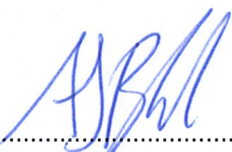


Transport Network Management Plan (TNMP) Southern Links Minor Arterial/Ōhaupō Road Roundabout

Hamilton City Council

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FINAL, JUNE 2019

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1. BACKGROUND

1.1. Purpose

The purpose of this Transport Network Management Plan (TNMP) is to satisfy the requirements of Southern Links designation condition 24 for the Southern Links Minor Arterial and Ōhaupō Road Roundabout Project.

Designation condition 24 requires that a TNMP is submitted to the Territorial Authority Chief Executive or nominee for certification.

1.2. Objective

The objective of the TNMP is to provide a framework to ensure that any adverse effects associated with the operation of the project can be avoided, remedied or mitigated. The TNMP describes proposed procedures, requirements and standards necessary for achieving that objective and includes:

- = An updated Design Philosophy Statement;
- = Localised traffic impacts and mitigation measures required as a result of road closures (direct or indirect);
- = Provision of cycle infrastructure;
- = Provision of pedestrian infrastructure;
- = Consideration of staged bus infrastructure;
- = Provision of pedestrian and cyclist connectivity to and from Hamilton Gardens, along the Waikato River and Peacocke gully system; and
- = Provision of pedestrian and cyclist connectivity from areas west of the Peacocke North-South Major Arterial to areas east of the arterial in the vicinity of the Glenview Club.

1.3. Project Overview

The Southern Links/Ōhaupō Road Roundabout project involves design of a dual circulating lane roundabout to form a new intersection on Ōhaupō Road (SH3) with the Southern Links East-West Minor Arterial, approximately 100m south of the existing Dixon Road intersection.

The new intersection will enable and accommodate residential growth in the Peacocke area. The design includes approximately 500m of the Minor Arterial within the Southern Links designation through the existing Northview property.

The project also includes improvements at the existing intersection, including restricting right turns from Dixon Road as these movements will be accommodated by the roundabout.

Key features of the roundabout and Minor Arterial include:

- = Dual circulating lanes and dual approach and departure lanes;
- = Three grade-separated underpasses to facilitate movements for pedestrians and cyclists through the central island of the roundabout;
- = Connectivity to the existing Ōhaupō Road cycleway north of Dixon Road;
- = Segregated on-road cycle lanes and 3.0m shared paths on each side of the Minor Arterial to connect to future stages; and
- = Provision for future passenger transport priority on the Minor Arterial approach to the roundabout.

A general arrangement plan showing the roundabout configuration is included in Figure 1.

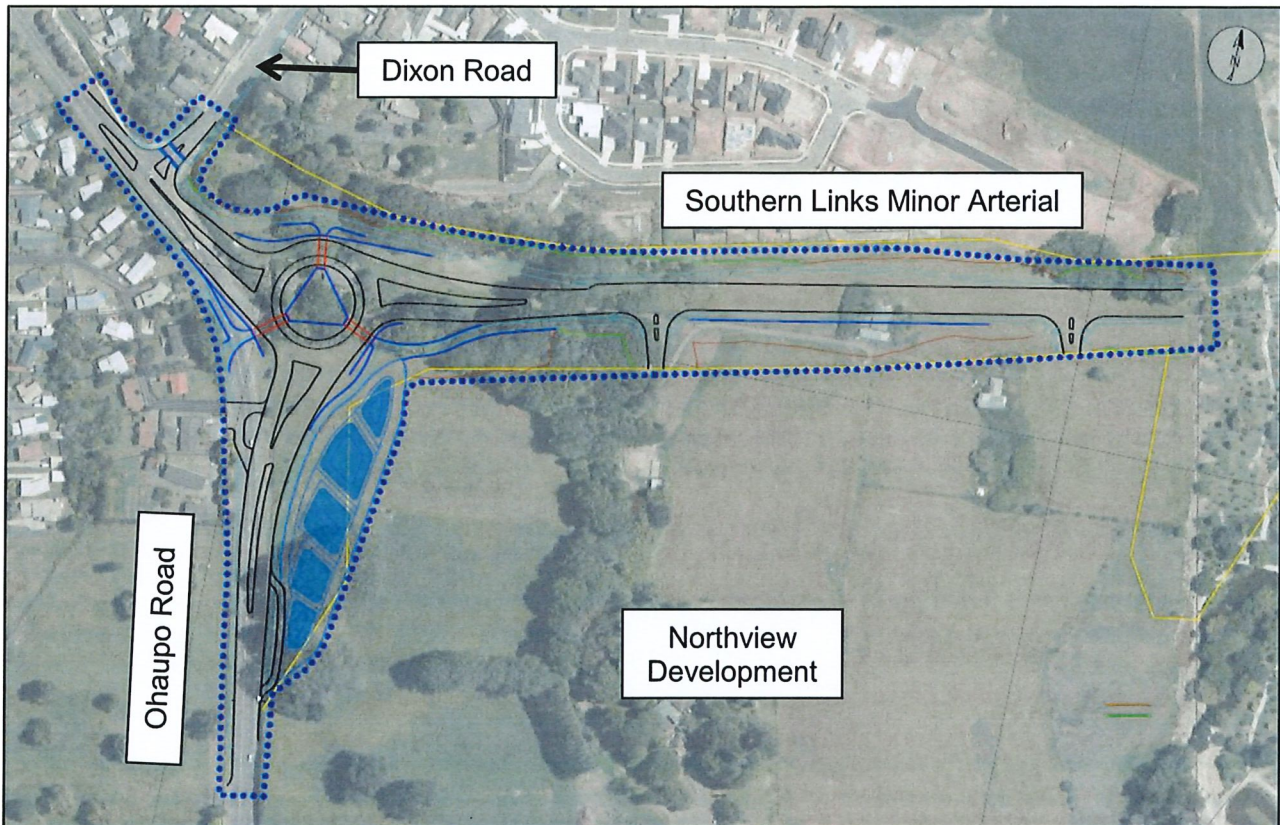


Figure 1: General Arrangement Plan

2. UPDATED DESIGN PHILOSOPHY STATEMENT

Design requirements for the Southern Links project were outlined in the Southern Links Preliminary Design Philosophy Statement (June 2014) prepared by AECOM.

A specific design philosophy statement for the Southern Links/Ōhaupō Road roundabout project is included in Appendix 1 and describes the standards adopted during the detailed design stage of the roundabout.

3. TRAFFIC IMPACTS

3.1. Objective

This TNMP is required to assess localised traffic impacts and describe any mitigation measures required as a direct or indirect result of road closures, diversions, new intersection arrangements and other measures necessary to accommodate the project.

3.2. Assessment of Impacts

The project is located at the western extremity of the Southern Links East-West Minor Arterial and will initially only provide a road connection to the Northview development. The roundabout will enable development of approximately 300 residential lots. Until the minor arterial is extended to the east, all vehicle access will be via the roundabout. As a result, there will be an increase in traffic on Ōhaupō Road and potentially Dixon Road. The effects of the additional traffic are consistent with that expected at the time of designation.

Significant travel pattern changes as a result of the roundabout and minor arterial are not expected to occur until Stage 2 of the minor arterial has been constructed. Impacts associated with travel pattern changes and localised impacts will be covered in a future TNMP that addresses that stage.

Short term effects are expected during construction. Mitigation of these effects and any route diversions will be considered in the Contractor's Traffic Management Plan (TMP), which is subject to approval by the New Zealand Transport Agency and Hamilton City Council.

3.3. Intersection Performance

Traffic modelling during the early stages of the intersection design suggests that the roundabout will operate at 'LOS A'. A summary of delays and queue lengths from the traffic modelling results is included in Table 1.

	AM Peak			PM Peak		
	Worst Average Delay	Worst Queue Length	LOS	Worst Average Delay	Worst Queue Length	LOS
Dual Lane Roundabout	12.4 sec/veh (south leg, right turn)	3.7 vehicles (28.4m) (east-west arterial, right turn)	LOS A	9.1 sec/veh (south leg, right turn)	3.3 vehicles (25.4m) (north leg, left turn)	LOS A

Table 1: Traffic Modelling Output Summary

This is consistent with traffic modelling presented in as Appendix O to the Notice of Requirement.

4. PEDESTRIAN AND CYCLIST FACILITIES

Key pedestrian and cyclist features of the roundabout and minor arterial include:

- = Three grade separated underpasses to provide pedestrian movements through the roundabout central island;
- = 4.5m wide shared paths on approaches to the southeast and north underpasses;
- = Connection to the Ōhaupō Road cycleway, west of Dixon Road; and
- = 2.0m wide segregated on-road cycle paths and 3.0m off-road paths on each side of the minor arterial.

The configuration of pedestrian and cycle facilities along the minor arterial is consistent with that planned for future stages of the East-West minor arterial and the wider Southern Links project area. The pedestrian and cycling facilities proposed exceed District Plan requirements for a residential minor arterial.

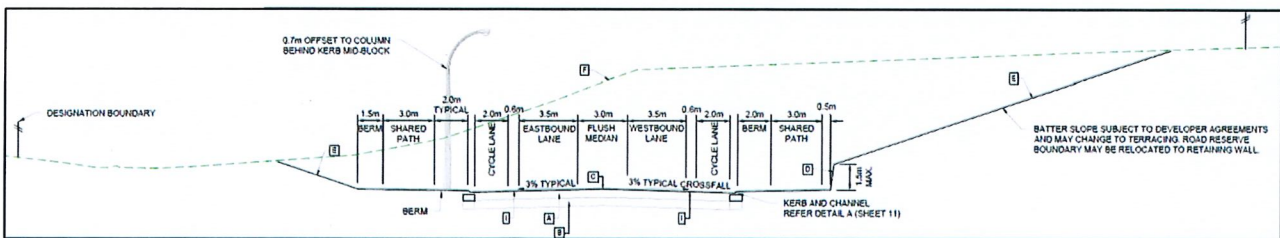


Figure 2: Minor Arterial Typical Cross-section

5. PASSENGER TRANSPORT INFRASTRUCTURE

The minor arterial cross section on approach to the roundabout includes provision for a future bus lane west of the Northview collector road.

Future bus services in the around the project area are currently unscheduled, however it is expected that a bus route will either use the minor arterial, or the Northview collector road.

6. ROAD SAFETY AUDIT

Southern Links designation condition 24.2 states that at the detailed design stage, the Requiring Authority shall undertake a Road Safety Audit in accordance with NZ Transport Agency's Road Safety Audit (RSA) for Projects. The condition also states that a copy of the RSA shall be provided to the Territorial Authority's Chief Executive or nominee.

A preliminary RSA was carried out in September 2017 at design stage. Recommendations from that audit have been incorporated into the detailed design. To close that loop, a detailed design audit will be carried out prior to construction and will be submitted separately, however it is noted that the preliminary RSA is an adequate response to the designation condition.

7. POST IMPLEMENTATION REVIEW

Southern Links designation condition 24.3 states that at implementation, the Requiring Authority shall undertake a Post Implementation Review (PIR) in accordance with NZ Transport Agency's PIR policy, reflecting the project objectives and objectives of the TNMP.

Hamilton City Council and NZ Transport Agency will conduct a PIR following construction of the roundabout in accordance with this condition.

8. ASSESSMENT AND CONCLUSION

8.1. Assessment

An assessment of how the project meets the requirements of Southern Links designation condition 24 is summarised in Table 2.

Condition	Description	Assessment
24.1	The TNMP shall include but not be limited to:	
d)	Updated Design Philosophy Statement	Refer Appendix 1
e)	Localised traffic impacts and accompanying mitigation measures	Localised traffic impacts not expected until future sections of the East-West minor arterial are completed
f)	Provision of cycle infrastructure and whether design of cycle features is consistent with current best practice	Complies – Design includes provision for cyclists with segregated on-road cycle lanes in mid-block locations and widened off-road paths on approaches to the roundabout.
g)	Provision of pedestrian infrastructure and whether the design of pedestrian infrastructure is consistent with current best practice guidelines	Complies – Design includes provision for pedestrians with underpasses at the roundabout to safely accommodate pedestrian movements through the intersection and 3.0m wide paths in mid-block locations. The adopted approach exceeds minimum requirements.
h)	Consideration of staged bus service infrastructure such as but not limited to:	
	i) Bus Priority detection equipment at all signalised intersections along the route	N/A – no signalised intersections within the proposed extent of works
	ii) Bus stopping lay-bys at appropriate locations along the route	Future bus routes currently unknown

Condition	Description	Assessment
	iii) Passenger waiting facilities and shelters with bus information as part of the final road design	Future bus routes currently unknown, eastern end of minor arterial within project extent likely the most appropriate location for a bus stop
	iv) Bus priority measures at all non-signalised, controlled intersections	Complies – The minor arterial approach allows for future provision of a bus lane west of the Northview collector road
i)	The provision of pedestrian and cyclist connectivity to and from Hamilton Gardens and along the Waikato River and Peacocke gully system	N/A – project is not located in the vicinity of Hamilton Gardens, Waikato River or Peacocke gully system
j)	The provision of pedestrian and cyclist connectivity from areas west of the Peacocke North-South Major Arterial to areas east of the arterial in the vicinity of the Glenview Club	N/A – The project does not affect pedestrian and cycle connectivity near the Glenview Club
24.2	In managing traffic safety effects across the whole of the project (or staged project) at the detailed design stage, the Requiring Authority shall undertake a Road Safety Audit for the relevant stage of the project in accordance with NZ Transport Agency's Road Safety Audit (RSA) for Projects. A copy of the RSA shall be provided to the Territorial Authority Chief Executive or nominee.	A preliminary design stage safety audit has been completed and the design has been updated to incorporate the RSA recommendations. A detailed design stage safety audit will be completed prior to construction and submitted separately.
24.3	In managing traffic effects across the whole of the project (or staged project) at the detailed design stage, the Requiring Authority shall undertake a Post Implementation Review (PIR) in accordance with NZ Transport Agency's PIR policy, having regard to the project objectives and the objectives of the TNMP. A copy of the PIR shall be provided to the Territorial Authority Chief Executive or nominee.	Hamilton City Council and NZ Transport Agency will conduct a PIR following construction of the roundabout in accordance with this condition

Table 2: Project Assessment against Southern Links designation condition 24

8.2. Conclusion

The Southern Links/Ōhaupō Road Roundabout project involves design of a dual circulating lane roundabout to form a new intersection on Ōhaupō Road (SH3) with the Southern Links East-West Minor Arterial, approximately 100m south of the existing Dixon Road intersection.

The new intersection will enable and accommodate growth in the Peacocke area. The design includes approximately 500m of the Minor Arterial within the Southern Links Designation through the existing Northview property, and includes provision for all transport modes including walking and cycling, and passenger transport.

The project also includes improvements at the existing Dixon Road intersection, including restricting right turns from Dixon Road as these movements will be accommodated by the roundabout.

The Southern Links/Ōhaupō Road roundabout design satisfies the requirements of Southern Links designation condition 24. Further assessment of localised effects of the minor arterial and surrounding transport network will be presented in TNMPs for future stages of the minor arterial.

Shorter term effects (i.e. during construction) are considered and mitigated as part of the Contractor's Traffic Management Plan.

Received
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17/07/2019

APPENDICES

Appendix 1: Updated Design Philosophy Statement

To: File
Copy:
From: Darryl Woodhouse
Date: 20 June 2019
Job Number: 14_191



SUBJECT: Southern Links Minor Arterial/Ohaupo Road Roundabout Design Philosophy Statement

1. INTRODUCTION

Hamilton City Council (HCC) engaged Gray Matter Ltd to complete the design of a roundabout at the future intersection of Ohaupo Road (SH3) and the Southern Links East-West minor arterial. This memo outlines the detailed design philosophy including the background, design features and application of/departure from standards.

2. BACKGROUND

The proposed roundabout forms a new intersection on Ohaupo Road (SH3) and enables access to development in the Peacocke area.

3. DESIGN AND KEY FEATURES

We have completed detailed design and drawings for the Southern Links east-west minor arterial and roundabout to form a new intersection with Ohaupo Road (SH3), for the purposes of Hamilton City Council and NZ Transport Agency's review, safety audit and tender.

3.1. Design Standards

Our design is based on the following design standards and guidelines:

- = Austroads Guide to Road Design – Part 1 to Part 6;
- = NZ Transport Agency Manual of Traffic Signs and Markings (MOTSAM) – Parts 1 and 2;
- = NZ Transport Agency Pedestrian Planning and Design Guide;
- = NZ Transport Agency Road and Traffic Guidelines RTS 18 – New Zealand on-road tracking curves for heavy vehicles;
- = Waikato LASS Regional Infrastructure Technical Specifications (RITS);
- = NZS 1158 Lighting for Roads and Public Spaces;
- = NZS 4404:2010 Land Development and Subdivision Infrastructure; and
- = NZ Building Code – Part E1.

3.2. Design Inputs

The following is a summary of inputs into the detailed design stage of this project:

- = SH3 and Peacockes East-West Arterial – Intersection Options (30 June 2017, prepared by Gray Matter);
- = Topographic survey (and lidar);
- = Traffic volumes (refer Table 2);
- = Consultation with Hamilton City Council and NZ Transport Agency;
- = Site observations;
- = Aerial photographs;
- = Service information (Before U Dig, on-site locate including potholing);
- = Geotechnical testing results (Subgrade CBR etc);
- = Geotechnical Factual Report (prepared by Aecom);
- = Preliminary stage Road Safety Audit; and
- = Surface runoff flow depth calculations (attached in Appendix A).

The following elements of the project have been designed by sub-contractors:

- = Landscaping;
- = Structures (retaining walls and underpasses);
- = Pavements and surfacing.

3.3. Design Criteria

The design criteria, assumptions and sources used in the project are described in Table 1.

Criteria	Description	Source
Design vehicles	<p>Semi-Trailer (17.9m) – Design vehicle for Ohaupo Road (SH3) and Minor Arterial, check vehicle for Dixon Road intersection.</p> <p>B-Train (20m) – Check vehicle for Ohaupo Road (SH3) and Minor Arterial.</p> <p>Large Rigid Truck (11.5m) – Design vehicle for Dixon Road, check vehicle for Ohaupo Road service lane.</p> <p>Medium Rigid Truck (8m) – Design vehicle for Ohaupo Road service lane.</p>	Austroads Part 4 (Table 5.2) RTS 18
Swept Path Clearance	0.5m clearance to kerbs 1.0m clearance between paths	Austroads Part 4
Vertical Clearance	5.9m (minimum) to bottom of overhead signs 2.5m (minimum) underpass height	Austroads Part 3 (Table 8.1)
Design speed	<p>70km/h design speed</p> <p>Existing 70km/h posted speed limit on Ohaupo Road expected to be reduced to 60km/h following completion of the roundabout (subject to NZTA Speed Limit Bylaw change process). Hamilton City Council have consulted on their Speed Management plan (2 April 2019), which shows the existing 70km/h speed limit on Ohaupo Road being reduced to 60km/h.</p>	<i>85th percentile, speed survey, District Plan/Development Manual etc.</i>

Criteria	Description		Source
Traffic Volume	Ohaupo Road (SH3)	21,000 veh/day (10% HCV assumed)	WRTM 2051
	Southern Links Minor Arterial	6,700 veh/day (10% HCV assumed)	WRTM 2051
	Dixon Road	2,900 veh/day (6% HCV)	Mobileroad.org (2018 Estimate)
Geometry	Central island radius	27.2m	Austroads Part 3 – Geometric Design Austroads Part 4B – Roundabouts
	Circulating lane width	9.0m	
	Inscribed circle diameter	72.4m	
	Crest curve min. K value	38.9	
	Sag curve min. K value	13	
	Roundabout Entry Path Radius	<80m (cutting lanes)	
Sight distances ($R_T=2.0s$)	Criterion 1/ASD/SISD	92m	Austroads Part 3 – Geometric Design (Table 5.4, 5.5) Austroads Part 4A – Intersections (Section 3.2) Austroads Part 4B – Roundabouts (Section 3.2)
	Criterion 2 (Approaching vehicle)	84m	
	Criterion 3 (Circulating vehicle)	42m	
	Stopping Sight Distance	92m	
Pedestrian/shared paths	Maximum path grade	1:14 (1:12 with allowance for landings/ rest areas)	Pedestrian Planning and Design Guide HCC District Plan
	Minimum width	1.8m (footpath) 3.0m (shared path)	
	Maximum path crossfall	2.0%	
Parking	N/A – no parking provided on minor arterial or Ohaupo Road		AS/NZS 2890.1/5, Dist. Plan
Boundaries	Southern Links Designation Boundaries		HCC
Stormwater			HCC District Plan TP10 NIWA HIRDS Waikato LASS RITS
Structures	Underpasses minimum 2.4m(W) x 2.1m(H) Retaining walls maximum 1.2m high where pedestrian visibility is required over the wall Segmented block walls		NZTA Pedestrian Planning and Design Guide HCC District Plan (fence height guidelines)
Street lighting	V3 (Ohaupo Road) V4 (Minor Arterial) P3 (Pedestrian Paths) P10 (Underpasses)		AS/NZS1158.1.1/Subcategory selection tool
Road Safety Barriers	Clear zone (minor arterial)	5.0-8.0m (Typically 5.5m)	Austroads Part 6

Criteria	Description		Source
	Clear zone (Ohaupo Road)	5.0-8.5m (Typically 6.5m)	Austrroads Part 6
	Deflection	1.2m	
	Runout	75m (minor arterial) 80m (Ohaupo Road)	
	Trailing point of need (barrier length past hazard)	22°/1:2.5	
Pedestrian Barriers	Pedestrian barriers to be provided where there is a fall hazard greater than 1.0m (e.g. retaining walls) or where 3H:1V or steeper slopes are within 1.0m of paths.		
PT Infrastructure	Minor arterial approach provides sufficient width to accommodate a bus lane.		
Services	Services being relocated as part of enabling works contract		
CPTED Considerations	Retaining wall alignments and planting have been designed to reduce CPTED concerns.		

Table 1: Design Criteria and assumptions

3.4. Pavement and Surfacing Design

Final pavement design is still being completed and will be confirmed prior to tender.

3.5. Site Constraints

Site constraints identified during detailed design are described in Table 3.

Constraint	Description	Impact/Solution
Designation boundaries	<p>The designation boundaries were based on a smaller roundabout size, narrower minor arterial cross section and different standards for stormwater treatment devices (e.g. wetlands).</p> <p>Increased standards for stormwater devices were adopted by Waikato Regional Council.</p> <p>The stormwater wetland was originally sized in the designation for road runoff only. Inclusion of development runoff treatment in the wetland has meant that the device size extends outside the Southern Links designation.</p>	<p>Earthworks cut batter (3H:1V) extends outside designation in localised area along minor arterial.</p> <p>No significant impact if a road only wetland is provided within the designation.</p> <p>Combined road and development wetland extends outside of designation on southeast corner of the roundabout.</p> <p>A Private Developer Agreement (PDA) is being arranged between the developer and HCC for construction of the wetland.</p>
Cabourne Drive wetland	<p>Existing wetland associated with adjacent development north of the proposed roundabout does not appear to have been formed as intended.</p> <p>Significant additional works are required to modify this wetland to be suitable to receive additional stormwater from the roundabout and adjacent catchment.</p>	<p>Design wetland on southeastern corner to accommodate additional road runoff.</p> <p>Redirect portion of minor arterial catchment further east and treat Ohaupo Road north catchment with a proprietary device where practicable. No road runoff to existing Cabourne Drive wetland.</p>

Constraint	Description	Impact/Solution
Exeter Street flood hazard	Existing Northview and east side of Ohaupo Road catchment discharges through 450mm dia. culvert below Ohaupo Road to an overland channel that runs behind Exeter Street.	Redirect wetland discharge below the roundabout via 1050mm dia. stormwater pipeline discharging through a new outlet structure combined with existing 1500mm dia. and 600mm dia. Outlets on the north-west corner of Dixon Road.
Topography	Levels around the existing gully on the northern corner of Dixon Road have meant that the tie-in to existing carriageway levels is most appropriate prior to the northern side of Dixon Road. The 6% maximum grade (based on Austroads guidance) on approach to the roundabout combined with the constraints at Dixon Road mean that the vertical curve K value on the southbound approach to the roundabout do not comply with Austroads guidance.	K value on Ohaupo Road north approach is reduced on approach to roundabout, with a grade break at the entry to the circulating lane. The resulting curve equates to a design speed of 50km/h which appears appropriate for an approach/entry speed of 30-40km/h. Awaiting feedback/confirmation from NZTA National Office.
Bulk Water Main (BWM)	Existing 750mm dia. DICL bulk water main in eastern berm of Ohaupo Road conflicts with southwest underpass. During site investigation stage of project, potholing showed that existing cover to the bulk water main near existing urban/rural speed threshold was less than minimum (<0.6m) and would not meet minimum clearance to bottom of pavement layer.	Redesigned alignment for bulk watermain. New alignment along western berm of Ohaupo Road, road crossing locations at Dixon Road and south of speed threshold. Construction of new BWM to be completed during enabling works contract ahead of roundabout construction.
Road Safety Barrier	Road Safety Barrier alignment on the Ohaupo Road (north) approach restricts visibility to the limit line (ASD requirement for a 70km/h design speed is 92m on a flat grade). Applying correction for the 6% uphill grade approaching the roundabout results an ASD requirement of 85m.	Reduced ASD to Ohaupo Road (north) limit line on approach to the roundabout. Approximately 80m unobstructed ASD to the limit line can be achieved on the approach to the roundabout. ASD is provided to the nose of the splitter island.

Table 2: Description of Constraints

3.6. Key Features

Key features of the roundabout and minor arterial include:

- = Dual circulating lanes.
- = Sufficient width on the minor arterial approach to accommodate a future bus lane.
- = Three underpasses provide pedestrian movements through the roundabout central island.
- = 4.5m wide shared paths on approaches to the southeast and north underpasses.
- = Connection to the Ohaupo Road cycleway, west of Dixon Road.
- = 2.0m wide segregated on-road cycle paths and 3.0m off-road paths on each side of the minor arterial.

3.7. Departures from Standards

We have aimed to satisfy the design criteria described in Table 1, however due to site constraints there are some aspects of the design that do not currently meet standards. Departures from standards are summarised in Table 4.

Criteria	Requirement	Description of departure	Adopted
K value (crest) on Ohaupo Road southbound approach	38.9 (visibility to limit line)	Shortened vertical curve along centreline on approach to circulating lane due to topographic constraints. Vertical curve adopted complies with a 50km/h design speed. Visibility to the limit line is achieved by introducing a grade break at the circulating lane.	13.8
Lighting (underpass)	P10	NZS1158.3.1 states that the lighting category for underpasses is P10. Lighting designers have suggested P8 as a practical solution, reducing the amount of lights required and providing a more consistent level of lighting between underpasses and pedestrian path lighting.	P8
ASD to limit line on Ohaupo Road southbound approach	92m (85m with grade correction)	12m deficiency in ASD to limit line on northern approach due to proposed road safety barrier (5m deficiency from grade corrected ASD). 80m ASD consistent with 65-70km/h approach speed.	80m

Table 3: Description of departures from standards

4. SAFETY IN DESIGN

A Safety in Design review will be held with the project team and HCC Safety Engineer/Network Manager.

5. SAFETY AUDIT

Concept and Preliminary design stage safety audits have been completed.

Changes resulting from the Preliminary stage audit include:

- = Changes to the Ohaupo Road service lane arrangement;
- = Realignment of shared paths at path intersections;
- = Further detail regarding road safety barrier ground beams;
- = Amendments to roadmarking and signs.

6. TRAFFIC MODELLING

SIDRA outputs from modelling completed in the early stages of the project are included as Appendix B.

7. COST ESTIMATE

The cost estimate for this project is currently in progress.

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17/07/2019

APPENDIX A – SURFACE RUNOFF CALCULATIONS

Flow depth formula

$$d = 0.046(Lf * p)^{0.5} / Sf^{0.2}$$

$$Sf = (Sl^2 + Sc^2)^{0.5}$$

- d* depth of flow at end of flow path (mm)
- Lf* Length of flow path (m)
- p* (or *I*) rainfall intensity (mm/hr)
- Sf* flow path slope (m/m)
- Sl* longitudinal grade (m/m)
- Sc* pavement crossfall (m/m)

p 93 Based on 2yr, 5 min event

Sourced from HCC ITS Section 4: Table 4-9 'Adjusted Rainfall Data - 2.1 degrees Celsius'

Ohaupo Road North

Chainage (m)	LHS					RHS				
	<i>Sl</i>	<i>Sc</i>	<i>Sf</i>	<i>Lf</i>	<i>d (mm)</i>	<i>Sl</i>	<i>Sc</i>	<i>Sf</i>	<i>Lf</i>	<i>d (mm)</i>
130	0.017	0.035	0.0389	6.98	2.24	0.017	0.035	0.0389	8.33	2.45
140	0.025	0.03	0.0391	7.89	2.38	0.025	0.031	0.0398	8.59	2.48
150	0.033	0.027	0.0426	17.44	3.48	0.033	0.031	0.0453	8.85	2.45
160	0.04	0.024	0.0466	7.82	2.29	0.04	0.031	0.0506	9.12	2.43
170	0.047	0.024	0.0528	11.63	2.72	0.047	0.03	0.0558	9.53	2.44
180	0.053	0.025	0.0586	7.56	2.15	0.053	0.029	0.0604	9.98	2.46
190	0.06	0.023	0.0643	8.55	2.25	0.06	0.029	0.0666	10.42	2.46
200	0.06	0.023	0.0643	9.57	2.38	0.06	0.03	0.0671	11.19	2.55
210	0.06	0.025	0.0650	10.24	2.45	0.06	0.03	0.0671	12.33	2.67
220	0.059	0.027	0.0649	10.56	2.49	0.059	0.028	0.0653	13.86	2.85
230	0.051	0.025	0.0568	10.91	2.60	0.051	0.025	0.0568	15.79	3.13
240	0.045	0.014	0.0471	13.67	3.02	0.045	0.02	0.0492	18.12	3.45

Ohaupo Road South

Chainage (m)	LHS					RHS				
	<i>Sl</i>	<i>Sc</i>	<i>Sf</i>	<i>Lf</i>	<i>d (mm)</i>	<i>Sl</i>	<i>Sc</i>	<i>Sf</i>	<i>Lf</i>	<i>d (mm)</i>
40	0.021	0.014	0.0252	23.09	4.45	0.021	0.01	0.0233	14.29	3.56
50	0.021	0.015	0.0258	20.49	4.17	0.021	0.013	0.0247	11.77	3.19
60	0.021	0.017	0.0270	18.17	3.89	0.021	0.021	0.0297	11.7	3.07
70	0.021	0.02	0.0290	16.06	3.61	0.021	0.028	0.0350	11.74	2.97
80	0.021	0.024	0.0319	14.22	3.33	0.021	0.032	0.0383	11.85	2.93
90	0.021	0.027	0.0342	12.69	3.10	0.021	0.033	0.0391	11.99	2.94
100	0.021	0.03	0.0366	11.47	2.91	0.021	0.031	0.0374	11.86	2.95
110	0.017	0.029	0.0336	10.55	2.84	0.017	0.029	0.0336	11.39	2.95
120	0.012	0.028	0.0305	9.94	2.81	0.012	0.029	0.0314	10.61	2.89
140	0.006	0.028	0.0286	9.69	2.81	0.006	0.032	0.0326	9.32	2.69
160	0.007	0.028	0.0289	10.56	2.93	0.007	0.033	0.0337	7.74	2.43
180	0.005	0.027	0.0275	11.09	3.03	0.005	0.02	0.0206	6.36	2.43

East-West Road

Chainage (m)	LHS					RHS				
	<i>Sl</i>	<i>Sc</i>	<i>Sf</i>	<i>Lf</i>	<i>d (mm)</i>	<i>Sl</i>	<i>Sc</i>	<i>Sf</i>	<i>Lf</i>	<i>d (mm)</i>
60	0.019	0.009	0.0210	22.01	4.51	0.019	0.003	0.0192	16.77	4.00
70	0.006	0.012	0.0134	19.31	4.62	0.006	0.005	0.0078	11.91	4.04
80	0.002	0.019	0.0191	17.14	4.05	0.002	0.011	0.0112	11.07	3.63
90	0.002	0.029	0.0291	15.22	3.51	0.002	0.02	0.0201	10.76	3.18
100	0.003	0.031	0.0311	13.6	3.27	0.003	0.032	0.0321	10.47	2.85
110	0.008	0.03	0.0310	12.3	3.12	0.008	0.03	0.0310	10.39	2.86
120	0.012	0.024	0.0268	11.23	3.07	0.012	0.03	0.0323	10.02	2.79
130	0.016	0.022	0.0272	10.08	2.90	0.016	0.03	0.0340	9.53	2.69
140	0.021	0.021	0.0297	8.83	2.66	0.021	0.03	0.0366	8.95	2.57
150	0.024	0.021	0.0319	7.46	2.41	0.024	0.029	0.0376	8.83	2.54
160	0.025	0.023	0.0340	6.29	2.19	0.025	0.028	0.0375	8.89	2.55
170	0.032	0.025	0.0406	5.54	1.98	0.032	0.027	0.0419	8.92	2.50
180	0.035	0.029	0.0455	5.22	1.88	0.035	0.027	0.0442	9.19	2.51
190	0.038	0.021	0.0434	7.6	2.29	0.038	0.027	0.0466	8.95	2.45
200	0.04	0.025	0.0472	7.6	2.25	0.04	0.027	0.0483	8.95	2.43
210	0.038	0.027	0.0466	7.6	2.26	0.038	0.027	0.0466	8.95	2.45

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220	0.037	0.027	0.0458	7.6	2.27	0.037	0.027	0.0458	8.94	2.46
230	0.035	0.026	0.0436	7.6	2.29	0.035	0.027	0.0442	8.93	2.47
240	0.032	0.025	0.0406	7.6	2.32	0.032	0.028	0.0425	8.65	2.45
250	0.03	0.024	0.0384	7.6	2.35	0.03	0.031	0.0431	7.6	2.29
260	0.027	0.03	0.0404	7.6	2.32	0.027	0.031	0.0411	7.6	2.32
270	0.024	0.024	0.0339	7.6	2.41	0.024	0.031	0.0392	7.6	2.34
280	0.023	0.024	0.0332	7.6	2.42	0.023	0.03	0.0378	7.6	2.35
290	0.017	0.024	0.0294	7.6	2.48	0.017	0.03	0.0345	7.6	2.40
300	0.015	0.023	0.0275	7.6	2.51	0.015	0.03	0.0335	7.6	2.41
310	0.013	0.023	0.0264	7.6	2.53	0.013	0.03	0.0327	7.6	2.42
320	0.011	0.023	0.0255	7.6	2.55	0.011	0.03	0.0320	7.6	2.44
330	0.008	0.023	0.0244	7.6	2.57	0.008	0.029	0.0301	7.6	2.46
340	0.007	0.023	0.0240	7.6	2.58	0.007	0.029	0.0298	7.6	2.47
350	0.005	0.023	0.0235	7.6	2.59	0.005	0.029	0.0294	7.6	2.48
360	0.001	0.023	0.0230	7.6	2.60	0.001	0.029	0.0290	7.6	2.48
370	0.003	0.024	0.0242	7.6	2.57	0.003	0.029	0.0292	7.6	2.48
380	0.003	0.031	0.0311	7.6	2.45	0.003	0.033	0.0331	7.6	2.42
390	0.006	0.024	0.0247	7.6	2.56	0.006	0.029	0.0296	7.6	2.47
400	0.011	0.024	0.0264	7.6	2.53	0.011	0.029	0.0310	7.6	2.45
410	0.012	0.025	0.0277	7.6	2.51	0.012	0.029	0.0314	7.6	2.44
420	0.014	0.025	0.0287	7.6	2.49	0.014	0.029	0.0322	7.6	2.43
430	0.017	0.025	0.0302	7.6	2.46	0.017	0.029	0.0336	7.6	2.41
440	0.02	0.026	0.0328	7.6	2.42	0.02	0.029	0.0352	7.6	2.39
450	0.02	0.026	0.0328	7.6	2.42	0.02	0.029	0.0352	7.6	2.39
460	0.021	0.027	0.0342	7.6	2.40	0.021	0.029	0.0358	12.48	3.05
470	0.026	0.028	0.0382	7.6	2.35	0.026	0.029	0.0389	16.53	3.45
480	0.027	0.028	0.0389	7.6	2.34	0.027	0.03	0.0404	11.93	2.91
490	0.03	0.029	0.0417	7.6	2.31	0.03	0.03	0.0424	7.6	2.30
500	0.037	0.03	0.0476	7.6	2.25	0.037	0.03	0.0476	7.6	2.25
510	0.038	0.03	0.0484	7.6	2.24	0.038	0.03	0.0484	7.6	2.24
520	0.04	0.03	0.0500	7.6	2.23	0.04	0.03	0.0500	7.6	2.23
530	0.043	0.03	0.0524	7.6	2.21	0.043	0.03	0.0524	7.6	2.21

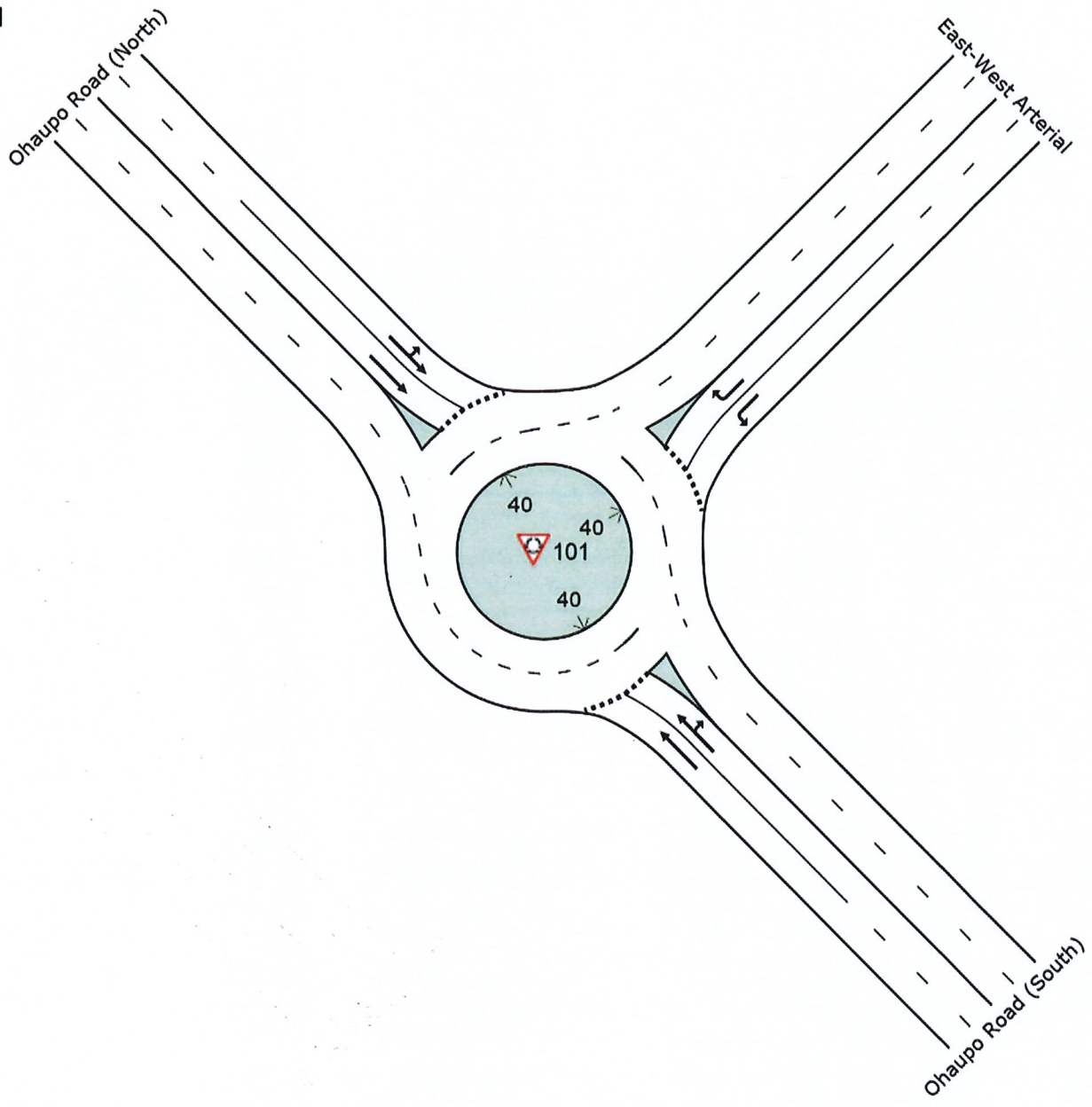
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APPENDIX B – SIDRA OUTPUT

SITE LAYOUT

 Site: 101 [Ohaupo/East-West Dual lane RAB AM peak]

New Site
Roundabout



MOVEMENT SUMMARY

 **Site: 101 [Ohaupo/East-West Dual lane RAB AM peak]**

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
SouthEast: Ohaupo Road (South)											
22	T1	187	10.0	0.133	5.6	LOS A	0.8	6.3	0.73	0.66	48.2
23	R2	12	10.0	0.133	12.4	LOS B	0.7	5.7	0.73	0.70	49.0
Approach		199	10.0	0.133	6.0	LOS A	0.8	6.3	0.73	0.66	48.3
NorthEast: East-West Arterial											
24	L2	43	10.0	0.047	2.8	LOS A	0.2	1.3	0.26	0.35	48.6
26	R2	804	10.0	0.545	8.2	LOS A	3.7	28.4	0.36	0.57	47.7
Approach		847	10.0	0.545	7.9	LOS A	3.7	28.4	0.35	0.56	47.7
NorthWest: Ohaupo Road (North)											
27	L2	324	10.0	0.195	2.1	LOS A	1.1	8.7	0.08	0.28	49.2
28	T1	125	10.0	0.099	1.3	LOS A	0.5	3.8	0.08	0.15	51.5
Approach		449	10.0	0.195	1.8	LOS A	1.1	8.7	0.08	0.24	49.8
All Vehicles		1495	10.0	0.545	5.8	LOS A	3.7	28.4	0.32	0.48	48.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 **Site: 101 [Ohaupo/East-West Dual lane RAB PM peak]**

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Prop. Queued Distance m	Effective Stop Rate per veh	Average Speed km/h	
SouthEast: Ohaupo Road (South)											
22	T1	175	10.0	0.089	2.7	LOS A	0.4	3.3	0.46	0.35	49.4
23	R2	19	10.0	0.089	9.1	LOS A	0.4	3.2	0.47	0.42	50.0
Approach		194	10.0	0.089	3.3	LOS A	0.4	3.3	0.46	0.36	49.5
NorthEast: East-West Arterial											
24	L2	7	10.0	0.008	3.1	LOS A	0.0	0.2	0.32	0.36	48.4
26	R2	388	10.0	0.287	8.3	LOS A	1.4	11.0	0.35	0.59	47.7
Approach		395	10.0	0.287	8.2	LOS A	1.4	11.0	0.35	0.59	47.7
NorthWest: Ohaupo Road (North)											
27	L2	767	10.0	0.458	2.1	LOS A	3.3	25.4	0.13	0.28	49.0
28	T1	200	10.0	0.175	1.3	LOS A	0.9	6.5	0.11	0.16	51.3
Approach		967	10.0	0.458	1.9	LOS A	3.3	25.4	0.12	0.26	49.5
All Vehicles		1556	10.0	0.458	3.7	LOS A	3.3	25.4	0.22	0.35	49.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.