer to Appendix A). The analysis shows that just over half of the occurred at intersections (53%) and most crashes occurred during clear (76%), daylight conditions (82%), with increased crash numbers coinciding with morning and afternoon peak periods. Forty-one per cent of crashes involved pedestrians and 18% involved cyclists.

These crashes include:

- Seven crashes involving pedestrians, including;
  - One 'Serious injury' crash on Nelson Road approximately 50 metres north of Thames Street in daylight conditions
  - Six 'Other injury' crashes
    - Three at cross intersections in daylight conditions
    - Three midblock crashes (2 in daylight conditions, 1 in dark conditions with street lights on)
- Three crashes involving cyclists
  - One 'Serious injury' crash at the roundabout intersection of Severn Street and Nelson Road (unknown light conditions)
  - Two 'Other injury crashes' under daylight conditions, one at the intersection of Arnold Street and Nelson Road, and one midblock on Nelson Road near Arnold Street
- One crash involving a motorcyclist
  - 'Other injury', 'Off path on straight' crash occurring at the intersection of Nelson Road and Thames Street in dawn light conditions
- Six crashes involving motor vehicles only
  - 'Other injury' crashes, three at cross intersections (2 daylight, 1 unknown lighting conditions), three at midblock in daylight conditions

In addition, it is noted that one crash was recorded in the first six months of 2020 (an 'other injury' crash involving a motorcyclist at the intersection of Thames Street and Nelson Road). While this crash is not included in the analysis discussion above, due to the impact of COVID-19 on typical travel patterns, it is of interest to note for the study.

2.6 DEMOGRAPHIC AND POPULATION TRENDS

The 2019 *Review of Strategic Direction* for the Box Hill Metropolitan Activity Centre included a review of economic and demographic projections. This noted that:

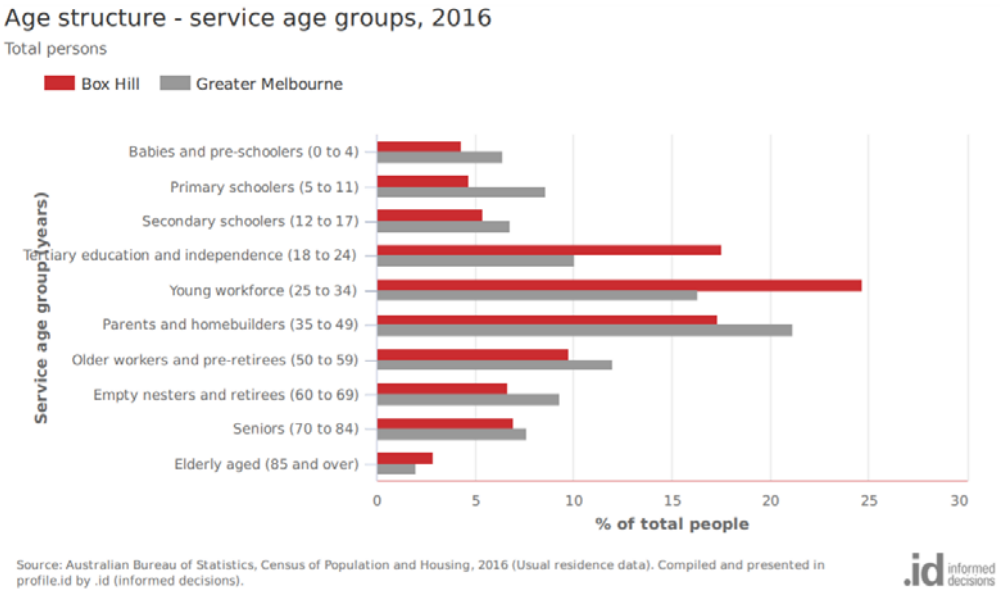
- Historical growth trends in Box Hill (over the 10 year period to 2016)
  - population growth is strong (with an average growth rate of 2.9% per annum)
  - employment growth has experienced an average growth rate of 2.3% per annum, with particularly strong growth in the health and education sectors (with average growth rates of 4.7% and 5.1% respectively)

- Future growth forecasts
    - population is expected to grow between 3.5% and 4.0% over the period 2016 to 2036
    - employment is expected to grow between 1.9% and 3.4% over the period 2016 to 2036, with the highest growth sectors expected to be health, education and entertainment/recreation.

A large proportion of residents in Box Hill are aged 18−34 years (42.2%) compared with Greater Melbourne (26.3%, see Figure 13). Box Hill also has a high level of cultural diversity, with 57.6%% of people born overseas compared to the Greater Melbourne average of 33.8% (Figure 14).

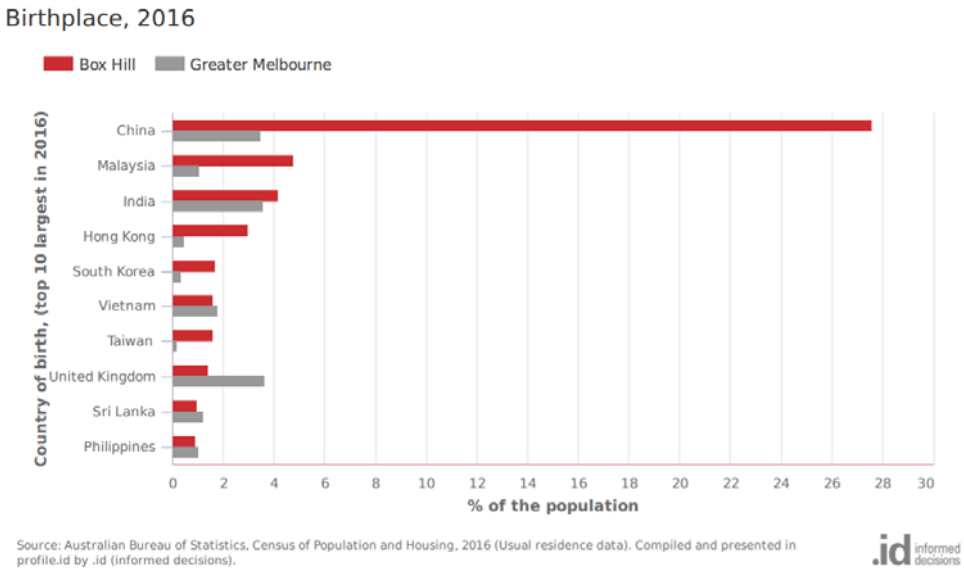
A higher proportion of people travelled to work by public transport (i.e. train, bus, tram; 29.2%) or walked (8.6%) compared to the Greater Melbourne average of 15.4% and 3.0% respectively (Figure 15).

With historic and projected strong population and employment growth, it is critical to balance community transport needs for motorists as well as pedestrian and cyclists, particularly given the importance of promoting and supporting active travel, community liveability and health outcomes.



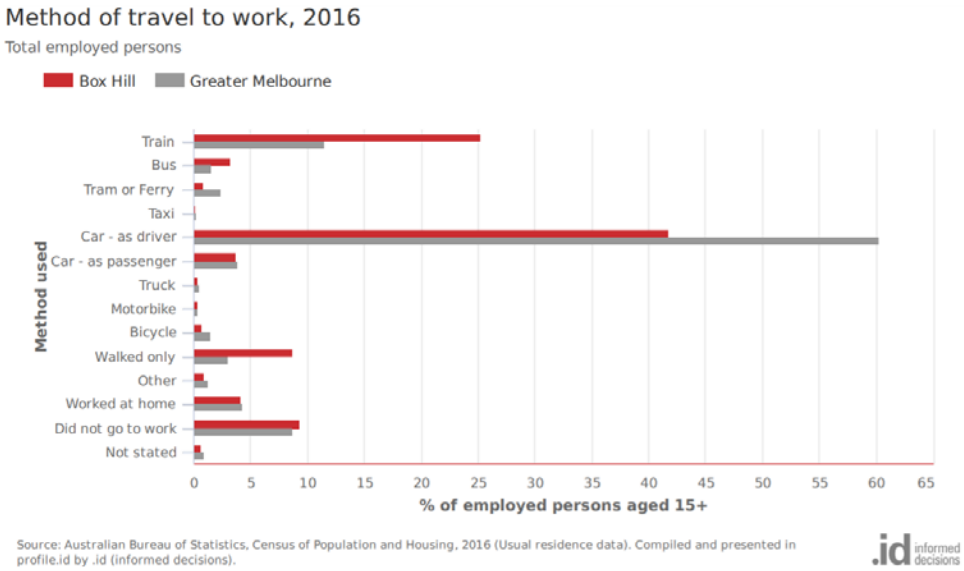
SOURCE: ID CONSULTING 2021, BOX HILL AGE STRUCTURE – SERVICE AGE GROUPS, VIEWED 11 JUNE 2021

FIGURE 13: RESIDENT AGE GROUPS



SOURCE: ID CONSULTING 2021, BOX HILL BIRTHPLACE, VIEWED 11 JUNE 2021

FIGURE 14: RESIDENT BIRTHPLACES



SOURCE: ID CONSULTING 2021, BOX HILL METHOD OF TRAVEL TO WORK, VIEWED 11 JUNE 2021

FIGURE 15: MAIN METHOD OF TRAVEL TO WORK

3 CONSULTATION

Community engagement is an important aspect of the Nelson Road pedestrian and cyclist safety investigation project. Workshops were held with the Project Working Group, which comprised representation from Council, O'Brien Traffic Engineers, key stakeholders and community advocates, in order to:

- Workshop 1 (Issues and opportunities workshop) – Identify key issues as well as ideas for potential design solutions along the corridor (Section 5.1)
- Workshop 2 (Design options workshop) – Seek feedback on preliminary design options and refine options prior to finalisation of the concept designs (Section 6.1).

4 SAFE SYSTEM PRINCIPLES FOR PEDESTRIANS AND CYCLISTS

> The Safe System approach recognises that people make mistakes, that crashes will continue to occur and that humans have a limited tolerance to impact forces. The approach seeks to eliminate the potential for fatal and serious injury crashes

Very low speed limits/speed environments are required to protect vulnerable road users in accordance with Safe System principles – speeds of around 30 km/h are the maximum any vulnerable or unprotected road user can withstand without sustaining death or serious injuries. This is compounded due to environments in which pedestrian (and cyclist) issues are most likely to arise – typically highly developed environments that also experience high vehicle demand and congestion, i.e. busy mixed-use environments with multiple road user types. Barriers to more effective management of pedestrian safety and amenity include[30]:

1. the 'roads are built for cars' mentality;
2. perceived costs of pedestrian safety treatments versus economic gains of vehicular traffic movement;
3. the absence of consideration of pedestrian waiting time in benefit cost analyses of road management policy;
4. ongoing expansion of vehicle capacity on roads;
5. victim-blaming; and
6. data collection problems at crashes which favour the drivers' perspective.

The Austroads *Guide to Road Safety Part 2: Safe Roads* (2021) identifies the following contributing factors for pedestrian crashes:

- Too much traffic for adequate gaps
- High-speed, multi-lane and two-way traffic
- Complex or unexpected traffic movements
- Traffic hidden by parked cars, other objects or excessive landscaping
- A marked crossing which is not evident to drivers
- Long signal cycles which encourage pedestrians to disobey signals
- Inappropriate device or lack of devices for mix of pedestrians (e.g. disabled)
- Inadequate lighting.

'Inattentional blindness' is also a key crash risk factor for pedestrians, cyclists and motorcyclists[31]. Inattentional blindness occurs where a person fails to notice an unexpected object in plain sight. This phenomenon is exacerbated for small objects and when the object is in a person's periphery. In the road environment, pedestrians, cyclists and motorcyclists are considerably smaller than motor vehicles on the road and are often located within a driver's peripheral vision zone (tending to be located

[30] Job, S 2012, *Overcoming Barriers to Pedestrian Safety*, ACRS Conference, Sydney.
[31] Asbury Park Complete Streets Coalition 2020, *Inattentive Blindness: Looked But Failed To See* https://apcompletestreets.org/inattentive-blindness-looked-but-failed-to-see/

towards or emerging from the sides of road carriageways) with lower relative movement[32].

Barriers that have been identified to greater cycling participation include[330]:

- Safety concerns (both perceived and real risks) are found to be among the most significant barriers preventing people from cycling.
- Individual barriers, such as a lack of skills and confidence
- Social and cultural factors, for example, low income areas tend to have fewer opportunities for cycling
- Environmental factors (urban design and bicycle infrastructure), for example, shorter trips (associated with higher density development) and provision of cyclist infrastructure are associated with higher cycling rates
- Policy and regulatory factors (such as congestion charging, urban density and motor vehicle speed limits) can influence cycling rates.

When considering needs and safety solutions for vulnerable road users, the following should be taken into consideration[34]:

- Pedestrian desire lines and accessibility needs to be taken into consideration, including the need for safe crossing points
- Footpaths should be well-maintained to maintain/improve levels of service and reduce the risk of slips, trips and falls, particularly for the elderly and people with disabilities
- Well maintained footpaths and cycle paths encourage greater active transport use
- Separation of bicycles and motor vehicles is preferred with increasing motor vehicle speeds and volumes
- Managing speeds down to survivable impact levels for vulnerable road users creates more walking and cycling-friendly environments
- High travel speeds do not align well in safe, equitable, liveable and accessible cities, where walking and cycling is safe and attractive.
- On urban roads, key crash risks typically occur at:
    - Intersections
    - High active mode activity, including children and elderly on roads with a 50km/h speed limit or higher.
    - High interaction with land use (link and place), e.g. CBDs, residential streets, mixed-use arterials.

[32] London cyclist 2012, *What an RAF pilot can teach us about being safe on the road,* www.londoncyclist.co.uk/raf-pilot-teach-cyclists/

[33] Bauman A., Rissel C., Garrard J., Ker I., Speidel R., Fishman E., 2008, *Cycling: Getting Australia Moving: Barriers, facilitators and interventions to get more Australians physically active through cycling*, Cycling Promotion Fund, Melbourne

[34] Ministry of Transport, 2018, *Overview of road safety in New Zealand*, Ministry of Transport, New Zealand

The following measures may help support and promote safe cycling[35]:

- Improved bicycle infrastructure to provide safe, attractive and enjoyable on- and off-road bicycle routes as well as high quality end of trip facilities
- Urban design to create a physical environment more conducive to cycling, such as higher density, mixed use development and shorter trip distances
- Marketing campaigns to promote the multiple health, environmental, transport, economic and social inclusion benefits of cycling, and address perceived barriers such as safety, required fitness level and road user behaviour.
- Bicycle education programs to increase confidence and skill levels
- Behaviour change programs to encourage greater cycling participation
- Cycling events to encourage infrequent and novice riders in a supportive social environment
- Funding

Victoria Walks advocates for measures to improve pedestrian safety, including submissions to Victorian and National Road Safety inquiries[36]:

- Improve road design
- Fund walking
- Reduce speed limits
- Use mode shift as a road safety strategy
- Enforce the road rules
- Driver education
- Improve crash reporting
- Safer vehicles
- Keep footpaths for feet

A Safe System approach seeks to eliminate the potential for fatal and serious injury (FSI) crashes, and where this is not possible treatments that seek to minimise the incidence and/or severity of crashes are considered. The Safe System Assessment Framework outlines a Safe System-based hierarchy of solutions, including treatments for pedestrian and cyclist crashes (Table 1).

[35] Bauman A., Rissel C., Garrard J., Ker I., Speidel R., Fishman E., 2008, *Cycling: Getting Australia Moving: Barriers, facilitators and interventions to get more Australians physically active through cycling*, Cycling Promotion Fund, Melbourne

[36] Victoria walks 2020, *10 steps to safer streets*

HIERARCHY	TYPE	TREATMENT	INFLUENCE (E = EXPOSURE L = LIKELIHOOD S = SEVERITY))
Safe System options ('primary' or 'transformational' treatments)		• Separation (footpath) • Separation (crossing point) • Very low speed environment, especially at intersections or crossing points.	E L L, S
		• Separation (separate cyclist path) • Very low speed environment, especially at intersections.	E L, S
Supporting treatments (compatible with future implementation of Safe System options)		• Reduce speed environment/speed limit • Pedestrian refuge • Reduce traffic volume.	L, S L E, L
		• Shared pedestrian/cyclist path • Cyclist lane • Reduce traffic volumes.	E L E, L
Supporting treatments (does not affect future implementation of Safe System options)		• Pedestrian signals • Skid resistance improvement • Improved sight distance to pedestrians • Improved lighting • Rest-on-red signals.	L L L L L, S
		• Separate cyclist signals at intersections • Cyclist box at intersections • Skid resistance improvement.	L L L
Other considerations		• Speed enforcement.	L, S
		• Speed enforcement • Enforcement of other regulations	L, S L

SOURCE: AUSTROADS 2016, *SAFE SYSTEM ASSESSMENT FRAMEWORK*, AP-R509-16.

TABLE 1: SAFE SYSTEM TREATMENT HIERARCHY: PEDESTRIAN AND CYCLIST TREATMENTS

It is also important to take into consideration needs for older pedestrians. Victoria Walks *Safer Road Design for Older Pedestrians* recommendations include[37]:

- Safer design standards for driveways to indicate priority for pedestrians and provide physical cues for drivers.
- Mid-block pedestrian crossings (ideally with flashing lights and raised surfaces), particularly in activity centres, in the vicinity of housing and facilities for older people and on routes that have been identified as popular with older pedestrians.

[37] Mantilla, J. and Burtt, D, 2016, *Safer Road Design for Older Pedestrians*, Victoria Walks, Melbourne, Version 1.1, August 2016

- Raised pedestrian crossings at intersections and roundabouts to reduce vehicle speeds at the crossing point, enhance priority for pedestrians and make them more conspicuous to drivers.
- Raised thresholds, which effectively extend the footpath across an intersection (usually side streets), to emphasise that drivers are required to give way when turning.
- Kerb extensions, median refuges and tighter turn radii at intersections and roundabouts to reduce vehicle speeds, distance of pedestrian exposure and complexity of crossings.
- Fully controlled right turn signal phases and right turn lag signal phases to protect older pedestrians from right-turning vehicles on the departure side of the intersection.
- Early-start signal phases and PUFFIN pedestrian detection signals to adjust phase times and allow older pedestrians to fully clear the intersection.
- Reduced speed limits and area wide traffic calming.

5 IDENTIFICATION OF POTENTIAL SOLUTIONS

5.1 ISSUES AND OPPORTUNITIES

The Project Working Group comprised representation from Council, O'Brien Traffic Engineers, key stakeholders and community advocates. The *Issues and Opportunities* workshop (held 29 April 2021) sought to identify and discuss key issues and opportunities for the project corridor. Workshop participants were guided through a series of questions and discussion points, in order to identify their perspectives on key issues along the corridor. Workshop participants also had an opportunity to contribute preferences and ideas for inclusion in potential designs, and ideas for consideration in potential designs. Workshop outcomes are summarised in Appendix B.

A list of key issues regarding pedestrian and cyclist safety, accessibility, mobility and amenity have been compiled based on a review of background literature, discussion points during the *Issues and Opportunities* workshop and site observations:

- Pedestrian and cyclist casualty crashes are a concern along Nelson Road
- There is a lack of safe cycling infrastructure may be contributing to cyclist crashes and a low journey to work cycling mode share
- There is poor pedestrian and cycling connectivity over the railway line along the Nelson Road and Thurston Street-Surrey Drive corridor (north-south route)
- High pedestrian volumes are associated with the Nelson Road medical and education precinct



FIGURE 16: ZEBRA CROSSING NEAR MEDICAL PRECINCT

- There is evidence that pedestrians are walking on the existing nature strip (existing footpaths may not be wide enough for demand)
- A broad range of walking abilities and needs are evident, reflecting the different demographics including fit able-bodied people, people with prams, through to elderly, ill, infirm or disabled (who may require use of mobility aids).
- Bicycle riders span a range of experience and competencies, from experienced commuters, to recreational



FIGURE 17: LOOKING SOUTH TOWARDS WHITEHORSE ROAD

- A range of issues contribute to prevent or discourage walking and cycling on the Nelson Road corridor:
  - high motor vehicle volumes and speed, mixture of vehicle and road user types
  - poor condition and design of footpaths
  - lack of pedestrian crossing facilities that align with key pedestrian desire lines (leading to pedestrians cross away from the formal crossings)
  - Obstructed visibility for crossing pedestrians due to parked cars
  - poor cycling facilities
  - Whitehorse Road
  - Poor sense of safety, security and amenity
- The Movement and Place assessment found the key issues along the Nelson Road corridor were pedestrian related
- Community and stakeholder engagement undertaken during the development of the ITS noted the challenge of walking between destinations was a particular concern at Nelson Road. In relation to Nelson Road, it was found that improvements should focus on:
  - Priority 1 – Ease of walking around (including crossing the street, moving between destinations)
  - Priority 2 – Maintenance of public spaces and street furniture
  - Priority 3 – Interesting things to look at (people, shops, views etc.)

Key guidelines drawn from the ITS include:

- Pedestrian and cyclist priority over vehicle access (i.e., crossovers are strong discouraged)
- Integration of a shared path or separate bicycle lane and additional pedestrian crossings
- Increasing the tree canopy is desired to support climate change resilience and provide comfort for the community.

5.2 PRELIMINARY DESIGN OPTIONS

Following the outcomes of the *Issues and Opportunities* workshop, a range of potential infrastructure solutions that could be implemented was developed. These options have been informed by key stakeholder considerations (identified during the *Issues and Opportunities* workshop) and have been developed in collaboration with Active City's travel behaviour consultant and Council.

5.2.1 Design principles

Taking the above into consideration, as well as directions from key Whitehorse City Council strategic documents, including the Box Hill MAC Integrated Transport Strategy, Box Hill Draft Structure Plan, the design principles for the Nelson Rd precinct focus on **lower speed limits and narrower traffic lanes to increase safety and make access easier for people walking and cycling, while maintaining vehicle access**. Preliminary design ideas are aligned with directions from key Whitehorse City Council strategic documents.

A number of high priority locations have been identified due to the number of pedestrian and vehicle movements, potential for conflict between modes and/or complexity of the intersection:

- Nelson Road / Arnold Street
- Nelson Road / Thames Street
- Nelson Road / Whitehorse Road

The approach to developing design concepts for the corridor is to enable infrastructure changes to be sequenced to implement priority actions for pedestrians and then build on these to improve access outcomes for both pedestrians and cyclists in the medium term (aligning with council priorities for the larger North-South cycling corridor into Box Hill), with minimal retrofit or new infrastructure/treatments. Most concept designs (and their variations) are designed within the existing kerb lines to provide a more cost-effective solution, while one concept option explores provision of additional space for pedestrians on the roadsides.

Short-term priorities

Design options align with high priority actions under the ITS, most importantly, improving pedestrian access and safety through improved footpaths, DDA compliant treatments and lower vehicle speeds within the precinct.

The design concepts include sequencing options to provide flexibility around the delivery timelines to align with other projects in the wider Box Hill precinct, such as changes to Maroondah Highway, improvements to bike access into Box Hill activity centre etc

ITS ACTION	SHORT TERM PRIORITIES - APPLICATION ON NELSON RD
1.1 Wider connected footpaths	Widen footpaths along the corridor, with priority between Thames Street and Whitehorse Road. Note this may be achieved by widening the footpath & verge space (relocating kerbs) or by

	increasing paved areas within existing verge area (i.e. paving grass areas)
2.1 DDA compliance	Apply best practice design and treatments to ensure changes are DDA compliant. Broader application includes making it easier to move around as a pedestrian by providing additional crossing locations and reducing travel distances
13.2 40km area wide hospital precinct	Recommend implementation of 40km precinct to commence reductions in travel speeds ahead of/in line with high priority changes to narrow traffic lanes to support safer pedestrian and cycling access
3.1 New zebra or wombat crossings at key intersections	Install four-way zebra crossings at Thames/Nelson Road roundabout and 3-way crossing at Arnold/Nelson. Consider location of additional mid-block crossing. Narrow median facilitates staged pedestrian crossing and provides safer informal crossing points along the corridor
4.1 Off-road or protected on-road bike lane	Sharrows in short term highlight the cycling corridor and the presence of cyclists (supported by 40km speed limit). Potential to provide cycling access as a shared path through the park in short term. Project sequencing allows for addition of protected bike lane in southerly direction (park side) and on-road lane in northerly direction when additional route connections are in place to encourage cycling (e.g. facilities at Whitehorse Rd intersection, crossing over train line).

TABLE 2: SHORT TERM PRIORITIES ON NELSON RD AND ALIGNMENT WITH ITS ACTIONS

Medium-term priorities

Medium-term actions under the ITS, or actions that council does not have independent control of (such as Maroondah Highway intersection upgrades) are identified below. These are taken into account in the sequencing of the concept designs and are listed in priority order for the project.

ITS ACTION	MEDIUM-TERM PRIORITIES - APPLICATION ON NELSON RD
13.3 Investigate further speed reductions	Recommend trial of 30km zone as a staged action after short term priority actions in place to narrow traffic lanes. This will further improve pedestrian safety in the medical precinct, especially as the density and activities within the area increases.
12.2 Modify traffic signals and timing to prioritise walking and cycling	Recommended design changes at the Maroondah Highway end of the Nelson Road corridor aim to support any future improvements to this intersection to improve access for people walking and cycling
10.2 Re-route bus 281 down Elgar Road	Concept designs maintain bus access/turning movements along the Nelson Road corridor.

TABLE 3: MEDIUM TERM PRIORITIES ON NELSON RD AND ALIGNMENT WITH ITS ACTIONS

5.2.2 Preliminary concept designs

A number of concepts were developed as outlined in Table 4 and Figure 18.

CONCEPT	KEY FEATURES	COMMENTS
Pedestrian Amenity concept	• wider footpaths and increased landscaping (kerbs moved in to reduce road reserve width) • 40 km/h speed limit • Sharrows (bikes on road) • Parking on both sides retained	Increased space for pedestrians. Reduced width of traffic lanes to support low speed environment. Cyclists on road with general traffic.
Pedestrian Staging concept	• Flush median with cutouts for tree planting • 40 km/h speed limit • Sharrows (bikes on road) • Parking on both sides retained	Provides an opportunity for pedestrians to stage their crossing (shorter crossing distance per movement), increases tree canopy, constrains lane widths. Flush median aids pedestrians with limited mobility. Reduced width of traffic lanes to support low speed environment.
Separated Cycling concept	• Copenhagen cycle lane (with buffer) • 40 km/h speed limit • No parking or on one side (depending on variant) • May incorporate flush median	Separated cycling facilities improves cyclist safety and amenity. Reduced width of traffic lanes to support low speed environment. Reduced parking provision.

TABLE 4: NOTES ON KEY CONCEPTS

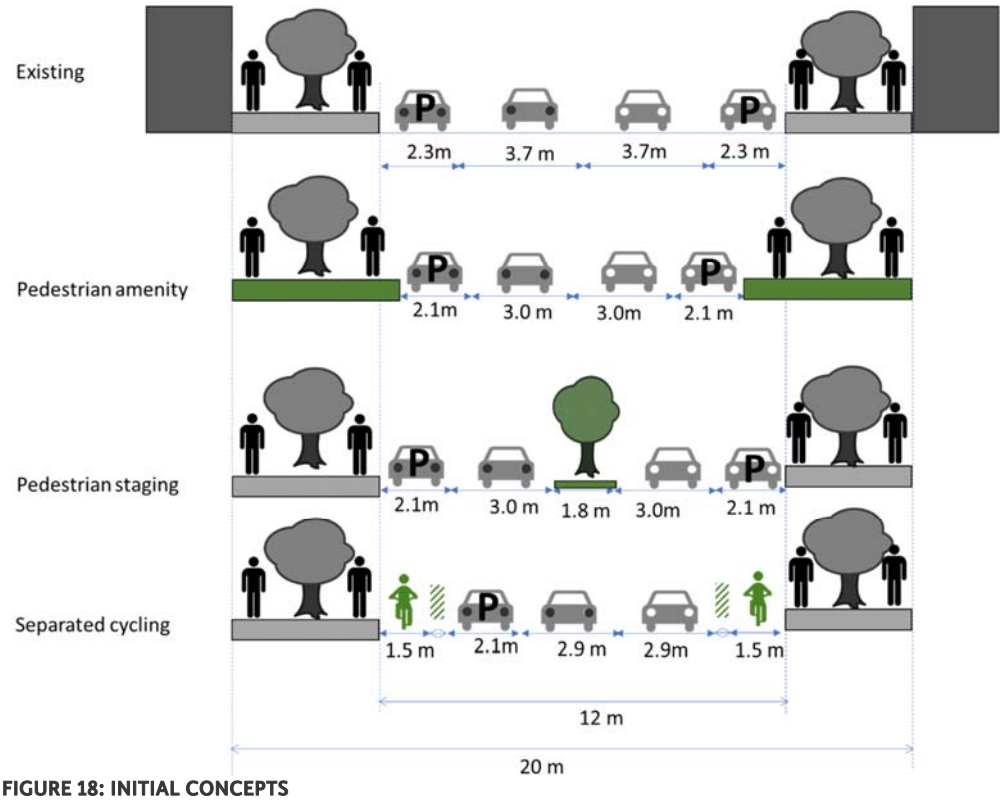


FIGURE 18: INITIAL CONCEPTS

Initial thoughts/staging

It was recommended a staged approach be considered in the implementation of design options. Design options are designed to progress/sequence from (a) initially improving pedestrian safety (given existing pedestrian volumes, and the range of walking abilities and needs, noting in particular a high proportion of pedestrians with limited mobility), to (b) incorporating improved facilities for cyclists (as resources, and coordination with complementary projects allow). Ultimately separated cycling facilities would be desirable along both sides of Nelson Road.

Refined concepts

Following review and feedback, the concepts were refined to include a number of additional variants of the initial concepts (Figure 19), with pros and cons for each identified (Table 5).

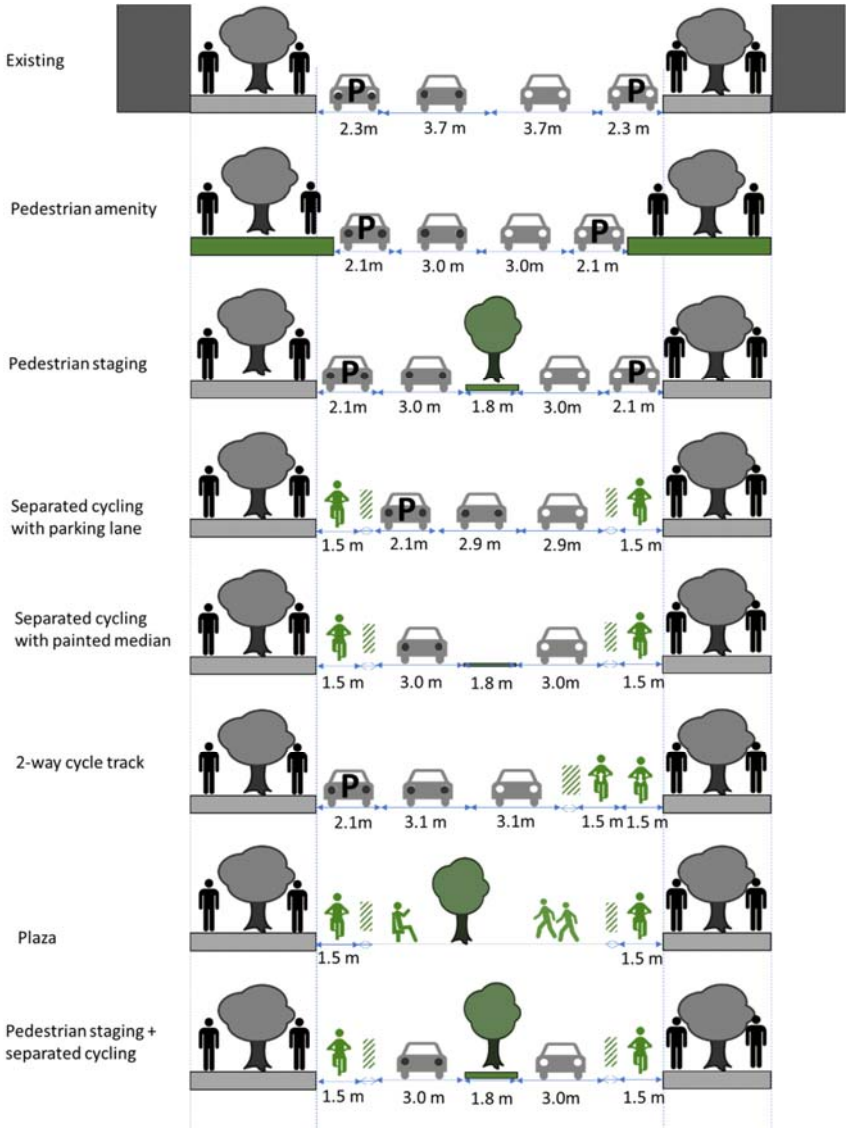


FIGURE 19: REFINED CONCEPTS

CONCEPT	PROS	CONS
Pedestrian Amenity concept	• Increased space for pedestrians via wider footpaths and increased landscaping • Reduced width of traffic lanes to support low speed environment (kerbs moved in to reduce road width) • Parking on both sides retained	• Cyclists on road with general traffic (sharrows) • Constrained environment for larger vehicles • Expensive (requires reconstruction of kerb and channel, street drainage, and streetscape)
Pedestrian Staging concept	• Median provides opportunity for pedestrians to stage crossing (shorter crossing distance per movement), aids pedestrians with limited mobility • Reduced width of traffic lanes to support low speed environment • Increased tree canopy (median with tree planting cutouts)	• Cyclists on road with general traffic (sharrows) • Constrained environment for larger vehicles
Separated Cycling concept – with parking lane	• Separated cycling facilities improves cyclist safety and amenity (via protected cycle lane with buffer). • Reduced width of traffic lanes to support low speed environment	• No significant improvement for pedestrians • Conflicts at driveways/streets. • Reduced parking provision (1 side only)
Separated Cycling concept – with painted median	• Separated cycling facilities improves cyclist safety and amenity (via protected cycle lane with buffer) • Painted median provides opportunity for pedestrians to stage crossing (shorter crossing distance per movement), aids pedestrians with limited mobility • Reduced width of traffic lanes to support low speed environment	• No physical infrastructure to protect pedestrians in median • Conflicts at driveways/streets • No on-street parking
2-way cycle track concept	• Separated cycling facilities improves cyclist safety and amenity (via protected cycle track with buffer)	• No significant improvement for pedestrians • May be confusing (uncommon treatment) • Conflicts at driveways/streets • Challenge to return path at ends of facility • Reduced parking provision (1 side only)
Nelson plaza concept	• No conflict of pedestrians and cyclists with motorised traffic • Improved cyclist safety and amenity • Opportunity for increased tree canopy	• Impact on local trips & through traffic (hospitals incl emergency vehicles, RSL, TAFE, other medical, residents, buses) • Lack of active frontages may inhibit amenity of area for pedestrians and cyclists
Pedestrian Staging + Separated Cycling concept	• Median provides opportunity for pedestrians to stage crossing (shorter crossing distance per movement), aids pedestrians with limited mobility • Separated cycling facilities improves cyclist safety and amenity (via protected cycle lane with buffer) • Reduced width of traffic lanes to support low speed environment • Increased tree canopy (median with tree planting cutouts) • Changes can be implemented (staged) over time • On-street parking retained during early phase(s)	• Constrained environment for larger vehicles • Cyclist conflicts at driveways/streets • No on-street parking (in final stage)

TABLE 5: CONCEPTS PROS & CONS COMPARISON

Complimentary treatments

Complementary treatments should be incorporated at key locations along the corridor length to improve pedestrian safety and amenity, and reduce potential for conflicts between modes (See Figure 23):

1. Wider footpaths/paved areas by paving current grass nature strip with cut-outs for plantings and/or street furniture (e.g. Figure 20). This increases pedestrian amenity by creating greater space for pedestrians (who are often already walking on the grass along Nelson Road) and also reduces trip hazards at edge of footpath and grass.
2. Flush kerb (roadside and median) at key locations (or whole length) to make crossing easier for mobility impaired pedestrians (e.g. Figure 21).
3. Midblock pedestrian crossings (zebra or wombat) supported by kerb outstands, textured/coloured pavement, etc.).
4. Arnold St intersection potential treatments:
    - Roundabout (fully mountable dome to accommodate buses & ambulances & minimize kerb changes) with wombat or zebra crossings on all 3 legs
    - Raised intersection with zebra crossings on all 3 legs
    - Sharrows (e.g. Figure 22)
    - Signalised intersection – consideration could be given to signalising intersection; however, pedestrians and cyclists would not have priority. This option may be useful to create time for drivers to get through (if pedestrian volumes were such that motorists were hindered in progressing through intersection).
5. Thames St intersection
    - incorporate wombat or zebra crossings on all 4 legs
    - seek opportunity to remove / relocate hospital driveway access from roundabout
    - Sharrows (Phase 1)



FIGURE 20: WIDE ATTRACTIVE FOOTPATH SURFACE, WITH PLANTINGS / STREET FURNITURE



FIGURE 21: FLUSH MEDIAN WITH CUT-OUT TREE PLANTING



FIGURE 22: SHARROWS THROUGH ROUNDABOUT



FIGURE 23: COMPLIMENTARY TREATMENTS

6 REVIEW, REFINEMENT AND DEVELOPMENT OF CONCEPT DESIGNS

6.1 EVALUATION FRAMEWORK FOR COMPARISON OF PRELIMINARY DESIGN OPTIONS

An evaluation framework was prepared to inform assessment and comparison of the preliminary options in terms of the key design considerations (noted in Section 6.1), as well as *alignment with Box Hill strategic objectives* and *cost*. The first three aspects were discussed with the Project Working Group (see Section 6.2). The last three aspects were considered separately by the project team in collaboration with Council.

KEY DESIGN CONSIDERATION	KEY QUESTIONS
Safety	Is safety improved for: • Pedestrians (inc. different demographics)? • Cyclists (inc. different demographics)? • Drivers (particularly whether the design supports lower vehicle speeds)?
Access, amenity and environment	Is there a good balance between access and placemaking opportunities? Does the design support streetscape improvements?
On-street car parking	What is the impact for on-street car parking?
Buildability	Can the design be staged / phased (and is this useful)?
Alignment with Box Hill strategic objectives	How does it align with strategic objectives including: • Primary bike and pedestrian connection? • Support active street frontages & priority for pedestrian and cyclist movements along street frontages? • Shared path or bicycle lane? • Formal pedestrian crossings? • Additional planting to increase environmental comfort for pedestrians and cyclists?
Cost	Is the design likely to be high, medium or low cost?

TABLE 6: PRELIMINARY DESIGN OPTIONS EVALUATION FRAMEWORK

6.2 REVIEW OF DESIGN OPTIONS'

The Design Options' workshop (11 November 2021) and an online survey provided an opportunity for Council and the project team to seek feedback on the design options from workshop stakeholders and community advocates. Illustrative cross-sections of preliminary designs supported by photographs of similar treatments were presented. Workshop outcomes are summarised in Appendix B. The following considerations (drawn from the Evaluation Framework) were discussed:

- Pedestrian safety and amenity[38]
- Cyclist safety and amenity[38]
- Motorist safety
- Streetscape
- Vehicle access
- Parking.

[38] Note safety and amenity for the pedestrians and cyclists along the corridor were considered in conjunction

6.3 SELECTION OF THE PREFERRED CONCEPT

The Pedestrian Staging + Separated Cycling concept was considered to have the greatest alignment with most objectives (Table 7 and Appendix C), while the impact to on-street parking is minimised in the short- to medium-term as part of the staged implementation approach (incorporation of the separated cycling lanes part of latter phases).

CONCEPT	PEDESTRIAN SAFETY & AMENITY	CYCLIST SAFETY & AMENITY	STREETSCAPE	LOWER SPEED ENV'MENT	VEHICLE ACCESS	PARKING	BUILDABILITY	STRATEGIC ALIGNMENT	OVERALL COST
Pedestrian Amenity concept	✓	✓	✓	✓	✓	✓	✓	✓	$$$$
Pedestrian Staging concept	✓	✓	✓	✓	✓	✓	✓	✓	$$
Separated Cycling concept	✓	✓	✗	✓	✓	✓	✗	✓	$$$
2-way cycle path concept	✓	✓	✗	✓	✓	✓	✗	✓	$$$
Nelson plaza	✓	✓	✓	✓	✗	✓	✗	✓	$$$$
Pedestrian Staging + Separated Cycling concept	✓	✓	✓	✓	✓	✓ Note, parking retained in early phase(s)	✓	✓	$$$

Key: ✓ Good ✓ Some ✗ No Change / Worse (for Buildability: unable to be staged)
Note: Buildability, Strategic alignment and Cost objectives were considered by the project team (not discussed with the project working group).

TABLE 7: PRELIMINARY DESIGN OPTIONS EVALUATION OVERVIEW

6.4 DEVELOPMENT OF CONCEPT DESIGNS

A meeting was held (February 2022) with Council to discuss the outcomes from the 'design options' workshop, as well as subsequent feedback received from the working group, and confirm the treatments that form the preferred design for the Nelson Road project corridor.

Taking on board feedback from the working group, outcomes from application of the preliminary design evaluation framework, it was agreed that the Pedestrian Staging + Separated Cycling concept was the preferred design. Council expressed the importance of the phased implementation of design elements, to enable staged implementation in alignment with changes along and surrounding the corridor. A preference for zebra crossings[39] and fully mountable roundabout at Arnold Street (to accommodate emergency vehicles, hospital delivery vehicles, buses, etc), as well as opportunities for low-cost versions of design aspects were also noted.

The proposed phasing of the design takes into account:

- Providing priority for pedestrians (noting the high numbers of frail people). This is achieved by:
  - Providing a (flush) median during Phase 1 to enable people to stage their crossing (shorter crossing distance per movement and crossing against one traffic flow at a time)
  - Providing additional footpath space for people walking along the corridor
  - Maintaining separation from people riding (bicycle lanes provided in latter phases)
- Safety for all road users through a lower speed environment (narrower vehicle lanes, enclosed avenue environment (created by median planting) and a lower speed limit
- Providing separated cyclist facilities incrementally through latter phases to allow coordination with other works surrounding/adjacent to the corridor.

Noting the above, a set of Concept Designs along the project corridor were developed (see Figure 24 and Appendix D).

[39] Note, latter phases of the concept design drawings show a midblock wombat crossing near Box Hill Institute to illustrate how this could be incorporated if desired in the future.

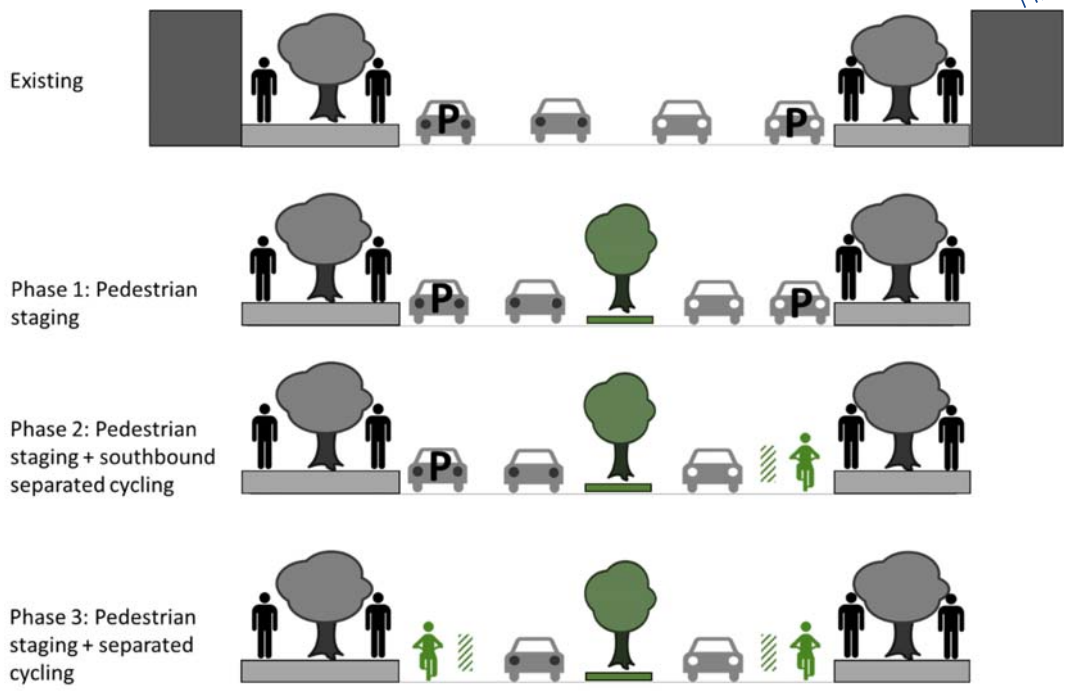


FIGURE 24: CONCEPTS PHASES

6.5 ROAD SAFETY AUDIT

An independent Road Safety Audit was undertaken of the Concept Designs. The Audit report is included Appendix E, with a summary if risks and recommendations presented in Table 8. The findings of the Road Safety Audit were reviewed by the O'Brien Traffic project team in collaboration with Council, with the project response also included in Table 8.

	ISSUE	RISK	AUDIT RECOMMENDATION & MITIGATED RISK	PROJECT TEAM RESPONSE / COMMENT
1	Roundabout intersections (all phases)	There is still the potential for operating speeds through the roundabouts to exceed the safe system threshold speed for vulnerable users of 30 km/h.	Consider raised safety platform treatments of one or both intersections	The project team support this recommendation from a safety perspective. However, feedback from Council indicates that raised platforms would not be favoured due to impacts on hospital operations.
2	Median (all phases)	Not an issue relating to safety risk. Median parking may be considered as a trade-off for the loss of kerb-side parking. There is some ped and cyclist risk associated with provision of median parking, however this is low risk. Note: If median parking was to be included, the medians would need to be widened from the		This is worth consideration, however may be a challenge while still providing suitable access for buses, emergency vehicles, waste vehicles (including

	ISSUE	RISK	AUDIT RECOMMENDATION & MITIGATED RISK	PROJECT TEAM RESPONSE / COMMENT
		proposed 1.8 metres. AS2890.5 specifies that a width range of 2.0 to 2.3 metres when then speed limit is less than 50 km/h. The wider medians could be achieved by reducing the through lanes widths from 3.0 metres to 2.8 metres.		specialised hospital waste vehicles) etc. There are also safety concerns for pedestrians and cyclists, including pedestrians emerging from parked vehicles (in the median), and dooring risk for cyclists
3 & 4	On-road cycling (Phase 1, 2A & 2b)	In phase 1 the median treatments and speed calming treatments will be applied but kerbside parking will remain. There will be no demarcated on-road bike lanes. The through lane will be 3.0 width. Although the narrower through lanes widths are likely to reduce operating speeds, there are potential issues for cyclists.	Consider sharrows along the full length of the subject site, or alternatively for the northbound through lane only	Inclusion of sharrows along the full length is supported. In phase 1, inclusion for both directions provides a more consistent application. In phase 2, sharrows for northbound cyclists helps increase conspicuity.

TABLE 8: AUDIT FINDINGS AND REPONSE SUMMARY

6.6 FINALISATION OF CONCEPT DESIGNS

Following the outcomes of the Road Safety Audit, final directions for the Concept Designs were considered in collaboration with Council and Active City's travel behaviour consultant (meeting in May 2022). Following this, a final set of Concept Designs were prepared (Appendix D):

- Phase 1: Improving pedestrian safety and amenity – Features a flush median with tree planting and sharrows along the project length. The flush median provides an at-grade surface for pedestrians staging their crossing (minimising potential trip hazards) while also providing an opportunity for vehicle access to adjacent properties. The tree planting means that vehicles are unlikely to encroach into the median (providing better protection for pedestrians). It is noted that the tree planting could be implemented in a number of ways:
  - Lower cost / trial by installing planter boxes with temporary kerbing
  - Higher cost / longer term by implanting pavement cut-outs for planting of larger trees. The species of tree selected would need to consider safety (not inhibit sight distance, small trunks so as not to pose a hazard for errant vehicles) and also Council's tree planting and vegetation policies

Increasing space for pedestrians walking along Nelson Road is also desirable. Paving the (existing) nature strip whilst retaining existing street trees in garden pockets along the length would provide additional space for pedestrians as well as retaining the shade and amenity of the trees. Note, this element may be undertaken during Phase 1 or latter phases (in-line with increasing volumes).

- Phase 2: Provision of bicycle lane for southbound direction – Incremental provision of separated bicycle lanes limits the reduction of on-street parking during early phases, and also means that the bicycle facilities can be coordinated with other works undertaken surrounding the corridor. Shorows are retained where separated cycling facilities are not yet incorporated:
  - Phase 2a: Southbound bicycle lane from Severn Street to Box Hill Gardens (short- to medium-term) – Improves access for cyclists by utilising the shared path through the park, supporting access for cyclists to the retail and public transport centre via Bruce Street). This would provide more direct access to the Box Hill centre until improved facilities are incorporated along Whitehorse Road.
  - Phase 2b: Southbound bicycle lane to Whitehorse Road – Provides separated facilities for cyclists in the more challenging uphill direction of travel, while retaining kerbside parking on the western side of Nelson Road. Sharrows are provided for cyclists travelling northbound, as well as through the roundabouts.
- Phase 3 (longer-term) Provision of bicycle lanes in both directions – This provides separated cyclist facilities for both directions of travel, supporting the objectives of a low-stress cycling route. Implementation of Phase 3 could be coordinated with planned improvements at the Whitehorse Road intersection and bridge across train line (to ensure cyclist safety at southern extent of corridor). Protection of the cycling lane would be a combination of a painted buffer (to retain property access) and some sections of a narrow kerb separator.

The concept designs illustrate the key aspects of each of the phases. Looking ahead, during development of detailed design plans, the following may be considered:

- Design of median taking into consideration Council's preference for median planting e.g. planter boxes or tree cut-outs. A kerb (barrier or mountable) would be recommended to protect planted area.
- Potential conflict between pedestrians and cyclists near zebra crossing in front of Box Hill hospital (cyclists transitioning from bicycle lane to shared path through gardens and zebra crossing in close proximity). Pavement markings may be used to help manage potential conflicts.
- Demand for cyclists turning left from Gardens onto Nelson Rd (towards Whitehorse Road) - wayfinding through gardens shared path network would support this.
- Need for changes to zebra crossing(s) to facilitate cyclist crossing (e.g. through conversion to a pedestrian and cyclist priority crossing) at Arnold St or Severn St.
- Consider key cyclist east-west desire lines (e.g. Thames St or Arnold St), and which east-west route Council wish to support (taking into consideration safety, key destinations, etc).
- Review bicycle lane termination point (consider location of hospital cycling facilities as convenient access will support uptake of staff cycling trips).

6.7 INDICATIVE COSTING OF CONCEPT DESIGNS ELEMENTS

Indicative costing for the concept design elements are summarised in Table 9, adopting the cost categories outlined in Appendix F.

DESIGN ELEMENT	PHASE	INDICATIVE COST
Flush median		
- With planter boxes & temporary kerbing	Phase 1	Moderate
- Pavement cut-outs and permanent kerbing	Phase 2	High
Footpath works (paving nature strip and establishment of garden beds)	Phase 1	High
Zebra crossing (midblock near Box Hill Institute)	Phase 1	Low[40]
Wombat crossing (midblock near Box Hill Institute) *As noted in Section 6.4, it is noted that zebra crossings are preferred (due to emergency vehicles etc), however a wombat crossing may be considered in the future if circumstances allow. Latter phases of the concept design drawings show a midblock wombat crossing to illustrate how this could be incorporated if desired in the future*	Phase 3	Moderate
Roundabout at Nelson St and Arnold St (featuring mountable dome to accommodate buses, with zebra crossings on 3 legs)	Phase 1	High
Zebra crossings (4 legs at Thames St intersection), including crossover works on south-western corner of Thames St (combined pedestrian ramp and vehicle cross-over) featuring coloured surface and DDA tactiles to indicate pedestrian area	Phase 1	Moderate
40 km/h speed limit	Phase 1	Low
Footpath works (paving nature strip and establishment of garden beds)	Phase 1	High
Sharrows pavement marking		
- Phase 1: both directions + intersections	Phase 1	Low
- Phase 2: northbound + intersections only (removal of southbound pavement marking)	Phase 2	Low
- Phase 3: intersections only (removal of midblock pavement marking)	Phase 3	Low
Bicycle lane (southbound from Severn Street to Box Hill Gardens) with green pavement treatment at conflict points	Phase 2A	High

[40] Note, low-cost category for zebra crossing works including line marking, kerb ramps and signs. Additional elements such as flashing lights would be associated with higher costs.

DESIGN ELEMENT	PHASE	INDICATIVE COST
Bicycle lane (southbound from Arnold Street to Whitehorse Road) with green pavement treatment at conflict points	Phase 2B	High
Bicycle lane (northbound from Whitehorse Road to Severn Street) with green pavement treatment at conflict points	Phase 3	High

TABLE 9: INDICATIVE COSTING OF CONCEPT DESIGNS ELEMENTS

6.8 PRIORITISATION FRAMEWORK

A spreadsheet-based prioritisation tool was used to help prioritise treatments within the final Concept Designs taking into account:

- impact on safety, access and amenity
- resourcing constraints (including indicative budgets)
- coordination with other potential works in the area
- Council priorities
- other relevant aspects.

A simple scoring system based was developed in order to prioritise recommended treatments (i.e. the higher the score, the higher the priority). The criteria are set out in Appendix F. A priority list of treatments are also presented in Appendix F, with treatments ranked according to their overall treatment prioritisation scores.

6.9 OTHER CONSIDERATIONS

Impact of future developments

Future developments along the Nelson Road corridor and the surrounding area, as well as population and employment growth in Box Hill, will likely lead to increased pedestrian and cyclist demand.

Clarify / sign shared use paths

It is not clear which paths through Box Hill Gardens are shared use paths (SUP) or footpaths. It is suggested that improved signage or stenciling may improve this understanding. To avoid signage clutter (and potential obstacles with signs on poles), pavement markings (standard stencil) may be used (this is more in the line of site of riders who tend to look downward).



FIGURE 25: WAYFINDING & SUP IDENTIFICATION WOULD ASSIST GUIDANCE

Broken kerb in some locations

Some sections of broken kerb were observed. It is recommended that this be checked and fixed during maintenance activities.

Addressing trip hazards / obstacles

Remedial maintenance may be considered to address potential trip hazards (e.g. uneven path, edge drop-off next to worn sections of nature strip). These issues would be rectified during proposed footpath works (increasing paved area along corridor), however if these works are not planned in the short term, remedial works would be recommended in the interim.

7 PERFORMANCE EVALUATION FRAMEWORK

In order to assess the success of the project in achieving the objectives of improving road safety as well as encouraging increased walking and cycling, the questions presented in Table 10 may be considered. A number of Key Performance Indicators have been identified which may be monitored over time to provide insights into this, and similar project's effectiveness. The corresponding performance measures and data requirements are also included.

Over the long-term, changes to crashes should be monitored and any longer-term changes to driver behaviour associated with the treatments should be assessed.

KEY PERFORMANCE INDICATOR (KPI)	KEY QUESTIONS	PERFORMANCE MEASURE	DATA REQUIRED
Safety	• What is the impact on: • casualty crashes? • casualties? • In what situations do changes in crashes and casualties occur?	*Long term* • Changes in casualties by crash type • Changes in casualty crashes by crash type	• Injury data • Crash data
		Short/medium term • Estimated change in casualty crashes using safety prediction models • Changes to driver behaviour (lower speeds, not stopping over crossings, etc.) • Improved perception of pedestrian and cyclist safety	• Vehicle speed data • Observational data re: driver behaviour and near misses • Community feedback re: driver behaviour and near misses

KEY PERFORMANCE INDICATOR (KPI)	KEY QUESTIONS	PERFORMANCE MEASURE	DATA REQUIRED
Driver behaviour	• Have there been any significant changes in driver behaviour e.g.: vehicle speeds (mean, 85th %ile, free speeds)? • In what situations do changes in driver behaviour occur?	• Vehicle speeds • Changes to driver behaviour	• Vehicle speed data • Observational data • Community feedback
Pedestrian and cyclist participation and comfort	• What is the impact on the incidence of walking and cycling? • What is the impact on pedestrian and cyclist comfort and amenity?	• Walking and cycling rates	• Pedestrian & cyclist data* • Community feedback
		• Impact on amenity	• Treatment location & type • Community feedback
Community and sustainability	• What is the community response/acceptance to the treatments? • Community wellbeing, e.g. the effect on access?	• Community acceptance	• Community feedback
		• Access for different road user groups	• Access audit • Community feedback • Treatment location & type
Operational	• What is the impact on traffic operations, e.g. traffic volumes, traffic composition?	• Changes in exposure	• Traffic volumes / day
		• Changes in traffic composition	• Vehicle types

Note:
* PEDESTRIAN AND CYCLIST DATA WERE NOT AVAILABLE FOR THIS PROJECT

TABLE 10: KPIS, KEY QUESTIONS, PERFORMANCE MEASURES AND ASSOCIATED DATA REQUIREMENTS

8 CONCLUSIONS AND RECOMMENDATIONS

Nelson Road is a key transport corridor within the Box Hill Metropolitan Activity Centre providing connection and access to the medical precinct, education precinct, recreational, residential areas and nearby retail. The route is an increasingly important active transport corridor. This Analysis Project sought to identify potential improvements along the corridor focussed on improving pedestrian and cyclist safety, access, mobility and amenity.





Following community stakeholder input, as well taking into consideration key Whitehorse City Council strategic documents, a series of design principles and priorities were developed, and subsequently a number of design concepts were prepared.

The preferred design concept was selected based on application on an evaluation framework, further feedback from key stakeholders and community advocates as well as discussion with Council. The preferred option (*Pedestrian Staging + Separated Cycling concept*) was considered to have the greatest alignment with corridor objectives, noting that this option:

Nelson Road preferred design:

- ✓ pedestrian safety and amenity
- ✓ cyclist safety and amenity
- ✓ lower speed environment
- ✓ increased tree canopy
- ✓ streetscape improvements
- ✓ staged implementation

- improves pedestrian safety and amenity:
  - the median supports pedestrians to stage their crossin g (shorter crossing distance per movement), aids pedestrians with limited mobility
  - additional zebra crossings provide improved formal crossing opportunities
  - a wider footpath provides additional space for pedestrians walking along the route
- improves cyclist safety and amenity through separated cycling facilities (in latter phases)
- supports a lower speed environment through reduced traffic lane widths
- improves safety at the Arnold St intersection through provision of a roundabout
- provides an opportunity to increase the tree canopy
- allows flexibility in implementation, with works able to be staged over time (may be coordinated with other planned improvements in Box Hill)
- retains on-street parking during early phases.

The phased implementation of the treatments will enhance the experience of pedestrians and cyclists along the Nelson Road corridor and will support increases in active transport in the area.

APPENDIX A

CRASH DATA & ANALYSIS

Crash map and summary table

Crashes within the study area were mapped (Figure C1) and crash characteristics summarised (Table C1). Crashes are shown for the five-year period January 2015 – December 2019 (prior to the impact of COVID-19). In addition, it is noted that one crash was recorded in the first six months of 2020 (crash no. 18); this crash involved a motorcyclist.



FIGURE C-1: STUDY AREA CRASH OVERVIEW (JAN 2015- JUNE 2020)

TABLE C-1: NELSON ROAD STUDY AREA CRASHES (JAN 2015- JUNE 2020)

MAP REF	DATE	SEVERITY	TYPE	GEMOETRY	SPEED ZONE	LIGHT COND.	HOUR OF DAY	CRASH TYPE	# OF PPL	# OF VEH
1	9/06/2015	Other injury	Pedestrian + Motor Vehicle	Not at intersection	60	Dark Street lights on	6	Pedestrian FAR SIDE. PED HIT BY VEHICLE FROM THE LEFT	2	1
2	3/08/2015	Other injury	Motor Vehicles Only	Not at intersection	40	Day	9	Same direction REAR END(VEHICLES IN SAME LANE)	2	2
3	12/10/2015	Other injury	Cyclist + Motor Vehicle	T intersection	50	Day	7	Opposing directions RIGHT THROUGH	2	2
4	13/03/2016	Other injury	Motor Vehicles Only	Cross intersection	50	Day	16	Adjacent directions CROSS TRAFFIC(INTERSECTIONS ONLY)	2	2
5	11/08/2016	Other injury	Cyclist + Motor Vehicle	Not at intersection	Not known	Day	8	Same direction LEFT TURN SIDESWIPE	2	2
6	27/09/2016	Other injury	Pedestrian + Unknown	Cross intersection	Not known	Day	8	Pedestrian PED NEAR SIDE. PED HIT BY VEHICLE FROM THE RIGHT.	2	1
7	10/11/2016	Serious injury	Pedestrian + Motor Vehicle	Not at intersection	50	Day	14	Pedestrian PED PLAYING/LYING/WORKING/STANDING ON CARRIAGEWAY.	2	1
8	1/12/2016	Other injury	Unknown	Cross intersection	60	Day	15	Miscellaneous FELL IN/FROM VEHICLE	2	1
9	10/08/2017	Other injury	Pedestrian + Unknown	Not at intersection	Not known	Day	16	Pedestrian PED ON FOOTHPATH STRUCK BY VEHENTERING/LEAVING DRIVEWAY.	2	1
10	9/11/2017	Other injury	Motor Vehicles Only	Not at intersection	50	Day	8	Miscellaneous PARKED CAR RUN AWAY	2	1

MAP REF	DATE	SEVERITY	TYPE	GEMOETRY	SPEED ZONE	LIGHT COND.	HOUR OF DAY	CRASH TYPE	# OF PPL	# OF VEH
11	19/04/2018	Other injury	Motor Vehicles Only	Cross intersection	60	Day	12	Adjacent directions CROSS TRAFFIC(INTERSECTIONS ONLY)	7	2
12	16/10/2018	Other injury	Motor Vehicles Only	Cross intersection	Not known	Unknown	20	Adjacent directions CROSS TRAFFIC(INTERSECTIONS ONLY)	2	2
13	19/11/2018	Other injury	Pedestrian + Motor Vehicle	Cross intersection	60	Day	15	Pedestrian PED EMERGES FROM IN FRONT OF PARKED OR STATIONARY VEHICLE	2	1
14	4/12/2018	Other injury	Pedestrian + Motor Vehicle	Not at intersection	50	Day	13	Pedestrian FAR SIDE. PED HIT BY VEHICLE FROM THE LEFT	2	1
15	17/05/2019	Serious injury	Cyclist + Motor Vehicle	Cross intersection	Not known	Unknown	9	Same direction REAR END(VEHICLES IN SAME LANE)	2	2
16	30/06/2019	Other injury	Pedestrian + Motor Vehicle	Cross intersection	60	Day	12	Pedestrian PED STRUCK WALKING TO/FROM OR BOARDING/ALIGHTING VEHICLE.	2	1
17	1/08/2019	Other injury	Motor Vehicles Only	Not at intersection	50	Day	13	On path VEHICLE COLLIDES WITH VEHICLE PARKED ON LEFT OF ROAD	1	3
18	14/05/2020	Other injury	Motorcyclist	Cross intersection	50	Dusk/Dawn	7	Off path on straight OFF CARRIAGEWAY TO LEFT	1	1

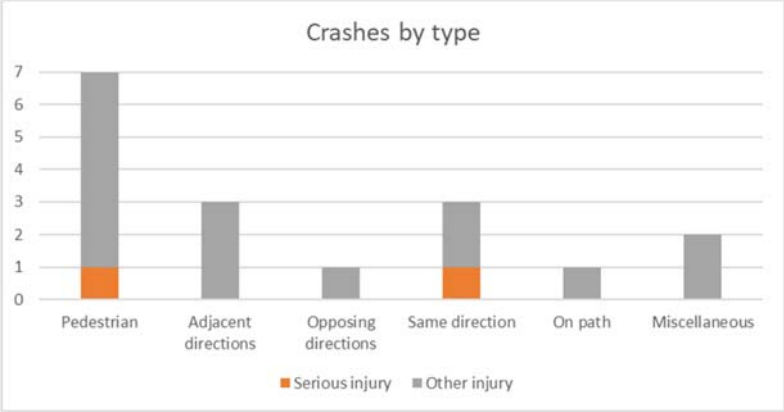
Crash data analysis (2015 – 2020)

The following series of tables and charts presents the data analysis results for the study area (2015 – 2019). The analysis shows that just over half of the occurred at intersections (53%) and most crashes occurred during clear (76%), daylight conditions (82%), with increased crash numbers coinciding with morning and afternoon peak periods. Forty-one per cent of crashes involved pedestrians and 18% involved cyclists. It is noted that 41% of crashes occurred on a Thursday.

In addition, one crash (crash number 18 in Table C1) was recorded during the first six months of 2020 (an 'other injury' crash involving a motorcyclist at the intersection of Thames Street and Nelson Road). While this crash is not included in the analysis discussion above, due to the impact of COVID-19 on typical travel patterns, it is of interest to note for the study.

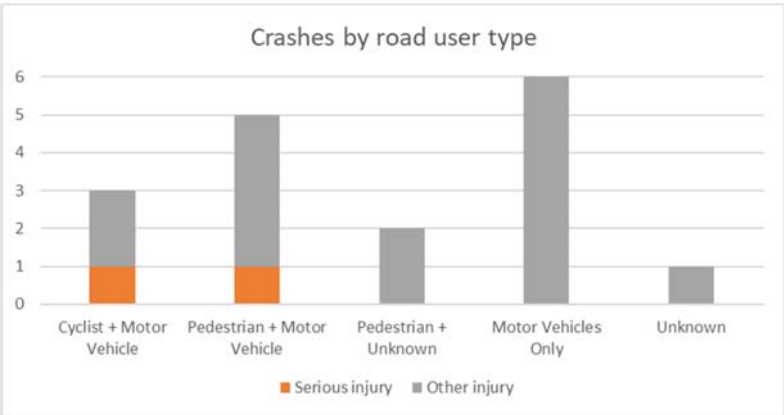
Crashes by type

	SERIOUS INJURY	OTHER INJURY	TOTAL
Pedestrian	1	6	7
Adjacent directions		3	3
Opposing directions		1	1
Same direction	1	2	3
On path		1	1
Miscellaneous		2	2
TOTAL	2	15	17



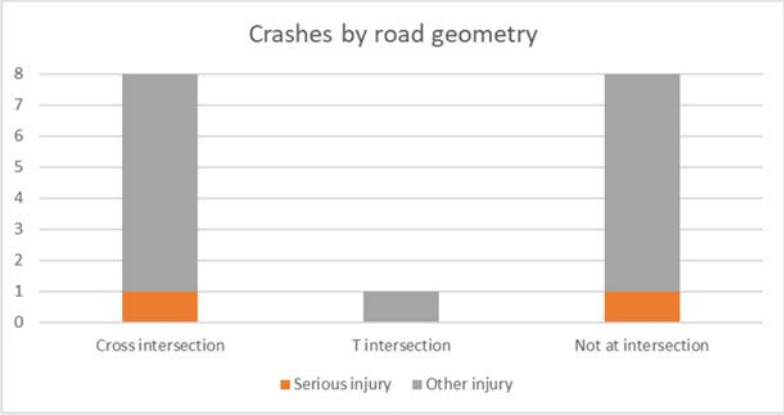
Crashes by road user

	SERIOUS INJURY	OTHER INJURY	TOTAL
Cyclist + Motor Vehicle	1	2	3
Pedestrian + Motor Vehicle	1	4	5
Pedestrian + Unknown		2	2
Motor Vehicles Only		6	6
Unknown		1	1



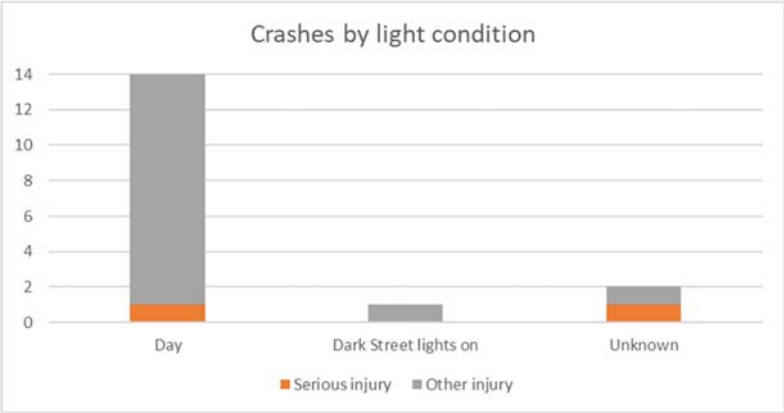
Crashes by geometry

	SERIOUS INJURY	OTHER INJURY	TOTAL
Cross intersection	1	7	8
T intersection		1	1
Not at intersection	1	7	8



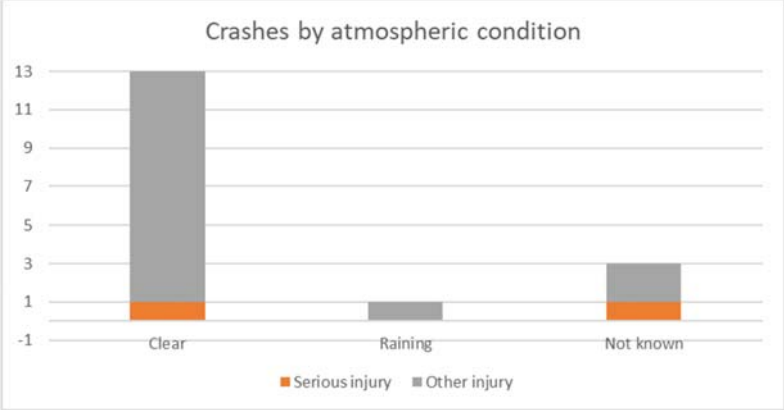
Crashes by light condition

	SERIOUS INJURY	OTHER INJURY	TOTAL
Day	1	13	14
Dark Street lights on		1	1
Unknown	1	1	2



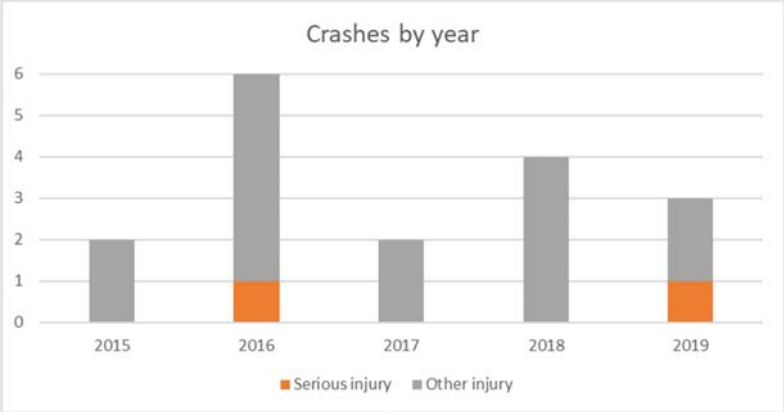
Crashes by atmospheric condition

	SERIOUS INJURY	OTHER INJURY	TOTAL
Clear	1	12	13
Raining		1	1
Not known	1	2	3



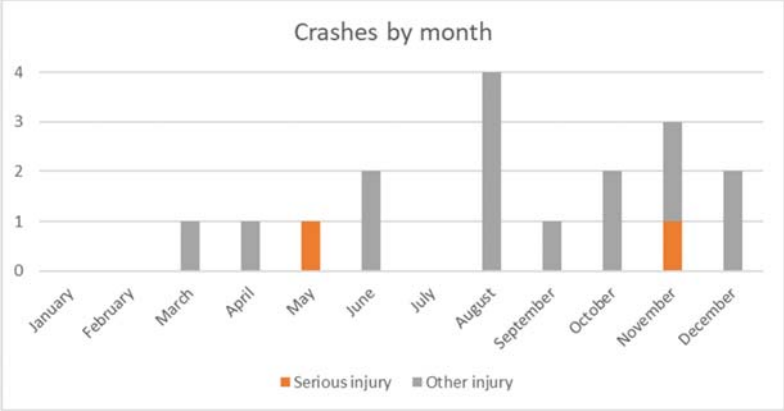
Crashes by year

	SERIOUS INJURY	OTHER INJURY	TOTAL
2015		2	2
2016	1	5	6
2017		2	2
2018		4	4
2019	1	2	3



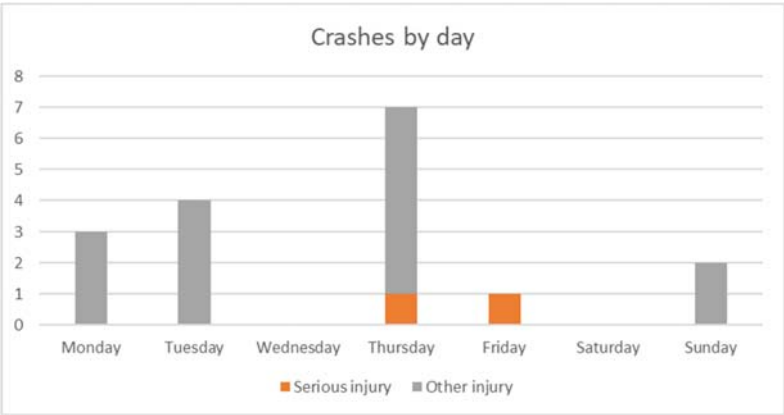
Crashes by month

	SERIOUS INJURY	OTHER INJURY	TOTAL
January			
February			
March		1	1
April		1	1
May	1		1
June		2	2
July			
August		4	4
September		1	1
October		2	2
November	1	2	3
December		2	2



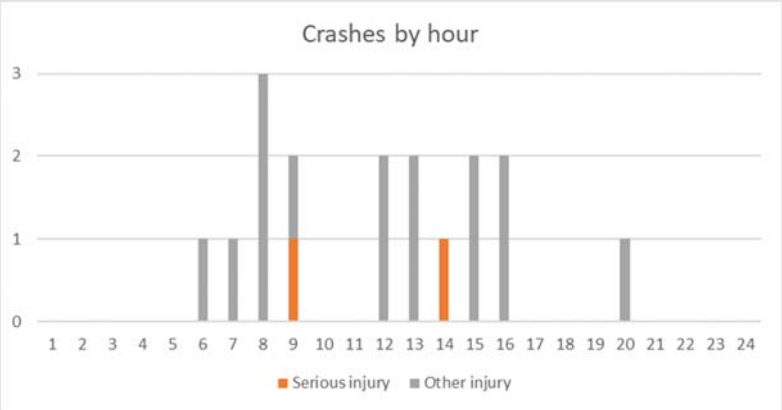
Crashes by day

	SERIOUS INJURY	OTHER INJURY	TOTAL
Monday		3	3
Tuesday		4	4
Wednesday			
Thursday	1	6	7
Friday	1		1
Saturday			
Sunday		2	2



Crashes by hour of day

	SERIOUS INJURY	OTHER INJURY	TOTAL
1			
2			
3			
4			
5			
6		1	1
7		1	1
8		3	3
9	1	1	2
10			
11			
12		2	2
13		2	2
14	1		1
15		2	2
16		2	2
17			
18			
19			
20		1	1
21			
22			
23			
24			



APPENDIX B

WORKSHOP SUMMARIES

NELSON ROAD – PEDESTRIAN AND CYCLIST SAFETY INVESTIGATION
ISSUES AND OPPORTUNITIES WORKSHOP SUMMARY

Community engagement is an important aspect of the Nelson Road pedestrian and cyclist safety investigation project. The project aims to investigate pedestrian and cyclist safety along Nelson Road, Box Hill between Whitehorse Road and Severn Street, and identify potential safety improvements along the corridor to address and support safety for pedestrians and cyclists. Nelson Road is an important corridor as it provides connection and access within the Box Hill Metropolitan Activity Centre (MAC) to key destinations including the hospital and medical precinct, education, recreation, residential and hotel developments.

A workshop was undertaken with the Project Working Group comprising representation from Council, O'Brien Traffic Engineers, key stakeholders and community advocates on 29 April 2021 at the Box Hill RSL. Workshop participants were guided through a series of questions and discussion points, in order to identify their perspectives on key issues along the corridor, and ideas for consideration in potential designs. Responses to each of these are summarised below.



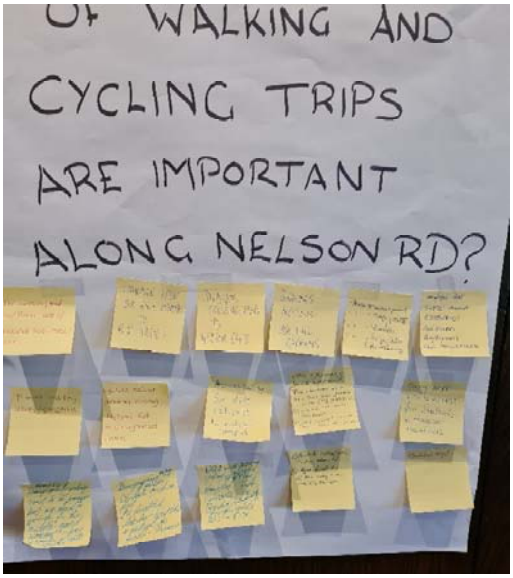
Whitehorse City Council and O'Brien Traffic thank the workshop participants for their time and contributions to the project, and Box Hill RSL for their hospitality in hosting the workshop.

Workshop attendees:
Whitehorse City Council – Chris Hui, Gina Niel
O'Brien Traffic – Matt Harridge, Lisa Steinmetz
Box Hill RSL – Brian Tateson
Box Hill Institute – Sam Pepper, Steve
Epworth Hospital – Rhonda Grant
Metro East Bicycle User Group – Elaine Hopper
Whitehorse Active Transport Action Group – David Morrison
Elgar Contact – William Orange

Workshop apologies:
Box Hill Hospital – Shane Macfarlane
Box Hill RSL – Denis Fernando, Chris Gray
Whitehorse City Council – John Nikas

What type of walking and cycling trips are important along the Nelson Road corridor?

The types of walking and cycling trips considered important for the whole community along the Nelson Road corridor were quite varied, reflecting the different demographics in the area. It was observed that walking and cycling were important modes for many of the key destinations in and near the Nelson Road corridor, for a range of demographics. Types of trips identified during the workshop may be summarised as:



- Commuters:
  - Walking or riding to public transport stops (train, tram, bus)
  - Riders travelling through along north – south, and east – west corridors.
  - Trips to access key destinations within / near the precinct, e.g:
  - Hospital staff and patients to hospitals and medical suites
  - TAFE students and staff to Box Hill institute
  - Other employers
  - Residents and local employees walking to railway station and bus interchange
  - Residents and local employees walking to Box Hill city centre
  - parks.

It was observed that many walking trips were from/to public transport or parked vehicles in the surrounding area to the destination. In particular, it was noted that easy, safe and quick access to public transport locations is important.

A broad range of walking abilities and needs were noted. For example, some pedestrians are 'nimble' on their feet, while others are ill, infirm or disabled and may require use of mobility aids. Similarly, bicycle riders span a range of experience and competencies, from experienced commuters, to recreational. It was noted that while the "demographic of cycling tend[s] to be younger … we need to provide for the *middle-aged woman* [as this is a] key barometer of safe cycling."

It was also observed that Nelson Road experiences a high proportion of pedestrians with mobility issues/concerns, including:

- Elderly
- Children, and people with prams
- People who use mobility devices
- Some student cohorts at Box Hill Institute
- to/from medical facilities (including the hospitals and medical precinct)
- to/from Box Hill Institute

- people accessing Cafes, Box Hill gardens, etc (demographics include students, staff, patients)

It was also observed that Nelson Road carries a lot of through movements, for example residents travelling north to rail, tram, Box Hill Central, etc.

What are the key destinations along the Nelson Road corridor?

Key walking and cycling destinations along or near the Nelson Road corridor include:

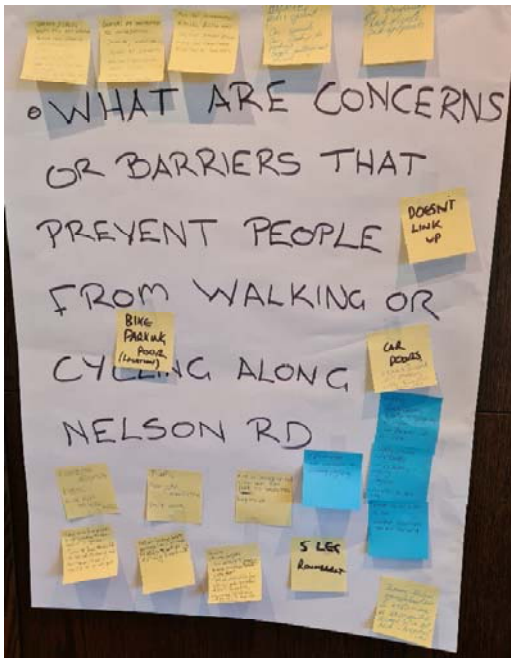


- medical facilities (including the hospitals and medical precinct)
- Box Hill Institute
- Box Hill RSL
- Box Hill gardens
- Box Hill City Centre (including train station, bus interchange, tram stops, Box Hill Central shopping centre, and retail, restaurants/cafes and business precinct)
- Residential apartments and homes (both within the corridor and within close proximity)
- Public transport (both within the corridor and on the surrounding network)
- Car parking spaces – both as a destination on Nelson Rd and beyond, as well as hospital car parks
- DHHS
- Motor repair / maintenance
- Café
- Bowls club
- Anglicare (located on Shipley St)
- Recreation and education near the corridor including:
  - Koonung trail / Bushy Creek
  - Hagenauer Reserve
  - Elgar Park
  - Schools (BHNPS, Koonung High School)

It was noted that there are a very high number of pedestrian movements at the Arnold Street intersection.

What are concerns and/or barriers that prevent people from walking and cycling along the corridor?

Workshop participants had a lot of views on aspects that prevent or discourage walking and cycling on the Nelson Road corridor. These included:



- Motor vehicles
  - high volumes and speed (Nelson Road is being used as a 'rat-run')
  - two-way traffic flow
  - mixture of vehicle types (emergency vehicles, buses and cars)
  - drivers often focussed on finding parking rather than pedestrians and cyclists
  - potential risk of 'dooring' from parked cars
  - constrained width for two vehicles to pass in some locations (e.g. near Thames St), means less/no space for cyclists
  - instances of double parking
  - Footpaths
  - Not conducive for mobility impaired pedestrians (e.g. wheel chairs, walkers) or people using trolleys
  - Camber – can be a challenge for pedestrians, particularly mobility impaired
  - Gutters – the step, and the transition from path to road, can be a challenge for mobility impaired
  - Crossing points (lack of pedestrian and cyclist priority crossings, particularly between park and hospitals), existing crossing points not always convenient, no priority pedestrian crossing facilities near Epworth hospital
  - Slopes not DDA compliant
  - Narrow footpaths
  - Poor condition (e.g. tree roots)
  - Cyclists
  - Hostile route for all but hardiest cyclists
  - High volume roundabout a challenge for cyclists (it was noted that Thames Street intersection is a 5-leg roundabout including the hospital driveway)
  - Poor bicycle parking facilities, including poor location (e.g. basement carparks) and lack of bicycle lock-up facilities
  - Poor connection (with other cycling routes)
  - High number of exits from hospital
  - Unpredictable driver behaviour
- Whitehorse Road is a barrier

- Poor sense of safety and security particularly at night (which is a challenge for staff who end shifts in the evenings)
  - Insufficient lighting
  - Insufficient passive surveillance
- Pedestrian and cyclist amenity
  - Hostile streetscape (not conducive to walking or cycling), particularly for women
  - Exposure to hot, cold and/or wet weather
  - Inadequate wayfinding
  - The amenity is not favourable at night-time at some destinations (e.g. Box Hill train station)

It was also noted that for some travellers, a car would be the preferred mode of travel.

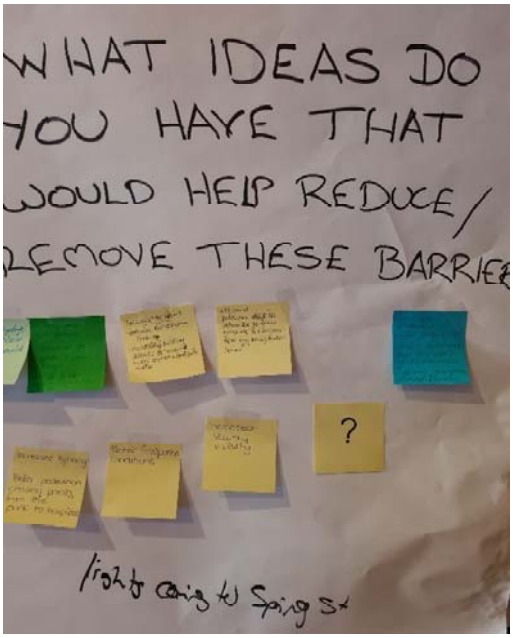
It was observed that Thames Street may be a preferred east-west route for cyclists rather than Severn Street

Concerns were expressed that if future developments along the corridor permitted building to property boundaries that pedestrian and cyclist amenity, and space available for the public realm may be impacted (potential for an urban street canyon).

What ideas do you have that would help reduce / remove these barriers?

The following summarises ideas workshop participants provided to remove barriers to walking and cycling on the Nelson Road corridor:

- Introduction of a walking/cycling 'plaza' (e.g. shared zone where pedestrians and cyclists have priority), applicable to either the whole length, or between Arnold and Thames Streets
- Lower speed environment
- Improvements to footpaths and pram crossings including:
  - Better condition paths
  - wider facilities
  - shared use paths
  - no gutters (flat transition from path to road)
  - pedestrian refuge near Arnold/Nelson intersection to improve access to Box Hill Gardens
- Provide better crossing opportunities including:
  - another marked pedestrian crossing across Nelson Road
  - an overpass
  - particularly between Box Hill Gardens and the hospital.



- Improved amenity for pedestrians and cyclists
  - Rest places, seating, shady places
  - Increased street planting
  - Mandatory building setbacks to increase public realm, and avoid an urban street canyon
- Improved safety for pedestrians and cyclists
  - Create an environment that feels safe
  - Increased lighting
  - Promote passive surveillance
  - Increased security visibility
- Provision of a bus lane that would also provide additional space for cyclists
- Improved cyclist facilities
  - Improved end-of-trip facilities and storage for cyclists
  - Street level bicycle parking
  - Improved wayfinding to bicycle facilities
- Provision of more car parking
- Consider reconfiguration of hospital driveway so it does not exit at Thames St roundabout
- Consider closure of Nelson Road to through vehicular traffic (partial road closure)

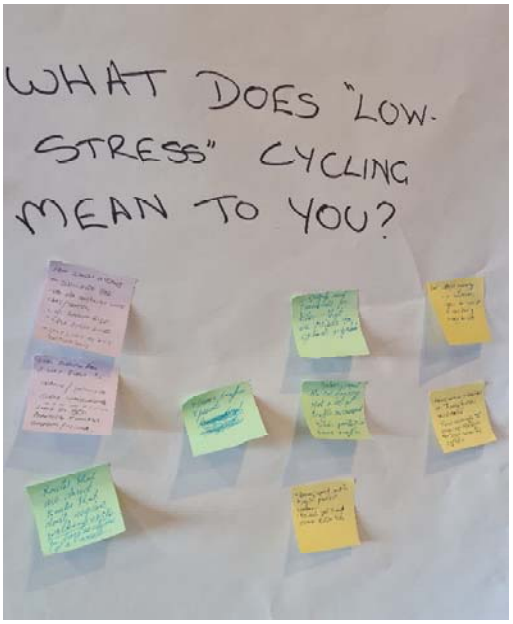
It was commented that the RSL masterplan includes increased (off-street) parking provision as well as a potential overpass to the Epworth hospital.

It was also noted that the planned pedestrian and cyclist bridge over the railway line from Nelson Road (south) to Thurston Road would also improve connectivity and amenity for pedestrians and cyclists, particularly for trips to Box Hill South.

What does a low stress cycling route mean to you?

Workshop participants were asked what a *low-stress cycling route* meant to them. Responses included:

- Routes that are direct with easy links to key destinations
- Space for cyclists to move freely, wide enough for two-way flow (3m)
- Dedicated path with no conflict from motor vehicle traffic
- Slower traffic speeds
- Inviting / intuitive, easy to use with clear way finding
- Good sight lines



- No risk of car dooring
- Routes that do not require bikes to be walked for long sections
- No obstacles
- Cyclist facilities (with signs showing where facilities are).

In relation to Nelson Road specifically, the following were suggested:

- Lower speed limit in hospital precinct
- More aware motorists at Thames/Nelson roundabouts
- Road markings to encourage motorists to leave space for cyclists

One participant also recommended to look at best practice examples (including overseas, and Holland in particular).

NELSON ROAD – PEDESTRIAN AND CYCLIST SAFETY INVESTIGATION
CONCEPTS OVERVIEW WORKSHOP SUMMARY

Date: Monday 8 November 2021

Time: 10am – 12noon

Location: Online (via Zoom). Note, following the online workshop, attendees were invited to provide subsequent feedback via an online survey.

Workshop attendees:

- Whitehorse City Council – Chris Hui, Gina Niel, John Nikas
- O'Brien Traffic – Matt Harridge, Lisa Steinmetz
- Epworth Health Care – Neil Caughey
- Whitehorse Active Transport Action Group – David Morrison
- Metro East Bicycle User Group – Elaine Hopper
- Elgar Contact – William Orange
- Box Hill Institute – Sam Pepper (joined at 10:20am)

Workshop apologies:

- Box Hill Hospital – Shane Macfarlane
- Box Hill RSL – Denis Fernando, Chris Gray, Brian Tateson
-

Recap of the previous Issues and Opportunities Workshop

OBT outlined what was heard from the first Issues and Opportunities Workshop.

Safety, security and amenity concerns raised included:

- high vehicle volumes & speed, mix of vehicle and road users
- high number of pedestrian and cyclist crashes
- poor condition and design of footpaths
- poor cycling facilities
- parked cars obstruct visibility for crossing pedestrians
- lack of pedestrian crossing facilities that align with key pedestrian desire lines
- Whitehorse Road and poor pedestrian and cycling connectivity over the railway line.

High / increasing demand for active transport modes with varying abilities:

- pedestrian volumes (medical and education precinct)
- range of walking abilities, needs and demographics
- range of bicycle riders' experience and competencies
- pedestrian and cyclist volumes will continue to grow with future growth and development.

What Design Principles have been adopted for the Nelson Road corridor?

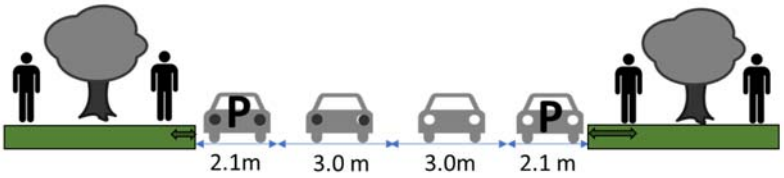
- Improved safety and access for people walking and cycling (highest priority pedestrians)
- Support range of walking abilities
- Support lower traffic speeds and reduced through traffic
- Consider opportunities for incremental infrastructure changes
- Alignment with Box Hill strategic objectives

The Preliminary Concepts

Each concept was explained, with key features and a discussion on pro's and cons of each concept outlined. Feedback and comments from the working group on each option was then sought.

Comment from participants: patient transport along with linen / oxygen / waste trucks will need to access the new Epworth development via Nelson Road – proposed concepts need to keep this in mind.

1. **Pedestrian Amenity**

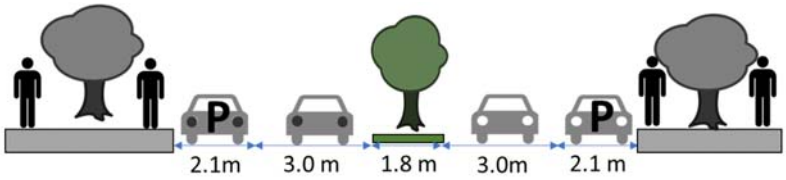


Comment from participants: this option signals that walking is encouraged and vehicles are discouraged – which was generally supported.

Council noted that reducing lane widths has been done in a number of locations around the municipality which has worked well.

-

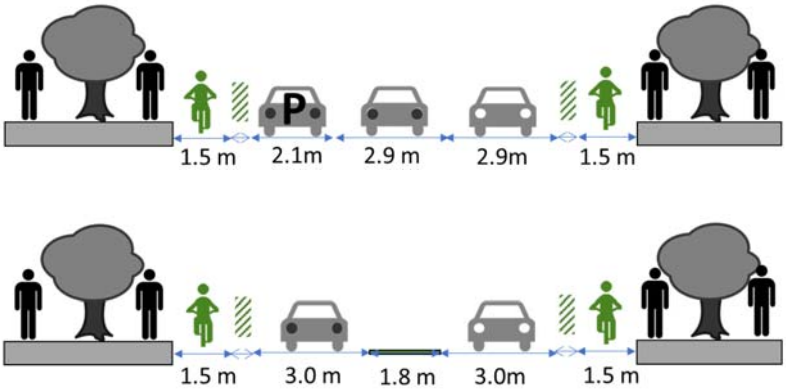
2. **Pedestrian Staging**



Comments from participants:

- If there is no bike facility, it is not providing a low stress environment for cyclists.
- Would the central median have a step up / step down? There may be tree planters to accommodate trees, but it is likely that the majority of the area would be at-grade.
- Consider a Shared Zone. Council noted that the traffic volume and access needs along Nelson Road would unlikely be conducive to a shared zone (and is therefore unlikely to meet the requirements).

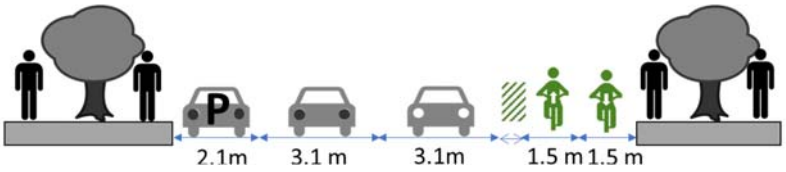
3. Separated Cycling Options



Comments from participants:

- some concerns about the loss of parking. Car parking demand in the area is high.
  - It was estimated that ~40 spaces would be removed from one side of the road.
  - Council noted that the Suburban Rail Loop would also result in significant parking losses at Whitehorse Road.
  - It was noted that off-street parking is provided, but the cost was considered quite significant.
- Pedestrians should be the priority. Box Hill Institute would not necessarily object to the removal of on-street car parking (as the campus does not rely on it).

4. Two-way Bicycle Lane



Comments from participants:

- MEBUG were not in favour of this option due to difficulties to get off and on at end points. MEBUG supports separated cycling and lower speed limit of 40 kph along the whole section.
- It was considered that this arrangement would be confusing.

5. Plaza

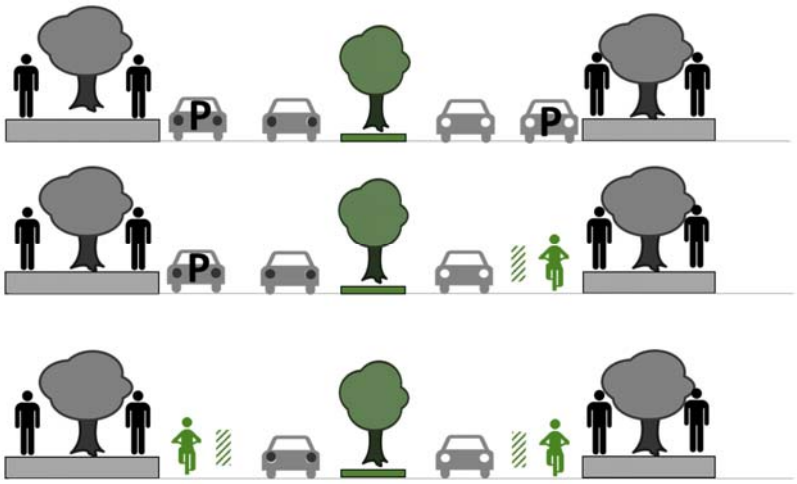


Comments from participants:

- Buses and emergency vehicles could be permitted to travel through the Plaza
- The Plaza option would not be supported by Box Hill Institute.
- A Plaza option would not be supported by Epworth between Whitehorse Road and Arnold Street. The removal of parking is a concern (however Epworth is providing off-street parking). A 40km/h speed zone for the area would be supported.
- A Plaza would have too many flow on issues (i.e. for nearby residential streets). A formal crossing is needed at Arnold Street
- A Plaza would be too hard to do. It would have flow on traffic issues for the surrounding area.
- Council noted that wider footpaths could and should be provided where possible i.e. widening footpaths between trees etc.
- an example of a Plaza option is shown below (for a short section and allowing particular road users to drive through). Easy Ride considerations are important. Could a constriction point be used instead of a Plaza?
- A Plaza could permit access for buses, specialist delivery vehicles and emergency vehicles. This option reduces through traffic, people searching for parking spaces and makes pedestrian safety and accessibility available to all levels of mobility without gutter drops.



6. Pedestrian Staging and Separated Cycling (Staged)



Comments from participants:

- Query: Would the drop off parking be removed for the options. Response: Yes, it is expected that this parking would be removed.
- Council noted that a 40km/h area wide speed limit is being proposed for this area (as a separate initiative).
- Swept paths for trucks entering and exiting the Epworth site will be vital to provide comfort that these treatments would not impact the operation of the hospital. Specific zebra crossings could be nominated.
- supported for option subject to specific zebra crossings being added and swept paths confirming access to Epworth would not be compromised.

Complimentary treatments

A discussion of complimentary treatments to improve safety and amenity along the corridor included:

- wider footpaths (by paving existing grass nature strip between footpath and kerb) – this provides additional space for pedestrians and reduces trip hazards.
- Midblock zebra crossings, flush kerb and/or kerb outstands at key locations to assist safe pedestrian crossing (particularly for range of pedestrian abilities)
- Improvements at Arnold Street and Thames Street intersections.

Comments from participants:

- Replacing grassed nature strip should be offset by more canopy tree planting to improve amenity and provide shade

Inclusion of complimentary treatments were generally supported by the group, particularly reducing trip hazards. Council noted that widening footpath in some areas may be inhibited by

grades. Retention of the hospital driveway exit into the Thames St roundabout was queried given the relocation of the emergency department to Rogerson Road.

Online survey

Following the online workshop, Council invited working group members to provide further feedback via an online survey. While only a few responses were received, these reflected the sentiments discussed during the online workshop, principally improving pedestrian and cyclist safety and amenity (indicated by preference for solutions with staged pedestrian crossings and separated cycling facilities). The highest preference was for *Pedestrian Staging and Separated Cycling*, noting also some responses for other solutions that featured separated cycling facilities or pedestrian staging or amenity (only).

Other key comments / points included:

- A suggestion to mix different solution types along the route, including consideration of a plaza (plaza provides a meeting place)
- Reduce parking to improve visibility of crossing pedestrians
- Consideration of level crossing points to support ease of pedestrians crossing and needs of pedestrians with accessibility issues
- Low (40 km/h) speed environment is important
- Consideration of traffic calming measures to support lower vehicle speeds
- Consider access needs for ambulances (e.g. avoiding humps)
- Need to maintain truck access for Epworth
- Consider other major Box Hill projects

Feedback received via the online survey reflected discussions during the online workshop. Solutions that strongly supported pedestrian and cyclist safety and amenity were preferred.

Overall Review

Comments / feedback from participants:

- Pedestrians are the priority
- Crossings should be raised wombat type to also provide traffic calming
- 40km/h area speed limit is supported. Could different treatments (different road surfacing) be used to communicate a pedestrian and cycling area?
- A strong message is needed at Whitehorse Road end (going north) that this is a low speed precinct
- Off-street parking could replace on-street parking as part of developments
- Parking removal is a positive change but it needs to be done incrementally and with community engagement

- Need to maintain awareness of the cycling NS2 route in the council cycling strategy for access to Koonung Trail in the north and the Box Hill CBD in south and all points along the way.
- Awareness of the uphill (going south along Nelson to Whitehorse Road) is important for cyclist amenity. If there is a combined traffic lane (only) it can be fear -inducing to have large truck behind them or speedy car on their back wheel
- WATAG supports Plaza near Arnold St and Ped Staging + separated cycling elsewhere. 2nd preference is the plaza with separate cycling with 1 parking lane. Pop up treatments could be trialled before final commitment.
- A staged approached seemed to be an appropriate method to ensure the community comes along the journey of changes.

APPENDIX C

PRELIMINARY DESIGN OPTIONS EVALUATION FRAMEWORK NOTES

CONCEPT	PEDESTRIAN AMENITY CONCEPT	PEDESTRIAN STAGING CONCEPT	SEPARATED CYCLING CONCEPT	2-WAY CYCLE PATH CONCEPT	NELSON PLAZA	PEDESTRIAN STAGING + SEPARATED CYCLING CONCEPT
Safety	✓ Reduced pedestrian crossing distance ✓ Reduced lane with (lower speed environment) ✓ 40 km/h speed limit ✗ Cyclists on road with general traffic	✓ Reduced pedestrian crossing distance (staged crossing) ✓ Reduced lane width (lower speed environment) ✓ 40 km/h speed limit ✓ Cyclists on road but sharrows	✓ Separated cycling facilities ✓ Reduced lane width (lower speed environment) ✓ 40 km/h speed limit ✗ No change for pedestrians	✓ Separated cycling facilities ✓ 40 km/h speed limit ✗ Potential for confusion ✗ No change for pedestrians	✓ Separation of cyclists and pedestrians from traffic (& no through traffic) ✓ Improved pedestrian & cyclist access & amenity ✓ 40 km/h speed limit	✓ Reduced pedestrian crossing distance (staged crossing) ✓ Reduced lane width (lower speed environment) ✓ 40 km/h speed limit ✓ Improved cycling facilities (incremental from Phase 2)
Access and amenity	✓ Increased space for pedestrians (wider footpaths & increased landscaping) ✓ 40 km/h speed limit ✓ Sharrows (bikes on road)	✓ Easier pedestrian crossing (staged)	✓ Improved cyclist access & amenity ✗ No change for pedestrians	✓ Improved cyclist access & amenity ✗ No change for pedestrians	✗ Impact on local trips & through traffic ✗ Lack of (current) active frontages may contribute to security concerns for pedestrians and cyclists	✓ Easier pedestrian crossing (staged) ✓ Improved cyclist access & amenity (from Phase 2)
Environment / Streetscape	✓ Opportunity increased tree canopy and streetscape improvements	✓ Increased tree canopy (Median tree planting)	✗ No additional planting	✗ No additional planting	✓ Increased tree canopy and streetscape improvements	✓ Increased tree canopy and streetscape improvements
Parking	✓ Parking on both sides retained	✓ Parking on both sides retained	✓ Parking on one side retained	✓ Parking on one side retained	✓ Parking retained (other section of street closure)	✓ Parking retained (Phases 1 & 2) ✗ No on-street parking (Stage 3)

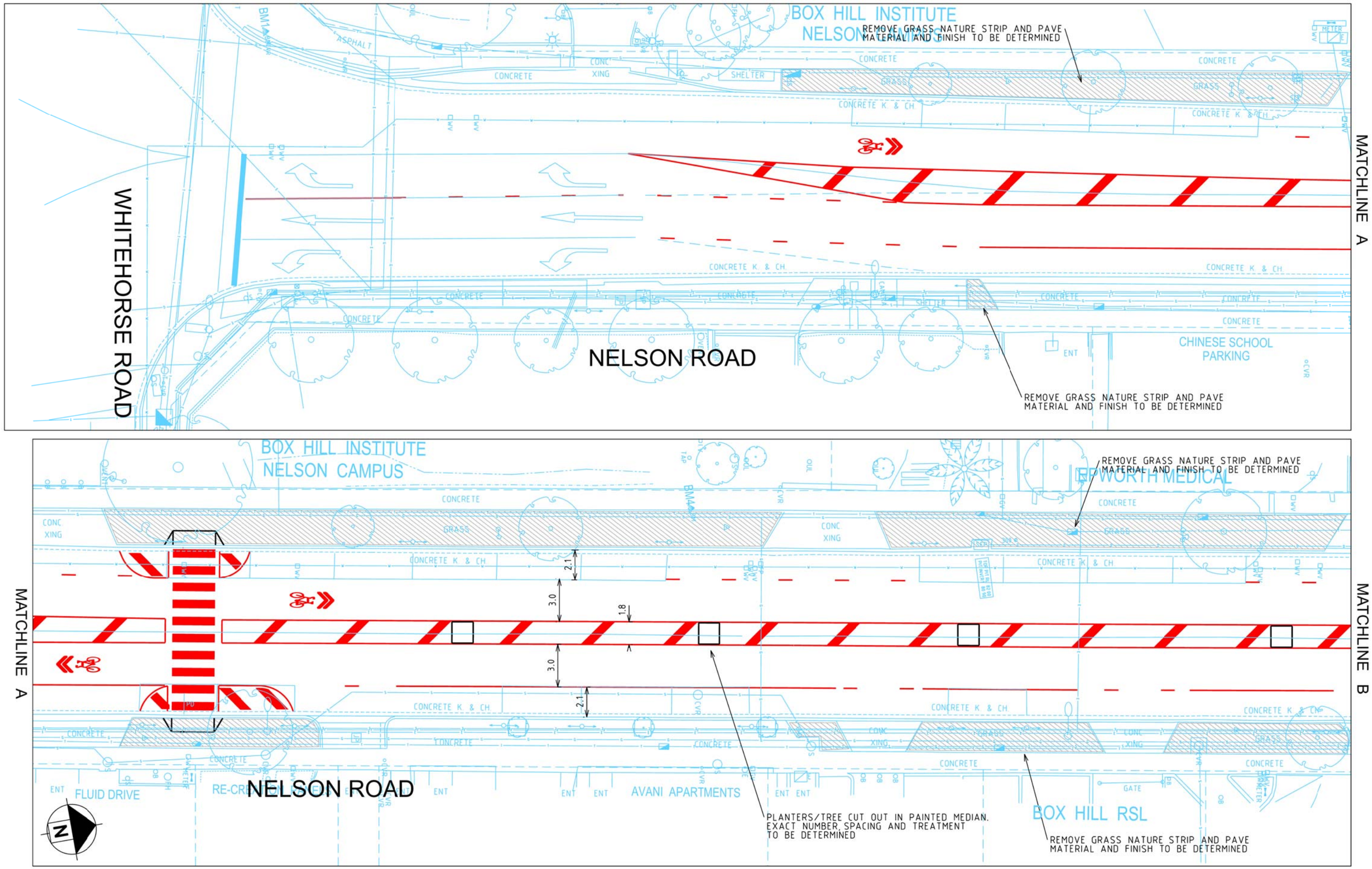
CONCEPT	PEDESTRIAN AMENITY CONCEPT	PEDESTRIAN STAGING CONCEPT	SEPARATED CYCLING CONCEPT	2-WAY CYCLE PATH CONCEPT	NELSON PLAZA	PEDESTRIAN STAGING + SEPARATED CYCLING CONCEPT
Buildability	✓ Implementation may be staged (across segments)	• Implementation can be staged (across segments)	✗ No staging of treatment	✗ No staging of treatment	✗ No staging of treatment ✓ Streetscape improvements may be added over time	✓ Implementation can be staged across phases ✓ Lower cost options may be explored / trialled
Alignment with Box Hill strategic objectives	✓ Improved pedestrian safety & amenity ✓ Opportunity for increased tree canopy ✗ No substantial change for cyclists	✓ Improved pedestrian and cyclist safety & amenity ✓ Opportunity for increased tree canopy	✓ Improved cyclist safety & amenity ✗ No substantial change for pedestrians ✗ No additional planting	✓ Improved cyclist safety & amenity ✗ No substantial change for pedestrians ✗ No additional planting	✓ Improved pedestrian and cyclist safety & amenity ✗ Opportunity for increased tree canopy	✓ Improved pedestrian and cyclist safety & amenity • Opportunity for increased tree canopy
Cost	**$$$$** Carriageway narrowed along project length (requires reconstruction of kerb and channel, street drainage, and streetscape)	**$$** • No change to kerb lines • Narrowing of traffic lanes and provision of flush median • Low cost option can be explored (e.g. painted median, temporary kerbing for median islands • Moderate cost option may feature painted median with planter boxes	**$$$** • No change to kerb lines • Involves removal of parking, narrowing of traffic lanes and provision of separated cycling lanes (physical separation where possible)	**$$$** • No change to kerb lines • Involves reconfiguration of carriageway: removal of parking (east side), narrowing of parking and traffic lanes, provision of separated 2-way cycle path (physical separation where possible)	**$$$$** • Road closure and construction of plaza	**$$$** • No change to kerb lines • Can be staged to manage costs • Phase 1 – narrowing of traffic lanes and provision of flush median (**$$**) • Phases 2A/B /3 – progressive removal of parking and provision of separated cycling lanes (physical

CONCEPT	PEDESTRIAN AMENITY CONCEPT	PEDESTRIAN STAGING CONCEPT	SEPARATED CYCLING CONCEPT	2-WAY CYCLE PATH CONCEPT	NELSON PLAZA	PEDESTRIAN STAGING + SEPARATED CYCLING CONCEPT
		• High cost option may feature flush median with plantings within pavement cut-outs				separation where possible) (**$$$**) • Low-cost options can be explored (e.g. temporary kerbing for median islands

APPENDIX D

CONCEPT LAYOUTS

- **PHASE 1**
- **PHASE 2A**
- **PHASE 2B**
- **PHASE 3**



ISSUE	DATE	AMENDMENTS	BY

NOT FOR CONSTRUCTION

NOTES:
1. NELSON ROAD
PROPOSED SPEED ZONE 40KM/H

O'BRIEN TRAFFIC
• Traffic Planning • Transport Planning
• Traffic Engineering • Road Safety
SUITE 2.03, 789 TOORAK ROAD
HAWTHORN EAST, VIC, 3123
P: +613 9804 3610
W: obrientraffic.com

ENGINEER: L STEINMETZ	DRAWING NO: 21314001-B
DESIGNED BY: B VANDERWERF	SHEET NO: 1 of 4
DATE: 12/07/2022	21314 NO: 21314
SCALE: 1:250	
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ISSUE: -	

NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 1

MATCHLINE B

MATCHLINE C

EPWORTH MEDICAL

CONSTRUCTION SITE

EPWORTH M

PLANTERS/TREE CUT OUT IN PAINTED MEDIAN. EXACT NUMBER, SPACING AND TREATMENT TO BE DETERMINED

REMOVE GRASS NATURE STRIP AND PAVE MATERIAL AND FINISH TO BE DETERMINED

RELOCATE EXISTING BUS STOP

REMOVE GRASS NATURE STRIP AND PAVE MATERIAL AND FINISH TO BE DETERMINED

BOX HILL RSL

NELSON ROAD

ARNOLD STREET

MATCHLINE C

MATCHLINE D

BOX HILL GARDENS

NELSON ROAD

ISSUE	DATE	AMENDMENTS	BY

NOT FOR CONSTRUCTION

NOTES:
1. NELSON ROAD
PROPOSED SPEED ZONE 40KM/H

O'BRIEN TRAFFIC

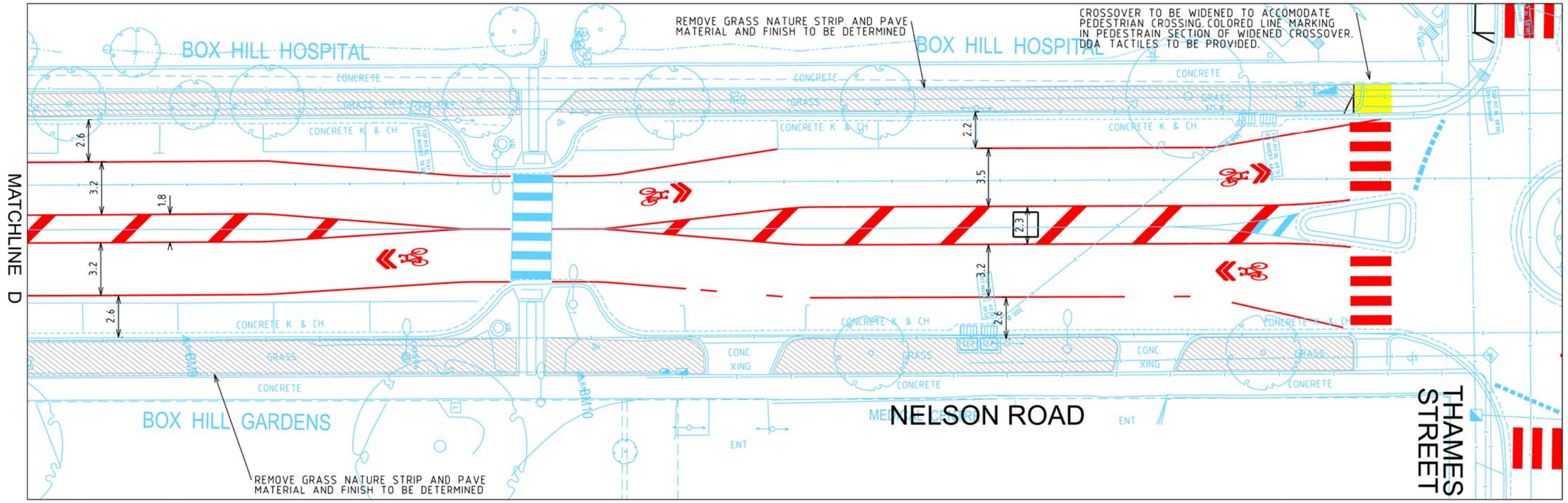
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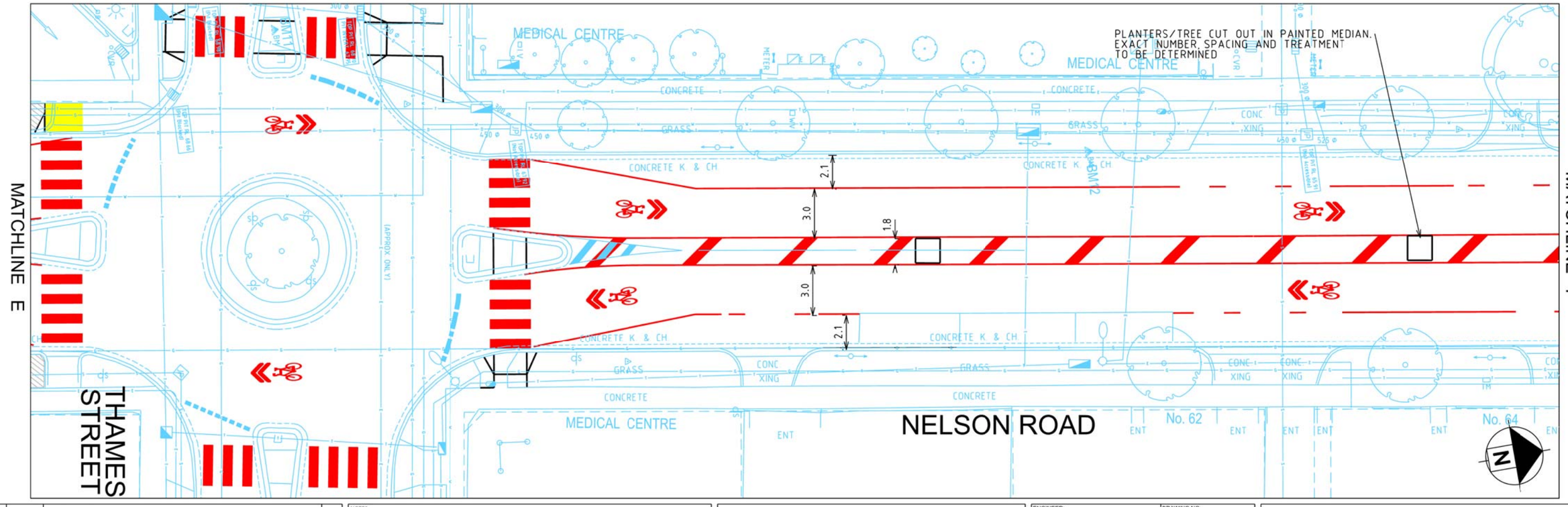
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ENGINEER: L STEINMETZ	DRAWING NO: 21314001-B
DESIGNED BY: B VANDERWERF	SHEET NO: 2 of 4
DATE: 12/07/2022	21314 NO: 21314
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Hor. Scale Ver. 0 2.5 5	ORIGINAL: A3 ISSUE: -

NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 1





ISSUE	DATE	AMENDMENTS	BY

NOT FOR CONSTRUCTION

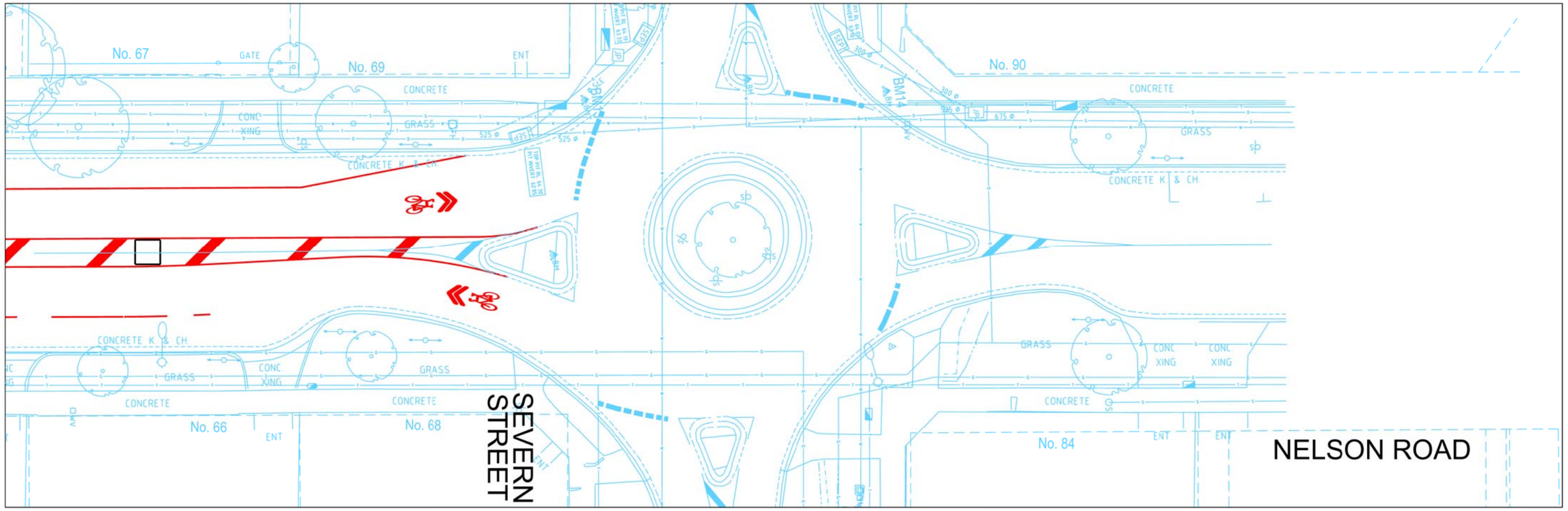
NOTES:
1. NELSON ROAD
PROPOSED SPEED ZONE 40KM/H

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ENGINEER: L STEINMETZ	DRAWING NO: 21314001-B
DESIGNED BY: B VANDERWERF	SHEET NO: 3 of 4
DATE: 12/07/2022	21314 NO: 21314
SCALE: 1:250	
Hor. Scale Ver. 0 2.5 5	ORIGINAL: A3 ISSUE: -

NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 1



MATCHLINE F

N

ISSUE	DATE	AMENDMENTS	BY

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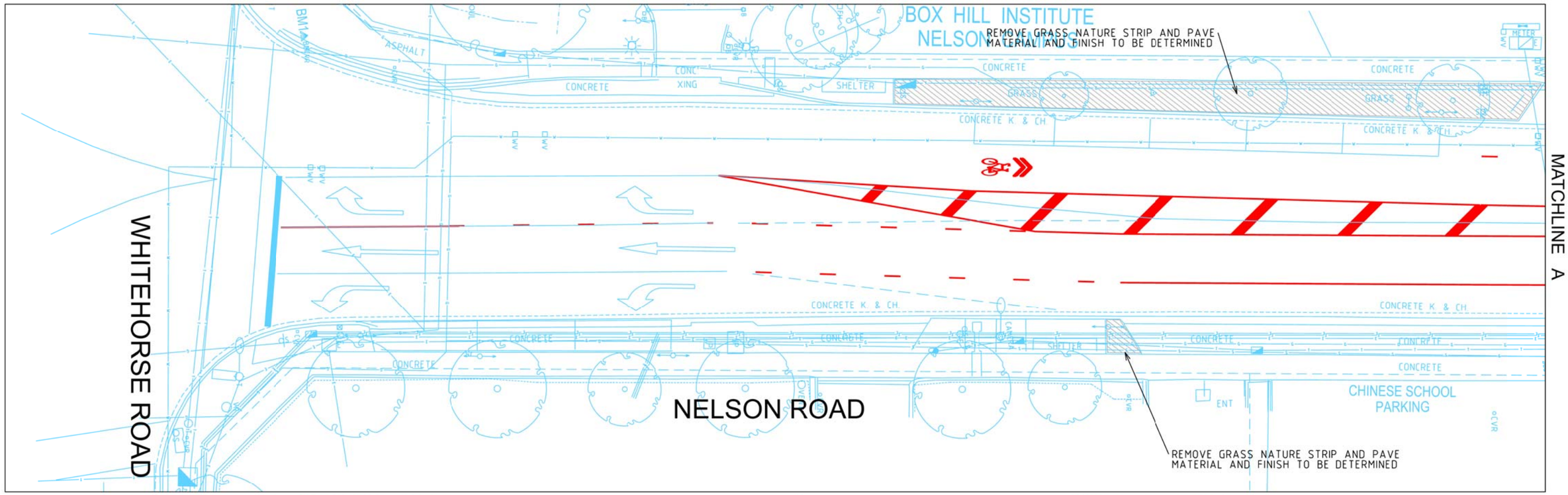
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ISSUE: -	

NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 1



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DATE: 12/07/2022	21314 NO: 21314
SCALE: 1:250	
Hor. Scale 0 2.5 5 Ver.	ORIGINAL: A3 ISSUE: -

NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 2A

MATCHLINE B

MATCHLINE C

EPWORTH MEDICAL

CONSTRUCTION SITE

EPWORTH M

PLANTERS/TREE CUT OUT IN PAINTED MEDIAN. EXACT NUMBER, SPACING AND TREATMENT TO BE DETERMINED

REMOVE GRASS NATURE STRIP AND PAVE MATERIAL AND FINISH TO BE DETERMINED

RELOCATE EXISTING BUS STOP

REMOVE GRASS NATURE STRIP AND PAVE MATERIAL AND FINISH TO BE DETERMINED

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER WIDTH AND TYPE TO BE DETERMINED

BOX HILL RSL

NELSON ROAD

ARNOLD STREET

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER WIDTH AND TYPE TO BE DETERMINED

MATCHLINE C

MATCHLINE D

BOX HILL GARDENS

NELSON ROAD

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER WIDTH AND TYPE TO BE DETERMINED

ISSUE	DATE	AMENDMENTS	BY

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NOTES:
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Hor. Scale Ver. 0 2.5 5	ORIGINAL: A3 ISSUE: -

NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 2A

MATCHLINE D

MATCHLINE E

BOX HILL HOSPITAL

BOX HILL GARDENS

NELSON ROAD

THAMES STREET

REMOVE GRASS NATURE STRIP AND PAVE MATERIAL AND FINISH TO BE DETERMINED

CROSSOVER TO BE WIDENED TO ACCOMODATE PEDESTRIAN CROSSING. COLORED LINE MARKING IN PEDESTRAIN SECTION OF WIDENED CROSSOVER. DDA TACTILES TO BE PROVIDED.

CYCLIST CONNECTION TO PARK

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER WIDTH AND TYPE TO BE DETERMINED

REMOVE GRASS NATURE STRIP AND PAVE MATERIAL AND FINISH TO BE DETERMINED

MATCHLINE E

MATCHLINE F

MEDICAL CENTRE

NELSON ROAD

THAMES STREET

PLANTERS/TREE CUT OUT IN PAINTED MEDIAN. EXACT NUMBER, SPACING AND TREATMENT TO BE DETERMINED

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER WIDTH AND TYPE TO BE DETERMINED

No. 62

No. 64

ISSUE	DATE	AMENDMENTS	BY

NOT FOR CONSTRUCTION

NOTES:
1. NELSON ROAD
PROPOSED SPEED ZONE 40KM/H

O'BRIEN TRAFFIC

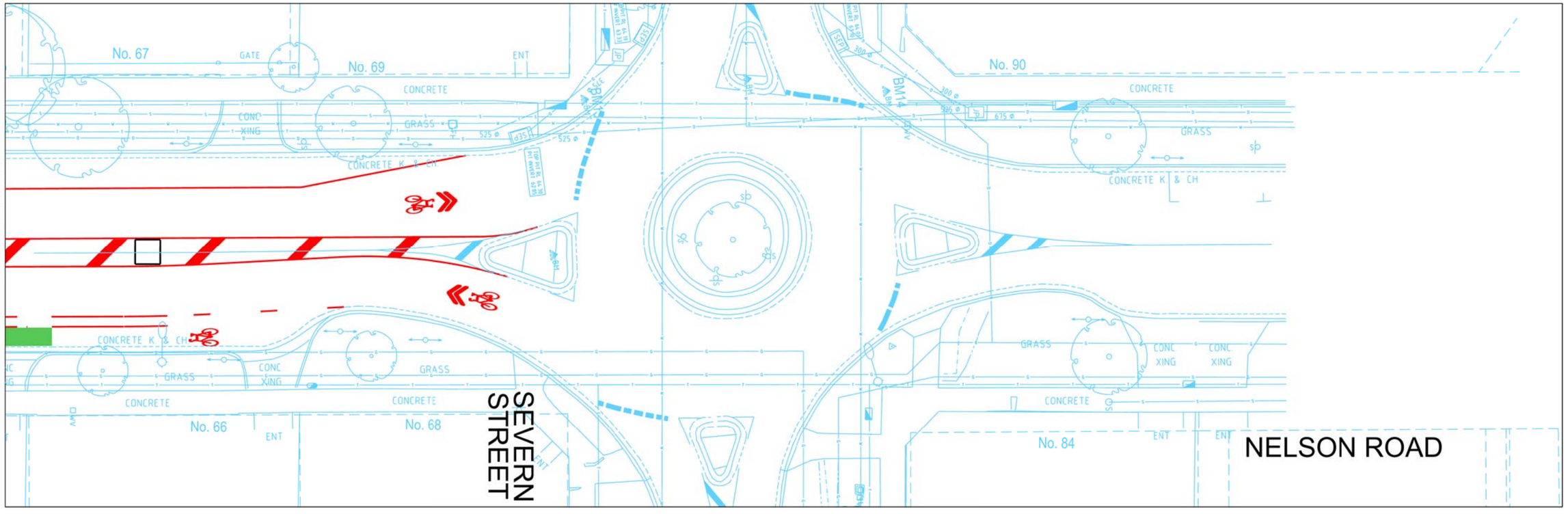
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NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 2A



ISSUE	DATE	AMENDMENTS	BY

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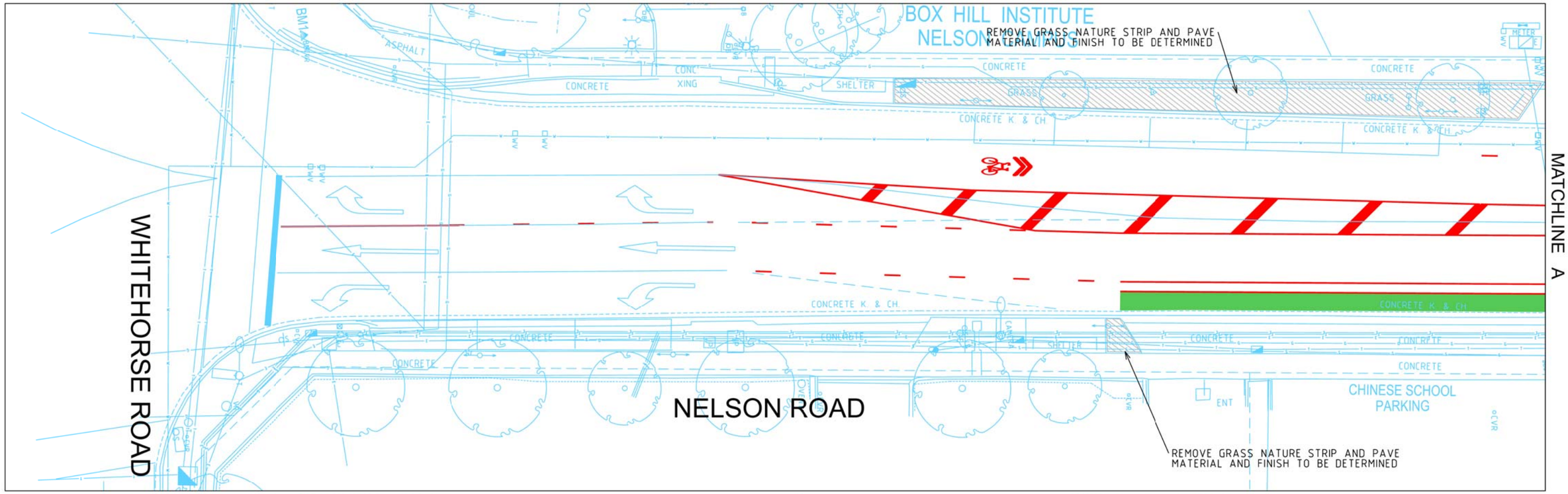
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NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 2A



ISSUE	DATE	AMENDMENTS	BY

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DATE: 12/07/2022	21314 NO: 21314
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Hor. Scale Ver. 0 2.5 5	ORIGINAL: A3 ISSUE: -

NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 2B

MATCHLINE B

MATCHLINE C

EPWORTH MEDICAL

CONSTRUCTION SITE

EPWORTH M

PLANTERS/TREE CUT OUT IN PAINTED MEDIAN. EXACT NUMBER, SPACING AND TREATMENT TO BE DETERMINED

REMOVE GRASS NATURE STRIP AND PAVE MATERIAL AND FINISH TO BE DETERMINED

RELOCATE EXISTING BUS STOP

REMOVE GRASS NATURE STRIP AND PAVE MATERIAL AND FINISH TO BE DETERMINED

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER WIDTH AND TYPE TO BE DETERMINED

BOX HILL RSL

NELSON ROAD

ARNOLD STREET

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER WIDTH AND TYPE TO BE DETERMINED

MATCHLINE C

MATCHLINE D

BOX HILL GARDENS

NELSON ROAD

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER WIDTH AND TYPE TO BE DETERMINED

ISSUE	DATE	AMENDMENTS	BY

NOT FOR CONSTRUCTION

NOTES:
1. NELSON ROAD
PROPOSED SPEED ZONE 40KM/H

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DATE: 12/07/2022	21314 NO: 21314
SCALE: 1:250	
Hor. Scale / Ver. 0 2.5 5	ORIGINAL: A3 ISSUE: -

NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 2B

REMOVE GRASS NATURE STRIP AND PAVE MATERIAL AND FINISH TO BE DETERMINED

CROSSOVER TO BE WIDENED TO ACCOMODATE PEDESTRIAN CROSSING. COLORED LINE MARKING IN PEDESTRAIN SECTION OF WIDENED CROSSOVER. DDA TACTILES TO BE PROVIDED.

BOX HILL HOSPITAL

BOX HILL GARDENS

NELSON ROAD

THAMES STREET

MATCHLINE D

MATCHLINE E

CYCLIST CONNECTION TO PARK

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER WIDTH AND TYPE TO BE DETERMINED

REMOVE GRASS NATURE STRIP AND PAVE MATERIAL AND FINISH TO BE DETERMINED

PLANTERS/TREE CUT OUT IN PAINTED MEDIAN. EXACT NUMBER SPACING AND TREATMENT TO BE DETERMINED

MEDICAL CENTRE

No. 62

No. 64

MATCHLINE E

MATCHLINE F

ISSUE	DATE	AMENDMENTS	BY

NOT FOR CONSTRUCTION

NOTES:
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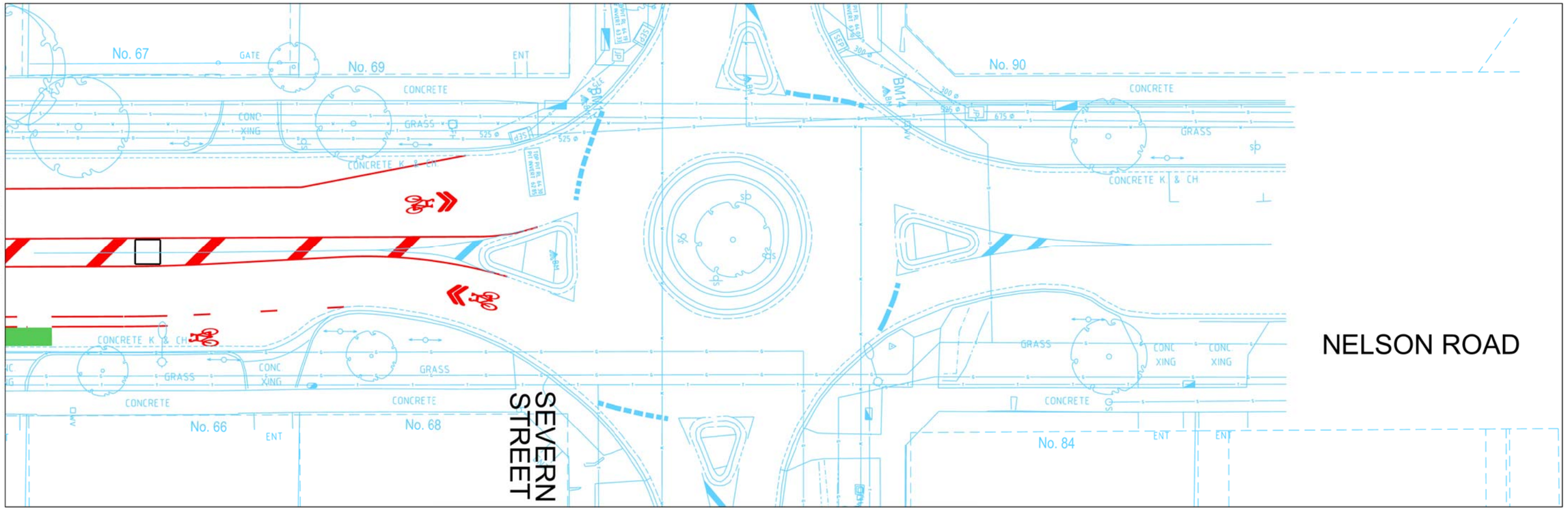
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NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 2B



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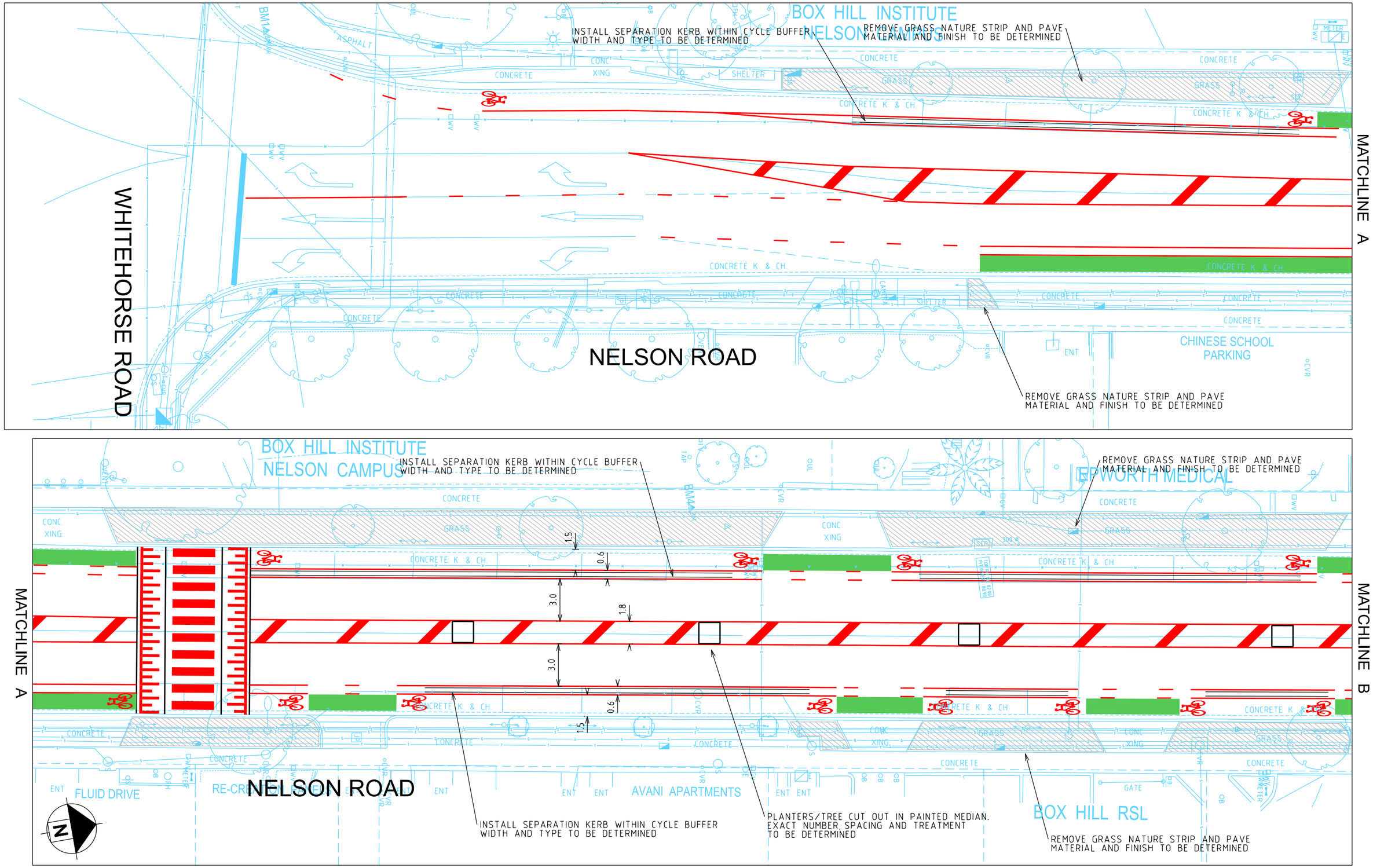
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NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 2B



ISSUE	DATE	AMENDMENTS	BY

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ENGINEER: L STEINMETZ	DRAWING NO: 21314003-A
DESIGNED BY: M FERGUSON	SHEET NO: 1 of 4
DATE: 12/07/2022	21314 NO: 21314
SCALE: 1:250	
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ISSUE: -	

NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 3

MATCHLINE B

MATCHLINE C

EPWORTH MEDICAL

CONSTRUCTION SITE

EPWORTH M

PLANTERS/TREE CUT OUT IN PAINTED MEDIAN.
EXACT NUMBER SPACING AND TREATMENT
TO BE DETERMINED

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER
WIDTH AND TYPE TO BE DETERMINED

REMOVE GRASS NATURE STRIP AND PAVE
MATERIAL AND FINISH TO BE DETERMINED

CONCRETE

CONC XING

GRASS

CONCRETE K & CH

3.0

1.8

0.6

1.5

BOX HILL RSL

NELSON ROAD

REMOVE GRASS NATURE STRIP AND PAVE
MATERIAL AND FINISH TO BE DETERMINED

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER
WIDTH AND TYPE TO BE DETERMINED

MATCHLINE C

MATCHLINE D

ARNOLD STREET

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER
WIDTH AND TYPE TO BE DETERMINED

CONCRETE

GRASS

SHELTER

CONC XING

CONCRETE K & CH

3.0

1.8

0.6

1.5

3.2

0.8

BOX HILL GARDENS

NELSON ROAD

INSTALL SEPARATION KERB WITHIN CYCLE BUFFER
WIDTH AND TYPE TO BE DETERMINED

N

ISSUE	DATE	AMENDMENTS	BY

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NOTES:
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PROPOSED SPEED ZONE 40KM/H

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NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 3

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BOX HILL HOSPITAL

BOX HILL GARDENS

MEDICAL CENTRE

NELSON ROAD

THAMES STREET

MATCHLINE D

MATCHLINE E

CYCLIST CONNECTION TO PARK

REMOVE GRASS NATURE STRIP AND PAVE MATERIAL AND FINISH TO BE DETERMINED

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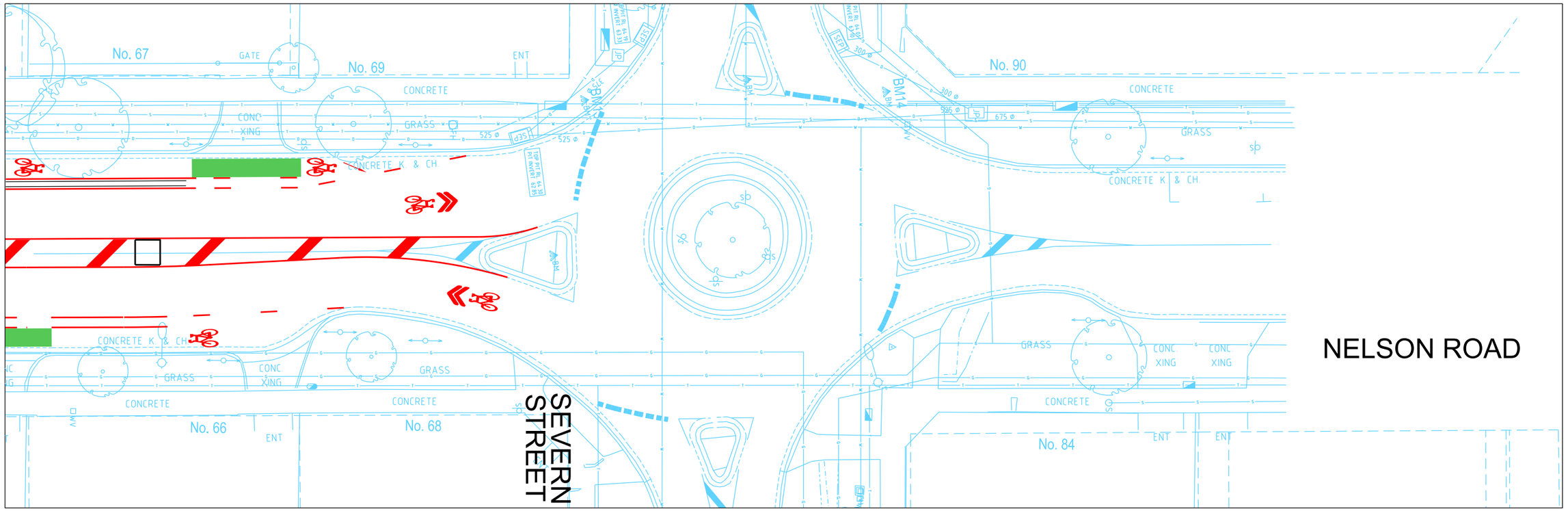
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PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 3



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NELSON ROAD, BOX HILL

PEDESTRIAN STAGING AND SEPERATED CYCLING TREATMENT CONCEPT LAYOUT PHASE 3

APPENDIX E

ROAD SAFTY AUDIT

Road Safety Audit Report



Location: **Nelson Road, Box Hill**

Project: **Local Area Traffic Management/ Cycling Treatments**

Audit Stage: **Concept Design**

Client: **O'Brien Traffic**

Report Issue Date: 10 June 2022

RSA Reference: 12665

Road Safety Audits
8/79 Manningham Rd
Bulleen, Victoria 3105
ABN 96 647 479 016
www.rsaudits.com.au

Contact
Mike Game
0466 308 873
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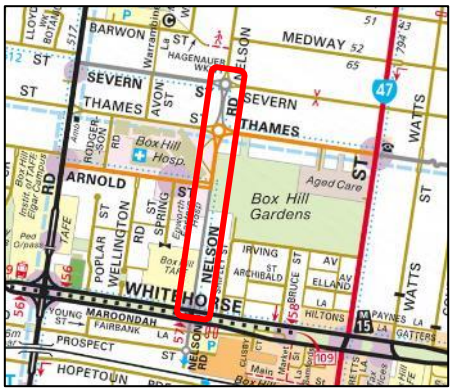
Specialised
Practical
Independent

Road Safety Audit Report

Nelson Road, Box Hill

O'Brien Traffic

RSA Reference: 12665



Melway Online

Document Record

Revision	Delivered	Road Safety Auditors	Contact
A	10 June 2022	Mike Game Peter Harris Bob Cumming	Mike Game

Road Safety Audits
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EXECUTIVE SUMMARY

RSA supports the overall programme of work as an integrated local area traffic management programme. The project supports enhanced cyclist and pedestrian amenity and reduces expected operating speeds, albeit with reduced on-street parking.

There are no major safety issues identified.

CONTENTS

Project Background **5**
Introduction 5
Project 5
Location and Road Conditions 6
1. Nelson Road, Box Hill 6
2. Public facilities – education, health, recreation, shopping 9
3. Whitehorse Road 9
4. Connectivity with other cycling networks 10
Project-Specific Audit Focus 10
Commencement Meeting 11
Constraints and Exclusions 11
Conduct of the Site Inspection 11
Documentation Provided for the Audit 11
Audit Findings and Treatment Options **12**
General Audit Comments 13
1. Raised Safety Platforms 13
2. Median parking 15
Specific Audit Comments 16
3. Phase 1 16
4. Phase 2A and 2B 17
5. Phase 3 18
Finalisation **19**
Concluding Statement 19
Responding to the Road Safety Audit 19
Road Safety Audit Background **20**
Road Safety Audit: Overview 20
Road Safety Audit Team and Quality Assurance 20
Audit Type 21
Scope: General 21
Scope: Safe System 21
References 21
Risk Ratings 23

PROJECT BACKGROUND

INTRODUCTION

This is a concept design stage road safety audit of local area traffic management treatments along Nelson Road, Box Hill.

The audit has been undertaken by Road Safety Audits, commissioned by O'Brien Traffic.

It has been conducted according to "Austroads Guide to Road Safety, Part 6 Road Safety Audit 2022" guidelines.

PROJECT

The project delivers local area traffic management treatments along Nelson Road, Box Hill between Whitehorse Road and Severn Street, approximately 600 metres in length.

The project will be delivered in phases. The audit scope includes assessment of the phases individually. In summary, the key elements of the project and the phasing are summarised in the following table.

Feature	Phase 1	Phase 2a	Phase 2b	Phase 3
40 km/h speed limit (previously 50 km/h)	Yes	Yes	Yes	Yes
'Sharrows' at intersections.	Yes	Yes	Yes	Yes
Painted median treatment & planter boxes (3.0 metre through lane widths).	Yes	Yes	Yes	Yes
Two Wombat Crossings	Yes	Yes	Yes	Yes
Conversion of Arnold Street T-intersection to a roundabout	Yes	Yes	Yes	Yes
Zebra Crossing (all legs of the two roundabouts and one mid-block location)	Yes	Yes	Yes	Yes
Kerbside parking removal and replacement with separated bike lanes.	No	East side only along northern section only.	East side only along the full extent.	Both sides.

Project elements and proposed phasing

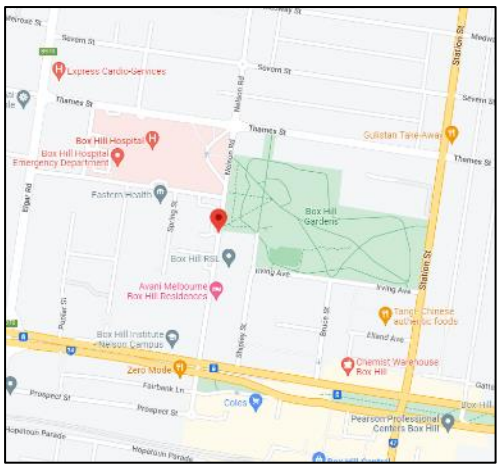
The client has advised the phasing timeline has not been established. However, each phase may be operational for an extended period such as several years. There is also the potential that latter phases will not be implemented; hence interim stages may become the ultimate state. Hence as agreed with the client, each phase has been assessed and audited as a 'stand-alone' phase.

LOCATION AND ROAD CONDITIONS

1. Nelson Road, Box Hill

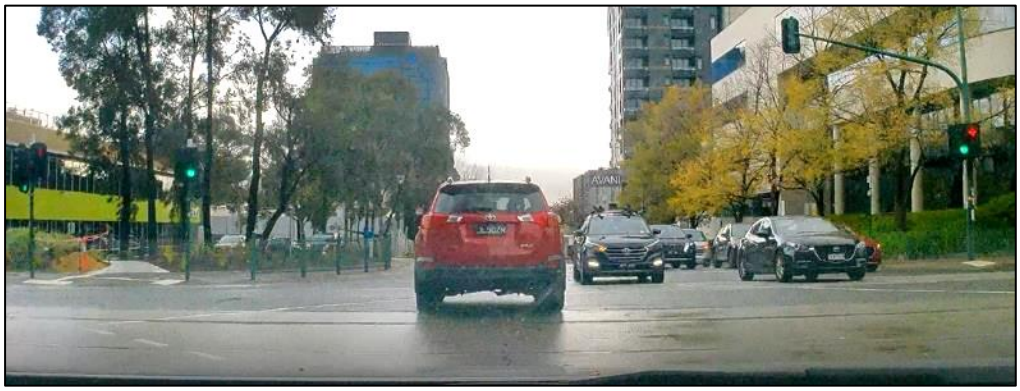
Nelson Road is a two-way, two-lane local road with kerb-side parking on both sides of the road. The default urban speed limit of 50 km/h is applicable. Public buses operate along Nelson Road and there are two northbound kerb-side bus stops and one southbound bus stop along road.

The subject site commences at the Nelson Road intersection with Whitehorse Road and extends north for approximately 600 metres to the Severn Street intersection with a downgrade 4% i.e., downhill for northbound cyclists. Along the subject site length there are two local road intersections, namely Arnold Street's t-intersection to the west side of Nelson Road and the Thames Street and Nelson Road intersection.

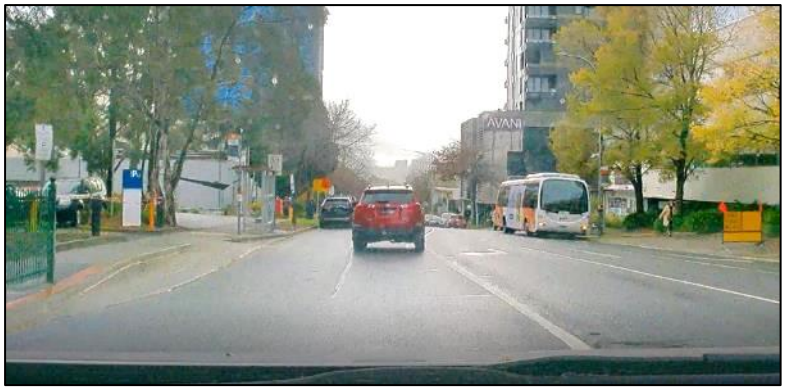


Google Maps

Box Hill Hospital, Box Hill Institute, Box Hill RSL and Box Hill Gardens all have Nelson Road frontage



Looking north toward Nelson Road at Whitehorse Road



Nelson Road northbound at the departure site of Whitehorse Road



Nelson Road northbound on approach to the RSL



Nelson Road northbound in the vicinity of Box Hill Hospital (left side) and Box Hill Gardens (right-side)



Nelson Road northbound approach to Thames Street



Nelson Road northbound approach to Severn Street



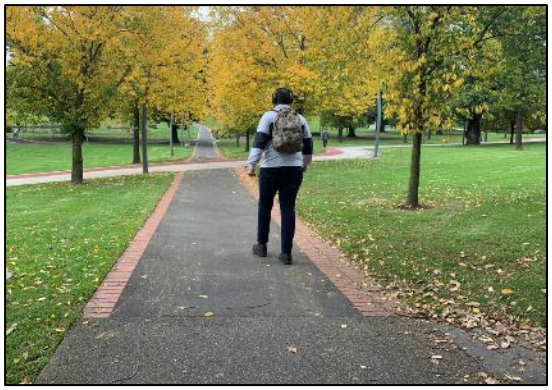
Nelson Road southbound approach to Thames Street



Nelson Road southbound approach to pedestrian crossing in the vicinty of the hospital and gardens



Looking south at the path connect between Nelson Road and Box Hill Gardens



Looking south-east along the path from Nelson Road



Looking north-west along the path toward Nelson Road

The following features of the subject site and adjoining areas are relevant to the audit;

2. Public facilities – education, health, recreation, shopping

Various public facilities have frontage to Nelson Road. Specifically, these are:

- Box Hill (Public) Hospital;
- Box Hill RSL;
- Box Hill Gardens; and
- Box Hill Institute

Additionally, the Box Hill Central Shopping Centre and train station are located a short distance south of the subject site.

As such, the subject site is a busy vehicular and pedestrian precinct. Additionally, it is expected that a proportion of pedestrians will have mobility issues given the proximity to the hospital. There is also a high volume of cross over activity i.e., vehicles accessing the various facilities. However, the key entrances including emergency entrance to Box Hill Hospital are not along the Nelson Road frontage.

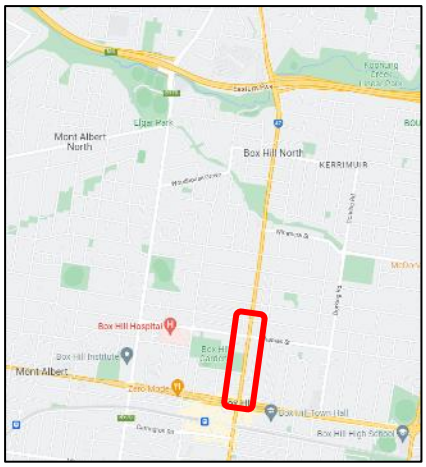
3. Whitehorse Road

Whitehorse Road is a four-lane, two-way divided arterial road with trams along the median. The posted speed limit is 70 km/h. There are no cycling facilities along Whitehorse Road near the subject site.

Although the project is intended to create a cyclist-friendly local area management zone, the overall amenity is necessarily limited by the poor cyclist connectivity at the Whitehorse Road end of the subject site.

4. Connectivity with other cycling networks

There are no cycling facilities adjacent to the subject site. However, the project will provide enhanced amenity for local cyclists accessing the Nelson Road public facilities and the Box Hill shopping centre and train station. Additionally, it will provide enhanced connection for cyclists travelling between Box Hill and the Eastern Freeway cycle network.



The project delivers improved cyclist amenity along the subject site (refer red rectangle in image), however there are no direct connections with pre-existing cycle paths

PROJECT-SPECIFIC AUDIT FOCUS

The audit has issues associated with the project, including but not limited to the following:

- Observed and expected use (e.g., pedestrians, cyclists, small vehicles, large vehicles);
- Expected operating speeds and speed limits;
- Proposed through lane and bike lane dimensions;
- Pedestrian crossing treatments, locations, and desire lines;
- Horizontal and vertical geometry;
- Each proposed treatment alone and in combination with other treatments;
- The rationale for each phase;
- Potential sight-line issues;
- Potential conflict issues at intersections (including approaches and departures);
- Connectivity with other paths and with adjacent and nearby amenities.

COMMENCEMENT MEETING

Telephone discussions between RSA and the client during May and June 2022.

CONSTRAINTS AND EXCLUSIONS

- This audit may cover DDA and accessibility issues but is not a full DDA and accessibility audit of the type as would be undertaken by a DDA/accessibility specialist.
- This audit may cover lighting issues but is not a full lighting assessment of the site to AS1158, as would be undertaken by a lighting specialist.

CONDUCT OF THE SITE INSPECTION

Site visits were conducted during 01.06.22 and 03.06.22. The site was inspected on-foot and in-vehicle.

DOCUMENTATION PROVIDED FOR THE AUDIT

The following documents were provided by the client to facilitate the audit:

- Drawing Number 2134001-A, Nelson Road Concept Layout Phase 1, 01.06.22 prepared by O'Brien Traffic, 4 sheets;
- Drawing Number 2134002A-A, Nelson Road Concept Layout Phase 2A, 01.06.22 prepared by O'Brien Traffic, 4 sheets;
- Drawing Number 2134002B-A, Nelson Road Concept Layout Phase 2B, 01.06.22 prepared by O'Brien Traffic, 4 sheets;
- Drawing Number 2134003-A, Nelson Road Concept Layout Phase 3, 01.06.22 prepared by O'Brien Traffic, 4 sheets;

Previous road safety audits:

- None supplied.

AUDIT FINDINGS AND TREATMENT OPTIONS

The initial section of the audit, entitled 'General Audit Comments' considers the overall multi-phase program of work. The subsequent section, entitled 'Specific Audit Comments' considers each phase as a 'stand-alone' project.

RSA supports the overall programme of work as an integrated local area traffic management programme. The project provides enhanced cyclist and pedestrian safety and amenity, albeit with reduced on-street parking.

However as noted in the Project-Specific Audit Focus section, additional network benefits of this project are limited by the following:

A) CONNECTIVITY WITH WHITEHORSE ROAD

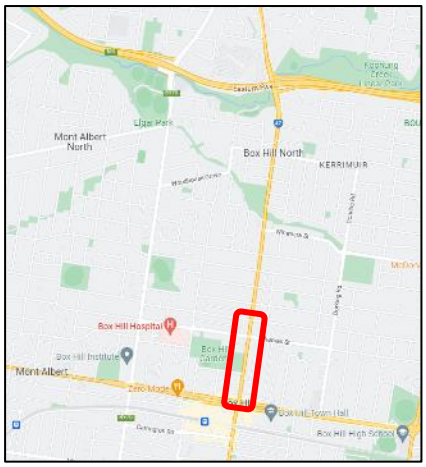
As discussed in the Project-specific audit focus section, Whitehorse Road is a four-lane, two-way divided arterial road with trams along the median. The posted speed limit is 70 km/h. There are no cycling facilities along Whitehorse Road near the subject site.

Although the project delivers a cyclist-friendly local area management zone along Nelson Road, the overall amenity is affected by poor cyclist connectivity at the Whitehorse Road end of the subject site.

For note.

B) CONNECTIVITY WITH OTHER CYCLING NETWORKS

There are no cycling facilities contiguous with the subject site. However, the project delivers enhanced amenity and safety for local cyclists accessing the Nelson Road public facilities and the Box Hill shopping centre and train station. Additionally, it provides enhanced connection for cyclists travelling between Box Hill and the Eastern Freeway cycle network.



The project delivers improved cyclist amenity along the subject site, however there are no direct connections with pre-existing cycle paths

For note.

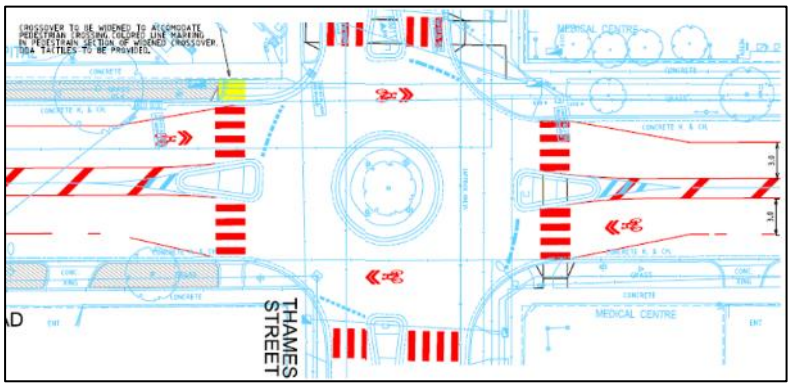
GENERAL AUDIT COMMENTS

1. Raised Safety Platforms

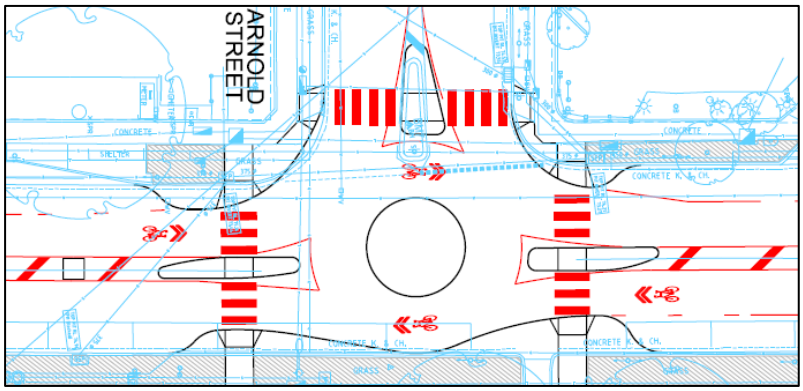
There are two roundabout intersections along the subject site, namely at the Arnold Street and Thames Street intersections.

In phase 1 and subsequent phases, the following treatments have been applied:

- Zebra crossings at each leg of the ramp (replacing kerb ramp crossings) with kerb outstands; and
- Sharrow treatment for cyclist along the Nelson Road approaches and within the roundabout



Thames Street intersection



Arnold Street intersection

Notwithstanding the proposed treatments, there is still the potential for operating speeds through the roundabouts to exceed the safe system threshold speed for vulnerable users of 30 km/h. Thus, cyclists and pedestrians are potentially exposed to crashes with vehicles at speeds exceeding 30 km/h.

Risk Rating (Austroads GRS6)
Risk Rating: Rare (>7Y) + Serious = Medium (FSI)

Comment
The likelihood is 'rare', however vehicle crashes with pedestrian or cyclists could cause serious injury.

Treatment option

Consider raised safety platform treatments of one or both intersections.

Risk Rating After Treatment
Risk Rating: Rare (>7Y) + Moderate = Low

Safe System Treatment Alignment
Primary: practically eliminates exceeding crash limits

2. Median parking

The proposed treatments comprise wide median without median parking. However, wide medians can also provide with parallel parking, assuming they are of sufficient width. An example is shown below along Munster Terrace, North Melbourne.



Google Street View

Example of wide median treatments with median, parallel parking, Munster Terrace, North Melbourne

From a safety perspective, wide median treatments without median parking are prime facie safer. Median, parallel parking creates risks including cyclist dooring, pedestrian exposure and side-swipe conflict, albeit all low risk.

However, median parking could be a trade-off for the loss of kerb-side parking. For example, the provision of median parking could allow the project to accelerate the transition to the latter phases earlier than would otherwise be the case.

Additionally, dooring risk will kerb-side parking is higher than median parallel parking as cyclists tend to 'hug' the left side.

For consideration.

Note: If median parking was to be included, the medians would need to be widened from the proposed 1.8 metres. AS2890.5 specifies that a width range of 2.0 to 2.3 metres when then speed limit is less than 50 km/h. The wider medians could be achieved by reducing the through lanes widths from 3.0 metres to 2.8 metres.

SPECIFIC AUDIT COMMENTS

3. Phase 1

ON-ROAD BIKE LANES

In phase 1 the median treatments and speed calming treatments will be applied but kerbside parking will remain. There will be no demarcated on-road bike lanes. The through lane will be 3.0 width.

Although the narrower through lanes widths are likely to reduce operating speeds, there are potential issues for cyclists, namely:

- Cyclists may tend to 'hug' the left-side of the lane increasing the risk of dooring from kerbside parked vehicles; and
- An increased risk of over-taking vehicles to side-swipe cyclists given the narrower through lane width.

Risk Rating (Austroads GRS6)
Risk Rating = Unlikely (3-7Y) + Moderate = Medium

Treatment option

Consider designating the northbound and southbound through lanes with shared bike/ vehicle status by applying sharrow pavement markings along the full length of the subject site (i.e., between Whitehorse Road and Severn Street).

Alternatively consider this treatment for the northbound through lane only given the downgrade supports cyclists' speeds whereas cyclists' speeds southbound will be low (i.e., <20 km/h) resulting in poor amenity for motorists unable to overtake cyclists.



Example of shared through lane environment in Wellington Street, East St Kilda (Google Street View)

4. Phase 2A and 2B

The rationale for Phase 2A providing southbound on-road bike lanes which connect with Box Hill Gardens paths is supported.

ON-ROAD BIKE LANES

As discussed in the Phase 1 section, along sections without separated bike lanes (i.e., northbound in Phase 2A and 2B and southbound south end in phase 2A) consider designating the through lanes as shared bike/ vehicle lanes by applying sharrow pavement markings.

5. Phase 3

There are no additional audit findings specific to Phase 3.

FINALISATION

CONCLUDING STATEMENT

- The audit has attempted to balance the safety needs of all road users within the site/design constraints. As per Austroads guidelines, the treatment options provided have attempted to be realistic, feasible, and commensurate with the risk posed.
- The audit attempts to raise all potential safety risks, however at times this is not possible due to a limited knowledge of the site and the design.
- Agreement to the issues and/or suggestions does not necessarily eliminate risk.
- The project team should incorporate audit findings into the broader design process and ask the audit team further questions where necessary.

Peter Harris
Senior Road Safety Auditor
CPEng, RPEQ, NER, BE (Civil),
BB (Bus. Admin.)

Bob Cumming
Senior Road Safety Auditor
BE (Civil),
BA (Geog. / Env.St.)

Mike Game
Road Safety Auditor
BE (Chem. Eng.), MBA

RESPONDING TO THE ROAD SAFETY AUDIT

The audit findings should be considered in combination with the knowledge and insight from the responding entity (client) and other stakeholders. The responding entity does not have to agree to the audit findings; however, a written response should be made to the audit findings raised. When responding to the audit, the responding entity is encouraged to focus on the 'audit finding', not the 'treatment option'. This is due to various options usually being available and Road Safety Audits having limited knowledge of the project background and constraints.

Road Safety Audits does not change the substance of the audit findings or sign off on the responses from the responding entity. However, the client is encouraged to provide the responses to RSA to check that each audit point has been understood.

ROAD SAFETY AUDIT BACKGROUND

ROAD SAFETY AUDIT: OVERVIEW

A road safety audit is an independent examination of a design or condition to evaluate potential safety issues for all road user types. It is carried out by a team of suitably qualified people and can provide treatment options for consideration by the client.

A road safety audit is fundamentally a qualitative process highly influenced by the experience and views of the individual team members in combination with contemporary evidence-based knowledge on road crash types and countermeasures.

ROAD SAFETY AUDIT TEAM AND QUALITY ASSURANCE

The road safety audit was carried out by Mike Game, Bob Cumming and Peter Harris. All team members conduct road safety audits full-time in various states of Australia and have experience in all stages of road safety audits, leading or participating in several hundred audits and risk assessments every year.

Road Safety Audits is accredited for the conduct of road safety audits under VicRoads' professional services register. Bob Cumming and Peter Harris are an accredited Senior Road Safety Auditors under VicRoads pre-qualified senior road safety audit scheme. Mike Game is an accredited Road Safety Auditor under VicRoads pre-qualified road safety audit scheme.

Road Safety Audits' quality assurance process encompasses three key areas:

- Staff: Utilising experienced road safety practitioners
- Staff: Customising the audit team for the project to inject the necessary skill set.
- Processes: Utilise customised checklists designed for niche areas in traffic engineering and road design such as safety barriers, public transport hubs, CBD / inner-urban, and cyclists.
- Training: Regular in-house and external training.
- Review: Up to four-layer review: 1. On-site auditor evaluation; 2. Media and data review; 3. Specialist auditor input; and 4. Blinded reviews.

AUDIT TYPE

A concept design stage road safety audit tends to examine the broad design for more fundamental issues that can't be changed later by minor signs or linemarking changes. This includes intersection layouts and types, horizontal and vertical alignments, access points, and all road user groups.

SCOPE: GENERAL

Road Safety Audits utilises a high experience base and focus on high-level fundamental safety issues affecting road safety, based on likely road user behaviour and expectations.

Checking compliance to road design guidelines is incorporated within the audit but forms a secondary consideration. "A Road Safety Audit is not a check of compliance to standards. Rather than checking for compliance, a road safety audit is checking fitness for purpose: will the road or treatment work safely for its expected road users?" (AGRS RSA 2022).

The scope is generally limited to the *safety* effects of the proposed changes and does not look beyond the limits of works to try to improve substandard conditions outside of the general scope of the works.

Where suggestions are provided, they are made from a safety perspective only, and are made in the absence of full project knowledge and design constraints. Road Safety Audits can provide a detailed risk assessment / issue evaluation report upon request.

Generally, a road safety audit only raises *issues* and does not discuss design elements if they are *not* safety issues. i.e., if a topic (such as 'drainage') is not mentioned, then it means that there are no issues of concern on that topic.

SCOPE: SAFE SYSTEM

Austroads guidelines encourage practitioners to adopt safe system principles within design and within road safety audits. Safe system (roads) calls for a design to not allow serious injury and fatalities to occur for the expected road users and the typical crash types expected for that design type. This design-objective is considered within this road safety audit and is detailed in the Risk Ratings section. However, a road safety audit is not a 'Safe System Assessment'.

REFERENCES

Relevant guidelines, standards, codes, road rules, and policy documents, including:

- Austroads Guide to Road Safety Part 6 – Road Safety Audit – 2022
- State-specific road safety audit guides where applicable (e.g., NSW *Guidelines for Road Safety Audit Practices*)
- Austroads Guide to Road Design Series (AGRD)
- Austroads Guide to Traffic Management Series (AGTM)
- Austroads Guide to Road Safety Series (AGRS)
- Miscellaneous Austroads Publications relating to road trauma, crash causality and statistics, traffic engineering treatments and Safe System
- AS 1742 Manual of Uniform Traffic Control Devices
- State road authority supplements to above documents
- State road authority technical publications including standard drawings, road design notes and other publications

- Other industry knowledge as disseminated through industry conferences, seminars, workshops via organisations including Austroads, ITE, ACRS, AITPM, TMAA and IRF

RISK RATINGS

Austroads Road Safety Audit Part 6 suggests that the organisation responding to the audit uses the following risk assessment method as a tool to give an indication of risk. Road Safety Audits will typically offer its own evaluation of risk for the responder to use as a guide.

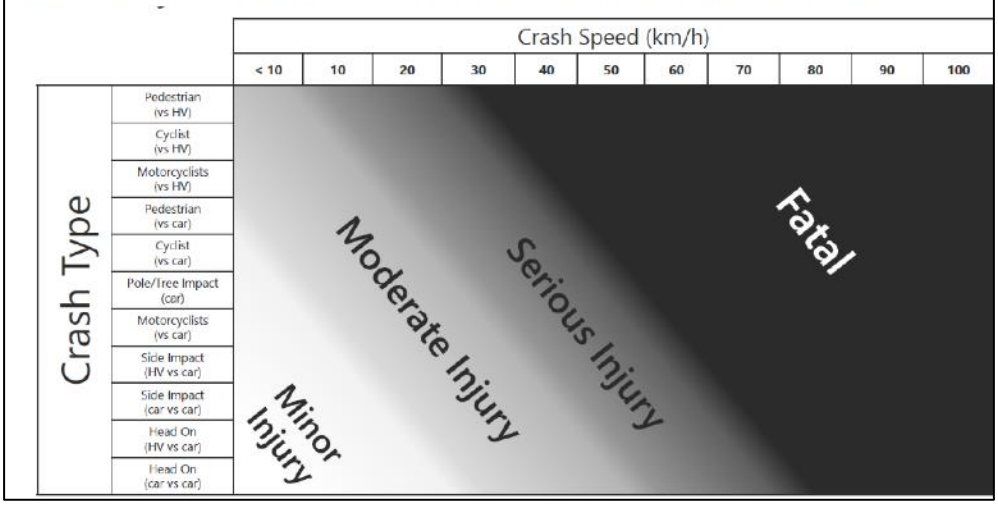
Figure 10.2: Austroads RSA risk matrix

Likelihood (includes exposure)			Severity*				
			Insignificant	Minor	Moderate	Serious	Fatal
			Property damage	Minor first aid	Major first aid and/or presents to hospital (not admitted)	Admitted to hospital	Death within 30 days of the crash
	Almost Certain	One per quarter	Medium	High	High	Extreme (FSI)	Extreme (FSI)
	Likely	Quarter to 1-year	Medium	Medium	High	Extreme (FSI)	Extreme (FSI)
	Possible	1 to 3 Years	Low	Medium	High	High (FSI)	Extreme (FSI)
	Unlikely	3 to 7 Years	Negligible	Low	Medium	High (FSI)	Extreme (FSI)
	Rare	7 years+	Negligible	Negligible	Low	Medium (FSI)	High (FSI)

*see Severity Guidance Sheet

Safe System crash outcome threshold

Figure 10.3: The severity guidance sheet – to be used with the risk matrix (Figure 10.2)

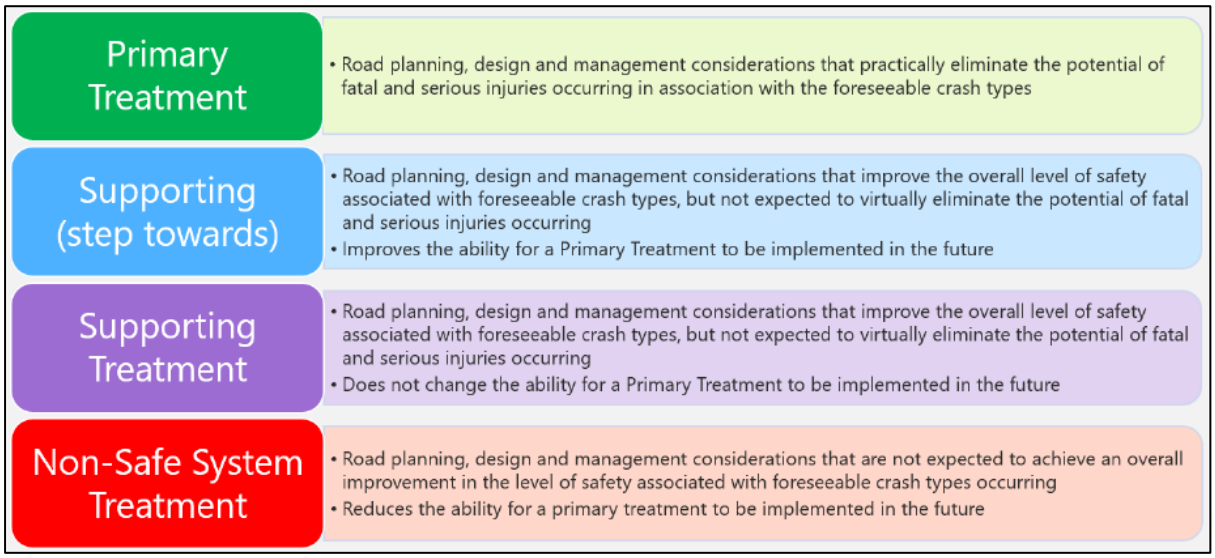


"The corresponding priorities for mitigation are categorised as:

- Negligible – no action required
- Low – should be corrected or the risk reduced if the treatment cost is low
- Medium – should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high
- High – should be corrected or the risk significantly reduced, even if the treatment cost is high
- Extreme – must be corrected regardless of cost.

No definitive guidance can be given as to the respective monetary values of the terms 'low', 'moderate' or 'high' regarding treatment costs, but it is expected that consideration against the total project cost would be an important factor when categorising mitigation of each risk." (AGRS-RSA2022)

Furthermore, suggested treatment options are given a safe system treatment ranking as follows:

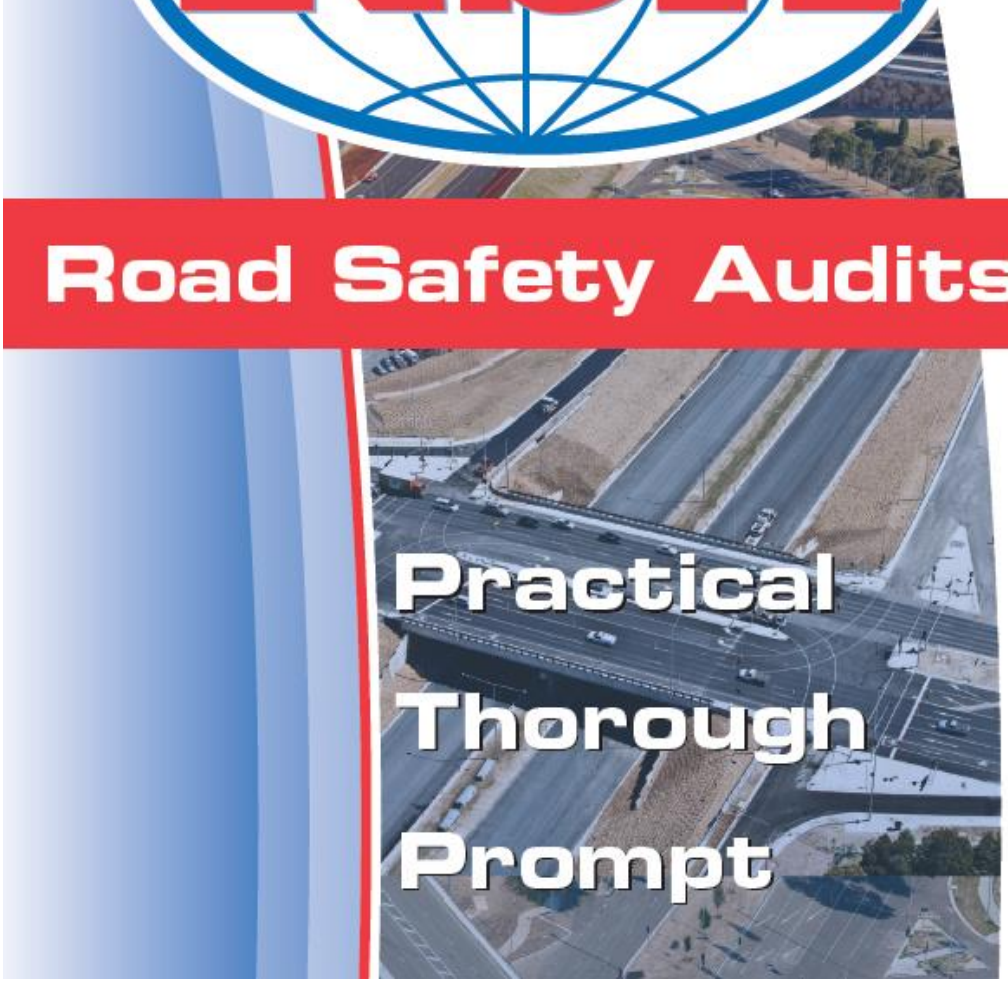


A risk cannot always be assigned to an issue when there is a highly indirect relationship between the issue 'leading to a crash'. However, the issue may still be *important* for the design, the project, general safety, and amenity. Other common language used, and its meaning are as follows:

- 'Urgent': Needs immediate attention / changes as per RSA suggestion or similar.
- 'Recommend' / 'Serious' / 'Important': Must be robustly reviewed. Most likely requires a change to avoid a high-risk road environment for one or more user groups.
- 'Should' / 'Suggest' / 'Significant': Based on the view of the RSA team the suggestion should be done, but it concedes that there could be reasons why inaction or alternative action is equally correct. Must be robustly reviewed by contractor and where relevant key traffic engineering project stakeholders.
- 'Review' / 'Consider': RSA is raising an observation but has no *strong* opinion on need for changes due to limitations in knowledge on the site / design /constraints.
- 'Minor': Typically, a low road-safety consequence / compliance issues (to guidelines or plans) / administrative controls. Unlikely to increase risk of crash.
- 'Note': Little or no road safety significance. Typically added to give a complete picture of the design, site, context, analysis, auditors understanding.

RSA

Road Safety Audits



APPENDIX F

TREATMENT PRIORITISATION
- **CRITERIA**
- **RESULTS**

Criteria

Safety Benefits

The expected safety benefits of recommended treatments were assessed taking into consideration the Safe System hierarchy[41]. Examples of the assessment for a range of treatments are given in Table F 1, while the scores assigned to each rating are listed in Table F 2.

TREATMENT	SAFETY BENEFIT (SAFE SYSTEM HIERARCHY)
Roundabout with zebras	Primary for vehicle crash types Supporting for pedestrian crash types
Wombat Crossing	Primary
Zebra crossing	Supporting
Splitter Island (Pedestrian and Cyclist Refuge)	Supporting
Painted median (separation of opposing traffic flows and pedestrian staging)	Supporting for head-on crash types Supporting for pedestrian crash types
Painted median with planter boxes/tree planting (separation of opposing traffic flows and pedestrian staging)	Primary for head-on crash types Supporting for pedestrian crash types
Bicycle lane (protected)	Primary
Bicycle lane (painted separator)	Supporting
Reduced speed limit	Supporting (all crash types)
Sharrows	Incremental
Footpath widening (no change to road width)	Incremental

TABLE F 1: SAFETY BENEFITS OF DIFFERENT TREATMENTS

SAFETY BENEFIT	SCORE
Primary	3
Supporting	2
Incremental	1

TABLE F 2: SCORING FOR SAFETY BENEFIT OF PROPOSED TREATMENT

[41] References for guidance on Safe System treatment alignment include:
Austroads 2016, *Safe System Assessment Framework*, AP-R509-16
Austroads 2020, *Integrating Safe System with Movement and Place for Vulnerable Road Users*, AP-R611-20

Supporting strategic objectives

The alignment with Council's strategic priorities (Table 6 in Section 6.1) was given a subjective rating of High, Medium, or Low. A treatment considered to support multiple objectives (e.g. the speed limit reduction supports improved safety for all road users) would be rated 'High', a treatment considered to support a couple of objectives would be rated 'Medium' (e.g. the flush median supports improved crossing safety and amenity for pedestrians and additional planting to increase environmental comfort), while 'sharrows' markings would be rated 'Low' due to supporting safety and amenity for cyclists only. The scores assigned to each rating are listed in Table F 3.

EASE OF IMPLEMENTATION	SCORE
High	3
Medium	2
Low	1

TABLE F 3: SCORING FOR EASE OF IMPLEMENTATION OF PROPOSED TREATMENT

Ease of Implementation

The ease of implementation of the proposed treatment was given a subjective rating of High, Medium, or Low based on the type of treatment. Typically, the installation of sharrows would be rated 'High' because the lanes are already in place and require only the paint treatment, a pedestrian ramp modification would be rated 'Medium' due to the need for a small amount of construction, and a raised threshold would be rated 'Low' due to its larger and more involved construction requirement. The need for further community consultation or the involvement of the Department of Transport, for example in a change to a speed limit, would also lower a project's ease of implementation. The scores assigned to each rating are listed in Table F 4.

EASE OF IMPLEMENTATION	SCORE
High	3
Medium	2
Low	1

TABLE F 4: SCORING FOR EASE OF IMPLEMENTATION OF PROPOSED TREATMENT

Cost

The scores assigned based on the treatment costs proposed are listed in Table F 5.

TOTAL TREATMENT COST	SCORE
High: >$100,000	1
Moderate: $40,000 - $100,000	2
Low: <$40,000	3

TABLE F 5: SCORING FOR COST OF PROPOSED TREATMENT

Results

TREATMENT	AMENITY	ROAD SAFETY	SAFETY BENEFIT	SUPPORT STRATEGIC PRIORITIES	EASE OF IMPLEME-NTATION	COST	TOTAL	RANK
PHASE 1								
Speed limit reduction (to 40 km/h)		✓	Supporting	High	High	Low	11	1
Flush median (with planter boxes & temporary kerbing)	✓	✓	Primary (head-on crash types) Supporting (Ped crash types)	Medium	Medium	Moderate	8.5	2
Sharrows pavement marking (Phase 1: both directions + intersections)	✓	✓	Incremental	Low	High	Low	8	3
Zebra crossing (midblock near Box Hill Institute)	✓	✓	Supporting	Low	Medium	Low	8	3
Roundabout at Arnold St (with mountable dome and zebra crossings on 3 legs)		✓	Primary (vehicle crash types) Supporting (Ped crash types)	High	Low	High	7.5	7
Zebra crossings (4 legs at Thames St intersection) + crossover works on south-western corner of Thames St	✓	✓	Supporting	Low	Medium	Moderate	7	8
Footpath works (paving nature strip and establishment of garden beds)	✓		Incremental	Medium	Low	High	5	14
PHASE 2								
Sharrows pavement marking (Phase 2: northbound + intersections only)	✓	✓	Incremental	Low	High	Low	8	3
Flush median (with pavement cut-outs and permanent kerbing)	✓	✓	Primary (vehicle crash types) Supporting (Ped crash types)	Medium	Low	High	6.5	10
Bicycle lane (southbound from Severn Street to Box Hill Gardens) + associated changes to sharrows pavement marking (removal of southbound pavement marking for treated segment)	✓	✓	Primary	Low	Low	High	6	11

TREATMENT	AMENITY	ROAD SAFETY	SAFETY BENEFIT	SUPPORT STRATEGIC PRIORITIES	EASE OF IMPLEME-NTATION	COST	TOTAL	RANK
Bicycle lane (southbound from Arnold Street to Whitehorse Road) + associated changes to sharrows pavement marking (removal of southbound pavement marking for treated segment)	✓	✓	Primary	Low	Low	High	6	11
PHASE 3								
Sharrows pavement marking (Phase 3: intersections only)	✓	✓	Incremental	Low	High	Low	8	3
Wombat crossing (midblock near Box Hill Institute)		✓	Primary	Low	Low	Moderate	7	8
Bicycle lane (northbound from Whitehorse Road to Severn Street) + associated changes to sharrows pavement marking (removal of midblock pavement marking)	✓	✓	Primary	Low	Low	High	6	11

TABLE F 6: TREATMENT PRIORITISATION OUTPUT