

Guidelines for the Submission of Road Improvement Projects

Revision	Date	Summary of Update/Revision
Number		
1	Feb 2016	Update to Section 2.4 – Road Safety Audits
		Addition of Section 2.5 – Agreements in Principle
		Update to Section 8.1 – Reference to current PTA Guidelines/requirements
		Addition of Section 10 – Summary worksheet included
2	Feb 2018	Update to Section 10 – Summary worksheet updated
3	Feb 2023	Update of economic evaluation unit costs to reflect current values in Road
		Improvement worksheet, indexing applied from 2011 to 2022.
4	Feb 2023	Update ROM traffic modelling requirements in Road Improvement worksheet

Preface

Guidelines for the submission of Metropolitan Regional Road Group (MRRG) funding applications for road improvement (upgrade/new) projects were originally established in 1996. Subsequently revised a number of times, the MRRG submission process allows Perth Metropolitan Councils to potentially receive up to \$2 million dollars for improvement submissions per annum.

In 2008 the MRRG Technical Committee identified that there were deficiencies in the previous Guidelines and that in particular, the improvement scheme process no longer aligned to modern day sustainable transport policies and planning. Furthermore, member Councils had raised concerns over perceived deficiencies and biases towards the allocation of funds – which frequently end up funding major road upgrades/new schemes.

Following a review of the Guidelines in 2009 and a series of recommendations, the MRRG Technical Committee agreed that the Guidelines needed to be re-developed to ensure funding is directed at those projects that are consistent and support regional (and local) objectives in terms of the movement of people, goods and services. As part of this, it was recognised that there was a need to prioritise projects primarily through a simple but robust evaluation process utilising tangible benefits (road user costs associated with travel time, vehicle operating costs and crash savings) relative to the project cost (construction and maintenance). It was acknowledged that a number of assumptions as part of such a process would need to be made to enable an individual with minimal experience in transport economics to undertake the analysis. Furthermore, some allowance for intangible benefits, outside of monetary value in the form of a simplified evaluation process were also considered necessary.

This updated version of the MRRG *Guidelines for the Submission of Road Improvement Projects* is intended to provide guidance to Local Government with respect to seeking funding for road improvement grants using a highly simplified evaluation of tangible/intangible benefits and costs in order to determine an overall rating or score for a proposed project.

It is intended that the base costs used in the Guidelines be updated as and when required following agreement by the MRRG Technical Committee.

Assistance

Contact details relating to any assistance with respect to the use of these Guidelines should be directed to the Main Roads WA Metropolitan Regional Road Group Programme Officers, contact number 138 138.

Acknowledgements

The Metropolitan Regional Road Group (MRRG) *Guidelines for the Submission of Road Improvement Projects* has been developed with guidance from a technical working group representing local government and Main Roads WA. They were assisted by the contracted authors from Opus International Consultants.

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1 Introduction

1.1 Purpose

The purpose of this document is to set out the user operational instructions for preparing a road improvement (upgrade/new) project submission to the Metropolitan Regional Road Group (MRRG). In particular, it details how to use the associated assessment Excel spreadsheet in the form of a user manual to ensure users understand the information that needs to be entered into the spreadsheet. The assessment spreadsheet will form the bulk of a road improvement project submission.

The assessment spreadsheet is intended to allow an overall score for a road improvement (upgrade/new) project, or project components to be determined for inclusion in a Local Government's application for MRRG funding.

2 Road Improvement Project Requirements

2.1 Strategic Alignment

In order to help maximise the benefits associated with the funding of road improvement projects across the Perth Metropolitan Region, proposed projects should be able to demonstrate that they are aligned with documented priorities, for instance as set down in state, regional or local planning or transport strategies. A number of relevant strategic documents exist to help guide decision makers (for example the MRRG and the supporting Technical Committee) with respect to the above:

- Perth Metropolitan Transport Strategy 1995-2020;
- Public Transport Plan for Perth 2012-2031;
- Perth CBD Transport Plan 2012;
- WA Bicycle Network Plan 2012-2021: draft for consultation (or updated version);
- Metropolitan Regional Scheme;
- State Planning Framework Policy;
- Perth Urban Corridor Strategy (2007);
- Directions 2031 and Beyond (2010); and
- Local planning strategies, local transport strategies and/or bike plans.

2.2 Roads Eligible for MRRG Funding

The 'State Road Funds to Local Government Procedures' (Issue 6.0 – Main Roads WA) indicates that funds made available by the State for local government roads should, amongst other things, maximise benefits to the community and preserve, improve and extend the road system. Furthermore, the State Road Funds to Local Government Agreement 2011/12 – 2015/16 notes that funds for road related projects should be of 'Regional significance' and 'prioritised against other road projects within the Region.'

Roads within the Perth Metropolitan Region, managed by various local governments, vary considerably in function ranging from providing efficient mobility on relatively high volume, fast moving traffic distributors, to roads which have low traffic volumes and are pedestrian and cyclist friendly residential streets. The Metropolitan Functional Road Hierarchy, developed by Main Roads in consultation with all Perth metropolitan local governments designates the function of all roads within the region and encourages uniform traffic management practices across roads of a similar function. Four functional types exist:

- Primary Distributors;
- District Distributors (types A and B);
- Local Distributors; and
- Access Roads.

Whilst Primary Distributors provide for major regional and inter-regional traffic movements and carry large volumes of generally fast moving traffic, they are managed by Main Roads WA with separate funding sources, and are not under the control of local government. Conversely, Local Distributors and Access Roads tend to carry low volumes of traffic within a specific local area. These are low in the road hierarchy and such roads are unlikely to play a strategic role in the movement of people and goods from the perspective of the entire Perth Metropolitan Region. Compared to District Distributors (A and B) roads which typically carry higher volumes of traffic between industrial, commercial and residential areas (not through them) and generally connect to Primary Distributors, they are unlikely to warrant MRRG program funding.

Accordingly, whilst all roads where the annual average daily traffic exceeds 2,000 vehicles per day or the design exceeds 10,000,000 Equivalent Standard Axles (ESA) for a 20 year design life can be considered for funding¹, only those schemes which impact on <u>District Distributors (A or B)</u> should preferably be considered for funding as these will have the greatest Regional significance/benefits (given higher volumes of traffic) and are managed by local government.

2.4 Road Safety Audits

It is mandatory for projects that are awarded funding to be subject to a formal, independent road safety audit in accordance with the Austroads Guide to Road Safety. Such road safety audits should be undertaken during the design process, for instance at the preliminary and/or detailed design stages. Costs associated with such road safety audits should be incorporated into the project costs.

2.5 Agreements in Principle

Where proposed road improvement projects have an impact on other key stakeholders (for example Main Roads WA, other adjacent Local Governments and/or the Public Transport Authority) which and therefore potentially requires their agreement in principle upgrade, evidence of their agreement must be supplied as part of the submission process. Such examples include Main Roads WA Agreement in Principle for the installation of traffic signal controls and/or agreements to any changes that impact on bus movements from the Public Transport Authority.

February 2023

¹ The 'State Road Funds to Local Government Procedures' (Issue 6.0 – Main Roads WA)

3 Evaluation Methodology

3.1 Do Minimum and Project Option

The evaluation process essentially compares a proposed Project Option against a Do Minimum scenario with respect to both tangible benefits/costs as well as intangible benefits.

- The Do Minimum is the least amount of work that is needed to take place if the preferred option is not progressed. It should be noted that it is not normally practical to do absolutely nothing as there as a minimum level of expenditure is required for maintenance and operational costs to maintain a basic level of service.
- Project Options are developed to address the current road network deficiencies such as capacity problems at congested intersections and midblock section lengths.

3.2 Road Improvement Types

The simplified MRRG evaluation procedures can be used for the following basic project types/elements:

- Individual midblock improvements (e.g. road reconstruction, new road, geometric improvements, road widening to increases capacity, safety improvements); and
- Individual intersection improvements (e.g. change of intersection control form, or increases
 in stop line capacities), using intersection modelling software such as SIDRA to determine
 delays, average speed and fuel usage;

Route improvements comprising a combination of mid-block and intersection improvements can be undertaken utilising individual link and/or node improvements. This requires each individual midblock section or intersection to be evaluated separately before being combined and averaged. Whilst this may in reality slightly over/under estimate the tangible benefits associated with a particular project, it should be noted that all projects are subject to the same process resulting in an unbiased assessment process. Accordingly, in each instance, individual elements forming a longer route improvement will need their specific costs and benefits to be identified and separated out in order to allow the evaluation to occur.

Whilst the procedures can best be utilised for upgrading existing midblock lengths and intersections (and hence route lengths through a combination of these nodes and links), the procedures can also be used for the construction of a new road (asset creation). For example, the process can be used to evaluate a new bypass which reduces the route length and/or travel time/vehicle operating costs for traffic between two fixed points. Details relating to calculating the benefits of such new schemes within the context of these broader Guidelines are contained in Appendix A.

3.3 Project Costs

Project costs are those incurred by the road controlling authority in constructing as well as maintaining and operating the road under consideration.

<u>For the purpose of this evaluation process</u>, these costs are for the physical works to either maintain and operate the do-minimum situation (such as routine maintenance/periodic rehabilitation) or to construct, maintain and operate the preferred option. These costs typically comprise the following:

- Planning, investigation and design fees including road safety audits;
- Costs of property required for the project;
- Construction costs, including pre-construction and supervision;
- Maintenance and renewal costs, including repair and reinstatement;
- Operating costs;
- Risk management costs;
- External impact mitigation costs;
- Service relocation; and
- Provisional costs.

For the purpose of the amount sought for funding from the MRRG program however, the submitted project cost as part of any application should <u>exclude</u> the maintenance and renewal costs of the option. Costs for land and/or property resumption should only be included within the funding submission when funds for this are being requested from the program – otherwise, these should also be excluded. The cost shown should be the cost for the whole project or the cost of each stage. Projects that are awarded funding and consist of a number of stages receive funding for all stages.

3.4 Project Benefits

3.4.1 Tangible Benefits

The tangible benefits utilised as part of the MRRG simplified evaluation process are associated with:

- Travel Time Cost (TTC) savings relating to vehicles travelling through the mid-block or intersection more quickly due to shorter distances or less delays compared to the Do Minimum;
- Vehicle Operating Cost (VOC) savings with CO₂ reductions related to improved vehicle operating costs and lower CO₂ emissions compared to the Do Minimum; and
- Crash Cost savings related to enhanced road safety due to the proposed improvements compared to the Do Minimum.

Assessment Time Periods and Future Years

The simplified evaluation methodology has been developed for projects to be evaluated over a 30 year time period whereby there is a 1 year construction period and a 29 year benefit. With the project timings defined, the discounting of benefits and costs become standardised. As part of this, four future years: 2, 8, 15 and 30 are to be assessed for the specified time periods with midpoint benefits to be derived and used to calculate Present Value Travel Time and Vehicle Operating Cost savings.

Notwithstanding the above, by allowing unconstrained growth to occur beyond Year 15, testing of the process identified that unrealistic levels of benefit were being derived by proposed Options when compared to the Do Minimum, particularly at intersections with high levels of existing congestion. By allowing unconstrained growth to occur at such locations, any evaluation would effectively ignore the fact that road users would choose an alternative route/different travel time to avoid a particularly heavily congested location. Rather than cap growth and/or delays at locations, (which would involve process complications), whilst still seeking to derive longer term benefits over 30 years, the travel speeds, total delay and total travel distance values that help derive costs for Year 30 have been assumed to be the same as in Year 15.

Travel Time and Vehicle Operating Costs vary by time of day and day of week. For the evaluation, data is required for either a day long period; or for the weekday morning (AM), inter and evening (PM) peak periods. Off peak, weekend peak and weekend off peak time period data is forecast using the inter-peak model results multiplied by a flow factor. Typically, for intersections and congested mid-block sections, the full range of time periods will be required rather than using a day long period. (However, in some cases, it may be permissible to model mid-block over a day long period only.)

Base Date

It should be noted for future updating of these guidelines that the base date used to identify dollar values the various benefits has been fixed at 01/07/2022.

3.4.2 Intangible Benefits

Intangible benefits are assessed against the following criteria:

- Public Transport related to the extent the proposed improvements assist public transport movements;
- Walking related to the extent the proposed improvements assist walking;
- Cycling related to the extent the proposed improvements assist cycling;
- Street Lighting related to the extent street lighting has been provided to assist safety and personal security; and
- Road Safety related to the extent that the proposed measures maintain or improve future road safety where minimal existing road safety problems exist.

3.5 Assessment Process

3.5.1 Assessment Spreadsheet Data Entry

Throughout the assessment spreadsheet, a number of fields have been fixed, whilst other 'inputs' into the evaluation are automatically calculated based on original evaluator inputs. In general, those cells with:

- An <u>orange background require data to be entered;</u>
- A red background is a drop down menu with a input to be chosen; and
- A light grey background with orange text is an automatically calculated value.

Depending upon the project type component (mid-block or intersection) and time period analysed, non-applicable cells within the spreadsheet will be 'greyed-out'. Only those cells with an orange or red background will be capable of having data entered.

3.5.2 Work Sheets

The following worksheets set out in Table 3.1 need to be completed for each element of the project. Sections 4 to 10 provide a step-by-step process to complete each of the Worksheets. Each Worksheet should be completed in numerical order.

Table 3.1 Worksheets within the Spreadsheet (see Tabs at bottom of Spreadsheet)

Worksheet	Description
1	Project Description (Section 4)
2	Cost of Do Minimum (Section 5)
3	Cost of Option (Section 6)
4	Travel Time (TT) cost savings (Section 7.1)
5	Vehicle Operating Cost (VOC) savings (Section 7.2)
6	Crash Cost savings (Section 7.3)
7	Intangible Benefits (Section 8)
8	Overall Score and Rating (Section 9)
-	Project Summary (Section 10)

3.5.3 Overall Element Rating

The Overall Rating Score is obtained through a combination of the tangible benefits (relative to cost) and intangible benefits.

The Present Value of the net unconstrained benefits are divided by the net costs to produce a ratio of unconstrained benefits to cost, with a maximum score of 50 permissible. Similarly, a maximum score of 50 can be obtained for the intangible benefits.

Due the importance of the ratio of unconstrained benefits to cost compared to the intangible benefits, a 75/25 weighting has been applied to the scores of the above respectively. Once this weighting has been applied, the scores are summed together to obtain the overall rating for the element/project type (i.e. intersection or midblock).

3.5.4 Combining Intersection/Midblock Elements for a Route Improvement

As indicated in Section 3.2, route improvements comprising of a combination of mid-block and intersection improvements can be undertaken utilising individual link and/or node improvements. In each instance, individual elements forming a longer route improvement will need their specific

components relating to project costs and benefits to be identified and separated out in order to determine the ratio of unconstrained benefits to cost as well as the intangible benefits scores.

As part of this process of combining intersection and mid-block improvement, it will be necessary to ensure that the base time periods used for the evaluation (AM/Inter/PM peak or all day) are the same for both intersection and mid-block sections.

For each element (midblock or intersection) making up the route, list the element and associated ratings, sum the ratings and calculate the average to determine the overall route score.

3.6 Before You Get Started - Required Data/Information

Prior to undertaking the evaluation, assessors should collate the following information to assist with the process:

- Confirm that the project meets strategic requirements according to documented future needs;
- Obtain any necessary Agreements in Principle from affected stakeholders;
- For a route assessment, split the route into intersections and mid-block lengths;
- Determine the road class and speed limit;
- Obtain forecast daily traffic volumes from Main Roads WA Regional Operations Model (ROM) for 2021 and 2036;
- Obtain annual and periodic maintenance costs along with any operating costs (broken down by intersection and midblock lengths as appropriate);
- Determine the Option cost (broken down by intersections and mid-block lengths as appropriate);
- Obtain AM, Inter and PM Peak (and daily if appropriate) traffic flows for mid-block sections and turning movements for intersections;
- For intersections, undertake a SIDRA analysis of the Do Minimum and Option for existing and stipulated future years (2, 8 and 15) and obtain Summary Outputs;
- Identify the street light/luminaire type for your area as well as existing numbers;
- Establish crash numbers and reductions using Main Roads WA Crash Analysis Reporting System (CARS); and
- Identify any public transport, walking, cycling, street lighting and road safety measures.

WORKSHEETS

4 Project Description

Worksheet 1 provides a summary of the general data used for the evaluation and the analysis results. The listed points below are to be read in conjunction with **Worksheet 1** – **Evaluation Summary** print out shown at the end of this section.

1 Applicant's Details

- Enter the name of the Local Authority or organisation making the submission.
- Provide the MRRG or Local Authority reference number/details (as appropriate).
- Enter the name and position of the person undertaking the assessment.
- Enter the name and position of the person reviewing the assessment.

2 Project Overview

- Provide the overall project name including details of its extent (e.g. from intersection to intersection).
- Select whether the particular individual site being evaluated is a midblock or intersection (from the drop-down menu). Note: as indicated previously, individual midblock and/or intersections need to be evaluated separately as part of a route improvement.
- Provide details of the mid-block or intersection under consideration e.g. names of intersecting roads or mid-block section between specified intersections
- Select the road type from the dropdown menu. For intersections, use the higher road type.

3 Problem Description

• Provide a general description of the problem/issue with the existing route, midblock or intersection, including evidence of any community support – for instance if consultation has been undertaken with respect to the raised concerns and/or the identified proposed improvements.

4 Location Details

• Provide a location reference of the site; attach a location map if necessary to the submission document.

5 Project Strategic Alignment

• Provide specific details (document and page number) relating to the proposed projects alignment to state/regional/local strategies and policies – see Section 2.1. A copy of the relevant page(s) of the supporting documentation should be attached to the hard copy of the Submission.

6 Project Details

- Describe the Do Minimum. This is usually the lowest cost option to maintain the road midblock or intersection, e.g. routine and periodic maintenance.
- Describe the options considered/assessed to improve the problem and how the preferred option will improve the current situation ahead of other options.

For MIDBLOCK lengths only:

- Enter the length for the Do Minimum and Option.
- Enter the total number of traffic lanes (both directions) for the Do Minimum and Option.

- From the drop down menu, enter the location context of the Do Minimum and Option:
 - Rural: very high speed roads with speed limit/operational speeds in excess of 70km/h and very low levels of adjacent roadside development with minimal pedestrian activity;
 - Semi-rural: high speed roads with speed limits/operational speeds typically in the order of 70km/h and low to medium levels of adjacent roadside development with limited pedestrian activity depending on the location;
 - Sub-urban: roads with speed limits/operational speeds typically in the order of 60km/h and medium to high levels of adjacent roadside development in built-up areas with pedestrian activity expected; and
 - Urban: roads with speed limits/operational speeds typically in the order of 50km/h and very high levels of adjacent roadside development in built-up areas with higher levels of pedestrian activity.
- From the drop down menu, enter the prevailing speed limit for the Do Minimum and Option.

7 Construction Details

For the economic evaluation, the construction start date is assumed to be the 1 July of the financial year in which the activity is submitted for a commitment to funding. Time zero is the date all benefits and cost are to be discounted to. As an example, an activity submitted for funding in the financial year 2015/16, time zero would be 1st July 2015. When projects are being re-submitted for funding, time zero should be updated to reflect the financial year the work is committed for. For the purposes of the simplified evaluation procedures, construction duration has been fixed at 12 months.

• Enter the date of the assumed Time Zero.

8 Time Frame Information

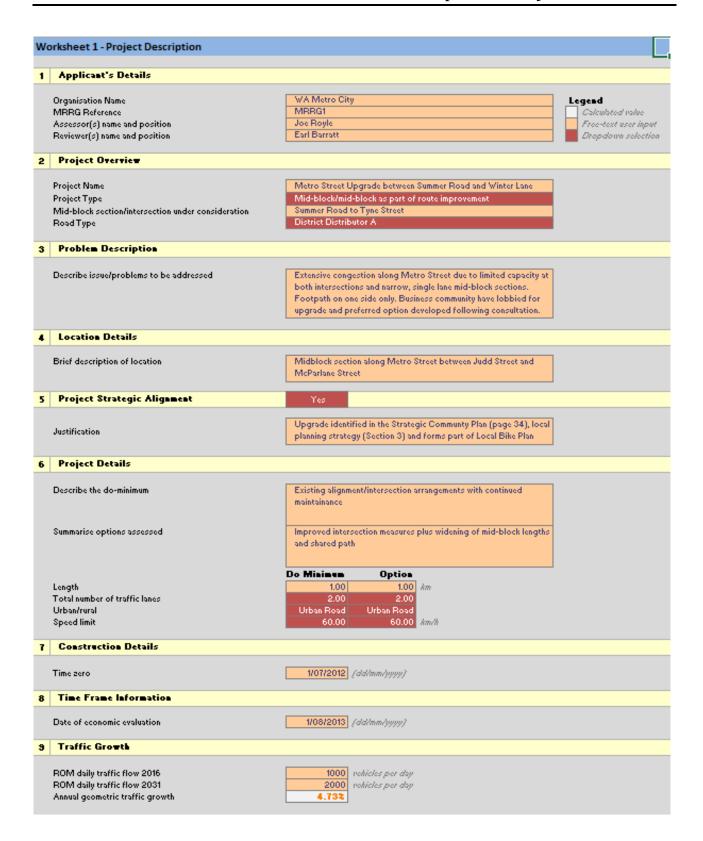
• Enter the date of the evaluation process.

9 Traffic Growth

To provide a consistent approach to forecasting traffic growth, whilst recognising different parts of the Metropolitan area will have different rates of growth and development, traffic data should be obtained from the Main Roads WA Regional Operations Model (ROM) for forecast <u>daily</u> traffic volumes on the roads under consideration. For intersections, traffic volumes along the main road/route under consideration should be used as the basis for calculating traffic growth.

- Enter daily traffic volumes from ROM for 2016.
- Enter daily traffic volumes from ROM for 2031.
- Annual geometric traffic growth between 2016 and 2031 will be calculated automatically.

For new roads, a request should be made to Main Roads WA to create a new link within ROM in order to determine forecast traffic volumes in 2016 and 2031 as a result of traffic re-assignment to the new link, with subsequent traffic growth calculated in the same way as above.



5 Do Minimum Cost

Worksheet 2 is used to calculate the Present Value (PV) cost of the Do Minimum. The Do Minimum is the lowest level of expenditure necessary to keep a road midblock or intersection open, and generally consists of maintenance work. The listed points below are to be read in conjunction with the **Worksheet 2 – Cost of the Do Minimum** screen print out at the end of this Section. Details of the equations and calculations used to determine the Present Value Do Minimum costs can be found in Appendix B.

1 Road Type

• The road type for the project will be automatically copied from **Worksheet 1**.

2 Present Value of Annual Maintenance Costs

- Enter the annual maintenance costs. These maintenance costs relate to routine costs such as potholing rather than periodic rehabilitation which are captured separately (see Step 3 below). If typical annual maintenance costs for the intersection or mid-block are not known, enter zero.
- The PV of the annual maintenance costs will be calculated automatically.

3 Present Value of Periodic Maintenance Costs

- The proposed rehabilitation treatment measure for the issue will be filled in automatically depending upon the road type selected e.g. District Distributor A/B 40mm SMA Overlay.
- Enter the site treatment area in square metres (from SLK to SLK).
- The rehabilitation cost will be calculated automatically based on the treatment type and area.
- The years and cost for periodic maintenance will be filled in automatically based on the road type selected (e.g. District Distributor A/B: every 15 years over the 30 year period).
- The PV of the periodic maintenance costs for relevant years will be calculated automatically.
- The sum of the PV of the periodic maintenance costs will be calculated automatically.

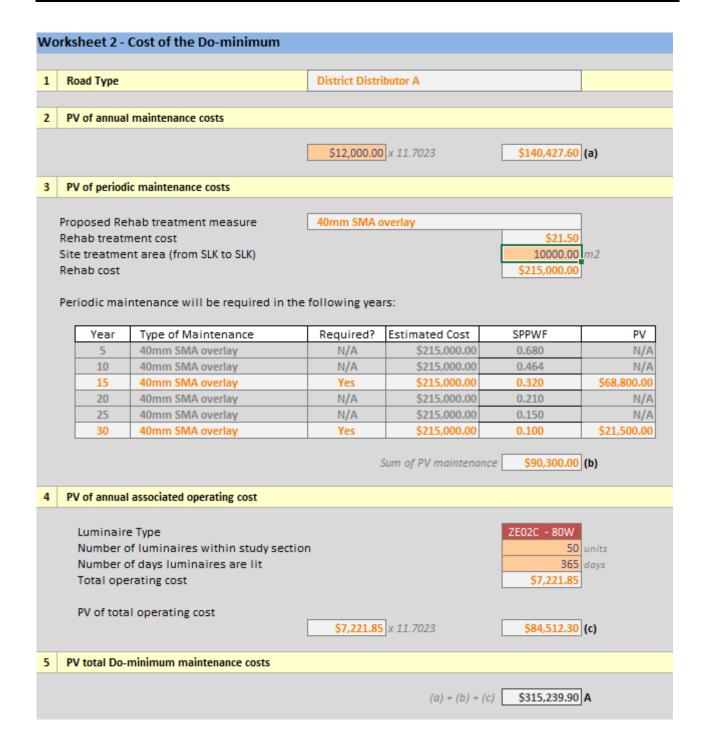
4 Present Value of Annual Associated Operating Costs

Operating cost includes elements such as power costs to run street lighting for a mid-block or signalised intersection. They are any costs that are incurred in day-to-day operations that are not considered part of a maintenance costs and are costs that would likely be billed by a supplier to operate. It is reasonable to have the operational cost at zero if there is no operating cost, or if they are common in the Do Minimum and option - as they will cancel each other out. It is therefore only to be included if there are particular operating saving opportunities (i.e. reduction or increase in lighting in the option).

- Select the appropriate Western Power tariff code and wattage that is appropriate for the luminaires (street lights) within drop down menu.
- Enter the number of luminaires (street lights) that currently exist within the study section.
- Enter the number of days the luminaries (street lights) are lit for (usually 365).
- The total annual operating cost will be calculated automatically based on the supplied data.
- The PV of the total operating costs will be calculated automatically.

5 Present Value of Do Minimum Maintenance Costs

• The total PV of the maintenance costs for the Do Minimum will be calculated automatically using the present values of the annual and periodic maintenance as well as operating costs.



6 Option Cost

Worksheet 3 is used to calculate the PV cost of the proposed option. The option cost includes capital expenditure cost, future maintenance cost and operational costs. This essentially will calculate the whole life cost of the option for the analysis period. The listed points below are to be read in conjunction with **Worksheet 3** – **Cost of the Option** screen print out at the end of this Section. Details of the equations and calculations used to determine the Present Value Option costs can be found in Appendix C.

1 Road Type

• The road type for the project will be automatically copied from **Worksheet 1**.

2 Present Value of Project Construction

- Enter the capital costs (see Section 3.3 of these Guidelines) of the proposed option. The option cost is to be estimated separately on an estimate sheet that should be attached to the hard copy of the Submission.
- The PV of the Option cost will be calculated automatically.

3 Present Value of Routine Maintenance Costs

- Enter the routine maintenance costs. These maintenance costs relate to routine costs such as potholing rather than periodic rehabilitation which are captured separately (see step 5 below). If typical annual maintenance costs for the intersection or mid-block are not known, enter zero.
- The PV of the annual maintenance costs will be calculated automatically.

4 Present Value of Maintenance Cost in Year 1

• The PV of maintenance cost in Year 1 will be automatically completed based on data in Work Sheet 2 for the Do Minimum maintenance strategy, as this is assumed to be the year that the proposed option works are carried out.

5 Present Value of Periodic Maintenance Costs

- The proposed rehabilitation treatment measure for the issue will be filled in automatically depending upon the road type selected e.g. District Distributor A/B 40mm SMA Overlay \$21.50.
- Enter the site treatment area in square metres (from SLK to SLK).
- The rehabilitation cost will be calculated automatically based on the cost treatment type and area.
- The years and cost for periodic maintenance will be filled in automatically based on the road type selected (e.g. District Distributor A/B: every 15 years over the 30 year period).
- The PV of the periodic maintenance costs for relevant years will be calculated automatically.
- The sum of the PV of the periodic maintenance costs will be calculated automatically.

6 Present Value of Annual Associated Operating Costs

Operating cost includes elements such as power costs to run lighting for a mid-block or signalised intersection. They are any costs that are incurred in day-to-day operations that are not considered part of a maintenance costs and are costs that would likely be billed by a supplier to operate. It is reasonable to have the operational cost at zero if there is no operating cost, or if they are common in

the Do Minimum and option - as they will cancel each other out. It is therefore only to be included if there are particular operating saving opportunities (i.e. reduction or increase in lighting in the option).

- Select the appropriate Western Power tariff code and wattage that is appropriate for the luminaires (street lights) within drop down menu.
- Enter the number of luminaires (street lights) that are proposed (existing and/or new) within the study section.
- Enter the number of days the luminaries (street lights) are lit for (usually 365).
- The total annual operating cost will be calculated automatically based on the supplied information.
- The PV of the total operating costs will be calculated automatically.

7 Present Value of Do Minimum Maintenance Costs

• The total PV of the maintenance costs for the Do Minimum will be calculated automatically using the present values of the proposed project cost, plus routine, Year 1 and periodic maintenance as well as operating costs.

Wc	rksheet 3	Cost of the Option				
		cost of the option				
1	Road Typ	ne e	District Dis	stributor A		
2	PV of est	imated cost of proposed wor	k (as per att	ached estimate s	heet)	
						_
			\$15,000.00	к 0.3259	\$13,888.50	(a)
_	DU (
3	PV of rou	tine maintenance costs follo	wing comple	etion of the work		
			\$15,000.00	l <i>v 10 7398</i>	\$161,097.00	rы
			* 10,000.00]	*101,001.00	(0)
4	PV of ma	intenance cost in year 1				
					\$128,877.60	(c)
_	DU (0					
5	PV of Up	tion periodic maintenance c	ost			
	Proposed B	ehab treatment measure	40mm SM/	A ouerlau		1
	Rehab treat		40111111 0111	Tovellay	\$21.50	
		nt area (from SLK to SLK)			400.00	m2
	Rehab cost	= . = = =			\$8,600.00	
						1
	Periodic mai	ntenance will be required in the fol	lowing years:			
	Year	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	5	40mm SMA overlay	N/A	\$8,600.00	0.680	N/A
	10	40mm SMA overlay	N/A	\$8,600.00	0.464	N/A
	15	40mm SMA overlay	Yes	\$8,600.00	0.320	\$2,752.00
	20	40mm SMA overlay	N/A	\$8,600.00	0.210	N/A
	25	40mm SMA overlay	N/A	\$8,600.00	0.150	N/A
	30	40mm SMA overlay	Yes	\$8,600.00	0.100	\$860.00
			Score	FV maintenance	\$3,612.00	ran
			Comror	r rmankenance	¥3,012.00	(4)
6	PV of An	nual associated operating co	ost			
	Luminaire				ZE02C - 80W	
		of Luminaires within study section			50	units
		of days luminaires are lit			365	days
	rotarope	rating cost			\$7,625.95	
	PV of annua	l operating costs (separate to main	ntenance costs	:)		
			\$7,625.95		\$81,901.12	(e)
_	B.1.					
7	PV total	costs of the preferred option				
			/-	1+151+6-1+6-1+6-1	\$389,376.22	В
			/3	ariorriorriorris	¥303,310.22	

7 Tangible Benefit Procedure

Tangible benefits are assessed against the following criteria:

- Travel Time Cost savings whether the project results in vehicles travelling through the midblock or intersection more quickly due to shorter distances or less delays compared to the Do Minimum;
- Vehicle Operating Cost savings whether the project results in improved vehicle operating costs and lower CO2 emissions compared to the Do Minimum; and
- Crash Cost savings does the project result in additional road safety due to the proposed improvements compared to the Do Minimum.

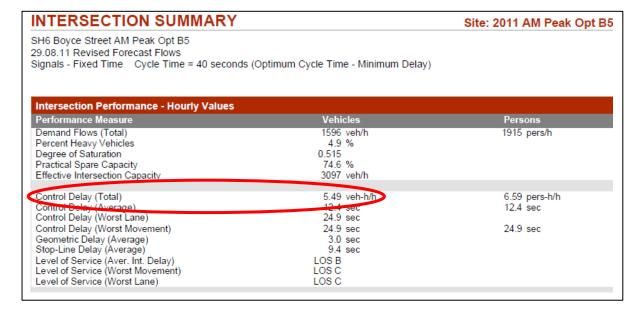
Worksheets 4, 5 and 6 should be utilised to assess each Option against the above tangible criteria. Details of the equations and calculations used to determine the Present Value cost savings for each of the tangible benefits can be found in Appendix D.

7.1 Travel Time Costs

Travel Time Cost (TTC) benefits relate to those time savings as a result of reduced travel distances and/or less congestion. **Worksheet 4** is used to calculate the PV of Travel Time Cost savings from midblock and intersection improvements. The listed points below are to be read in conjunction with the **Worksheet 4** – **Travel time Cost Savings** screen print out at the end of this Section.

Required inputs for travel time cost calculations vary according to whether the assessment is for a mid-block section or an intersection.

- For midblock modelling, the calculation uses data related to mid-block vehicle speeds, traffic volume and section length.
- For intersections, the calculation primarily uses SIDRA Intersection Summary outputs related to a vehicle's Control Delay (Total) as an external input into the process.



7.1.1 Intersections

1 Road Type

• Select the road type for the project – automatically copied from **Worksheet 1**.

2 Project Type

• Select the project type for the project – automatically copied from **Worksheet 1**.

3 Modelling Period

• From the drop down menu, select the morning (AM)/Inter-Peak (IP)/evening (PM) peak modelling periods. (All Day modelling periods should not be used for intersections.)

4 Traffic Volumes

• Not required for Intersections.

5B and 6B Control Delay

- Model the intersection performance for the Do Minimum for Time Zero in SIDRA and apply
 the growth factor to the modelling in SIDRA for Years 2, 8 and 15. The SIDRA outputs should
 be attached to the hard copy of the Submission.
- Enter the SIDRA modelling Control Delay (Total) from the Intersection Summary output (see above) for the Do Minimum for the weekday AM/Inter/PM peak periods for the Years 2, 8 and 15. Weekday off-peak and weekend results, along with Year 30 data will be automatically entered based on the supplied data.
- Model the intersection performance for the Option for Time Zero in SIDRA and apply the growth factor to the modelling in SIDRA for Years 2, 8 and 15. The SIDRA outputs should be attached to the hard copy of the Submission.
- Enter the SIDRA modelling Control Delay (Total) from the Intersection Summary output (see above) for the Option for the weekday AM/Inter/PM peak periods for the Years 2, 8 and 15. Weekday off-peak and weekend results, along with Year 30 data will be automatically entered based on the supplied data.

5D and 6D Annual Travel Time

 Annual travel time will be automatically calculated based on the Control Delay, travel time periods and Travel Time Costs for each time period and future years.

7, 8 and 9 PV Travel Time Cost Savings (C)

- The TTC midpoint values for the Do Minimum and Option will be automatically calculated by averaging the TTC at the start and end of each of the four modelled periods.
- The mid-point benefits will be automatically calculated by subtracting Option TTC midpoint from the Do Minimum TTC midpoint to obtain m1, m2 and m3.
- The PV Travel Time Cost savings will be automatically calculated.

7.1.2 Mid-Block Sections

1 Road Type

• The road type for the project will be automatically copied from **Worksheet 1**.

2 Project Type

• The project type for the project will be automatically copied from **Worksheet 1**.

3 Modelling Period

• From the drop down menu, select the morning (AM)/Inter-Peak (IP)/evening (PM) peak or All Day modelling periods. (If the mid-block section is part of a route assessment including intersections, then the AM/Inter/PM peak modelling period should be used for consistency along the route.)

4 Traffic Volumes

- For both the Do Minimum and Option (for midblock sections only), enter the total two-way traffic flow along the length under consideration at Time Zero for each of the AM/Inter/PM peak periods (vehicles per hour); or the average daily traffic for a day long period.
- Traffic volumes will be automatically calculated for the four future assessment years using this data as well as for the weekday off-peak and weekend periods.

5C and 6C Control Delay

 Midblock Control Delays will be automatically calculated based on the traffic volumes, project length and forecast vehicle speeds (related to traffic flow) for each time period and future years.

5D and 6D Annual Travel Time

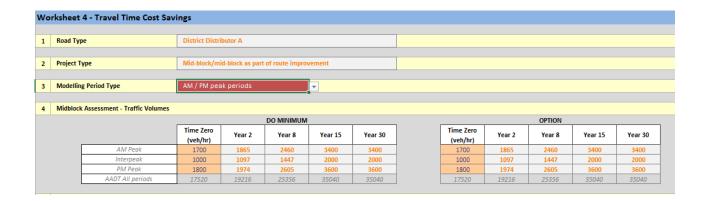
 Annual travel time will be automatically calculated based on the Control Delay, travel time periods and Travel Time Costs for each time period and future years.

5E and 6E Annual Travel Time

• Midblock Control Delays and annual travel time will be automatically calculated using the time Zero daily traffic volumes if the day long modelling period has been chosen.

7, 8 and 9 PV Travel Time Cost Savings (C)

- The annual TTC for the Do Minimum and Option will be automatically transposed.
- The TTC midpoint values for the Do Minimum and Option will be automatically calculated by averaging the TTC at the start and end of each of the four modelled periods.
- The mid-point benefits will be automatically calculated by subtracting Option TTC midpoint from the Do Minimum TTC midpoint to obtain m1, m2 and m3.
- The PV Travel Time costs savings will be automatically calculated.



Time Period Flow Factor Time Periods Time	L		5A Project Timings from Annualisation Factors	Annualisation F	actors			5B Isolated Intersection	Intersection		ιń	5C Road Midblock Improvement	k Improvement			CD Annual Transf	(accord 2) to 2 confi leneral leneral A		
Freeding House Flow Feating Flow Feating Tito Religiation Year 15 Year 2 Year 3 Year 3 Year 14 60 Year 3 Year 3 Year 14 60 Year 3				Time	eriods	TTC	Me	delling Results	Inputs (veh.hr/h	6	Mo	delling Results	'nputs (veh.hr/h	ir)		OU AIIIIUAI ITAVEI	IIIIIe COSt (3/yed	1	
Machine 1		Time Period	Flow Factor	hours/day	days/year	TTC Table 6 (\$/hr)	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
Cerebidory Interpreted 1 8 245 527.01 1.96 2.59 5.22 5.22 5.448 33.31 4465 4465 Cerebidory Interpreted 1 2 245 52.23 5.25 5.29 1.459 1.459 2.449 32.37 4465 4465 Cerebidory Interpreted 0.45 8 1.20 5.25.53 0.89 1.05 3.35 2.35 6.48 8.25 1.182 1.182 6.56 6.48 8.25 1.182 <		Weekday AM Peak	1	2	245	\$22.54	2.43	3.77	14.60	14.60	24.49	32,32	44.69	44.69	\$270,451.07	\$356,963.34	\$493,601.62	\$493,601.62	(a)
Pecietary PAM Peark 1		Weekday Interpeak	1	80	245	\$27.01	1.96	2.59	5.22	5.22	24.48	32.31	44.65	44.65	\$1,295,961.26	\$1,710,227.85	\$2,363,886.33	\$2,363,886.33	(9)
Neeklory Off Peark 0.45 12 245 572.91 0.49 0.65 131 131 3.60 4.75 6.56 6.56 6.56		Weekday PM Peak	1	2	245	\$22.30	3.73	6.10	14.59	14.59	24.49	32,32	44.69	44.69	\$267,571.38	\$353,162.49	\$488,345.88	\$488,345.88	0
Necetical Peois 0.45 8 120 53.55 0.88 117 2.35 2.35 6.48 8.55 1182 1182 1182 Aul periods N/A 24 365 5.2570 0.29 0.39 0.78 0.78 0.75 1.65 1.387 1.917 Aul periods N/A 24 3.65 5.2570 0.29 0.39 0.78 0.78 0.75 1.951 1.387 1.917 Aul periods N/A 24 3.65 5.2570 0.29 0.39 0.78 0.78 0.78 0.75 1.951 1.387 1.917 Aul periods N/A 24 3.65 2.2570 0.29 0.39 0.78 0.78 0.75 1.051 1.387 1.917 Aul periods N/A 24 3.65 2.2570 0.29 0.29 0.29 0.29 0.29 0.29 0.29 0.29 0.29 0.29 Aul periods N/A 24 2.25 0.29 0.29 0.25 0.25 0.25 0.25 0.25 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 0.00 0.00 Aul periods N/A 24 3.85 2.5570 0.00 Aul periods N/A 24 3		Weekday Off Peak	0.25	12	245	\$22.91	0.49	0.65	1.31	1.31	3.60	4.75	92'9	6.56	\$242,424.72	\$319,888.21	\$442,073.14	\$442,073.14	(D)
No. 12 12 12 12 12 12 12 1		Weekend Peak	0.45	80	120	\$25.55	0.88	1.17	2.35	2.35	6.48	8.55	11.82	11.82	\$158,914.29	\$209,697.41	\$289,803.79	\$289,803.79	(e)
N/A 24 365 5.55 70 10 10 10 10 10 10 10		Weekend Off Peak	0.15	16	120	\$24.80	0.29	0.39	0.78	0.78	2.16	2.85	3.94	3.94	\$102,824.65	\$135,679.63	\$187,501.19	\$187,501.19	(£)
(Q) (R) (R) (R) (R) (N) (N) (N) (N) (N) (N) (N) (N) (N) (N		All periods	N/A	24	365	\$25.70	10	10	10	10	10.51	13.87	19.17	19.17	\$2,366,379.80	\$3,122,691.90	\$4,315,857.29	\$4,315,857.29	(8)
Comparison Factors Comparison Factors Comparison Compariso		(0)	(R)	(s)	Œ	(n)	(V)	(M)	(X)	W	S	(W)	(X)	(X)	\$2,338,147.38	\$3,085,618.94	\$4,265,211.94	\$4,265,211.94	Total for All Day Periods
Flow Factor	L	6A Proj	ect Timings from	Annualisation F	actors			6B Isolated	Intersection		9	C Road Midbloc	k Improvement				3		
Flow Factor Hours/day days/year TC Table 4.2 Year 8 Year 1.5 Year 8 Year 1.5 Year 9.0 Year 7 Year 9.0 1				Time	eriods	TTC	Mc	odelling Results	Inputs (veh.hr/h	0	Mo	delling Results	'nputs (veh.hr/h	ır)		on Annual Travel	bD Annual Iravel Ilme Cost (s/year)	ı,	
1 2 245 5254 2.94 3.54 3.94 23.35 30.87 43.72 43.72 1 1 8 245 \$270.0 2.19 2.58 3.43 3.93 90.79 42.88 42.88 1 1 2 245 \$270.0 2.19 2.89 3.45 5.33 30.87 43.72 43.72 0.25 1.2 245 \$22.91 0.55 0.65 0.86 0.86 3.43 4.52 6.25 6.25 0.45 8 1.20 \$25.55 0.99 1.16 1.54 6.17 8.14 11.25 11.25 N/A 24 355.70 1.0 1.0 1.0 1.0 1.01 1.01 3.67 8.15 8.25 6.25		Time Period	Flow Factor	hours/day	days/year	TTC Table 4.2 (S/hr)	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
1 8 245 \$27.01 2.19 2.58 3.43 3.43 23.31 30.79 42.58 42.58 1 2 245 \$22.30 3.23 3.87 5.46 5.46 23.35 30.87 43.72 43.72 0.25 12 245 \$22.31 0.55 0.65 0.86 3.43 4.52 6.25 6.25 0.45 8 120 \$25.23 0.99 1.16 1.54 6.17 8.14 1.12 1.15 0.45 8 120 \$28.53 0.99 1.16 1.54 6.17 8.14 1.15 11.5 0.45 16 10 10 10 10 10.01 26.42 36.51 36.51 36.51	L	Weekday AM Peak	1	2	245	\$22.54	2.49	2.94	3.94	3.94	23.35	30.87	43.72	43.72	\$257,884.31	\$340,897.50	\$482,891.92	\$482,891.92	(a)
1 2 245 5230 3.23 3.87 5.46 5.46 23.35 30.87 43.72 43.72 43.72 0.25 12 245 52.24 0.55 0.65 0.86 3.43 4.52 6.25 6.25 0.45 8 120 52.24 0.55 0.65 0.86 0.86 3.43 4.52 6.25 6.25 0.45 8 120 52.24 0.59 1.16 1.54 6.17 8.14 1.15 1.15 0.15 16 10 10 10 10 10 1.01		Weekday Interpeak	1	80	245	\$27.01	2.19	2.58	3.43	3.43	23.31	30.79	42.58	42.58	\$1,234,248.82	\$1,629,870.77	\$2,254,339.39	\$2,254,339.39	(<u>a</u>)
0.25 12 245 \$22.91 0.55 0.65 0.86 0.86 3.43 4.52 6.25 6.25 6.25 0.45 8 120 \$25.55 0.99 1.16 1.54 1.54 8.17 8.14 11.25 11.25 0.15 16 120 \$24.50 0.39 0.16 1.54 6.17 8.14 11.25 11.25 1 1.00 1.00 0.51 0.51 0.51 3.17 3.55 1 1.00 1.00 1.00 1.00 1.00 1.00 2.41 3.65 3.65		Weekday PM Peak	1	2	245	\$22.30	3.23	3.87	5.46	5.46	23.35	30.87	43.72	43.72	\$255,138.43	\$337,267.71	\$477,750.22	\$477,750.22	(0)
0.45 8 120 \$25.55 0.99 1.16 1.54 1.54 1.54 1.54 1.17 1.125		Weekday Off Peak	0.25	12	245	\$22.91	0.55	0.65	98.0	0.86	3.43	4.52	6.25	6.25	\$230,880.68	\$304,655.44	\$421,022.04	\$421,022.04	(D)
0.15 16 120 \$24.80 0.33 0.39 0.51 0.51 2.06 2.71 3.75 3.75 3.75 N/A 24 365 \$25.70 10 10 10 1001 26.42 36.51 36.51		Weekend Peak	0.45	80	120	\$25.55	66.0	1.16	1.54	1.54	6.17	8.14	11.25	11.25	\$151,346.95	\$199,711.82	\$276,003.61	\$276,003.61	(e)
N/A 24 365 525.70 10 10 10 10 10 10.01 26.42 36.51 36.51		Weekend Off Peak	0.15	16	120	\$24.80	0.33	0.39	0.51	0.51	2.06	2.71	3.75	3.75	\$97,928.24	\$129,218.70	\$178,572.56	\$178,572.56	(£)
		All periods	N/A	24	365	\$25.70	10	10	10	10	10.01	26.42	36.51	36.51	\$2,253,695.05	\$5,947,984.58	\$8,220,680.56	\$8,220,680.56	(g)
(Q) (R) (S) (T) (U) (V) (W) (X) (Y) (W) (Y) (W) (X) (Y) (S2.227.427.44		(0)	(R)	(s)	Έ	(n)	(3)	(W)	(x)	w	S	(w)	(X)	3	\$2,227,427.44	\$2,941,621.94	\$4,090,579.74		\$4,090,579.74 Total for All Day Periods

			Annual Tra	vel Time Cost (S/year) for mod	elled years	
		Start Year 2	End Year 7	Start Year 8	End Year 14	Start Year 15	End Year 30
	Travel Time Cost Do-minimum	\$2,338,147.38	\$3,085,618.94	\$3,085,618.94	\$4,265,211.94	\$4,265,211.94	\$4,265,211.94
	Travel Time Cost Option	\$2,227,427.44	\$2,941,621.94	\$2,941,621.94	\$4,090,579.74	\$4,090,579.74	\$4,090,579.74
	Midpoint at end of year	Ye	er 4	Year	11.5	Yea	r 22
	Duration Years	(5		7	1	.6
	Do-minimum TTC at midpoint	\$2,711	,883.16	\$3,675	,415.44	\$4,265	,211.94
	Option TTC at midpoint	\$2,584	,524.69	\$3,516	,100.84	\$4,090	,579.74
	Midpoint Benefits	\$127,	358.47	\$159,	314.60	\$174,0	532.20
		n	1	n	12	n	13
- D./ T							
9 PV T	ravel Time Cost Savings						

7.2 Vehicle Operating Costs and CO2

Vehicle Operating Costs (VOC) are those incurred by motorists due to fuel and vehicle deterioration costs. Such costs are primarily a function of road gradients, surface roughness, vehicle operating speed, and vehicle kilometres travelled (although for the purposes of this simplified procedure, gradient and surface roughness are not used in this instance). The purpose of this Guideline, VOC also includes a component for CO₂ costs, which typically make up 4% of VOC. For simplicity however, the term VOC has been used to mean both sets of costs.

Required inputs for Vehicle Operating Cost calculations vary according to whether the assessment is for a mid-block section or an intersection:

- For midblock modelling, the calculation uses data related to mid-block vehicle speeds, traffic volume and section length.
- For intersections, the calculation primarily uses SIDRA Intersection Summary outputs related to a vehicle's Travel Distance (Total) and Travel Speed as an external input into the process.

NTERSECTION SUMMARY		Site: 2011 AM Peak Opt B
H6 Boyce Street AM Peak Opt B5 0.08.11 Revised Forecast Flows gnals - Fixed Time	otimum Cycle Time - Minimum Delay	<i>(</i>)
ntersection Performance - Hourly Values Performance Measure	Vehicles	Persons
Demand Flows (Total) Demand Flows (Total) Dercent Heavy Vehicles Degree of Saturation Dractical Spare Capacity Effective Intersection Capacity	1596 veh/h 4.9 % 0.515 74.6 % 3097 veh/h	1915 pers/h
Control Delay (Total) Control Delay (Average) Control Delay (Worst Lane) Control Delay (Worst Movement) Control Delay (Average) Control Delay (Average) Copenitro Delay (Average) evel of Service (Aver. Int. Delay) evel of Service (Worst Movement) evel of Service (Worst Lane)	5.49 veh-h/h 12.4 sec 24.9 sec 24.9 sec 3.0 sec 9.4 sec LOS B LOS C LOS C	6.59 pers-h/h 12.4 sec 24.9 sec
5% Back of Queue - Vehicles (Worst Lane) 5% Back of Queue - Distance (Worst Lane) otal Effective Stops Effective Stop Rate Proportion Queued Performance Index	3.8 veh 26.6 m 1024 veh/h 0.64 per veh 0.69 41.4	1229 pers/h 0.64 per pers 0.69 41.4
ravel Distance (Total) ravel Distance (Average) ravel Time (Total) ravel Time (Average) ravel Speed	919.3 veh-bh/h 576 m 24.3 veh-h/h 54.7 3.5 37.9 km/b	1103.2 pers-km/h 576 m 29.1 pers-h/h 54.7 sec 37.9 km/h

7.2.1 Intersections

1. Road Type

• The road type for the project will automatically copied from **Worksheet 1**.

2. Project Type

• The project type for the project will be automatically copied from **Worksheet 1**.

3. Modelling Period

• From the drop down menu, select the morning (AM)/Inter-Peak (IP)/evening (PM) peak modelling periods. (All Day modelling periods should not be used for intersections.)

4 and 5 MIDBLOCK ONLY: Traffic Volumes

• Not required for Intersections

6 and 7 Vehicle Speeds and VOC – Do Minimum

- Model the intersection performance for the Do Minimum for Time Zero in SIDRA and apply
 the growth factor to the modelling in SIDRA for Years 2, 8 and 15. The SIDRA outputs should
 be attached to the hard copy of the Submission.
- Enter the SIDRA modelling Travel Distance (Total) and Travel Speed data from the Intersection Summary outputs in Tables 6A and 6C respectively (see above) for the Do Minimum for the weekday AM/Inter/PM peak periods for the Years 2, 8 and 15. Weekday off-peak and weekend results, along with Year 30 data will be automatically entered based on the supplied data. The minimum permitted travel speed that can be entered is 10km/h any value less than this will be highlighted and users will be requested to enter 10km/h instead of the SIDRA output value.
- VOC (cents/km) and Annual VOC will be automatically calculated based on entered data.

8 and 9 Vehicle Speeds and VOC - Option

- Model the intersection performance for the Option for Time Zero in SIDRA and apply the growth factor to the modelling in SIDRA for Years 2, 8 and 15. The SIDRA outputs should be attached to the hard copy of the Submission.
 - Enter the SIDRA modelling Travel Distance (Total) and Travel Speed data from the Intersection Summary outputs in Tables 8A and 8C respectively (see above) for the Option for the weekday AM/Inter/PM peak periods for the Years 2, 8 and 15. Weekday off-peak and weekend results, along with Year 30 data will be automatically entered based on the supplied data. The minimum permitted travel speed that can be entered is 10km/h any value less than this will be highlighted and users will be requested to enter 10km/h instead of the SIDRA output value.
- VOC (cents/km) and Annual VOC will be automatically calculated based on entered data.

10, 11 and 12 Present Value of Vehicle Operating Costs

- The annual VOC for the Do Minimum and Option will be automatically transposed.
- The VOC midpoint values for the Do Minimum and Option will be automatically calculated by averaging the VOC at the start and end of each of the four modelled periods
- The mid-point benefits will be automatically calculated by subtracting Option VOC midpoint from the Do Minimum VOC midpoint to obtain m1, m2 and m3.
- The PV Vehicle Operating Cost savings will be automatically calculated.

7.2.2 Mid-Block Sections

1 Road Type

• Select the road type for the project – automatically copied from **Worksheet 1**.

2 Project Type

• Select the project type for the project – automatically copied from **Worksheet 1**.

3 Modelling Period

• From the drop down menu, select the morning (AM)/Inter-Peak (IP)/evening (PM) peak or All Day modelling periods. (If the mid-block section is part of a route assessment including intersections, then the AM/Inter/PM peak modelling period should be used for consistency along the route.)

4 and 5 MIDBLOCK ONLY: Traffic Volumes

• Traffic volumes for different modelling periods and future years will be automatically copied from Worksheet 4 for both the Do Minimum and Options.

6 and 7 Vehicle Speeds and VOC – Do Minimum

- The mean speed will be calculated automatically based on previously entered data relative to the traffic flow in Table 6B for the Do Minimum for the weekday AM/Inter/PM peak or All Day modelling periods for the Years 2, 8 and 15. Similarly, weekday off-peak and weekend results, along with Year 30 data will be automatically entered based on the supplied data.
- The total travel distance will be calculated automatically based on previously entered data relative to the traffic flow and midblock length in Table 6D for the Do Minimum for the weekday AM/Inter/PM peak or All Day modelling periods for the Years 2, 8 and 15. Similarly, weekday off-peak and weekend results, along with Year 30 data will be automatically entered based on the supplied data. The minimum permitted travel speed that can be entered for midblock sections is 10km/h any value less than this will be automatically increased to 10km/h.
- VOC (cents/km) and Annual VOC will be automatically calculated based on entered data.

8 and 9 Vehicle Speeds and VOC - Option

- The mean speed will be calculated automatically based on previously entered data relative to the traffic flow in Table 8B for the Option for the weekday AM/Inter/PM peak or All Day modelling periods for the Years 2, 8 and 15. Similarly, weekday off-peak and weekend results, along with Year 30 data will be automatically entered based on the supplied data.
- The total travel distance will be calculated automatically based on previously entered data relative to the traffic flow and midblock length in Table 8D for the Option for the weekday AM/Inter/PM peak or All Day modelling periods for the Years 2, 8 and 15. Similarly, weekday off-peak and weekend results, along with Year 30 data will be automatically entered based on the supplied data. The minimum permitted travel speed that can be entered for mid-block sections is 10km/h any value less than this will be automatically increased to 10km/h.
- VOC (cents/km) and Annual VOC will be automatically calculated based on entered data.

10, 11 and 12 Present Value of Vehicle Operating Costs

- The Annual VOC for the Do Minimum and Option will be automatically transposed.
- The VOC midpoint values for the Do Minimum and Option will be automatically calculated by averaging the VOC at the start and end of each of the four modelled periods

- The mid-point benefits will be automatically calculated by subtracting Option VOC midpoint from the Do Minimum VOC midpoint to obtain m1, m2 and m3.
- The PV Vehicle Operating Cost savings will be automatically calculated.

		at a translati							
1	Road Type	District Distrit	outor A						
2	Project Type	Mid-block/mid	d-block as part of	route improveme	ent				
3	Modelling Period Type	AM / PM peak	c periods						
4	Do-minimum Traffic Flow	MID BLOCK O	NLY						
	4Δ Project	timings from Annua	alication Factors						7
	4A Hoject	cinnigs from Aima	Time p	eriods		4B Traffic Flov	v Data (veh/hr)		
	Time Period	Flow Factor	Time periods (hrs/day)	Days/year	Year 2	Year 8	Year 15	Year 30	
	Weekday AM Peak	1	2	245	1701	1703	1705	1705	(a)
	Weekday Interpeak	1	8	245	1000	1002	1003	1003	(b)
	Weekday PM Peak	1	2	245	1801	1803	1805	1805	(c)
	Weekday Off Peak	0.25	12	245	250	250	251	251	(d)
	Weekend Peak	0.45	8	120	450	451	451	451	(e)
	Weekend Off Peak	0.15	16	120	150	150	150	150	(f)
						AADT (\	/eh/day)		
	All periods	N/A	24	365	17527	17548	17573	17573	(g)
	(Q)	(R)	(S)	(T)	(U)	(V)	(W)	(X)	
5	(Q) Option Traffic Flow	(R) MID BLOCK O		(Т)	(U)	(V)	(W)	(X)	
5	Option Traffic Flow		NLY	(T)	(U)			(X)	
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	Annual VOC Cost - Option	\$1,665,506.80	\$2,197,649.39	\$2,197,649.39	\$3,036,960.00	\$3,036,960.00	\$3,036,960.00	
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7.3 Crash Costs

Crash Cost savings are determined using the MRWA Crash Analysis Reporting System (CARS) using crash data over the most recent last five years. Similar to the SIDRA results for the Travel Time Costs and Vehicle Operating Costs, the Net Present Value (NPV) outputs from CARS are treated as an external input into the MRRG procedures. It is necessary to manipulate the NPV of crash cost saving because the MRRG economics is based on a 30 year analysis period. Additionally, CARS does not consider traffic growth and the increases in crashes over time as a result of this.

Only those intersections or mid-block sections with crash numbers meeting the State Black Spot program for Local Roads criteria for the most recent five year period should be assessed for crash cost benefits. Where less than five crashes at an intersection/short midblock section up to 3 kilometres in length, or an average of less than 2 crashes per kilometre for mid-block lengths in excess of 3 kilometres over a five year period have been recorded, a score of zero (o) should be entered for the NPV of Crash Cost savings.

Similarly, some treatments may not have, nor are intended to have, any impact on existing crash numbers and types. An example of this may be the duplication of a single carriageway road (single lane in each direction) due to capacity constraints but without any head-on collisions to a dual carriageway (with a central median or barrier). In such an instance, the proposed improvement will have no impact on head-on collisions – as no such crashes exist. Accordingly, this may result in a negative NPV calculated by CARS despite the proposed arrangement meeting good practice and a reduction in the risk of future head-on collisions. Where an improvement to address a capacity or congestion concern is proposed but no existing road safety problems (common crash types) exist, a score of zero (o), rather than a negative value (see below) should be entered for the NPV of Crash Cost savings. To encourage the practice of providing appropriate road safety engineering measures whilst acknowledging the costs associated with such treatments, an additional score can be entered for road safety within the Intangible benefit worksheet (Worksheet 7) where a score of zero (o) has been entered for the NPV of Crash Cost savings.

Notwithstanding the above, due to the nature of some treatments, the potential to increase crashes compared to the Do Minimum may exist – for instance an increase in rear-end shunts following the installation of traffic signals at an intersection. As a result, a negative NPV may be calculated in CARS. Where this happens, the negative value should be transposed into the MRRG spreadsheet in the same manner as would occur if a positive value is calculated.

Given the nature of calculating Crash Cost savings, the process is unable to determine potential road safety benefits associated with a new road (such as a bypass) due to a reduction in exposure and risk once road users transfer to the new road. In the same vein however, any potential increase in crash numbers on the new road are not considered as part of the evaluation process.

Worksheet 6 is used to calculate the PV of Crash Cost savings for midblock, and intersection improvements projects. The points below are to be read in conjunction with the **Worksheet 6** – **Crash Cost savings** screen print out at the end of this Section.

1. Project Types

• Select the project type for the project – automatically copied from **Worksheet 1**.

2. Crash Summary

• Provide a breakdown of crash numbers, factors, road user movements and patterns over the most recent five year period. In particular, provide comment on any crashes affected by the proposed improvements (either positively or negatively). Note, the outputs from CARS should be attached to a hard copy of the Submission. Over the most recent five year period, where less than five crashes at an intersection/short midblock section up to 3 kilometres in length, or an average of less than 2 crashes per kilometre for mid-block lengths in excess of 3 kilometres have been recorded, this should be noted and a score of zero (o) should be entered for the NPV of Crash Cost savings.

3. Countermeasures

• Utilising the countermeasure list in CARS, enter the recognised treatments into the spreadsheet. The costs of these countermeasures should match/tie in with the Option costs entered in Worksheet 3. Note, the outputs from CARS should be attached to a hard copy of the Submission.

4. Net Present Value of Crash Cost savings

• Enter the NPV derived from CARS – if less than five fatal or injury crashes have been recorded or where an improvement is proposed but no existing road safety problems (common crash types) exist, zero (0) should be entered.

5. Annual Crash Cost savings

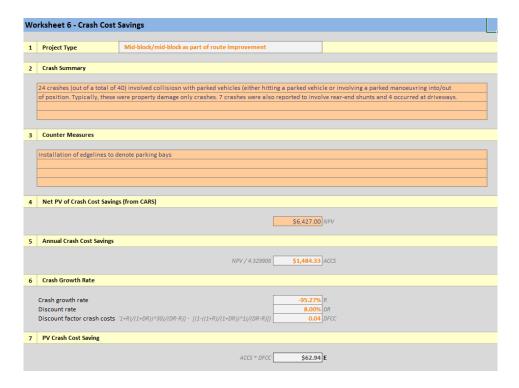
• The annual Crash Cost savings will be calculated automatically.

6. Crash Growth Rate

• The crash growth rate will be calculated automatically.

7. Present Value of Crash Cost Saving

• The PV of Crash Cost savings will be automatically calculated.



8 Intangible Benefit Procedure

Intangible benefits are assessed against the following criteria:

- Public Transport Does the project have a significant benefit for public transport through the provision of supported infrastructure improvements?
- Walking Does the project make specific exclusive provision for pedestrians to improve accessibility and safety?
- Cycling Does the project make specific exclusive provision for cycling to improve accessibility and safety?
- Street Lighting Does the street lighting meet Australian Standard AS1158?
- Road Safety Where the project does not have any existing crash savings but the proposed improvements are intended to address future safety performance and a construction cost associated with this exists.

The following tables should be utilised to assess each future project against the intangible criteria with the assessed scores and a justification of the effect to be provided in **Worksheet** 7 – **Intangible Benefits**.

8.1 Public Transport Measures

Bus priority measures can improve the operating efficiency and reliability of the bus based public transport network as well as providing a better service to the travelling public. These benefits that are not necessarily covered within the main tangible benefit worksheets. Whilst these Guidelines are based primarily on road improvements, the potential to assist public transport operations as part of any project should not be overlooked in order to enhance the integrated transport network.

Bus priority improvements that can be considered include those contained in the *Public Transport Authority's 'Bus Planning and Design Guidelines for Efficient People Movement'* (2015). They do not include the provision of a bus embayment (either as a positive or negative effect) and/or bus stop facilities.

To claim any point score within this assessment criteria, written confirmation from the PTA indicating their support for the indicated bus priority measure MUST be provided with the submission. Similarly, any proposed improvement involving Intelligent Transport System (ITS) solutions (including traffic signal systems) MUST be supported by Main Roads WA with written confirmation confirming their Approval in Principal provided with the submission. It is noted that any proposed intersection improvement catering for public transport should be modelled as such with the data included within the appropriate tangible worksheets.

All proposed measures must be shown and provided on a Schematic Plan supporting the application.

Effect	Description	Score
Major positive	Provision of facilities intended to enhance service reliability and reduce bus journey times over the majority of the length of the project or at specific intersections over its length (rather than isolated improvements) with measures meeting the PTA Guidelines. Such measures include those priority treatments set out in the Guideline meeting the desirable minimum Transit levels, including: • Bus/Transit lanes (including contra-flow bus lanes). • Intersection bypass lanes – queue jump facility. • ITS Active/passive bus priority.	15
Positive	Provision of facilities intended to enhance service reliability and reduce bus journey times over sections of the route or at isolated intersections with measures meeting the PTA Guidelines. Such measures include bus priority treatments identified in the PTA Guideline not meeting the desirable minimum Transit level and/or the use of other localised measures listed in the Guideline such as: • Bus only movements. • Banned turns. • Removal or minor re-timing of traffic signals to better favour bus movements. • Parking controls. • Bus stop clearways.	8
Neutral	No expected change on overall public transport performance with no specific new/upgraded public transport infrastructure provided or removed.	0
Negative	Existing public transport routes (with greater than 6 services per hour) unduly affected causing reduced service reliability and increased bus travel times, for instance due to some increased delays for buses from side roads.	-8
Major negative	Removal of any existing public transport priority measures having an impact on service reliability and increased bus travel times. Alternatively, existing public transport routes (greater than 15 bus services per hour) significantly affected causing reduced service reliability and increased travel times and/or PTA objections.	-15

Use the drop down menu to indicate the effect for the particular component (intersection or midblock) under consideration. The associated score for public transport measures will be automatically entered. Use the 'Justification' box to describe the public transport improvements at this location to support the reported effect.

8.2 Pedestrian Facilities

High quality pedestrian facilities can encourage a mode shift from private motor cars to walking for shorter journey's as well as providing enhanced access to public transport for longer trips, thereby assisting with reducing congestion. They can also improve road safety for pedestrians, which may not be fully captured as part of the road safety tangible benefit worksheets. Whilst these Guidelines are based primarily on road improvements, the potential to assist walking as part of any project should not be overlooked in order to enhance the integrated transport network.

Pedestrian facilities include those measures intended to assist movement along and across roads.

All proposed measures must be shown and provided on a Schematic Plan supporting the application.

Effect	Description	Score
Major	Provision of enhanced high quality pedestrian facilities along/across the road (over	10
positive	the route length/meeting pedestrian desire lines and connecting to other facilities)	
	exceeding minimum standards set out in appropriate MRWA and Austroads design guidelines.	
	Any provided crossing facilities demonstrated to be appropriate based on demand	
	and safety as well as meeting DDA requirements.	
	High levels of existing (or expected) pedestrian activity due to adjacent land uses	
	and/or routes along a pedestrian desire line.	
Positive	Demonstrated enhancement of existing pedestrian facilities to assist walking either	5
	along or across the road with measures meeting absolute minimum standards set out	
	in appropriate MRWA and Austroads design guides with isolated facilities to meet	
	existing demand.	
	Low to moderate levels of pedestrian activity adjacent to or crossing the road length.	
Neutral	No expected change on overall pedestrian levels of service with no specific walking	0
	infrastructure improvements provided or existing facilities removed.	
Negative	Existing pedestrian routes and facilities with low to moderate levels of pedestrian	-5
	activity unduly affected causing reduced level of service along or across roads	
	compared to existing facilities – for instance due to increased traffic/additional lanes	
	but no complimentary crossing facilities or a reduction in footpath widths.	
Major	Removal of any existing pedestrian facilities along and/or across the road without	-10
negative	alternative measures of at least the same standard.	
	Existing pedestrian routes along or across roads significantly affected causing	
	reduced accessibility with high levels of pedestrian activity in the area due to	
	associated land use.	

Use the drop down menu to indicate the effect for the particular component (intersection or midblock) under consideration. The associated score for pedestrian facilities will be automatically entered. Use the 'Justification' box to describe the pedestrian facility improvements at this location to support the reported effect.

8.3 Cycling Facilities

Cycling facilities encourage healthier living as well as having a lower environmental impact compared to motorised modes of transport. High quality facilities can encourage a mode shift from private motor cars (including better access to public transport such as to train stations), thereby assisting with reducing congestion. They can also improve road safety for cyclists, which may not be fully captured as part of the road safety tangible benefit worksheets. Whilst these Guidelines are based primarily on road improvements, the potential to assist cycling as part of any project should not be overlooked in order to enhance the integrated transport network.

Cycle facilities should fundamentally be denoted as being provided along cycle routes within the Council's Local Bike Plan/Strategy and be designed and cater/meet the requirements for the identified cycle user types as a minimum in order to have a positive/major positive effect.

All proposed measures must be shown and provided on a Schematic Plan supporting the application.

Effect	Description	Score
Major positive	High levels of existing (or expected) cycling activity along a recognised designated existing cycling route or a route denoted as such within a Council's Local Bike Plan. Provision of enhanced high quality cycling facilities along/across the road length (connecting to other facilities) exceeding minimum standards set out in appropriate MRWA and Austroads design guides. Such facilities can include the provision of onroad or off-road facilities that meet as a minimum the desired standards. Any provided crossing facilities demonstrated to be appropriate based on demand and safety.	10
Positive	Low to moderate levels of existing (or expected) cycling activity along a recognised designated existing cycling route or a route denoted as such within a Council's Local Bike Plan. Demonstrated enhancement of existing cycling facilities either along or across the road length under consideration with measures connecting to other facilities and meeting minimum standards set out in appropriate MRWA and Austroads design guides.	5
Neutral	No expected change on overall cycling levels of service with no specific cycling infrastructure improvements provided or existing facilities removed.	0
Negative	Existing signed/marked cycle routes and facilities with low to moderate levels of activity unduly affected causing reduced level of service along or across roads compared to existing facilities – for instance due to increased traffic/speed above expected guidelines for on-road facilities or a reduction in cycle lane/path widths.	-5
Major negative	Removal of any existing cycle facilities along and/or across the road without alternative measures of at least the same standard from a safety and efficiency perspective. Existing cycle routes along or across roads significantly affected causing reduced accessibility with high levels of cycle activity in the area.	-10

Use the drop down menu to indicate the effect for the particular component (intersection or midblock) under consideration. The associated score for cycling facilities will be automatically entered. Use the 'Justification' box to describe the cycle facility improvements at this location to support the reported effect.

8.4 Street Lighting

It is recognised that the cost of maintaining and/or supplying street lighting is included as part of the Do Minimum and Option costing worksheets with benefits associated with the provision of such facilities recognised through the crash cost calculation where such problems exist.

Notwithstanding this, it is noted that for new roads and/or significant road/intersection upgrades, any road safety benefits supporting their inclusion within the project scope may not gain any scored benefits within this process, whilst still attracting a cost – thereby potentially discouraging street lighting from being included within a project scope and cost. The provision and/or improvement of street lighting can assist with both road safety as well as personal security.

Existing condition	Service Level
No street lighting provided.	0
Street lights provided but not meeting AS1158 requirements.	1
Street lights meeting AS1158 requirements.	2

Effect	Description	Point Score
Major positive	Change from service level 0 to service level 2.	3
Positive	Change from service level 1 to service level 2.	1
	(Note: any upgrade should meet AS1158 requirements, therefore upgrades from service level 0 to 1 receives no score.)	
Neutral	No change in service level.	0
Negative	Existing lighting standard is reduced.	-3

The Point Score will apply to:

• Every 250m of road with traffic exceeding 8,000 vehicles per day.

OR

If not covered within the above, the Point Score will apply to:

- Every intersection;
- Every bridge:
- Every formal pedestrian crossing facility (including refuge islands) or per 100m of road with significant adjacent pedestrian activity; and
- Every potential hazard within or along the road (e.g. traffic islands or severe curves) that can be justified/supported as requiring street lighting from a road safety perspective.

A maximum/minimum point score for street lighting of +9/-9 is permissible.

Use the drop down menu to indicate the score for street lighting for the particular component (intersection or mid-block) under consideration. Use the 'Justification' box to describe the street lighting improvements and calculations to support the street lighting score used in the drop down box.

8.5 Road Safety

Similar to street lighting, new roads and/or proposed improvements can or may have intended/unintended road safety benefits (or dis-benefits) in the future that are not fully accounted for based on the previous crash history. By simply relying on previous crash history, the inclusion of measures intended to address road safety within the project scope may not gain any scored benefits whilst still attracting a cost – thereby potentially discouraging road safety measures from being included within a project scope and cost.

The provision of a road safety score as an intangible benefit is intended to reward or take into account future road safety issues that are not reflected in the crash cost benefits due to the lack of an existing road safety problem, but which the proposed measure may improve (or make worse) in the future.

In order to minimise any double counting of road safety benefits, <u>this intangible score is ONLY possible if a zero (o) NPV has been entered in **Worksheet 6.**</u>

All proposed measures must be shown and provided on a Schematic Plan supporting the application.

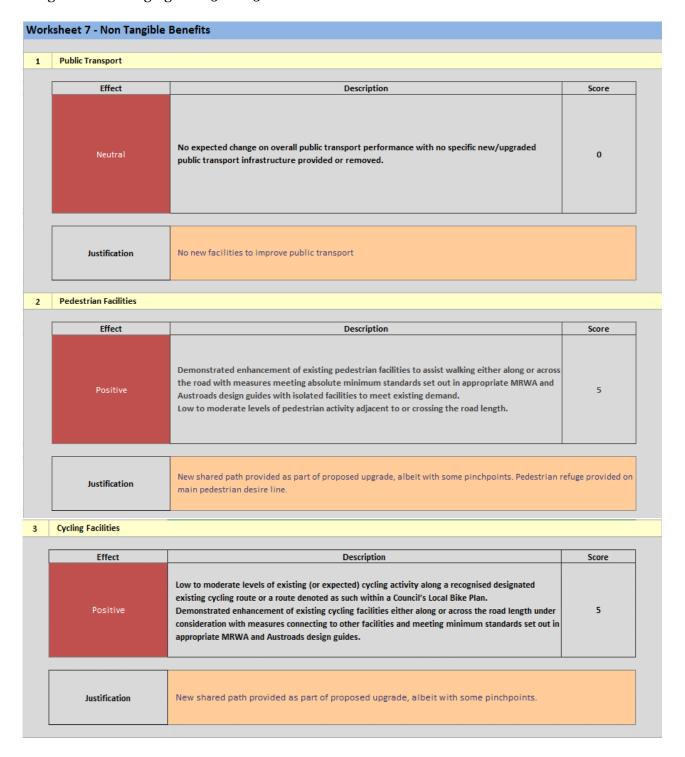
Effect	Description	Score
Positive	The proposed measures and design are intended to minimise the overall number	6
	and severity of crashes.	
	A road safety audit has already been undertaken and any concerns have been	
	addressed and mitigated against as part of the design.	
Neutral	A positive (+) or negative (-) NPV score has been entered into Worksheet 6 – Crash	О
	Costs, or the proposed measures have negligible impact on road safety overall.	
Negative	The proposed measures may result in an overall reduction in road safety performance	-6
	compared to the Do Minimum.	
	A road safety audit has already been undertaken but concerns cannot be fully	
	addressed and/or mitigated against for various reasons as part of the design.	

Use the drop down menu to indicate the effect for the particular component (intersection or midblock) under consideration. The associated score for road safety will be automatically entered. Use the 'Justification' box to describe the road safety improvements or deficiency at this location to support the reported effect.

As indicated in Section 2, projects that are successfully awarded funding must be subject to a formal, independent road safety audit at an appropriate stage of design.

8.6 Non Tangible Scores

When combined, each of the intangible criteria results in the option obtaining an Overall Non Tangible Score ranging from 50 to -50.





9 Overall Score and Rating

The Present Value costs and benefits associated with the Do Minimum and Option calculated in each of the worksheets as well as the intangible benefit score will be automatically copied through from **Worksheets 2 to 7** into **Worksheet 8.**

Worksheet 8 is used to calculate the overall scores and rating for midblock, and intersection improvements projects. The points below are to be read in conjunction with the **Worksheet 8** – **Overall Score** screen print out at the end of this Section.

1 PV Cost of the Do Minimum

• Use **Worksheet 2** (refer to Section 5) to calculate the Present Value (PV) cost of the Do Minimum. This gets automatically transferred into the relevant cell.

2 PV Cost of the Option

• Use **Worksheet 3** (refer to Section 6) to estimate the preferred Option PV cost. This gets automatically transferred into the relevant cell.

3 Unconstrained Benefit Savings

- Use Worksheet 4 (Travel Time TT savings, Section 7.1), Worksheet 5 (Vehicle operating cost VOC savings, Section 7.3) and **Worksheet 6** (Crash Cost savings, Section 7.4) to estimate the various cost savings. These get automatically transferred into the relevant cells.
- To bring the benefits up to the base year values year, use appropriate update factors done automatically.

4 Ratio of Unconstrained Benefits to Costs

• Calculate the Ratio of Unconstrained Benefits to Cost by dividing the PV of the net unconstrained benefits by the PV of net costs. This is automatically calculated as part of the spread sheet and is capped at a maximum of 50.

5 First Year Rate of Return

• First Year Rate of Return (FYRR) is calculated as the benefits in the first full year following completion, divided by the activity costs. This is calculated automatically. In the event that the total overall score of different projects are ties, the ratio of unconstrained benefits to costs and/or the first year rate of return may be used as part of the prioritisation process.

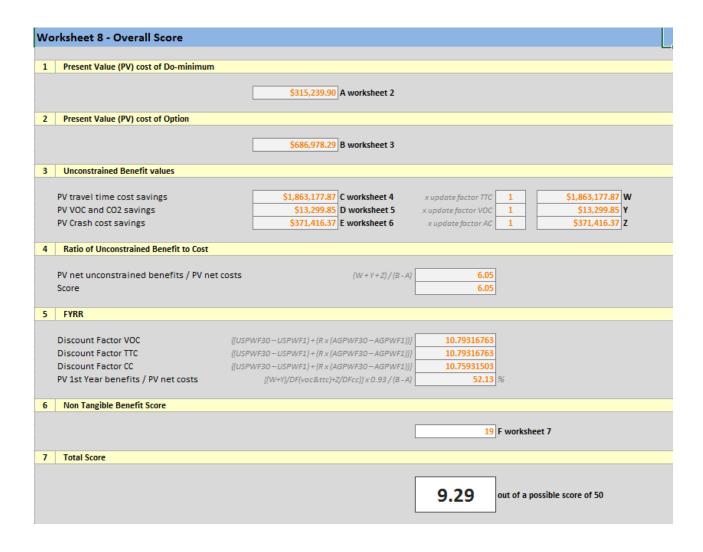
6 Intangible Benefit Score

• Use **Worksheet** 7 to calculate the Intangible Benefit Score. This gets automatically transferred into the relevant cell, and has a maximum score of 50.

7 Total Score

• The overall score for the Option is automatically determined by summing a 75% contribution from the capped ratio of unconstrained benefits to cost and a 25% contribution from the Non Tangible Benefit score to get a total score out of 50.

For route length improvements, the total scores from each individual midblock and intersection elements must be summed together and averaged to obtain the final score (with the potential exception of the scenario for a new link as discussed in Appendix A).



10 Project Summary

The Project Summary worksheet is used to provide an overall summary of the proposed road improvement project including project details and description, scoring and cost information. This should be included at the front of each submission for quick reference.

The Project Summary worksheet allows more details relating to the staging of the work to be provided, for example any detailed design and road safety audit costs in the first year with construction the following year(s) as well as confirmation as to the total overall funding request.

In addition, a checklist of potential supporting information for inclusion in the submission is provided.

MRRG Road Improvement Project Summary

TO BE INCLUDED AT THE FRONT OF EACH SUBMISSION

1 General Details

Local Authority

Project Name

Proposed Improvement

SLK From

Road Type

Blue Sky City

Main Street Upgrade

Duplication of existing narrow carriageway with intersection upgrades at either end in line with the City's

Strategic Plan

3.11 4.61

To

District Distributor A

2 Score and Funding

Final score

Total Estimated Cost

Total Requested Funding

16

\$1,500,000

\$1,000,000

3 Staging

Staged Project Cost - Year 1

Staged Project Cost - Year 2

Staged Project Cost - Year 3

Staged Project Cost - Year 4

\$150,000 - Detailed Design

\$850,000 - Construction

4 Submission Inclusions?

Cost breakdown

Milestone and Project Complexity Form

Worksheets

Concept Design

Traffic Counts

ROM Data

CARS reports

SIDRA reports

Agreements in Principle (eg. traffic signals, PTA)

Evidence of project's strategic alignment

Yes
Yes

11 Worked Examples

The following worked examples have been provided for an isolated intersection, a mid-block section and a combination of the midblock and intersection elements as part of a route improvement.

Worked Example 1 – Gnangara Road, Swan (Existing Road Improvements)

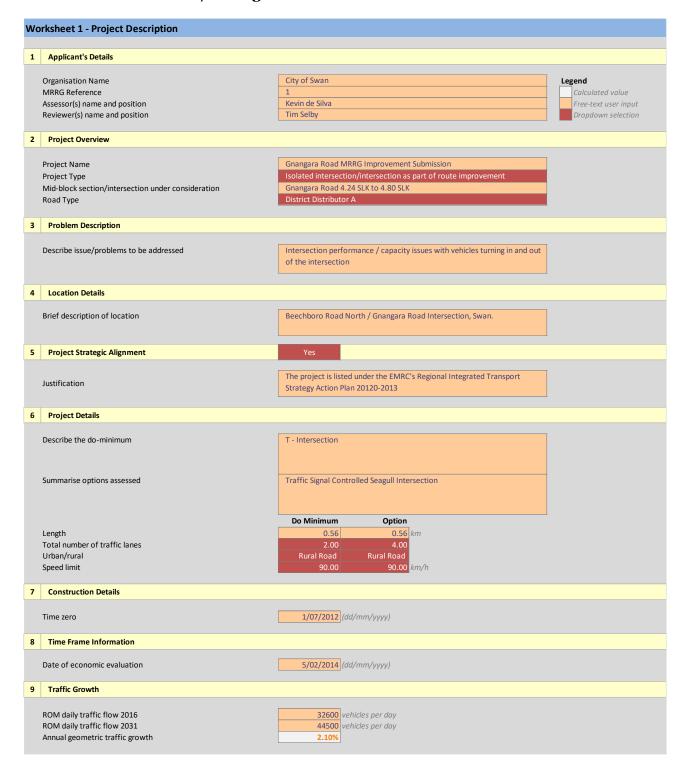
Existing route improvements comprising a combination of mid-block and intersection improvements.

Worked Example 2 - Southern Link Road, Cannington (New Road)

Construction of a new road (asset creation) between two fixed points.

11.1 Worked Example 1 – Gnangara Road, Swan (Existing Road Improvements)

Beechboro Road North / Gnangara Road Intersection



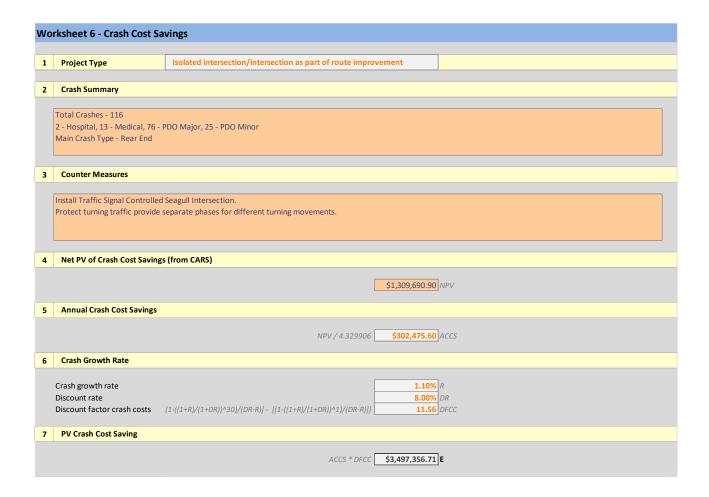
	of annual	maintenance costs				
	of annual	maintenance costs				
D) (
			\$1,737.68	x 11.7023	\$20,334.8	5 (a)
PV	of periodi	ic maintenance costs				
Dron	acad Daha	h traatment maasura	40mm SMA ov	rowler.		
•	ab treatme	b treatment measure	40mm SiviA 00	renay	\$21.50	0
		area (from SLK to SLK)			5992.00	
	ab cost	area (Holli SER to SER)			\$128,828.0	
Perio	odic mainte	enance will be required in the follow	ing years:			
_		'	· · · · · · · · · · · · · · · · · · ·			
	Year	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	5	40mm SMA overlay	N/A	\$128,828.00	0.680	N/A
	10	40mm SMA overlay	N/A	\$128,828.00	0.464	N/A
	15	40mm SMA overlay	Yes	\$128,828.00	0.320	\$41,224.96
_	20	40mm SMA overlay	N/A	\$128,828.00	0.210	N/A
	25	40mm SMA overlay	N/A	\$128,828.00	0.150	N/A
L	30	40mm SMA overlay	Yes	\$128,828.00	0.100	\$12,882.80
PV	of annual	associated operating cost		Sum of PV maintenance	\$54,107.70	6 (b)
L	Luminaire 1	Гуре			ZE02C - 80MV	
		luminaires within study section				<mark>6</mark> units
1	Number of	days luminaires are lit			36	<mark>5</mark> days
7	Total opera	ating cost			\$866.6	2
F	PV of total	operating cost		1		7
			\$866.62	x 11.7023	\$10,141.4	<mark>8</mark> (c)
PV	total Do-r	minimum maintenance costs				

Road Type		District Distrib	utor A		
PV of estima	ated cost of proposed work (as per atta	ached estimate sl	neet)		
		\$3,253,496.00	V 0 0250	\$3,012,411.95	(a)
		\$5,255,496.00	X 0.9239	\$5,012,411.95	(d)
PV of routin	e maintenance costs following comple	tion of the work			
		\$3,166.80	x 10.7398	\$34,010.80	(b)
DV of maint	concess cost in year 1				
PV OI IIIaiiii	enance cost in year 1				
				\$1,737.68	(c)
PV of Optio	n periodic maintenance cost				
	ab treatment measure	40mm SMA or	verlay	634.50	
Rehab treatm				\$ 21.50 10920.00	m?
Rehab cost	t area (from SLK to SLK)			\$234,780.00	1112
iteriab cost				\$254,700.00	
Periodic main	tenance will be required in the following	g years:			
Year	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
5	40mm SMA overlay	N/A	\$234,780.00	0.680	N/A
5 10	40mm SMA overlay 40mm SMA overlay	N/A N/A	\$234,780.00 \$234,780.00	0.680 0.464	N/# N/#
5 10 15	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A N/A Yes	\$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320	N/A N/A \$75,129.60
5 10 15 20	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A N/A Yes N/A	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210	N/A N/A \$75,129.60 N/A
5 10 15 20 25	40mm SMA overlay	N/A N/A Yes N/A	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150	N/A N/A \$75,129.60 N/A
5 10 15 20	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A N/A Yes N/A	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210	N/A N/A \$75,129.60 N/A
5 10 15 20 25	40mm SMA overlay	N/A N/A Yes N/A N/A Yes	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150	N// N// \$75,129.66 N// N// \$23,478.00
5 10 15 20 25 30	40mm SMA overlay	N/A N/A Yes N/A N/A Yes	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150 0.100	N/A N/A \$75,129.66 N/A N/A \$23,478.00
5 10 15 20 25 30	40mm SMA overlay	N/A N/A Yes N/A N/A Yes	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150 0.100 \$98,607.60	N/A N/A \$75,129.66 N/A N/A \$23,478.00
5 10 15 20 25 30 PV of Annua	40mm SMA overlay	N/A N/A Yes N/A N/A Yes	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150 0.100 \$98,607.60	N// N// \$75,129.66 N// N// \$23,478.00
5 10 15 20 25 30 PV of Annual	40mm SMA overlay	N/A N/A Yes N/A N/A Yes	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150 0.100 \$98,607.60	N/A N/A \$75,129.60 N/A N/A \$23,478.00 (d)
5 10 15 20 25 30 PV of Annua Luminaire Number o Number o	40mm SMA overlay Type f luminaires within study section f days luminaires are lit	N/A N/A Yes N/A N/A Yes	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150 0.100 \$98,607.60 ZE20C - 70ML 20 365	N/A N/A \$75,129.60 N/A N/A \$23,478.00 (d)
5 10 15 20 25 30 PV of Annua Luminaire Number o Number o	40mm SMA overlay	N/A N/A Yes N/A N/A Yes	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150 0.100 \$98,607.60	N/A N/A \$75,129.60 N/A N/A \$23,478.00 (d)
5 10 15 20 25 30 PV of Annua Luminaire Number o Number o Total oper	40mm SMA overlay Type f luminaires within study section f days luminaires are lit	N/A N/A Yes N/A N/A Yes	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150 0.100 \$98,607.60 ZE20C - 70ML 20 365	N/A N/A \$75,129.60 N/A N/A \$23,478.00 (d)
5 10 15 20 25 30 PV of Annua Luminaire Number o Number o Total oper	40mm SMA overlay Type f luminaires within study section f days luminaires are lit	N/A N/A Yes N/A N/A Yes Sun	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150 0.100 \$98,607.60 ZE20C - 70ML 20 365	N/A N/A \$75,129.60 N/A N/A \$23,478.00 (d)
5 10 15 20 25 30 PV of Annua Luminaire Number o Number o Total oper	40mm SMA overlay Type f luminaires within study section f days luminaires are lit rating cost	N/A N/A Yes N/A N/A Yes Sun	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150 0.100 \$98,607.60 ZE20C - 70ML 20 365 \$5,210.87	N/A N/A \$75,129.60 N/A N/A \$23,478.00 (d)
5 10 15 20 25 30 PV of Annua Luminaire Number o Number o Total oper	40mm SMA overlay Type f luminaires within study section f days luminaires are lit rating cost operating costs (separate to maintenance Tota	N/A N/A Yes N/A N/A Yes Sun	\$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00 \$234,780.00	0.680 0.464 0.320 0.210 0.150 0.100 \$98,607.60 ZE20C - 70ML 20 365 \$5,210.87	N/A N/A \$75,129.60 N/A N/A \$23,478.00 (d)

Worksheet 4 - Tra	Worksheet 4 - Travel Time Cost Savings	Sá																
1 Road Type		District Distributor A	utor A															
2 Project Type		Isolated inter	section/inters	ection as part o.	Isolated intersection/intersection as part of route improvement	ment												
Modelling Period Type	od Type	AM / Inter / Pi	AM / Inter / PM peak periods															
4 Midblock Asses	Midblock Assessment - Traffic Volumes																	
		Time Zero		DO MINIMUM				Time Zero		OPTION								
		(veh/hr)	Year 2	Year 8	Year 15	Year 30		(veh/hr)	Year 2	Year 8	Year 15	Year 30						
	AMPeak	1700	1772	2007	2321	2321		1700	1772	2007	2321	2321						
	rnerpeuk PM Peak	1800	1876	2125	2457	2457		1800	1876	2125	2457	2457						
	AADT All periods	17520	18262	20683	23915	23915		17520	18262	20683	23915	23915						
5 Do-minimum Modelling	And elling																	
	5A Proje	5A Project Timings from Annualisation Factors	Annualisation	Factors			5B Isolated Intersection	ntersection		55	5C Road Midblock Improvement	Improvement						
		0	Time	Time Periods	TTC		Modelling Results Inputs (veh.hr/hr)	nputs (veh.hr/)		Mod	lelling Results In	outs (veh.hr/hr)		ıń .	D Annual Trave	5D Annual Travel Time Cost (\$/year)	ar)	
	Time Period	Flow Factor	hours/day	hours/day days/year	\$/HR		Year 8	Year 15		Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Н	
	Weekday AM Peak		2 0	245	\$22.54	21.87	46.61	113.51	113.51	12.42	14.08	16.29	16.29	\$241,545.40	\$514,788.81	\$1,253,672.55	\$1,253,672.55	(a)
	Weekday PM Peak		2	245	\$22.30	92.52	312.71	1159.23	1159.23	12.42	14.08	16.29		\$1.010.966.04	\$3.416,982.17	\$12.666.906.21		£ (3
	We ekday Off Peak	0.25	12	245	\$22.91	2.21	6.41	10.66	10.66	1.82	2.07	2.39	2.39	\$148,687.05	\$431,411.34	\$717,671.79	Ш	9
	Weekend Peak	0.45	8	120	\$25.55	3.97	11.53	19.18	19.18	3.28	3.72	4.30	4.30	\$97,462.01	\$282,783.31	\$470,422.51	\$470,422.51	(e)
2	Weekend Off Peak	0.15	16	120	\$24.80	1.32	3.84	6.39	6.39	1.09	1.24	1.43	1.43	\$63,067.39	\$182,988.29	\$304,409.09	\$304,409.09	
1	(O)	(8)	(S)	205 E)7.52.70 (u)	2	(X)	2 8	2 5	2,33	(W)	(X)		\$2,231,320.00	\$6.185.266.47	-	-	_
														\$2,251,320.00	\$2,251,320.00	\$2,251,320.00	\$2,251,320.00	
6 Option Modelling	8																	
	6A Proje	6A Project Timings from Annualisation Factors	Annualisation	Factors			6B Isolated Intersection	ntersection		29	6C Road Midblock Improvement	Improvement		19	D Annual Travel	6D Annual Travel Time Cost (\$/vear)	2	
			Lime	Time Periods	J LIC		Modelling Results Inputs (veh.hr/hr)	nputs (veh.hr/	- 1 -	Mod	delling Results In	puts (veh.hr/hr)	00					
	Weekday AM Peak	Flow Factor	nours/day 2	days/year	\$/HK	12.81	16.73	26.22	z6.22	12.41	14.06	16.26	16.26	\$141.481.33	\$184.776.16	\$289.589.41	\$289.589.41	(e)
	Weekday Interpeak	-		245	\$27.01	5.3	6.37	8.02	8.02	12.41	14.05	16.25	16.25	\$280,579.88	\$337,225.25	\$424,575.59	\$424,575.59	<u>e</u>
	Weekday PM Peak	1	2	245	\$22.30	10.19	12.99	18.32	18.32	12.41	14.06	16.26	16.26	\$111,346.13	\$141,941.73	\$200,182.64	\$200,182.64	(2)
	Weekday Off Peak	0.25	12	245	\$22.91	1.33	1.59	2.01	2.01	1.82	2.07	2.39		\$89,245.91	\$107,263.47	\$135,047.58	+	(G)
	Weekend Off Peak	0.15	16	120	\$25.55	0.80	0.96	1.20	1.20	1.09	1.24	1.43	1.43	\$37.854.72	\$45,497.09	\$57.282.05	\$57.282.05	(e) (E)
<u>6</u> E	All periods	N/A	24	365	\$25.70	10	10	10	10	5.33	6.03	6.98		\$2,251,320.00	\$2,251,320.00	\$2,251,320.00		
	(0)	(R)	(s)	(£)	(n)	(2)	(w)	Œ.	ω	(2)	(w)	(X)		\$719,007.24	\$887,013.21			\$1,195,198.82 Total for All Day Periods \$2,251,320.00 Total for Day Long
7 Annual Travel T	7 Annual Travel Time Cost for Modelled Years	ars																
			AnnualTr	avel Time Cost	Annual Travel Time Cost (\$/year) for modelled years	delled years												
	Towns Times Cant	Start Year 2	End Year /	Start Year 8	End Year 14	Start Year 15	End Year 30											
	Do-minimum	\$2,029,184.56	\$6,185,266.47	\$6,185,266.47	\$2,029,184.56 \$6,185,266.47 \$6,185,266.47 ####################################	***************************************	##############											
	Travel Time Cost	\$719 007 24 \$887 013 21	\$887.013.21	_	\$887.013.21 \$1.195.198.82 \$1.195.198.82 \$1.195.198.82	\$1 195 198 82	\$1 195 198 82											
	Option	The state of the	11:010,1004	_	100000000000000000000000000000000000000		- C.											
	Midpoint Duration Years	Year 4	3r 4	rea	rear 11.5	Ye	rear 22 16											
Do-1	Do-minimum TTC at midpoint	\$4,107,225.51	225.51	\$11,92	\$11,927,317.18	\$17,669,	9,367.90											
2	Option TTC at midpoint	\$803,010.23	10.23	\$1,041	\$1,041,106.02	\$1,195,	5,198.82											
&	Midpoint Benefits	\$3,304,	215.28	\$10,88	6,211.16	\$16,47	4,169.07											
		Ī			7H		Ē											
9 PV Travel Time Cost Savings	Cost Savings																	
		[(m1×6×0.7416)+(m2×7×0.4511)+(m3×16×0.1958)]	6)+(m2×/×	0.4511)+(m3	x 16 x 0.1958 //		5100,688,102.18	o										

	Worksheet 5 - VOC and CO2 Cost Savings	vings												
		District Distril	outor A											
		Isolated inter		on as part of rou	te improvement									
This bis Decided with the part This bis Decided with the part	+													
True Freed Free Freed Freed Free Freed Fr	-	AM / Inter / I	PM peak periods											
		MID BLOCK C	INILY											
Thing Period Thou Period	4A Project	t timings from Annu	alisation Factors	op circle		4B Traffic Flow	Data (veh/hr)							
	Time Period	Flow Factor	Time periods	Days/year	Year 2	Year 8	Year 15	Year 30						
	Weekday AM Peak	1	(ms/ day)	245	1772	2007	2321		(a)					
Processor (17/10) 6.45 2.50 2	Weekday Interpeak Weekday DM Beak		88 6	245	1042	1181	1365		(a)					
Particular Par	Weekday Off Peak	0.25	12	245	261	295	341		œ œ					
Control Cont	Weekend Peak Weekend Off Peak	0.45	80 2	120	469	531	614		(e)					
Claim Clai			3		001	AADT (v	:h/day)	П	Ē					
Time Freidad	All periods (a)	N/A	(s)	365 (T)	18262 (U)	20683	(w)	5	(8)					
Transperior		MID BLOCK C	NILY											
Think based														
True Period Figure 1974	SA Projec	t timings from Annu	Time I	oerio ds		5B Traffic Flow	Data (veh/hr)							
	Time Period	Flow Factor	Time periods	Days/year	Year 2	Year 8	Year 15	Year 30						
Weeledgy My	Weekday AM Peak		(nrs/day)	245	1772	2007	2321		(a)					
	Weekday Interpeak		∞ .	245	1042	1181	1365		2					
Notice of Color Co	Weekday PM Peak Weekday Off Peak	0.25	2 21	245	1876	2125	341		<u>o</u>					
Miles Speeds and VOC costs - Or miles 1850 18	Weekend Peak	0.45	∞ .	120	469	531	614		(a)					
Vidite Speeds and VOC cost. Do minimum Fig. 1 (II) (VID)	Weekend Off Peak	0.15	16	120	156	177 AADT (v	205 205 2h/dav)		Œ					
Victories Internal Hr (9) (7) (M) (7) (M) (10) (All periods	N/A	24	365	18262	20683	23915	5	(8)					
Void of Speed and VOIC cost - Do-minimum 4 Col Laines Inclined speeds and VOIC costs - Do-minimum 4 Col Laines 1 Losis del interaction as part of rotate improvement 3 Speed Q Speed <th>Ø.</th> <th>Œ</th> <th>(S)</th> <th>Ê</th> <th>ĵ</th> <th>2</th> <th><u>(</u></th> <th>8</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	Ø.	Œ	(S)	Ê	ĵ	2	<u>(</u>	8						
Fig. Fig. High-Hale High Hi	6 & 7 Vehicle Speeds and VOC costs - Do-r	ninimum												
Year 2 Year 8 Year 15 Year 9 Year 5 Year 8 Year 15 Year 30 Year 5 Year 30 Year 5 Year 8 Year 15 Year 9 Year 15 Year 30 Yea	Akcelik Link Paramet	ш_				Speed	Q 1850		tf (min/km)		0.25*rf			
			ortion fintareactic	tion so not	- momonomin	PAId blod	mid block as n	ant of route image	, iomon					
12.0 12.0			6A Mean Sp	eed (km/hr)			6B Mean Sp	eed (km/hr)			7A VOC Cos	(cents/km)		
10 10 10 10 10 10 10 10	Year	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
14.7 26.9 21.3 21.3 79.95 79.94 79.92 79.95	Weekday AM Peak	37.8	26.2	15.7	15.7	79.87	79.83	79.76	79.76	30.01	35.22	42.82		
45.7 26.9 21.3 21.3 79.99	Weekday Interpeak	45.7	26.9	21.3	21.3	79.95	79.94	79.92	79.92	29.2	35.22	38.44		
45.7 26.9 21.3 79.98 79.98 79.97 79.97 29.2 35.22 38.44 38.44 38.44 38.44 47. 47. 47. 79.97 79.95	Weekday Off Peak	45.7	26.9	21.3	21.3	79.99	79.99	79.99	79.99	29.2	35.22	38.44		
Soluted intersection as part of route improvement Mid-block/mid-block as part of route improvement Mid-block/mid-block as part of route improvement Mid-block/mid-block as part of route improvement Air 79.97 79.96 79.95 79.95 79.95 79.97 78.41 7	Weekend Peak Weekend Off Peak	45.7	26.9	21.3	21.3	79.98	79.98	79.97	79.97	29.2	35.22	38.44		
Statisted intersection/inters	All periods	47	47	47	47	79.97	79.96	79.95	79.95	29.2	29.2	29.2		
Vear 2 Vear 3 Vear 4 Vear 5 Vear 5 Vear 5 Vear 5 Vear 5 Vear 5 Vear 4 Vear 5 Vear 6 Vear 5 Vear 6 Vear 7 Vear 6 Vear 7 Vear 7 Vear 6 Vear 7 Vear 6 Vear 7 Vear 6 Vear 7 Vear 7<		Isolated inters	ection/intersectic	in as part of rout tance (veh.km/h	e improvement	Mid-bloc	block	of route	2		7B Annual VO	Cost (\$/vear)		
1456 1760	Year	, , ,	0 200	Von 15	00,000	, Cass 7	Noor o	Voor 15	Voce 30	Vess	0,000	Vone 1E	00,000	
1456.6 1790.6 2176.6 2	Time period	rearz	rear &	rear 15	rear 30	rear z	rear 8	rear 13	rear 30	rear 2	rear o		- 1	
1548.2 1848.8 2296.3 2296.3 1051 1190 1376 1376 5334,900.2 544,088.56 545,583.55 547,583.75 547,	Weekday AM Peak Weekday Interpeak	1456.6	1750.6	2176.6	2176.6	584	1124	1300	1300	\$214,191.57	\$302,115.05		ما ام	
21066 240.875 299.725 299.725 240.875 259.725 240.87	Weekday PM Peak	1548.2	1848.8	2296.3	2296.3	1051	1190	1376	1376	\$324,840.23	\$441,088.55		انماة	
ul Penk 379,17 446,175 539,356 239 344 344 \$100,829,39 \$150,0021 \$190,002 <td>Weekday Off Peak</td> <td>210.65</td> <td>247.875</td> <td>299.725</td> <td>299.725</td> <td>146</td> <td>165</td> <td>191</td> <td>191</td> <td>\$180,838.81</td> <td>\$256,666.63</td> <td></td> <td>، اب</td> <td></td>	Weekday Off Peak	210.65	247.875	299.725	299.725	146	165	191	191	\$180,838.81	\$256,666.63		، اب	
1006 2 2 2 426 483 558 558 55,115.84	Weekend Peak Weekend Off Peak	379.17	148.725	179.835	179.835	263	297	344	344	\$106,288.93	\$150,857.12	\$199,090.29	\$199,090.29 (e) \$132.726.86 (f)	
\$1,935,743.11 \$2,578,370.61 \$5,115.84 \$5,115.84 \$5,115.84 \$5,115.84	All periods	2	2	2	2	426	483	558	558	\$5,115.84	\$5,115.84		\$5,115.84 (g)	
										\$1,379,255.67	\$1,935,743.11		\$2,578,370.61 Total for All Day per \$5,115.84 Total for day long	spo
									1					

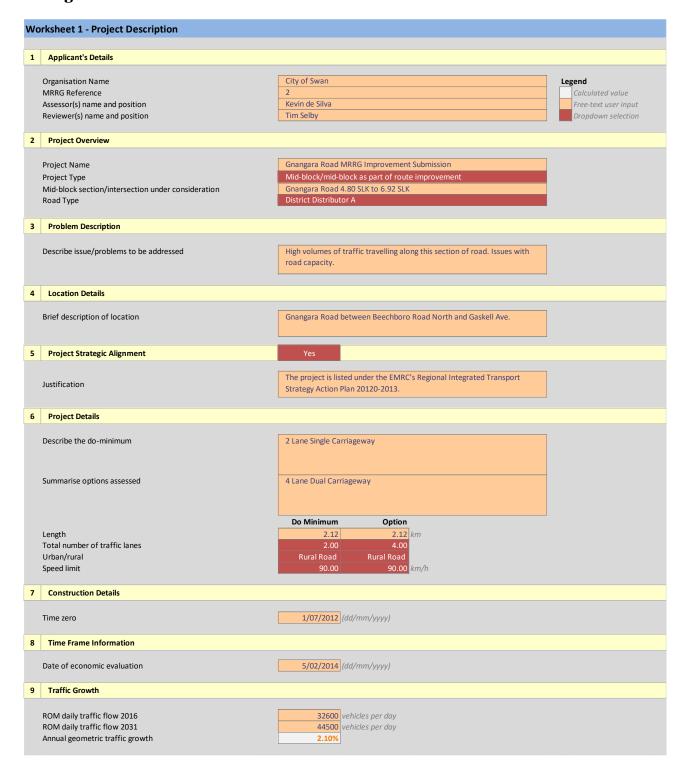
Material Distriction		# of Lanes	Interval	ŧ	Ç	Speed	ď	Αľ	tt (min/km)	t	0.25 °rt		
Note	kcelik Link Parameters	4	10.00		0.75	80	1850	2.31		80.00	20.00		
Number N		Isolated intersec	tion/intersection	n as part of route	improvement	Mid-block/	mid-block as par	rt of route impre	ovement				
			8A Mean Sp	eed (km/hr)			8B Mean Spet	ed (km/hr)			9A VOC Cost	(cents/km)	
10.00 10.0	Year	- Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30
According Acco	eekday AM Peak	43.3	41.5	36.8	36.8	79.96	79.95	79.94	79.94	29.2	30.0	31.2	
10 10 10 10 10 10 10 10	ekday Interpeak	49.3	48.9	48.2	48.2	79.98	79.97	79.97	79.97	28.7	28.7	28.7	
40.3 48.9 48.2 48.2 48.2 48.2 79.99 79	ekday PM Peak	48	46.6	44.3	44.3	79.96	79.95	79.94	79.94	28.7	29.2	29.2	
Mail	ekday Off Peak	49.3	48.9	48.2	48.2	80.00	79.99	79.99	79.99	28.7	28.7	28.7	
1963 1969	Veekend Peak	49.3	48.9	48.2	48.2	79.99	79.99	79.99	79.99	28.7	28.7	28.7	
	ekend Off Peak	49.3	48.9	48.2	48.2	80.00	80.00	80.00	80.00	28.7	28.7	28.7	
	All periods	35	35	35	35	79.98	79.98	79.98	79.98	31.2	31.2	31.2	
Vota 2 V													
Verical Strate Veri		Isolated interse	ction/intersectio	n as part of route	improvement	Mid-block	/mid-block as pan	rt of route impro	wement		000		
1353 1404		8		tance (ven.km/hr		08	Iotal Iravel Dista	ance (ven.km/nr,			98 Annual VOC	Cost (\$/year)	T
1553 1991 1992	Year Time period	- Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30
1963 1984 1984 1984 1985 1984 1985 1984 1986 1984	ekday AM Peak	1353.8	1593.1	1926.2	1926.2	992	1124	1300	1300	\$193,701.70	\$234,263.76	\$294,477.46	19
14897 14804 2018 2018 2018 1051 1190 1376 1376 1370	ekday Interneak	785.5	924.3	1117.6	1117.6	584	661	764	764	\$441,859.46	\$519,937,24	\$628.672.35	1 50
156-375 231-075 231-075 279.4 279.4 216.5 217.5	enday marpean	1439.7	1694.2	2048.5	2048 5	1051	1190	1376	1376	\$202 465 01	\$242,006,14	\$2 03 000 38	0
11.815 136.455 147.455 147.455 147.455 147.455 147.455 147.455 147.5	chay ner cak	100 275	221 075	270 4	270.0	1007	100	101	101	¢16E 607 30	¢104 076 46	C1 02 7E2 12	
11.825 15.65 15.65 15.75 15.	erday Olj Peak	190.373	445 025	279.4	4.67.2	140	COT	191	191	5105,097.30	\$194,976.46	\$235,752.13	
11.32 138.045 14.044 1	veekend Peak	353.475	415.935	502.92	502.92	203	767	344	344	\$97,389.43	\$114,598.41	\$138,554.52	v I i
State Stat	екепа ОЈЈ Реак	11/.825	138.645	16/.64	16/.64	88	66	115	115	\$64,926.29	\$76,398.94	\$92,376.35	\$92,376.35 (1)
Start Year 2	All periods	0	0	0	0	426	483	228	228	\$13,665.60	\$13,665.60	\$13,665.60	
State Stat										C42 CCF C0	C42 CCF C0	C4.2 CCF C0	
Start Vear 2	erating Cost for Mod	elled Years											
Start Year 2			A Comment										
\$1,379,255.67 \$1,335,743.11 \$1,395,743.11 \$2,578,370.61 \$2,578,370.61 \$1,345,743.11 \$1,345,743.11 \$2,578,370.61 \$2,578,370.61 \$1,345,743.11 \$1,345,743,743.11 \$1,345,743.1		Carry Vong	End Yoar 7	Ctort Voor 6	End Year) for mod	tart Vears	End Von 20						
70 \$1,166,039.19 \$1,382,580.95 \$1,382,580.95 \$1,682,942.18 11.5 6 7 7 6 7 81,267,499.39 \$2,257,056.86 \$1,274,310.07 \$1,532,761.57 11.5 11.5 11.5 11.5 11.5 11.5 11.5	al VOC Cost - Do- minimum	\$1,379,255.67	\$1,935,743.11	\$1,935,743.11			\$2,578,370.61						
Vear4 11.5 6 7 7 6 7 81,557,499.39 \$\$2,257,056.86 \$\$1,234,310.07 \$\$1,532,761.57 \$\$1,532,189.32 \$\$338,189.32 \$\$724,295.30 \$\$1387,189.32	I VOC Cost - Option	\$1,166,039.19	\$1,382,580.95	\$1,382,580.95		1,682,942.18	\$1,682,942.18						
Opt \$1,57,493.39 \$2,257,056.86 \$1,274,310.07 \$1,532,761.57 \$1,274,310.07 \$1,532,761.57													
51,657,499.39 \$2,257,056.86 \$2,257,056.86 \$1,27,7310.07 \$1,532,761.5	Midpoint	Yea	r.4	11.	5	22							
cont \$1,657,499.39 \$2,257,056.86 \$1,274,310.07 \$1,532,761.57 \$383,189.32 \$774,295.30 m.1 m.2	Juration Years	9		7		16							
\$1,274,310.07 \$1,532,761.57 \$1	num VOC at midpoint		499.39	\$2,257,0	98.950	\$2,578,3	70.61						
\$388,189.32 \$724,295.30 m.1 m.2	on VOC at midpoint	\$1,274,	310.07	\$1,532,7	761.57	\$1,682,9	42.18						
m1 m2	dpoint Benefits	\$383,1	89.32	\$724,28	95.30	\$895,42	8.43						
on Cost swines		Ε	1	m2		m3							
on Cost Savings													



Effect	Description	Score
Neutral	No expected change on overall public transport performance with no specific new/upgraded public transport infrastructure provided or removed.	0
Justification	There are no bus routes provided along the project route between Beechboro Road North to Dumpelliar Dr no improvements suggested for public transport as part of this project.	ive and there are
Pedestrian Facilities		
Effect	Description	Score
Positive	Demonstrated enhancement of existing pedestrian facilities to assist walking either along or across the road with measures meeting absolute minimum standards set out in appropriate MRWA and Austroads design guides with isolated facilities to meet existing demand. Low to moderate levels of pedestrian activity adjacent to or crossing the road length.	5
Justification	Central Median will provide a refuge for any pedestrians crossing the road	
Cycling Facilities		
Effect	Description	Score
Positive	Low to moderate levels of existing (or expected) cycling activity along a recognised designated existing cycling route or a route denoted as such within a Council's Local Bike Plan. Demonstrated enhancement of existing cycling facilities either along or across the road length under consideration with measures connecting to other facilities and meeting minimum standards set out in appropriate MRWA and Austroads design guides.	5
Justification	Provision of on-road 1.8m cycle lane along length of road.	
Street Lighting		
		Score 9
Justification	300m of road is lit at present (assumed to be to AS1158 standards). 1000m of road near intersection is prop AS 1158 standards. Therefore it is assumed that 3×250 sections will be upgraded from Service level 0 to 2 (while 1×250 section of road is upgraded from Service level 1 to 2 ($1 \times 1 = 1$ point). It is also assumed that intersection will be lit according to AS 1158 standards (1 point). Therefore maximum points are awarded.	$3 \times 3 = 9 \text{ points}$),
Road Safety		
Effect	Description	Score
Positive	The proposed measures and design are intended to minimise the overall number and severity of crashes. A road safety audit has already been undertaken and any concerns have been addressed and mitigated against as part of the design.	6
Justification		
overall Score		

Wo	rksheet 8 - Overall Score		
1	Present Value (PV) cost of Do-minimum		
		\$84,584.09 A worksheet 2	
2	Present Value (PV) cost of Option		
	resent value (1 v) cost of option		
		\$3,202,731.74 B worksheet 3	
3	Unconstrained Benefit values		
	PV travel time cost savings	\$100,688,102.18 C worksheet 4 x update factor TTC 1 \$100,688,102.18 W	
	PV VOC and CO2 savings	\$6,797,344.63 D worksheet 5 x update factor VOC 1 \$6,797,344.63 Y \$3,497,356.71 E worksheet 6 x update factor AC 1 \$3,497,356.71 Z	
	PV Crash cost savings	\$3,497,356.71 E worksheet 6 x update factor AC 1 \$3,497,356.71 Z	
4	Ratio of Unconstrained Benefit to Cost		
	PV net unconstrained benefits / PV net costs	(W + Y + Z) / (B - A) 35.59	
	Score	35.59	
_	5/00		
5	FYRR		
	Discount Factor VOC	{(USPWF30 – USPWF1) + (R x (AGPWF30 – AGPWF1))} 10.76345372	
		{(USPWF30 – USPWF1) + (R x (AGPWF30 – AGPWF1))} 10.76345372	
		{(USPWF30 – USPWF1) + (R x (AGPWF30 – AGPWF1))} 10.75216952	
	PV 1st Year benefits / PV net costs	[(W+Y)/DF(voc&ttc)+Z/DFcc)] x 0.93 / (B - A) 307.54 %	
6	Non Tangible Benefit Score		
		19 F worksheet 7	
7	Total Score		
,			
		31.44 out of a possible score of 50	
			

Gnangara Road mid-block between Beechboro Road North and Gaskell Avenue

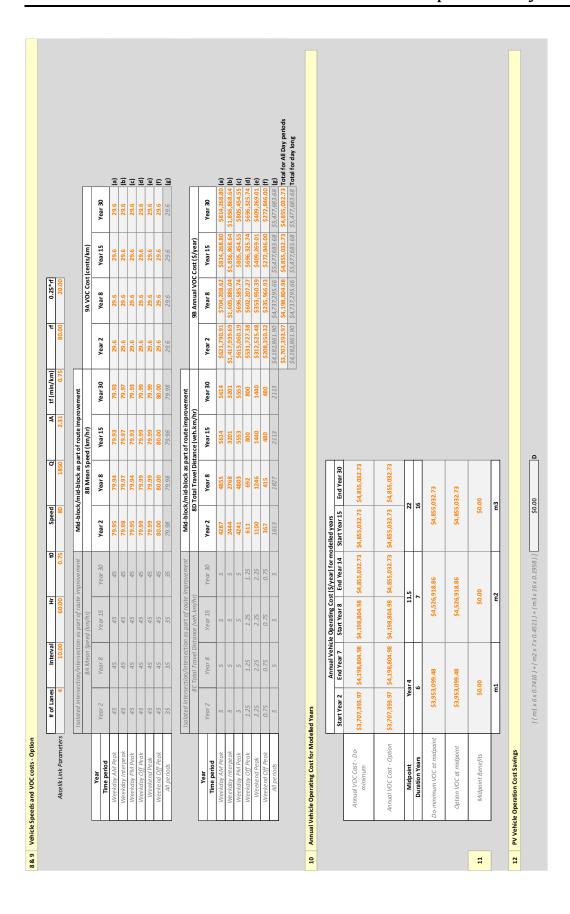


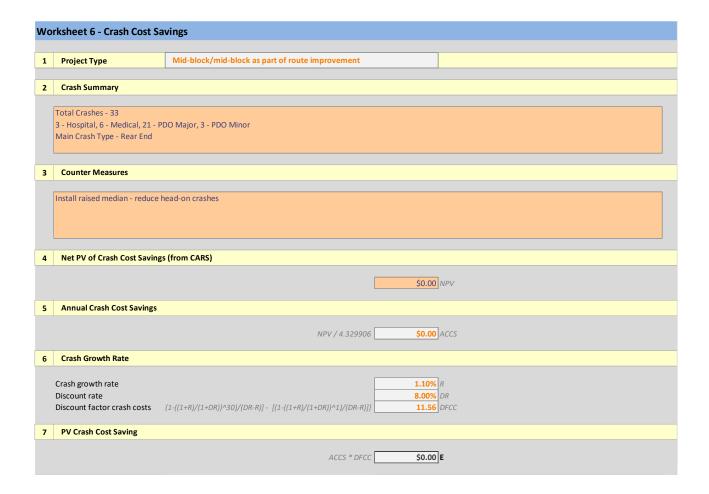
	Road Type		District Distrib	utor A		
						_
	PV of annua	I maintenance costs				
			\$4 549 52	x 11.7023	\$53,239.8	(a)
			ψ 1,3 13.32		V33,233 10.	- (u)
	PV of period	ic maintenance costs				
D	ronosed Reha	ab treatment measure	40mm SMA ov	verlav		
	tehab treatme		4011111 SWA 01	renay	\$21.50	1
		area (from SLK to SLK)			15688.00	
	tehab cost	a.ea (ee. ee ee)			\$337,292.0	_
	.,	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
		Type of Maintenance	Poguirod?	Estimated Cost	SDD\A/E	D\/
	l Year					
	Year 5	40mm SMA overlay		\$337,292.00	0.680	N/A
		**	N/A N/A			
	5	40mm SMA overlay	N/A	\$337,292.00	0.680	N/A
	5 10	40mm SMA overlay 40mm SMA overlay	N/A N/A	\$337,292.00 \$337,292.00	0.680 0.464	N/A \$107,933.44
	5 10 15	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A N/A Yes	\$337,292.00 \$337,292.00 \$337,292.00	0.680 0.464 0.320	N/A \$107,933.44 N/A
	5 10 15 20	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A N/A Yes N/A	\$337,292.00 \$337,292.00 \$337,292.00 \$337,292.00	0.680 0.464 0.320 0.210	N/A \$107,933.44 N/A N/A
	5 10 15 20 25 30	40mm SMA overlay	N/A N/A Yes N/A N/A	\$337,292.00 \$337,292.00 \$337,292.00 \$337,292.00 \$337,292.00	0.680 0.464 0.320 0.210 0.150 0.100	N/A \$107,933.44 N/A N/A \$33,729.20
	5 10 15 20 25 30 PV of annua Luminaire Number of	40mm SMA overlay 1 associated operating cost 1 associated operating cost 1 associated operating cost 1 days luminaires within study section 1 days luminaires are lit	N/A N/A Yes N/A N/A	\$337,292.00 \$337,292.00 \$337,292.00 \$337,292.00 \$337,292.00 \$337,292.00	0.680 0.464 0.320 0.210 0.150 0.100 \$141,662.66	N/A \$107,933.44 N/A \$33,729.20 4 (b)
	5 10 15 20 25 30 PV of annua Luminaire of Number of Number of Total operations	40mm SMA overlay 1 associated operating cost 1 associated operating cost 1 associated operating cost 1 days luminaires within study section 1 days luminaires are lit	N/A N/A Yes N/A N/A Yes	\$337,292.00 \$337,292.00 \$337,292.00 \$337,292.00 \$337,292.00 \$337,292.00	0.680 0.464 0.320 0.210 0.150 0.100 \$141,662.66	units days

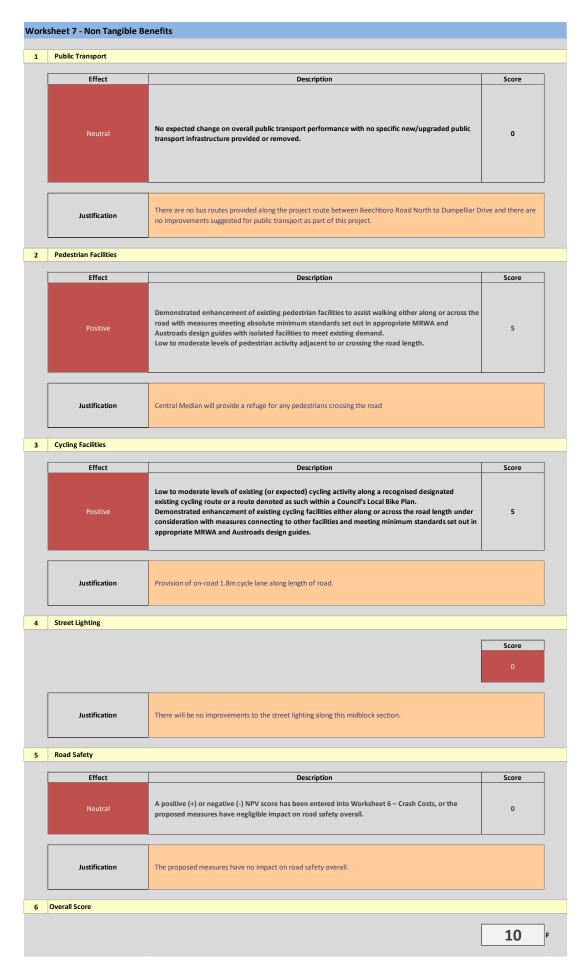
Vor	rksheet 3 -	Cost of the Option				
			<u> </u>			
1	Road Type		District Distrib	utor A		
_						
2	PV of estima	ated cost of proposed work (as per atta	ached estimate sl	heet)		
			\$6,755,592.00	l _v 0 0250	\$6,255,002.63	(2)
			30,733,392.00	X 0.9239	\$0,255,002.05	(a)
3	PV of routin	e maintenance costs following comple	tion of the work			
				1		
			\$9,836.80	x 10.7398	\$105,645.26	(b)
1	DV of maint	onance cost in year 1				
•	PV OI IIIaiiii	enance cost in year 1				
					\$4,549.52	(c)
5	PV of Option	n periodic maintenance cost				
	_					
	Proposed Reh Rehab treatm	ab treatment measure	40mm SMA or	verlay	\$21.50	
		area (from SLK to SLK)			33920.00	m2
	Rehab cost	area (nom sex to sex)			\$729,280.00	7772
	Year	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	5	40mm SMA overlay	N/A	\$729,280.00	0.680	N/A
	10	40mm SMA overlay	N/A	\$729,280.00	0.464	N/A
	15	40mm SMA overlay	Yes	\$729,280.00	0.320	\$233,369.60
	20	40mm SMA overlay 40mm SMA overlay	N/A N/A	\$729,280.00 \$729,280.00	0.210	N/A N/A
	30	40mm SMA overlay	Yes	\$729,280.00	0.100	\$72,928.00
			<u>'</u>			
			Sun	n of PV maintenance	\$306,297.60	(d)
;	PV of Annua	al associated operating cost				
	Luminaira	Tuno			ZE20C - 70ML	
	Luminaire Number of	Type Iuminaires within study section				units
		days luminaires are lit			365	
	Total oper	ating cost			\$0.00	
	PV of annual o	perating costs (separate to maintenanc	e costs)			
	r v Oi alliludi (perating costs (separate to maintenanc Total		x 10.7398	\$0.00	(e)
<u>'</u>	PV total cos	ts of the preferred option				
				(a) + (b) + (c) + (d) + (e)	\$6.671.495.03	R
				(u) + (b) + (c) + (u) + (e	30,0/1,495.02	Б

Worksheet 4 - Travel Time Cost Savings	t Savings																
1 Road Type	District Distributor A	ributor A															
2 Project Type	Mid-block/	'mid-block as	Mid-block/mid-block as part of route improvement	rovement													
3 Modelling Period Type	AM/Inter/	AM / Inter / PM peak periods	riods														
4 Midblock Assessment - Traffic Volumes	/olumes																
	Time Zero	-	8_				Time Zero		OPTION	\vdash							
	(veh/hr)	Year 2	Year 8	Year 15	Year 30		(veh/hr)	Year 2	Year 8	Year 15	Year 30						
AM Peak	1940	2022		2648	2648		1940	2022	2290	2648	2648						
PM Peak	1919	2000	2265	2619	2619		1919	2000	2265	2619	2619						
AADT All perio	ds 17520	18262		23915	23915		17520	18262	20683	23915	23915						
5 Do-minimum Modelling																	
	5A Project Timings from Annualisation Factors	m Annualisati	ion Factors			5B Isolated Intersection	ntersection		5C F	5C Road Midblock Improvement	mprovement			leverTlenand C	5D Annual Travel Time Cost (\$/vear)	arl	
Line Day	Elour Eactor	4		υ Ε	Voor 2	10delling Results	inputs (veh.hr/hr)) Voc 20	Mode	Modelling Results Inputs (veh.hr/hr)	puts (veh.hr/hr)	06.200	Carry	0.000	Voca 1E	00,000	
Weekday AM Peak	Ī.	2 2	ay days/year	+	2.43	3.77	14.60	14.60	53.69		70.46	70.46	\$593,030.12	\$672,093.77	\$778,254.93	l g	
Weekday Interpeak	reak 1	80	245	\$27.01	1.96	2.59	5.22	5.22	53.63	60.75	70.26	П	\$2,839,058.68	\$3,215,868.66	\$3,719,364.50	\$3,719,364.50	(a)
Weekday PM Peak		2	245	\$22.30	3.73	6.10	14.59	14.59	53.69	60.85	70.46	†	\$586,715.69	\$664,937.49	\$769,968.27	\$769,968.27	<u></u>
Weekday Off F	eak 0.25	17	245	\$22.91	0.49	0.65	2.31	2.31	13.75	8.65	10.00	10.00	\$514,509.61	\$582,719.21	\$673,810.80	\$673,810.80	(p)
Weekend Off Peal		16	120	\$24.80	0.29	0.39	0.78	0.78	4.58	5.19	0.00	t	\$218,222.54	\$247,150.52	\$285,781.90	\$285,781.90	(£)
SE All periods	N/A	24	365	\$25.70	10	10	10	10	20.17	22.85	26.42	2	\$4,541,633.70	\$5,144,005.20		\$5,948,600.28	(8)
(a)	<u>(F)</u>	(S)	Ε	ĵ)	8	(M)	8	(X)	2	(w)	ŝ	ε	\$5,088,833.67 \$4,541,633.70	\$5,764,791.38 \$5,144,005.20	\$6,668,934.56	\$ 6,668,934.56 \$5,948,600.28	Total for All Day Periods Total for Day Long
6 Option Modelling																	
	6A Project Timings from Annualisation Factors	m Annualisati	ion Factors			6B Isolated Intersection	ntersection		90.1	6C Road Midblock Improvement	mprovement			iD Annual Travel	6D Annual Travel Time Cost (\$/vear)	ar)	
i i		= 3	me Periods	Σ E	V/	fodelling Results	inputs (veh.hr/hr	, N 20		elling Results Inp	uts (veh.hr/hr			2			
Weekday AM Peak	Pok 1	r nours/day	ay days/year	3/HK	2 49	2 94	3 94	3 94	rear 2	60.74	70.24	70.24	\$592,224.48	\$670.802.94	\$775,781,41	\$775, 781,41	(a)
Weekday Interpeak	le ak 1		245	\$27.01	2.19	2.58	3.43	3.43	53.60	60.71	70.21	Ħ	\$2,837,792.63	\$3,214,097.81	-	\$3,716,686.67	(a)
Weekday PM Peak		2	245	\$22.30	3.23	3.87	5.46	5.46	53.62	60.74	70.24	70.24	\$585,918.63	\$663,660.41	\$767,521.09	\$767,521.09	© :
Weekend Peak		21 80	120	\$22.91	0.99	1.16	1.54	1.54	13.75	5.03	18.01	18.01	\$337,247.82	\$381,956.55	\$441.663.13	\$41.663.13	(a)
Weekend Off P	eak 0.15	16	120	\$24.80	0.33	0.39	0.51	0.51	4.58	5.19	00.9	00.9	\$218,213.42	\$247,138.71	\$285,765.90	\$285,765.90	£
6E All periods	N/A	24	365	\$25.70	10	10	10	10	20.17	22.84	26.41		\$4,540,543.21	\$5,142,534.42	\$5,946,492.48	\$5,946,492.48	(8)
(Ö)	<u>&</u>	(s)	E	2	8	(W)	8	(£	Σ	<u>§</u>	<u>×</u>	3	\$5,085,868.94 \$4,540,543.21	\$5,760,326.53 \$5,142,534.42	\$6,661,161.87 \$5,946,492.48	\$6,661,161.87	\$6,661,161.87 Total for All Day Periods \$5,946,492.48 Total for Day Long
7 Annual Travel Time Cost for Modelled Years	odelled Years																
		Circary	Transl Times	(choos) for m	moor pollope												
	Start Year 2	"	nd Year 7 Start Year 8 End Year 14 Start Year	End Year 14	Start Year 15	15 End Year 30											
Travel Time Cost		7 \$5 764 791	\$5.088 833.67 \$5.764 791 38 \$5.764 791 38 \$6.668 934 56 \$6.668 934 56	3 \$6 668 934 5	6 \$6 668 934 56	\$6.668 934.56											
Do-minimum Do-minimum																	
Option		4 \$5,760,326	\$5,085,868.94 \$5,760,326.53 \$5,760,326.53 \$6,661,161.87 \$6,661,161	3 \$6,661,161.8	37 \$6,661,161.87	.87 \$6,661,161.87											
Midpoint		Year 4	Yei	Year 11.5	Ye	Year 22											
Do-minimum TTC at mideoint		6 \$5.426.812.53	\$6.21	\$6.216.862.97	\$6.668.9	16											
Option TTC at midpoint		\$5,423,097.74	\$6,21	\$6,210,744.20	\$6,661	661,161.87											
8 Midpoint Benefit	fits \$3,	714.79	\$6,	118.77	\$7,7	72.70											
		m1		m2		m3											
9 PV Travel Time Cost Savings																	
	l (m1 x b x U.A	416)+(mzx	[(m1 × 6 × 0.7416) + (m2 × 7 × 0.4511) + (m3 × 16 × 0.1958)]	x 16 x 0.1958,		\$60,200.89	U										

1 Notice Participate														
	Н	District Distrib	utor A											
National Plate Pla	Н	Mid-block/mi	1-block as part o		nent									
National Annual Section Protection National Annual Ann	\vdash	AM / Inter / P	M peak periods											
1 10 10 10 10 10 10 10		MID BLOCK OF	AT.											
1	4A Project	timings from Annua	ilisation Factors			4B Traffic Flow	Data (veh/hr)							
1 2 2 200	Time Period	Flow Factor	Time periods	<u>- </u>	Year 2	Year 8	Year 15	Year 30						
1	Weekday AM Peak		2	245	2022	2290	2648		(a)					
According 1.0 2.0	Weekday Merpeak Weekday PM Peak	1 1	2	245	2000	2265	2619		(a)					
NA 24 25 250 210 2	Weekday Off Peak	0.25	12	245	288	326	377		(p)					
Mail Si Si Si Si Si Si Si	Weekend Off Peak	0.15	16	120	173	196	226		(£)					
No. Cont. No.						AADT (ve	eh/day)							
National Particular Trime pa	All periods (Q)	(R)	(S)	365	18262 (U)	Z0683	(w)	5	(8)					
Participa Part		MID BLOCK OF	ATA.											
Time periods Day/year Year 2 Year 8 Year 15 Year 30 E.	SA Project	timings from Annus	lisation Factors											
WebClob Time periods of Lange (s) 1289 Year 15 (s) 1589 Year 15 (s)	polici un		Time p	1 8		5B Traffic Flow	Data (veh/hr)							
1 17.5 245 245 2450 2450 2563 2510 (b) 1.0 1	Time Period	Flow Factor	Time periods		Year 2	Year 8	Year 15	Year 30						
1 2 2 245 1153 1150 1510 10 10 10 10 10	Weekday AM Peak	-	(hrs/day)		2022	2290	2648		(e)					
1 2 245 286 275 226 (4) 0.00 0.25 0.00 0.25 0.00	Wee kday Interpeak	H	∞	245	1153	1306	1510		(q)					
N/A 24 365 120 133 185 236 679 670	Weekday PM Peak Weekday Off Peak	0.25	2 12	245	2000	3265	377		(c)					
	Weekend Peak	0.45	8	120	519	588	629		(e)					
	Weekend Off Peak	0.15	16	120	173	196 AADT (ve	226 h/dav)		Œ					
Interval Hr 10 Speed Q 1850 1231 (finin/km) rf 0.25*rf 2	All periods	N/A	24	365	18262	20683	23915	5	(g)					
Pitches Interval Hr t0 Speed Q 1850 T (min/km) rf 0.75 R0.00 2.05°rf 90 3.00 6.0.00 0.75 Speed Q 1.85 3.21 0.75 80.00 2.00 91 3.0.00 0.75 Speed 0.75 Kear 3 7.84	(5)	(u)	(c)	Ē	2	Ē	(an)	3						
	6 & 7 Vehicle Speeds and VOC costs - Do-m	inimum												
		ш	Interval			Speed			tf (min/km)		Ш			
Soluted Intersection/Intersection Signature Mid-block/mid-block as part of route improvement Soluted Intersection/Intersection Of South Signature Vear 2 Vear 3 Vear 5 Vear 5 Vear 5 Vear 6 Vear 15 Vear 6 Vear 15 Vear 8 Vear 15 Vear 9 Vear 15 Vear 16 Vear 9 Vear 17 Vear 9 Vear 9 Vear 17 Vear 9 Vear 9 Vear 9 Vear 9 Vear 9	Akcelik Link Paramete	rs 2	10.00			80	1850		0.75	80.00	20.01			
Year 2 Year 3 Year 3 Year 3 Year 4 Year 5 Year 5 Year 5 Year 5 Year 6 Year 15 Year 6 Year 15 Year 7 Year 8 Year 15 Year 9 Year 15 Year 15 Year 9 Year 15 Year 9 Year 15		Isolated inters	ction	n as part of route	improvement	Mid-block	/mid-block as p	art of route impr	ovement					
	Year	:	6A Mean Sp	eed (km/nr)	9	:	ob Mean Sp.	eed (km/hr)	:	:	A VOC CO	t (cents/km)	:	
47 47 47 47 47 47 47 47	Time period	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15		
47 47 47 47 47 47 47 47		47	47	47	47	79.84	79.79	79.67	79.67	29.6	29.6	29.6		
	Weekday PM Peak	47	47	47	47	79.84	79.79	79.67	79.67	29.6	29.6	29.6		
47 47 55 55 79.39 79.37	Weekday Off Peak	47	47	55	55	79.99	79.99	79.98	79.98	29.6	29.6	29.6		
A	Weekend Peak Weekend Off Peak	47	47	55	55	79.98	79.97	79.97	79.97	29.6	29.6	29.6		
Solicited Intersection/Intersection on sport of Fourier Improvement Muld-block/mild-block as part of route improvement Near 1 Near 2 Near 2 Near 3 Near 3 Near 3 Near 1 Near 2 Near 1 Near 3 Near 2 Near 2 Near 3 Near 2 Near 3 Near 2 Near 2 Near 3 Near 2 Near 3 Near	All periods	47	47	47	47	79.97	79.96	79.95	79.95	29.6	29.6	29.6		
Year 2 Year 3 Year 3 Year 3 Year 3 Year 3 Year 3 Year 4 Year 15 Year 3		Isolated inters	(-	2 2	improvement	Mid-block 6D	/mid-block as pa Total Travel Dist	art of route impr	ovement		78 Annual VO	C Cost (\$/vear)		
C	Year	Year 2	Year 8	Vear 15	Ve ar 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year8	Year 15	Vear 30	
C	Time period	1	5				2		B		9			
6 6 6 6 4241 4883 5553 5553 5515,060.19 566,585.74 5805,435.74 1.5 1.5 1.5 1.5 611 692 800 5831,727.38 \$602,007.27 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5695,335.73 5772,346.73 5772,446.72 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,446.77 5772,447 5772,4477,648.67 57772,4477,648.67 57777,498.67 57777,948.77 57777,948.77 57777,948.77 57777,948.77 57777,948.77 57777,948.77 57777,948.77 57777,948.77 57777,948.77 577777,948.77	Weekday AM Peak Weekday Interneak	9	9	9	9	74287	2768	3201	3201	\$621,790.91	_	\$814,268.80	\$814,268.80 (a)	
15 15 15 15 15 611 692 800 800 \$533,723 \$660,235.7 \$660,235	Weekday PM Peak	9	9	9	9	4241	4803	5553	5553	\$615,060.19	\$696,585.74	\$805,454.5	\$805,454.55 (c)	
2.7 2.7 2.7 100 1246 1440 1440 531,252,48 533590,39 5402,600,00 0.9 0.9 0.9 0.9 36.7 1613 1827 2113 2113 5418,861.90 54,198,804.98 54,198,804.98 54,198,804.98 54,158,502.72 2 2 2 2 2 2 2 2 2 1613 1827 213 2113 2113 5418,861.90 54,198,804.98 54,855,032.73	Weekday Off Peak	1.5	1.5	1.5	1.5	611	692	800	800	\$531,727.38	\$602,207.27	\$696,325.7	\$696,325.74 (d)	
2 2 2 2 1613 1827 2113 2113 2112.8612.96 \$4,77,835.66 \$4,77,6835.07 \$4,198,804.98 \$4,655,032.77	Weekend Peak Weekend Off Beak	2.7	2.7	2.7	2.7	1100	1246	1440	1440	\$312,525.48	\$353,950.39	\$409,269.01	\$409,269.01 (e)	
\$4,198,804.98 \$4,855,032.73	All periods	2	2	2	2	1613	1827	2113	2113	\$4,182,861.90	\$4,737,295.66	\$5,477,683.68	\$5,477,683.68 (8)	
\$4 727 205 66 \$5 477 682 68										\$3,707,393.97	\$4,198,804.98	\$4,855,032.73	\$4,855,032.73 Tota	I for All Day periods







Wo	rksheet 8 - Overall Score		
1	Present Value (PV) cost of Do-minimum		
		\$194,902.49 A worksheet 2	
2	Present Value (PV) cost of Option		
		\$6,671,495.02 B worksheet 3	
3	Unconstrained Benefit values		
	PV travel time cost savings PV VOC and CO2 savings PV Crash cost savings	\$60,200.89 C worksheet 4 x update factor TTC 1 \$60,200.89 W \$0.00 D worksheet 5 x update factor VOC 1 \$0.00 Y \$0.00 E worksheet 6 x update factor AC 1 \$0.00 Z	
4	Ratio of Unconstrained Benefit to Cost		
	PV net unconstrained benefits / PV net costs Score	(W + Y + Z) / (B - A) 0.01 0.01	
5	FYRR		
	Discount Factor TTC Discount Factor CC PV 1st Year benefits / PV net costs	{(USPWF30 – USPWF1) + (R x (AGPWF30 – AGPWF1))} 10.76345372 {(USPWF30 – USPWF1) + (R x (AGPWF30 – AGPWF1))} 10.76345372 {(USPWF30 – USPWF1) + (R x (AGPWF30 – AGPWF1))} 10.75216952 [(W+Y)/DF(voc&ttc)+Z/DFcc)] x 0.93 / (B - A) 0.08 %	
6	Non Tangible Benefit Score		
		10 F worksheet 7	
7	Total Score		
		out of a possible score of 50	

Gnangara Road / Gaskell Avenue Intersection

Wo	orksheet 1 - Project Description		
1	Applicant's Details		
	Organisation Name MRRG Reference Assessor(s) name and position Reviewer(s) name and position	City of Swan 3 Kevin de Silva Tim Selby	Calculated value Free-text user input Dropdown selection
2	Project Overview		
	Project Name Project Type Mid-block section/intersection under consideration Road Type	Gnangara Road MRRG Improvement Submission Isolated intersection/intersection as part of route improvement Gnangara Road 6.92 SLK to 7.17 SLK District Distributor A	
3	Problem Description		
	Describe issue/problems to be addressed	Intersection performance / capacity issues with vehicles turning in and out of the intersection.	
4	Location Details		
	Brief description of location	Gaskell Avenue / Gnangara Road Intersection, Swan.	
5	Project Strategic Alignment	Yes	
	Justification	The project is listed under the EMRC's Regional Integrated Transport Strategy Action Plan 20120-2013.	
6	Project Details		
	Describe the do-minimum	T - Intersection	
	Summarise options assessed	Seagull Intersection	
	Length Total number of traffic lanes Urban/rural Speed limit	Do Minimum Option 0.25 0.25 2.00 4.00 Rural Road Rural Road 90.00 90.00	
7	Construction Details		
	Time zero	1/07/2012 (dd/mm/yyyy)	
8	Time Frame Information		
	Date of economic evaluation	5/02/2014 (dd/mm/yyyy)	
9	Traffic Growth		
	ROM daily traffic flow 2016 ROM daily traffic flow 2031 Annual geometric traffic growth	32600 vehicles per day 44500 2.10%	

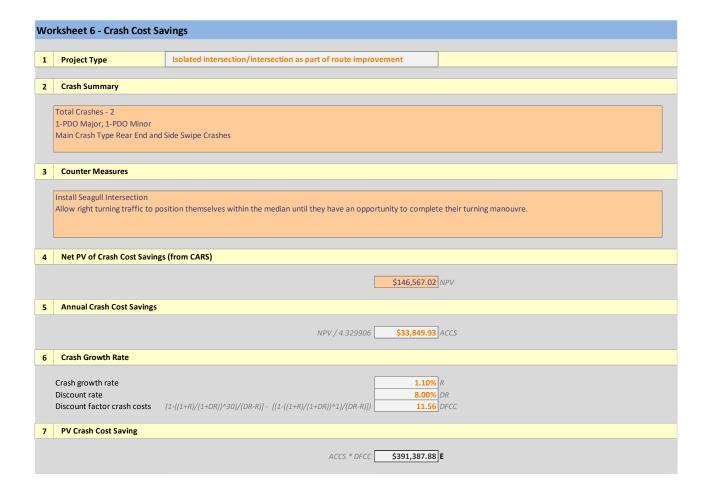
	Road Type		District Distrib	utor A		
	noau Type		District Distrib	utor A		
Т	PV of annual	I maintenance costs				
			\$819.25	x 11.7023	\$9,587.1	11 (a)
T	PV of period	ic maintenance costs				
	15.1					
	•	ab treatment measure	40mm SMA ov	verlay	404	
	ehab treatme				\$21.5	
		area (from SLK to SLK)			2825.0	_
K	ehab cost				\$60,737.5	00
P	eriodic maint	enance will be required in the follo	wing vears:			
		<u> </u>				
		Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	Year			1		
	5	40mm SMA overlay	N/A	\$60,737.50	0.680	N/A
	5 10	40mm SMA overlay 40mm SMA overlay	N/A N/A	\$60,737.50	0.464	N/A
	5 10 15	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A N/A Yes	\$60,737.50 \$60,737.50	0.464 0.320	N/A \$19,436.00
	5 10 15 20	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A N/A Yes N/A	\$60,737.50 \$60,737.50 \$60,737.50	0.464 0.320 0.210	N/A \$19,436.00 N/A
	5 10 15 20 25	40mm SMA overlay	N/A N/A Yes N/A N/A	\$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50	0.464 0.320 0.210 0.150	N/A \$19,436.00 N/A N/A
	5 10 15 20	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A N/A Yes N/A	\$60,737.50 \$60,737.50 \$60,737.50	0.464 0.320 0.210	N/A \$19,436.00 N/A N/A
	5 10 15 20 25 30	40mm SMA overlay	N/A N/A Yes N/A N/A	\$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50	0.464 0.320 0.210 0.150 0.100	N/A \$19,436.00 N/A N/A \$6,073.75
	5 10 15 20 25 30	40mm SMA overlay	N/A N/A Yes N/A N/A	\$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50	0.464 0.320 0.210 0.150 0.100	N/A \$19,436.00 N/A N/A \$6,073.75
	5 10 15 20 25 30 PV of annual	40mm SMA overlay	N/A N/A Yes N/A N/A	\$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50	0.464 0.320 0.210 0.150 0.100 e \$25,509.7	N/A \$19,436.00 N/A N/A \$6,073.75
	5 10 15 20 25 30 PV of annual Luminaire T	40mm SMA overlay	N/A N/A Yes N/A N/A	\$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50	0.464 0.320 0.210 0.150 0.100 e \$25,509.7	N/A \$19,436.00 N/A N/A \$6,073.75
	5 10 15 20 25 30 PV of annual Luminaire T	40mm SMA overlay 10mm SMA overlay 11mm SMA overlay 12mm SMA overlay 12mm SMA overlay 13mm SMA overlay 14mm SMA overlay 15mm S	N/A N/A Yes N/A N/A	\$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50	0.464 0.320 0.210 0.150 0.100 e \$25,509.7	N/A \$19,436.00 N/A N/A \$6,073.75 (b)
	5 10 15 20 25 30 PV of annual Luminaire Thumber of Number of Total operations	40mm SMA overlay 10mm SMA overlay 11mm SMA overlay 12mm SMA overlay 12mm SMA overlay 13mm SMA overlay 14mm SMA overlay 15mm S	N/A N/A Yes N/A N/A	\$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50	0.464 0.320 0.210 0.150 0.100 e \$25,509.7	N/A \$19,436.00 N/A N/A \$6,073.75 (b)
	5 10 15 20 25 30 PV of annual Luminaire Thumber of Number of Total operations	40mm SMA overlay	N/A N/A Yes N/A N/A Yes	\$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50 \$60,737.50	0.464 0.320 0.210 0.150 0.100 e \$25,509.7	N/A \$19,436.00 N/A N/A \$6,073.75 (b)

Νo	rksheet 3 -	Cost of the Option				
1	Road Type		District Distrib	utor A		
_	Road Type		District Distrib	utor A		<u> </u>
2	PV of estima	ited cost of proposed work (as per a	ttached estimate s	heet)		
				1		1
			\$796,650.00	x 0.9259	\$737,618.24	(a)
3	PV of routin	e maintenance costs following comp	oletion of the work			
-						
			\$1,522.50	x 10.7398	\$16,351.35	(b)
4	DV of maint	enance cost in year 1				
•	PV OI IIIaiiit	enance cost in year 1				
					\$819.25	(c)
	_					
5	PV of Option	n periodic maintenance cost				
	Proposed Reh	ab treatment measure	40mm SMA o	verlav		
	Rehab treatm			,	\$21.50	
	Site treatment	area (from SLK to SLK)			5250.00	m2
	Rehab cost				\$112,875.00	
	Periodic maint	enance will be required in the follow				
	Year	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	5	40mm SMA overlay	N/A	\$112,875.00	0.680	N/A
	10	40mm SMA overlay 40mm SMA overlay	N/A Yes	\$112,875.00 \$112,875.00	0.464	N/A \$36,120.00
	20	40mm SMA overlay	N/A	\$112,875.00	0.210	350,120.00 N/A
	25	40mm SMA overlay	N/A	\$112,875.00	0.150	N/A
	30	40mm SMA overlay	Yes	\$112,875.00	0.100	\$11,287.50
					4-5	1
			Sun	n of PV maintenance	\$47,407.50](d)
5	PV of Annua	l associated operating cost				
	Luminaire				ZE20C - 70ML	
		luminaires within study section				units
	Total oper	days luminaires are lit			\$0.00	days
	PV of annual o	perating costs (separate to maintena To		x 10.7398	\$0.00	(e)
7	PV total cos	ts of the preferred option				
					A000 100 00	ام
				(a) + (b) + (c) + (d) + (e)	\$802,196.33	В

		Worksheet 4 - Tra	Worksheet 4 - Travel Time Cost Savings	SS																
				District Distrib	outor A															
				Isolated inter	section/inters	ection as part of	f route improve	ment												
			od Type	AM / Inter / P	M peak period															
This control Figure Figu	This continue This continu	4 Midblock Asses	sment - Traffic Volumes																	
Figure Marcia M						DO MINIMUN						OPTION								
100 1912 1913 1	100 100			Time Zero (veh/hr)	Year 2	Year 8	Year 15	Year 30		Time Zero (veh/hr)	Year 2	Year 8	Year 15	Year 30						
	Third 18 18 18 18 18 18 18 1		AM Peak	1700	1772	2007	2321	2321		1700	1772	2002	2321	2321						
1.			Interpeak PM Peak	1000	1042	1181	1365	1365		1000	1042	2125	1365	1365						
This Control	This color Thi		AADT All periods	17520	18262	20683	23915	23915		17520	18262	20683	23915	23915						
The part	1	5 Do-minimum M	10 delling																	
The period The	1		5A Proje	ect Timings from	Annualisation	Factors			5B Isolated I	ntersection		50	Road Midblock	mprovement			Flourationan	imp Cort (¢/upa		
1 2 2 2 2 2 2 2 2 2	1				Time	Periods	TTC	ĕ	delling Results	Inputs (veh.hr/h		Moc	Jelling Results Inp	uts (veh.hr/hr)			D Annual I ravel	ilme cost (5/ year		
1	1		Time Period	Flow Factor	hours/day	days/year	\$/HR	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
1	1		Weekday Interpolak		v «	245	\$22.34	3.48	3.71	3.8	3.80	5.53	6.28	7.27	7.76	\$184,229.81	\$187.406.18	\$201,170.48	\$22,733.13 (d)	
Column C	1		Weekday PM Peak		2	245	\$22.30	2.71	2.82	3.33	3.33	5.55	6.28	7.27	7.27	\$29,612.17	\$30,814.14	\$36,386.91	\$36,386.91 (c)	
1.0 1.0	1. 1. 1. 1. 1. 1. 1. 1.		We ekday Off Peak	0.25	12	245	\$22.91	0.87	0.89	0.95	0.95	0.81	0.92	1.07		\$58,599.20	\$59,609.53	\$63,987.63	\$63,987.63 (d)	-
1	13 15 15 15 15 15 15 15	1	Weekend Peak	0.45	∞ !	120	\$25.55	1.57	1.59	1.71	1.71	1.47	1.66	1.92		\$38,410.85	\$39,073.10	\$41,942.88	\$41,942.88 (e)	·
	Fig.		Weekend Off Peak	0.15	16	120	\$24.80	0.52	0.53	10.57	1.0	0.49	2.69	2.12	Ť	-	\$25,284.10	\$27,141.12	\$27,141.12 (f)	~ =
			(O)	(R)	(S)	E	(C)	2	(M)	(X)	3	(X)	(W)	3.12	t		\$383,162.52	\$423.422.21	\$423.422.21 To	;; otal for All Dav Periods
The Petrol Time Petrol T	The period The															\$2,251,320.00	\$2,251,320.00	\$2,251,320.00	\$2,251,320.00 To	otal for Day Long
Transport Tran	The Part The Part	6 Option Modellin	Bu																	
	1		6A Proje	act Timings from	Annualisation	Factors			6B Isolated	ntersection		99	Road Midblock	mprovement		19) Annual Travel T	ime Cost (\$/year	-	
1 2 2 2465 25254 329 359 433 433 554 628 726 726 55658-13 55658-13 5578-13 5778-13	1 2 2 2465 2524 329 329 43		Time Period	Flow Factor	hours/day		S/HR		Year 8	Year 15		Year 2	Vear 8	Vear 15	Year 30	Year 2	Year 8	Year 15	Year 30	
1 8 245 24	1 2 2 245 25230 23.0 23		Weekday AM Peak	1	2		\$22.54	3.29	3.59	4.33	4.33	5.54	6.28	7.26	7.26	\$36,336.73	\$39,650.11	\$47,823.12		
1	1		We ekday Interpeak	1	88	245	\$27.01	3.46	3.5	3.71	3.71	5.54	6.27	7.25		\$183,171.02	\$185,288.60	\$196,405.92		
12 12 12 12 12 12 12 12	12 12 12 12 12 12 12 12		Weekday PM Peak	100	2	245	\$22.30	2.7	2.76	2.99	2.99	5.54	6.28	7.26		\$29,502.90	\$30,158.52	\$32,671.73		
NA 24 365 356	15 16 120		Weekend Peak	0.45	8	120	\$25.51	1.56	1.58	1.67	1.67	1.47	1.66	1.92		\$38,190,10	\$38,631.60	\$40.949.50		
R S T C C C C C C C C C	R		Weekend Off Peak	0.15	16	120	\$24.80	0.52	0.53	0.56	0.56	0.49	0.55	0.64		\$24,712.70	\$24,998.40	\$26,498.30		
(8) (9) (7) (7) (7) (7) (7) (8)	(8) (9) (10) (1		All periods	N/A	24	365	\$25.70	10	10	10	10	2.38	2.69	3.11			\$2,251,320.00	\$2,251,320.00		•
Satisface Satisf	Start Vear 2		ලි	Œ	(S)	Ē	<u>5</u>	2	(w)	œ.	ε	Ξ	(x)	8		+	\$377,663.21 \$2,251,320.00	\$406,820.70 \$2,251,320.00	\$406,820.70 To	otal for All Day Periods otal for Day Long
Start Veal 7 Start Veal 7 Start Veal 6 Start Veal 7 Start Veal 8 End Veal 7 End	Start Year 2 End Year 1 Start Year 2 End Year 1 Start Year 2 End Year 2 End Year 1 Start Year 1 Start Year 2 Start Year 2 End Year 1 Start Year 2 Start Year 2 Start Year 3 Start Year 3 Start Year 4 Start Year 4 Year 1 Start Year 3 Start Year 4 Year 1 Start Year 3 Start Year 4 Year 1 Start Year 5 Start Ye	7 Annual Travel T	ime Cost for Modelled Ye	ars																
Travel Time Cost Santabar Tarken	Start Vear 2					i														
Travel Time Cost 5372,596.54 5383,162,52 5383,162,52 5472,422,21 Travel Time Cost 5370,175,87 5377,663.21 5377,663.21 5406,620.70 Option	Travel Time Cost \$372,596.54 \$483,162.52 \$483,462.52 \$443,422.21 \$423,422.21 \$423,422.21 Dornimum			Start Year 2	End Year 7	Start Year 8	End Year 14	Start Year 15	_											
Dorninnm	Do minimum		Travel Time Cost	\$372.596.54	\$383.162.52	\$383.162.52	\$423,422,21	\$423.422.21												
Travel Time Cost \$370,175,67 \$377,663.21 \$377,663.21 \$406,820.70	Travel Time Cost Savings		Do-minimum	1000000	10.000		-	-	,											
Midpoint Vear4 Vear11.5 Duration Years Fear4 Vear11.5 Duration Year Fear4 Vear11.5 Duration	Midpoint Vear4 Vear1.5 Vear2.		Travel Time Cost	\$370,175.87	\$377,663.21		\$406,820.70		\$406,820.70											
Duration Years 6 7 7 7 7 7 7 7 7 7	Duration Years 6 7 16		Midpoint	Yea	r.4	Year	r 11.5	Yea	122											
Doc minimum Tric or midgoint S\$77,279.5.5 \$403,292.56	Do-minimum TTC or midpoint S377,879.53 \$403,22.56 \$423,42.2.1		Duration Years	,	2		7	1	9											
Option TC or milpoint	Option TC or midpoint \$573,319.54 \$582,241.95 \$606,820.70 Midpoint Benefits	Do-n	ninimum TTC at midpoint	\$377,8	379.53	\$403,	292.36	\$423,	422.21											
Midpoint Benefits	Midpoint Betre/15		Option TTC at midpoint	\$373,5	919.54	\$392,	241.95	\$406,	820.70											
PV Travel Time Cost Savings	PV Travel Time Cost Savings	×	Midpoint Benefits	16,55	1.99	,117	050.41 n2	S16,¢	3											
_	PV Travel Time Cost Savings																			
		_	Cost Savings																	
[(m1x 6x 0.7416) + (m2x 7x 0.4511) + (m3x 16x 0.1958)] \$104,523.46																				

Project Type Isolated intersection/inter	M peak periods	ection as part of route improvement	improvement									
AMV Inter / P	filon Factors filon Factors filon Factors filon Factors Time per Prime per P											
MID BLOCK OI	filton Factors Time per me periods (hrs/day) 2 2 2 2 2 2 2 2 4 2 2 2 2 2 2 2 2 2 2 2											
Flow Factor 1 1 1 1 1 1 1 1 1	tion Factors Time per me periods (hrs/day)											
Flow Factor 1 1 1 1 1 1 1 1 1	me periods (hrs/day) 2 2 2 2 4 (5)	spoi		4B Traffic Flow Data (veh/hr.	Data (veh/hr)							
1 1 0.25 0.45 0.45 0.45	2 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Days/year	Year 2	Year 8	Year 15	Year 30						
		245	1772	2007	2321		æ					
		245	1042	1181	1365	1365	(a)					
		245	1876	2125	2457		o €					
Peak		120	469	531	614		î a					
periods		120	156	177	205		=					
2000		365	18262	20683	h/day) 23915	23915	(0)					
		E	(n)	2	(w)	×	ā					
Option Traffic Flow MID BLOCK ONLY												
5A Project timings from Annualisation Factors	tion Factors			5B Traffic Flow Data (veh/hr.	Data (veh/hr)							
	Time periods	riods										
Flow Factor	(hrs/day)	Days/year	Year 2	Year 8	Year 15	Year 30						
Weekday AM Peak	2	245	1772	2007	2321		œ :					
Weekday Interpeak	80 6	245	1042	1181	1365		6 7					
. *	12	245	261	295	341	341	· 🙃					
Weekend Peak 0.45	80	120	469	531	614		(e)					
Weekend Off Peak 0.15	16	120	156	177 AADT (ve	205 1/dav)	205	~					
All periods N/A	24	365	18262	20683	23915	5	(g)					
(Q) (R)	(s)	Ê	<u>e</u>	3	(<u>%</u>	×						
6 & 7 Vehicle Speeds and VOC costs - Do-minimum												
About 1 int Documenton	Interval	Hr	10	Speed	0	AL	tf (min/km)	ıf 8000	0.25*rf			
Ancella Fills Foll differens	POTOT	00:00	250	00	OCOT	16.2	25	00.00	20.07			
Isolated intersection/intersection as part of route improvement	in/intersection	as part of route i	mprovement	Mid-block,	Mid-block/mid-block as part of route improvement	t of route impro	vement		400 000 45	(m)/m		
	oA Mean Spec	ia (km/nr)	:		ob iviean speed (km/nr)	ia (km/nr)		;	/A VOC COSt (cents/ km)	(cents/ km)	3	
	rear &	rear 15	rear 30	rear 2	rear &	rear 15	rear 30	rear 2	rears	rear 15		
	74.1	73.3	73.3	79.87	79.83	79.76	79.76	29.14	29.14	29.14		(a)
Weekday PM Peak 75.3	76.5	76.8	98.9	79.87	79.83	79.76	79.76	29.14	29.14	29.14		(a)
	67.1	68.9	68.9	79.99	79.99	79.99	79.99	28.51	28.51	28.77		· ©
	67.1	6.89	68.9	79.98	79.98	79.97	79.97	28.51	28.51	28.77		(e)
Weekend Off Peak 64.6	67.1	68.9	68.9	79.99	79.99	79.99	79.99	28.51	28.51	28.77	28.77	(±)
								1	4:04	4		ò
Isolated intersection/intersection as part of route improvement	n/intersection	as part of route i	mprovement	Mid-block,	5 1	t of route improv	ement		007	1		
	tai i ravei Dista	bc. Iotal Iravel Distance (ven.km/nr)		70	Total Iravel Dista	ince (ven.km/nr)			/B Annual VOC Cost (5/year)	cost (5/year)		
po	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
Weekday AM Peak 1497.4	1762.1	2130.5	2130.5	443	502	580	580	\$213,807.76	\$251,603.21	\$304,205.57	12 5	(a)
Weekday Interpeak 849.2 Weekday PM Peak 1469.7	1729.5	2091.2	2091.2	707	53.1	541	541	\$474,529.50	\$226,404.04	\$681,350.70	\$681,350.70	(a 7:
	249.825	302.075	302.075	65	74	85	85	\$177.948.59	\$209,401.82	\$255,506.51	인덩	G (D
382.14	449.685	543.735	543.735	117	133	154	154	\$104,590.19	\$123,076.99	\$150,175.26	\$150,175.26	(e)
Peak	149.895	181.245	181.245	39	44	51	51	\$69,726.79	\$82,051.32	\$100,116.84	#	Œ.
All periods 2	2	2	2	190	215	249		\$5,115.84	\$5,115.84	\$5,115.84	\$5,115.84	\$5,115.84 (8)

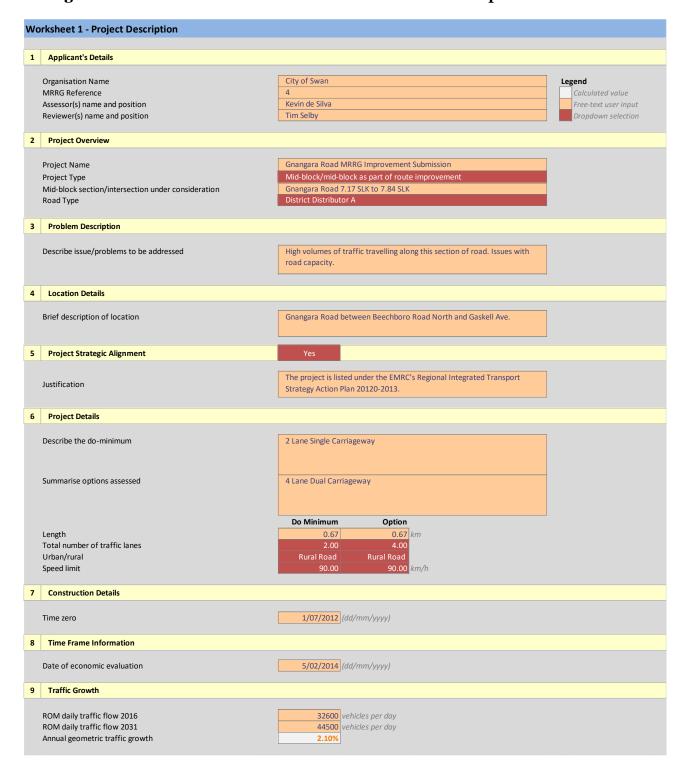
Soluted intersection/intersection as part of route improvement	as part of	0.75	=	0.23			
Solated intersection/intersection as part of route improvement	n Speed (km/hr)		80.00	20.00			
Year 2	n Speed (km/nr) Year 15	ment					
Year 2	\dashv	1		9A VOC COST (cents/ km	(cents/ km)	:	
13.5 14.4 14.4 17.4 17.4 17.4 17.4 17.5		Year 30	Year 2	Year 8	Year 15	Year 30	
1000.2 1		79.94	29.1	29.1	29.1	29.1	(e)
19.3 17.4 17.4 17.5	+	19.97	5.8.5	28.5	28.8	8.82	(a)
64.6 67.1 69.2 69.2 70.4 64.6 67.1 69.2 70.2 64.6 67.1 69.2 70.2 56.6 67.1 69.2 70.2 56.6 67.1 69.2 70.2 56.6 67.1 69.2 70.2 56.6 67.1 69.2 70.2 56.6 67.1 69.2 70.2 56.6 67.1 69.2 70.2 56.6 67.1 69.2 70.2 56.6 67.1 70.2 70.2 56.6 70.2 70.2 56.6 70.2 70.2 56.6 70.2 70.2 56.7 70.2 70.2 56.7 70.2 70.2 56.8 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2 56.8 70.2 70.2	70.00	70.00	1.62	1.62	29.6	29.p	<u></u>
Section Sect		70.00	20.5	20 E	20.0	20.00	(n) (3
Solated intersection/intersection as part of route improvement Scriptal Travel Distance (veh.km/hr) Year 2 Year 8 Year 15 Year 30 Year 15 Year 9 Year 15 Year 9 Year 15 Year 9 Year 15 Year 9 Year 1000.2 Year 1		80.00	28.5	28.5	28.8	28.8	(e)
Isolated intersection/intersection as part of route improvement 8 C Total Travel Distance (veh.km/hr) Year 2 Year 8 Year 15 Year 30 Year 15 Year 15 Year 15 Year 16 Year 16 Year 16 Year 16 Year 16 Year 16 Year 17		79.98	31.2	31.2	31.2	31.2	(g)
Section/Intersection is part of note improvement Section/Intersection is part of note improvement Section/Intersection is part of note improvement Section/Intersection is part of section Section Intersection Section Section Intersection Section Section Intersection Section Intersection Section Intersection Section Intersection Section Intersection Section Inte		1					
Year 2 Year 3 Year 15 Year 30 Year 2 1982 2 1763 2131.7 2131.7 443 1000.2 1209.3 1209.3 261	BCK/IIIIG-BIOCK AS PUTCOJ TOUCE IIII DI OVEN 8D Total Travel Distance (veh km/hr)	nent.		9B Annual VOC Cost (\$/vear)	Cost (\$/vear)		
1498.2 1763 2131.7 2131.7 443 649.9 1000.2 1209.3 1209.3 261	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
449.5 1/03 2.131.7 443 443 443 1209.3 1209.3 261	001	002	00 100 0100	CT 10T 13C	00 250 000	20 250 500	3
049:9 TOOLS TOOLS TOOLS	280	280	\$213,921.99	\$251,731.72	\$304,376.92	\$304,376.92	(e)
2001 E	241	341	\$474,920.72	\$338,907.76	\$502,914.60	\$502,914.50	(a)
60h C.120.2 C.120.2 1.62.1 6.60h1	670	570	#1.100,002¢	\$240,970.94	OT.TCC/COCC	T. Lee, cose	
212.475 250.05 302.325 302.325	32	85	\$178,095.27	\$209,590.41	\$255,717.97	\$255,717.97	(e) (j
382.455 450.09 544.185 544.185	154	154	\$104,676.40	\$123,187.83	\$150,299.54	\$150,299.54	(e)
Weekend UJJ Peak 12/485 156.03 181.395 181.395 39 44	240	51	\$69,784.27	\$82,125.22	\$100,199.70	\$100,199.70 (1)	£ 3
067 6 6 6	243	ı		\$13,003.00	\$13,005.00	\$13,003.00	\$1.3,003.00 (B)
				\$13,665.60	\$13,665.60	\$13,665.60	\$13,665.60 Total for day long
Annual Vehicle Operating Cost for Modelled Years							
Annual Vehicle Operating Cost (\$/year) for modelled years Start Year 2 End Year 7 Start Year 8 End Year 14 Start Year 15 End Year 30	30						
FT 700 5F5 54	1						
minimum (31,789,1948.97) (31,471,486.57) (31,789,948.97) (31,789,948.97) (31,789,948.97)	76.9						
Annual VOC Cost - Option \$1,251,279.79 \$1,472,519.89 \$1,472,519.89 \$1,795,839.88 \$1,795,859.88 \$1,795,859.88	883						
L							
Milipoint rear4 II.5 22 Duration Years 6 7 16							
	1						
Do-minimum VOC at midpoint \$1,360,971.02 \$1,630,717.77 \$1,789,948.97							
Option VOC at midpoint \$1,361,899.84 \$1,634,189.88 \$1,795,859.88							
Midpoint Benefits -\$3.472.12 -\$5.910.92							
m1 m2 m3							
12 DVVahirle Oneration Cret Savinos							



Public Transport		
Effect	Description	Score
Neutral	No expected change on overall public transport performance with no specific new/upgraded public transport infrastructure provided or removed.	0
Justification	There are no bus routes provided along the project route between Beechboro Road North to Dumpelliar Dr	ive and there are
	no improvements suggested for public transport as part of this project.	
Pedestrian Facilities		
Effect	Description	Score
Positive	Demonstrated enhancement of existing pedestrian facilities to assist walking either along or across the road with measures meeting absolute minimum standards set out in appropriate MRWA and Austroads design guides with isolated facilities to meet existing demand. Low to moderate levels of pedestrian activity adjacent to or crossing the road length.	5
Justification	Central Median will provide a refuge for any pedestrians crossing the road	
Cycling Facilities		
Effect	Description	Score
Positive	Low to moderate levels of existing (or expected) cycling activity along a recognised designated existing cycling route or a route denoted as such within a Council's Local Bike Plan. Demonstrated enhancement of existing cycling facilities either along or across the road length under consideration with measures connecting to other facilities and meeting minimum standards set out in	5
Justification	Provision of on-road 1.8m cycle lane along length of road.	
Street Lighting		
		Score 0
Justification	At present there is no street lighting. The proposed intersection will also not have any street lighting. Therefore, change in service level.	fore there is no
Road Safety		
Effect	Description	Score
Positive	The proposed measures and design are intended to minimise the overall number and severity of crashes. A road safety audit has already been undertaken and any concerns have been addressed and mitigated against as part of the design.	6
Justification		
Justification		
Dverall Score		

Wo	rksheet 8 - Overall Score	
1	Present Value (PV) cost of Do-minimum	
		\$35,096.86 A worksheet 2
2	Present Value (PV) cost of Option	
		\$802,196.33 B worksheet 3
3	Unconstrained Benefit values	
	PV travel time cost savings PV VOC and CO2 savings PV Crash cost savings	\$104,523.46 C worksheet 4
4	Ratio of Unconstrained Benefit to Cost	
	PV net unconstrained benefits / PV net costs Score	(W + Y + Z) / (B - A) 0.60 0.60
5	FYRR	
	Discount Factor TTC	{(USPWF30 – USPWF1) + (R x (AGPWF30 – AGPWF1))} 10.76345372 {(USPWF30 – USPWF1) + (R x (AGPWF30 – AGPWF1))} 10.76345372 {(USPWF30 – USPWF1) + (R x (AGPWF30 – AGPWF1))} 10.75216952 [(W+Y)/DF(voc&ttc)+Z/DFcc] x 0.93 / (B - A) 5.21 %
6	Non Tangible Benefit Score	
		10 F worksheet 7
7	Total Score	
		2.95 out of a possible score of 50

Gnangara Road mid-block between Gaskell Avenue and Drumpelliar Drive



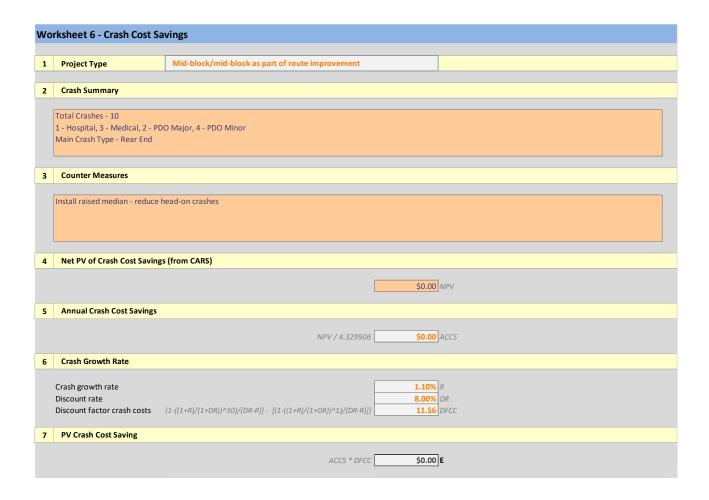
	Road Type		District Distrib	utor A		
	noau Type		District Distrib	utor A		
	PV of annua	I maintenance costs				
	·····	. mantenance costs				
			\$1,437.82	x 11.7023	\$16,825.8	<mark>0</mark> (a)
T	PV of period	ic maintenance costs				
	•	ab treatment measure	40mm SMA ov	verlay		
	ehab treatme				\$21.5	
		area (from SLK to SLK)			4958.0	
R	ehab cost				\$106,597.0	0
	Year	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
		/ 1				21/2
	5	40mm SMA overlay	N/A	\$106,597.00	0.680	N/A
		40mm SMA overlay 40mm SMA overlay	N/A N/A	\$106,597.00 \$106,597.00	0.680	N/A N/A
	5	,				-
	5 10	40mm SMA overlay	N/A	\$106,597.00	0.464	N/A
	5 10 15	40mm SMA overlay 40mm SMA overlay	N/A Yes	\$106,597.00 \$106,597.00	0.464 0.320	N/A \$34,111.04
	5 10 15 20	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A Yes N/A	\$106,597.00 \$106,597.00 \$106,597.00	0.464 0.320 0.210	N/A \$34,111.04 N/A
	5 10 15 20 25 30	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A Yes N/A N/A	\$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00	0.464 0.320 0.210 0.150 0.100	N/A \$34,111.04 N/A N/A \$10,659.70
	5 10 15 20 25 30	40mm SMA overlay	N/A Yes N/A N/A	\$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00	0.464 0.320 0.210 0.150 0.100	N/A \$34,111.04 N/A N/A \$10,659.70
	5 10 15 20 25 30 PV of annua	40mm SMA overlay	N/A Yes N/A N/A	\$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00	0.464 0.320 0.210 0.150 0.100 \$44,770.7	N/A \$34,111.04 N/A N/A \$10,659.70 4 (b)
	5 10 15 20 25 30 PV of annua Luminaire Number of Number of Number of	40mm SMA overlay Type I uminaires within study section days luminaires are lit	N/A Yes N/A N/A	\$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00	0.464 0.320 0.210 0.150 0.100 \$44,770.7	N/A \$34,111.04 N/A N/A \$10,659.70 4 (b)
	5 10 15 20 25 30 PV of annua Luminaire Number of	40mm SMA overlay Type I uminaires within study section days luminaires are lit	N/A Yes N/A N/A	\$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00	0.464 0.320 0.210 0.150 0.100 \$44,770.7	N/A \$34,111.04 N/A N/A \$10,659.70 4 (b)
	5 10 15 20 25 30 PV of annua Luminaire 1 Number of Number of Total opera	40mm SMA overlay Type I uminaires within study section days luminaires are lit	N/A Yes N/A N/A Yes	\$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00 Sum of PV maintenance	0.464 0.320 0.210 0.150 0.100 2 \$44,770.7 ZE02C - 80MV 36 \$0.0	N/A \$34,111.04 N/A N/A \$10,659.70 4 (b)
	5 10 15 20 25 30 PV of annua Luminaire 1 Number of Number of Total opera	40mm SMA overlay Type I luminaires within study section days luminaires are lit ating cost	N/A Yes N/A N/A Yes	\$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00 \$106,597.00	0.464 0.320 0.210 0.150 0.100 2 \$44,770.7 ZE02C - 80MV 36 \$0.0	N/A \$34,111.04 N/A N/A \$10,659.70 4 (b)

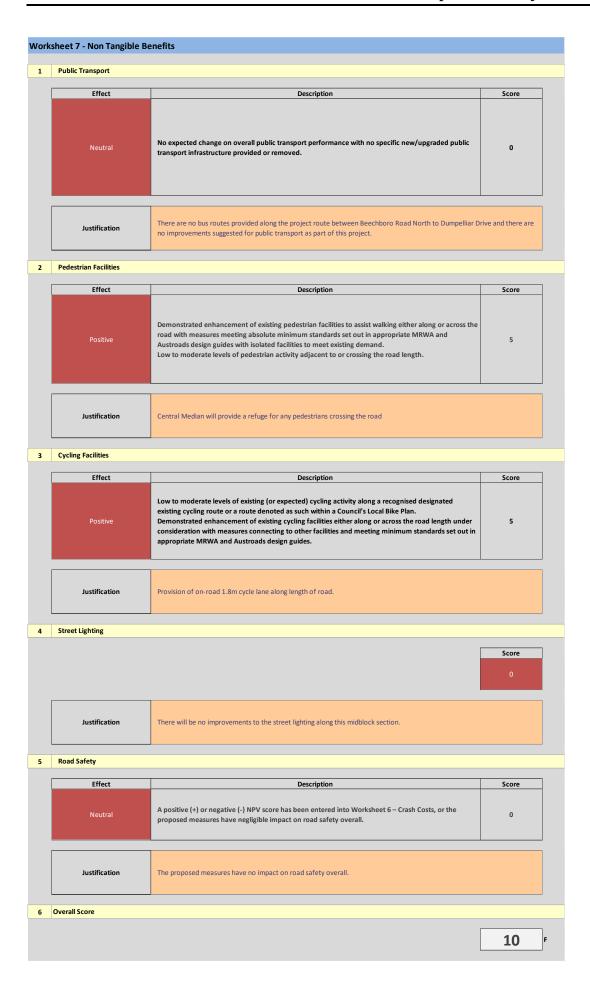
Vor	rksheet 3 -	Cost of the Option				
1	Road Type		District Distrib	utor A		
2	PV of estima	ated cost of proposed work (as per atta	ched estimate sl	heet)		
			\$2,135,022.00	V 0 0350	\$1,976,816.87	۵۱
			\$2,135,022.00	X U.9259	\$1,976,816.87	a)
3	PV of routin	e maintenance costs following comple	tion of the work			
			\$3,108.80	x 10.7398	\$33,387.89	b)
_						
1	PV of maint	enance cost in year 1				
					\$1,437.82	c)
					\$1,437.02	~ ,
5	PV of Option	n periodic maintenance cost				
		ab treatment measure	40mm SMA o	verlay		
	Rehab treatm				\$21.50	
		area (from SLK to SLK)			10720.00 r	n2
	Rehab cost				\$230,480.00	
1		renance will be required in the following		Estimated Cost	CDDW/F	DV
	Year 5	Type of Maintenance 40mm SMA overlay	Required? N/A	\$230,480.00	SPPWF 0.680	PV N/A
	10	40mm SMA overlay	N/A	\$230,480.00	0.464	N/A
	15	40mm SMA overlay	Yes	\$230,480.00	0.320	\$73,753.60
	20	40mm SMA overlay	N/A	\$230,480.00	0.210	N/A
	25	40mm SMA overlay	N/A	\$230,480.00	0.150	N/A
	30	40mm SMA overlay	Yes	\$230,480.00	0.100	\$23,048.00
			Sun	n of PV maintenance	\$96,801.60	d)
				.,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	- ,
;	PV of Annua	al associated operating cost				
	Luminaire	•••			ZE20C - 70ML	
		luminaires within study section days luminaires are lit			365	ınits
	Total oper				\$0.00	iuys
					75.50	
١	PV of annual o	perating costs (separate to maintenanc		1		
		Total	\$0.00	x 10.7398	\$0.00	e)
,	PV total cos	ts of the preferred option				
	111111111111111111111111111111111111111					
				(a) + (b) + (c) + (d) + (e)	\$2,108,444.18 E	3

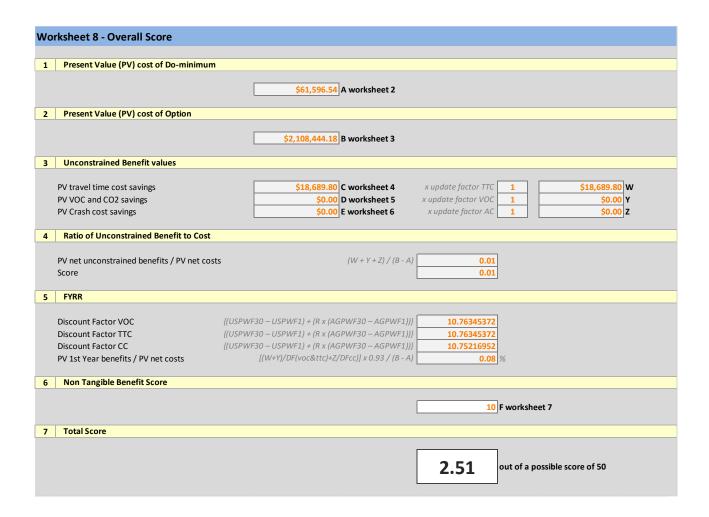
1	Worksheet 4 - Tra	Worksheet 4 - Travel Time Cost Savings	SS																
			District Distril	butor A															
			Mid-block/m	id-block as pa	art of route imp	rovement													
	-	d Type	AM / Inter / P	M peak period	ş														
		ment - Traffic Volumes																	
					DO MINIMU.	Σ					OPTION								
Control Cont			Time Zero (veh/hr)	Year 2	Year 8	Year 15	Year 30		Time Zero (veh/hr)	Year 2	Year 8	Year 15	Year 30						
Part		AM Peak	1941	2023	2291	2650	2650		1941	2023	2291	2650	2650						
Comparison Com		Interpeak PM Peak AADT All periods	1901 1901 17520	1139 1982 18262	2244 20683	2595 23915	2595 23915		1901 17520	1139 1982 18262	2244 20683	2595 23915	2595 23915						
Control Processing Control	-	odelling																	
This provided Part		5A Proje	ect Timings from	Annualisation	. Factors			5B Is olated	ntersection		5C F	Road Midblock I	mprovement			T leverT lendud (ime Cost (\$/vear		
			Flow Factor	Time hours/day	Periods days/vear	+	Vear 2	Aodelling Results	Inputs (veh.hr/hr	Vear 30		elling Results Inp	uts (veh.hr/hr)	Vear 30		Vear	Vear 15		
		Weekday AM Peak	1	nours/ day	_	-	2.43	3.77	14.60	14.60	16.98	19.24	22.28	22.28	\$187,512.94	\$212,510.05	\$246,069.48		(a)
The control of the		Weekday Interpeak	1		245	\$27.01	1.96	2.59	5.22	5.22	16.96	19.21	22.21		Н	\$1,016,843.09	\$1,176,038.89		(9)
Common C		Weekday PM Peak	1	2	245	\$22.30	3.73	6.10	14.59	14.59	16.98	19.24	22.28		+	\$210,247.30	\$243,449.40	\$243,449.40	<u> </u>
Control Cont		Weekend Peak	0.45	8	120	\$22.91	0.88	1.17	2.35	2.35	4.29	4.86	5.62		+	\$119,313.65	\$210,446.09	\$210,446.09	(a)
Figure F		Weekend Off Peak	0.15	16	120	\$24.80	0.29	0.39	0.78	0.78	1.43	1.62	1.87	T	\vdash	\$77,190.70	\$89,256.14	\$89,256.14	€
Copies Modeling Compact Compac		All periods	N/A	24	365	\$25.70	10	10	10	10	6.38	7.22	8.35			\$1,625,699.76	\$1,879,982.17		(8)
Communication Except Ex		đ	(R)	(S)	Ē	2	3	(34)	Ŕ	8	દ	<u> </u>	Š		_	\$1,818,101.04 \$1,625,699.76	\$2,103,229.25 \$1,879,982.17	\$2,103,229.25 \$1,879,982.17	Total for All Day Periods Total for Day Long
Transferred Composition	_	80																	
Time Period Rew Factor InterPeriod InterP		6A Proj	ect Timings from	Annualisation	. Factors			6B Isolated	ntersection		109	Road Midblock	mprovement		19	Annual Travel T	ime Cost (\$/vear		
			1	Time	⊣∡		V	Aodelling Results	Inputs (veh.hr/hr	(-		elling Results Inp	uts (veh.hr/hr)	3		:			
Westing principal 1		Time Period	Flow Factor	hours/day	-	+	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15		Year 2	Year 8		_ 8	3
Weeking Oif-Peek No. 2 2.66 52.20 2.25		Weekday Interpeak	-	4 00	245	\$27.01	2.19	2.58	3.43	3.43	16.95	19.20	22.20		+	\$1,016,294.63	\$1,175,211.33	_ I m	(e)
Weeting Place		Weekday PM Peak	1	2	245	\$22.30	3.23	3.87	5.46	5.46	16.95	19.20	22.21		Н	\$209,848.86	\$242,689.14		: ©
Weeken Office Color Colo		Weekday Off Peak	0.25	12	245	\$22.91	0.55	0.65	0.86	0.86	2.39	2.70	3.12	Н	\vdash	\$181,981.11	\$210,425.42	\$210,425.42	(Đ)
Control Cont		Weekend Peak Weekend Off Peak	0.45	8 4	120	\$25.55	0.99	1.16	1.54	1.54	1.43	1.62	1.87	$^{+}$	+	\$119,293.60	\$137,941.26	\$137,941.26	(e)
Annual Travel Time Cost for Modelled Years Annual Travel Time Cost for Modelled Years Continue Travel Time Cost Continue Time Travel Time Cost Continue Time Trave		All periods	N/A	24	365	\$25.70	10	10	10	10	6.37	7.22	8.35		+	\$1,625,234.93	\$1,879,316.02		(8)
Sant Year 2		(5)	(R)	(s)	E	ĵ)	(3)	(W)	(X)	8	2	(w)	Œ.		-	\$1,816,712.59 \$1,625,234.93	\$2,100,819.39 \$1,879,316.02	\$2,100,819.39	Total for All Day Periods Total for Day Long
Annual Travel Time Cost Start Vear 2 End Vear 7 Start Vear 4 End Vear 14 Start Vear 15 End Vear 15 End Vear 15 End Vear 16 End Vear 16 End Vear 17 End Vear 17 End Vear 19 Start Vear 18 End Vear 14 Start Vear 15 End Vear 19 Start Vear 14 Start Vear 15 Start Vear 14 Start Vear 15 Start Vear	7 Annual Travel Ti	me Cost for Modelled Ye	ears																
Travel Time Cost Start Vear 2 End Year 7 End Year 7 End Year 9 End Year 14 Start Vear 15 End Year 16 End Year 16 End Year 16 End Year 17 End Year 17 End Year 17 End Year 18 End Year 18 End Year 19 End Year				Tleman	- Syol Time Cost	(\$/wear) for mo	adolled vears												
Travel Time Cost S1,604,923;98 \$1,818,101.04 \$1,818,101.04 \$2,103,729,25 \$2,103,729,25 \$2,103,729,25 \$2,103,729,25 \$2,103,729,25 \$2,103,729,25 \$2,103,729,25 \$2,103,729,25 \$2,103,729,25 \$2,103,729,25 \$2,100,819,39 \$2,100,81			Start Year 2	End Year 7	Start Year 8	End Year 14	Start Year 15												
Top-ching		Travel Time Cost	\$1.604.923.98	\$1.818.101.04	1 \$1.818.101.0	4 \$2.103.229.2	5 \$2.103.229.25												
Travel Time Cost Savings		Do-minimum																	
Wear 115 Wear 22 Wear 22 Wear 115 Wear 22 Wear 22 Wear 23 Wear 24 Wear 115 Wear 22 Wear 25 W		Option	\$1,604,000.66	\$1,816,712.5	9 \$1,816,712.5	\$2,100,819.3	\$2,100,819.3	\$2,100,819.39											
Duration National Continuom TTC of midpoint S1,711,512.51 S1,960,665.14 S2,118,329.55		Midpoint	Ye	ar 4	Ye	ar 11.5	Ye	ar 22											
Option TTC of midpoint	Do-m	Duration Years	\$1 711	512 51	\$1.06	7 30 665 14	\$3.10	16											
Midpoint Benefits	TO S	otion TTC at midpoint	\$1,710,	.356.62	\$1,95	38,765.99	\$2,10	1,819.39											
m3 m3 PV Travel Time Cost Savings 1/ m1 x 6 x 0 7416 + / m3 x 16 x 0 1958 1 5 x 8 689.80		Midpoint Benefits	\$1,1\$	55.89	\$1,	899.15		98.601											
PV Travel Time Cost Savings			E	11		m2		ш3											
\$18.689.80	-	Cost Savings																	
			[(m1 x 6 x 0.741	x 2 x 2 m) + (9	.0.4511)+(m	1 x 16 x 0.1958 J	\$18	589.80	U										

						2	T		373 (d)	671 (e)		23915 (g)	<u>×</u>				Year 30		1492 (b)				23915 (g)	×		A tf(min/km) rf 0.25*ff 20.00	tof route improvement	ed (km/hr) 7A VOC Cost (cents/km)	Year15 Year30 Year2 Year8 Year15 Year30	79.68 29.6 29.6 29.6	79.31 29.6 29.6 29.6 29.6 29.6 79.6 29.6	79.99 29.6 29.6 29.6 29.6	79.97 29.6 29.6 29.6 29.6	79.39 79.39 29.6 29.6 29.6 (f) 79.95 79.95 29.6 (g) (g)		nce (veh.km/hr) 7B Annual VOC Cost (\$/year)	Year 30 Year 2	1775 1775 \$196.610.69 \$222.671.22 \$257.472.32 \$257.472.32	1000 \$442,855.19 \$501,555.16 \$579,942.80 \$579,942.80		1739 \$192,558.95 \$218,082.42 \$252,166.34 \$252,166.34	1739 \$192,558.95 \$218,082.42 250 \$166,070.69 \$188,083.18
				Data (veh/hr)	-	Year 15 Year 30			373 373		\$	2.	(x) (w)			· Data (veh/hr)	Year 15 Year 30		1492 1492			4	15 2.	(x) (m)		Q JA 2.3	Mid-block/mid-block as part of route improvement	6B Mean Speed (km/hr)	Year 8 Year 15		+	79.99		79.99 79.99 79.99	mi chica de trans en docta binal.	Mid-block/mid-block as part of route improvement 6D Total Travel Distance (veh.km/hr)	Year 8 Year 15	1535 1775				1504 1739 216 250
				48 Traffic Flow Data (veh/hr)		rears	1290	2244	323	581	AADT (veh/day)	20683	2			5B Traffic Flow Data (veh/hr)	Year 8	2291	1290	323	581	194 22 AADT (veh/dav)	20683	2		Speed 80	Mid-block		Year 2	79.84	79.94	79.99	79.98	79.99	Joseph Priori	ο ο ο ο ο ο ο ο ο ο ο ο ο ο ο ο ο ο ο	Year 2	1356	763		1328	191
tue me	ement					rear 2	1139	1982	285	513	1/1	18262	9				Year 2	2023	1139	1982	513	171	18262	<u>(</u>)		t0 0.7.	te improvement		Year 30	47	55	55	55	55	tromonorani of	re improvement nr)	Year 30	9	9		9	0 6 1.5
of route improve	Mid-block/mid-block as part of route improvement				ē_	Days/year	245	245	245	120	750	365	Ē			periods	Days/year	245	245	245	120	120	365	Ē		Hr 60.00	on as part of route	seed (km/hr)	Year 15	47	55	55	55	47	incase of som	ction as part of route improvement Distance (veh.km/hr)	Year 15	9	9	,	9	0 6 7.5
utor A d-block as part	d-block as part o	AM / Inter / PM peak periods	NLY	alisation Factors	Time periods	(hrs/day)	7 8	2	12	∞ ÷	OT	24	(S)	NLY	alisation Factors	Time	Time periods Days/	(III3/ udy)	∞ (2 21	∞	16	24	(s)		Interval 10.00	ection/intersecti	6A Mean Sp	Year 8	47	47	47	47	47	1 0	se se	Year 8	9	9	3	9	6 1.5
District Distributor A	Mid-block/m	AM / Inter / F	MID BLOCK ONLY	4A Project timings from Annualisation Factors		Flow Factor	- 1	-	0.25	0.45	0.13	N/A	œ	MID BLOCK ONLY	5A Project timings from Annualisation Factors		Flow Factor	1		0.25	0.45	0.15	N/A		imum	# of Lanes	Isolated inters		Year 2	47	47	47	47	47	and interest	Isolatea Intersection/Inter	Year 2	9	9	2	9	6 6 1.5
Road Type Project Type	Project Type	Modelling Period Type	4 Do-minimum Traffic Flow	4A Project tin		lime Period	Weekday AM Peak Weekday Interneak	Weekday PM Peak	Weekday Off Peak	Weekend Peak	weekend off reak	All periods	(g)	Option Traffic Flow	5A Project tin		Time Period	Weekday AM Peak	Weekday Interpeak	Weekday PM Peak Weekday Off Peak	Weekend Peak	Weekend Off Peak	All periods	(a)	6 & 7 Vehicle Speeds and VOC costs - Do-minimum	Akcelik Link Parameters			Year Time period	Weekday AM Peak	Weekday Interpeak	Weekday Off Peak	Weekend Peak	Weekend Off Peak All periods			Year	Weekday AM Peak	Weekday Interpeak	The Control of the Co	Weekday PM Peak	Weekday Off Peak Weekday Off Peak

Akcelik Link Parameters	# of Lanes	Interval	Ŧ	\$	Speed	σ		JA tf (min/km)	Ŧ	0		
	4	10.00	00:09	0.75	80	1850	2.31	1 0.75	80.0			
	Isolated intersection/intersection	ion/intersection	0	is part of route improvement	Mid-block	Mid-block/mid-block as part of route improvement	art of route im	provement				
		8A Mean Spee	eed (km/hr)			8B Mean Speed (km/hr	eed (km/hr)			9A VOC Cos	9A VOC Cost (cents/km)	
Year	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30
Weekday AM Peak	45	45	45	45	79.95	79.94	79.93	79.93	29.6	29.6	29.6	29.6
Weekday Interpeak	45	45	45	45	79.98	79.97	79.97	79.97	29.6	29.6	29.6	
Weekday PM Peak	45	45	45	45	79.95	79.94	79.93	79.93	29.6	29.6	29.6	
Weekday Off Peak	45	45	45	45	66.62	79.99	79.99	79.99	29.6	29.6	29.6	
Weekend Peak	45	45	45	45	79.99	79.99	79.99	79.99	29.6	29.6	29.6	
Weekend Off Peak	45	45	45	45	80.00	80.00	80.00	80.00	29.6	29.6	29.6	
All periods	35	35	35	35	79.98	79.98	79.98	79.98	29.6	29.6	29.6	29.6 (g)
. [
	Isolated intersection/intersection	ion/intersectio	~	as part of route improvement	Mid-block	Mid-block/mid-block as part of route improvement	art of route im	provement				
	8CT	8C Total Travel Dista	tance (veh.km/hr,	D	38	8D Total Travel Distance (veh.km/hr)	tance (veh.km	/hr)		9B Annual VC	9B Annual VOC Cost (\$/year)	
Year	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30
Time period	L	L	L	L	2400	1010			400 000	4		6
Weekaay AM Реак	2	5	2	2	1356	1535	1//5	1//5	\$196,610.69	1		\$257,472.32 (a)
Weekday Interpeak	2	2	5	5	763	865	1000	1000	\$442,855.19			\$579,942.80 (b
Weekday PM Peak	5	5	5	5	1328	1504	1739	1739	\$192,558.95			\$252,166.34 (c
Weekday Off Peak	1.25	1.25	1.25	1.25	191	216	250	250	\$166,070.69	\$188,083.18	\$217,478.55	\$217,478.55 (d
Weekend Peak	2.25	2.25	2.25	2.25	343	389	450	450	\$97,608.90	\$110,546.85	\$127,824.13	\$127,824.13 (e)
Weekend Off Peak	0.75	0.75	0.75	0.75	114	130	150	150	\$65,072.60	\$73,697.90	\$85,216.08	\$85,216.08 (f.
All periods	-2	-22	5	-2-	510	577	899	899	\$1.321.942.20	\$1.497.164.20	\$1.731.154.75	\$1.731.154.75 (2)
									\$1,160,777.01			
Annual Vehicle Operating Cost for Modelled Years	d Years											
L			:									
	ŀ	Annual Venik	cie Operating Co	Annual Vehicle Operating Cost (5/year) for modelled years	delled years							
	Start Year 2	End Year 7	Start Year 8	End Year 14 Start Year 15	Start Year 15	End Year 30						
Annual VOC Cost - Do-	1,160,777.01 \$	1,314,636.73	\$1,314,636.73	\$1,160,777.01 \$1,314,636.73 \$1,314,636.73 \$1,520,100.22 \$1,520,100.22 \$1,520,100.22	\$1,520,100.22	\$1,520,100.22						
Annual VOC Cost - Option \$	\$1,160,777.01 \$1,314,636.73	1,314,636.73		\$1,314,636.73 \$1,520,100.22 \$1,520,100.22 \$1,520,100.22	\$1,520,100.22	\$1,520,100.22						
Midnoint	- Vacov		-	11.6	1							
Duration Years	4		1	7	16							
Cara account					1							
Do-minimum VOC at midpoint	\$1,237,706.87	16.87	\$1,417	\$1,417,368.47	\$1,520,100.22	100.22						
Option VOC at midpoint	\$1,237,706.87	6.87	\$1,417	\$1,417,368.47	\$1,520,	\$1,520,100.22						
Midpoint Benefits	\$0.00		,0\$	\$0.00	\$0.00	00						
	m1		E	m2	m3	3						







Combined Score

MRRG Reference	Total Score
1	31.44
2	2.51
3	2.95
4	2.51

Average Total Score	9.85
Final Score	9.85

The Final Score is the Average Total Score.

11.2 Worked Example 2 – Southern Link Road, Cannington (New Road)

Southern Link Road mid-block – New Link

Wo	orksheet 1 - Project Description		
1	Applicant's Details		
	Organisation Name MRRG Reference Assessor(s) name and position Reviewer(s) name and position	City of Canning 1 Kevin de Silva Tim Selby	Legend Calculated value Free-text user input Dropdown selection
2	Project Overview		
	Project Name Project Type Mid-block section/intersection under consideration Road Type	Southern Link Road Mid-block/mid-block as part of route improvement New Link - Southern Link Road: Liege St to Jameson St District Distributor A	
3	Problem Description		
	Describe issue/problems to be addressed	No direct link from the Grose Ave/Liege St intersection to the Lake St/Jameson St/Gerald St intersection	
4	Location Details		
	Brief description of location	Near Westfield Carousel, Cannington	
5	Project Strategic Alignment	Yes	
	Justification	Reference to the Strategic Community Plan	
6	Project Details		
	Describe the do-minimum	Existing Staggered Route - Lake Street (westbound), Grose Ave (south bound), Grose Ave (eastbound).	
	Summarise options assessed	Proposed Direct Southern Link Road - between intersections Grose Ave/Liege St and Lake St/Jameson St/Gerald St.	
	Length Total number of traffic lanes Urban/rural Speed limit	Do Minimum Option 1.09 0.72 2.00 2.00 Urban Road Urban Road 50.00 60.00	
7	Construction Details		
	Time zero	1/07/2012 (dd/mm/yyyy)	
8	Time Frame Information		
	Date of economic evaluation	5/02/2014 (dd/mm/yyyy)	
9	Traffic Growth		
	ROM daily traffic flow 2016 ROM daily traffic flow 2031 Annual geometric traffic growth	4500 vehicles per day 5300 vehicles per day 1.10%	

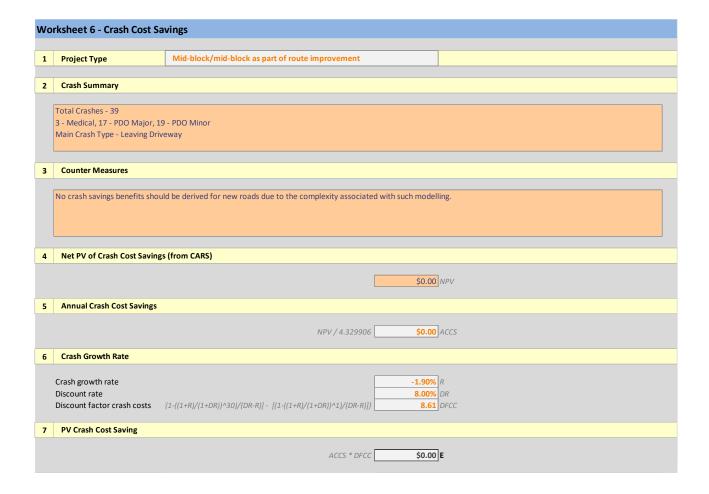
	Road Type		District Distrib	utor A		
	PV of annua	maintenance costs				
			1	1		
			\$27,500.00	x 11.7023	\$321,813.2	<u>25</u> (a)
Ī	PV of period	ic maintenance costs				
_	Proposed Peha	ab treatment measure	40mm SMA ov	vorlav		
	Rehab treatme		4011111 31414 01	veriay	\$21.5	50
		area (from SLK to SLK)			11000.0	_
	Rehab cost	area (morn out to out)			\$236,500.0	
F	Periodic maint	enance will be required in the follow	ing vears:			
		<u>, </u>				1
	Year	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	5	40mm SMA overlay	N/A	\$236,500.00	0.680	N/A
			N/A	\$236,500.00	0.464	N/A
	10	40mm SMA overlay		400C F00 00	0.000	ATT 600 00
	15	40mm SMA overlay	Yes	\$236,500.00	0.320	
	15 20	40mm SMA overlay 40mm SMA overlay	Yes N/A	\$236,500.00	0.210	N/A
	15 20 25	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	Yes N/A N/A	\$236,500.00 \$236,500.00	0.210 0.150	\$75,680.00 N/A N/A
	15 20	40mm SMA overlay 40mm SMA overlay	Yes N/A	\$236,500.00	0.210	N/A N/A
	15 20 25	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	Yes N/A N/A	\$236,500.00 \$236,500.00 \$236,500.00	0.210 0.150 0.100	N/A N/A \$23,650.00
	15 20 25	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	Yes N/A N/A	\$236,500.00 \$236,500.00	0.210 0.150 0.100	N/A N/A \$23,650.00
	15 20 25 30	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	Yes N/A N/A	\$236,500.00 \$236,500.00 \$236,500.00	0.210 0.150 0.100	N/A N/A \$23,650.00
	15 20 25 30	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	Yes N/A N/A	\$236,500.00 \$236,500.00 \$236,500.00	0.210 0.150 0.100	N/A N/A \$23,650.00
	15 20 25 30	40mm SMA overlay	Yes N/A N/A	\$236,500.00 \$236,500.00 \$236,500.00	0.210 0.150 0.100	N/A N/A \$23,650.00
	20 25 30 PV of annua	40mm SMA overlay	Yes N/A N/A	\$236,500.00 \$236,500.00 \$236,500.00	0.210 0.150 0.100 \$99,330.0	N/A N/A \$23,650.00
	20 25 30 PV of annua Luminaire Number of	40mm SMA overlay	Yes N/A N/A	\$236,500.00 \$236,500.00 \$236,500.00	0.210 0.150 0.100 \$99,330.0 ZE07C - 250M	N/A N/A \$23,650.00 (b)
	20 25 30 PV of annua Luminaire Number of	40mm SMA overlay Type 1 uminaires within study section 1 days luminaires are lit	Yes N/A N/A	\$236,500.00 \$236,500.00 \$236,500.00	0.210 0.150 0.100 \$99,330.0	N/A N/A \$23,650.00 (b)
	20 25 30 PV of annual Luminaire 1 Number of Number of Total opera	40mm SMA overlay I associated operating cost Type I luminaires within study section days luminaires are lit ating cost	Yes N/A N/A	\$236,500.00 \$236,500.00 \$236,500.00	0.210 0.150 0.100 \$99,330.0 ZE07C - 250M	N/A N/A \$23,650.00 (b)
	20 25 30 PV of annual Luminaire 1 Number of Number of Total opera	40mm SMA overlay Type 1 uminaires within study section 1 days luminaires are lit	Yes N/A N/A Yes	\$236,500.00 \$236,500.00 \$236,500.00 Sum of PV maintenance	0.210 0.150 0.100 \$99,330.0 ZE07C - 250M 2 36 \$6,112.7	N/A N/A \$23,650.00 (b)
	20 25 30 PV of annual Luminaire 1 Number of Number of Total opera	40mm SMA overlay I associated operating cost Type I luminaires within study section days luminaires are lit ating cost	Yes N/A N/A Yes	\$236,500.00 \$236,500.00 \$236,500.00	0.210 0.150 0.100 \$99,330.0 ZE07C - 250M	N/A N/A \$23,650.00 (b)
	20 25 30 PV of annua Luminaire Number of Number of Total opera	40mm SMA overlay I associated operating cost Type I luminaires within study section days luminaires are lit ating cost	Yes N/A N/A Yes	\$236,500.00 \$236,500.00 \$236,500.00 Sum of PV maintenance	0.210 0.150 0.100 \$99,330.0 ZE07C - 250M 2 36 \$6,112.7	N/A N/A \$23,650.00 (b)

	Road Type		District Distrib	utor A		
T	PV of estima	ated cost of proposed work (as pe	r attached estimate sh	neet)		
						1
			\$800,000.00	x 0.9259	\$740,720.00](a)
I	PV of routin	e maintenance costs following co	mpletion of the work			
			\$20,000.00	x 10 7398	\$214,796.00	(b)
_			\$20,000.00	X 10.7030	V 221)730100	_(~)
	PV of maint	enance cost in year 1				
					\$27,500.00	(c)
_						
	PV of Optio	n periodic maintenance cost				
F	Proposed Reh	ab treatment measure	40mm SMA ov	verlav		1
	Rehab treatm				\$21.50	
	Site treatmen	t area (from SLK to SLK)			8000.00	
_						
F	Rehab cost		owing vegree		\$172,000.00	
F	Rehab cost Periodic main	tenance will be required in the follo		Estimated Cost		-
F	Rehab cost Periodic main Year	tenance will be required in the follo	Required?	Estimated Cost	SPPWF	PV
F	Periodic main Year 5	tenance will be required in the follo Type of Maintenance 40mm SMA overlay	Required?	\$172,000.00	SPPWF 0.680	PV N/A
F	Rehab cost Periodic main Year	tenance will be required in the follo Type of Maintenance 40mm SMA overlay 40mm SMA overlay	Required?	\$172,000.00 \$172,000.00	SPPWF	PV N//
F	Periodic main Year 5 10	Type of Maintenance 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	Required? N/A N/A	\$172,000.00	SPPWF 0.680 0.464	PV N/A N/A \$55,040.00
F	Periodic main Year 5 10 15	tenance will be required in the follo Type of Maintenance 40mm SMA overlay 40mm SMA overlay	Required? N/A N/A Yes	\$172,000.00 \$172,000.00 \$172,000.00	SPPWF 0.680 0.464 0.320	PV N/A N/A \$55,040.00
F	Periodic main Year 5 10 15	Type of Maintenance 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	Required? N/A N/A Yes N/A	\$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00	SPPWF 0.680 0.464 0.320 0.210	PV N/A N/A \$55,040.00 N/A
F	Periodic main Year 5 10 15 20 25	Type of Maintenance 40mm SMA overlay	Required? N/A N/A Yes N/A N/A Yes	\$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00	SPPWF 0.680 0.464 0.320 0.210 0.150	PV N// N// \$55,040.00 N// N// \$17,200.00
F	Periodic main Year 5 10 15 20 25 30	Type of Maintenance 40mm SMA overlay	Required? N/A N/A Yes N/A N/A Yes	\$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00	SPPWF 0.680 0.464 0.320 0.210 0.150 0.100	PV N/A \$55,040.00 N/A N/A \$17,200.00
F	Periodic main Year 5 10 15 20 25 30	Type of Maintenance 40mm SMA overlay	Required? N/A N/A Yes N/A N/A Yes	\$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00	SPPWF 0.680 0.464 0.320 0.210 0.150 0.100	PV N// N// \$55,040.00 N// N// \$17,200.00
F	Periodic main Year 5 10 15 20 25 30 PV of Annua Luminaire	Type of Maintenance 40mm SMA overlay	Required? N/A N/A Yes N/A N/A Yes	\$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00	SPPWF 0.680 0.464 0.320 0.210 0.150 0.100 \$72,240.00	PV N// N// \$55,040.00 N// \$17,200.00
F	Periodic main Year 5 10 15 20 25 30 PV of Annua Luminaire Number of	Type of Maintenance 40mm SMA overlay	Required? N/A N/A Yes N/A N/A Yes	\$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00	SPPWF 0.680 0.464 0.320 0.210 0.150 0.100 \$72,240.00	PV N/A \$55,040.00 N/A \$17,200.00
F	Periodic main Year 5 10 15 20 25 30 PV of Annua Luminaire Number of	Type of Maintenance 40mm SMA overlay Type f luminaires within study section f days luminaires are lit	Required? N/A N/A Yes N/A N/A Yes	\$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00	SPPWF 0.680 0.464 0.320 0.210 0.150 0.100 \$72,240.00	PV N/A N/A \$55,040.00 N/A \$17,200.00 (d)
F	Periodic main Year 5 10 15 20 25 30 PV of Annua Luminaire Number of Number of Total oper	Type of Maintenance 40mm SMA overlay 61 associated operating cost Type 65 Iuminaires within study section of days Iuminaires are literating cost	Required? N/A N/A Yes N/A N/A Yes Sum	\$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00	SPPWF 0.680 0.464 0.320 0.210 0.150 0.100 \$72,240.00	PV N/A N/A \$55,040.00 N/A \$17,200.00 (d)
F	Periodic main Year 5 10 15 20 25 30 PV of Annua Luminaire Number of Number of Total oper	Type of Maintenance 40mm SMA overlay	Required? N/A N/A Yes N/A N/A Yes Sum	\$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00	SPPWF 0.680 0.464 0.320 0.210 0.150 0.100 \$72,240.00	PV N/A \$55,040.00 N/A \$17,200.00
F	Periodic main Year 5 10 15 20 25 30 PV of Annua Luminaire Number of Number of Total oper PV of annual of	Type of Maintenance 40mm SMA overlay	Required? N/A N/A Yes N/A N/A Yes Sum	\$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00 \$172,000.00	SPPWF 0.680 0.464 0.320 0.210 0.150 0.100 \$72,240.00 ZE07C - 250MV 52 365 \$13,244.23	PV N/A \$55,040.00 N/A \$17,200.00 (d)

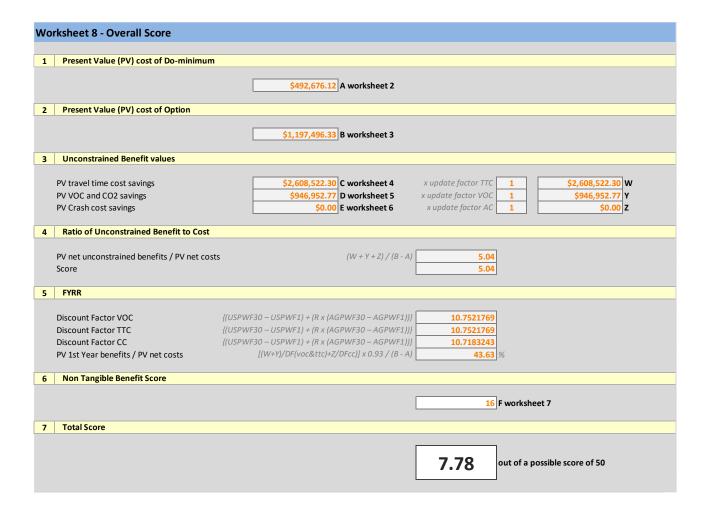
		District																
			Distributor A															
		old-biM	ck/mid-block a	is part of route in	nprovement													
Part																		
Property	-	AM / In	er / PM peak pe	eriods														
Thirty T		Volumes																
Control Cont		Time Ze	L			H		Time Zero		NOLLION								
Part				\dashv	\dashv	_		(veh/hr)	Year 2	Year 8	Year 15	Year 30						
Continue	AMPeak				+	+		291	297	318	343	343						
Particular Par	Interped.				+	+		134	137	146	317	317						
Contact Cont	AADT All per				\parallel			17520	17906	19118	20635	20635						
Column C																		
Control Cont						_												
Property of the property Prop		5A Project Timings	from Annualisa	ation Factors	1		5B Isolate	d Intersection	7	5C	Road Midblock	Improvement		s,	D Annual Travel	Time Cost (\$/yea	ir)	
This continue with the part of the part	Time Deric		hour		\downarrow		Wodeling Resul	S Inputs (ven.nry,	Vear 30		Vear 8	Vear 15			Vear 8	Vear 15		
	Weekdov AM	T	-		-		3.77	14.60	14.60	7.21	7.69	8.30	8.30	\$79.588.51	\$84.973.70	\$91.718.85	\$91.718.85	(a)
This control of the color of	Weekday Inte	peak 1	00	245	\$27.01		2.59	5.22	5.22	7.21	7.69	8.30	8.30	\$381,431.70	\$407,235.79	\$439,555.44	\$439,555.44	(p)
Proceeding Process P	Weekday PM			245	\$22.30		6.10	14.59	14.59	7.21	7.69	8.30	8.30	\$78,741.08	\$84,068.92	\$90,742.25	\$90,742.25	
	Weekday Off			245	\$22.91		0.65	1.31	1.31	0.83	0.89	0.96	96.0	\$55,862.38	\$59,641.10	\$64,373.88	\$64,373.88	П
Comparison Com	Weekend P				\$25.55		1.17	2.35	2.35	1.49	1.59	1.72	1.72	\$36,617.81	\$39,094.83	\$42,197.26	\$42,197.26	(e)
Quien Modelling Fig. Page Pag		_			\$24.80		10	10/8	10	18.09	19 3.1	20.85	20.85	\$23,694.41	\$25,297.16	\$27,304.57	\$27,304.57	
Part					(C)	-	(W)	(X)	(X)	(3)	(w)	(X)	(3)	\$655,935.88	\$700,311.50	\$755,892.24	\$755,892.24	
Thing being Thing														\$4,072,030.25	\$4,347,787.23	\$4,693,242.32	\$4,693,242.32	
The Project Timing From Authorized Project Proje	_																	
Time Ferind Row Poton Interferind Row Poton Interferind Row Poton Interferind Row Poton Interferind Interfer		6A Project Timings	from Annualisa	tion Factors			6B Isolate	d Intersection		109	Road Midblock	Improvement			D Annual Travel	Time Cost (\$/yea	<u>,</u>	
	Time Deric		tor hours/o	day days/yes			Modelling Resul	Vear 15	Vear 30		Vear 8	Vear 15	- 1	Vear 2	Vear 8	Vear 15	Vear 30	
Three-legy House, color 1	WeekdavAM	l	+	+			2.94	3.94	3.94	4.76	5.08	5.49	5.49	\$52,572.23	\$56,129.42	\$60,584.93	\$60,584.93	(a)
Weekboy Mily	Weekday Inte	peak 1	80	245	\$27.01		2.58	3.43	3.43	4.76	5.08	5.48	5.48	\$251,954.88	\$268,999.79	\$290,348.54	\$290,348.54	
Weeting Period	Weekday PM			245	\$22.30		3.87	5.46	5.46	4.76	5.08	5.49	5.49	\$52,012.45	\$55,531.77	\$59,939.84	\$59,939.84	(c)
Weeken Colf Paper Olis See S	Weekday Off			120	\$22.91	+	1.16	0.86	0.86	0.55	1.05	0.63	0.63	\$36,899.92	\$39,395.96	\$42,522.20	\$42,522.20	(g)
Annual Travel Time Cost for Modeled Years	Weekend Off	Peak	<u> </u>	120	\$24.80		0.39	0.51	0.51	0.33	0.35	0.38	Ť	\$15,651.35	\$16,710.05	+	+	
Annual Travel Time Cost for Modeled Years Annual Travel Time Cost for Modeled Years Commitment Travel Time Cost for Modeled Years Start Year Start Year Year Start Year Start Year Start Year Start Year Year	All period				\$25.70		10	10	10	11.95	12.76	13.77		\$2,689,781.45	\$2,871,932.85			
Annual Travel Time Cost for Modelled Years France Time Cost for Modelled Years	(a)	(R)			2	S	(W)	8	3	ŝ	(X)	œ.		\$433,278.75	\$462,591.09		_	
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Do-minimum TTC at midpoint \$678,123.69 \$728,101.87 \$1755,892.24 Option TTC at midpoint \$447,934.92 \$480,948.03 \$499,304.97 Option TTC at midpoint \$447,934.92 \$480,948.03 \$499,304.97 Indipoint Benefits	Duration Ye	ars	9		7		16											
Option TTC or midpoint \$447,934,92 \$460,948.03 \$499,304,97	Do-minimum TTC a	idpoint	678,123.69	\$	728,101.87	\$75	5,892.24											
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PV Travel Time Cost Savings [// mt v & c n 73/16] L / m3 v 7 v n 46ft L / m3 v 46 v n 1660] (2) 200 53 20			m1	ń	247,153.85 m?	\$25	6,587.28 m3											
PV Travel Time Cost Savings [// mt v & c n 73/16 L / m3 v 3 v n deft L / m3 v 4 c n 1 (600)] [
¢2 609 E22 30	9 PV Travel Time Cost Savings																	
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																										Г	T		(a)	<u> </u>	② ③	E E	(8)	Г		3	05 (b)	71 (c)	\$36,920.27 (d)	(e) (c)	(g) 62 (g)	07 PM
																												Year 30	29.2	29.2	29.2	29.2	29.2		Year 30	470 674	\$98,454	\$49,410	\$36,920	\$21,700	\$2.397,174.	VENDERM
																											(cents/km)	Year 15	29.2	29.2	29.2	29.2	29.2	Coet (¢ (year)	Year 15	7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	\$98,454.05	\$49,410.73	\$36,920.27	\$21,700.08	\$2.397.174.62	20.411,150,24
																									0.25*rf 11.25		/A VOC COST	Year 8	29.2	29.2	29.2	29.2	29.2	TB Annual VOC Cost (\$ (wear)	Year 8	00 000	\$49,522.08	\$45,778.14	\$34,205.97	\$20,104.73	\$2.220,939.72	77,720,733.12
																									rf 45.00			Year 2	29.2	29.2	29.2	29.2	29.2		Year 2	400 200 72	\$85.436.87	\$42,877.83	\$32,038.83	\$18,830.98	\$2.080,230.36	22/200/200100
								(a)	<u>(a</u>	(E)	(e)	: 3	(8)					(a)	<u>(a</u>	(G) (S)	(e)	3 3			tf (min/km)	ovement		Year 30	44.99	44.99	45.00	45.00	44.95	ovement	Year 30	220	172	345	43	77	937	100
							Year 30			39		L	(X)				Year 30		317		71	L	(X)		JA 6.72	irt of route impr	ea (km/nr)	Year 15	44.99	44.99	45.00	45.00	44.95	irt of route impr	Year 15	27.0	172	345	43	77	937	100
						Data (veh/hr)	Year 15	343	317	39	71	eh/day)	(w)			Data (veh/hr)	Year 15	343	317	39	71	eh/day)	(w)		Q 1700	Mid-block/mid-block as part of route improvement	ob iviean spe	Year 8	44.99	44.99	45.00	45.00	44.96	Mid-block/mid-block as part of route improvement	Year 8	200	159	320	40	72	868	200
						4B Traffic Flow Data (veh/hr)	Year 8	318	146	37	99	AADT (veh/day)	(X)			5B Traffic Flow Data (veh/hr)	Year 8	318	146	37	66	AADT (veh/day)	(X)		Speed 45	Mid-bloc		Year 2	44.99	44.99	45.00	45.00	44.96	Mid-block	Year 2	200	149	300	37	67	813	040
		ent					Year 2	297	137	34	62	17005	(n)				Year 2	297	137	34	62	A 700 Oct. 1	(n)		t0 1.33	improvement		Year 30	47	47	55	55	47	improvement	Year 30	,	0 9	9	1.5	2.7	2.9	7
		Mid-block/mid-block as part of route improvement				eriods	Days/year	245	245	245	120	200	(E)			eriods	Days/year	245	245	245	120	400	E		Hr 60.00	ction as part of route	ea (km/nr)	Year 15	47	47	55	55	47	on as part of route	Year 15		9	9	1.5	2.7	2	4
	torA	-block as part of	1 peak periods	2		isation Factors Time p	Time periods Days/y (hrs/day)	2	8 2	12	16	200	(S)	۲,	raction Contract	Time p	Time periods Days/	2	88 2	12	8	7 ((s)		Interval 10.00	rse	od mean spe	Year 8	47	47	47	47	47	tion/intersection	Year 8	,	9	9	1.5	2.7	2.9	7
SS	District Distributor A	Mid-block/mid	AM / Inter / PM peak peri	VINO NO IS GIVE	MID BLOCK ON	4A Project timings from Annualisation Factors	Flow Factor	1		0.25	0.45	8170	(R)	MID BLOCK ONLY	EA Desirat their act from Assuralization Eathers	IIIgs IIOIII AIIIIIda	Flow Factor	1	-	0.25	0.45	47.14	(R)	E nu	# of Lanes	Isolated intersection/inte		Year 2	47	47	47	47	47	Isolated intersec	Year 2		9	9	1.5	2.7	0.3	7
Worksheet 5 - VOC and CO2 Cost Savings	9	e du	Modelling Period Type	T aminimum T	m Iramic Flow	4A Project tim	Time Period	Weekday AM Peak	Weekday Interpeak Weekday PM Peak	Weekday Off Peak	Weekend Peak Weekend Off Peak	ab airea IIA	Au periods (Q)	affic Flow	- Andrews	in refer we	Time Period	Weekday AM Peak	Weekday Interpeak Weekday PM Peak	Weekday Off Peak	Weekend Peak Weekend Off Peak	-F-1	(O)	6 & 7 Vehicle Speeds and VOC costs - Do-minimum	Akcelik Link Parameters		Year	Time period	Weekday AM Peak	Weekday PM Peak	Weekday Off Peak	Weekend Off Peak	All periods		Year	Time period	Weekday Interpeak	Weekday PM Peak	Weekday Off Peak	Weekend Peak	weekend Ojj Pedk All periods	control in
Vorksheet 5 -	1 Road Type	2 Project Type	3 Modelling						1					5 Option Traffic Flow				1						8.7 Vehicle Sp					1							1		1				

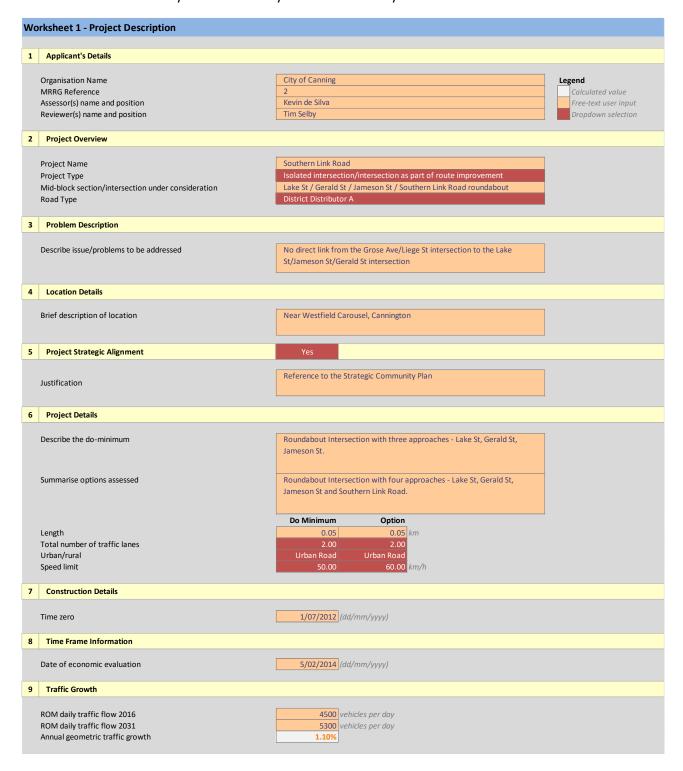
	# of Lanes 10,000	1.33	Speed	c		46 / min // m)					
	Soloted Intersection/Intersection Soloted Intersection/Intersection Soloted Intersection/Intersection Soloted Intersection/Intersection Soloted Intersection/Intersection Soloted Intersection/Intersection Soloted Intersection Soloted Int	1.33		5		(IIIII/NIII)	Έ	0.25*rf			
	Isolated intersection/intersection Sah Mean Sg. Year 2 Year 8 45 45 45 45 45 45 45 45		45	1700	6.72	1.33	42:00	11.25			
	BA Mean Speed (km/hr) Year 2	ovement	Mid-block/mid	-block as part of	route improve	ment					
	45 45 45 45 45 45 45 45 45 45 45 45 45 4		8	B Mean Speed (km/hr)			9A VOC Cost	(cents/km)		
	45 45 45 45 45 45 45 45 45 45 45 45 45 45 45 45 45 45 45 35 35 35				fear 15	Year 30	Year 2	Year 8	Year 15	Year 30	
	45 45 45 45 45 45 45 45 45 45 45 45 45 45 45 35 35 35			44.99	44.99	44.99	29.2	29.2	29.2	29.2	(a)
	45 45 45 45 45 45 45 45 45 45 35 35 35			44.99	44.99	44.99	29.2	29.2	29.2	29.2	(9)
4 4 4 4 4 4 4 4 4 4	45 45 45 45 45 45 45 45 45 45 45 35 35 35 35 35			44.99	44.99	44.99	29.2	29.2	29.2	29.2	(S)
	45 45 45 45 45 45 35 35 35			45.00	45.00	45.00	29.2	29.2	29.2	29.2	<u> </u>
	45 45 45 35 35 35			45.00	45.00	45.00	29.2	29.2	29.2	29.2	(e)
Section Sect	35 35 35			45.00	45.00	45.00	29.2	29.2	29.2	29.2	€
					44.95	44.95	29.2	29.2	29.2	29.2	(g)
	- 13		Paris Lineth Land								
Year	3 3		NIIG-BIOCK/ INIG	-block as part of	(veh.km/hr)	Tient.		OR Annual VOC	Cost (\$/vear)		
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1	5 5 5		214	229	247	247	\$30,639.35	\$32,711.83	\$35,307.57	\$35,307.57	
1.25 1.25 1.25 1.25 1.25 1.25 1.25 2.8	5 5 5		66	105	114	114	\$56,435.36	\$60,252.72	\$65,033.87	\$65,033.87	_
125 125	5 5 5		198	211	228	228	\$28,322.97	\$30,238.77	\$32,638.26	\$32,638.26	
2.25 2.25	1.25 1.25 1.25		25	26	28	28	\$21,163.26	\$22,594.77	\$24,387.70	\$24,387.70	_
0.75 0.75 0.75 0.75 15 15 15 16 17 17 17 18 18 18 18 18	2.25 2.25 2.25		44	47	51	51	\$12,438.81	\$13,280.19	\$14,334.00	\$14,334.00	
Size	0.75 0.75 0.75		15	16	17	17	\$8,292.54	\$8,853.46	\$9,556.00	\$9,556.00	_
Start Year Sta	5 5		537	574	619			\$1,467,042.75	\$1,583,454.80	\$1,583,454.80	
Start Year 2 End Year 1 End Year 1 End Year 2 End Year 2 End Year 3 End Year 3 End Year 3 End Year 3 End Year 4 End Year 1 End Year 3 End Year 3 End Year 4 End Year 5 End Year 5 End Year 6 End Year 6 End Year 7 End Year 7 End Year 9 E			-	-			_	\$167,931.75	\$181,257.39	\$181,257.39	
Start Vear 2						7.		\$1,467,042.75	\$1,583,454.80	\$1,583,454.80	Total for day long
Start Year 2	J Vehicle Operating Cost for Modelled Years										
Signt Year 2 Annual Vehicle Operating Cost (5/yea) for modelled years											
Sient Vear 2 End Year 7 Start Vear 16 End Vear 14 Start Vear 15		year) for modelled	Ì								
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\$83,564.5.1 \$89,722.2.1 m.1 m.2	\$162,612.03	,	\$181,257.39								
m1 m2	\$83,564.51		\$93,146.16								
hicle Operation Cst Savings		Н	m3	П							
	hicle Operation Cost Savings										



Public Transport		
Effect	Description	Score
Neutral	No expected change on overall public transport performance with no specific new/upgraded public transport infrastructure provided or removed.	0
Justification	There are no public transport facilities provided in Southern Link Road. There are no public transport facilitie staggered route.	s on the existing
Pedestrian Facilities		
Effect	Description	Score
Positive	Demonstrated enhancement of existing pedestrian facilities to assist walking either along or across the road with measures meeting absolute minimum standards set out in appropriate MRWA and Austroads design guides with isolated facilities to meet existing demand. Low to moderate levels of pedestrian activity adjacent to or crossing the road length.	5
Justification	Pedestrian access in the area is improved as Southern Link Road will have a footpath along the northern ker connectivity provided to existing footpaths on Grose Avenue and Lake Street	bline with
Cycling Facilities		
Effect	Description	Score
Positive	Low to moderate levels of existing (or expected) cycling activity along a recognised designated existing cycling route or a route denoted as such within a Council's Local Bike Plan. Demonstrated enhancement of existing cycling facilities either along or across the road length under consideration with measures connecting to other facilities and meeting minimum standards set out in appropriate MRWA and Austroads design guides.	5
Justification	1.5m wide bike plans are proposed on both sides of the Southern Link Road.	
Street Lighting		
		Score 0
Justification	The existing alignment has street lighting, however does not meet AS 1158. The proposed Southern Link Roal lighting that meet AS 1158. However, the existing traffic volumes are less than 8000 vpd. As such, no points	
Road Safety		
Effect	Description	Score
Positive	The proposed measures and design are intended to minimise the overall number and severity of crashes. A road safety audit has already been undertaken and any concerns have been addressed and mitigated against as part of the design.	6
Justification	Raised Median has been provided along entire stretch of Southern Link Road as opposed to only certain sec existing staggered route having a raised median.	tions of the
Overall Score		



Southern Link Road / Lake Street / Gerald Street / Jameson Street Intersection



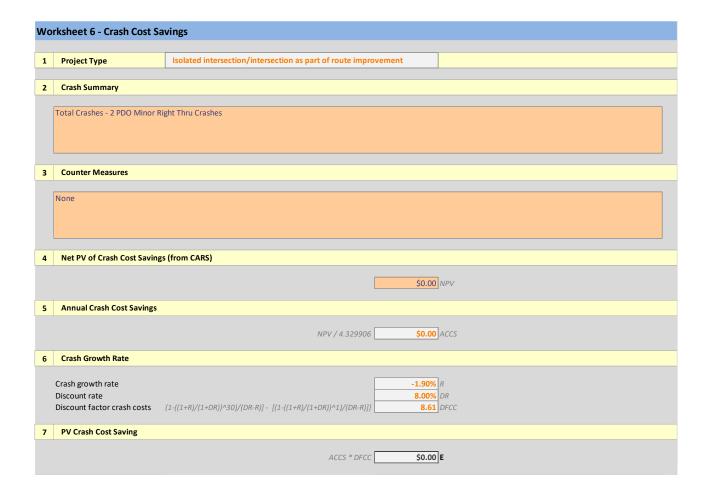
	Road Type		District Distrib	utor A		
			'			'
	PV of annua	I maintenance costs				
			\$500.00	x 11.7023	\$5,851.15	(a)
			\$300.00]× 11.7023	\$3,831.13) (a)
	PV of period	ic maintenance costs				
D	Iranacad Daha	ah traatmant maasura	40mm SMA ov	rowler.		7
	roposeu kena Rehab treatme	ab treatment measure	40mm SiviA 00	reriay	\$21.50	
		area (from SLK to SLK)			200.00	
	Rehab cost	area (Holli SER to SER)			\$4,300.00	_
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				Ţ 1,530.01	
D	Periodic maint	enance will be required in the follo	wing years:			
	criodic maine	chance will be required in the rollo	wing years.			
	Year	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	5	40mm SMA overlay	N/A	\$4,300.00	0.680	N/A
	10	40mm SMA overlay	N/A	\$4,300.00	0.464	N/A
	15	40mm SMA overlay	Yes	\$4,300.00	0.320	\$1,376.00
		40mm SMA overlay	N/A	\$4,300.00	0.210	N/A
	20					N/A
	20	40mm SMA overlay	N/A	\$4,300.00	0.150	
		· · · · · · · · · · · · · · · · · · ·	N/A Yes	\$4,300.00 \$4,300.00	0.150 0.100	\$430.00
	25	40mm SMA overlay	-	\$4,300.00	0.100	\$430.00
	25	40mm SMA overlay	-		0.100	\$430.00
	25	40mm SMA overlay 40mm SMA overlay	-	\$4,300.00	0.100	\$430.00
	25	40mm SMA overlay	-	\$4,300.00	0.100	\$430.00
	25 30 PV of annua	40mm SMA overlay 40mm SMA overlay	-	\$4,300.00	0.100 \$1,806.00	\$430.00 (b)
	25 30 PV of annua	40mm SMA overlay 40mm SMA overlay I associated operating cost	-	\$4,300.00	0.100 \$1,806.00 ZE07C - 250MV	\$430.00 (b)
	25 30 PV of annua Luminaire Number of	40mm SMA overlay 40mm SMA overlay	-	\$4,300.00	0.100 \$1,806.00 ZE07C - 250MV	\$430.00) (b)
	25 30 PV of annua Luminaire Number of	40mm SMA overlay 40mm SMA overlay I associated operating cost Type I luminaires within study section days luminaires are lit	-	\$4,300.00	0.100 \$1,806.00 ZE07C - 250MV	\$430.00 (b) units days
	25 30 PV of annua Luminaire 1 Number of Number of	40mm SMA overlay 40mm SMA overlay I associated operating cost Type I luminaires within study section days luminaires are lit	-	\$4,300.00	0.100 \$1,806.00 ZE07C - 250MV	\$430.00 (b) units days
	PV of annual Luminaire 1 Number of Number of Total opera	40mm SMA overlay 40mm SMA overlay I associated operating cost Type I luminaires within study section days luminaires are lit	-	\$4,300.00	0.100 \$1,806.00 ZE07C - 250MV	\$430.00 (b) units days
	PV of annual Luminaire 1 Number of Number of Total opera	40mm SMA overlay 40mm SMA overlay I associated operating cost Type I luminaires within study section days luminaires are lit ating cost	Yes	\$4,300.00	0.100 \$1,806.00 ZE07C - 250MV	\$430.00 (b) units days
	PV of annual Luminaire 1 Number of Number of Total opera	40mm SMA overlay 40mm SMA overlay I associated operating cost Type I luminaires within study section days luminaires are lit ating cost	Yes	\$4,300.00 Sum of PV maintenance	0.100 \$1,806.00 ZE07C - 250MV	\$430.00 (b) units days
	PV of annual Luminaire Number of Number of Total operation	40mm SMA overlay 40mm SMA overlay I associated operating cost Type I luminaires within study section days luminaires are lit ating cost	Yes	\$4,300.00 Sum of PV maintenance	0.100 \$1,806.00 ZE07C - 250MV	\$430.00 (b) units days
	PV of annual Luminaire Number of Number of Total operation	40mm SMA overlay 40mm SMA overlay I associated operating cost Type I luminaires within study section days luminaires are lit ating cost operating cost	Yes	\$4,300.00 Sum of PV maintenance	0.100 \$1,806.00 ZE07C - 250MV	\$430.00 (b) units days (c)

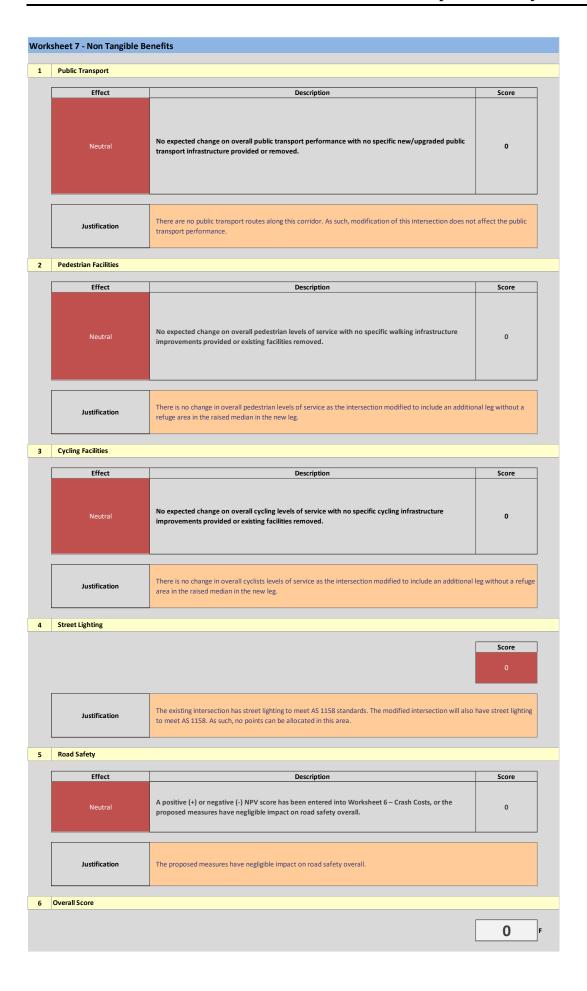
Wo	rksheet 3 -	Cost of the Option				
1	Road Type		District Distrib	utor A		
	I					
2	PV of estima	ated cost of proposed work (as per atta	ched estimate sl	neet)		
			\$1,000,000.00	V 0 0250	\$925,900.00 (2)
			\$1,000,000.00	X 0.9259	\$925,900.00	a)
3	PV of routin	e maintenance costs following comple	tion of the work			
			\$500.00	x 10.7398	\$5,369.90	b)
	D) (() ()					
4	PV of maint	enance cost in year 1				
					\$500.00 (c)
					,	,
5	PV of Optio	n periodic maintenance cost				
		ab treatment measure	40mm SMA or	verlay	424.50	
	Rehab treatm	ent cost t area (from SLK to SLK)			\$21.50 200.00 r	m?
	Rehab cost	talea (IIOIII SEK to SEK)			\$4,300.00	112
	Year	tenance will be required in the following Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	5	40mm SMA overlay	N/A	\$4,300.00	0.680	N/A
	10	40mm SMA overlay	N/A	\$4,300.00	0.464	N/A
	15	40mm SMA overlay	Yes	\$4,300.00	0.320	\$1,376.00
	20	40mm SMA overlay	N/A	\$4,300.00	0.210	N/A
	30	40mm SMA overlay 40mm SMA overlay	N/A Yes	\$4,300.00 \$4,300.00	0.150 0.100	N/A \$430.00
	30	40IIIII SIWA OVEIIAY	les	34,300.00	0.100	3430.00
			Sun	n of PV maintenance	\$1,806.00	d)
	I					
6	PV of Annua	al associated operating cost				
	Luminaire	Tyne			ZE07C - 250MV	
		f luminaires within study section				ınits
		f days luminaires are lit			365	lays
	Total oper	ating cost			\$1,273.48	
	DV of annual of	operating costs (separate to maintenanc	e costs)			
	r v Oi alliludi (operating costs (separate to maintenanc Total		x 10.7398	\$13,676.95	e)
7	PV total cos	ts of the preferred option				
				(a) + (b) + (c) + (d) + (e)	\$047.252.05	
				(u) + (b) + (c) + (a) + (c)	7 3347,252.85	

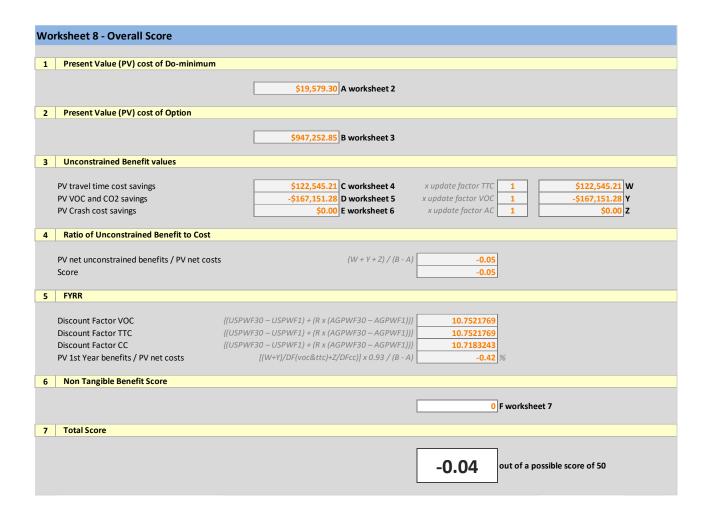
Worksheet 4 - T	Worksheet 4 - Travel Time Cost Savings	ħ.																	
1 Road Type		District Distributor A	utor A																
2 Project Type		Isolated in ters	ection/interse	ction as part of	Isolated intersection/intersection as part of route improvement	nent													
3 Modelling Period Type	riod Type	AM / Inter / PM peak periods	A peak periods																
4 Midblock Ass	4 Midblock Assessment - Traffic Volumes			MIMIMIM						NOITAG									
		Time Zero	Year 2	Year 8	Year 15	Year 30		Time Zero	Year 2	Year 8	Year 15	Year 30							
L	AM Peak	(veh/hr) 291	297	318	343	343		(veh/hr) 291	297	318	343	343							
	Interpeak	134	137	146	158	158		134	137	146	158	158							
	PM Peak AADT All periods	269 17520	275	294	20635	317		269	275	294	317	317							
5 Do-minimum Modelling	Modelling																		
	5A Proje	5A Project Timings from Annualisation Factors	Annualisation	Factors			5B Isolated Intersection	tersection		35	5C Road Midblock Improvement	Improvement							
			Time	Time Periods	ЭЩ	Mo	Modelling Results Inputs (veh.hr/hr)	iputs (veh.hr/h			delling Results In	puts (veh.hr/hr)			D Annual Travel	5D Annual Iravel Iime Cost (\$/year		Ī	
	Time Period	Flow Factor hours/day days/year	hours/day	days/year	\$/HR	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	3	
	Weekday Interpeak	-	v 00	245	\$22.34	2.03	2.19	2.43	2.43	0.33	0.35	0.38		\$107.467.39	\$115.937.72	\$128.643.23	\$128.643.23	æ æ	
	Weekday PM Peak	1	2	245	\$22.30	2.41	2.60	3.02	3.02	0.33	0.35	0.38		\$26,334.07	\$28,410.20	\$32,999.54	⊬		
	Weekday Off Peak	0.25	12	245	\$22.91	0.51	0.55	0.61	0.61	0.04	0.04	0.04	0.04	\$34,182.87	\$36,877.08	\$40,918.41	Н	(P)	
	Weekend Peak	0.45	∞	120	\$25.55	0.91	66.0	1.09	1.09	0.07	0.07	0.08		\$22,406.33	\$24,172.34	\$26,821.37	\$26,821.37	(e)	
<u> </u>	Weekend Off Peak	0.15	16	120	\$24.80	0.30	0.33	0.36	0.36	0.02	0.02	0.03	0.03	\$14,499.07	\$15,641.86	\$17,356.03	\$17,356.03	€ 3	
, i	Au perioas (0)	(R)	(S)	COS E	07.674	2 2	(M)	2 8	2 2	5.03	(W)	(X)		\$228,966.95	\$2,251,320.00	\$275,675,43	Н	(g) Total for All Day Periods	
	Į.													\$2,251,320.00	\$2,251,320.00	\$2,251,320.00	0,	Total for Day Long	
6 Option Modelling	lling																		
	6A Proje	6A Project Timings from Annualisation Factors	Annualisation	Factors			6B Isolated Intersection	tersection		99	6C Road Midblock Improvement	Improvement		9	D Annual Travel	6D Annual Travel Time Cost (\$/year)	ar)		
	Time Deriod	Flow Factor	hours/day	day days/year	3/HB	Vear 2	Voor 8 Voor 15	year 15	Voor 30	Voor 2	Voor 8	Voor 15	Voor 30	Vear	Vest	Voor 15	Vear 30		
	Weekday AM Peak	1	nours/ uay		\$22.54	1.80	1.94	2.19	2.19	0.33	0.35	0.38	0.38	\$19,880.28	\$21,426.52	\$24,187.67	\$24,187.67	(a)	
	Weekday Interpeak	1	8	245	\$27.01	1.93	2.08	2.32	2.32	0.33	0.35	0.38	0.38	\$102,173.43	\$110,114.37	\$122,819.87	\$122,819.87	(<u>a</u>)	
	Weekday PM Peak	-	2	245	\$22.30	2.59	2.83	3.30	3.30	0.33	0.35	0.38	0.38	\$28,300.93	\$30,923.41	\$36,059.10	\$36,059.10	(c)	
	Weekday Off Peak	0.25	12	120	\$22.91	0.48	0.52	0.58	1.04	0.04	0.04	0.04	0.04	\$32,498.98	\$35,024.81	\$39,066.13	\$39,066.13	(P) (3)	
	Weekend Off Peak	0.15	16	120	\$24.80	0.29	0.31	0.35	0.35	0.02	0.02	0.03	0.03	\$13,784.83	\$14,856.19	\$16,570.37	\$16,570.37	£ £	
99	Allperiods	N/A	24	365	\$25.70	10	10	10	10	0.83	0.89	0.96		\$2,251,320.00	\$2,251,320.00	\$2,251,320.00	\$2,251,320.00	(8)	
	(ō)	(R)	(s)	Ê	ĵ)	2	(w)	€	Ξ	Σ	(w)	(X)		\$217,941.02 \$2,251,320.00	\$235,303.51 <i>\$2,251,320.00</i>	\$264,310.38 \$2,251,320.00	-	\$224,310.38 Total for All Day Periods \$2,251,320.00 Total for Day Long	
7 Annual Trave	7 Annual Travel Time Cost for Modelled Years	ars																	
		Ctart Voar 2	Annual Tra	vel Time Cost (Annual Travel Time Cost (\$/year) for modelled years	telled years	End Voor 20												
	Travel Time Cost				2 100 100	27 100 100													
	Do-minimum	\$228,966.95	\$246,994.02		\$475,675.43	\$246,994.02	\$475,075.43												
	Travel Time Cost	\$217,941.02 \$235,303.51	\$235,303.51		\$235,303.51 \$264,310.38	\$264,310.	38 \$264,310.38												
	Midnoint	Vear	.4	Vear	Vear 11.5	Vear 22	.22												
	Duration Years	9			7	16	8												
Di	Do-minimum TTC at midpoint	\$237,980.48	80.48	\$261,	\$261,334.72	\$275,6	\$275,675.43												
[Option TTC at midpoint	\$226,6	22.26	\$249,	806.94	\$264,3	310.38												
∞	Midpoint Benefits	\$11,358	58.22	\$11,5	.,527.78 m2	\$11,365	365.05												
9 PV Travel Tim	PV Travel Time Cost Savings																		
					100000000000000000000000000000000000000														
		(mixbxu.7+	b)+(mzx/x	0.4511) + (1115.	X 10 X U. 1936 / J	\$122,545.21	245.21 C												

Worksheet 5 - VOC and CO2 Cost Savings	Så												
1 Road Type	District Distributor A	utor A											
2 Project Type	Isolated inters	ection/intersect	Isolated intersection/intersection as part of route improvement	ite improvement									
3 Modelling Period Type	AM / Inter / PI	AM / Inter / PM peak periods											
4 Do-minimum Traffic How	MID BLOCK ONLY	ALY											
4A Project ti	4A Project timings from Annualisation Factors	lisation Factors	actors		4B Traffic Flow Data (veh/hr.	Data (veh/hr)							
Time Period	Flow Factor	Time periods (hrs/dav)	Days/year	Year 2	Year 8	Year 15	Year 30						
Weekday AM Peak	1	2	245	297	318	343		(a)					
Weekday Interpeak Weekday PM Peak		8 2	245	275	146	317	317	(c)					
Weekday Off Peak	0.25	12	245	34	37	39		(P)					
Weekend Peak Weekend Off Peak	0.45	16	120	62	99	71		(e)					
All socionals	N/A	24	336	17005	AADT (W	sh/day)	30636						
(a)	(R)	(S)	(E)	(n)	(V)	(w)	(X)	(8)					
S Option Traffic Flow	MID BLOCK ONLY	A.											
5A Project ti	5A Project timings from Annualisation Factors	alisation Factors Time periods	reiods		5B Traffic Flow Data (veh/hr,	Data (veh/hr)							
Time Period	Flow Factor	Time periods	Days/year	Year 2	Year 8	Year 15	Year 30						
Weekday AM Peak		(hrs/day)		297	318	343		(a)					
		. 00	245	137	146	158		(a)					
Weekday PM Peak Weekday Off Peak	0.25	2 12	245	275	294	317	317	(c)					
Weekend Peak	0.45	∞	120	62	99	7.1		(e)					
Weekend Off Peak	0.15	16	120	21	22 AADT (ve	24 eh/day)	24	<u>(£)</u>					
All periods	N/A	24	365	17906	19118	20635	20635	(g)					
6.8.7 Vehicle Speeds and VOC costs - Do-minimum		2	3				3						
780													
Akcelik Link Parameters	# of Lanes	Interval 10.00	Hr 60.00	1.33	Speed 45	Q 1700	JA 6.72	tf (min/km) .72 1.33	rf 45.00	0.25*rf 11.25			
	Isolated intersection/intersectio	ction/intersectio	on as part of rout	n as part of route improvement	Mid-block	Mid-block/mid-block as part of route improvement	art of route impr	ovement		7A VOC Cost (cents /km)	(cente/km)		
Year	Year 2	Year 8		Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
Ime period Weekday AM Peak	38	37.9	37.8	37.8	44.99	44.99	44.99	44.99	30.01	30.01	30.01		
Weekday Interpeak	38	37.9	37.8	37.8	44.99	44.99	44.99	44.99	30.01	30.01	30.01	30.01 (b)	
Weekday Off Peak	38	37.9	37.8	37.8	45.00	45.00	45.00	45.00	30.01	30.01	30.01		
Weekend Peak	88	37.9	37.8	37.8	45.00	45.00	45.00	45.00	30.01	30.01	30.01		
Weekend UJT Peak All periods	38	47	47	47	44.96	45.00	44.95	45.00	29.2	29.2	29.7		
	Isolated interse	ction/intersectic	Isolated intersection/intersection as part of route improvement	e improvement	Mid-block	/mid-block	as part of route impro	mprovement					
Year	9	Total Travel Dr	stance (ven.km/)	(Ju		101	tance (ven.km/ nr			/B Annual VOC Cost (\$/year)	Cost (\$/year)		
Time period	real 2	rear o	Tear 13	26 Par	reur z	o inai	CT IDAL	75'U 30	Teal 2	rear o	CT JP31	rear 30	
Weekday Ann Peak Weekday Interpeak	355.1	379.2	413.5	426.5	7	7	8	8	\$208,868.40			\$243,716.4	
Weekday PM Peak	418.7	447.1	482.6	482.6	14	15	16	16	\$61,569.42			\$73,779.8	
Weekday Off Peak Weekend Peak	159.795	170.64	103.375	103.375	2 3	2 2	2	2	\$78,325.65			\$91,207.1	
Weekend Off Peak	53.265	26.88	62.025	62.025	1	1	1	1	\$30,690.87			\$35,738.3	
All periods	2	2	2	2	37	40	43	43	\$5,115.84			\$5,115.8	I for All Day again de
									\$5,115.84	\$5,115.84	\$5,115.84	\$5,115.8	Total for day long

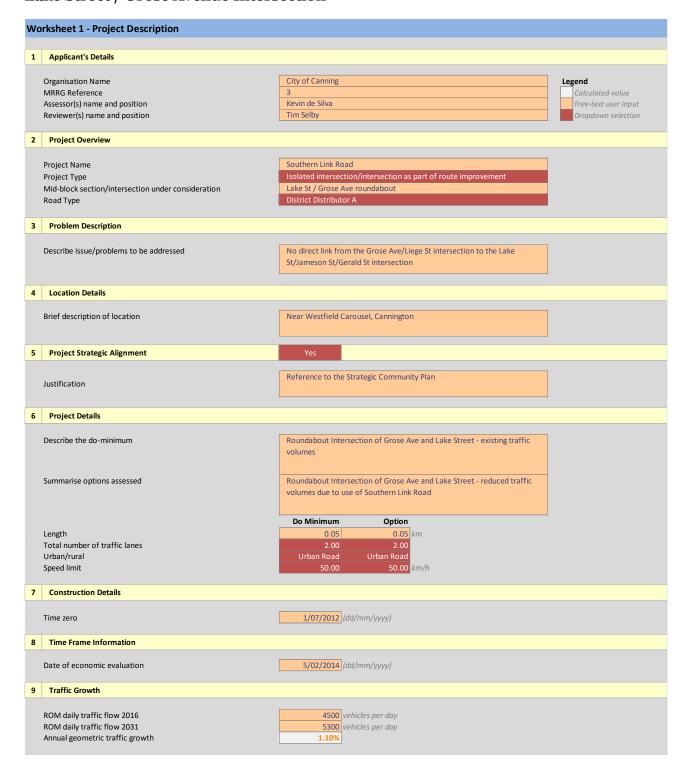
9A VC Year Year Year Year Year Year Year Year	1700 6.72 Mid-block/mid-block as part of route improves 8 Mean Speed (km/hr) Year 2 Year 8 Year 15	tf (min/km) rf	0.25*rf	
1972 1972	block/mid-block as part of route improver 8B Mean Speed (km/hr) Year 8	1.33 45.00	11.25	
	8 Mean Speed (km/hr) Year 8 Year 15			Γ
	Year 8 Year 15		_	<u> </u>
184 185		Year 2		
1884 882 882 44599 45599 44599 4	44.99 44.99		30.0	(a)
17.0 17.0	44.99 44.99		30.0	(2)
38.4 38.2 38.2 45.00 45.00 45.00 45.00 30.0 30.0 38.4 38.2 38.2 45.00 45.00 45.00 45.00 30.0 30.0 38.4 38.2 38.2 45.00 45.00 45.00 45.00 30.0 38.4 38.2 38.2 45.00 45.00 45.00 45.00 30.0 38.4 38.2 38.2 45.00 45.00 45.00 45.00 30.0 38.4 38.2 38.2 45.00 45.00 45.00 45.00 45.00 38.4 38.2 38.2 45.00 45.00 45.00 45.00 45.00 38.4 38.2 38.2 45.00 45.00 45.00 45.00 38.4 38.2 45.00 45.00 45.00 45.00 45.00 38.4 38.2 45.00 45.00 45.00 45.00 38.4 38.2 45.00 45.00 45.00 38.4 38.2 45.00 45.00 38.4 38.2 45.00 45.00 38.4 48.5 49.5 49.5 49.5 38.4 48.5 49.5 49.5 49.5 38.5 49.5 49.5 49.5 49.5 38.5 49.5 49.5 49.5 38.5 49.5 49.5 49.5 38.5 49.5 49.5 49.5 38.5 49.5 49.5 38.5 49.5 49.5 38.5 49.5 49.5 38.5 49.5 49.5 38.5 49.5 49.5 38.5 49.5 49.5 38.5 49.5 49.5 38.5 49.5 49.5 39.5 49.5 49.5 39.5 49.5 49.5 39.5 49.5 49.5 39.5 49.5 49.5 39.5 49.5 49.5 39.5 49.5 49.5 39.5 49.5 49.5 39.5 49.5 49.5 39.5 49.5 49.5 39.5 49.5 49.5 39.5 49.5 39.5 49.5 49.5 39.5	44.99 44.99		30.0	©
18.64 18.62 18.6	45.00 45.00		30.0	©
18.4 28.4 28.2 28.2 29.2 29.0	45.00 45.00		30.0	(e)
Note Part	44.96 44.95			E 8
String Transmit				
Near 8 Near 15 Near 2	Mid-block/mid-block as part of route improvement 8D Total Travel Distance (veh. km/hr)	86	4nnual VOC Cost (\$/year)	Г
385.4 429.4 429.4 15 15 17 17 17 17 17 17	Year 8 Year 15	Year 2	Year 8 Year 15 Year 30	
5 3945.6 424.9 15 15 17 37,322.9 6 3545.6 424.9 425.5 428.5				
State	16 17	\$54,334.61	\$62,481.12	.12 (a)
13 15 15 15 15 15 15 15	2 8	\$212,279.94	\$252,571.36 \$	
\$ 96.58 107.35 107.35 2 2 2 2 2 579.6043 886.0043 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	15 16	\$66,863.18	\$78,465.35	
Second Control Contr	2 2	\$79,604.98	\$94,714.26	
S S S S S S S S S S	3 4	\$46,788.23	\$55,668.79	
S S S S S S S S S S	1 1	\$31,192.15	\$37,112.53	
Annual Vehicle Operating Cost 5/40 and for modelled years	40 43	\$13,665.60	\$13,665.60	(8)
ar 2 End Year 7 Start Year 8 End Year 15 End Year 15 End Year 30 1.11 \$\$12,596.91 \$\$12,596.91 \$\$560,268.25 \$\$\$560,268.25 \$\$\$560,268.25 \$\$\$\$560,268.25 \$\$\$\$560,268.25 \$\$\$\$\$560,268.25 \$\$\$\$\$560,268.25 \$\$\$\$\$\$560,268.25 \$\$\$\$\$\$\$560,268.25 \$			\$581,013.41	\$581,013.41 Total for All Day periods
AnnualVehicle Operating Cost (\$f/rear) for modelled years ar 2 End Year 7 Start Year 8 End Year 14 Start Year 15				
Start Year 2 End Year 7 Start Year 8 End Year 14 Start Year 15				
Start Vear 2 End Vear 7 Start Vear 8 End Vear 14 Start Vear 15	delled years			
\$480,031.11 \$512,596.91 \$550,268.25 \$560,268.25 \$560,268.25 \$560,268.25 \$550,268.25 \$550,268.25 \$550,03.41 \$531,03.				
\$491,063.08 \$524,391.74 \$524,391.74 \$581,013.41 \$581,013.41 \$581,013.41 \$581,013.41 \$581,013.41 \$581,013.41 \$581,013.41 \$580,013.41 \$580,013.41 \$580,013.41 \$582,702.57 \$580,013.41 \$581,013.41 \$582,702.57 \$580,013.41 \$581,013.41 \$582,702.57 \$720,74 \$720,7				
Year 4 11.5 22				
Year 4				
\$496,314.01 \$536,432.58 \$530,727.41 \$552,702.57 \$511,413.40 -\$16,270.00	22			
\$496,314.01 \$536,421.58 \$507,727.41 \$552,702.57 -\$11,413.40 -\$16,720.00	16			
\$550,727.41 \$552,702.57 \$11,413.40 \$15,000 \$11,413.40 \$	\$560,268.25			
-\$11,413.40 -\$16,270.00 m1 m2	\$581,013.41			
m2	-\$20,745.16			
	m3			







Lake Street / Grose Avenue Intersection



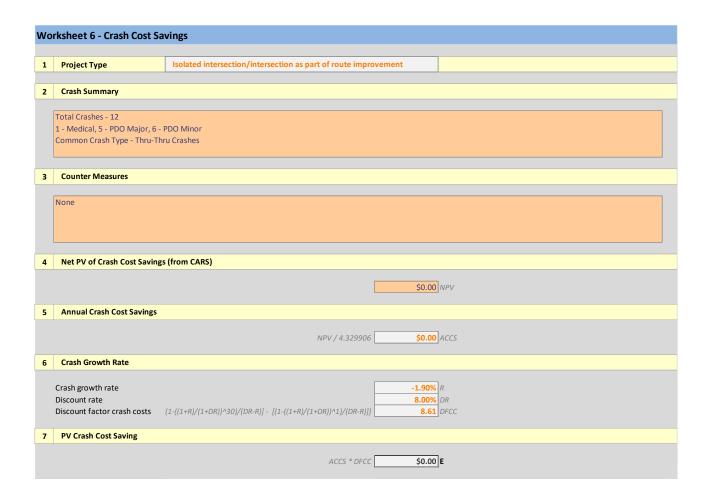
	Road Type		District Distrib	utor A		
	PV of annual	l maintenance costs				
			\$500.00	x 11.7023	\$5,851.15	(a)
_				1		
	PV of period	ic maintenance costs				
-	Pronosed Reha	ab treatment measure	40mm SMA ov	verlav]
	Rehab treatme		40111111 011111 0	renay	\$21.50	
		area (from SLK to SLK)			200.00	
	Rehab cost	,			\$4,300.00	-
F	eriodic maint	enance will be required in the follow	ing years:			
		·	- T			
	Year	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	5	40mm SMA overlay	N/A	\$4,300.00	0.680	N/A
	10	40mm SMA overlay	N/A	\$4,300.00	0.464	N/A
	15	40mm SMA overlay	Yes	\$4,300.00	0.320	\$1,376.00
	20	40mm SMA overlay	N/A	\$4,300.00	0.210	N/A
	25	40mm SMA overlay	N/A	\$4,300.00	0.150	N/A
	30	40mm SMA overlay	Yes	\$4,300.00	0.100	\$430.00
	PV of annual	associated operating cost		Sum of PV maintenance	\$1,806.00	(b)
	Lunain aina '	T			ZE07C - 250MV	
	Luminaire 1	luminaires within study section				units
		days luminaires are lit				days
	Total opera	•			\$1,018.79	
	Total oper	ating 503t			71,010.73	
	PV of total	operating cost				
			\$1.018.79	x 11.7023	\$11,922.15	(c)
			7-/-20170		,,-	_,,
;	PV total Do-r	minimum maintenance costs				

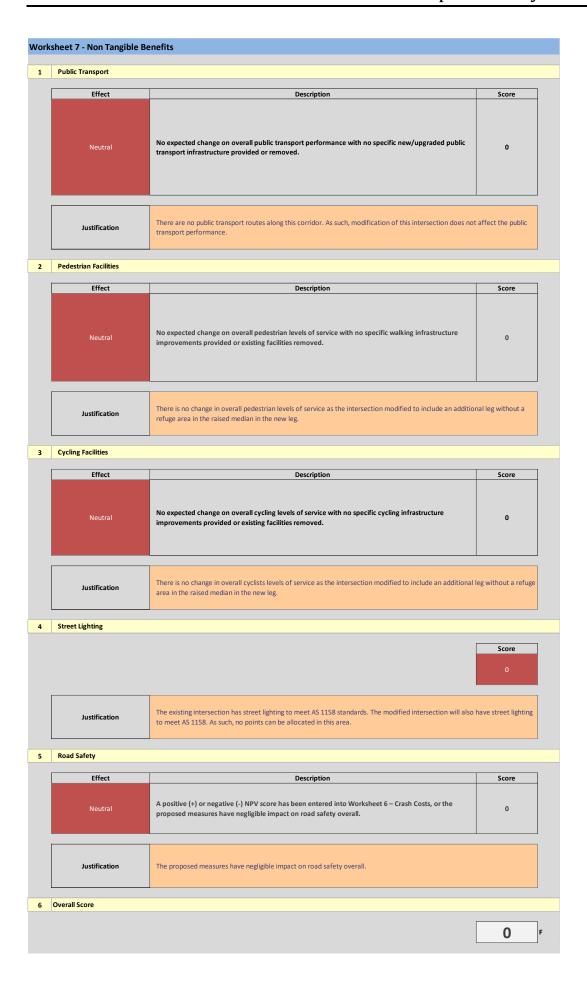
Wo	rksheet 3 -	Cost of the Option				
1	Road Type		District Distrib	utor A		
	ı					
2	PV of estima	ated cost of proposed work (as per atta	ached estimate s	heet)		
				1		
			\$1,000,000.00	x 0.9259	\$925,900.00	(a)
-	DV of routin	a maintananca casta fallouing comple	tion of the work			
3	PV 01 TOULIN	e maintenance costs following comple	tion of the work			
			\$500.00	x 10.7398	\$5,369.90	(b)
			φ300.00	X 10.7000	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	1~)
4	PV of maint	enance cost in year 1				
	I					
					\$500.00	(c)
5	PV of Option	n periodic maintenance cost				
		ab treatment measure	40mm SMA or	verlay	631.50	
	Rehab treatment	ent cost t area (from SLK to SLK)			\$ 21.50	m?
	Rehab cost	talea (IIOIII SEK to SEK)			\$4,300.00	112
	richab cost				\$4,300.00	
	Periodic main	tenance will be required in the following	; years:			
	Year	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	5	40mm SMA overlay	N/A	\$4,300.00	0.680	N/A
	10	40mm SMA overlay	N/A	\$4,300.00	0.464	N/A
	15	40mm SMA overlay	Yes	\$4,300.00	0.320	\$1,376.00
	20	40mm SMA overlay	N/A	\$4,300.00	0.210	N/A
	25	40mm SMA overlay	N/A	\$4,300.00	0.150	N/A
	30	40mm SMA overlay	Yes	\$4,300.00	0.100	\$430.00
			Sun	n of PV maintenance	\$1,806.00	(d)
				.,	. , , , , , , , , , , , , , , , , , , ,	, - ,
6	PV of Annua	al associated operating cost				
		· -				
	Luminaire	Туре			ZE07C - 250MV	
	Number of	f luminaires within study section			4	units
		f days luminaires are lit			365	days
	Total oper	ating cost			\$1,018.79	
	D) / of a		\			
	PV of annual o	perating costs (separate to maintenanc Total		v 10 7208	\$10,941.56	(a)
		Total	\$1,018.79	X 10.7390	\$10,941.56	(e)
7	PV total cos	ts of the preferred option				
	total cos	to the presented option				
				(a) + (b) + (c) + (d) + (e)	\$944.517.46	В
				(=) - (=) - (=) - (=)	75.1,527.10	

			Worksheet 4 - Travel Time Cost Savings	SB																
			1 Road Type	District Distril	outor A															
Part	Part		2 Project Type	Isolated inte	section/interse	ction as part of	route improve	ment												
Part	Property continuent Dec. Property Pr	Proper parameter; Unit Property Proper	3 Modelling Period Type	AM / Inter / F	M peak periods															
	Part	Triangle	4 Midblock Assessment - Traffic Volumes																	
Part	Continue	Part		Time Zero		DO MINIMUM	L			Time Zero		OPTION								
Continue	Part	Control Cont		(veh/hr)	Year 2	Year 8	Year 15	Year 30		(veh/hr)	Year 2	Year 8	Year 15	Year 30						
		Participation Participatio	AM Peak	291	297	318	343	343		291	297	318	343	343						
Particular Par	Particular Par	Province	Interpeak PM Peak	269	275	294	317	317		134	275	294	317	317						
Particular Par	Company Notice Comp	Continue Notable Continue No	AADT All periods	17520	17906	19118	20635	20635		17520	17906	19118	20635	20635						
The Property The		The part of the	5 Do-minimum Modelling																	
Third Fine Part P	This properate Parce Par	This provided by Company This provided by Co	SAPro	ject Timings from	Annualisation	Factors			5B Isolated I	ntersection		25	Road Midblock	Improvement						
Part	Particle	Thirtie Feed Control			Time	eriods	ΣĖ	Mo	delling Results I	nputs (veh.hr/h	-	Mo	delling Results Ir	puts (veh.hr/hr)			5D Annual Travel	Time Cost (\$/yea	£	
Participation Participatio			Time Period	Flow Factor	hours/day	days/year	\$/HR	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15		;
Participal Participa			Weekday AM Peak		2 0	245	\$22.54	1.73	1.87	2.10	2.10	0.33	0.35	0.38	0.38	\$19,107.16	\$20,653.40	\$23,193.66		(a)
Particular Par			Weekday Interpeak		∞ r	245	\$27.01	1.99	2.16	2.44	2.44	0.33	0.35	0.38	0.38	\$105,349.80	\$114,349.54	\$129,172.62	\$129,172.62	(a) (3
Particular Par			Weekday rw reak	0.25	12	245	\$22.91	0.50	3.04	0.61	0.61	0.03	0.04	0.30	0.30	\$33,509,31	\$36,371.92	\$30,001.30	\$41.086.79	2 3
		Protect of the color	Weekend Peak	0.45		120	\$25.55	0.90	0.97	1.10	1.10	0.07	0.07	0.08	0.08	\$21,964.82	\$23,841.22	\$26,931.74	\$26,931.74	(e)
Part	Mail	Figure F		0.15	16	120	\$24.80	0.30	0.32	0.37	0.37	0.02	0.02	0.03	0.03	\$14,213.38	\$15,427.58	Н	\$17,427.46	€
Column C	Control Modelling Cont	Comparison Com	SE All periods	N/A	24	365	\$25.70	10	10	10	10	0.83	0.89	96.0	96.0	\$2,251,320.00	\$2,251,320.00	\dashv	\$2,251,320.00	(8)
Chical Modelling Chic	Part	Part	(a)	<u>R</u>	(s)	Ê	2	2	(w)	ŝ	ε	2	(<u>w</u>	<u>S</u>	ε	\$224,521.53	\$2,251,320.00	\$276,493.86	\$2,251,320.00	Total for All Day Periods Total for Day Long
Transference Annual Francisco Annual Francisc	Figure F	Control Cont																		
Time Field Flow Facts Flo	Time Period How factor Ho	Time Period	6A P ro	ject Timings from	Annualisation	Factors			6B Isolated I	ntersection)9	Road Midblock	Improvement			lour Thursd Co	Timo Coet It has		
	Time Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine Fine	Time Continue Co		-	Time	eriods) E		delling Results I	nputs (veh.hr/h	-	Mo	delling Results Ir	puts (veh.hr/hr)				illie cost (4) year		
Weeking Miles 1	With Early Mile With Early		Time Period	Flow Factor	hours/day	days/year	\$/HR	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15		
Weedlog Pin Pin Strategic Pin Pin Strategic Pin Pin Strategic Pin			Weekday AM Peak		2 0	245	\$22.54	1.17	1.26	1.42	1.42	0.33	0.35	0.38	0.38	\$12,922.18	\$13,916.20	\$15,683.33		(e)
			Weekday Merpeak	4 44	9	245	\$27.01	1.82	1.97	2.24	2.24	0.33	0.35	0.38	0.38	\$19.887.14	\$21.526.19	\$24.476.48		(a)
Figure Continue			Weekday Off Peak	0.25	12	245	\$22.91	0.41	0.45	0.50	0.50	0.04	0.04	0.04	0.04	\$27,784.10	\$30,141.54	\$33,846.09		<u> </u>
Weekend Off Pole No. 1	Weeken of Front Weeken of	Weeking of Peorle Week	Weekend Peak	0.45	œ	120	\$25.55	0.74	0.81	0.90	06:0	0.07	0.07	0.08	0.08	\$18,212.04	\$19,757.30	\$22,185.58		(e)
AnnualTravel Time Cost for Modelled Years AnnualTravel Time Cost for Modelled Years Travel Time Cost for Year of	Annual Tave Tine Cost for Modelled Years Annual Tave Tine Cost for Modelled Years Trave Tine Cost for Years Trave Tine Years Trave Tine Years Trave Tine Years Trave Tin	Columbia Cost for Modellied Years		0.15	16	120	\$24.80	0.25	0.27	0.30	0.30	0.02	0.02	0.03	0.03	\$11,784.96	\$12,784.90	\$14,356.22	\$14,356.22	€:
(F)	(i) (i) (ii) (ii) (ii) (iii) (ii	(F)	_	N/A	24	365	\$25.70	10	10	10	10	0.83	0.89	0.96	96.0	\$2,251,320.00	\$2,251,320.00	\$2,251,320.00	\$2,251,320.00	(8)
Start Vear 2	Start Vear 2 End Vear 7 Start Vear 8 End Vear 14 Start Vear 15 Start Vear 17 Start Vear 17 Start Vear 17 Start S	Start Year 2 End Year 7 Start Near 8 End Year 15 2224,521.53 \$243,861.73 \$243,861.73 \$726,493.86 \$726,493.86 \$177,940.76 \$192,888.01 \$192,888.01 \$216,965.30 \$7216,956.30 Vear 4 Year 11.5 Year 16 \$224,191.63 \$726,903.17 \$0 \$224,191.63 \$726,903.17 \$0 \$224,191.63 \$726,903.17 \$0 \$226,772.55 \$44.30 \$7216,903.17 \$0 \$226,772.55 \$726,903.17 \$7216,903.18 \$7216,903.18 \$226,772.55 \$7216,903.17 \$7216,903.18 \$226,772.55 \$7216,903.17 \$7216,903.18 \$226,772.55 \$7216,903.17 \$7216,903.18 \$226,772.55 \$7216,903.18	ĝ	<u>8</u>	(s)	Ē	<u>S</u>	2	<u>(</u>)	S	ε	2	<u>§</u>	8	ε	\$2,251,320.00	\$192,888.01	\$2,251,320.00	\$2,251,320.00	Total for All Day Periods Total for Day Long
Start Year 2 End Year 7 Start Year 4 Start Year 15 Trave! Time Cost \$124,521.53 \$243,861.73 \$243,861.73 \$243,661.73 \$246,995.80 Trave! Time Cost \$177,940.76 \$192,888.01 \$192,888.01 \$216,956.30 \$216,956.30 Option Trave! Time Cost \$177,940.76 \$192,888.01 \$192,888.01 \$216,956.30 \$216,956.30 Option Trave! Time Cost \$177,240.76 \$192,888.01 \$216,956.30 \$216,956.30 Option Trave! Time Cost \$234,191.63 \$236,177.80 Option Trave! Time Cost \$234,191.63 \$236,177.80 Option Trave! Time Cost \$388,419.63 \$236,927.80 Option Trave! Time Cost \$388,419.63 \$236,927.80 Option Trave! Time Cost \$388,419.63 \$326,927.80 Option Trave! Time Cost \$386,419.80 \$326,92	Start Year 2 End Year 7 Start Year 4 Start Year 1	Travel Time Cost Start Vear 2 End Vear 3 Start Year 4 Start Vear 4 Start Vear 4 Start Vear 5 Start Vear 5 Start Vear 6 Start Vear 14 Start Vear 15 Start Vear 15 Start Vear 15 Start Vear 16 Start Vear 17 Sta	Annual Travel Time Cost for Modelled Y.	ears																
Trave Time Cost Start Year 2 Amilia Irave III Trave Cost Start Year 3 Start Year 4 Start Year 5 Start Year 5 Start Year 6 Start Year 6 Start Year 6 Start Year 1 Start Year 1 Start Year 6 Start Year 7 Start Year 6 Sta	Start Vear 2	Travel Time Cost Savings				i		1												
Travel Time Cost Start Feet 2 First Feet 2 First Feet 2 First Feet 2	Trave Time Cost Sant tear 2 Sant tear 2 Sant tear 3	Travel Time Cost State Service State Ser		C.test Vees	Annual Tra	ivel Time Cost (5/year) for mod	delled years	C											
Travel Time Cost Savings S122,888.01 S192,888.01 S192,8	Travel Time Cost Savings	Travel Time Cost Savings Travel Time Cost Sa	Transl Time Cort	Statt real 2	Fild real /	o lear o			Ella real 30											
Travel Time Cost \$177,940.76 \$192,888.01 \$192,888.01 \$516,956.30 \$716,956.	Travel Time Cost \$177,940.76 \$192,888.01 \$192,888.01 \$216,956.30 \$216,956.	Travel Time Cost \$177,940.76 \$192,888.01 \$192,888.01 \$216,956.30 \$216,956.	Do-minimum	\$224,521.53	\$243,861.73	\$243,861.73			\$276,493.86											
Option	Midpoint State S	Option	Travel Time Cost	2000		2000000	000000	00 0000	000000											
Midpoint Year4 Year11.5	Nideoint Vear4 Vear11.5	Nulpoint Year1.1.5	Option	\$177,940.76		\$192,888.01	\$216,956.30	\$216,956.30	\$216,956.30											
Duration Years S185,414.39 \$264,922.15	Description TC of midgoint \$128,191.63 \$260,177.80	De-minimum Tra minimum	Midpoint	Ye	ar 4	Year	11.5	Yea	122											
Do-minmun Til Cit midgoint S224,131.83 S264,922.15 Open Til Cit midgoint S124,131.83 S26,922.15 Open Til Cit midgoint S126,443.9 S26,255.64 Open Til Cit midgoint S46,777.25 S52,555.64 Open Til Cit midgoint S46,777.25 S52,555.64 Open Til midgoint S46,777.25 S72,555.64 Open Til midgoint S46,777.25 S72,555.64 Open Til midgoint S46,777.25 S72,575.64 Open Til midgoint S72,575.64 Open Til midgoin	Do-minmun Tit Cit midpoint \$224,191.63 \$260,171.80	Do-minmun Till Cit mingpoint \$224,114.33 \$7.80,717.80	Duration Years				7	1												
Cuproint 1. Common Subs. And. 32 Subs. A	Commission Com	Coprofit 1. Cot mapping	211	\$234,	191.63	\$260,	177.80	\$276,	93.86											
Midpoint Benefits \$48,777.25 \$55,255.64 \$359, PV Travel Time Cost Savings	Midpoint Benefits \$48,777.25 \$55,255.64 \$559, PV Travel Time Cost Savings	Midpoint Benefits	5	\$185,	14.39	\$204,	922.15	\$216,	56.30											
PV Travel Time Cost Savings	PV Travel Time Cost Savings	PV Travel Time Cost Savings ((m1 x 6 x 0.7416) + (m2 x 7 x 0.4511) + (m3 x 16 x 0.1958)]]	748,7	11.25	7,556	25.64	2,825	37.36											
ш		PV Travel Time Cost Savings [(m1 x 6 x 0.7416) + (m2 x 7 x 0.4511) + (m3 x 16 x 0.1958)]																		
			9 PV Travel Time Cost Savings																	
$[(m1 \times 6 \times 0.7416) + (m2 \times 7 \times 0.4511) + (m3 \times 16 \times 0.1958)]$ \$578,039.25 C																				

1 Road Type	District Distributor A	utorA											
2 Project Type	Isolated inters	Isolated intersection/intersect	tion as part of route improvement:	te improvement									
3 Modelling Period Type	AM / Inter / P	AM / Inter / PM peak periods											
4 Do-minimum Traffic Flow	MID BLOCK ONLY	NLY											
4A Pro	4A Project timings from Annualisation Factors	alisation Factors	S		4B Traffic Flow Data (veh/hr)	Data (veh/hr)							
Time Period	Flow Factor	אוע	Days/year	Year 2	Year 8	Year 15	Year 30						
Weekday AM Peal		(nrs/day)	245	297	318	343	343	(a)					
Weekday Interpeak	1 1	œ (245	137	146	158	158	(a)					
Weekday PM Pea Weekday Off Pea	+	2 21	245	275	294	317	317	(c)					
Weekend Peak	0.45	80	120	62	99	71	71	(e)					
Weekend Off Peak		16	120	21	22	24	24	(£)					
All periods (Q)	N/A (R)	24	365	17906	19118 (V)	20635 (W)	20635 (X)	(g)					
;													
5 Option Traffic Flow	MID BLOCK ONLY	NLY											
5A Pro	5A Project timings from Annualisation Factor	alisation Factors			58 Traffic Flow Data (veh/hr.	Data (veh/hr)							
	_	Time	periods		and a second sec	(()							
Time Period	Flow Factor	Time periods (hrs/day)	Days/year	Year 2	Year 8	Year 15	Year 30						
Weekday AM Peak	k 1	2	245	297	318	343	343	(a)					
Weekday Interpeak	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	8 2	245	137	146	317	317	(a)					
Weekday Off Peak		12	245	34	37	39	39	(p)					
Weekend Peak Weekend Off Pea	0.45	8 16	120	62	99	71	71	(e)					
					AADT (W	:h/day)							
All periods (Q)	N/A (R)	24 (S)	365 (T)	17906 (U)	19118 (V)	20635 (w)	20635 (X)	(8)					
6 & 7 Vehicle Speeds and VOC costs - Do-minimum	Jo-minimum												
	# of Lanes	Interval	主	to	Speed	σ	Al	tf (min/km)	£	0.25*rf			
Akcelik Link Parameters	meters	10.00	90.00	1.33	45	1/00	7/'9	1.33	45.00	11.25			
	Isolated interse	ction/intersecti	Isolated intersection / Intersection as part of route improvement	e improvement	Mid-block	Mid-block/mid-block as part of route improvement	art of route impr	ovement		7A VOC Cost (conts/km)	(conts/km)		
Year	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
Time period Weekday AM Peak		37	36.8	36.8	44.99	44.99	44.99	44.99	31.2	31.2	31.2		
Weekday Interpeak		36.2	36	36	44.99	44.99	44.99	44.99	31.2	31.2	31.2		. 6
Weekday PM Peal	35.3	35.1	34.7	34.7	44.99	44.99	44.99	44.99	31.2	31.2	31.2		© 3
Weekuy Ojj reu Weekend Peak		36.2	36	36	45.00	45.00	45.00	45.00	31.2	31.2	31.2	31.2	3 a
Weekend Off Peal		36.2	36	36	45.00	45.00	45.00	45.00	31.2	31.2	31.2		· c
All periods	47	47	47	47	44.96	44.96	44.95	44.95	29.2	29.2	29.2	29.2	(8
	Isolated interse	ection/intersection	Isolated intersection /intersection as part of route improvement	e improvement	Mid-bloc	k/mid-block as pa	as part of route improv	vement		Joseph John John John John John John John Joh	Coord of Association		
Year		Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year8	Year 15	Year 30	
Weekday AM Peak		292.2	323.2	323.2	15	16	17	17	\$41.827.97		\$49 410.82	\$49.410.5	
Weekday Interpeal	z 283.2	302.4	334.8	334.8	7	7	8	8	\$173,182.46		\$204,736.90	\$204,736.9	î a
Weekday PM Pea		379.3	422.5	422.5	14	15	16	16	\$54,302.98		\$64,591.80	\$64,591.8	<u> </u>
Weekend Peak Weekend Peak		136.08	83.7	83.7	2 8	2 8	2 4	2	\$64,943.42		\$76,776.34	\$76,776.3	-
Weekend Off Peak		45.36	50.22	50.22	1	1	1	1	\$25,447.22	\$27,172.45	\$30,083.79	\$30,083.7	(£)
All periods		2	2	2	37	40	43	43	\$5,115.84		\$5,115.84	\$5,115.8	(8

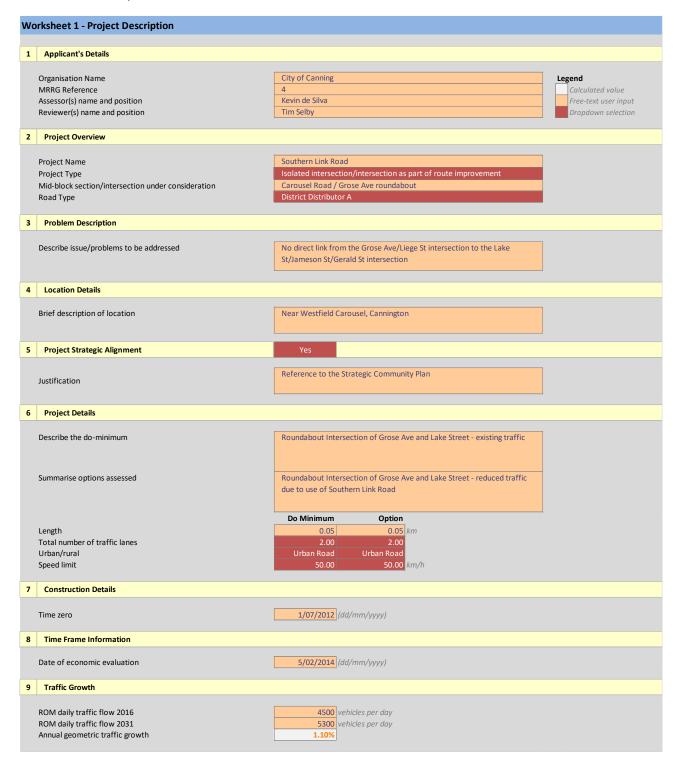
45.00 11.25





Wo	rksheet 8 - Overall Score	
1	Present Value (PV) cost of Do-minimum	
		\$19,579.30 A worksheet 2
2	Present Value (PV) cost of Option	
		\$944,517.46 B worksheet 3
3	Unconstrained Benefit values	
	PV travel time cost savings PV VOC and CO2 savings PV Crash cost savings	\$578,039.25 C worksheet 4 x update factor TTC 1 \$578,039.25 W \$910,209.57 D worksheet 5 x update factor VOC 1 \$910,209.57 Y \$0.00 E worksheet 6 x update factor AC 1 \$0.00 Z
4	Ratio of Unconstrained Benefit to Cost	
	PV net unconstrained benefits / PV net costs Score	(W + Y + Z) / (B - A) 1.61 1.61
5	FYRR	
	Discount Factor TTC	{(USPWF30 - USPWF1) + (R x (AGPWF30 - AGPWF1))} 10.7521769 {(USPWF30 - USPWF1) + (R x (AGPWF30 - AGPWF1))} 10.7521769 {(USPWF30 - USPWF1) + (R x (AGPWF30 - AGPWF1))} 10.7183243 [(W+Y)/DF(voc&ttc)+Z/DFcc)] x 0.93 / (B - A) 13.92 %
6	Non Tangible Benefit Score	
		0 F worksheet 7
7	Total Score	
		1.21 out of a possible score of 50

Grose Avenue / Carousel Road Intersection



	Road Type		District Distrib	utor A		
T	PV of annua	maintenance costs				
			4222.22	1	4= ==	- 1
			\$500.00	x 11.7023	\$5,851.1	5 (a)
Ī	PV of period	ic maintenance costs				
Е	ranged Paha	ab treatment measure	40mm SMA ov	vorlav.		
	ehab treatme		4011111 31VIA 01	renay	\$21.50	0
		area (from SLK to SLK)			200.00	
	ehab cost	area (IIOIII SER to SER)			\$4,300.00	
						_
F	eriodic maint	enance will be required in the follow	ing vears:			
		<u>, </u>				
	Year	Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	5	40mm SMA overlay	N/A	\$4,300.00	0.680	N/A
10 40mm SMA overlay		N/A	\$4,300.00	0.464	N/A	
	15 40mm SMA overlay		Yes	\$4,300.00	0.320	\$1,376.00
		*	NI/A	¢4 300 00	0.210	NI/A
	20	40mm SMA overlay	N/A	\$4,300.00	0.210	_
	20 25	40mm SMA overlay 40mm SMA overlay	N/A	\$4,300.00	0.150	N/A N/A \$430.00
	20	40mm SMA overlay				
	20 25	40mm SMA overlay 40mm SMA overlay	N/A	\$4,300.00 \$4,300.00	0.150 0.100	N/A \$430.00
	20 25	40mm SMA overlay 40mm SMA overlay	N/A	\$4,300.00	0.150 0.100	N/A \$430.00
	20 25 30	40mm SMA overlay 40mm SMA overlay	N/A	\$4,300.00 \$4,300.00	0.150 0.100	N/A \$430.00
	20 25 30	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A	\$4,300.00 \$4,300.00	0.150 0.100	N/A \$430.00
	20 25 30 PV of annua	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay associated operating cost Type	N/A	\$4,300.00 \$4,300.00	0.150 0.100	N/A \$430.00
	20 25 30 PV of annua Luminaire Number of	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 1 associated operating cost Type Iuminaires within study section	N/A	\$4,300.00 \$4,300.00	0.150 0.100 \$1,806.00 ZE07C - 250MV	N/A \$430.00 0 (b)
	20 25 30 PV of annua Luminaire Number of Number of	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay I associated operating cost Type I uminaires within study section days luminaires are lit	N/A	\$4,300.00 \$4,300.00	0.150 0.100 \$1,806.00 ZE07C - 250MV	N/A \$430.00 (b)
	20 25 30 PV of annua Luminaire Number of	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay I associated operating cost Type I uminaires within study section days luminaires are lit	N/A	\$4,300.00 \$4,300.00	0.150 0.100 \$1,806.00 ZE07C - 250MV	N/A \$430.00 (b)
	20 25 30 PV of annua Luminaire 1 Number of Number of Total opera	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 1 associated operating cost Type 1 luminaires within study section 2 days luminaires are lit 2 ating cost	N/A	\$4,300.00 \$4,300.00	0.150 0.100 \$1,806.00 ZE07C - 250MV	N/A \$430.00 (b)
	20 25 30 PV of annua Luminaire 1 Number of Number of Total opera	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay I associated operating cost Type I uminaires within study section days luminaires are lit	N/A Yes	\$4,300.00 \$4,300.00 Sum of PV maintenance	0.150 0.100 \$1,806.00 ZE07C - 250MV 36: \$1,528.1	N/A \$430.00 0 (b)
	20 25 30 PV of annua Luminaire 1 Number of Number of Total opera	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 1 associated operating cost Type 1 luminaires within study section 2 days luminaires are lit 2 ating cost	N/A Yes	\$4,300.00 \$4,300.00	0.150 0.100 \$1,806.00 ZE07C - 250MV	N/A \$430.00 0 (b)
	20 25 30 PV of annua Luminaire Number of Number of Total opera	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 1 associated operating cost Type 1 luminaires within study section 2 days luminaires are lit 2 ating cost	N/A Yes	\$4,300.00 \$4,300.00 Sum of PV maintenance	0.150 0.100 \$1,806.00 ZE07C - 250MV 36: \$1,528.1	N/A \$430.00 0 (b)

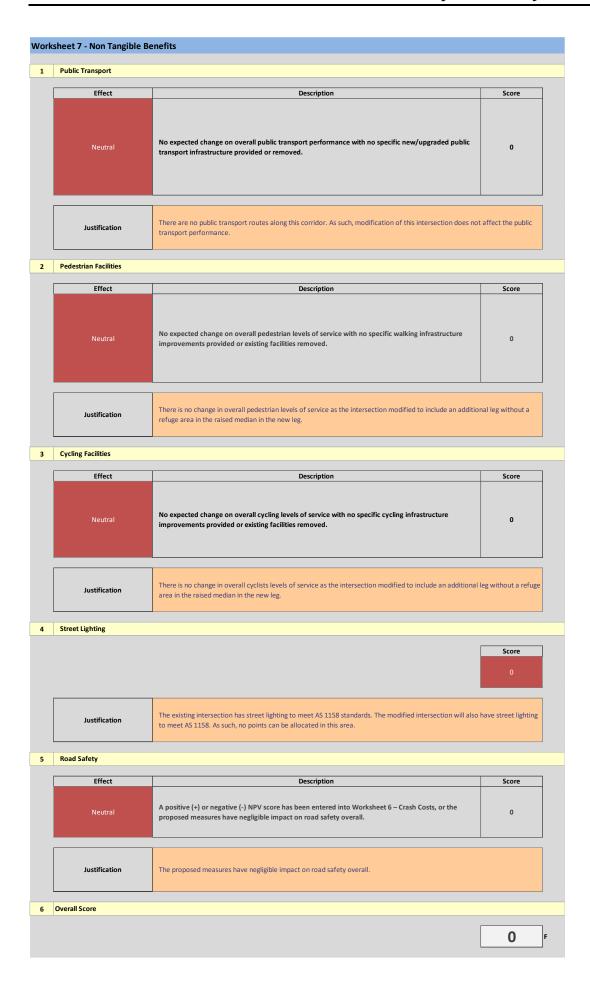
	rksneet 3 -	Cost of the Option				
1	Road Type		District Distrib	utor A		
-	Road Type		District Distrib	101 A		
2	PV of estima	ated cost of proposed work (as pe	r attached estimate sh	neet)		
						7
			\$1,000,000.00	x 0.9259	\$925,900.00	(a)
3	PV of routin	e maintenance costs following co	mpletion of the work			
_						
			\$500.00	x 10.7398	\$5,369.90	(b)
4	DV of maint	enance cost in year 1				
•	P V OI IIIaiiit	enance cost in year 1				
					\$500.00	(c)
	_					
5	PV of Option	n periodic maintenance cost				
	Proposed Reh	ab treatment measure	40mm SMA ov	verlav]
	Rehab treatme		40111111 011111 0	renay	\$21.50	
	Site treatment	area (from SLK to SLK)			200.00	
	Rehab cost				\$4,300.00	
	Year	renance will be required in the follo Type of Maintenance	Required?	Estimated Cost	SPPWF	PV
	5	40mm SMA overlay	N/A	\$4,300.00	0.680	N/A
	10	40mm SMA overlay 40mm SMA overlay	N/A N/A	\$4,300.00 \$4,300.00	0.680 0.464	N/A N/A
		*	-			
	10	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A Yes N/A	\$4,300.00 \$4,300.00 \$4,300.00	0.464	N/A \$1,376.00 N/A
	10 15 20 25	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A Yes N/A N/A	\$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00	0.464 0.320 0.210 0.150	N/A \$1,376.00 N/A N/A
	10 15 20	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A Yes N/A	\$4,300.00 \$4,300.00 \$4,300.00	0.464 0.320 0.210	N/A \$1,376.00 N/A N/A
	10 15 20 25	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A Yes N/A N/A Yes	\$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00	0.464 0.320 0.210 0.150	N/A \$1,376.00 N/A N/A \$430.00
6	10 15 20 25 30	40mm SMA overlay 40mm SMA overlay 40mm SMA overlay 40mm SMA overlay	N/A Yes N/A N/A Yes	\$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00	0.464 0.320 0.210 0.150 0.100	N/A \$1,376.00 N/A N/A \$430.00
5	10 15 20 25 30 PV of Annua Luminaire Number of	40mm SMA overlay Type luminaires within study section days luminaires are lit	N/A Yes N/A N/A Yes	\$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00	0.464 0.320 0.210 0.150 0.100 \$1,806.00	N/A \$1,376.00 N/A N/A \$430.00 (d)
5	10 15 20 25 30 PV of Annua Luminaire Number of Number of Total oper	40mm SMA overlay Type Illuminaires within study section days luminaires are lit ating cost perating costs (separate to mainte	N/A Yes N/A N/A Yes	\$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00	0.464 0.320 0.210 0.150 0.100 \$1,806.00 ZE07C - 250MV 6 365	N/A \$1,376.00 N/A N/A \$430.00 (d)
5	10 15 20 25 30 PV of Annua Luminaire Number of Number of Total oper	40mm SMA overlay Type I luminaires within study section days luminaires are lit ating cost	N/A Yes N/A N/A Yes Sum	\$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00	0.464 0.320 0.210 0.150 0.100 \$1,806.00 ZE07C - 250MV 6 365 \$1,528.18	N/A \$1,376.00 N/A N/A \$430.00 (d)
	10 15 20 25 30 PV of Annua Luminaire Number of Number of Total oper	40mm SMA overlay Type Illuminaires within study section days luminaires are lit ating cost perating costs (separate to mainte	N/A Yes N/A N/A Yes Sum	\$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00 \$4,300.00	0.464 0.320 0.210 0.150 0.100 \$1,806.00 ZE07C - 250MV 6 365 \$1,528.18	N/A \$1,376.00 N/A N/A \$430.00 (d)

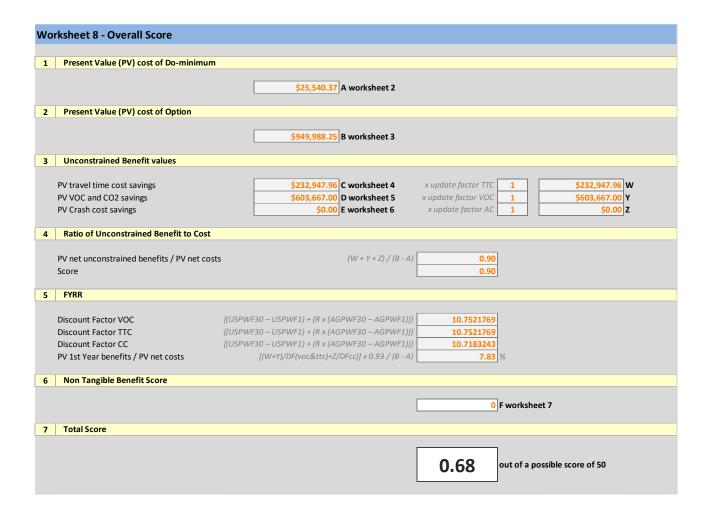
Worksheet 4 - Travel Time Cost Savings	t Savings																
1 Road Type	District D	District Distributor A															
-																	
2 Project Type	Isolated	Isolated intersection/intersection as part of route improvement	ersection as part	of route improv	ement												
3 Modelling Period Type	AM/Inte	AM / Inter / PM peak periods	spo														
4 Midblock Assessment - Traffic Volumes	olumes																
			DO MINIMUM	Σ					OPTION								
	Time Zero (veh/hr)		Year 8	Year 15	Year 30		Time Zero (veh/hr)	Year 2	Year 8	Year 15	Year 30						
AM Peak	291		318	343	343		291	297	318	343	343						
PM Peak	269	275	294	317	317		269	275	294	317	317						
							04004		Over								
5 Do-minimum Modelling																	
	5A Project Timings from Annualisation Factors	rom Annualisatic	on Factors			5B Isolated Intersection	ntersection		SC R	5C Road Midblock Improvement	Improvement			Clovest lendar	5D Annual Traval Time Cost (\$ /vear)		
i i		Ţ.	Time Periods		Σ	odelling Results	Modelling Results Inputs (veh.hr/hr)		Mode	esults In	puts (veh.hr/hr)	0000000		Delina ii avei	100 (3/ Acad		
Weekday AM Deak	Flow Factor	tor hours/day	y days/year	s/HR	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	(e)
Weekday Interped	iok 1	N 00	245	\$27.01	1.27	1.37	1.54	1.54	0.33	0.35	0.38		\$67,233.29	\$72,527.25	\$81,526.98	\$81,526.98	(e)
Weekday PM Peak		2	245	\$22.30	2.01	2.18	2.54	2.54	0.33	0.35	0.38		\$21,963.27	\$23,820.86	\$27,754.58	1 1	(c)
Weekday Off Pe			245	\$22.91	0.32	0.34	0.39	0.39	0.04	0.04	0.04	0.04	\$21,385.34	\$23,069.22	\$25,931.83	\$25,931.83	(e)
Weekend Peak		+	120	\$25.55	0.57	0.62	0.69	0.69	0.07	0.07	0.08	0.08	\$14,017.75	\$15,121.51	\$16,997.90		(e)
SE All periods		24	365	\$25.70	10	10	10	10	0.83	0.89	0.96		\$2,251,320.00	\$2,251,320.00	\$2,251,320.00	\$2,251,320.00	(g)
	(R)		E	(n)	3	(w)	X	ε	3	(w)	(X)		Н	\$155,258.09	\$175,580.55	\$175,580.55	
6 Option Modelling													00.025,152,00	52,251,320.00	00:0251,520.00	\$2,231,320.00	Total for Day Long
	6A Project Timings from Annualisation Factors	rom Annualisatic	on Factors			6B Isolated Intersection	ntersection		6C R	6C Road Midblock Improvement	Improvement						
		Tim	Time Periods	Щ	Ž	odelling Results	Modelling Results Inputs (veh.hr/hr)	ir)	Mode	Illing Results Inp	outs (veh.hr/hr)		9	D Annual Iravel	6D Annual Iravel IIme Cost (\$/year)	J.	
Time Period	Flow Factor	hours/	y days/year	r \$/HR	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
Weekday AM Peak	ack 1	2	245	\$22.54	0.74	0.80	0.90	0.90	0.33	0.35	0.38	0.38	\$8,173.00	\$8,835.68	\$9,940.14		(a)
Weekday Interpeak	ak 1	2 8	245	\$27.01	1.14	1.22	1.30	1.38	0.33	0.35	0.38	0.38	\$16,718.31	\$18,029,55	\$73,056.65	\$70,652.03	(a)
Weekday Off Peak	ak 0.25		245	\$22.91	0.29	0.31	0.35	0.35	0.04	0.04	0.04		\$19,196.29	\$20,543.40	\$23,237.61		9
Wee kend Peak			120	\$25.55	0.51	0.55	0.62	0.62	0.07	0.07	0.08		\$12,582.86	\$13,465.87	\$15,231.89	\$15,231.89	(e)
Weekend	ok 0.15	+	120	\$24.80	0.17	0.18	0.21	0.21	0.02	0.02	0.03	Ì	-	\$8,713.73	\$9,856.51	\$9,856.51	(£)
(Q)	(R)	(S)	COS E	(n)	3	(W)	(X)	(A)	C.833	(w)	(X)	36.0	_	\$2,251,320.00	\$2,251,320.00	\$151,974.83	(B) Total for All Day Periods
												_	\$2,251,320.00	\$2,251,320.00	\$2,251,320.00		Total for Day Long
7 Annual Travel Time Cost for Modelled Years	delled Years																
		Tonany	Travel Time Cor	16/yearl for mo	acon pollop												
	Start Year 2	_	7 Start Year	nd Year 7 Start Year 8 End Year 14 Start Year	Start Year 15	15 End Year 30											
Travel Time Cost		\$1		\$155,258.09 \$175,580.55 \$175,580.55	\$175,580.55	\$175,580.55											
Do-minmum Travel Time Cost			_														
Option		\$125,163.95 \$134,174.54	\rightarrow	\$134,174.54 \$151,974.83	\$151,974.	83 \$151,974.83											
Midpoint		Year 4	×	Year 11.5	Ye.	Year 22											
Duration Years Do-minimum TTC at midpoint		149.544.81	\$16	\$165,419.32	1b	1b \$175.580.55											
Option TTC at midpoint		\$129,669.24	\$14	13,074.69	\$151,	\$151,974.83											
Midpoint Benefits		\$19,875.57	\$2.	\$22,344.63	\$23,	,605.71											
		m1		m2		m3											
9 PV Travel Time Cost Savings																	
	[(m1x6x6	$[(m1 \times 6 \times 0.7416) + (m2 \times 7 \times 0.4511) + (m3 \times 16 \times 0.1958)]$	7 x 0.4511)+(m	3 x 16 x 0.1958).		\$232,947.96	U										

Workshe	Worksheet 5 - VOC and CO2 Cost Savings	Sa												
1 Ros	Road Type	District Distributor A	utor A											
2 Pro	Project Type	Isolated intersection/interse	ection/intersecti	ection as part of route improvement	te improvement									
3 Mo	Modelling Period Type	AM / Inter / PM peak perio	M peak periods											
4 Do-m	Do-minimum Traffic Flow	MID BLOCK ONLY	NLY											
	4A Project tim	4A Project timings from Annualisation Factors	alisation Factors	ors ne periods		4B Traffic Flow Data (veh/hr.	Data (veh/hr)							
	Time Period	Flow Factor	Time periods (hrs/dav)	Days/year	Year 2	Year 8	Year 15	Year 30						
	Weekday AM Peak		2	245	297	318	343		(a)					
	Weekday PM Peak Weekday PM Peak		2	245	275	294	317		(c)					
	Weekday Off Peak Weekend Peak	0.25	12	245	34	37	39	39	(q)					
	Weekend Off Peak	0.15	16	120	21	22	24		(f)					
	All periods (Q)	N/A (R)	24	365	17906	19118	20635 (W)	20635 (X)	(8)					
5 00	5 Option Traffic Flow	MID BLOCK ONLY	NLY											
	5A Project tim	5A Project timings from Annualisation Factors	lisation Factors											
	III Tadou No	migs more with	Time p	Time periods		5B Traffic Flow Data (veh/hr.	Data (veh/hr)							
	Time Period	Flow Factor	Time periods	Days/year	Year 2	Year 8	Year 15	Year 30						
	Weekday AM Peak	1	(ms) day)	245	297	318	343		(a)					
	Weekday Interpeak		∞ ^	245	137	146	158	158	(p)					
	Weekday Off Peak	0.25	12	245	34	37	39		(a)					
	Weekend Peak Weekend Off Peak	0.45	8	120	62	66	71	71	(e)					
	Monitor WA	M//A	2.4	320	17005	AADT (ve	eh/day)	ų	: 3					
	(o)	(R)	(s)	E	(n)	3	(w)	(X)						
6 & 7 Vel	6 & 7 Vehicle Speeds and VOC costs - Do-minimum	mnm												
	Akrelik Link Durameters	# of Lanes	Interval	H.	t0	Speed	Q 1700	AL 6773	tf (min/km)	rf 45.00	0.25*rf			
			0001	00:00	CC'T	ç	7007	0.72	CCT	43.00	C7'TT			
		Isolated interse	Isolated intersection/intersection as part of route improvement 6A Mean Speed (km/hr)	n as part of rout eed (km/hr)	e improvement	Mid-block	Mid-block/mid-block as part of route improvement 68 Mean Speed (km/hr)	art of route impried (km/hr)	ovement		7A VOC Cost (cents/km	(cents/km)		
	Year	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
	Weekday AM Peak	39.5	39.5	39.4	39.4	44.99	44.99	44.99	44.99	30.01	30.01	30.01	30.01	(a)
	Weekday Interpeak Weekday PM Peak	39.2	39.1	38.9	38.9	44.99	44.99	44.99	44.99	30.01	30.01	30.01	30.01	(a)
	Weekday Off Peak	39.2	39.1	38.9	38.9	45.00	45.00	45.00	45.00	30.01	30.01	30.01	30.01	€ €
	Weekend Peak Weekend Off Peak	39.2	39.1	38.9	38.9	45.00	45.00	45.00	45.00	30.01	30.01	30.01	30.01	(e) (±)
	All periods	47	47	47	47	44.96	44.96	44.95	44.95	29.2	29.2	29.5	29.2	(8)
		Isolated interse	Isolated intersection/intersection as part of route improvement	n as part of rout	e improvement	Mid-bloc	k/mid-block as part	rt of route improv	wement					
		9	C Total Travel Dis	tance (veh.km/h	r.	79	O Total Travel Dist	tance (veh.km/hr)			7B Annual VOC Cost (\$/year	Cost (\$/year)		
	Time period	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2				
	Weekday AM Peak Weekday Interpeak	192.5	205.6	305.2	305.2	15	16	17	17	\$28,306.93				(a) (b)
	Weekday PM Peak	375.5	401	451.3	451.3	14	15	16	16	\$55,216.90				∵ ⊚∶
	Weekday Off Peak Weekend Peak	63.9	68.225	76.3	137.34	2 8	2 8	2 4	2 4	\$56,378.59	\$60,194.51	\$67,319.03		\$67,319.03 (d) \$39,567.10 (e)
	Weekend Off Peak	38.34	40.935	45.78	45.78	1 22	1 40	1 43	1 42	\$22,091.20				€ 3
	All perious	7	7	7	7	10	04	43	40	\$345,473.32				us/ Total for All Day periods
										\$5,115.84		\$5,115.84		Total for day long

New Year State New Sta	Vericol Veri	Akcelik Link Parameters	# of Lanes	Interval 10.00	Hr 60.00	1.33	Speed 45	Q 1700	AL 6.72	tf (min/km) 1.33	rf 45.00	0.25*rf 11.25			
	No. 2		Isolated intersec	tion/intersection	as part of route	e improvement	Mid-block	/mid-block as pa	irt of route imp	rovement					_
				8A Mean Sp	ed (km/hr)			8B Mean Spe	ed (km/hr)			9A VOC Cos	t (cents/km)		
38.2 38.2	1912 1912	Time period	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
SSS	SSS	eekday AM Peak	39.2	39.2	39.1	39.1	44.99	44.99	44.99	44.99	30.0	30.0	30.0	30.0	(a)
10 10 10 10 10 10 10 10	SS SS SS SS SS SS SS S	ekday Interpeak	39.1	39	38.9	38.9	44.99	44.99	44.99	44.99	30.0	30.0	30.0	30.0	(b)
10 10 10 10 10 10 10 10	Shift Shif	eekday PM Peak	38.5	38.4	38.3	38.3	44.99	44.99	44.99	44.99	30.0	30.0	30.0	30.0	(2)
10 10 10 10 10 10 10 10	10 10 10 10 10 10 10 10	eekday Off Peak	39.1	39	38.9	38.9	45.00	45.00	45.00	45.00	30.0	30.0	30.0	30.0	(P)
State Stat	State Stat	Weekend Peak	39.1	39	38.9	38.9	45.00	45.00	45.00	45.00	30.0	30.0	30.0	30.0	(e)
Total clinical interaction is part of route improvement Most Section discoting part of paule improvement Most Section discoting part of paule improvement Most Section discoting part of paule improvement Most Section discoting paule improvement Most Most Most Most Most Most Most Most	State Stat	eekend Off Peak	39.1	33	38.9	38.9	45.00	45.00	45.00	45.00	30.0	30.0	30.0	30.0	(£)
		All periods	35	35	35	35	44.96	44.96	44.95	44.95	31.2	31.2	31.2	31.2	(8)
New Year	Veri		Isolated intersec	ion/intersection	as part of route	9 improvement	Mid-block	/mid-block as par	rt of route impre	vement					
Heart	Vent 2 Vent 8 Vent 15 Vent 1		36	Total Travel Dist	ance (veh.km/h	ı)	18	7 Total Travel Dist	ance (veh.km/h.	t)		9B Annual VOC	Cost (\$/year)		
1848 1857 1755	145.8 145.7 175.5 175.	Year	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	Year 2	Year 8	Year 15	Year 30	
1438 153, 173, 173 173, 173 173, 173 1	1348 135, 135 135	Time period						,		-					
10,000 1	1246 1253 1213	reekday AM Peak	145.8	155.7	1/5.5	175.5	15	16	1/	1/	\$21,439.74	\$22,895.53	\$25,807.10	\$25,807.10	$\overline{}$
SSSS SSS	See	leekday Interpeak	224.6	239.9	271.5	271.5	7	7	8	00	\$132,108.82	\$141,108.22	\$159,695.21	\$159,695.21	
Signature Sign	Signature Sign	Veekday PM Peak	283.2	302.5	342.9	342.9	14	15	16	16	\$41,644.28	\$44,482.32	\$50,423.10	\$50,423.10	
101.07 107.955 12.175 12.135 3 4 4 5.941126 531,014.0 551,98.13 531,48.13 3	101.07 107.055 122.175 3 3 4 4 52.117.86 531.01.00 535.198.13 535.198.13 2	Veekday Off Peak	56.15	59.975	67.875	67.875	2	2	2	2	\$49,540.81	\$52,915.58	\$59,885.71	\$59,885.71	_
\$3.69 \$5.985 \$6.725 \$7 \$7 \$1 \$1 \$1 \$1 \$1 \$1	SSS	Weekend Peak	101.07	107.955	122.175	122.175	27	33	4	4	\$29,117.86	\$31,101.40	\$35,198.13	\$35,198.13	
State Stat	Start Year 2 State	Veekend Off Peak	33.69	35.985	40.725	40.725	1	1	1	1	\$19,411.91	\$20,734.27	\$23,465.42	\$23,465.42	
Start Year 2 End Year 7 Start Year 8 End Year 14 Start Year 8 Start Year 8 Start Year 9 Start Y	State Stat	All periods	2	22	15	.5	37	40	43	43	\$13.665.60	\$13.665.60	\$13.665.60	\$13.665.60	
Start Year 2 Start Year 2 Start Year 3 Start Year 4 Start Year 5 Start Year 5 Start Year 6 Start Year 6 Start Year 7 Start Year 7 Start Year 8 End Year 14 Start Year 7 Start Year 8 End Year 14 Start Year 8 Start Year 9 Start	Start Year 2 Start Year 3 Start Year 4 Start Year 5 Start Year 5 Start Year 6 Start Year 7 Start Year 7 Start Year 7 Start Year 8 Start Year 8 Start Year 9 Star										\$293.263.42	\$313,237,33	\$354.474.67	\$354.474.67	
Start Year 2 End Year 7 Start Year 8 End Year 15	Start Year 2 End Year 3 Start Year 8 End Year 16 Start Year 2 End Year 3 Start Year 3 Start Year 3 Start Year 4 Start Year 3 Start Year 4 Start Yea										\$13,665.60	\$13,665.60	\$13,665.60	\$13,665.60	
Start Year 2	Start Year 2	perating Cost for Mode	lled Years												
Signature Annual Vale kie Operating Cost (\$\seta\text{Vear 1} \text{ Find Year 15} \\ Signature	Start Vear 2 End Year 7 Start Vear 8 End Vear 14 Start Vear 15	0													
Start Year 2 End Year 7 Start Year 8 End Year 14 Start Year 15	Start Vear 2 End Vear 7 Start Vear 8 End Vear 14 Start Vear 15			Annual Vehic	e Operating Cost	t (\$/vear) for mo	delled vears	ſ							
0ht \$289,263.42	8345,473.32 \$368,879.17 \$368,879.17 \$413,024,93 \$413,0		Start Year 2	End Year 7	Start Year 8	End Year 14	Start Year 15	End Year 30							
note \$299,263.42 \$313,237,33 \$513,237,33 \$513,237,33 \$5354,746.7 \$5354,746.7 note \$6 7 11.5 22 22 note \$357,176.24 \$390,952.05 \$413,02 c \$333,25.87 \$333,856.00 \$3354,47 note \$333,925.87 \$333,956.05 \$588,558 note note note note	vert \$333,256.37 \$333,256.00 \$334,74.67 \$354,74.67 cohr \$357,176.24 \$3390,952.05 \$413,02 c \$333,856.00 \$335,47 r \$333,856.00 \$335,47 r \$330,256.87 \$530,066.05 \$535,05 r r r r	nual VOC Cost - Do- minimum	\$345,473.32	\$368,879.17	\$368,879.17	\$413,024.93	\$413,024.93	\$413,024.93							
11.5 239,250,47 5313,237,33 5354,474.67 5354,474	11 12 13 13 13 13 13 13														
7 11.5 11.5 11.5 1.0 1.1 1.5 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	Year 4 11.5 6	Annual VOC Cost - Option	\$293,263.42	\$313,237.33	\$313,237.33	\$354,474.67	\$354,474.67	\$354,474.67							
Vear4	Vear4 11.5														
t \$390,952.05 \$303,250.37 \$333,856.00 \$53,925.87 \$57,096.05 m1 m2	oint \$357,176.24 \$330,952.05 \$330,250.37 \$333,856.00 \$53,925.87 \$57,096.05 mil mil mil	Midpoint Duration Years	Year	4	11	· .	27								
5330,250.37 \$333,856.00 \$333,856.00 \$333,925.65 \$333,925.67 \$333,9	cont \$357,176.24 \$390,922.05 \$333,25.60 \$53,925.87 \$57,096.05 mil m2														
\$33,925.87 \$33,856.00 \$53,925.87 \$57,096.05 mt m2	\$333,856.00 \$53,925.87 \$57,096.05 mil m2	Do-minimum VOC at midpoint	\$357,1	76.24	6'06E\$	92.05	\$413,0	24.93							
\$53,925.87 \$57,096.05 m1 m2	\$53,925.87 \$57,096.05 m1 m2	Option VOC at midpoint	\$303,25	50.37	\$333,8	156.00	\$354,4	74.67							
m1 m2	ml m2	Midpoint Benefits	\$53,92	5.87	\$57,09	96.05	\$58,55	90.26							
	ation Cost Savings		Em.		Ē	2	Ê								
	tion Cost Savings														

Wo	rksheet 6 - Crash Cost S	avings
1	Project Type	Isolated intersection/intersection as part of route improvement
2	Crash Summary	
	Total Crashes - 2 PDO Major (Same Lane Rear End, Same Lane Left Rear), 1 PDO Minor (Thru - Right)
3	Counter Measures	
	None	
4	Net PV of Crash Cost Saving	gs (from CARS)
		\$0.00 NPV
5	Annual Crash Cost Savings	
		NPV / 4.329906 \$0.00 ACCS
	Crash Growth Rate	
6	Crash Growth Rate	
	Crash growth rate	-1.90% <i>R</i>
	Discount rate	8.00% DR
	Discount factor crash costs	(1-((1+R)/(1+DR))^30)/(DR-R)] - [(1-((1+R)/(1+DR))^1)/(DR-R)]) 8.61
7	PV Crash Cost Saving	
		4000 4000 4000 5
		ACCS * DFCC \$0.00 E





Combined Score

MRRG Reference	Total Score
1	7.78
2	-0.04
3	1.21
4	0.68

Average Total Score	2.41
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Final Score	7.78
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The Final Score is the higher of the Average Total Score and Individual Assessment Scores.

Appendix A New Links

Whilst the procedures can best be utilised for upgrading existing midblock lengths and intersections (and hence route lengths through a combination of these nodes and links), the potential also exists to use the procedures for the construction of a new road (asset creation), such as a bypass which reduces the route length and/or travel time/vehicle operating costs for traffic between two fixed points.

The benefits associated with a new road with respect to improved travel times and/or vehicle operating costs/CO2 can be attributed to:

- 1. Those vehicles transferring to the new route which may be shorter and/or have less traffic on it than the existing route (potentially resulting in increased speeds); and
- 2. Those vehicles using the existing route having less traffic on it (potentially resulting in increased speeds/fewer delays at intersections) due to reassigned traffic using the new route.

Given the above, benefits can be calculated using <u>either/or both</u> of the following elements:

- 1. Transferring vehicle benefits considered as a mid-block calculation:
 - Treat both the existing road/route (Do Minimum) and the new road (Option) as section lengths in their <u>entirety</u> (i.e. between where the existing and new roads/routes intersect at either end) regardless of whether there are intersections along either road/route length when entering the Project Length data in Worksheet 1.
 - Use the same traffic volumes (equating to the re-assigned traffic flow) for both the Do Minimum and the Option for the mid-block information requirements in Worksheet 4 and 5 for the Travel Time and VOC benefits (as we're comparing like for like i.e. transferred traffic at this stage of the assessment).

It is acknowledged that the actual current total traffic on the existing route will include those vehicles that will transfer to a new route in due course as well as other vehicles heading elsewhere. As such, simply using the re-assigned traffic volumes for the Do Minimum may result in the associated calculated average mid-block speeds being artificially high. However for comparative purposes, this is considered acceptable.

- 2. Existing route benefits derived from reduced delays etc. at intersections only along the existing route (mid-block benefits are not recognised in this instance given that the majority of benefits will be derived at intersections and the potentially overly time consuming nature of working out each mid-block length):
 - At intersections, use the existing traffic turning movements for the Do Minimum and the revised turning movements (without the transferred/reassigned traffic) for the Option to determine benefits at each intersection along the existing route.
 - For the Option cost in this instance, use the total cost of the new road at each intersection being assessed, as without the full Option being built, no benefits will be derived at the intersections on the existing route.

It is recognised that due to the need to use the full Option cost for each intersection assessment along the existing route, a low ratio of unconstrained benefit to cost may be achieved. When such benefits at intersections along the existing route are averaged out in

conjunction with the mid-block benefits along the new road, the overall score may reduce. In such instances, it is acceptable to simply provide/declare the mid-block benefits associated with the new road only (with any spin-off benefits for the intersections along the existing route being undisclosed).

To allow for a robust analysis, no crash saving benefits should be derived for new roads due to the complexity associated with such modelling.

Appendix B Do Minimum Cost Calculations

- 1. Select the road type for the project.
- 2. Calculate the PV of annual maintenance cost **(a)** for the Do Minimum by multiplying the Do Minimum maintenance cost by the discount factor 11.7023. If typical annual maintenance costs for the intersection or mid-block are not known, enter zero.
- 3. Calculate the Do Minimum periodic maintenance cost using the following steps:
 - (i) The proposed rehab treatment measure for the issue will be filled in automatically depending upon the road type selected e.g. District Distributor A/B 40mm SMA Overlay \$21.50
 - (ii) Enter the site treatment area in square metres (from SLK to SLK).
 - (iii) Calculate the Rehabilitation Cost (\$) = (i) x (ii).

Calculate the PV of the periodic maintenance cost over the 30 year life of the road. This will be calculated using the following steps:

- (iv) The years for periodic maintenance will be filled in automatically based on the road type selected e.g. District Distributor A/B: every 15 years over the 30 year period.
- (v) Enter the estimated period maintenance cost for each year selected as indicated in Step 3.
- (vi) The appropriate Single Payment Present Worth Factor (SPPWF) from Table B1 below will be selected automatically to determine the PV at time zero (estimated cost x SPPWF).
- (vii) Sum the PV of the periodic costs to determine the PV of total periodic maintenance costs **(b)** this will be done automatically.

Table B1 - Single Payment I	Present Worth Factor SP	PWF (for 8%	discount rate)
Table D1 - Single I ayment I	i ceciit woi in ractor or	1 441 (101 070	uiscoulit rate,

Year	SPPWF	Year	SPPWF
1	0.93	16	0.29
2	0.86	17	0.27
3	0.79	18	0.25
4	0.74	19	0.23
5	0.68	20	0.21
6	0.63	21	0.20
7	0.58	22	0.18
8	0.54	23	0.17
9	0.50	24	0.16
10	0.464	25	0.15
11	0.43	26	0.14
12	0.40	27	0.13
13	0.37	28	0.12
14	0.34	29	0.11
15	0.32	30	0.10

4. Insert the annual associated operating cost of the project length based on street lighting costs. This will be calculated using the following steps:

(i) Select the appropriate Western Power tariff code and wattage that is appropriate for the luminaires (street lights) - within drop down menu. This provides a cost in terms of \$/lamp/day. The values that will be within the drop down menu are shown in Table B2 below.

Table B2 – Luminaire Values

Western Power Tariff Code	Wattage	\$/lamp/day
ZE02C	8oMV	0.395718
ZEo ₃ C	125MV	0.505919
ZEo ₇ C	250MV	0.697799
ZE13C	150HPS	0.523202
ZE15C	250HPS	0.792204
ZE19C	70HPS	0.408487
ZE20C	70ML	0.713818
ZE21C	150ML	0.999235
ZE22C	250ML	1.261879
ZE87SC	42CFL	0.335294

- (ii) Enter the number of luminaires (street lights) that are currently existing within your study section.
- (iii) Enter the number of days the luminaries (street lights) are lit for.
- (iv) The total annual operating $cost = (\$/lamp/day) \times (no of luminaires (street lights)) \times (no days the luminaires (street lights) are lit for).$
- (v) Calculate the PV of the annual associated operating cost of the road midblock, or isolated intersection by multiplying it by 10.7398 (c).
- 5. Calculate the sum of (a) + (b) + (c) to obtain the PV total cost of the Do Minimum.

Appendix C Option Cost Calculations

- 1. Select the road type for the project automatically copied from Worksheet 1.
- 2. Enter the capital costs of the proposed option. Multiply the project cost by the discount factor 0.9259 and enter at **(a)**.
- 3. Calculate the PV of annual maintenance cost for the option by multiplying the Do Minimum maintenance cost by the discount factor 10.7398 and enter at **(b)**.
- The cost of the maintenance for year 1 at **(c)** is assumed to be the same as the existing maintenance strategy in year that the proposed option works are carried out.
- 5 Calculate the option maintenance costs using the following steps:
 - (i) The proposed rehabilitation treatment measure and cost will be filled in automatically based on the selected road type e.g. District Distributor A/B 40mm SMA Overlay \$21.50.
 - (ii) Enter the site treatment area for the option typically this will be same as in **Worksheet 2** (from SLK to SLK).
 - (iii) Calculate the Rehabilitation Cost $(\$) = (i) \times (ii)$.

The periodic maintenance costs for the option will be calculated using the following steps:

- (iv) The years for periodic maintenance will be filled in automatically based on the selected road type e.g. District Distributor A/B: every 15 years over the 30 year period.
- (v) Enter the estimated period maintenance cost for each year selected.
- (vi) The appropriate Single Payment Present Worth Factor (SPPWF) from Table C1 will be selected automatically to determine the PV at time zero (estimated cost x SPPWF).
- (vii) Sum the PV of the periodic costs to determine the PV of total periodic maintenance costs (d).

Table C1 - Single	Payment Present	Worth Factor SPPWF	(for 8% discount rate)
-------------------	------------------------	---------------------------	------------------------

Year	SPPWF	Year	SPPWF
1	0.93	16	0.29
2	0.86	17	0.27
3	0.79	18	0.25
4	0.74	19	0.23
5	0.68	20	0.21
6	0.63	21	0.20
7	0.58	22	0.18
8	0.54	23	0.17
9	0.50	24	0.16
10	0.464	25	0.15
11	0.43	26	0.14
12	0.40	2 7	0.13
13	0.37	28	0.12
14	0.34	29	0.11
15	0.32	30	0.10

- Insert the annual associated operating cost of the project length under consideration for street lighting. This will be calculated using the following steps:
 - (i) Select Western Power tariff code and wattage that is appropriate for the luminaires (street lights) that are needed for the option within your study section from the list (within drop down menu), this will give you the cost \$/lamp/day. The values that will be within the drop down menu are shown in Table C2.

Table C2 - Luminaire Values

Western Power Tariff Code	Wattage	\$/lamp/day
ZE02C	8oMV	0.395718
ZEo ₃ C	125MV	0.505919
ZEo ₇ C	250MV	0.697799
ZE13C	150HPS	0.523202
ZE15C	250HPS	0.792204
ZE19C	70HPS	0.408487
ZE20C	70ML	0.713818
ZE21C	150ML	0.999235
ZE22C	250ML	1.261879
ZE87SC	42CFL	0.335294

- (ii) Insert the number of luminaires (street lights) that are needed for the option within your study section
- (iii) Enter the number of days the luminaries (street lights) will be lit for.
- (iv) The total annual operating cost = (\$/lamp/day) x (no of luminaires (street lights)) x (no days the luminaires (street lights) are lit for).
- (v) Calculate the PV of the annual associated operating cost of the road midblock, or isolated intersection by multiplying the value obtained in Step (iv) by 10.7398 at **(e)**.
- Calculate the sum of (a)+(b)+(c)+(d)+(e) to obtains the PV cost of the preferred option at **B**. Transfer the PV cost of the preferred option to **B** in **Worksheet 1** this value will be entered automatically.

Appendix D Tangible Benefit Cost Saving Calculations

D1 Travel Time Costs

- 1 Select the road type for the project.
- 2 Select the project type.
- 3 Enter the modelling period type either morning (AM)/Inter-peak/evening (PM) peak periods; or a day long period.
- For midblock sections only, enter the total two-way traffic flow along the length affected for the Do Minimum and Option at Time Zero for each of the AM, Inter-peak and PM peak periods (vehicles per hour); or the AADT for day long modelled periods.
- 5/6 Follow the Steps (A to E) shown below for both the Do Minimum and Option.

Step 5A/6A

Enter the following Annualisation factors (these are calculated automatically as part of the process):

- Time periods (column (Q) row (a) to (g)) identified/highlighted automatically;
- Flow factors (column (**R**) row (**d**) to (**g**)) for off peak periods not modelled;
- Hours per day(column (S) row (a) to (g)); and
- Days per year (column **(T)** row **(a)** to **(g)**).

Note: For intersections and congested midblock sections, a range of time periods will be required, Column **(Q)** rows **(a)** to **(f)**. In some cases it will be possible to model mid-blocks with a day long time period; for these situation use only Column **(Q)** row **(g)**.

Enter the TTC in units \$/hr into (column (U) row (a) to (g)) for the time periods modelled and road type using Table D1. Table D1 provides Travel Time Costs for District Distributor A and B road types for all time relevant periods.

Table D1 - Travel Time Costs for District Distributors A and B for all time periods (Base Date July 2022)

Time period	Base value of time (\$/hr)
Morning commuter peak	22.54
Daytime inter-peak	27.01
Afternoon commuter peak	22.30
Evening/night time	22.91
Weekday all periods	25.55
Weekend/holiday	24.80
All periods	25.70

Step 5B/6B - Intersections

Three future years: 2, 8, 15 are to be modelled for the specified time period with Year 30 being the same as Year 15. Once the existing intersection has been modelled, the three future years can be modelled relatively simply in SIDRA by applying the traffic growth factor and the desired future year assessment.

For intersection projects, enter the SIDRA modelling control delay (total) from the "Intersection Summary" output, into columns **(V)** to **(Y)** rows **(a)** to **(c)** for each time period and model year for both the Do Minimum and Option.

Step 5C/6C – Mid-Block

For road midblock projects with multiple modelled time periods (per day), for example morning, inter peak and evening peak periods, enter the veh.hr/hr values into columns **(V)** to **(Y)** rows **(a)** to **(c)** (similar to isolated intersections) for each time period and model year for both the Do Minimum and option. These values are calculated using:

- Mean vehicle speed (km/hr);
- Traffic volume (veh/hr); and
- Section length (km).

Mean speeds are determined as set out in Appendix D2 for intersections using outputs from the SIDRA intersection modelling.

Use these model outputs with the equations below to determine the veh.hr/hr values for entering into the Do Minimum and Option tables.

For Do Minimums with multiple time periods in day use:

$$\frac{(\textit{veh/hr}\ (\textit{do}\ \text{min}\ \textit{hourly}\ traffic\ flow)*\textit{Length}\ (\textit{in}\ \textit{km}\ \textit{for}\ \textit{do}\ \text{min})}{\textit{Mean}\ \textit{Speed}\ (\textit{for}\ \textit{domin}\ \textit{in}\ \frac{\textit{km}}{\textit{hr}})} = \text{veh.hr/hr}$$

For options with multiple time periods in day use:

$$\frac{(\textit{veh/hr} \; (\textit{Option hourly traffic flow})*Length \; (\textit{in km for Option})}{\textit{Mean Speed (for Option in } \frac{\textit{km}}{\textit{hr}})} = \text{veh.hr/hr}$$

If the modelling has only been done for day long time periods, skip Step 5C and go to Step 5D:

Step 5D/6D

For road midblock projects that have been modelled with day long time periods, enter modelling outputs veh.hr/hr in columns **(V)** to **(Y)** row **(g)** for each modelled year and option (Do Minimum and option). These values are calculated using:

- Mean vehicle speed,(km/hr);
- Traffic volume AADT (veh/day); and
- Section length (km).

Mean speeds are determined as set out in Appendix D2 for mid-block sections using a speed-flow model.

Use these outputs with the equations below to determine veh.hr/hr for entering into the Do Minimum and Option tables as described previously.

For Do Minimums with a day long time period use:

$$\frac{(\frac{AADT}{24}(do \min \ avererage \ hourly \ traffic \ flow)*Length \ (in \ km \ for \ do \ min)}{Mean \ Speed \ (for \ domin \ in \frac{km}{hr})} = \text{veh.hr/hr}$$

For options with a day long time period use:

$$\frac{(\frac{AADT}{24}(Option\ avererage\ hourly\ traffic\ flow)*Length\ (in\ km\ for\ do\ min)}{Mean\ Speed\ (for\ domin\ in\ \frac{km}{hr})} = \text{veh.hr/hr}$$

Enter Do Minimum and option modelling results in units of veh.hr/hr in the appropriate model year columns **(V)** to **(Y)**, row **(g)**.

Step 5E/6E

For projects with multiple modelled time periods, calculate the Do Minimum and Option annual travel time costs for each time period and modelled year by multiplying the hour and day Annualisation Factors together with the TTC (\$/hr) and modelling inputs (veh.hr/hr) – calculated automatically. Add the various time periods together to obtain the total annual TTC for the day long period.

For projects with a day long modelled time period, calculate the Do Minimum and Option annual travel time costs for each modelled year by multiplying the day and year Annualisation Factors together with the TTC (\$/hr) and modelling inputs (veh.hr/hr) – calculated automatically.

7 Determine and enter the Do Minimum and Option TTC midpoint values by averaging the TCC at the start and end of each of the four modelled periods – carried out automatically.

Example: in the first six year period (years start 2 - end 7), the end of year 4 is the mid-point. The value to input for midpoint is:

- 8 Calculate the 'mid-point benefits' by subtracting Option TTC midpoint from the Do Minimum TTC midpoint to obtain \mathbf{m}^1 , \mathbf{m}^2 and \mathbf{m}^3 carried out automatically.
- 9 Using the formula provided in the spread sheet, calculate the PV of the travel time cost savings for the project option calculated automatically at **C**.

D2 Vehicle Operating Costs

- 1 Select the road type for the project.
- 2 Select the project type.
- 3 Enter the modelling period type either morning (AM)/Inter-peak/evening (PM) peak periods; or a day long period.
- 4/5 Follow the Steps (A and B) below for the Do Minimum and Option.

Step 4A/5A

Enter the following project Annualisation factors:

- Time periods (column (Q) row (a) to (g));
- Flow factors (column (R) row (d) to (g)) for off peak periods not modelled;
- Hour per day(column (S) row (a) to (g)); and
- Days per year (column **(T)** row **(a)** to **(g)**).

Note: For intersection and congested midblock projects, a range of time periods will be required as shown in column **(Q)** rows **(a)** to **(f)**. In some cases road mid-blocks will have been modelled for a day long time period - for these situation use only column **(Q)** row **(g)**.

Step 4B/5B

For midblock projects only, enter the traffic flow data for the four future assessed years for each time period.

6/7 Enter the modelling results (see below) for each time period and year modelled along with the corresponding VOC cost for the Do Minimum.

Step 6A/6B/7A – Mean Speed and VOC

For intersections, enter the SIDRA modelling "Travel Speed" (mean speed) from the "Intersection Summary" outputs for each year and peak periods modelled in rows (a) to (c). (Note: the off peak, weekend peak and weekend off peak time periods use the same mean speeds as the inter-peak.) The minimum permitted speed to be entered for intersections is 10km/h as below this speed, an inconsistent relationship with operating and travel time costs exists.

For midblock projects, the forecast operating speeds for each time period and each future year is calculated using a speed-flow model developed by Akcelik (Speed Flow Models for Uninterrupted Facilities, 2003 Version 3) as indicated overleaf. This speed flow model has been cross-referenced with the Highway Capacity Manual (2000) with regards to average and typical free flow travel speeds for different street classes. These models are based on traffic flow by direction and the number of traffic lanes. To simplify the process and allow for a variety of traffic data inputs to be used, it has been necessary to combine the 2-way weekday peak hour volumes and subsequently obtain an average per direction for the peak periods. Outside these weekday peak periods, the supplied/calculated traffic volumes are used within the speed-flow model. For the day long modelled time period, it has been necessary to derive an average hourly flow over the entire period.

$$t = t_0 \left\{ 1 + 0.25 r_f \left[(x - 1) + \sqrt{(x - 1)^2 + \frac{8J_A x}{Q t_0 r_f}} \right] \right\}$$

where: t = average travel time (minutes/km);

 $t_0 = minimum (zero-flow) travel time (minutes/km);$

J_A = Curve Parameter;

x = q/Q = degree of saturation,

T_f = Analysis Flow Period, taken as 60 minutes (min);

q = demand (arrival) Flow rate (veh/hr);

Q = Link Capacity (veh/hr);

 r_f = ratio of flow period T_f , to minimum travel time t_0 (r_f = T_f/t_0)

The minimum permitted speed to be entered for mid-block sections is 10km/h as below this speed, an inconsistent relationship with operating and travel time costs exists.

Determine the VOC for each year and model period. To obtain the value, look up the mean speed in Table D2. Table D2 provides VOC for District Distributors A and B, based on average operating speed.

Table D2 - Vehicle Operating Costs (including CO₂ emissions) in cents/km by mean vehicle speed for District Distributors A and B (Base date: July 2022)

Mean vehicle speed (km/hr)	VOC cents/km
5	54.57
10	48.69
15	42.82
20	38.44
25	35.22
30	32.89
35	31.20
40	30.01
45	29.20
50	28.70
55	28.45
60	28.40
65	28.51
70	28.77
75	29.14
80	29.60
85	30.16
90	30.78
95	31.47
100	32.20
105	32.99
110	33.82
115	34.68

Step 6C/6D/7B – Travel Distance and Annual VOC

For intersections, enter the SIDRA modelling "Travel Distance (Total)" from the "Intersection Summary" output for each year and peak period modelled in rows (a) to (c). Note: for the

time periods; off peak; weekend peak and weekend off peak, modelling results are predicted using inter-peak model results multiplied by the flow factor.

For midblock projects where the modelling has been broken down into peak periods, enter the Total Travel Distance (veh.km/hr) in rows (a) to (c) – see below. If the midblock modelling has been done for a day period, then enter the Total Travel Distance in row (g).

Calculate the Total Travel Distance by using the following model parameters:

- Project length (km); and
- Traffic volume (veh/hr or AADT (veh/day)).

This calculation, using the equations shown below, is undertaken automatically as part of the spread sheet process.

For mid-block projects, where a number of time periods are used in the modelling, use the following equation to determine the Total Distance Travelled for each peak period and year modelled:

```
Veh/hr (do min hourly traffic flow) x Length (in km for do-min) = veh.km/hr
```

For road midblock projects where one day long period was modelled use the following equation to determine the Total Distance Travelled:

```
\underline{AADT} (do min average hourly traffic flow) x Length (in km for do min) = veh.km/hr 24
```

Calculate the Do Minimum annual VOC for each modelled year and time period by multiplying the hour and day Annualisation Factors together with the VOC (cents/km) and Total Travel Distance (veh.km/hr) – calculated automatically. Add the various time periods together to obtain the total annual TTC for the day long period.

For projects with a day long modelled time period, calculate the Do Minimum annual VOC for each modelled year by multiplying the day and year Annualisation Factors together with the VOC (cents/km) and Total Travel Distance (veh.km/hr) – calculated automatically.

- 8/9 Calculate the preferred Option annual VOC costs for each modelled year using the same process as identified in Steps 6 and 7 above for the Do Minimum.
- Determine and enter the Do Minimum and Option VOC midpoint values by averaging the Annual VOC at the start and end of each of the four modelled periods.

Example: in the first six year period (years start 2 – end 7), the end of year 4 is the midpoint. The value to input for midpoint is:

$$(VOC_{Start of Year 2} + VOC_{End of Year 7})/2$$

- 11 Calculate the 'mid-point benefits' by subtracting Option VOC midpoint from the Do Minimum VOC midpoint to obtain m1, m2 and m3.
- Using the formula provided in the spread sheet, calculate the PV of the total VOC (including CO₂) savings for the project over the 30 year analysis period at **D**.

D3 Crash Costs

- 1 Select the road type for the project.
- 2 Enter a summary of crash types and numbers.
- 3 Enter the countermeasure(s) selected in the CARS to address any road safety problems as part of the option design.
- Enter the NPV of Crash Cost savings as an output from CARS unless less than five fatal or injury crashes have been recorded or the proposed treatment isn't intended to address the crash problem, in which case zero (o) should be entered.
- 5 Convert this NPV Crash Cost saving into Annual Crash Cost Saving by the following equation:

```
Annual Crash Cost savings (ACCS) = NPV (from WA CRASH Tool) / 4.329906
```

Note: the factor 4.329906 is taken from the USPWF calculations.

6 Crash growth rate (R) is assumed to be a function of traffic growth and the speed environment. The following adjustments shown in Table D3 below should be applied to the traffic growth rate to give the "R" crash growth rate. This is done automatically in the spreadsheet.

Table D2 Growth rate adjustment factors

Modification to traffic	Posted speed limit	
growth rate (R)	40, 50 and 60 km/hr	70 km/hr and above
	-3%	-1%

The negative growth numbers indicate that if there was a zero or a low traffic growth, crash numbers would be reducing annually. For example in a speed environment of 50 km/hr with a growth rate of 4%, the "R" growth value would be (4%-3%) or 1%. The logic being that as time goes on, crash rates will reduce with better and safer road infrastructure, safer vehicles fleets with improved breaking and crash systems, and more awareness with safety education of motorist.

Convert the Annual Crash Cost savings into the PV Crash Cost saving for the 30 year analysis period with growth adjustment using the following method (calculated automatically):

PV Crash Cost savings

$$=ACCS \times \{[(1-((1+R)/(1+DR))^e)/(DR-R)] - [(1-((1+R)/(1+DR))^s)/(DR-R)]\}$$

=ACCS x DFCC

Where:

- ACCS Annual Crash Cost savings from step 5;
- DR discount rate as a decimal i.e. 0.08;

- R Geometric growth rate as a decimal, this is a modified growth rate as discussed above for crashes;
- s is start year of benefits which is end of year 1;
- e is end of year benefits which is end of year 30; and
- DFCC is discount factor Crash Costs.

The equation with these inputs becomes:

- $= ACCS \times \{ [(1-((1+R)/(1+0.08))^3 30)/(0.08-R)] [(1-((1+R)/(1+0.08))^1)/(0.08-R)] \}$
- =PV Crash Cost saving (for a 30 year analysis period)
- 7 Enter this PV crash cost saving into E