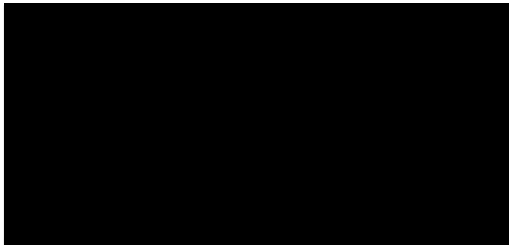


14 December 2016



Dear 

**Request made under the Official Information Act 1982**

Thank you for your email of 5 October 2016 requesting the following information under the Official Information Act 1982:

*The economic assessments that have been undertaken for the bridge improvement projects listed below. Please include any benefit cost analysis and benefit cost ratios that have been produced.*

- Taipa Bridge SH 10
- Kaeo River Bridge Sh10
- Tirohanga Stream Bridge SH11
- Andersons Bridge SH 12
- Waihou River (Rangiahua) SH1N
- Darby and Joan Kauri Bridge SH 12
- Taheke Bridge SH 12
- Matakohē River (Hardies) Bridge SH 12

The NZ Transport Agency is taking a business case approach to the Northland bridge projects. So far, economic assessments have been undertaken for four of these bridges – the Matakohē Bridges (Anderson and Hardies), Taipa Bridge and Kaeo Bridge. I have attached the following documents which comprise the economic assessments which informed the planning for the first four bridges:

- Attachment 1: Economic Assessment of Taipa Bridge, undertaken by Opus
- Attachment 2: DRAFT Economic Assessment of Kaeo River Bridge, undertaken by Opus
- Attachment 3: Economic Assessment of Matakohē Bridges (Anderson and Hardies), undertaken by Opus.

These assessments were conducted using monetised benefits set out in the Transport Agency's standard economic evaluation methodology – such as travel time savings and reduced deaths and serious injuries. They did not take account of any wider economic benefits for the region that will accrue from the revitalisation of the Twin Coast Discovery Route to become a premier tourist route.

Economic assessments for the other bridges will be progressed through on-going corridor studies within the region as part of a strategic collaboration between the Ministry of Business Innovation and Employment (MBIE) and the Transport Agency. This work will inform the 2018–21 Regional Land Transport Plan for Northland.

## **Regional economic development is an important consideration in assessing economic benefits of the Northland projects**

The Tai Tokerau Northland Economic Action Plan published in February 2016 highlights the importance of transport to Northland's economic prosperity; describes transport as one of the 'game changers' for the region; and details the importance of revitalising the Twin Coast Discovery Route to become a premier tourist route as a means for enabling economic growth.

The Transport Agency is seeking to recognise and support these wider economic benefits and opportunities as part of its planning and investment in Northland. It is therefore taking a package approach for the implementation (design and construction) of the two Matakoho bridges, Taipa Bridge, Kaeo Bridge, and the Loop Road to Smeatons Hill project (which will help to improve safety and access to the Twin Coast Discovery Route).

As a package, these projects will help revitalise the Twin Coast Discovery Route to become a premier tourist route, thereby enabling increased economic growth, greater access to tourist amenities, and improving the social well-being of local communities.

### **Economic assessment of the package**

While the two Matakoho bridges and the Loop Road to Smeatons Hill project (which has an indicative benefit cost ratio of 1.2) stand alone in meeting funding eligibility criteria under the Transport Agency's standard economic evaluation methodology, the Taipa and Kaeo bridges do not.

However, alongside the monetised benefits assessed as part of the Transport Agency's standard economic evaluation methodology, the Transport Agency's Economic Evaluation Manual also allows wider economic benefits to be taken into consideration. To take account of the wider economic benefits outlined above (particularly from revitalisation of the Twin Coast Discovery Route to become a premier tourist route), a monetary value has been assigned for these benefits based on a back calculation which equates to 20c per vehicle or \$2 per tourist vehicle. With these additional benefits, the package of five projects has been assessed as having an indicative cost benefit ratio of 0.8–1.2.

Yours sincerely



**Robert Brodnax**  
Group Manager, Planning & Investment  
For Chief Executive

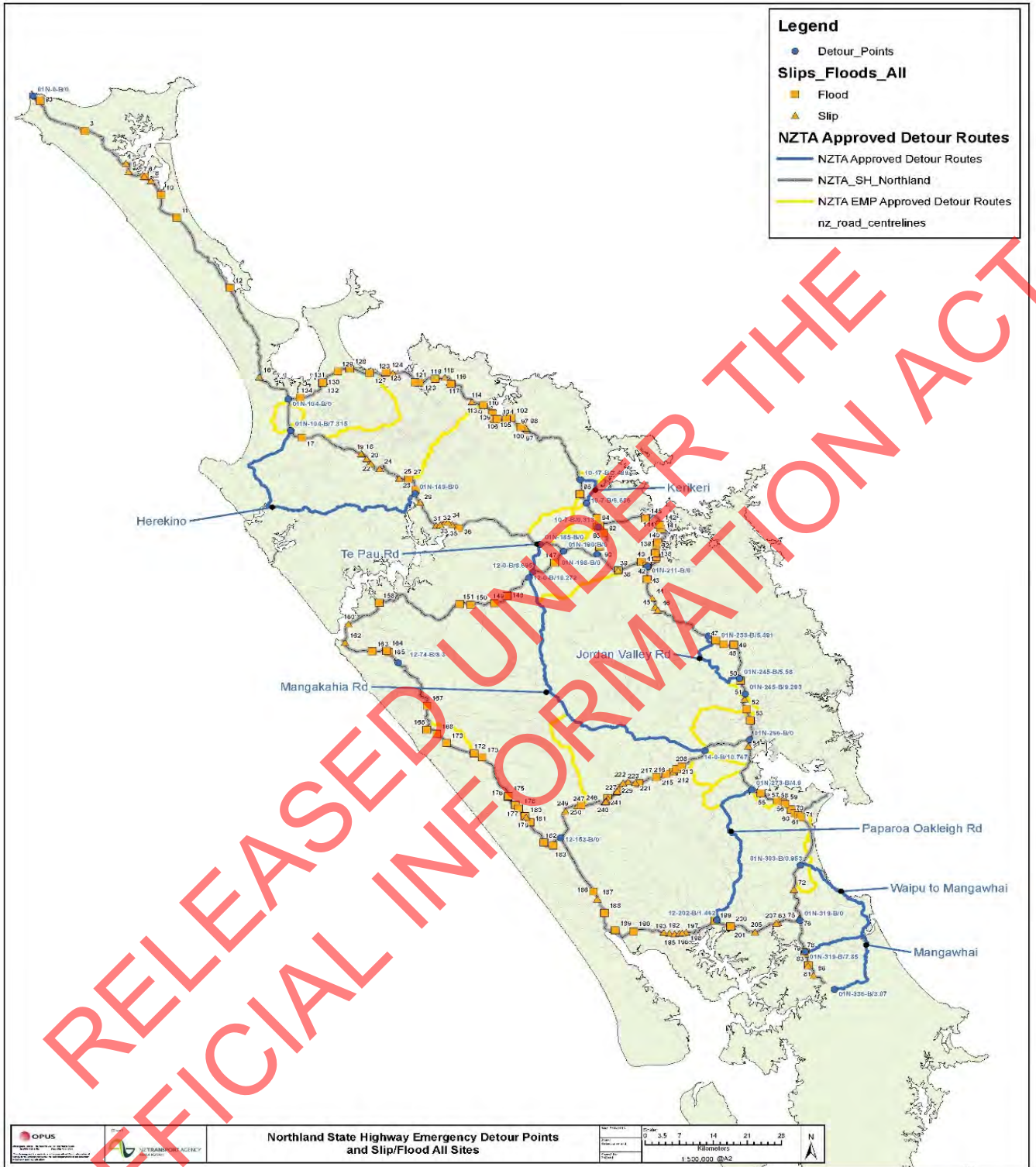
## Taipa One Lane Bridge Economics Summary

NPV Benefits	NPV \$	Comment
Travel Time Costs - Delays at Bridge	\$ 3,501,915	Methodology as per "Delays and Conflicts at One Lane Bridges, (Saunders, 1988)
Travel Time Costs - Detours for Closures	\$ 104,178	Detours as per Fig.13 NZTA Approved Detours
Vehicle Operating Costs - Delays at Bridge	\$ 149,270	Methodology as per "Delays and Conflicts at One Lane Bridges, (Saunders, 1988)
Vehicle Operating Costs - Detours for Closures	\$ 72,012	Detours as per Fig.13 NZTA Approved Detours
Crash benefits 1-Lane vs 2-Lane	\$ 1,386,323	As per EEM
Crash Costs - Detours for Closures	\$ 95,310	Additional Traffic on network
Network Resilience	\$ 891,315	HPMV Waiting time during SH1 Closures
Wider Economic Benefits of reduced closures	\$ 5,674	Used Results from 2013 Network resilience case
<b>Total Benefits</b>	<b>\$ 6,205,997</b>	
NPV Costs	NPV \$	Comment
Do-Min - New Bridge in Year 25	\$ 3,284,956	Assumed 25 year life in existing bridge
Do-Min - Residual Value of Bridge in Year 40	-\$ 749,501	
Do-Min: Increased Maintenance Costs	\$ 13,550	Extra \$1k pa for years 1-25
Subtotal: NPV Do-Min Costs	\$ 2,535,455	
Option - New Bridge in Year 0	\$ 14,098,607	Includes approach works
Option - Residual Value of Bridge in Year 40	-\$ 732,951	
Subtotal: NPV Option Costs	\$ 13,365,656	
<b>Net Costs</b>	<b>\$ 10,830,201</b>	
<b>Indicative BCR</b>	<b>0.6</b>	

Taipa Bridge - Site Location, SH10 RP 79/3.59, 110m long bridge



# NZTA Approved Detours



Taipa Bridge - SH1 HPMV closures							
#	State Highway	Start Location	End Location	Impact	Description	Event Comments	Event Duration (hh.mm)
57	1N	01N-0000/15.63	01N-0000/15.63	Road Closed	Flooding	Road Closed By Flooding, At Te Paki	17.41
43	1N	01N-0020/13.31	01N-0020/13.31	Road Closed	Washout	Washout At The Mitimiti Stream Bridge	32.37
56	1N	01N-0020/21.96	01N-0020/21.96	Road Closed	Flooding	Road Closed At The Te Kao Stream Bridge	20.4
52	1N	01N-0083/14.69	01N-0083/14.69	Road Closed	Crash	Police Have Reported A Serious Crash On The State Highway. Caution Advised	10.38
37	1N	01N-0104/06.95	01N-0104/06.95	Road Closed	Flooding	Motorists Are Advised That Due To Severe Weather Conditions There Are Road Closures In The Area	12.31
68	1N	01N-0104/13.36	01N-0104/13.36	Road Closed	Crash	A Lime Truck Has Run Off The Road, About 3km South Of Kaitaia.	1.41
116	1N	01N-0119/02.56	01N-0119/02.56	Road Closed	Object/Obstruction	Due To A Serious Incident In This Area The Road Is Closed. Emergency Services Are On Site. Please Delay Your Journey Or Use An Alternative Route.	2.48
81	1N	01N-0119/02.74	01N-0119/02.74	Road Closed	Crash	Road Reopened.	4.06
13	1N	01N-0119/04.03	01N-0119/04.03	Road Closed	Crash	Logging Truck Rolled Off The Side Of The Road / Diversions In Place	16.23
3	1N	01N-0149/14.29	01N-0149/14.29	Road Closed	Flooding	Rangiahua Bridge Is Closed Due To Flooding	21.09
44	1N	01N-0149/14.45	01N-0149/14.45	Road Closed	Flooding	The Rangiahua Bridge Is Under Water, & Impassable	21.17
50	1N	01N-0149/14.81	01N-0149/14.81	Road Closed	Flooding	Severe Flooding	3.42
11	1N	01N-0149/15.00	01N-0149/15.00	Road Closed	Flooding	This Is A Low Lying Bridge That Is Flooding. Tidal Flooding - Will Be Updated As Soon As The Tide Changes.	4.21
90	1N	01N-0149/15.57	01N-0149/15.57	Road Closed	Flooding	Due To Flooding This Section Of State Highway 1 Is Closed. Expect Delays. Avoid The Area Or Delay Your Trip If Possible.	16.2
62	1N	01N-0167/12.01	01N-0167/12.01	Road Closed	Crash	Due To A Crash In This Area Okaihau, Expect Long Delays. Avoid The Area If Possible Or Delay Your Trip.	5.45
29	1N	01N-0167/15.82	01N-0167/15.82	Road Closed	Crash	Crash On Sh1 And Police Needs Sh1 To Be Closed From The Intersection Of Sh1 And Te Pua Road To The Intersection Of Sh1 And Wehirua Road	25.23
49	1N	01N-0190/02.30	01N-0190/02.30	Road Closed	Crash	Due To An Incident, Sh1 Is Closed In Pakaraka Between Old Bay Rd And Sh10. Expect Delays, Avoid The Area If Possible.	4.09
38	1N	01N-0190/07.41	01N-0190/07.41	Road Closed	Flooding	Motorists Are Advised That Due To The Severe Weather Conditions In The Region There Will Be Roads Closed	9.57
96	1N	01N-0190/07.62	01N-0190/07.62	Road Closed	Crash	Road Now Open.	2.07
14	1N	01N-0198/00.96	01N-0198/00.96	Road Closed	Other	Police Scene Examination Of Crash Site; Accident 26.07.09	0.34
55	1N	01N-0198/05.58	01N-0198/05.58	Road Closed	Flooding	Otiria Stream Bridge Is Closed, Flooding	5.1
4	1N	01N-0198/06.10	01N-0198/06.10	Road Closed	Flooding	Flooding Has Closed Sh 1n At The Otiria Stream Bridge, Just North Of Moerewa	1.46
92	1N	01N-0198/06.38	01N-0198/06.38	Road Closed	Flooding	Due To Flooding At Otiria Stream Bridge This Section Of Highway Is Closed. Expect Delays Or Avoid The Area If Possible	12.31
111	1N	01N-0198/06.85	01N-0198/06.85	Road Closed	Crash	**road Now Open** Due To A Serious Incident In This Area The Road Is Closed. Emergency Services Are On Site. Please Delay Your Journey Or Use An Alternative Route.	4.32
99	1N	01N-0198/09.52	01N-0198/09.52	Road Closed	Crash	Road Now Open. Due To An Incident, This Section Of State Highway 1 Is Closed.	3.11
58	1N	01N-0198/12.00	01N-0198/12.00	Road Closed	Crash	Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible.	2.52
118	1N	01N-0198/12.58	01N-0198/12.58	Road Closed	Crash	A Serious Crash Involving Several Vehicles Just North Of The Kawakawa Township.	4.12
93	1N	01N-0215/07.04	01N-0215/07.04	Road Closed	Washout	Due To A Slip This Section Of The State Highway Is Closed. Long Delays Are Expected. Avoid The Area Or Delay Your Trip If Possible.	155.17
67	1N	01N-0215/07.96	01N-0215/07.96	Road Closed	Crash	Due To An Incident, The State Highway Is Closed At The Intersection Of Callaghan Rd. Delays Are Expected. Avoid The Area Or Delay Your Trip If Possible.	10.02
110	1N	01N-0215/12.61	01N-0215/12.61	Road Closed	Crash	A Serious Incident Has Been Reported In This Area. Emergency Services Are On Site. An Update Will Be Provided As Soon As More Information Is Available.	1.3
6	1N	01N-0215/14.52	01N-0215/14.52	Road Closed	Crash	Motor Vehicle Accident, 2kms South Of Towai. Both Lanes Are Closed	0.43
53	1N	01N-0215/17.57	01N-0215/17.57	Road Closed	Crash	Due To An Incident On The Intersection Of Sh1 And Rusk Road South Of Kawakawa, Diversions Are In Place Onto Paiaka Road And Rusk Road. Expect Possible Delays	3.03
40	1N	01N-0233/00.52	01N-0233/00.52	Road Closed	Crash	Due To An Earlier Incident This Section Of Highway Is Closed. Expect Delays	3.49
8	1N	01N-0233/02.69	01N-0233/02.69	Road Closed	Other	Road Closed Due To Scheduled Road Works To Allow For Repairs From 7am Till 7pm	13.11

Worksheet A1 - Discounting

YEAR	TIME	Growth	3%	DM TTC (Delays)				DM TTC (Detours)				TTC (HPMV Detours)			
				COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL
2016	0	1	3797	\$ 101,204.28	\$ 101,204.28	1.44	\$ 145,734.16	\$4,196.09	\$ 4,196.09	1.44	\$ 6,042.36	\$ 35,906.59	\$ 35,906.59	1.44	\$ 51,705.49
2017	1	0.943396226	3911	\$ 108,505.27	\$ 102,363.46	1.44	\$ 147,403.38	\$4,322.07	\$ 4,077.42	1.44	\$ 5,871.49	\$ 36,983.79	\$ 34,890.37	1.44	\$ 50,242.13
2018	2	0.88999644	4025	\$ 116,066.93	\$ 103,299.15	1.44	\$ 148,750.78	\$4,448.05	\$ 3,958.75	1.44	\$ 5,700.60	\$ 38,060.99	\$ 33,874.14	1.44	\$ 48,778.76
2019	3	0.839619283	4139	\$ 124,556.61	\$ 104,580.13	1.44	\$ 150,595.39	\$4,574.03	\$ 3,840.45	1.44	\$ 5,530.24	\$ 39,138.18	\$ 32,861.17	1.44	\$ 47,320.09
2020	4	0.792093663	4253	\$ 133,046.29	\$ 105,385.13	1.44	\$ 151,754.58	\$4,700.01	\$ 3,722.85	1.44	\$ 5,360.91	\$ 40,215.38	\$ 31,854.35	1.44	\$ 45,870.26
2021	5	0.747258173	4367	\$ 141,535.98	\$ 105,763.91	1.44	\$ 152,300.04	\$4,826.00	\$ 3,606.26	1.44	\$ 5,193.02	\$ 41,292.58	\$ 30,856.22	1.44	\$ 44,432.95
2022	6	0.70496054	4481	\$ 150,025.66	\$ 105,762.17	1.44	\$ 152,297.52	\$4,951.98	\$ 3,490.95	1.44	\$ 5,026.97	\$ 42,369.78	\$ 29,869.02	1.44	\$ 43,011.39
2023	7	0.665057114	4595	\$ 158,515.34	\$ 105,421.75	1.44	\$ 151,807.33	\$5,077.96	\$ 3,377.13	1.44	\$ 4,863.07	\$ 43,446.97	\$ 28,894.72	1.44	\$ 41,608.40
2024	8	0.627412371	4709	\$ 167,005.02	\$ 104,781.02	1.44	\$ 150,884.66	\$5,203.94	\$ 3,265.02	1.44	\$ 4,701.63	\$ 44,524.17	\$ 27,935.02	1.44	\$ 40,226.42
2025	9	0.591898464	4823	\$ 175,494.70	\$ 103,875.05	1.44	\$ 149,580.07	\$5,329.92	\$ 3,154.77	1.44	\$ 4,542.87	\$ 45,601.37	\$ 26,991.38	1.44	\$ 38,867.59
2026	10	0.558394777	4937	\$ 183,984.39	\$ 102,735.92	1.44	\$ 147,939.72	\$5,455.91	\$ 3,046.55	1.44	\$ 4,387.03	\$ 46,678.57	\$ 26,065.07	1.44	\$ 37,533.70
2027	11	0.526787525	5051	\$ 193,084.52	\$ 101,714.52	1.44	\$ 146,468.90	\$5,581.89	\$ 2,940.47	1.44	\$ 4,234.28	\$ 47,755.76	\$ 25,157.14	1.44	\$ 36,226.28
2028	12	0.496969364	5165	\$ 202,938.74	\$ 100,854.34	1.44	\$ 145,230.24	\$5,707.87	\$ 2,836.64	1.44	\$ 4,084.76	\$ 48,832.96	\$ 24,268.49	1.44	\$ 34,946.62
2029	13	0.468839022	5279	\$ 212,792.96	\$ 99,765.64	1.44	\$ 143,662.53	\$5,833.85	\$ 2,735.14	1.44	\$ 3,938.60	\$ 49,910.16	\$ 23,399.83	1.44	\$ 33,695.76
2030	14	0.442300964	5393	\$ 222,647.18	\$ 98,477.06	1.44	\$ 141,806.97	\$5,959.83	\$ 2,636.04	1.44	\$ 3,795.90	\$ 50,987.36	\$ 22,551.76	1.44	\$ 32,474.53
2031	15	0.417265061	5507	\$ 232,501.40	\$ 97,014.71	1.44	\$ 139,701.18	\$6,085.82	\$ 2,539.40	1.44	\$ 3,656.73	\$ 52,064.56	\$ 21,724.72	1.44	\$ 31,283.60
2032	16	0.393646284	5621	\$ 242,355.62	\$ 95,402.39	1.44	\$ 137,379.44	\$6,211.80	\$ 2,445.25	1.44	\$ 3,521.16	\$ 53,141.75	\$ 20,919.05	1.44	\$ 30,123.44
2033	17	0.371364419	5735	\$ 252,209.84	\$ 93,661.76	1.44	\$ 134,872.94	\$6,337.78	\$ 2,353.63	1.44	\$ 3,389.22	\$ 54,218.95	\$ 20,134.99	1.44	\$ 28,994.38
2034	18	0.350343791	5849	\$ 262,064.06	\$ 91,812.52	1.44	\$ 132,210.03	\$6,463.76	\$ 2,264.54	1.44	\$ 3,260.94	\$ 55,296.15	\$ 19,372.66	1.44	\$ 27,896.63
2035	19	0.33051301	5963	\$ 271,918.28	\$ 89,872.53	1.44	\$ 129,416.44	\$6,589.74	\$ 2,178.00	1.44	\$ 3,136.31	\$ 56,373.35	\$ 18,632.12	1.44	\$ 26,830.26
2036	20	0.311804727	6077	\$ 281,772.51	\$ 87,858.00	1.44	\$ 126,515.52	\$6,715.73	\$ 2,094.00	1.44	\$ 3,015.35	\$ 57,450.54	\$ 17,913.35	1.44	\$ 25,795.23
2037	21	0.294155403	6191	\$ 291,626.73	\$ 85,783.58	1.44	\$ 123,528.35	\$6,841.71	\$ 2,012.53	1.44	\$ 2,898.04	\$ 58,527.74	\$ 17,216.25	1.44	\$ 24,791.40
2038	22	0.277505097	6305	\$ 301,480.95	\$ 83,662.50	1.44	\$ 120,474.00	\$6,967.69	\$ 1,933.57	1.44	\$ 2,784.34	\$ 59,604.94	\$ 16,540.67	1.44	\$ 23,818.57
2039	23	0.261797261	6419	\$ 311,335.17	\$ 81,506.69	1.44	\$ 117,369.64	\$7,093.67	\$ 1,857.10	1.44	\$ 2,674.23	\$ 60,682.14	\$ 15,886.42	1.44	\$ 22,876.44
2040	24	0.246978548	6533	\$ 321,189.39	\$ 79,326.89	1.44	\$ 114,230.72	\$7,219.65	\$ 1,783.10	1.44	\$ 2,567.66	\$ 61,759.33	\$ 15,253.23	1.44	\$ 21,964.65
2041	25	0.232998631	6647		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2042	26	0.219810029	6761		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2043	27	0.207367952	6875		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2044	28	0.195630143	6989		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2045	29	0.184556739	7103		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2046	30	0.174110131	7217		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2047	31	0.16425484	7331		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2048	32	0.154957397	7445		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2049	33	0.146186223	7559		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2050	34	0.137911531	7673		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2051	35	0.130105218	7787		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2052	36	0.122740772	7901		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2053	37	0.115793181	8015		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2054	38	0.10923885	8129		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -
2055	39	0.103055519	8243		\$ -	1.44	\$ -		\$ -	1.44	\$ -		\$ -	1.44	\$ -

\$ 3,501,914.54

\$ 104,177.71

\$ 891,314.97

Worksheet A1 - Discounting

YEAR	TIME	Growth SPPWF	3% AADT	DM VOC (Delays)				DM VOC (Detours)				Crash Cost Difference @ Bridge			
				COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL
2016	0	1	3797	\$ 6,758.82	\$ 6,758.82	1	\$ 6,758.82	\$ 4,176.74	\$ 4,176.74	1	\$ 4,176.74	\$ 93,799.33	\$ 93,799.33	1	\$ 93,799.33
2017	1	0.943396226	3911	\$ 7,187.63	\$ 6,780.78	1	\$ 6,780.78	\$ 4,302.14	\$ 4,058.62	1	\$ 4,058.62	\$ 94,737.32	\$ 89,374.83	1	\$ 89,374.83
2018	2	0.88999644	4025	\$ 7,624.19	\$ 6,785.50	1	\$ 6,785.50	\$ 4,427.54	\$ 3,940.50	1	\$ 3,940.50	\$ 95,675.31	\$ 85,150.69	1	\$ 85,150.69
2019	3	0.839619283	4139	\$ 8,088.35	\$ 6,791.13	1	\$ 6,791.13	\$ 4,552.94	\$ 3,822.74	1	\$ 3,822.74	\$ 96,613.31	\$ 81,118.40	1	\$ 81,118.40
2020	4	0.792093663	4253	\$ 8,552.50	\$ 6,774.38	1	\$ 6,774.38	\$ 4,678.34	\$ 3,705.69	1	\$ 3,705.69	\$ 97,551.30	\$ 77,269.77	1	\$ 77,269.77
2021	5	0.747258173	4367	\$ 9,016.66	\$ 6,737.77	1	\$ 6,737.77	\$ 4,803.74	\$ 3,589.64	1	\$ 3,589.64	\$ 98,489.29	\$ 73,596.93	1	\$ 73,596.93
2022	6	0.70496054	4481	\$ 9,480.82	\$ 6,683.60	1	\$ 6,683.60	\$ 4,929.14	\$ 3,474.85	1	\$ 3,474.85	\$ 99,427.29	\$ 70,092.31	1	\$ 70,092.31
2023	7	0.665057114	4595	\$ 9,944.98	\$ 6,613.98	1	\$ 6,613.98	\$ 5,054.55	\$ 3,361.56	1	\$ 3,361.56	\$ 100,365.28	\$ 66,748.64	1	\$ 66,748.64
2024	8	0.627412371	4709	\$ 10,409.14	\$ 6,530.82	1	\$ 6,530.82	\$ 5,179.95	\$ 3,249.96	1	\$ 3,249.96	\$ 101,303.27	\$ 63,558.93	1	\$ 63,558.93
2025	9	0.591898464	4823	\$ 10,873.29	\$ 6,435.89	1	\$ 6,435.89	\$ 5,305.35	\$ 3,140.23	1	\$ 3,140.23	\$ 102,241.27	\$ 60,516.45	1	\$ 60,516.45
2026	10	0.558394777	4937	\$ 11,337.45	\$ 6,330.77	1	\$ 6,330.77	\$ 5,430.75	\$ 3,032.50	1	\$ 3,032.50	\$ 103,179.26	\$ 57,614.76	1	\$ 57,614.76
2027	11	0.526787525	5051	\$ 11,821.54	\$ 6,227.44	1	\$ 6,227.44	\$ 5,556.15	\$ 2,926.91	1	\$ 2,926.91	\$ 104,117.25	\$ 54,847.67	1	\$ 54,847.67
2028	12	0.496969364	5165	\$ 12,330.26	\$ 6,127.76	1	\$ 6,127.76	\$ 5,681.55	\$ 2,823.56	1	\$ 2,823.56	\$ 105,055.25	\$ 52,209.24	1	\$ 52,209.24
2029	13	0.468839022	5279	\$ 12,838.98	\$ 6,019.41	1	\$ 6,019.41	\$ 5,806.95	\$ 2,722.53	1	\$ 2,722.53	\$ 105,993.24	\$ 49,693.77	1	\$ 49,693.77
2030	14	0.442300964	5393	\$ 13,347.69	\$ 5,903.70	1	\$ 5,903.70	\$ 5,932.35	\$ 2,623.89	1	\$ 2,623.89	\$ 106,931.23	\$ 47,295.79	1	\$ 47,295.79
2031	15	0.417265061	5507	\$ 13,856.41	\$ 5,781.80	1	\$ 5,781.80	\$ 6,057.76	\$ 2,527.69	1	\$ 2,527.69	\$ 107,869.23	\$ 45,010.06	1	\$ 45,010.06
2032	16	0.393646284	5621	\$ 14,365.13	\$ 5,654.78	1	\$ 5,654.78	\$ 6,183.16	\$ 2,433.98	1	\$ 2,433.98	\$ 108,807.22	\$ 42,831.56	1	\$ 42,831.56
2033	17	0.371364419	5735	\$ 14,873.85	\$ 5,523.62	1	\$ 5,523.62	\$ 6,308.56	\$ 2,342.77	1	\$ 2,342.77	\$ 109,745.21	\$ 40,755.47	1	\$ 40,755.47
2034	18	0.350343791	5849	\$ 15,382.56	\$ 5,389.19	1	\$ 5,389.19	\$ 6,433.96	\$ 2,254.10	1	\$ 2,254.10	\$ 110,683.21	\$ 38,777.17	1	\$ 38,777.17
2035	19	0.33051301	5963	\$ 15,891.28	\$ 5,252.27	1	\$ 5,252.27	\$ 6,559.36	\$ 2,167.95	1	\$ 2,167.95	\$ 111,621.20	\$ 36,892.26	1	\$ 36,892.26
2036	20	0.311804727	6077	\$ 16,400.00	\$ 5,113.60	1	\$ 5,113.60	\$ 6,684.76	\$ 2,084.34	1	\$ 2,084.34	\$ 112,559.19	\$ 35,096.49	1	\$ 35,096.49
2037	21	0.294155403	6191	\$ 16,908.71	\$ 4,973.79	1	\$ 4,973.79	\$ 6,810.16	\$ 2,003.25	1	\$ 2,003.25	\$ 113,497.19	\$ 33,385.81	1	\$ 33,385.81
2038	22	0.277505097	6305	\$ 17,417.43	\$ 4,833.43	1	\$ 4,833.43	\$ 6,935.56	\$ 1,924.65	1	\$ 1,924.65	\$ 114,435.18	\$ 31,756.35	1	\$ 31,756.35
2039	23	0.261797261	6419	\$ 17,926.15	\$ 4,693.02	1	\$ 4,693.02	\$ 7,060.96	\$ 1,848.54	1	\$ 1,848.54	\$ 115,373.17	\$ 30,204.38	1	\$ 30,204.38
2040	24	0.246978548	6533	\$ 18,434.86	\$ 4,553.02	1	\$ 4,553.02	\$ 7,186.37	\$ 1,774.88	1	\$ 1,774.88	\$ 116,311.17	\$ 28,726.36	1	\$ 28,726.36
2041	25	0.232998631	6647		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2042	26	0.219810029	6761		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2043	27	0.207367952	6875		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2044	28	0.195630143	6989		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2045	29	0.184556739	7103		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2046	30	0.174110131	7217		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2047	31	0.16425484	7331		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2048	32	0.154957397	7445		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2049	33	0.146186223	7559		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2050	34	0.137911531	7673		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2051	35	0.130105218	7787		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2052	36	0.122740772	7901		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2053	37	0.115793181	8015		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2054	38	0.10923885	8129		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -
2055	39	0.103055519	8243		\$ -	1	\$ -		\$ -	1	\$ -		\$ -	1	\$ -

\$ 149,270.26

\$ 72,012.05

\$ 1,386,323.42



Worksheet A1 - Discounting

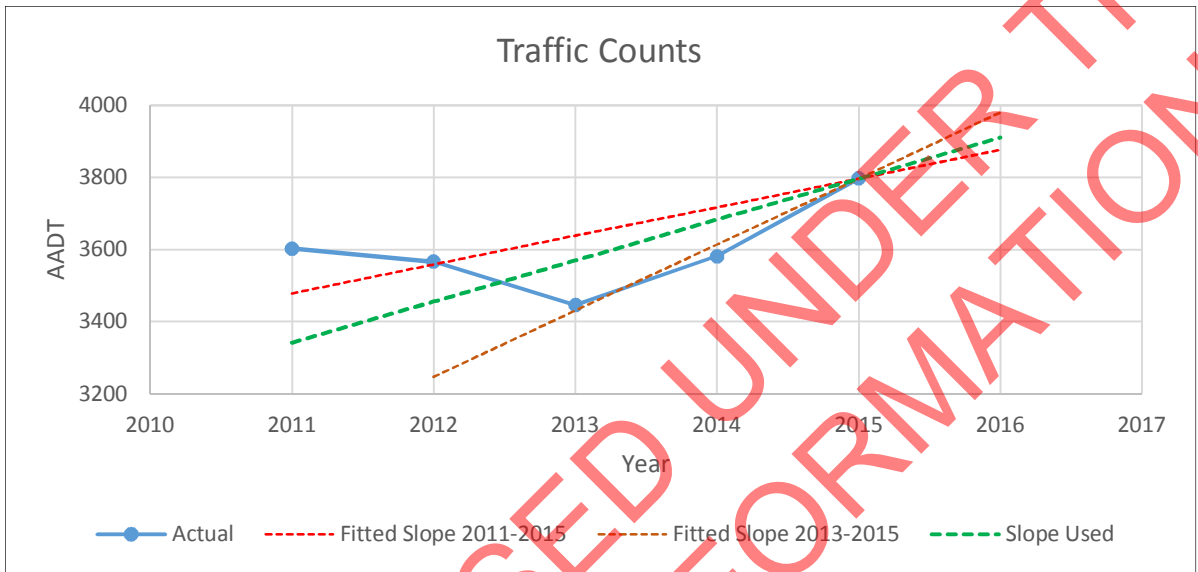
YEAR	TIME	Growth SPPWF	3% AADT	Detour Crash Benefits				DM CONSTRUCTION		OPT CONSTRUCTION	
				COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	COST	PV COST
2016	0	1	3797	\$ 6,448.73	\$ 6,448.73	1	\$ 6,448.73	\$ 1,000.00	\$ 1,000.00	\$ 14,098,607.00	\$ 14,098,607.00
2017	1	0.943396226	3911	\$ 6,513.22	\$ 6,144.55	1	\$ 6,144.55	\$ 1,000.00	\$ 943.40	\$ -	\$ -
2018	2	0.88999644	4025	\$ 6,577.71	\$ 5,854.14	1	\$ 5,854.14	\$ 1,000.00	\$ 890.00	\$ -	\$ -
2019	3	0.839619283	4139	\$ 6,642.19	\$ 5,576.91	1	\$ 5,576.91	\$ 1,000.00	\$ 839.62	\$ -	\$ -
2020	4	0.792093663	4253	\$ 6,706.68	\$ 5,312.32	1	\$ 5,312.32	\$ 1,000.00	\$ 792.09	\$ -	\$ -
2021	5	0.747258173	4367	\$ 6,771.17	\$ 5,059.81	1	\$ 5,059.81	\$ 1,000.00	\$ 747.26	\$ -	\$ -
2022	6	0.70496054	4481	\$ 6,835.66	\$ 4,818.87	1	\$ 4,818.87	\$ 1,000.00	\$ 704.96	\$ -	\$ -
2023	7	0.665057114	4595	\$ 6,900.14	\$ 4,588.99	1	\$ 4,588.99	\$ 1,000.00	\$ 665.06	\$ -	\$ -
2024	8	0.627412371	4709	\$ 6,964.63	\$ 4,369.70	1	\$ 4,369.70	\$ 1,000.00	\$ 627.41	\$ -	\$ -
2025	9	0.591898464	4823	\$ 7,029.12	\$ 4,160.52	1	\$ 4,160.52	\$ 1,000.00	\$ 591.90	\$ -	\$ -
2026	10	0.558394777	4937	\$ 7,093.61	\$ 3,961.03	1	\$ 3,961.03	\$ 1,000.00	\$ 558.39	\$ -	\$ -
2027	11	0.526787525	5051	\$ 7,158.09	\$ 3,770.79	1	\$ 3,770.79	\$ 1,000.00	\$ 526.79	\$ -	\$ -
2028	12	0.496969364	5165	\$ 7,222.58	\$ 3,589.40	1	\$ 3,589.40	\$ 1,000.00	\$ 496.97	\$ -	\$ -
2029	13	0.468839022	5279	\$ 7,287.07	\$ 3,416.46	1	\$ 3,416.46	\$ 1,000.00	\$ 468.84	\$ -	\$ -
2030	14	0.442300964	5393	\$ 7,351.56	\$ 3,251.60	1	\$ 3,251.60	\$ 1,000.00	\$ 442.30	\$ -	\$ -
2031	15	0.417265061	5507	\$ 7,416.04	\$ 3,094.46	1	\$ 3,094.46	\$ 1,000.00	\$ 417.27	\$ -	\$ -
2032	16	0.393646284	5621	\$ 7,480.53	\$ 2,944.68	1	\$ 2,944.68	\$ 1,000.00	\$ 393.65	\$ -	\$ -
2033	17	0.371364419	5735	\$ 7,545.02	\$ 2,801.95	1	\$ 2,801.95	\$ 1,000.00	\$ 371.36	\$ -	\$ -
2034	18	0.350343791	5849	\$ 7,609.50	\$ 2,665.94	1	\$ 2,665.94	\$ 1,000.00	\$ 350.34	\$ -	\$ -
2035	19	0.33051301	5963	\$ 7,673.99	\$ 2,536.35	1	\$ 2,536.35	\$ 1,000.00	\$ 330.51	\$ -	\$ -
2036	20	0.311804727	6077	\$ 7,738.48	\$ 2,412.89	1	\$ 2,412.89	\$ 1,000.00	\$ 311.80	\$ -	\$ -
2037	21	0.294155403	6191	\$ 7,802.97	\$ 2,295.28	1	\$ 2,295.28	\$ 1,000.00	\$ 294.16	\$ -	\$ -
2038	22	0.277505097	6305	\$ 7,867.45	\$ 2,183.26	1	\$ 2,183.26	\$ 1,000.00	\$ 277.51	\$ -	\$ -
2039	23	0.261797261	6419	\$ 7,931.94	\$ 2,076.56	1	\$ 2,076.56	\$ 1,000.00	\$ 261.80	\$ -	\$ -
2040	24	0.246978548	6533	\$ 7,996.43	\$ 1,974.95	1	\$ 1,974.95	\$ 1,000.00	\$ 246.98	\$ -	\$ -
2041	25	0.232998631	6647	\$ -	\$ -	1	\$ -	\$ 14,098,607.00	\$ 3,284,956.12	\$ -	\$ -
2042	26	0.219810029	6761	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2043	27	0.207367952	6875	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2044	28	0.195630143	6989	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2045	29	0.184556739	7103	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2046	30	0.174110131	7217	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2047	31	0.16425484	7331	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2048	32	0.154957397	7445	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2049	33	0.146186223	7559	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2050	34	0.137911531	7673	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2051	35	0.130105218	7787	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2052	36	0.122740772	7901	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2053	37	0.115793181	8015	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2054	38	0.10923885	8129	\$ -	\$ -	1	\$ -	\$ -	\$ -	\$ -	\$ -
2055	39	0.103055519	8243	\$ -	\$ -	1	\$ -	\$ 7,272,791.78	\$ 749,501.33	\$ 7,112,192.69	\$ 732,950.71

\$ 95,310.16

\$ 2,549,005.15

\$ 13,365,656.29

Traffic Counts	
Year	AADT
2011	3602
2012	3566
2013	3446
2014	3581
2015	3797
2016	
Best Fit Slope for 2011-2015	79.7
Best Fit Slope for 2013-2015	183.6
% Growth (2011-2015)	2.10%
% Growth (2013-2015)	4.84%
% Growth Used	3.00%



Delays & Conflicts at One Lane Bridges					Year	AADT	Delay (mins per day)	Wait (mins per day)	Total Stops
Table 3: Total Delay in minutes per day					2016	3797	820.14	180.44	1,030.87
Interpolated figures for 110m Bridge					2017	3911	879.31	194.23	1,093.00
AADT	3500	4000	5000	7000	2018	4025	940.59	208.78	1,155.55
100m	627	877	1464	2840	2019	4139	1,009.39	225.99	1,219.62
120m	705	974	1594	3020	2020	4253	1,078.19	243.20	1,283.69
<b>110m</b>	<b>666</b>	<b>925.5</b>	<b>1529</b>	<b>2930</b>	2021	4367	1,146.98	260.42	1,347.75
					2022	4481	1,215.78	277.63	1,411.82
Table 4: Total waiting time in minutes per day					2023	4595	1,284.58	294.85	1,475.89
AADT	3500	4000	5000	7000	2024	4709	1,353.38	312.06	1,539.96
100m	130	186	327	715	2025	4823	1,422.18	329.27	1,604.03
120m	159	224	385	813	2026	4937	1,490.98	346.49	1,668.09
<b>110m</b>	<b>144.5</b>	<b>205</b>	<b>356</b>	<b>764</b>	2027	5051	1,564.73	366.40	1,732.17
					2028	5165	1,644.58	389.66	1,796.27
Table 5: Total number of stops per day					2029	5279	1,724.44	412.92	1,860.37
AADT	3500	4000	5000	7000	2030	5393	1,804.30	436.17	1,924.46
100m	824	1091	1645	2765	2031	5507	1,884.15	459.43	1,988.56
120m	914	1192	1762	2891	2032	5621	1,964.01	482.68	2,052.66
<b>110m</b>	<b>869</b>	<b>1141.5</b>	<b>1703.5</b>	<b>2828</b>	2033	5735	2,043.87	505.94	2,116.75
					2034	5849	2,123.72	529.20	2,180.85
					2035	5963	2,203.58	552.45	2,244.95
					2036	6077	2,283.44	575.71	2,309.04
					2037	6191	2,363.30	598.96	2,373.14
					2038	6305	2,443.15	622.22	2,437.24
					2039	6419	2,523.01	645.48	2,501.33
					2040	6533	2,602.87	668.73	2,565.43

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## Worksheets A4: Travel time cost savings, continued



## Worksheet A4.1 - Travel time cost savings

Option (1)	Direction (2)	Period (3)	No./Year (4)	Road Category (5)	Period Volume (6)	TT (mins) (7)	TTC (\$/hr) (8)	Congest (\$/hr) (9)	Reliability (\$/hr) (10)	Annual Cost (\$) (11)
DM - Bridge Delays	Both	2016	245	RS	3,797	820.1430	\$25.34	\$4.88	\$0.00	\$101,204
DM - Bridge Delays	Both	2017	245	RS	3,911	879.3090	\$25.34	\$4.88	\$0.00	\$108,505
DM - Bridge Delays	Both	2018	245	RS	4,025	940.5875	\$25.34	\$4.88	\$0.00	\$116,067
DM - Bridge Delays	Both	2019	245	RS	4,139	1009.3865	\$25.34	\$4.88	\$0.00	\$124,557
DM - Bridge Delays	Both	2020	245	RS	4,253	1078.1855	\$25.34	\$4.88	\$0.00	\$133,046
DM - Bridge Delays	Both	2021	245	RS	4,367	1146.9845	\$25.34	\$4.88	\$0.00	\$141,536
DM - Bridge Delays	Both	2022	245	RS	4,481	1215.7835	\$25.34	\$4.88	\$0.00	\$150,026
DM - Bridge Delays	Both	2023	245	RS	4,595	1284.5825	\$25.34	\$4.88	\$0.00	\$158,515
DM - Bridge Delays	Both	2024	245	RS	4,709	1353.3815	\$25.34	\$4.88	\$0.00	\$167,005
DM - Bridge Delays	Both	2025	245	RS	4,823	1422.1805	\$25.34	\$4.88	\$0.00	\$175,495
DM - Bridge Delays	Both	2026	245	RS	4,937	1490.9795	\$25.34	\$4.88	\$0.00	\$183,984
DM - Bridge Delays	Both	2027	245	RS	5,051	1564.7255	\$25.34	\$4.88	\$0.00	\$193,085
DM - Bridge Delays	Both	2028	245	RS	5,165	1644.5825	\$25.34	\$4.88	\$0.00	\$202,939
DM - Bridge Delays	Both	2029	245	RS	5,279	1724.4395	\$25.34	\$4.88	\$0.00	\$212,793
DM - Bridge Delays	Both	2030	245	RS	5,393	1804.2965	\$25.34	\$4.88	\$0.00	\$222,647
DM - Bridge Delays	Both	2031	245	RS	5,507	1884.1535	\$25.34	\$4.88	\$0.00	\$232,501
DM - Bridge Delays	Both	2032	245	RS	5,621	1964.0105	\$25.34	\$4.88	\$0.00	\$242,356
DM - Bridge Delays	Both	2033	245	RS	5,735	2043.8675	\$25.34	\$4.88	\$0.00	\$252,210
DM - Bridge Delays	Both	2034	245	RS	5,849	2123.7245	\$25.34	\$4.88	\$0.00	\$262,064
DM - Bridge Delays	Both	2035	245	RS	5,963	2203.5815	\$25.34	\$4.88	\$0.00	\$271,918
DM - Bridge Delays	Both	2036	245	RS	6,077	2283.4385	\$25.34	\$4.88	\$0.00	\$281,773
DM - Bridge Delays	Both	2037	245	RS	6,191	2363.2955	\$25.34	\$4.88	\$0.00	\$291,627
DM - Bridge Delays	Both	2038	245	RS	6,305	2443.1525	\$25.34	\$4.88	\$0.00	\$301,481
DM - Bridge Delays	Both	2039	245	RS	6,419	2523.0095	\$25.34	\$4.88	\$0.00	\$311,335
DM - Bridge Delays	Both	2040	245	RS	6,533	2602.8665	\$25.34	\$4.88	\$0.00	\$321,189

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## Worksheets A4: Travel time cost savings, continued



## Worksheet A4.1 - Travel time cost savings

Option (1)	Direction (2)	Period (3)	No./Year (4)	Road Category (5)	Period Volume (6)	TT (mins) (7)	TTC (\$/hr) (8)	Congest (\$/hr) (9)	Reliability (\$/hr) (10)	Annual Cost (\$) (11)
DM - Diversions	Both	2016	-	RS	3,797.00	9935.4833	\$25.34	\$0.00	\$0.00	\$4,196
DM - Diversions	Both	2017	-	RS	3,911.00	10233.7833	\$25.34	\$0.00	\$0.00	\$4,322
DM - Diversions	Both	2018	-	RS	4,025.00	10532.0833	\$25.34	\$0.00	\$0.00	\$4,448
DM - Diversions	Both	2019	-	RS	4,139.00	10830.3833	\$25.34	\$0.00	\$0.00	\$4,574
DM - Diversions	Both	2020	-	RS	4,253.00	11128.6833	\$25.34	\$0.00	\$0.00	\$4,700
DM - Diversions	Both	2021	-	RS	4,367.00	11426.9833	\$25.34	\$0.00	\$0.00	\$4,826
DM - Diversions	Both	2022	-	RS	4,481.00	11725.2833	\$25.34	\$0.00	\$0.00	\$4,952
DM - Diversions	Both	2023	-	RS	4,595.00	12023.5833	\$25.34	\$0.00	\$0.00	\$5,078
DM - Diversions	Both	2024	-	RS	4,709.00	12321.8833	\$25.34	\$0.00	\$0.00	\$5,204
DM - Diversions	Both	2025	-	RS	4,823.00	12620.1833	\$25.34	\$0.00	\$0.00	\$5,330
DM - Diversions	Both	2026	-	RS	4,937.00	12918.4833	\$25.34	\$0.00	\$0.00	\$5,456
DM - Diversions	Both	2027	-	RS	5,051.00	13216.7833	\$25.34	\$0.00	\$0.00	\$5,582
DM - Diversions	Both	2028	-	RS	5,165.00	13515.0833	\$25.34	\$0.00	\$0.00	\$5,708
DM - Diversions	Both	2029	-	RS	5,279.00	13813.3833	\$25.34	\$0.00	\$0.00	\$5,834
DM - Diversions	Both	2030	-	RS	5,393.00	14111.6833	\$25.34	\$0.00	\$0.00	\$5,960
DM - Diversions	Both	2031	-	RS	5,507.00	14409.9833	\$25.34	\$0.00	\$0.00	\$6,086
DM - Diversions	Both	2032	-	RS	5,621.00	14708.2833	\$25.34	\$0.00	\$0.00	\$6,212
DM - Diversions	Both	2033	-	RS	5,735.00	15006.5833	\$25.34	\$0.00	\$0.00	\$6,338
DM - Diversions	Both	2034	-	RS	5,849.00	15304.8833	\$25.34	\$0.00	\$0.00	\$6,464
DM - Diversions	Both	2035	-	RS	5,963.00	15603.1833	\$25.34	\$0.00	\$0.00	\$6,590
DM - Diversions	Both	2036	-	RS	6,077.00	15901.4833	\$25.34	\$0.00	\$0.00	\$6,716
DM - Diversions	Both	2037	-	RS	6,191.00	16199.7833	\$25.34	\$0.00	\$0.00	\$6,842
DM - Diversions	Both	2038	-	RS	6,305.00	16498.0833	\$25.34	\$0.00	\$0.00	\$6,968
DM - Diversions	Both	2039	-	RS	6,419.00	16796.3833	\$25.34	\$0.00	\$0.00	\$7,094
DM - Diversions	Both	2040	-	RS	6,533.00	17094.6833	\$25.34	\$0.00	\$0.00	\$7,220

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Worksheets A4: Travel time cost savings, continued



Worksheet A4.1 - Travel time cost savings

Option (1)	Direction (2)	Period (3)	No./Year (4)	Road Category (5)	Period Volume (6)	TT (mins) (7)	TTC (\$/hr) (8)	Congest (\$/hr) (9)	Reliability (\$/hr) (10)	Annual Cost (\$) (11)
DM - HPMV Delays	Both	2016	-	RS	50.00	893.9400	\$48.20	\$0.00	\$0.00	\$35,907
DM - HPMV Delays	Both	2017	-	RS	51.50	893.9400	\$48.20	\$0.00	\$0.00	\$36,984
DM - HPMV Delays	Both	2018	-	RS	53.00	893.9400	\$48.20	\$0.00	\$0.00	\$38,061
DM - HPMV Delays	Both	2019	-	RS	54.50	893.9400	\$48.20	\$0.00	\$0.00	\$39,138
DM - HPMV Delays	Both	2020	-	RS	56.00	893.9400	\$48.20	\$0.00	\$0.00	\$40,215
DM - HPMV Delays	Both	2021	-	RS	57.50	893.9400	\$48.20	\$0.00	\$0.00	\$41,293
DM - HPMV Delays	Both	2022	-	RS	59.00	893.9400	\$48.20	\$0.00	\$0.00	\$42,370
DM - HPMV Delays	Both	2023	-	RS	60.50	893.9400	\$48.20	\$0.00	\$0.00	\$43,447
DM - HPMV Delays	Both	2024	-	RS	62.00	893.9400	\$48.20	\$0.00	\$0.00	\$44,524
DM - HPMV Delays	Both	2025	-	RS	63.50	893.9400	\$48.20	\$0.00	\$0.00	\$45,601
DM - HPMV Delays	Both	2026	-	RS	65.00	893.9400	\$48.20	\$0.00	\$0.00	\$46,679
DM - HPMV Delays	Both	2027	-	RS	66.50	893.9400	\$48.20	\$0.00	\$0.00	\$47,756
DM - HPMV Delays	Both	2028	-	RS	68.00	893.9400	\$48.20	\$0.00	\$0.00	\$48,833
DM - HPMV Delays	Both	2029	-	RS	69.50	893.9400	\$48.20	\$0.00	\$0.00	\$49,910
DM - HPMV Delays	Both	2030	-	RS	71.00	893.9400	\$48.20	\$0.00	\$0.00	\$50,987
DM - HPMV Delays	Both	2031	-	RS	72.50	893.9400	\$48.20	\$0.00	\$0.00	\$52,065
DM - HPMV Delays	Both	2032	-	RS	74.00	893.9400	\$48.20	\$0.00	\$0.00	\$53,142
DM - HPMV Delays	Both	2033	-	RS	75.50	893.9400	\$48.20	\$0.00	\$0.00	\$54,219
DM - HPMV Delays	Both	2034	-	RS	77.00	893.9400	\$48.20	\$0.00	\$0.00	\$55,296
DM - HPMV Delays	Both	2035	-	RS	78.50	893.9400	\$48.20	\$0.00	\$0.00	\$56,373
DM - HPMV Delays	Both	2036	-	RS	80.00	893.9400	\$48.20	\$0.00	\$0.00	\$57,451
DM - HPMV Delays	Both	2037	-	RS	81.50	893.9400	\$48.20	\$0.00	\$0.00	\$58,528
DM - HPMV Delays	Both	2038	-	RS	83.00	893.9400	\$48.20	\$0.00	\$0.00	\$59,605
DM - HPMV Delays	Both	2039	-	RS	84.50	893.9400	\$48.20	\$0.00	\$0.00	\$60,682
DM - HPMV Delays	Both	2040	-	RS	86.00	893.9400	\$48.20	\$0.00	\$0.00	\$61,759

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 First edition, Amendment 1  
 Effective from 1 January 2016

## Additional VOC due to delays

### Assumptions

- Additional VOC due to stops (Cents per speed change cycle), Table A5.41 of EEM
- Additional VOC due to waiting time (Cents per min), Table A5.23 of EEM

Year	Total vehicle stops per day	Additional VOC	Total waiting time (min per day)	Additional VOC (c/min)	Days per year	Annual Cost
2016	1030.865	2.151	180.437	3	245	\$ 6,758.82
2017	1092.995	2.151	194.231	3	245	\$ 7,187.63
2018	1155.55	2.151	208.775	3	245	\$ 7,624.19
2019	1219.618	2.151	225.989	3	245	\$ 8,088.35
2020	1283.686	2.151	243.203	3	245	\$ 8,552.50
2021	1347.754	2.151	260.417	3	245	\$ 9,016.66
2022	1411.822	2.151	277.631	3	245	\$ 9,480.82
2023	1475.89	2.151	294.845	3	245	\$ 9,944.98
2024	1539.958	2.151	312.059	3	245	\$ 10,409.14
2025	1604.026	2.151	329.273	3	245	\$ 10,873.29
2026	1668.094	2.151	346.487	3	245	\$ 11,337.45
2027	1732.17475	2.151	366.404	3	245	\$ 11,821.54
2028	1796.27125	2.151	389.66	3	245	\$ 12,330.26
2029	1860.36775	2.151	412.916	3	245	\$ 12,838.98
2030	1924.46425	2.151	436.172	3	245	\$ 13,347.69
2031	1988.56075	2.151	459.428	3	245	\$ 13,856.41
2032	2052.65725	2.151	482.684	3	245	\$ 14,365.13
2033	2116.75375	2.151	505.94	3	245	\$ 14,873.85
2034	2180.85025	2.151	529.196	3	245	\$ 15,382.56
2035	2244.94675	2.151	552.452	3	245	\$ 15,891.28
2036	2309.04325	2.151	575.708	3	245	\$ 16,400.00
2037	2373.13975	2.151	598.964	3	245	\$ 16,908.71
2038	2437.23625	2.151	622.22	3	245	\$ 17,417.43
2039	2501.33275	2.151	645.476	3	245	\$ 17,926.15
2040	2565.42925	2.151	668.732	3	245	\$ 18,434.86

## Additional VOC due to Detours

### Assumptions

- 1 Bridge closure in last 5 years = 20% annual probability of closure
- 4 hour closure to clear site, inspect structure
- Assumed average detour is 99.1km, 78.5 min (=76km/h)
- VOC cost Table A5.9, 75km/h, 2% grade

Year (1)	AADT (2)	% AADT affected (3)	P (Diversion) (4)	Number of Veh Diverted (5) = (2)x(3)x(4)	Additional Journey Distance (6)	VOC Cost, cents per km (7)	Annual Cost
2016	3,797	16.67%	0.2000	126.57	99.1	33.3	\$ 4,176.74
2017	3,911	16.67%	0.2000	130.37	99.1	33.3	\$ 4,302.14
2018	4,025	16.67%	0.2000	134.17	99.1	33.3	\$ 4,427.54
2019	4,139	16.67%	0.2000	137.97	99.1	33.3	\$ 4,552.94
2020	4,253	16.67%	0.2000	141.77	99.1	33.3	\$ 4,678.34
2021	4,367	16.67%	0.2000	145.57	99.1	33.3	\$ 4,803.74
2022	4,481	16.67%	0.2000	149.37	99.1	33.3	\$ 4,929.14
2023	4,595	16.67%	0.2000	153.17	99.1	33.3	\$ 5,054.55
2024	4,709	16.67%	0.2000	156.97	99.1	33.3	\$ 5,179.95
2025	4,823	16.67%	0.2000	160.77	99.1	33.3	\$ 5,305.35
2026	4,937	16.67%	0.2000	164.57	99.1	33.3	\$ 5,430.75
2027	5,051	16.67%	0.2000	168.37	99.1	33.3	\$ 5,556.15
2028	5,165	16.67%	0.2000	172.17	99.1	33.3	\$ 5,681.55
2029	5,279	16.67%	0.2000	175.97	99.1	33.3	\$ 5,806.95
2030	5,393	16.67%	0.2000	179.77	99.1	33.3	\$ 5,932.35
2031	5,507	16.67%	0.2000	183.57	99.1	33.3	\$ 6,057.76
2032	5,621	16.67%	0.2000	187.37	99.1	33.3	\$ 6,183.16
2033	5,735	16.67%	0.2000	191.17	99.1	33.3	\$ 6,308.56
2034	5,849	16.67%	0.2000	194.97	99.1	33.3	\$ 6,433.96
2035	5,963	16.67%	0.2000	198.77	99.1	33.3	\$ 6,559.36
2036	6,077	16.67%	0.2000	202.57	99.1	33.3	\$ 6,684.76
2037	6,191	16.67%	0.2000	206.37	99.1	33.3	\$ 6,810.16
2038	6,305	16.67%	0.2000	210.17	99.1	33.3	\$ 6,935.56
2039	6,419	16.67%	0.2000	213.97	99.1	33.3	\$ 7,060.96
2040	6,533	16.67%	0.2000	217.77	99.1	33.3	\$ 7,186.37



## Worksheets A6: Accident cost savings continued



## Worksheet A6.4a - Accident rate analysis

Option	Taipa - New 2 Lane Bridge		
Posted speed limit	100km/h near rural	Traffic growth rate	3%
Road category	Rural Strategic	Time zero	Jul-15
Accident prediction model			
1 Table used			3.4
2 Parameter $b_0$			8.283425368
3 Parameter $b_1$			
4 Parameter $b_2$			
5 Lowest or side road AADT ( $Q_{minor}$ )			
6 Highest or primary AADT ( $Q_{major}$ )			3797
7 Typical accident rate (accidents per year), $A_T$ (formula from crash compendium)			0.114879037
			Go to step 8
Exposure-based accident prediction equation			
1a Table used			
2a Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)			
3a Cross section adjustment factor from crash compendium table 5 (1.0 for no adjustment)			
4a Adjusted coefficient (2a) x (3a)			
5a Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)			
7 Typical accident rate (accidents per year), $A_T$ (4a) x (5a)			
8 Accident trends factor for adjusting typical accident rate (appendix A6.5 method B)			-0.02
9 Adjustment factor for accident trend ( $1 + (8) \times (\text{time zero year} - 2006)$ ) (appendix A6.5 B)			0.82
10 Typical accident rate per year adjusted for accident trends, $A_T$ (7) x (9)			0.09420081
11 Cost per reported injury accident (table A6.5)		\$	570,000
12 Total accident cost per year (10) x (11)		\$	53,694.46

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## Worksheets A6: Accident cost savings continued



## Worksheet A6.4a - Accident rate analysis

Option		Taipa - Detour Route Crashes	
Posted speed limit	100km/h near rural	Traffic growth rate	3%
Road category	Rural Strategic	Time zero	Jul-15
Accident prediction model			
1	Table used		3.0
2	Parameter $b_0$		22
3	Parameter $b_1$		
4	Parameter $b_2$		
5	Lowest or side road AADT ( $Q_{minor}$ )		
6	Highest or primary AADT ( $Q_{major}$ )		632.8333333
7	Typical accident rate (accidents per year), $A_T$ (formula from crash compendium)		0.013797032
			Go to step 8
Exposure-based accident prediction equation			
1a	Table used		
2a	Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)		
3a	Cross section adjustment factor from crash compendium table 5 (1.0 for no adjustment)		
4a	Adjusted coefficient (2a) x (3a)		
5a	Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)		
7	Typical accident rate (accidents per year), $A_T$ (4a) x (5a)		
8	Accident trends factor for adjusting typical accident rate (appendix A6.5 method B)		-0.02
9	Adjustment factor for accident trend ( $1 + (8) \times (\text{time zero year} - 2006)$ ) (appendix A6.5 B)		0.82
10	Typical accident rate per year adjusted for accident trends, $A_T$ (7) x (9)		0.011313567
11	Cost per reported injury accident (table A6.5)	\$	570,000
12	Total accident cost per year (10) x (11)	\$	6,448.73

## Worksheets A6: Accident cost savings continued



## Worksheet A6.5a - Weighted accident procedure - do minimum

Option	Taipa - Existing 1 Lane Bridge		
Posted speed limit	100km/h near rural	Traffic growth rate	3%
Road category	Rural Strategic	Time zero	Jul-15
Site-specific accident rate			
1	Number of years of accident records		5
2	Number of reported injury accidents over period		1
3	Number of accidents per year (2) / (1)		0.2
4	Trend adjustment factor (table A6.1(a))		1.06
5	Site specific accident rate (accidents per year), $A_S$ (3) x (4)		0.212
Accident prediction model			
6	Table used		3.3
7	Parameter $b_0$		103.1220248
8	Parameter $b_1$		
9	Parameter $b_2$		
10	Lowest or side road AADT ( $Q_{minor}$ )		
11	Highest or primary AADT ( $Q_{major}$ )		3797
12	Typical accident rate (accidents per year), $A_T$ (formula from crash compendium)		1.430152184
			Go to step 13
Exposure-based accident prediction equation			
6a	Table used		
7a	Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)		
8a	Cross section adjustment factor from table A6.13 (1.0 for no adjustment)		
9a	Adjusted coefficient (7a) x (8a)		
10a	Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)		
12	Typical accident rate (accidents per year), $A_{T,dm}$ (9a) x (10a)		
13	Accident trend factor for adjusting typical accident rate, $f_t$ (appendix A6.5 method B)		-0.02
14	Adjustment factor for accident trend ( $1 +$ (13) x (time zero - 2006) (app. A6.5 method B)		0.82
15	Typical accident rate per year adjusted for accident trends, $A_{T,dm}$ (12) x (14)*		1.17272479
	* For all mid-block analyses, the typical accident rate (15) must be divided by the mid-block length (in km)		
Weighting factor			
16	k value (from Crash Compendium)		0.3
17	Weighting factor, $w$ , (16) / [(16) + (15) x (1)]		0.048672664
18	Do-minimum weighted accident rate, $A_{W,dm}$ [(17) x (15)] + [1 - (17)] x (5)		0.258761035
19	Cost per reported injury accident (table A6.5)	\$	570,000
20	Total accident cost per year (18) x (19)	\$	147,493.79

## Network Resilience: Detour Calculations

Assumptions:-

- 1 Bridge closure in last 5 years = 20% annual probability of closure
- 4 hour closure to clear site, inspect structure
- Assumed Average Detour = 99.1km, 78.5 mins

Year (1)	AADT (2)	% AADT affected (3)	P (Diversion) (4)	Number of Veh Diverted (5) = (2)x(3)x(4)	Additional Journey Time (6)
2016	3,797	16.67%	0.2000	126.5667	78.5
2017	3,911	16.67%	0.2000	130.3667	78.5
2018	4,025	16.67%	0.2000	134.1667	78.5
2019	4,139	16.67%	0.2000	137.9667	78.5
2020	4,253	16.67%	0.2000	141.7667	78.5
2021	4,367	16.67%	0.2000	145.5667	78.5
2022	4,481	16.67%	0.2000	149.3667	78.5
2023	4,595	16.67%	0.2000	153.1667	78.5
2024	4,709	16.67%	0.2000	156.9667	78.5
2025	4,823	16.67%	0.2000	160.7667	78.5
2026	4,937	16.67%	0.2000	164.5667	78.5
2027	5,051	16.67%	0.2000	168.3667	78.5
2028	5,165	16.67%	0.2000	172.1667	78.5
2029	5,279	16.67%	0.2000	175.9667	78.5
2030	5,393	16.67%	0.2000	179.7667	78.5
2031	5,507	16.67%	0.2000	183.5667	78.5
2032	5,621	16.67%	0.2000	187.3667	78.5
2033	5,735	16.67%	0.2000	191.1667	78.5
2034	5,849	16.67%	0.2000	194.9667	78.5
2035	5,963	16.67%	0.2000	198.7667	78.5
2036	6,077	16.67%	0.2000	202.5667	78.5
2037	6,191	16.67%	0.2000	206.3667	78.5
2038	6,305	16.67%	0.2000	210.1667	78.5
2039	6,419	16.67%	0.2000	213.9667	78.5
2040	6,533	16.67%	0.2000	217.7667	78.5

## Network Resilience: HPMV Waiting Time

HPMV Waiting Time on SH1 if no HPMV route available

- Last 10 years = 15 closures (RS 104-198)
- Total Closure time = 148.99 Hours
- Average Closure time per year = 14.899 hours
- SH1 RP 119/11.46 AADT = 1085 with 14%HCV
- 150 HCV per year, assumed 50 HPMV (local advice) with 3% growth rate
- EEM TTC Costs, used \$20.1 for driver, \$28.1 for HCV2 = \$48.2

## Network Resilience : Layer 2 Benefits

Figures from Network Resilience Business Case (Opus,2013)

- Layer 1 = Traditional EEM Benefits
- Layer 2 = Extended Benefits from wider economy effects
- Layer 2 Benefits were from 48 Hour Closure
- Layer 2 benefits peer reviewed by ASCARI Partners
- Recognising that link severances have wider economy effects, propose to use results from 2013 stu

Layer 1 Benefit:	63000000
Layer 2 Benefit:	15800000
%	25.08% For 48 hour closures
Adjustment	2.09% For 4 Hour Closure

TTC Detour Benefits	\$ 104,177.71
VOC Detour Benefits	\$ 72,012.05
ACC Detour Benefits	\$ 95,310.16
Layer 2 Benefits	\$ 5,674.20

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Kaeo Bridge Replacement - BCR Summary					
OPTIONS					
NPV Benefits	Opt 90	Opt 100A	Opt 100B	Opt 100C	Comment
Travel Time Costs - Delays at Bridge	\$ 1,459,788	\$ 1,459,788	\$ 1,459,788	\$ 1,459,788	Methodology as per "Delays and Conflicts at One Lane Bridges, (Saunders, 1988)
Travel Time Costs - Detours for Closures	\$ 880,061	\$ 880,061	\$ 880,061	\$ 880,061	Detours as per Fig.13 NZTA Approved Detours
Travel Time Costs - New Alignment	\$ 464,795	\$ 1,003,278	\$ 1,230,007	\$ 1,133,647	As per EEM
Vehicle Operating Costs - Delays at Bridge	\$ 66,647	\$ 66,647	\$ 66,647	\$ 66,647	Methodology as per "Delays and Conflicts at One Lane Bridges, (Saunders, 1988)
Vehicle Operating Costs - Detours for Closures	\$ 608,336	\$ 608,336	\$ 608,336	\$ 608,336	Detours as per Fig.13 NZTA Approved Detours
Vehicle Operating Costs - New Alignment	\$ 1,098,049	\$ 1,031,791	\$ 1,252,309	\$ 925,271	As per EEM
Crash Costs 1-Lane vs 2-Lane	\$ 3,118,212	\$ 3,118,212	\$ 3,118,212	\$ 3,118,212	As per EEM
Crash Costs - Detours for Closures	\$ 161,063	\$ 161,063	\$ 161,063	\$ 161,063	Additional Traffic on network
Crash Costs - New Alignment	\$ 796,749	\$ 809,662	\$ 846,556	\$ 830,876	As per EEM
Cycling Benefits	\$ 22,209	\$ 22,209	\$ 22,209	\$ 22,209	As per EEM
Emissions	\$ 88,652	\$ 85,339	\$ 96,365	\$ 80,013	5% of VOC as per EEM A9.6
Network Resilience	\$ 891,315	\$ 891,315	\$ 891,315	\$ 891,315	HPMV Waiting time during SH1 Closures
Wider Economic Benefits of reduced closures	\$ 76,271	\$ 76,271	\$ 76,271	\$ 76,271	Used Results from 2013 Network resilience case
<b>Total Benefits</b>	<b>\$ 9,732,146</b>	<b>\$ 10,213,971</b>	<b>\$ 10,709,139</b>	<b>\$ 10,253,708</b>	
<b>NPV Costs</b>					
Do-Min - New Bridges in Year 25 (2040)	\$ 1,314,472	\$ 1,235,944	\$ 1,196,680	\$ 1,235,944	Existing Bridge Built in 1933
Do-Min - Maintenance Costs	\$ 268,342	\$ 268,342	\$ 268,342	\$ 268,342	
Subtotal: NPV Do-Min Costs	\$ 1,582,814	\$ 1,504,286	\$ 1,465,022	\$ 1,504,286	
Option - New Bridges in Year 0	\$ 8,191,935	\$ 7,702,541	\$ 7,457,843	\$ 7,702,541	
Option - Maintenance Costs	\$ 86,174	\$ 85,390	\$ 83,150	\$ 84,102	
Option - New Alignment	\$ 9,920,017	\$ 7,776,792	\$ 8,426,372	\$ 8,536,886	
Subtotal: NPV Option Costs	\$ 18,198,126	\$ 15,564,723	\$ 15,967,366	\$ 16,323,529	
<b>Net Costs</b>	<b>\$ 16,615,312</b>	<b>\$ 14,060,437</b>	<b>\$ 14,502,344</b>	<b>\$ 14,819,243</b>	
<b>Indicative BCR</b>	<b>0.59</b>	<b>0.73</b>	<b>0.74</b>	<b>0.69</b>	

## Worksheet 5: First year rate of return



1 Preferred activity option	Opt 100B				
2 PV of total net cost	\$	14,502,344			
3 Midpoint of first year benefits	1.5				
4 SPPWF of first year of benefits	0.916307417				
Benefit	Annual costs of preferred option (5)	Annual costs of do-minimum (6)	Net annual benefit (at time zero) (7)	Growth rate (decimal) (8)	PV of benefits in first year (9) = [1.0 + (3) x (8)] x (4) x (7)
Travel time savings	\$ 385,012	\$ 602,356	\$ 217,344	0.0300	\$ 208,115.89
Vehicle operating cost savings	\$ 374,465	\$ 469,847	\$ 95,382	0.0300	\$ 91,332.43
Accident cost savings	\$ 122,654	\$ 391,771	\$ 269,118	0.0100	\$ 250,293.41
Reduced driver frustration		\$ -	\$ -	0.0300	\$ -
Vehicle emission reduction	\$ 18,723	\$ 23,492	\$ 4,769	0.0300	\$ 4,566.62
Pedestrian/Cycling Benefits			\$ 1,288	0.0300	\$ 1,233.62
10 Sum of PV of benefits in first year					\$ 555,541.98
11 FYRR = [(10) / (2)]					3.83%

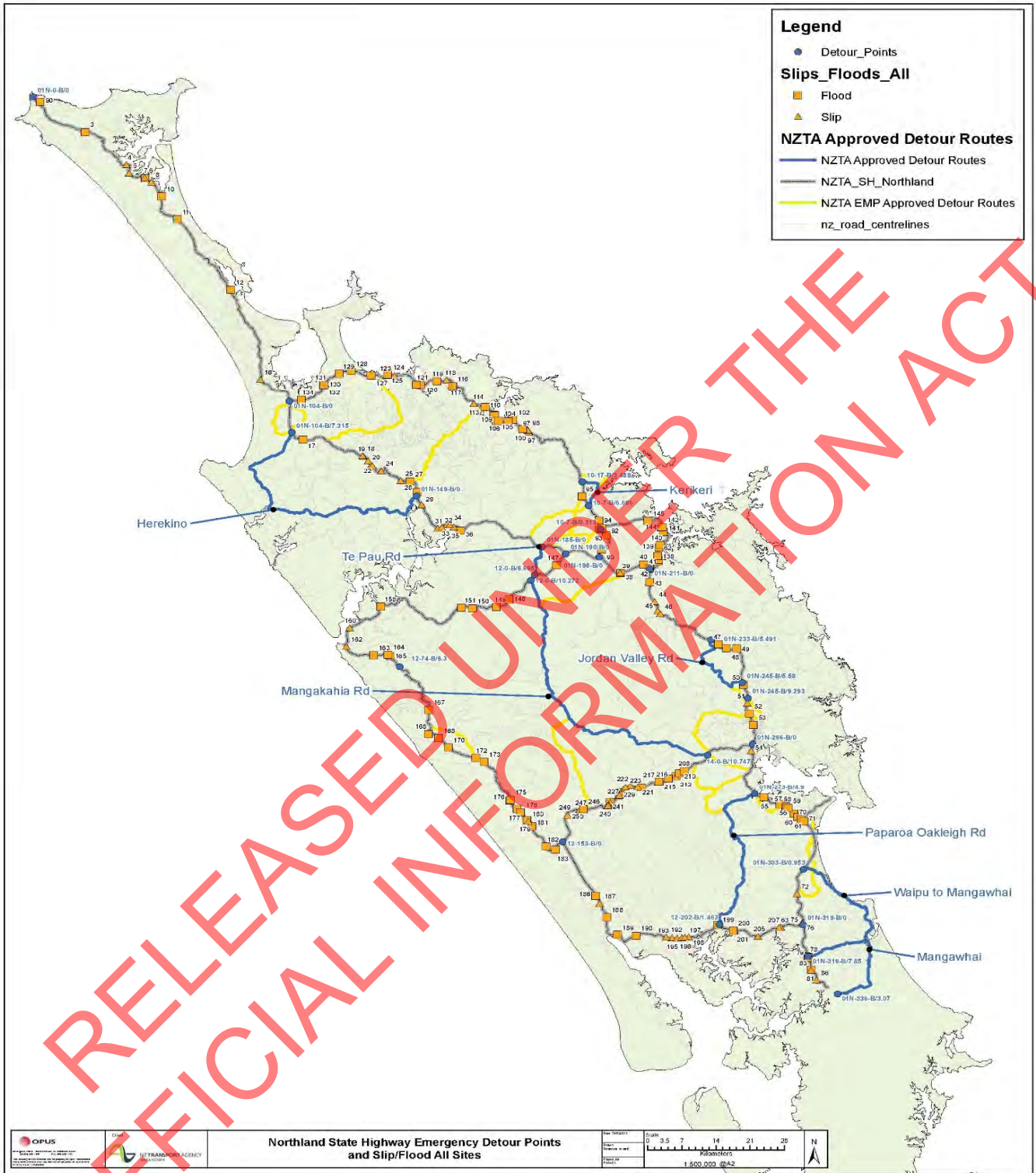
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Kaeo Bridge - Site Location, SH10 RP 33/11.79, 70m long bridge





# NZTA Approved Detours



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Kaeo Bridge - SH1 HPMV closures							
#	State Highway	Start Location	End Location	Impact	Description	Event Comments	Event Duration (hh.mm)
37	1N	01N-0104/06.95	01N-0104/06.95	Road Closed	Flooding	Motorists Are Advised That Due To Severe Weather Conditions There Are Road Closures In The Area	12.31
68	1N	01N-0104/13.36	01N-0104/13.36	Road Closed	Crash	A Lime Truck Has Run Off The Road, About 3km South Of Kaitaia.	1.41
116	1N	01N-0119/02.56	01N-0119/02.56	Road Closed	Object/Obstruction	Due To A Serious Incident In This Area The Road Is Closed. Emergency Services Are On Site. Please Delay Your Journey Or Use An Alternative Route.	2.48
81	1N	01N-0119/02.74	01N-0119/02.74	Road Closed	Crash	Road Reopened.	4.06
13	1N	01N-0119/04.03	01N-0119/04.03	Road Closed	Crash	Logging Truck Rolled Off The Side Of The Road / Diversions In Place	16.23
3	1N	01N-0149/14.29	01N-0149/14.29	Road Closed	Flooding	Rangiahua Bridge Is Closed Due To Flooding	21.09
44	1N	01N-0149/14.45	01N-0149/14.45	Road Closed	Flooding	The Rangiahua Bridge Is Under Water, & Impassable	21.17
50	1N	01N-0149/14.81	01N-0149/14.81	Road Closed	Flooding	Severe Flooding	3.42
11	1N	01N-0149/15.00	01N-0149/15.00	Road Closed	Flooding	This Is A Low Lying Bridge That Is Flooding. Tidal Flooding - Will Be Updated As Soon As The Tide Changes.	4.21
90	1N	01N-0149/15.57	01N-0149/15.57	Road Closed	Flooding	Due To Flooding This Section Of State Highway 1 Is Closed. Expect Delays. Avoid The Area Or Delay Your Trip If Possible.	16.2
62	1N	01N-0167/12.01	01N-0167/12.01	Road Closed	Crash	Due To A Crash In This Area Okaihau, Expect Long Delays. Avoid The Area If Possible Or Delay Your Trip.	5.45
29	1N	01N-0167/15.82	01N-0167/15.82	Road Closed	Crash	Crash On Sh1 And Police Needs Sh1 To Be Closed From The Intersection Of Sh1 And Te Pua Road To The Intersection Of Sh1 And Wehirua Road	25.23
49	1N	01N-0190/02.30	01N-0190/02.30	Road Closed	Crash	Due To An Incident, Sh1 Is Closed In Pakaraka Between Old Bay Rd And Sh10. Expect Delays, Avoid The Area If Possible.	4.09
38	1N	01N-0190/07.41	01N-0190/07.41	Road Closed	Flooding	Motorists Are Advised That Due To The Severe Weather Conditions In The Region There Will Be Roads Closed	9.57
96	1N	01N-0190/07.62	01N-0190/07.62	Road Closed	Crash	Road Now Open.	2.07

RELEASED UNDER THE OFFICIAL INFORMATION ACT

Worksheet A1 - Discounting

YEAR	TIME	Growth	3.0%	DM TTC (Delays)				DM TTC (Detours)				DM TTC (HPMV Detours)			
		SPPWF	AA DT	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL
2016	0	1	2,900	\$ 40,502.21	\$ 40,502.21	1.44	\$ 58,323.18	\$35,454.39	\$ 35,454.39	1.44	\$ 51,054.32	\$ 35,906.59	\$ 35,906.59	1.44	\$ 51,705.49
2017	1	0.943396226	2,987	\$ 43,000.74	\$ 40,566.74	1.44	\$ 58,416.10	\$36,516.76	\$ 34,449.78	1.44	\$ 49,607.68	\$ 36,983.79	\$ 34,890.37	1.44	\$ 50,242.13
2018	2	0.88999644	3,074	\$ 45,922.20	\$ 40,870.59	1.44	\$ 58,853.65	\$37,580.36	\$ 33,446.38	1.44	\$ 48,162.79	\$ 38,060.99	\$ 33,874.14	1.44	\$ 48,778.76
2019	3	0.839619283	3,161	\$ 48,917.44	\$ 41,072.03	1.44	\$ 59,143.72	\$38,643.95	\$ 32,446.21	1.44	\$ 46,722.54	\$ 39,138.18	\$ 32,861.17	1.44	\$ 47,320.09
2020	4	0.792093663	3,248	\$ 51,912.69	\$ 41,119.71	1.44	\$ 59,212.39	\$39,707.55	\$ 31,452.10	1.44	\$ 45,291.02	\$ 40,215.38	\$ 31,854.35	1.44	\$ 45,870.26
2021	5	0.747258173	3,335	\$ 54,907.94	\$ 41,030.41	1.44	\$ 59,083.79	\$40,771.14	\$ 30,466.57	1.44	\$ 43,871.86	\$ 41,292.58	\$ 30,856.22	1.44	\$ 44,432.95
2022	6	0.70496054	3,422	\$ 57,903.19	\$ 40,819.46	1.44	\$ 58,780.03	\$41,834.74	\$ 29,491.84	1.44	\$ 42,468.25	\$ 42,369.78	\$ 29,869.02	1.44	\$ 43,011.39
2023	7	0.665057114	3,509	\$ 61,057.25	\$ 40,606.56	1.44	\$ 58,473.44	\$42,898.33	\$ 28,529.84	1.44	\$ 41,082.97	\$ 43,446.97	\$ 28,894.72	1.44	\$ 41,608.40
2024	8	0.627412371	3,596	\$ 65,587.69	\$ 41,150.53	1.44	\$ 59,256.76	\$43,961.93	\$ 27,582.26	1.44	\$ 39,718.45	\$ 44,524.17	\$ 27,935.02	1.44	\$ 40,226.42
2025	9	0.591898464	3,683	\$ 70,118.14	\$ 41,502.82	1.44	\$ 59,764.06	\$45,025.52	\$ 26,650.54	1.44	\$ 38,376.77	\$ 45,601.37	\$ 26,991.38	1.44	\$ 38,867.59
2026	10	0.558394777	3,770	\$ 74,648.59	\$ 41,683.38	1.44	\$ 60,024.07	\$46,089.12	\$ 25,735.92	1.44	\$ 37,059.73	\$ 46,678.57	\$ 26,065.07	1.44	\$ 37,533.70
2027	11	0.526787525	3,857	\$ 79,179.03	\$ 41,710.53	1.44	\$ 60,063.16	\$47,152.71	\$ 24,839.46	1.44	\$ 35,768.82	\$ 47,755.76	\$ 25,157.14	1.44	\$ 36,226.28
2028	12	0.496969364	3,944	\$ 83,709.48	\$ 41,601.05	1.44	\$ 59,905.51	\$48,216.31	\$ 23,962.03	1.44	\$ 34,505.32	\$ 48,832.96	\$ 24,268.49	1.44	\$ 34,946.62
2029	13	0.468839022	4,031	\$ 88,588.03	\$ 41,533.53	1.44	\$ 59,808.28	\$49,279.90	\$ 23,104.34	1.44	\$ 33,270.25	\$ 49,910.16	\$ 23,399.83	1.44	\$ 33,695.76
2030	14	0.442300964	4,118	\$ 94,095.42	\$ 41,618.50	1.44	\$ 59,930.64	\$50,343.50	\$ 22,266.98	1.44	\$ 32,064.45	\$ 50,987.36	\$ 22,551.76	1.44	\$ 32,474.53
2031	15	0.417265061	4,205	\$ 99,602.82	\$ 41,560.77	1.44	\$ 59,847.52	\$51,407.09	\$ 21,450.38	1.44	\$ 30,888.55	\$ 52,064.56	\$ 21,724.72	1.44	\$ 31,283.60
2032	16	0.393646284	4,292	\$ 105,110.21	\$ 41,376.24	1.44	\$ 59,581.79	\$52,470.69	\$ 20,654.89	1.44	\$ 29,743.04	\$ 53,141.75	\$ 20,919.05	1.44	\$ 30,123.44
2033	17	0.371364419	4,379	\$ 110,617.60	\$ 41,079.44	1.44	\$ 59,154.39	\$53,534.28	\$ 19,880.73	1.44	\$ 28,628.25	\$ 54,218.95	\$ 20,134.99	1.44	\$ 28,994.38
2034	18	0.350343791	4,466	\$ 116,124.99	\$ 40,683.67	1.44	\$ 58,584.48	\$54,597.88	\$ 19,128.03	1.44	\$ 27,544.36	\$ 55,296.15	\$ 19,372.66	1.44	\$ 27,896.63
2035	19	0.33051301	4,553	\$ 121,632.38	\$ 40,201.08	1.44	\$ 57,889.56	\$55,661.47	\$ 18,396.84	1.44	\$ 26,491.45	\$ 56,373.35	\$ 18,632.12	1.44	\$ 26,830.26
2036	20	0.311804727	4,640	\$ 127,139.77	\$ 39,642.78	1.44	\$ 57,085.61	\$56,725.07	\$ 17,687.14	1.44	\$ 25,469.49	\$ 57,450.54	\$ 17,913.35	1.44	\$ 25,795.23
2037	21	0.294155403	4,727	\$ 132,647.16	\$ 39,018.88	1.44	\$ 56,187.19	\$57,788.66	\$ 16,998.85	1.44	\$ 24,478.34	\$ 58,527.74	\$ 17,216.25	1.44	\$ 24,791.40
2038	22	0.277505097	4,814	\$ 138,154.55	\$ 38,338.59	1.44	\$ 55,207.57	\$58,852.26	\$ 16,331.80	1.44	\$ 23,517.79	\$ 59,604.94	\$ 16,540.67	1.44	\$ 23,818.57
2039	23	0.261797261	4,901	\$ 143,661.94	\$ 37,610.30	1.44	\$ 54,158.84	\$59,915.85	\$ 15,685.81	1.44	\$ 22,587.56	\$ 60,682.14	\$ 15,886.42	1.44	\$ 22,876.44
2040	24	0.246978548	4,988	\$ 149,169.33	\$ 36,841.63	1.44	\$ 53,051.94	\$60,979.45	\$ 15,060.62	1.44	\$ 21,687.29	\$ 61,759.33	\$ 15,253.23	1.44	\$ 21,964.65
2041	25	0.232998631	5,075		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2042	26	0.219810029	5,162		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2043	27	0.207367952	5,249		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2044	28	0.195630143	5,336		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2045	29	0.184556739	5,423		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2046	30	0.174110131	5,510		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2047	31	0.16425484	5,597		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2048	32	0.154957397	5,684		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2049	33	0.146186223	5,771		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2050	34	0.137911531	5,858		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2051	35	0.130105218	5,945		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2052	36	0.122740772	6,032		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2053	37	0.115793181	6,119		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2054	38	0.10923885	6,206		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2055	39	0.103055519	6,293		\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -

\$ 1,459,787.66

\$ 880,061.36

\$ 891,314.97

Worksheet A1 - Discounting

YEAR	TIME	Growth	3.0%	DM TTC (Alignment)				OPT TTC (Alignment 90)				OPT TTC (Alignment 100A)			
		SPPWF	AA DT	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL
2016	0	1	2,900	\$ 306,439.84	\$ 306,439.84	1.44	\$ 441,273.37	\$ 291,675.99	\$ 291,675.99	1.44	\$ 420,013.43	\$ 274,571.54	\$ 274,571.54	1.44	\$ 395,383.01
2017	1	0.943396226	2,987	\$ 315,633.03	\$ 297,767.01	1.44	\$ 428,784.50	\$ 300,426.27	\$ 283,421.01	1.44	\$ 408,126.26	\$ 282,808.68	\$ 266,800.64	1.44	\$ 384,192.93
2018	2	0.88999644	3,074	\$ 324,826.23	\$ 289,094.19	1.44	\$ 416,295.63	\$ 309,176.55	\$ 275,166.03	1.44	\$ 396,239.08	\$ 291,045.83	\$ 259,029.75	1.44	\$ 373,002.84
2019	3	0.839619283	3,161	\$ 334,019.42	\$ 280,449.15	1.44	\$ 403,846.77	\$ 317,926.83	\$ 266,937.50	1.44	\$ 384,390.00	\$ 299,282.97	\$ 251,283.76	1.44	\$ 361,848.61
2020	4	0.792093663	3,248	\$ 343,212.62	\$ 271,856.54	1.44	\$ 391,473.42	\$ 326,677.11	\$ 258,758.87	1.44	\$ 372,612.77	\$ 307,520.12	\$ 243,584.74	1.44	\$ 350,762.02
2021	5	0.747258173	3,335	\$ 352,405.81	\$ 263,338.12	1.44	\$ 379,206.90	\$ 335,427.39	\$ 250,650.86	1.44	\$ 360,937.24	\$ 315,757.27	\$ 235,952.20	1.44	\$ 339,771.16
2022	6	0.70496054	3,422	\$ 361,599.01	\$ 254,913.03	1.44	\$ 367,074.77	\$ 344,177.67	\$ 242,631.68	1.44	\$ 349,389.61	\$ 323,994.41	\$ 228,403.28	1.44	\$ 328,900.72
2023	7	0.665057114	3,509	\$ 370,792.20	\$ 246,597.99	1.44	\$ 355,101.11	\$ 352,927.95	\$ 234,717.24	1.44	\$ 337,992.83	\$ 332,231.56	\$ 220,952.96	1.44	\$ 318,172.26
2024	8	0.627412371	3,596	\$ 379,985.40	\$ 238,407.54	1.44	\$ 343,306.86	\$ 361,678.23	\$ 226,921.40	1.44	\$ 326,766.81	\$ 340,468.70	\$ 213,614.28	1.44	\$ 307,604.56
2025	9	0.591898464	3,683	\$ 389,178.59	\$ 230,354.21	1.44	\$ 331,710.07	\$ 370,428.51	\$ 219,256.07	1.44	\$ 315,728.73	\$ 348,705.85	\$ 206,398.46	1.44	\$ 297,213.78
2026	10	0.558394777	3,770	\$ 398,371.79	\$ 222,448.73	1.44	\$ 320,326.17	\$ 379,178.79	\$ 211,731.46	1.44	\$ 304,893.30	\$ 356,943.00	\$ 199,315.10	1.44	\$ 287,013.75
2027	11	0.526787525	3,857	\$ 407,564.98	\$ 214,700.15	1.44	\$ 309,168.22	\$ 387,929.07	\$ 204,356.19	1.44	\$ 294,272.92	\$ 365,180.14	\$ 192,372.34	1.44	\$ 277,016.17
2028	12	0.496969364	3,944	\$ 416,758.18	\$ 207,116.05	1.44	\$ 298,247.11	\$ 396,679.35	\$ 197,137.48	1.44	\$ 283,877.98	\$ 373,417.29	\$ 185,576.95	1.44	\$ 267,230.81
2029	13	0.468839022	4,031	\$ 425,951.37	\$ 199,702.63	1.44	\$ 287,571.78	\$ 405,429.63	\$ 190,081.23	1.44	\$ 273,716.97	\$ 381,654.43	\$ 178,934.49	1.44	\$ 257,665.67
2030	14	0.442300964	4,118	\$ 435,144.57	\$ 192,464.86	1.44	\$ 277,149.40	\$ 414,179.91	\$ 183,192.17	1.44	\$ 263,796.73	\$ 389,891.58	\$ 172,449.42	1.44	\$ 248,327.17
2031	15	0.417265061	4,205	\$ 444,337.76	\$ 185,406.62	1.44	\$ 266,985.54	\$ 422,930.19	\$ 176,473.99	1.44	\$ 254,122.55	\$ 398,128.73	\$ 166,125.21	1.44	\$ 239,220.30
2032	16	0.393646284	4,292	\$ 453,530.96	\$ 178,530.78	1.44	\$ 257,084.32	\$ 431,680.47	\$ 169,929.41	1.44	\$ 244,698.35	\$ 406,365.87	\$ 159,964.42	1.44	\$ 230,348.76
2033	17	0.371364419	4,379	\$ 462,724.16	\$ 171,839.29	1.44	\$ 247,448.57	\$ 440,430.75	\$ 163,560.31	1.44	\$ 235,526.84	\$ 414,603.02	\$ 153,968.81	1.44	\$ 221,715.08
2034	18	0.350343791	4,466	\$ 471,917.35	\$ 165,333.31	1.44	\$ 238,079.97	\$ 449,181.03	\$ 157,367.78	1.44	\$ 226,609.61	\$ 422,840.16	\$ 148,139.43	1.44	\$ 213,320.77
2035	19	0.33051301	4,553	\$ 481,110.55	\$ 159,013.29	1.44	\$ 228,979.14	\$ 457,931.31	\$ 151,352.25	1.44	\$ 217,947.25	\$ 431,077.31	\$ 142,476.66	1.44	\$ 205,166.39
2036	20	0.311804727	4,640	\$ 490,303.74	\$ 152,879.02	1.44	\$ 220,145.79	\$ 466,681.59	\$ 145,513.52	1.44	\$ 209,539.48	\$ 439,314.46	\$ 136,980.32	1.44	\$ 197,251.67
2037	21	0.294155403	4,727	\$ 499,496.94	\$ 146,929.72	1.44	\$ 211,578.80	\$ 475,431.87	\$ 139,850.85	1.44	\$ 201,385.23	\$ 447,551.60	\$ 131,649.72	1.44	\$ 189,575.60
2038	22	0.277505097	4,814	\$ 508,690.13	\$ 141,164.10	1.44	\$ 203,276.31	\$ 484,182.15	\$ 134,363.01	1.44	\$ 193,482.74	\$ 455,788.75	\$ 126,483.70	1.44	\$ 182,136.53
2039	23	0.261797261	4,901	\$ 517,883.33	\$ 135,580.44	1.44	\$ 195,235.83	\$ 492,932.43	\$ 129,048.36	1.44	\$ 185,829.64	\$ 464,025.89	\$ 121,480.71	1.44	\$ 174,932.22
2040	24	0.246978548	4,988	\$ 527,076.52	\$ 130,176.59	1.44	\$ 187,454.30	\$ 501,682.71	\$ 123,904.87	1.44	\$ 178,423.01	\$ 472,263.04	\$ 116,638.84	1.44	\$ 167,959.93
2041	25	0.232998631	5,075	\$ 536,269.72	\$ 124,950.11	1.44	\$ 179,928.16	\$ 510,432.99	\$ 118,930.19	1.44	\$ 171,259.47	\$ 480,500.19	\$ 111,955.89	1.44	\$ 161,216.48
2042	26	0.219810029	5,162	\$ 545,462.91	\$ 119,898.22	1.44	\$ 172,653.43	\$ 519,183.26	\$ 114,121.69	1.44	\$ 164,335.23	\$ 488,737.33	\$ 107,429.37	1.44	\$ 154,698.29
2043	27	0.207367952	5,249	\$ 554,656.11	\$ 115,017.90	1.44	\$ 165,625.78	\$ 527,933.54	\$ 109,476.50	1.44	\$ 157,646.16	\$ 496,974.48	\$ 103,056.58	1.44	\$ 148,401.47
2044	28	0.195630143	5,336	\$ 563,849.30	\$ 110,305.92	1.44	\$ 158,840.52	\$ 536,683.82	\$ 104,991.53	1.44	\$ 151,187.81	\$ 505,211.62	\$ 98,834.62	1.44	\$ 142,321.86
2045	29	0.184556739	5,423	\$ 573,042.50	\$ 105,758.85	1.44	\$ 152,292.75	\$ 545,434.10	\$ 100,663.54	1.44	\$ 144,955.50	\$ 513,448.77	\$ 94,760.43	1.44	\$ 136,455.02
2046	30	0.174110131	5,510	\$ 582,235.69	\$ 101,373.13	1.44	\$ 145,977.31	\$ 554,184.38	\$ 96,489.12	1.44	\$ 138,944.33	\$ 521,685.92	\$ 90,830.80	1.44	\$ 130,796.36
2047	31	0.16425484	5,597	\$ 591,428.89	\$ 97,145.06	1.44	\$ 139,888.88	\$ 562,934.66	\$ 92,464.74	1.44	\$ 133,149.23	\$ 529,923.06	\$ 87,042.43	1.44	\$ 125,341.10
2048	32	0.154957397	5,684	\$ 600,622.08	\$ 93,070.83	1.44	\$ 134,022.00	\$ 571,684.94	\$ 88,586.81	1.44	\$ 127,565.01	\$ 538,160.21	\$ 83,391.90	1.44	\$ 120,084.34
2049	33	0.146186223	5,771	\$ 609,815.28	\$ 89,146.59	1.44	\$ 128,371.09	\$ 580,435.22	\$ 84,851.63	1.44	\$ 122,186.35	\$ 546,397.35	\$ 79,875.77	1.44	\$ 115,021.10
2050	34	0.137911531	5,858	\$ 619,008.47	\$ 85,368.41	1.44	\$ 122,930.51	\$ 589,185.50	\$ 81,255.47	1.44	\$ 117,007.88	\$ 554,634.50	\$ 76,490.49	1.44	\$ 110,146.31
2051	35	0.130105218	5,945	\$ 628,201.67	\$ 81,732.32	1.44	\$ 117,694.53	\$ 597,935.78	\$ 77,794.57	1.44	\$ 112,024.17	\$ 562,871.65	\$ 73,232.54	1.44	\$ 105,454.86
2052	36	0.122740772	6,032	\$ 637,394.86	\$ 78,234.34	1.44	\$ 112,657.45	\$ 606,686.06	\$ 74,465.12	1.44	\$ 107,229.77	\$ 571,108.79	\$ 70,098.33	1.44	\$ 100,941.60
2053	37	0.115793181	6,119	\$ 646,588.06	\$ 74,870.49	1.44	\$ 107,813.50	\$ 615,436.34	\$ 71,263.33	1.44	\$ 102,619.20	\$ 579,345.94	\$ 67,084.31	1.44	\$ 96,601.41
2054	38	0.10923885	6,206	\$ 655,781.25	\$ 71,636.79	1.44	\$ 103,156.98	\$ 624,186.62	\$ 68,185.43	1.44	\$ 98,187.02	\$ 587,583.09	\$ 64,186.90	1.44	\$ 92,429.14
2055	39	0.103055519	6,293	\$ 664,974.45	\$ 68,529.29	1.44	\$ 98,682.17	\$ 632,936.90	\$ 65,227.64	1.44	\$ 93,927.80	\$ 595,820.23	\$ 61,402.56	1.44	\$ 88,419.69
				\$ 9,647,339.7				\$ 9,182,544.3				\$ 8,644,061.7			

Worksheet A1 - Discounting

YEAR	TIME	Growth	3.0%	OPT TTC (Alignment 100B)				OPT TTC (Alignment 100C)				DM VOC (Delays)			
		SPPWF	AADT	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL
2016	0	1	2,900	\$ 267,369.66	\$ 267,369.66	1.44	\$ 385,012.31	\$ 270,430.46	\$ 270,430.46	1.44	\$ 389,419.86	\$ 2,810.17	\$ 2,810.17	1	\$ 2,810.17
2017	1	0.943396226	2,987	\$ 275,390.75	\$ 259,802.59	1.44	\$ 374,115.73	\$ 278,543.37	\$ 262,776.76	1.44	\$ 378,398.54	\$ 2,976.12	\$ 2,807.66	1	\$ 2,807.66
2018	2	0.88999644	3,074	\$ 283,411.84	\$ 252,235.53	1.44	\$ 363,219.16	\$ 286,656.28	\$ 255,123.07	1.44	\$ 367,377.22	\$ 3,168.61	\$ 2,820.06	1	\$ 2,820.06
2019	3	0.839619283	3,161	\$ 291,432.93	\$ 244,692.71	1.44	\$ 352,357.50	\$ 294,769.20	\$ 247,493.90	1.44	\$ 356,391.22	\$ 3,365.74	\$ 2,825.94	1	\$ 2,825.94
2020	4	0.792093663	3,248	\$ 299,454.02	\$ 237,195.63	1.44	\$ 341,561.71	\$ 302,882.11	\$ 239,911.00	1.44	\$ 345,471.84	\$ 3,562.86	\$ 2,822.12	1	\$ 2,822.12
2021	5	0.747258173	3,335	\$ 307,475.11	\$ 229,763.29	1.44	\$ 330,859.13	\$ 310,995.02	\$ 232,393.57	1.44	\$ 334,646.75	\$ 3,759.99	\$ 2,809.68	1	\$ 2,809.68
2022	6	0.70496054	3,422	\$ 315,496.20	\$ 222,412.37	1.44	\$ 320,273.81	\$ 319,107.94	\$ 224,958.50	1.44	\$ 323,940.25	\$ 3,957.11	\$ 2,789.61	1	\$ 2,789.61
2023	7	0.665057114	3,509	\$ 323,517.29	\$ 215,157.47	1.44	\$ 309,826.76	\$ 327,220.85	\$ 217,620.56	1.44	\$ 313,373.60	\$ 4,162.12	\$ 2,768.05	1	\$ 2,768.05
2024	8	0.627412371	3,596	\$ 331,538.38	\$ 208,011.28	1.44	\$ 299,536.24	\$ 335,333.77	\$ 210,392.55	1.44	\$ 302,965.28	\$ 4,435.45	\$ 2,782.85	1	\$ 2,782.85
2025	9	0.591898464	3,683	\$ 339,559.47	\$ 200,984.73	1.44	\$ 289,418.01	\$ 343,446.68	\$ 203,285.56	1.44	\$ 292,731.21	\$ 4,708.77	\$ 2,787.12	1	\$ 2,787.12
2026	10	0.558394777	3,770	\$ 347,580.56	\$ 194,087.17	1.44	\$ 279,485.52	\$ 351,559.59	\$ 196,309.04	1.44	\$ 282,685.02	\$ 4,982.10	\$ 2,781.98	1	\$ 2,781.98
2027	11	0.526787525	3,857	\$ 355,601.65	\$ 187,326.51	1.44	\$ 269,750.18	\$ 359,672.51	\$ 189,470.99	1.44	\$ 272,838.23	\$ 5,255.43	\$ 2,768.50	1	\$ 2,768.50
2028	12	0.496969364	3,944	\$ 363,622.74	\$ 180,709.36	1.44	\$ 260,221.48	\$ 367,785.42	\$ 182,778.09	1.44	\$ 263,200.44	\$ 5,528.76	\$ 2,747.62	1	\$ 2,747.62
2029	13	0.468839022	4,031	\$ 371,643.83	\$ 174,241.13	1.44	\$ 250,907.22	\$ 375,898.33	\$ 176,235.81	1.44	\$ 253,779.56	\$ 5,813.21	\$ 2,725.46	1	\$ 2,725.46
2030	14	0.442300964	4,118	\$ 379,664.92	\$ 167,926.16	1.44	\$ 241,813.67	\$ 384,011.25	\$ 169,848.55	1.44	\$ 244,581.91	\$ 6,117.74	\$ 2,705.88	1	\$ 2,705.88
2031	15	0.417265061	4,205	\$ 387,686.01	\$ 161,767.82	1.44	\$ 232,945.67	\$ 392,124.16	\$ 163,619.71	1.44	\$ 235,612.39	\$ 6,422.28	\$ 2,679.79	1	\$ 2,679.79
2032	16	0.393646284	4,292	\$ 395,707.10	\$ 155,768.63	1.44	\$ 224,306.82	\$ 400,237.08	\$ 157,551.84	1.44	\$ 226,874.65	\$ 6,726.81	\$ 2,647.99	1	\$ 2,647.99
2033	17	0.371364419	4,379	\$ 403,728.18	\$ 149,930.28	1.44	\$ 215,899.61	\$ 408,349.99	\$ 151,646.66	1.44	\$ 218,371.18	\$ 7,031.35	\$ 2,611.19	1	\$ 2,611.19
2034	18	0.350343791	4,466	\$ 411,749.27	\$ 144,253.80	1.44	\$ 207,725.47	\$ 416,462.90	\$ 145,905.19	1.44	\$ 210,103.48	\$ 7,335.88	\$ 2,570.08	1	\$ 2,570.08
2035	19	0.33051301	4,553	\$ 419,770.36	\$ 138,739.57	1.44	\$ 199,784.98	\$ 424,575.82	\$ 140,327.83	1.44	\$ 202,072.08	\$ 7,640.42	\$ 2,525.26	1	\$ 2,525.26
2036	20	0.311804727	4,640	\$ 427,791.45	\$ 133,387.40	1.44	\$ 192,077.85	\$ 432,688.73	\$ 134,914.39	1.44	\$ 194,276.72	\$ 7,944.95	\$ 2,477.27	1	\$ 2,477.27
2037	21	0.294155403	4,727	\$ 435,812.54	\$ 128,196.61	1.44	\$ 184,603.12	\$ 440,801.64	\$ 129,664.19	1.44	\$ 186,716.43	\$ 8,249.49	\$ 2,426.63	1	\$ 2,426.63
2038	22	0.277505097	4,814	\$ 443,833.63	\$ 123,166.10	1.44	\$ 177,359.18	\$ 448,914.56	\$ 124,576.08	1.44	\$ 179,389.55	\$ 8,554.02	\$ 2,373.79	1	\$ 2,373.79
2039	23	0.261797261	4,901	\$ 451,854.72	\$ 118,294.33	1.44	\$ 170,343.83	\$ 457,027.47	\$ 119,648.54	1.44	\$ 172,293.90	\$ 8,858.56	\$ 2,319.15	1	\$ 2,319.15
2040	24	0.246978548	4,988	\$ 459,875.81	\$ 113,579.46	1.44	\$ 163,554.42	\$ 465,140.38	\$ 114,879.70	1.44	\$ 165,426.76	\$ 9,163.09	\$ 2,263.09	1	\$ 2,263.09
2041	25	0.232998631	5,075	\$ 467,896.90	\$ 109,019.34	1.44	\$ 156,987.85	\$ 473,253.30	\$ 110,267.37	1.44	\$ 158,785.01	\$ -	\$ -	1	\$ -
2042	26	0.219810029	5,162	\$ 475,917.99	\$ 104,611.55	1.44	\$ 150,640.63	\$ 481,366.21	\$ 105,809.12	1.44	\$ 152,365.13	\$ -	\$ -	1	\$ -
2043	27	0.207367952	5,249	\$ 483,939.08	\$ 100,353.46	1.44	\$ 144,508.98	\$ 489,479.13	\$ 101,502.28	1.44	\$ 146,163.29	\$ -	\$ -	1	\$ -
2044	28	0.195630143	5,336	\$ 491,960.17	\$ 96,242.24	1.44	\$ 138,588.82	\$ 497,592.04	\$ 97,344.00	1.44	\$ 140,175.36	\$ -	\$ -	1	\$ -
2045	29	0.184556739	5,423	\$ 499,981.26	\$ 92,274.91	1.44	\$ 132,875.87	\$ 505,704.95	\$ 93,331.26	1.44	\$ 134,397.01	\$ -	\$ -	1	\$ -
2046	30	0.174110131	5,510	\$ 508,002.35	\$ 88,448.36	1.44	\$ 127,365.63	\$ 513,817.87	\$ 89,460.90	1.44	\$ 128,823.69	\$ -	\$ -	1	\$ -
2047	31	0.16425484	5,597	\$ 516,023.44	\$ 84,759.35	1.44	\$ 122,053.46	\$ 521,930.78	\$ 85,729.66	1.44	\$ 123,450.71	\$ -	\$ -	1	\$ -
2048	32	0.154957397	5,684	\$ 524,044.53	\$ 81,204.58	1.44	\$ 116,934.59	\$ 530,043.69	\$ 82,134.19	1.44	\$ 118,273.24	\$ -	\$ -	1	\$ -
2049	33	0.146186223	5,771	\$ 532,065.62	\$ 77,780.66	1.44	\$ 112,004.16	\$ 538,156.61	\$ 78,671.08	1.44	\$ 113,286.36	\$ -	\$ -	1	\$ -
2050	34	0.137911531	5,858	\$ 540,086.71	\$ 74,484.19	1.44	\$ 107,257.23	\$ 546,269.52	\$ 75,336.87	1.44	\$ 108,485.09	\$ -	\$ -	1	\$ -
2051	35	0.130105218	5,945	\$ 548,107.80	\$ 71,311.69	1.44	\$ 102,688.83	\$ 554,382.44	\$ 72,128.05	1.44	\$ 103,864.39	\$ -	\$ -	1	\$ -
2052	36	0.122740772	6,032	\$ 556,128.89	\$ 68,259.69	1.44	\$ 98,293.95	\$ 562,495.35	\$ 69,041.11	1.44	\$ 99,419.20	\$ -	\$ -	1	\$ -
2053	37	0.115793181	6,119	\$ 564,149.98	\$ 65,324.72	1.44	\$ 94,067.60	\$ 570,608.26	\$ 66,072.55	1.44	\$ 95,144.47	\$ -	\$ -	1	\$ -
2054	38	0.10923885	6,206	\$ 572,171.07	\$ 62,503.31	1.44	\$ 90,004.77	\$ 578,721.18	\$ 63,218.84	1.44	\$ 91,035.12	\$ -	\$ -	1	\$ -
2055	39	0.103055519	6,293	\$ 580,192.16	\$ 59,792.00	1.44	\$ 86,100.49	\$ 586,834.09	\$ 60,476.49	1.44	\$ 87,086.15	\$ -	\$ -	1	\$ -
				\$ 8,417,332.2				\$ 8,513,692.3				\$ 66,646.93			

Worksheet A1 - Discounting

YEAR	TIME	Growth	3.0%	DM VOC (Detours)				DM VOC (Alignment)				OPT VOC (Alignment 90)			
		SPPWF	AADT	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL
2016	0	1	2,900	\$ 35,290.91	\$ 35,290.91	1	\$ 35,290.91	\$ 431,746.40	\$ 431,746.40	1	\$ 431,746.40	\$ 381,521.17	\$ 381,521.17	1	\$ 381,521.17
2017	1	0.943396226	2,987	\$ 36,348.39	\$ 34,290.93	1	\$ 34,290.93	\$ 444,698.79	\$ 419,527.16	1	\$ 419,527.16	\$ 392,966.81	\$ 370,723.41	1	\$ 370,723.41
2018	2	0.88999644	3,074	\$ 37,407.08	\$ 33,292.17	1	\$ 33,292.17	\$ 457,651.19	\$ 407,307.93	1	\$ 407,307.93	\$ 404,412.45	\$ 359,925.64	1	\$ 359,925.64
2019	3	0.839619283	3,161	\$ 38,465.77	\$ 32,296.60	1	\$ 32,296.60	\$ 470,603.58	\$ 395,127.84	1	\$ 395,127.84	\$ 415,858.08	\$ 349,162.46	1	\$ 349,162.46
2020	4	0.792093663	3,248	\$ 39,524.46	\$ 31,307.07	1	\$ 31,307.07	\$ 483,555.97	\$ 383,021.62	1	\$ 383,021.62	\$ 427,303.72	\$ 338,464.57	1	\$ 338,464.57
2021	5	0.747258173	3,335	\$ 40,583.15	\$ 30,326.09	1	\$ 30,326.09	\$ 496,508.36	\$ 371,019.93	1	\$ 371,019.93	\$ 438,749.35	\$ 327,859.04	1	\$ 327,859.04
2022	6	0.70496054	3,422	\$ 41,641.84	\$ 29,355.85	1	\$ 29,355.85	\$ 509,460.75	\$ 359,149.73	1	\$ 359,149.73	\$ 450,194.99	\$ 317,369.70	1	\$ 317,369.70
2023	7	0.665057114	3,509	\$ 42,700.53	\$ 28,398.29	1	\$ 28,398.29	\$ 522,413.15	\$ 347,434.58	1	\$ 347,434.58	\$ 461,640.62	\$ 307,017.38	1	\$ 307,017.38
2024	8	0.627412371	3,596	\$ 43,759.22	\$ 27,455.08	1	\$ 27,455.08	\$ 535,365.54	\$ 335,894.96	1	\$ 335,894.96	\$ 473,086.26	\$ 296,820.17	1	\$ 296,820.17
2025	9	0.591898464	3,683	\$ 44,817.91	\$ 26,527.65	1	\$ 26,527.65	\$ 548,317.93	\$ 324,548.54	1	\$ 324,548.54	\$ 484,531.89	\$ 286,793.68	1	\$ 286,793.68
2026	10	0.558394777	3,770	\$ 45,876.60	\$ 25,617.26	1	\$ 25,617.26	\$ 561,270.32	\$ 313,410.42	1	\$ 313,410.42	\$ 495,977.53	\$ 276,951.26	1	\$ 276,951.26
2027	11	0.526787525	3,857	\$ 46,935.30	\$ 24,724.93	1	\$ 24,724.93	\$ 574,222.71	\$ 302,493.36	1	\$ 302,493.36	\$ 507,423.16	\$ 267,304.19	1	\$ 267,304.19
2028	12	0.496969364	3,944	\$ 47,993.99	\$ 23,851.54	1	\$ 23,851.54	\$ 587,175.11	\$ 291,808.04	1	\$ 291,808.04	\$ 518,868.80	\$ 257,861.90	1	\$ 257,861.90
2029	13	0.468839022	4,031	\$ 49,052.68	\$ 22,997.81	1	\$ 22,997.81	\$ 600,127.50	\$ 281,363.19	1	\$ 281,363.19	\$ 530,314.43	\$ 248,632.10	1	\$ 248,632.10
2030	14	0.442300964	4,118	\$ 50,111.37	\$ 22,164.31	1	\$ 22,164.31	\$ 613,079.89	\$ 271,165.83	1	\$ 271,165.83	\$ 541,760.07	\$ 239,621.00	1	\$ 239,621.00
2031	15	0.417265061	4,205	\$ 51,170.06	\$ 21,351.48	1	\$ 21,351.48	\$ 626,032.28	\$ 261,221.40	1	\$ 261,221.40	\$ 553,205.70	\$ 230,833.41	1	\$ 230,833.41
2032	16	0.393646284	4,292	\$ 52,228.75	\$ 20,559.65	1	\$ 20,559.65	\$ 638,984.67	\$ 251,533.94	1	\$ 251,533.94	\$ 564,651.34	\$ 222,272.90	1	\$ 222,272.90
2033	17	0.371364419	4,379	\$ 53,287.44	\$ 19,789.06	1	\$ 19,789.06	\$ 651,937.07	\$ 242,106.23	1	\$ 242,106.23	\$ 576,096.97	\$ 213,941.92	1	\$ 213,941.92
2034	18	0.350343791	4,466	\$ 54,346.13	\$ 19,039.83	1	\$ 19,039.83	\$ 664,889.46	\$ 232,939.89	1	\$ 232,939.89	\$ 587,542.61	\$ 205,841.91	1	\$ 205,841.91
2035	19	0.33051301	4,553	\$ 55,404.82	\$ 18,312.01	1	\$ 18,312.01	\$ 677,841.85	\$ 224,035.55	1	\$ 224,035.55	\$ 598,988.24	\$ 197,973.41	1	\$ 197,973.41
2036	20	0.311804727	4,640	\$ 56,463.51	\$ 17,605.59	1	\$ 17,605.59	\$ 690,794.24	\$ 215,392.91	1	\$ 215,392.91	\$ 610,433.88	\$ 190,336.17	1	\$ 190,336.17
2037	21	0.294155403	4,727	\$ 57,522.20	\$ 16,920.47	1	\$ 16,920.47	\$ 703,746.63	\$ 207,010.87	1	\$ 207,010.87	\$ 621,879.52	\$ 182,929.22	1	\$ 182,929.22
2038	22	0.277505097	4,814	\$ 58,580.90	\$ 16,256.50	1	\$ 16,256.50	\$ 716,699.03	\$ 198,887.63	1	\$ 198,887.63	\$ 633,325.15	\$ 175,750.96	1	\$ 175,750.96
2039	23	0.261797261	4,901	\$ 59,639.59	\$ 15,613.48	1	\$ 15,613.48	\$ 729,651.42	\$ 191,020.74	1	\$ 191,020.74	\$ 644,770.79	\$ 168,799.23	1	\$ 168,799.23
2040	24	0.246978548	4,988	\$ 60,698.28	\$ 14,991.17	1	\$ 14,991.17	\$ 742,603.81	\$ 183,407.21	1	\$ 183,407.21	\$ 656,216.42	\$ 162,071.38	1	\$ 162,071.38
2041	25	0.232998631	5,075		\$ -	1	\$ -	\$ 755,556.20	\$ 176,043.56	1	\$ 176,043.56	\$ 667,662.06	\$ 155,564.34	1	\$ 155,564.34
2042	26	0.219810029	5,162		\$ -	1	\$ -	\$ 768,508.59	\$ 168,925.90	1	\$ 168,925.90	\$ 679,107.69	\$ 149,274.68	1	\$ 149,274.68
2043	27	0.207367952	5,249		\$ -	1	\$ -	\$ 781,460.99	\$ 162,049.96	1	\$ 162,049.96	\$ 690,553.33	\$ 143,198.63	1	\$ 143,198.63
2044	28	0.195630143	5,336		\$ -	1	\$ -	\$ 794,413.38	\$ 155,411.20	1	\$ 155,411.20	\$ 701,998.96	\$ 137,332.16	1	\$ 137,332.16
2045	29	0.184556739	5,423		\$ -	1	\$ -	\$ 807,365.77	\$ 149,004.79	1	\$ 149,004.79	\$ 713,444.60	\$ 131,671.01	1	\$ 131,671.01
2046	30	0.174110131	5,510		\$ -	1	\$ -	\$ 820,318.16	\$ 142,825.70	1	\$ 142,825.70	\$ 724,890.23	\$ 126,210.73	1	\$ 126,210.73
2047	31	0.16425484	5,597		\$ -	1	\$ -	\$ 833,270.55	\$ 136,868.72	1	\$ 136,868.72	\$ 736,335.87	\$ 120,946.73	1	\$ 120,946.73
2048	32	0.154957397	5,684		\$ -	1	\$ -	\$ 846,222.95	\$ 131,128.50	1	\$ 131,128.50	\$ 747,781.50	\$ 115,874.27	1	\$ 115,874.27
2049	33	0.146186223	5,771		\$ -	1	\$ -	\$ 859,175.34	\$ 125,599.60	1	\$ 125,599.60	\$ 759,227.14	\$ 110,988.55	1	\$ 110,988.55
2050	34	0.137911531	5,858		\$ -	1	\$ -	\$ 872,127.73	\$ 120,276.47	1	\$ 120,276.47	\$ 770,672.77	\$ 106,284.66	1	\$ 106,284.66
2051	35	0.130105218	5,945		\$ -	1	\$ -	\$ 885,080.12	\$ 115,153.54	1	\$ 115,153.54	\$ 782,118.41	\$ 101,757.69	1	\$ 101,757.69
2052	36	0.122740772	6,032		\$ -	1	\$ -	\$ 898,032.51	\$ 110,225.20	1	\$ 110,225.20	\$ 793,564.04	\$ 97,402.66	1	\$ 97,402.66
2053	37	0.115793181	6,119		\$ -	1	\$ -	\$ 910,984.91	\$ 105,485.84	1	\$ 105,485.84	\$ 805,009.68	\$ 93,214.63	1	\$ 93,214.63
2054	38	0.10923885	6,206		\$ -	1	\$ -	\$ 923,937.30	\$ 100,929.85	1	\$ 100,929.85	\$ 816,455.31	\$ 89,188.64	1	\$ 89,188.64
2055	39	0.103055519	6,293		\$ -	1	\$ -	\$ 936,889.69	\$ 96,551.65	1	\$ 96,551.65	\$ 827,900.95	\$ 85,319.76	1	\$ 85,319.76

\$ 608,335.74

\$ 9,439,056.4

\$ 8,341,007.32

Worksheet A1 - Discounting

YEAR	TIME	Growth	3.0%	OPT VOC (Alignment 100A)				OPT VOC (Alignment 100B)				OPT VOC (Alignment 100C)			
		SPPWF	AA DT	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL
2016	0	1	2,900	\$ 384,551.85	\$ 384,551.85	1	\$ 384,551.85	\$ 374,465.24	\$ 374,465.24	1	\$ 374,465.24	\$ 389,424.13	\$ 389,424.13	1	\$ 389,424.13
2017	1	0.943396226	2,987	\$ 396,088.40	\$ 373,668.30	1	\$ 373,668.30	\$ 385,699.20	\$ 363,867.17	1	\$ 363,867.17	\$ 401,106.85	\$ 378,402.69	1	\$ 378,402.69
2018	2	0.88999644	3,074	\$ 407,624.96	\$ 362,784.76	1	\$ 362,784.76	\$ 396,933.15	\$ 353,269.09	1	\$ 353,269.09	\$ 412,789.57	\$ 367,381.25	1	\$ 367,381.25
2019	3	0.839619283	3,161	\$ 419,161.51	\$ 351,936.09	1	\$ 351,936.09	\$ 408,167.11	\$ 342,704.98	1	\$ 342,704.98	\$ 424,472.30	\$ 356,395.13	1	\$ 356,395.13
2020	4	0.792093663	3,248	\$ 430,698.07	\$ 341,153.21	1	\$ 341,153.21	\$ 419,401.07	\$ 332,204.93	1	\$ 332,204.93	\$ 436,155.02	\$ 345,475.63	1	\$ 345,475.63
2021	5	0.747258173	3,335	\$ 442,234.62	\$ 330,463.44	1	\$ 330,463.44	\$ 430,635.03	\$ 321,795.54	1	\$ 321,795.54	\$ 447,837.74	\$ 334,650.41	1	\$ 334,650.41
2022	6	0.70496054	3,422	\$ 453,771.18	\$ 319,890.78	1	\$ 319,890.78	\$ 441,868.98	\$ 311,500.20	1	\$ 311,500.20	\$ 459,520.47	\$ 323,943.80	1	\$ 323,943.80
2023	7	0.665057114	3,509	\$ 465,307.73	\$ 309,456.22	1	\$ 309,456.22	\$ 453,102.94	\$ 301,339.33	1	\$ 301,339.33	\$ 471,203.19	\$ 313,377.03	1	\$ 313,377.03
2024	8	0.627412371	3,596	\$ 476,844.29	\$ 299,178.01	1	\$ 299,178.01	\$ 464,336.90	\$ 291,330.71	1	\$ 291,330.71	\$ 482,885.92	\$ 302,968.60	1	\$ 302,968.60
2025	9	0.591898464	3,683	\$ 488,380.84	\$ 289,071.87	1	\$ 289,071.87	\$ 475,570.86	\$ 281,489.66	1	\$ 281,489.66	\$ 494,568.64	\$ 292,734.42	1	\$ 292,734.42
2026	10	0.558394777	3,770	\$ 499,917.40	\$ 279,151.27	1	\$ 279,151.27	\$ 486,804.81	\$ 271,829.26	1	\$ 271,829.26	\$ 506,251.36	\$ 282,688.12	1	\$ 282,688.12
2027	11	0.526787525	3,857	\$ 511,453.96	\$ 269,427.56	1	\$ 269,427.56	\$ 498,038.77	\$ 262,360.61	1	\$ 262,360.61	\$ 517,934.09	\$ 272,841.22	1	\$ 272,841.22
2028	12	0.496969364	3,944	\$ 522,990.51	\$ 259,910.26	1	\$ 259,910.26	\$ 509,272.73	\$ 253,092.94	1	\$ 253,092.94	\$ 529,616.81	\$ 263,203.33	1	\$ 263,203.33
2029	13	0.468839022	4,031	\$ 534,527.07	\$ 250,607.15	1	\$ 250,607.15	\$ 520,506.68	\$ 244,033.84	1	\$ 244,033.84	\$ 541,299.53	\$ 253,782.34	1	\$ 253,782.34
2030	14	0.442300964	4,118	\$ 546,063.62	\$ 241,524.47	1	\$ 241,524.47	\$ 531,740.64	\$ 235,189.40	1	\$ 235,189.40	\$ 552,982.26	\$ 244,584.59	1	\$ 244,584.59
2031	15	0.417265061	4,205	\$ 557,600.18	\$ 232,667.07	1	\$ 232,667.07	\$ 542,974.60	\$ 226,564.33	1	\$ 226,564.33	\$ 564,664.98	\$ 235,614.97	1	\$ 235,614.97
2032	16	0.393646284	4,292	\$ 569,136.73	\$ 224,038.56	1	\$ 224,038.56	\$ 554,208.56	\$ 218,162.14	1	\$ 218,162.14	\$ 576,347.71	\$ 226,877.13	1	\$ 226,877.13
2033	17	0.371364419	4,379	\$ 580,673.29	\$ 215,641.40	1	\$ 215,641.40	\$ 565,442.51	\$ 209,985.23	1	\$ 209,985.23	\$ 588,030.43	\$ 218,373.58	1	\$ 218,373.58
2034	18	0.350343791	4,466	\$ 592,209.84	\$ 207,477.04	1	\$ 207,477.04	\$ 576,676.47	\$ 202,035.02	1	\$ 202,035.02	\$ 599,713.15	\$ 210,105.78	1	\$ 210,105.78
2035	19	0.33051301	4,553	\$ 603,746.40	\$ 199,546.04	1	\$ 199,546.04	\$ 587,910.43	\$ 194,312.05	1	\$ 194,312.05	\$ 611,395.88	\$ 202,074.29	1	\$ 202,074.29
2036	20	0.311804727	4,640	\$ 615,282.95	\$ 191,848.13	1	\$ 191,848.13	\$ 599,144.38	\$ 186,816.05	1	\$ 186,816.05	\$ 623,078.60	\$ 194,278.85	1	\$ 194,278.85
2037	21	0.294155403	4,727	\$ 626,819.51	\$ 184,382.35	1	\$ 184,382.35	\$ 610,378.34	\$ 179,546.09	1	\$ 179,546.09	\$ 634,761.33	\$ 186,718.47	1	\$ 186,718.47
2038	22	0.277505097	4,814	\$ 638,356.06	\$ 177,147.06	1	\$ 177,147.06	\$ 621,612.30	\$ 172,500.58	1	\$ 172,500.58	\$ 646,444.05	\$ 179,391.52	1	\$ 179,391.52
2039	23	0.261797261	4,901	\$ 649,892.62	\$ 170,140.11	1	\$ 170,140.11	\$ 632,846.26	\$ 165,677.42	1	\$ 165,677.42	\$ 658,126.77	\$ 172,295.79	1	\$ 172,295.79
2040	24	0.246978548	4,988	\$ 661,429.18	\$ 163,358.82	1	\$ 163,358.82	\$ 644,080.21	\$ 159,074.00	1	\$ 159,074.00	\$ 669,809.50	\$ 165,428.58	1	\$ 165,428.58
2041	25	0.232998631	5,075	\$ 672,965.73	\$ 156,800.09	1	\$ 156,800.09	\$ 655,314.17	\$ 152,687.30	1	\$ 152,687.30	\$ 681,492.22	\$ 158,786.75	1	\$ 158,786.75
2042	26	0.219810029	5,162	\$ 684,502.29	\$ 150,460.47	1	\$ 150,460.47	\$ 666,548.13	\$ 146,513.96	1	\$ 146,513.96	\$ 693,174.94	\$ 152,366.80	1	\$ 152,366.80
2043	27	0.207367952	5,249	\$ 696,038.84	\$ 144,336.15	1	\$ 144,336.15	\$ 677,782.09	\$ 140,550.28	1	\$ 140,550.28	\$ 704,857.67	\$ 146,164.89	1	\$ 146,164.89
2044	28	0.195630143	5,336	\$ 707,575.40	\$ 138,423.08	1	\$ 138,423.08	\$ 689,016.04	\$ 134,792.31	1	\$ 134,792.31	\$ 716,540.39	\$ 140,176.90	1	\$ 140,176.90
2045	29	0.184556739	5,423	\$ 719,111.95	\$ 132,716.96	1	\$ 132,716.96	\$ 700,250.00	\$ 129,235.86	1	\$ 129,235.86	\$ 728,223.12	\$ 134,398.48	1	\$ 134,398.48
2046	30	0.174110131	5,510	\$ 730,648.51	\$ 127,213.31	1	\$ 127,213.31	\$ 711,483.96	\$ 123,876.56	1	\$ 123,876.56	\$ 739,905.84	\$ 128,825.10	1	\$ 128,825.10
2047	31	0.16425484	5,597	\$ 742,185.06	\$ 121,907.49	1	\$ 121,907.49	\$ 722,717.91	\$ 118,709.92	1	\$ 118,709.92	\$ 751,588.56	\$ 123,452.06	1	\$ 123,452.06
2048	32	0.154957397	5,684	\$ 753,721.62	\$ 116,794.74	1	\$ 116,794.74	\$ 733,951.87	\$ 113,731.27	1	\$ 113,731.27	\$ 763,271.29	\$ 118,274.53	1	\$ 118,274.53
2049	33	0.146186223	5,771	\$ 765,258.17	\$ 111,870.20	1	\$ 111,870.20	\$ 745,185.83	\$ 108,935.90	1	\$ 108,935.90	\$ 774,954.01	\$ 113,287.60	1	\$ 113,287.60
2050	34	0.137911531	5,858	\$ 776,794.73	\$ 107,128.95	1	\$ 107,128.95	\$ 756,419.79	\$ 104,319.01	1	\$ 104,319.01	\$ 786,636.73	\$ 108,486.28	1	\$ 108,486.28
2051	35	0.130105218	5,945	\$ 788,331.28	\$ 102,566.01	1	\$ 102,566.01	\$ 767,653.74	\$ 99,875.76	1	\$ 99,875.76	\$ 798,319.46	\$ 103,865.53	1	\$ 103,865.53
2052	36	0.122740772	6,032	\$ 799,867.84	\$ 98,176.40	1	\$ 98,176.40	\$ 778,887.70	\$ 95,601.28	1	\$ 95,601.28	\$ 810,002.18	\$ 99,420.29	1	\$ 99,420.29
2053	37	0.115793181	6,119	\$ 811,404.40	\$ 93,955.10	1	\$ 93,955.10	\$ 790,121.66	\$ 91,490.70	1	\$ 91,490.70	\$ 821,684.91	\$ 95,145.51	1	\$ 95,145.51
2054	38	0.10923885	6,206	\$ 822,940.95	\$ 89,897.12	1	\$ 89,897.12	\$ 801,355.61	\$ 87,539.17	1	\$ 87,539.17	\$ 833,367.63	\$ 91,036.12	1	\$ 91,036.12
2055	39	0.103055519	6,293	\$ 834,477.51	\$ 85,997.51	1	\$ 85,997.51	\$ 812,589.57	\$ 83,741.84	1	\$ 83,741.84	\$ 845,050.35	\$ 87,087.10	1	\$ 87,087.10

\$ 8,407,265.37

\$ 8,186,746.93

\$ 8,513,785.59

Worksheet A1 - Discounting

YEAR	TIME	Growth	3.0%	DM CO2				OPT CO2				DM ACC (Bridges)			
		SPPWF	AADT	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL
2016	0	1	2,900	\$ 23,492.37	\$ 23,492.37	1	\$ 23,492.37	\$ 18,723.26	\$ 18,723.26	1	\$ 18,723.26	\$ 257,200.60	\$ 257,200.60	1	\$ 257,200.60
2017	1	0.943396226	2,987	\$ 24,201.17	\$ 22,831.29	1	\$ 22,831.29	\$ 19,284.96	\$ 18,193.36	1	\$ 18,193.36	\$ 259,772.60	\$ 245,068.49	1	\$ 245,068.49
2018	2	0.88999644	3,074	\$ 24,911.34	\$ 22,171.01	1	\$ 22,171.01	\$ 19,846.66	\$ 17,663.45	1	\$ 17,663.45	\$ 262,344.61	\$ 233,485.77	1	\$ 233,485.77
2019	3	0.839619283	3,161	\$ 25,621.75	\$ 21,512.52	1	\$ 21,512.52	\$ 20,408.36	\$ 17,135.25	1	\$ 17,135.25	\$ 264,916.61	\$ 222,429.10	1	\$ 222,429.10
2020	4	0.792093663	3,248	\$ 26,332.16	\$ 20,857.54	1	\$ 20,857.54	\$ 20,970.05	\$ 16,610.25	1	\$ 16,610.25	\$ 267,488.62	\$ 211,876.04	1	\$ 211,876.04
2021	5	0.747258173	3,335	\$ 27,042.57	\$ 20,207.79	1	\$ 20,207.79	\$ 21,531.75	\$ 16,089.78	1	\$ 16,089.78	\$ 270,060.63	\$ 201,805.01	1	\$ 201,805.01
2022	6	0.70496054	3,422	\$ 27,752.99	\$ 19,564.76	1	\$ 19,564.76	\$ 22,093.45	\$ 15,575.01	1	\$ 15,575.01	\$ 272,632.63	\$ 192,195.25	1	\$ 192,195.25
2023	7	0.665057114	3,509	\$ 28,463.79	\$ 18,930.05	1	\$ 18,930.05	\$ 22,655.15	\$ 15,066.97	1	\$ 15,066.97	\$ 275,204.64	\$ 183,026.80	1	\$ 183,026.80
2024	8	0.627412371	3,596	\$ 29,178.01	\$ 18,306.64	1	\$ 18,306.64	\$ 23,216.84	\$ 14,566.54	1	\$ 14,566.54	\$ 277,776.64	\$ 174,280.50	1	\$ 174,280.50
2025	9	0.591898464	3,683	\$ 29,892.23	\$ 17,693.17	1	\$ 17,693.17	\$ 23,778.54	\$ 14,074.48	1	\$ 14,074.48	\$ 280,348.65	\$ 165,937.93	1	\$ 165,937.93
2026	10	0.558394777	3,770	\$ 30,606.45	\$ 17,090.48	1	\$ 17,090.48	\$ 24,340.24	\$ 13,591.46	1	\$ 13,591.46	\$ 282,920.66	\$ 157,981.42	1	\$ 157,981.42
2027	11	0.526787525	3,857	\$ 31,320.67	\$ 16,499.34	1	\$ 16,499.34	\$ 24,901.94	\$ 13,118.03	1	\$ 13,118.03	\$ 285,492.66	\$ 150,393.97	1	\$ 150,393.97
2028	12	0.496969364	3,944	\$ 32,034.89	\$ 15,920.36	1	\$ 15,920.36	\$ 25,463.64	\$ 12,654.65	1	\$ 12,654.65	\$ 288,064.67	\$ 143,159.31	1	\$ 143,159.31
2029	13	0.468839022	4,031	\$ 32,749.67	\$ 15,354.32	1	\$ 15,354.32	\$ 26,025.33	\$ 12,201.69	1	\$ 12,201.69	\$ 290,636.67	\$ 136,261.81	1	\$ 136,261.81
2030	14	0.442300964	4,118	\$ 33,465.45	\$ 14,801.80	1	\$ 14,801.80	\$ 26,587.03	\$ 11,759.47	1	\$ 11,759.47	\$ 293,208.68	\$ 129,686.48	1	\$ 129,686.48
2031	15	0.417265061	4,205	\$ 34,181.23	\$ 14,262.63	1	\$ 14,262.63	\$ 27,148.73	\$ 11,328.22	1	\$ 11,328.22	\$ 295,780.68	\$ 123,418.95	1	\$ 123,418.95
2032	16	0.393646284	4,292	\$ 34,897.01	\$ 13,737.08	1	\$ 13,737.08	\$ 27,710.43	\$ 10,908.11	1	\$ 10,908.11	\$ 298,352.69	\$ 117,445.43	1	\$ 117,445.43
2033	17	0.371364419	4,379	\$ 35,612.79	\$ 13,225.32	1	\$ 13,225.32	\$ 28,272.13	\$ 10,499.26	1	\$ 10,499.26	\$ 300,924.70	\$ 111,752.73	1	\$ 111,752.73
2034	18	0.350343791	4,466	\$ 36,328.57	\$ 12,727.49	1	\$ 12,727.49	\$ 28,833.82	\$ 10,101.75	1	\$ 10,101.75	\$ 303,496.70	\$ 106,328.19	1	\$ 106,328.19
2035	19	0.33051301	4,553	\$ 37,044.35	\$ 12,243.64	1	\$ 12,243.64	\$ 29,395.52	\$ 9,715.60	1	\$ 9,715.60	\$ 306,068.71	\$ 101,159.69	1	\$ 101,159.69
2036	20	0.311804727	4,640	\$ 37,760.14	\$ 11,773.79	1	\$ 11,773.79	\$ 29,957.22	\$ 9,340.80	1	\$ 9,340.80	\$ 308,640.71	\$ 96,235.63	1	\$ 96,235.63
2037	21	0.294155403	4,727	\$ 38,475.92	\$ 11,317.90	1	\$ 11,317.90	\$ 30,518.92	\$ 8,977.30	1	\$ 8,977.30	\$ 311,212.72	\$ 91,544.90	1	\$ 91,544.90
2038	22	0.277505097	4,814	\$ 39,191.70	\$ 10,875.90	1	\$ 10,875.90	\$ 31,080.61	\$ 8,625.03	1	\$ 8,625.03	\$ 313,784.73	\$ 87,076.86	1	\$ 87,076.86
2039	23	0.261797261	4,901	\$ 39,907.48	\$ 10,447.67	1	\$ 10,447.67	\$ 31,642.31	\$ 8,283.87	1	\$ 8,283.87	\$ 316,356.73	\$ 82,821.33	1	\$ 82,821.33
2040	24	0.246978548	4,988	\$ 40,623.26	\$ 10,033.07	1	\$ 10,033.07	\$ 32,204.01	\$ 7,953.70	1	\$ 7,953.70	\$ 318,928.74	\$ 78,768.56	1	\$ 78,768.56
2041	25	0.232998631	5,075	\$ 37,777.81	\$ 8,802.18	1	\$ 8,802.18	\$ 32,765.71	\$ 7,634.37	1	\$ 7,634.37	\$ 57,776.03	\$ 13,461.74	1	\$ 13,461.74
2042	26	0.219810029	5,162	\$ 38,425.43	\$ 8,446.29	1	\$ 8,446.29	\$ 33,327.41	\$ 7,325.70	1	\$ 7,325.70	\$ 58,238.24	\$ 12,801.35	1	\$ 12,801.35
2043	27	0.207367952	5,249	\$ 39,073.05	\$ 8,102.50	1	\$ 8,102.50	\$ 33,889.10	\$ 7,027.51	1	\$ 7,027.51	\$ 58,700.45	\$ 12,172.59	1	\$ 12,172.59
2044	28	0.195630143	5,336	\$ 39,720.67	\$ 7,770.56	1	\$ 7,770.56	\$ 34,450.80	\$ 6,739.62	1	\$ 6,739.62	\$ 59,162.66	\$ 11,574.00	1	\$ 11,574.00
2045	29	0.184556739	5,423	\$ 40,368.29	\$ 7,450.24	1	\$ 7,450.24	\$ 35,012.50	\$ 6,461.79	1	\$ 6,461.79	\$ 59,624.87	\$ 11,004.17	1	\$ 11,004.17
2046	30	0.174110131	5,510	\$ 41,015.91	\$ 7,141.29	1	\$ 7,141.29	\$ 35,574.20	\$ 6,193.83	1	\$ 6,193.83	\$ 60,087.07	\$ 10,461.77	1	\$ 10,461.77
2047	31	0.16425484	5,597	\$ 41,663.53	\$ 6,843.44	1	\$ 6,843.44	\$ 36,135.90	\$ 5,935.50	1	\$ 5,935.50	\$ 60,549.28	\$ 9,945.51	1	\$ 9,945.51
2048	32	0.154957397	5,684	\$ 42,311.15	\$ 6,556.43	1	\$ 6,556.43	\$ 36,697.59	\$ 5,686.56	1	\$ 5,686.56	\$ 61,011.49	\$ 9,454.18	1	\$ 9,454.18
2049	33	0.146186223	5,771	\$ 42,958.77	\$ 6,279.98	1	\$ 6,279.98	\$ 37,259.29	\$ 5,446.80	1	\$ 5,446.80	\$ 61,473.70	\$ 8,986.61	1	\$ 8,986.61
2050	34	0.137911531	5,858	\$ 43,606.39	\$ 6,013.82	1	\$ 6,013.82	\$ 37,820.99	\$ 5,215.95	1	\$ 5,215.95	\$ 61,935.91	\$ 8,541.68	1	\$ 8,541.68
2051	35	0.130105218	5,945	\$ 44,254.01	\$ 5,757.68	1	\$ 5,757.68	\$ 38,382.69	\$ 4,993.79	1	\$ 4,993.79	\$ 62,398.11	\$ 8,118.32	1	\$ 8,118.32
2052	36	0.122740772	6,032	\$ 44,901.63	\$ 5,511.26	1	\$ 5,511.26	\$ 38,944.39	\$ 4,780.06	1	\$ 4,780.06	\$ 62,860.32	\$ 7,715.52	1	\$ 7,715.52
2053	37	0.115793181	6,119	\$ 45,549.25	\$ 5,274.29	1	\$ 5,274.29	\$ 39,506.08	\$ 4,574.54	1	\$ 4,574.54	\$ 63,322.53	\$ 7,332.32	1	\$ 7,332.32
2054	38	0.10923885	6,206	\$ 46,196.86	\$ 5,046.49	1	\$ 5,046.49	\$ 40,067.78	\$ 4,376.96	1	\$ 4,376.96	\$ 63,784.74	\$ 6,967.77	1	\$ 6,967.77
2055	39	0.103055519	6,293	\$ 46,844.48	\$ 4,827.58	1	\$ 4,827.58	\$ 40,629.48	\$ 4,187.09	1	\$ 4,187.09	\$ 64,246.95	\$ 6,621.00	1	\$ 6,621.00

\$ 505,701.95

\$ 409,337.35

\$ 3,946,499.27











Worksheet A1 - Discounting

YEAR	TIME	Growth	3.0%	OPT BRIDGE (90)		OPT BRIDGE (100A)		OPT BRIDGE (100B)		OPT BRIDGE (100C)		OPT MTCE (90)		OPT MTCE (100A)	
				SPPWF	AADT	COST	PV COST	COST	PV COST	COST	PV COST	COST	PV COST	COST	PV COST
2016	0	1	2,900	\$ 9,106,240.0	\$ 9,106,240.0	\$ 8,562,224.0	\$ 8,562,224.0	\$ 8,290,216.0	\$ 8,290,216.0	\$ 8,562,224.0	\$ 8,562,224.0	\$ 5,403.08	\$ 5,403.08	\$ 5,353.92	\$ 5,353.92
2017	1	0.943396226	2,987	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 5,097.24	\$ 5,353.92	\$ 5,050.87
2018	2	0.88999644	3,074	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 4,808.72	\$ 5,353.92	\$ 4,764.97
2019	3	0.839619283	3,161	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 4,536.53	\$ 5,353.92	\$ 4,495.26
2020	4	0.792093663	3,248	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 4,279.74	\$ 5,353.92	\$ 4,240.81
2021	5	0.747258173	3,335	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 4,037.49	\$ 5,353.92	\$ 4,000.76
2022	6	0.70496054	3,422	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 3,808.95	\$ 5,353.92	\$ 3,774.31
2023	7	0.665057114	3,509	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 3,593.35	\$ 5,353.92	\$ 3,560.67
2024	8	0.627412371	3,596	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 3,389.96	\$ 5,353.92	\$ 3,359.12
2025	9	0.591898464	3,683	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 3,198.07	\$ 5,353.92	\$ 3,168.98
2026	10	0.558394777	3,770	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 3,017.05	\$ 5,353.92	\$ 2,989.60
2027	11	0.526787525	3,857	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 2,846.27	\$ 5,353.92	\$ 2,820.38
2028	12	0.496969364	3,944	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 2,685.16	\$ 5,353.92	\$ 2,660.74
2029	13	0.468839022	4,031	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 2,533.17	\$ 5,353.92	\$ 2,510.13
2030	14	0.442300964	4,118	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 2,389.79	\$ 5,353.92	\$ 2,368.05
2031	15	0.417265061	4,205	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 2,254.51	\$ 5,353.92	\$ 2,234.01
2032	16	0.393646284	4,292	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 2,126.90	\$ 5,353.92	\$ 2,107.55
2033	17	0.371364419	4,379	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 2,006.51	\$ 5,353.92	\$ 1,988.26
2034	18	0.350343791	4,466	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 1,892.93	\$ 5,353.92	\$ 1,875.71
2035	19	0.33051301	4,553	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 1,785.79	\$ 5,353.92	\$ 1,769.54
2036	20	0.311804727	4,640	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 1,684.70	\$ 5,353.92	\$ 1,669.38
2037	21	0.294155403	4,727	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 1,589.34	\$ 5,353.92	\$ 1,574.89
2038	22	0.277505097	4,814	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 1,499.38	\$ 5,353.92	\$ 1,485.74
2039	23	0.261797261	4,901	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 1,414.51	\$ 5,353.92	\$ 1,401.64
2040	24	0.246978548	4,988	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 1,334.44	\$ 5,353.92	\$ 1,322.30
2041	25	0.232998631	5,075	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 1,258.91	\$ 5,353.92	\$ 1,247.46
2042	26	0.219810029	5,162	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 1,187.65	\$ 5,353.92	\$ 1,176.85
2043	27	0.207367952	5,249	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 1,120.42	\$ 5,353.92	\$ 1,110.23
2044	28	0.195630143	5,336	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 1,057.00	\$ 5,353.92	\$ 1,047.39
2045	29	0.184556739	5,423	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 997.17	\$ 5,353.92	\$ 988.10
2046	30	0.174110131	5,510	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 940.73	\$ 5,353.92	\$ 932.17
2047	31	0.16425484	5,597	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 887.48	\$ 5,353.92	\$ 879.41
2048	32	0.154957397	5,684	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 837.25	\$ 5,353.92	\$ 829.63
2049	33	0.146186223	5,771	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 789.86	\$ 5,353.92	\$ 782.67
2050	34	0.137911531	5,858	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 745.15	\$ 5,353.92	\$ 738.37
2051	35	0.130105218	5,945	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 702.97	\$ 5,353.92	\$ 696.57
2052	36	0.122740772	6,032	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 663.18	\$ 5,353.92	\$ 657.14
2053	37	0.115793181	6,119	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 625.64	\$ 5,353.92	\$ 619.95
2054	38	0.10923885	6,206	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,403.08	\$ 590.23	\$ 5,353.92	\$ 584.86
2055	39	0.103055519	6,293	\$ -8,871,963.5	\$ -914,304.80	\$ -8,341,943.4	\$ -859,683.31	\$ -8,076,933.4	\$ -832,372.56	\$ -8,341,943.4	\$ -859,683.31	\$ 5,403.08	\$ 556.82	\$ 5,353.92	\$ 551.75
				\$ 8,191,935.20		\$ 7,702,540.7		\$ 7,457,843.44		\$ 7,702,540.7		\$ 86,174.05		\$ 85,390.14	



**Worksheet A1 - Discounting**

YEAR	TIME	Growth	3.0%	OPT ALIGN (100B)		OPT ALIGN (100C)	
		SPPWF	AADT	COST	PV COST	COST	PV COST
2016	0	1	2,900	\$ 8,426,372.00	\$ 8,426,372.00	\$ 8,536,886.00	\$ 8,536,886.00
2017	1	0.943396226	2,987	\$ -	\$ -	\$ -	\$ -
2018	2	0.88999644	3,074	\$ -	\$ -	\$ -	\$ -
2019	3	0.839619283	3,161	\$ -	\$ -	\$ -	\$ -
2020	4	0.792093663	3,248	\$ -	\$ -	\$ -	\$ -
2021	5	0.747258173	3,335	\$ -	\$ -	\$ -	\$ -
2022	6	0.70496054	3,422	\$ -	\$ -	\$ -	\$ -
2023	7	0.665057114	3,509	\$ -	\$ -	\$ -	\$ -
2024	8	0.627412371	3,596	\$ -	\$ -	\$ -	\$ -
2025	9	0.591898464	3,683	\$ -	\$ -	\$ -	\$ -
2026	10	0.558394777	3,770	\$ -	\$ -	\$ -	\$ -
2027	11	0.526787525	3,857	\$ -	\$ -	\$ -	\$ -
2028	12	0.496969364	3,944	\$ -	\$ -	\$ -	\$ -
2029	13	0.468839022	4,031	\$ -	\$ -	\$ -	\$ -
2030	14	0.442300964	4,118	\$ -	\$ -	\$ -	\$ -
2031	15	0.417265061	4,205	\$ -	\$ -	\$ -	\$ -
2032	16	0.393646284	4,292	\$ -	\$ -	\$ -	\$ -
2033	17	0.371364419	4,379	\$ -	\$ -	\$ -	\$ -
2034	18	0.350343791	4,466	\$ -	\$ -	\$ -	\$ -
2035	19	0.33051301	4,553	\$ -	\$ -	\$ -	\$ -
2036	20	0.311804727	4,640	\$ -	\$ -	\$ -	\$ -
2037	21	0.294155403	4,727	\$ -	\$ -	\$ -	\$ -
2038	22	0.277505097	4,814	\$ -	\$ -	\$ -	\$ -
2039	23	0.261797261	4,901	\$ -	\$ -	\$ -	\$ -
2040	24	0.246978548	4,988	\$ -	\$ -	\$ -	\$ -
2041	25	0.232998631	5,075	\$ -	\$ -	\$ -	\$ -
2042	26	0.219810029	5,162	\$ -	\$ -	\$ -	\$ -
2043	27	0.207367952	5,249	\$ -	\$ -	\$ -	\$ -
2044	28	0.195630143	5,336	\$ -	\$ -	\$ -	\$ -
2045	29	0.184556739	5,423	\$ -	\$ -	\$ -	\$ -
2046	30	0.174110131	5,510	\$ -	\$ -	\$ -	\$ -
2047	31	0.16425484	5,597	\$ -	\$ -	\$ -	\$ -
2048	32	0.154957397	5,684	\$ -	\$ -	\$ -	\$ -
2049	33	0.146186223	5,771	\$ -	\$ -	\$ -	\$ -
2050	34	0.137911531	5,858	\$ -	\$ -	\$ -	\$ -
2051	35	0.130105218	5,945	\$ -	\$ -	\$ -	\$ -
2052	36	0.122740772	6,032	\$ -	\$ -	\$ -	\$ -
2053	37	0.115793181	6,119	\$ -	\$ -	\$ -	\$ -
2054	38	0.10923885	6,206	\$ -	\$ -	\$ -	\$ -
2055	39	0.103055519	6,293	\$ -	\$ -	\$ -	\$ -

**\$ 8,426,372.00**
**\$ 8,536,886.00**

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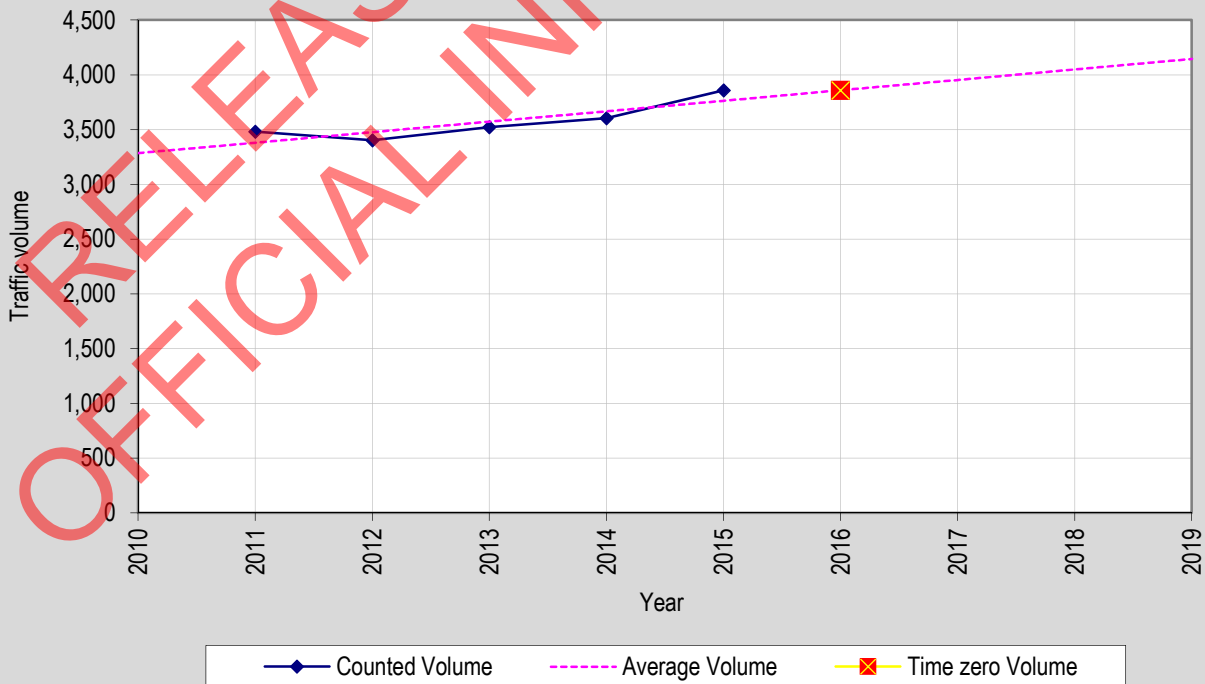
Worksheets A2: Traffic Data



**Worksheet A2.4 - Time zero traffic volume and growth rates**

1	Activity option	Count Station 01000029
2	Road/section/movement	SH10 RS 17 RP 11.14: About 1km south of Takou Bay Road
3	Time period	2011-2015 Traffic Count Data

Year (4)	AADT or average volume (5)	Regression output		
2010		6	Constant	-188668.3
2011	3480	7	X coefficient	95.5
2012	3403	8	R squared	0.748993157
2013	3522	9	Time zero	2016
2014	3604	10	Time zero traffic volume	3,860
2015	3857	11	Growth rate at time zero	2.5%



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Worksheets A2: Traffic Data

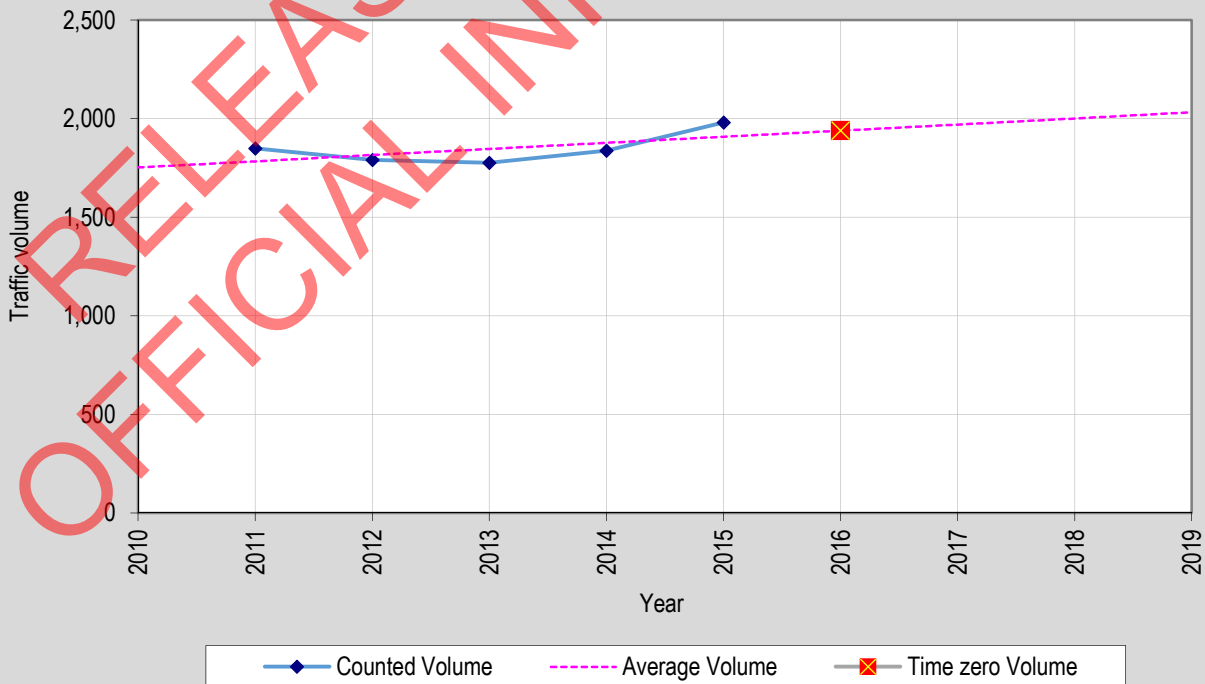


**Worksheet A2.4 - Time zero traffic volume and growth rates**

1	Activity option	Count Station 01000060
2	Road/section/movement	SH10 RS 48 RP 11.93: About 1.1km north of Salvation Road
3	Time period	2011-2015 Traffic Count Data

Year (4)	AADT or average volume (5)
2010	
2011	1849
2012	1791
2013	1777
2014	1838
2015	1981

Regression output		
6	Constant	-60757.1
7	X coefficient	31.1
8	R squared	0.37090824
9	Time zero	2016
10	Time zero traffic volume	1,941
11	Growth rate at time zero	1.6%



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# Worksheets A2: Traffic Data

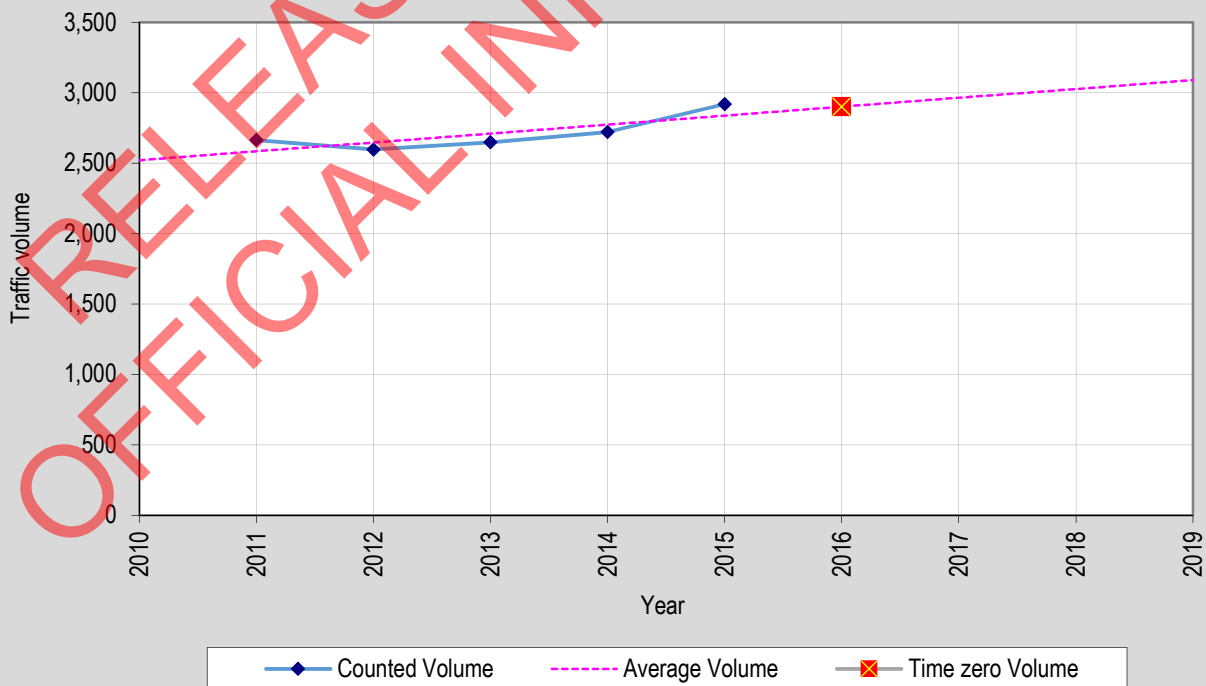


## Worksheet A2.4 - Time zero traffic volume and growth rates

1	Activity option	Average of Count Station 01000029 & 01000060
2	Road/section/movement	
3	Time period	2011-2015 Traffic Count Data

Year (4)	AADT or average volume (5)	Regression output		
2010		6	Constant	-124712.7
2011	2664.5	7	X coefficient	63.3
2012	2597	8	R squared	0.643147093
2013	2649.5	9	Time zero	2016
2014	2721	10	Time zero traffic volume	2,900
2015	2919	11	Growth rate at time zero	2.2%

Traffic Growth of 3.0% adopted based on growth projections from:-  
 "Tai Tokerau Northland Economic Action Plan" (February 2016)



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Delays & Conflicts at One Lane Bridges						Year	AADT	Delay (mins per day)	Wait (mins per day)	Total Stops
Table 3: Total Delay in minutes per day						2016	2,900	328.22	62.60	445.93
Interpolated figures for 70m Bridge						2017	2,987	348.47	66.43	472.09
AADT	2500	3000	3500	4000	5000	2018	3,074	372.15	70.55	502.86
60m	208	313	440	632	1111	2019	3,161	396.42	74.73	534.44
80m	262	390	542	772	1319	2020	3,248	420.69	78.90	566.02
<b>70m</b>	<b>235</b>	<b>351.5</b>	<b>491</b>	<b>702</b>	<b>1215</b>	2021	3,335	444.97	83.08	597.61
Table 4: Total waiting time in minutes per day						2022	3,422	469.24	87.26	629.19
AADT	2500	3000	3500	4000	5000	2023	3,509	494.80	91.76	661.81
60m	38	57	77	114	212	2024	3,596	531.51	99.06	703.48
80m	52	77	105	152	273	2025	3,683	568.23	106.37	745.16
<b>70m</b>	<b>45</b>	<b>67</b>	<b>91</b>	<b>133</b>	<b>242.5</b>	2026	3,770	604.94	113.68	786.83
Table 5: Total number of stops per day						2027	3,857	641.65	120.99	828.50
AADT	2500	3000	3500	4000	5000	2028	3,944	678.37	128.30	870.18
60m	287	424	589	813	1300	2029	4,031	717.90	136.39	912.86
80m	364	528	726	981	1517	2030	4,118	762.53	145.92	957.36
<b>70m</b>	<b>325.5</b>	<b>476</b>	<b>657.5</b>	<b>897</b>	<b>1408.5</b>	2031	4,205	807.17	155.45	1,001.86
						2032	4,292	851.80	164.97	1,046.36
						2033	4,379	896.43	174.50	1,090.86
						2034	4,466	941.06	184.03	1,135.36
						2035	4,553	985.69	193.55	1,179.86
						2036	4,640	1,030.32	203.08	1,224.36
						2037	4,727	1,074.95	212.61	1,268.86
						2038	4,814	1,119.58	222.13	1,313.36
						2039	4,901	1,164.21	231.66	1,357.86
						2040	4,988	1,208.84	241.19	1,402.36

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## Worksheets A4: Travel time cost savings, continued



## Worksheet A4.1 - Travel time cost savings

Option (1)	Direction (2)	Period (3)	No./Year (4)	Road Category (5)	Period Volume (6)	TT (mins) (7)	TTC (\$/hr) (8)	Congest (\$/hr) (9)	Reliability (\$/hr) (10)	Annual Cost (\$) (11)
DM - Bridge Delays	Both	2016	245	RS	2,900	328.2233	\$25.34	\$4.88	\$0.00	\$40,502
DM - Bridge Delays	Both	2017	245	RS	2,987	348.4710	\$25.34	\$4.88	\$0.00	\$43,001
DM - Bridge Delays	Both	2018	245	RS	3,074	372.1460	\$25.34	\$4.88	\$0.00	\$45,922
DM - Bridge Delays	Both	2019	245	RS	3,161	396.4190	\$25.34	\$4.88	\$0.00	\$48,917
DM - Bridge Delays	Both	2020	245	RS	3,248	420.6920	\$25.34	\$4.88	\$0.00	\$51,913
DM - Bridge Delays	Both	2021	245	RS	3,335	444.9650	\$25.34	\$4.88	\$0.00	\$54,908
DM - Bridge Delays	Both	2022	245	RS	3,422	469.2380	\$25.34	\$4.88	\$0.00	\$57,903
DM - Bridge Delays	Both	2023	245	RS	3,509	494.7980	\$25.34	\$4.88	\$0.00	\$61,057
DM - Bridge Delays	Both	2024	245	RS	3,596	531.5120	\$25.34	\$4.88	\$0.00	\$65,588
DM - Bridge Delays	Both	2025	245	RS	3,683	568.2260	\$25.34	\$4.88	\$0.00	\$70,118
DM - Bridge Delays	Both	2026	245	RS	3,770	604.9400	\$25.34	\$4.88	\$0.00	\$74,649
DM - Bridge Delays	Both	2027	245	RS	3,857	641.6540	\$25.34	\$4.88	\$0.00	\$79,179
DM - Bridge Delays	Both	2028	245	RS	3,944	678.3680	\$25.34	\$4.88	\$0.00	\$83,709
DM - Bridge Delays	Both	2029	245	RS	4,031	717.9030	\$25.34	\$4.88	\$0.00	\$88,588
DM - Bridge Delays	Both	2030	245	RS	4,118	762.5340	\$25.34	\$4.88	\$0.00	\$94,095
DM - Bridge Delays	Both	2031	245	RS	4,205	807.1650	\$25.34	\$4.88	\$0.00	\$99,603
DM - Bridge Delays	Both	2032	245	RS	4,292	851.7960	\$25.34	\$4.88	\$0.00	\$105,110
DM - Bridge Delays	Both	2033	245	RS	4,379	896.4270	\$25.34	\$4.88	\$0.00	\$110,618
DM - Bridge Delays	Both	2034	245	RS	4,466	941.0580	\$25.34	\$4.88	\$0.00	\$116,125
DM - Bridge Delays	Both	2035	245	RS	4,553	985.6890	\$25.34	\$4.88	\$0.00	\$121,632
DM - Bridge Delays	Both	2036	245	RS	4,640	1030.3200	\$25.34	\$4.88	\$0.00	\$127,140
DM - Bridge Delays	Both	2037	245	RS	4,727	1074.9510	\$25.34	\$4.88	\$0.00	\$132,647
DM - Bridge Delays	Both	2038	245	RS	4,814	1119.5820	\$25.34	\$4.88	\$0.00	\$138,155
DM - Bridge Delays	Both	2039	245	RS	4,901	1164.2130	\$25.34	\$4.88	\$0.00	\$143,662
DM - Bridge Delays	Both	2040	245	RS	4,988	1208.8440	\$25.34	\$4.88	\$0.00	\$149,169

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## Worksheets A4: Travel time cost savings, continued



## Worksheet A4.1 - Travel time cost savings

Option (1)	Direction (2)	Period (3)	No./Year (4)	Road Category (5)	Period Volume (6)	TT (mins) (7)	TTC (\$/hr) (8)	Congest (\$/hr) (9)	Reliability (\$/hr) (10)	Annual Cost (\$) (11)
DM - Diversions	Both	2016	1	RS	1,069	78.5000	\$25.34	\$0.00	\$0.00	\$35,454
DM - Diversions	Both	2017	1	RS	1,101	78.5000	\$25.34	\$0.00	\$0.00	\$36,517
DM - Diversions	Both	2018	1	RS	1,134	78.5000	\$25.34	\$0.00	\$0.00	\$37,580
DM - Diversions	Both	2019	1	RS	1,166	78.5000	\$25.34	\$0.00	\$0.00	\$38,644
DM - Diversions	Both	2020	1	RS	1,198	78.5000	\$25.34	\$0.00	\$0.00	\$39,708
DM - Diversions	Both	2021	1	RS	1,230	78.5000	\$25.34	\$0.00	\$0.00	\$40,771
DM - Diversions	Both	2022	1	RS	1,262	78.5000	\$25.34	\$0.00	\$0.00	\$41,835
DM - Diversions	Both	2023	1	RS	1,294	78.5000	\$25.34	\$0.00	\$0.00	\$42,898
DM - Diversions	Both	2024	1	RS	1,326	78.5000	\$25.34	\$0.00	\$0.00	\$43,962
DM - Diversions	Both	2025	1	RS	1,358	78.5000	\$25.34	\$0.00	\$0.00	\$45,026
DM - Diversions	Both	2026	1	RS	1,390	78.5000	\$25.34	\$0.00	\$0.00	\$46,089
DM - Diversions	Both	2027	1	RS	1,422	78.5000	\$25.34	\$0.00	\$0.00	\$47,153
DM - Diversions	Both	2028	1	RS	1,454	78.5000	\$25.34	\$0.00	\$0.00	\$48,216
DM - Diversions	Both	2029	1	RS	1,486	78.5000	\$25.34	\$0.00	\$0.00	\$49,280
DM - Diversions	Both	2030	1	RS	1,519	78.5000	\$25.34	\$0.00	\$0.00	\$50,343
DM - Diversions	Both	2031	1	RS	1,551	78.5000	\$25.34	\$0.00	\$0.00	\$51,407
DM - Diversions	Both	2032	1	RS	1,583	78.5000	\$25.34	\$0.00	\$0.00	\$52,471
DM - Diversions	Both	2033	1	RS	1,615	78.5000	\$25.34	\$0.00	\$0.00	\$53,534
DM - Diversions	Both	2034	1	RS	1,647	78.5000	\$25.34	\$0.00	\$0.00	\$54,598
DM - Diversions	Both	2035	1	RS	1,679	78.5000	\$25.34	\$0.00	\$0.00	\$55,661
DM - Diversions	Both	2036	1	RS	1,711	78.5000	\$25.34	\$0.00	\$0.00	\$56,725
DM - Diversions	Both	2037	1	RS	1,743	78.5000	\$25.34	\$0.00	\$0.00	\$57,789
DM - Diversions	Both	2038	1	RS	1,775	78.5000	\$25.34	\$0.00	\$0.00	\$58,852
DM - Diversions	Both	2039	1	RS	1,807	78.5000	\$25.34	\$0.00	\$0.00	\$59,916
DM - Diversions	Both	2040	1	RS	1,839	78.5000	\$25.34	\$0.00	\$0.00	\$60,979

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## Worksheets A4: Travel time cost savings, continued



## Worksheet A4.1 - Travel time cost savings

Option (1)	Direction (2)	Period (3)	No./Year (4)	Road Category (5)	Period Volume (6)	TT (mins) (7)	TTC (\$/hr) (8)	Congest (\$/hr) (9)	Reliability (\$/hr) (10)	Annual Cost (\$) (11)
DM - HPMV Delays	Both	2016	1	RS	50.00	893.9400	\$48.20	\$0.00	\$0.00	\$35,907
DM - HPMV Delays	Both	2017	1	RS	51.50	893.9400	\$48.20	\$0.00	\$0.00	\$36,984
DM - HPMV Delays	Both	2018	1	RS	53.00	893.9400	\$48.20	\$0.00	\$0.00	\$38,061
DM - HPMV Delays	Both	2019	1	RS	54.50	893.9400	\$48.20	\$0.00	\$0.00	\$39,138
DM - HPMV Delays	Both	2020	1	RS	56.00	893.9400	\$48.20	\$0.00	\$0.00	\$40,215
DM - HPMV Delays	Both	2021	1	RS	57.50	893.9400	\$48.20	\$0.00	\$0.00	\$41,293
DM - HPMV Delays	Both	2022	1	RS	59.00	893.9400	\$48.20	\$0.00	\$0.00	\$42,370
DM - HPMV Delays	Both	2023	1	RS	60.50	893.9400	\$48.20	\$0.00	\$0.00	\$43,447
DM - HPMV Delays	Both	2024	1	RS	62.00	893.9400	\$48.20	\$0.00	\$0.00	\$44,524
DM - HPMV Delays	Both	2025	1	RS	63.50	893.9400	\$48.20	\$0.00	\$0.00	\$45,601
DM - HPMV Delays	Both	2026	1	RS	65.00	893.9400	\$48.20	\$0.00	\$0.00	\$46,679
DM - HPMV Delays	Both	2027	1	RS	66.50	893.9400	\$48.20	\$0.00	\$0.00	\$47,756
DM - HPMV Delays	Both	2028	1	RS	68.00	893.9400	\$48.20	\$0.00	\$0.00	\$48,833
DM - HPMV Delays	Both	2029	1	RS	69.50	893.9400	\$48.20	\$0.00	\$0.00	\$49,910
DM - HPMV Delays	Both	2030	1	RS	71.00	893.9400	\$48.20	\$0.00	\$0.00	\$50,987
DM - HPMV Delays	Both	2031	1	RS	72.50	893.9400	\$48.20	\$0.00	\$0.00	\$52,065
DM - HPMV Delays	Both	2032	1	RS	74.00	893.9400	\$48.20	\$0.00	\$0.00	\$53,142
DM - HPMV Delays	Both	2033	1	RS	75.50	893.9400	\$48.20	\$0.00	\$0.00	\$54,219
DM - HPMV Delays	Both	2034	1	RS	77.00	893.9400	\$48.20	\$0.00	\$0.00	\$55,296
DM - HPMV Delays	Both	2035	1	RS	78.50	893.9400	\$48.20	\$0.00	\$0.00	\$56,373
DM - HPMV Delays	Both	2036	1	RS	80.00	893.9400	\$48.20	\$0.00	\$0.00	\$57,451
DM - HPMV Delays	Both	2037	1	RS	81.50	893.9400	\$48.20	\$0.00	\$0.00	\$58,528
DM - HPMV Delays	Both	2038	1	RS	83.00	893.9400	\$48.20	\$0.00	\$0.00	\$59,605
DM - HPMV Delays	Both	2039	1	RS	84.50	893.9400	\$48.20	\$0.00	\$0.00	\$60,682
DM - HPMV Delays	Both	2040	1	RS	86.00	893.9400	\$48.20	\$0.00	\$0.00	\$61,759

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Worksheets A5: Vehicle operating cost savings, continued



Worksheet A5.1 - Unit vehicle operating costs

Option (1)	Direction (2)	Length (km) (3)	Gradient (%) (4)	Rough (IRI) (5)	Road Category (6)	Section Speed (7)	V/C Ratio (8)	Base cost (c/km) (9)	Pavement (c/km) (10)	Cost (Cents) (16)
DM	Both	1.702	1	3.01	RS	100	N/A	35.400	0.302	60.764
OPT 90	Both	1.539	1	2.65	RS	95	N/A	34.800	0.090	53.696
OPT 100A	Both	1.525	1	2.65	RS	100	N/A	35.400	0.090	54.122
OPT 100B	Both	1.485	1	2.65	RS	100	N/A	35.400	0.090	52.703
OPT 100C	Both	1.502	1	2.65	RS	100	N/A	36.400	0.090	54.808

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## Worksheets A5: Vehicle operating cost savings



### Worksheet A5.2 - Vehicle operating cost savings

Option (1)	Year	Direction (2)	Time units (3)	Period (4)	No./Year (5)	Road Category (6)	Period Volume (7)	Cost (cents) (8)	Annual Cost (\$) (9)
DM	2016	Both	Weekday	24HR	245	RS	2,900	60.764	\$ 431,746.40
OPT 90	2016	Both	Weekday	24HR	245	RS	2,900	53.696	\$ 381,521.17
OPT 100A	2016	Both	Weekday	24HR	245	RS	2,900	54.122	\$ 384,551.85
OPT 100B	2016	Both	Weekday	24HR	245	RS	2,900	52.703	\$ 374,465.24
OPT 100C	2016	Both	Weekday	24HR	245	RS	2,900	54.808	\$ 389,424.13

The NZ Transport Agency's *Economic Evaluation Manual*  
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## Additional VOC due to delays

### Assumptions

- Additional VOC due to stops (Cents per speed change cycle), Table A5.41 of EEM
- Additional VOC due to waiting time (Cents per min), Table A5.23 of EEM

Year	Total vehicle stops per day	Additional VOC	Total waiting time (min per day)	Additional VOC (c/min)	Days per year	Annual Cost
2016	445.93	2.151	62.60	3	245	\$ 2,810.17
2017	464.86	2.151	65.37	3	245	\$ 2,930.29
2018	485.44	2.151	68.25	3	245	\$ 3,059.86
2019	508.31	2.151	71.27	3	245	\$ 3,202.60
2020	531.18	2.151	74.30	3	245	\$ 3,345.35
2021	554.05	2.151	77.32	3	245	\$ 3,488.09
2022	576.91	2.151	80.34	3	245	\$ 3,630.84
2023	599.78	2.151	83.37	3	245	\$ 3,773.58
2024	622.65	2.151	86.39	3	245	\$ 3,916.33
2025	645.52	2.151	89.42	3	245	\$ 4,059.07
2026	671.87	2.151	93.52	3	245	\$ 4,228.09
2027	702.05	2.151	98.81	3	245	\$ 4,426.02
2028	732.22	2.151	104.10	3	245	\$ 4,623.95
2029	762.40	2.151	109.40	3	245	\$ 4,821.88
2030	792.58	2.151	114.69	3	245	\$ 5,019.80
2031	822.76	2.151	119.98	3	245	\$ 5,217.73
2032	852.93	2.151	125.27	3	245	\$ 5,415.66
2033	883.11	2.151	130.56	3	245	\$ 5,613.59
2034	914.39	2.151	136.72	3	245	\$ 5,823.71
2035	946.62	2.151	143.62	3	245	\$ 6,044.23
2036	978.84	2.151	150.52	3	245	\$ 6,264.76
2037	1,011.06	2.151	157.42	3	245	\$ 6,485.29
2038	1,043.29	2.151	164.32	3	245	\$ 6,705.81
2039	1,075.51	2.151	171.22	3	245	\$ 6,926.34
2040	1,107.74	2.151	178.11	3	245	\$ 7,146.86

## Additional VOC due to Detours

### Assumptions

- 8.85 hours of closure per year
- Assumed average detour is 99.1km, 78.5 min (=76km/h)
- VOC cost Table A5.9, 75km/h, 2% grade

Year (1)	AADT (2)	% AADT affected (3)	Number of Veh Diverted (5) = (2)x(3)x(4)	Additional Journey Distance (6)	VOC Cost, cents per km (7)	Annual Cost
2016	2,900	36.88%	1069.41	99.1	33.3	\$ 35,290.91
2017	2,963	36.88%	1092.61	99.1	33.3	\$ 36,056.33
2018	3,026	36.88%	1115.84	99.1	33.3	\$ 36,822.97
2019	3,089	36.88%	1139.07	99.1	33.3	\$ 37,589.61
2020	3,152	36.88%	1162.30	99.1	33.3	\$ 38,356.25
2021	3,215	36.88%	1185.53	99.1	33.3	\$ 39,122.89
2022	3,278	36.88%	1208.76	99.1	33.3	\$ 39,889.53
2023	3,341	36.88%	1231.99	99.1	33.3	\$ 40,656.16
2024	3,404	36.88%	1255.23	99.1	33.3	\$ 41,422.80
2025	3,467	36.88%	1278.46	99.1	33.3	\$ 42,189.44
2026	3,530	36.88%	1301.69	99.1	33.3	\$ 42,956.08
2027	3,593	36.88%	1324.92	99.1	33.3	\$ 43,722.72
2028	3,656	36.88%	1348.15	99.1	33.3	\$ 44,489.35
2029	3,719	36.88%	1371.38	99.1	33.3	\$ 45,255.99
2030	3,782	36.88%	1394.61	99.1	33.3	\$ 46,022.63
2031	3,845	36.88%	1417.84	99.1	33.3	\$ 46,789.27
2032	3,908	36.88%	1441.08	99.1	33.3	\$ 47,555.91
2033	3,971	36.88%	1464.31	99.1	33.3	\$ 48,322.55
2034	4,034	36.88%	1487.54	99.1	33.3	\$ 49,089.18
2035	4,097	36.88%	1510.77	99.1	33.3	\$ 49,855.82
2036	4,160	36.88%	1534.00	99.1	33.3	\$ 50,622.46
2037	4,223	36.88%	1557.23	99.1	33.3	\$ 51,389.10
2038	4,286	36.88%	1580.46	99.1	33.3	\$ 52,155.74
2039	4,349	36.88%	1603.69	99.1	33.3	\$ 52,922.37
2040	4,412	36.88%	1626.93	99.1	33.3	\$ 53,689.01

## Worksheets A6: Accident cost savings



### Worksheet A6.1 - Summary of accident costs

1	Project name:	Kaeo Bridge Replacement				
2	Historic accident period:	from	2011	to	2015	
3	Summary of accidents					
	Movement category	Number of injury accidents			Number of non-injury accidents	
		Fatal	Serious	Minor		
	Head on	-	-	2	1	
	Lost control off road	-	-	-	4	
	Rear end, crossing	-	-	-	1	
		-	-	-	-	
		-	-	-	-	
		-	-	-	-	
		-	-	-	-	
		-	-	-	-	
	Total	0	0	2	6	
4	Description of likely causative factors: Single lane bridge; Narrow shoulders					
5	Description of project options & predicted accident savings New two-lane bridge Higher standard realignment 163-217m of route shortening (depending on Option)					
6	Terrain type	Rolling				
7	Traffic volume (time zero)	2,900				
8	Traffic growth rate (time zero)	3.0%				
9	Length of project (km)	DM	OPT 90	OPT 100A	OPT 100B	OPT 100C
		1.702	1.539	1.525	1.485	1.502
10	Exposure (time zero)	1802863.12	1630203.49	1615373.83	1573003.36	1591010.81
11	Injury accidents per year (time zero)	0.4	0.21649461	0.21526285	0.21174354	0.21323925
12	Accident rate (time zero per 100M VKT)	22.19	13.28	13.33	13.46	13.40
13	Typical accident rate (per 100M VKT)	23	15.68	15.68	15.68	15.68
14	Summary of annual accident costs					
	Movement category	DM	OPT 90	OPT 100A	OPT 100B	OPT 100C
	Bridge Crashes	\$ 257,201	\$ 46,221	\$ 46,221	\$ 46,221	\$ 46,221
	Alignment Crashes	\$ 123,673	\$ 79,212	\$ 78,492	\$ 76,433	\$ 77,308
	Detour Crashes from Closures	\$ 10,898	\$ -	\$ -	\$ -	\$ -
		\$ -	\$ -	\$ -	\$ -	\$ -
		\$ -	\$ -	\$ -	\$ -	\$ -
		\$ -	\$ -	\$ -	\$ -	\$ -
		\$ -	\$ -	\$ -	\$ -	\$ -
		\$ -	\$ -	\$ -	\$ -	\$ -
	Total	\$ 391,771	\$ 125,433	\$ 124,712	\$ 122,654	\$ 123,529

## Worksheets A6: Accident cost savings continued



## Worksheet A6.4 - Accident rate analysis

Option	Kaeo - New 2 Lane Bridge		
Posted speed limit	100km/h near rural	Traffic growth rate	2%
Road category	Rural Strategic	Time zero	Jul-15
Accident prediction model			
1 Table used			3.4
2 Parameter $b_0$			9.335676478
3 Parameter $b_1$			
4 Parameter $b_2$			
5 Lowest or side road AADT ( $Q_{minor}$ )			
6 Highest or primary AADT ( $Q_{major}$ )			2,900
7 Typical accident rate (accidents per year), $A_T$ (formula from crash compendium)			0.098889229
			Go to step 8
Exposure-based accident prediction equation			
1a Table used			
2a Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)			
3a Cross section adjustment factor from crash compendium table 5 (1.0 for no adjustment)			
4a Adjusted coefficient (2a) x (3a)			
5a Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)			
7 Typical accident rate (accidents per year), $A_T$ (4a) x (5a)			
8 Accident trends factor for adjusting typical accident rate (appendix A6.5 method B)			-0.02
9 Adjustment factor for accident trend ( $1 + (8) \times (\text{time zero year} - 2006)$ ) (appendix A6.5 B)			0.82
10 Typical accident rate per year adjusted for accident trends, $A_T$ (7) x (9)			0.081089168
11 Cost per reported injury accident (table A6.5)		\$	570,000
12 Total accident cost per year (10) x (11)		\$	46,220.83

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## Worksheets A6: Accident cost savings continued



## Worksheet A6.4 - Accident rate analysis

Option	Kaeo - Detour Route Crashes		
Posted speed limit	100km/h near rural	Traffic growth rate	2%
Road category	Rural Strategic	Time zero	Jul-15
Accident prediction model			
1 Table used			3.0
2 Parameter $b_0$			22
3 Parameter $b_1$			
4 Parameter $b_2$			
5 Lowest or side road AADT ( $Q_{minor}$ )			
6 Highest or primary AADT ( $Q_{major}$ )			1069.411875
7 Typical accident rate (accidents per year), $A_T$ (formula from crash compendium)			6.38776E-05
			Go to step 8
Exposure-based accident prediction equation			
1a Table used			
2a Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)			22
3a Cross section adjustment factor from crash compendium table 5 (1.0 for no adjustment)			1
4a Adjusted coefficient (2a) x (3a)			22
5a Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)			0.001059787
7 Typical accident rate (accidents per year), $A_T$ (4a) x (5a)			0.023315318
8 Accident trends factor for adjusting typical accident rate (appendix A6.5 method B)			-0.02
9 Adjustment factor for accident trend ( $1 + (8) \times (\text{time zero year} - 2006)$ ) (appendix A6.5 B)			0.82
10 Typical accident rate per year adjusted for accident trends, $A_T$ (7) x (9)			0.019118561
11 Cost per reported injury accident (table A6.5)		\$	570,000
12 Total accident cost per year (10) x (11)		\$	10,897.58

## Worksheets A6: Accident cost savings continued



## Worksheet A6.5 - Weighted accident procedure - do minimum

Option		Kaeo - Existing 1 Lane Bridge	
Posted speed limit	100km/h near rural	Traffic growth rate	2.2%
Road category	Rural Strategic	Time zero	Jul-15
<b>Site-specific accident rate</b>			
1	Number of years of accident records		5
2	Number of reported injury accidents over period	Crash IDs 201105186, 201203733	2
3	Number of accidents per year (2) / (1)		0.4
4	Trend adjustment factor (table A6.1(a))		1.06
5	Site specific accident rate (accidents per year), $A_s$ (3) x (4)		0.424
<b>Accident prediction model</b>			
6	Table used		3.3
7	Parameter $b_0$		95.11371494
8	Parameter $b_1$		
9	Parameter $b_2$		
10	Lowest or side road AADT ( $Q_{minor}$ )		
11	Highest or primary AADT ( $Q_{major}$ )		2,900
12	Typical accident rate (accidents per year), $A_{T,opt}$ (formula from crash compendium)		1.007502987
			Go to step 13
<b>Exposure-based accident prediction equation</b>			
6a	Table used		
7a	Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)		
8a	Cross section adjustment factor from table A6.13 (1.0 for no adjustment)		
9a	Adjusted coefficient (7a) x (8a)		
10a	Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)		
12	Typical accident rate (accidents per year), $A_{T,opt}$ (9a) x (10a)		
13	Accident trend factor for adjusting typical accident rate, $f_t$ (appendix A6.5 method B)		-0.02
14	Adjustment factor for accident trend $(1 + (13) \times (\text{time zero} - 2006))$ (app. A6.5 method B)		0.82
15	Typical accident rate per year adjusted for accident trends, $A_{T,dm}$ (12) x (14)*		0.82615245
	* For all mid-block analyses, the typical accident rate (15) must be divided by the mid-block length (in km)		
<b>Weighting factor</b>			
16	k value (from Crash Compendium)		0.3
17	Weighting factor, $w$ , (16) / [(16) + (15) x (1)]		0.06770844
18	Do-minimum weighted accident rate, $A_{w,dm}$ [(17) x (15)] + [1 - (17)] x (5)		0.451229115
19	Cost per reported injury accident (table A6.5)		\$ 570,000
20	Total accident cost per year (18) x (19)		\$ 257,200.60



## Worksheets A6: Accident cost savings continued



## Worksheet A6.5 - Weighted accident procedure - do minimum

Option	Kaeo - Existing Alignment		
Posted speed limit	100km/h near rural	Traffic growth rate	0.0%
Road category	Rural Strategic	Time zero	Jul-15
<b>Site-specific accident rate</b>			
1	Number of years of accident records		5
2	Number of reported injury accidents over period		0
3	Number of accidents per year (2) / (1)		0
4	Trend adjustment factor (table A6.1(a))		1.06
5	Site specific accident rate (accidents per year), $A_S$ (3) x (4)		0
<b>Accident prediction model</b>			
6	Table used		
7	Parameter $b_0$		
8	Parameter $b_1$		
9	Parameter $b_2$		
10	Lowest or side road AADT ( $Q_{minor}$ )		
11	Highest or primary AADT ( $Q_{major}$ )		2,900
12	Typical accident rate (accidents per year), $A_{T,opt}$ (formula from crash compendium)		
			Go to step 13
<b>Exposure-based accident prediction equation</b>			
6a	Table used		3.1
7a	Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)	Primary Collector, Curved	23
8a	Cross section adjustment factor from table 5 (1.0 for no adjustment)		0.96
9a	Adjusted coefficient (7a) x (8a)		22.08
10a	Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)		0.018028631
12	Typical accident rate (accidents per year), $A_{T,opt}$ (9a) x (10a)		0.398072176
13	Accident trend factor for adjusting typical accident rate, $f_t$ (appendix A6.5 method B)		-0.02
14	Adjustment factor for accident trend $(1 + (13) \times (\text{time zero} - 2006))$ (app. A6.5 method B)		0.82
15	Typical accident rate per year adjusted for accident trends, $A_{T,dm}$ (12) x (14)*		0.326419184
	* For all mid-block analyses, the typical accident rate (15) must be divided by the mid-block length (in km)		
<b>Weighting factor</b>			
16	k value (from Crash Compendium)		3
17	Weighting factor, $w$ , (16) / [(16) + (15) x (1)]		0.647654982
18	Do-minimum weighted accident rate, $A_{W,dm}$ [(17) x (15)] + [1 - (17)] x (5)		0.211407011
19	Cost per reported injury accident (table A6.5)		\$ 585,000
20	Total accident cost per year (18) x (19)		\$ 123,673.10

## Worksheets A6: Accident cost savings continued

**Worksheet A6.6 - Weighted accident procedure - option**

Option	OPT 90		
Posted speed limit	100km/h near rural	Traffic growth rate	3.0%
Road category	Rural Strategic	Time zero	Jul-15
<b>Accident prediction model</b>			
1	Table used		
2	Parameter $b_0$		
3	Parameter $b_1$		
4	Parameter $b_2$		
5	Lowest or side road AADT ( $Q_{\text{minor}}$ )		
6	Highest or primary AADT ( $Q_{\text{major}}$ )		2,900
7	Typical accident rate (accidents per year), $A_T$ (formula from crash compendium)		
			Go to step 8
<b>Exposure-based accident prediction equation</b>			
1a	Table used		3.1
2a	Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)	Primary Collector, Curved	23
3a	Cross section adjustment factor from table A6.13 (1.0 for no adjustment)		0.68
4a	Adjusted coefficient (2a) x (3a)		15.64
5a	Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)		0.016302035
7	Typical accident rate (accidents per year), $A_{T, \text{dm}}$ (4a) x (5a)		0.254963825
8	Accident trend factor for adjusting typical accident rate, $f_t$ (appendix A6.5 method B)		-0.02
9	Adjustment factor for accident trend $(1 + (8) \times (\text{time zero} - 2006))$ (app. A6.5 method B)		0.82
10	Typical accident rate per year adjusted for accident trends, $A_{T, \text{dm}}$ (7) x (9)*		0.209070337
	* For all mid-block analyses, the typical accident rate (10) must be divided by the mid-block length (in km)		
<b>Weighting factor</b>			
11	Do-minimum typical accident rate, $A_{T, \text{dm}}$ (from worksheet A6.5)		0.326419184
12	Do-minimum weighted accident rate, $A_{W, \text{dm}}$ (from worksheet A6.5)		0.211407011
13	Option weighted accident rate, $A_{W, \text{opt}}$ (10) x (12) / (11)		0.135405445
14	Cost per reported injury accident (table A6.5)	\$	585,000
15	Total accident cost per year (13) x (14)	\$	79,212.19

## Worksheets A6: Accident cost savings continued



## Worksheet A6.6 - Weighted accident procedure - option

Option	OPT 100A		
Posted speed limit	100km/h near rural	Traffic growth rate	3.0%
Road category	Rural Strategic	Time zero	Jul-15
Accident prediction model			
1	Table used		
2	Parameter $b_0$		
3	Parameter $b_1$		
4	Parameter $b_2$		
5	Lowest or side road AADT ( $Q_{\text{minor}}$ )		
6	Highest or primary AADT ( $Q_{\text{major}}$ )		2,900
7	Typical accident rate (accidents per year), $A_T$ (formula from crash compendium)		
			Go to step 8
Exposure-based accident prediction equation			
1a	Table used		3.1
2a	Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)	Primary Collector, Curved	23
3a	Cross section adjustment factor from table A6.13 (1.0 for no adjustment)		0.68
4a	Adjusted coefficient (2a) x (3a)		15.64
5a	Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)		0.016153738
7	Typical accident rate (accidents per year), $A_{T, \text{dm}}$ (4a) x (5a)		0.252644466
8	Accident trend factor for adjusting typical accident rate, $f_t$ (appendix A6.5 method B)		-0.02
9	Adjustment factor for accident trend $(1 + (8) \times (\text{time zero} - 2006))$ (app. A6.5 method B)		0.82
10	Typical accident rate per year adjusted for accident trends, $A_{T, \text{dm}}$ (7) x (9)*		0.207168462
	* For all mid-block analyses, the typical accident rate (10) must be divided by the mid-block length (in km)		
Weighting factor			
11	Do-minimum typical accident rate, $A_{T, \text{dm}}$ (from worksheet A6.5)		0.326419184
12	Do-minimum weighted accident rate, $A_{W, \text{dm}}$ (from worksheet A6.5)		0.211407011
13	Option weighted accident rate, $A_{W, \text{opt}}$ (10) x (12) / (11)		0.134173687
14	Cost per reported injury accident (table A6.5)	\$	585,000
15	Total accident cost per year (13) x (14)	\$	78,491.61

## Worksheets A6: Accident cost savings continued



## Worksheet A6.6 - Weighted accident procedure - option

Option	OPT 100B		
Posted speed limit	100km/h near rural	Traffic growth rate	3.0%
Road category	Rural Strategic	Time zero	Jul-15
Accident prediction model			
1 Table used			
2 Parameter $b_0$			
3 Parameter $b_1$			
4 Parameter $b_2$			
5 Lowest or side road AADT ( $Q_{\text{minor}}$ )			
6 Highest or primary AADT ( $Q_{\text{major}}$ )			2,900
7 Typical accident rate (accidents per year), $A_T$ (formula from crash compendium)			
			Go to step 8
Exposure-based accident prediction equation			
1a Table used			3.1
2a Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)	Primary Collector, Curved		23
3a Cross section adjustment factor from table A6.13 (1.0 for no adjustment)			0.68
4a Adjusted coefficient (2a) x (3a)			15.64
5a Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)			0.015730034
7 Typical accident rate (accidents per year), $A_{T, \text{dm}}$ (4a) x (5a)			0.246017726
8 Accident trend factor for adjusting typical accident rate, $f_t$ (appendix A6.5 method B)			-0.02
9 Adjustment factor for accident trend $(1 + (8) \times (\text{time zero} - 2006))$ (app. A6.5 method B)			0.82
10 Typical accident rate per year adjusted for accident trends, $A_{T, \text{dm}}$ (7) x (9)*			0.201734536
* For all mid-block analyses, the typical accident rate (10) must be divided by the mid-block length (in km)			
Weighting factor			
11 Do-minimum typical accident rate, $A_{T, \text{dm}}$ (from worksheet A6.5)			0.326419184
12 Do-minimum weighted accident rate, $A_{W, \text{dm}}$ (from worksheet A6.5)			0.211407011
13 Option weighted accident rate, $A_{W, \text{opt}}$ (10) x (12) / (11)			0.130654377
14 Cost per reported injury accident (table A6.5)		\$	585,000
15 Total accident cost per year (13) x (14)		\$	76,432.81

## Worksheets A6: Accident cost savings continued



## Worksheet A6.6 - Weighted accident procedure - option

Option	OPT 100C		
Posted speed limit	100km/h near rural	Traffic growth rate	3.0%
Road category	Rural Strategic	Time zero	Jul-15
Accident prediction model			
1	Table used		
2	Parameter $b_0$		
3	Parameter $b_1$		
4	Parameter $b_2$		
5	Lowest or side road AADT ( $Q_{\text{minor}}$ )		
6	Highest or primary AADT ( $Q_{\text{major}}$ )		2,900
7	Typical accident rate (accidents per year), $A_T$ (formula from crash compendium)		
			Go to step 8
Exposure-based accident prediction equation			
1a	Table used		3.1
2a	Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)	Primary Collector, Curved	23
3a	Cross section adjustment factor from table A6.13 (1.0 for no adjustment)		0.68
4a	Adjusted coefficient (2a) x (3a)		15.64
5a	Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)		0.015910108
7	Typical accident rate (accidents per year), $A_{T,dm}$ (4a) x (5a)		0.248834091
8	Accident trend factor for adjusting typical accident rate, $f_t$ (appendix A6.5 method B)		-0.02
9	Adjustment factor for accident trend $(1 + (8) \times (\text{time zero} - 2006))$ (app. A6.5 method B)		0.82
10	Typical accident rate per year adjusted for accident trends, $A_{T,dm}$ (7) x (9)*		0.204043954
	* For all mid-block analyses, the typical accident rate (10) must be divided by the mid-block length (in km)		
Weighting factor			
11	Do-minimum typical accident rate, $A_{T,dm}$ (from worksheet A6.5)		0.326419184
12	Do-minimum weighted accident rate, $A_{W,dm}$ (from worksheet A6.5)		0.211407011
13	Option weighted accident rate, $A_{W,opt}$ (10) x (12) / (11)		0.132150084
14	Cost per reported injury accident (table A6.5)	\$	585,000
15	Total accident cost per year (13) x (14)	\$	77,307.80

CRASH ROAD	CRASH DIST	CRASH DIRN	INTSN	SIDE ROAD	CRASH ID	CRASH DATE	CRASH DOW	CRASH TIME	MVMT	VEHICLES	CAUSES	OBJECTS STRUCK	ROAD CURVE	ROAD WET	LIGHT	WTHRa	JUNC TYPE	TRAF CTRL	ROAD MARK	SPD LIM	CRASH FAT CNT	CRASH SEV CNT	CRASH MIN CNT
10/33/11.799			I	WHANGAROA ROAD	201338050	22/08/2013	Thu	1342	DB	CN1	131A	B	E	W	OF	H	T	G	N	100	0	0	0
10/33/11.799			I	WHANGAROA ROAD	201139734	11/08/2011	Thu	800	FB	VN1T	112B		R	W	B	M	T	G	C	100	0	0	0
WHANGAROA ROAD			I	10/33/11.799	201105186	23/10/2011	Sun	2020	BB	CN1C	124A 830A 832		E	D	DN	F	T	G	C	100	0	0	4
10/33/11.836			A	KAEO RIV BR	201335689	27/06/2013	Thu	1630	BA	CW1C	301A 375A		R	W	TF	F		G	N	100	0	0	0
10/33/11.836			A	KAEO RIV BR	201203733	10/05/2012	Thu	1811	BA	CN14	112A 301A 801		R	W	TN	L		G	N	100	0	0	1
10/33/11.999	200	W		WHANGAROA ROAD	201241373	24/11/2012	Sat	1725	CB	OE1	136A 631A	F	R	D	ON	F		N	C	100	0	0	0
10/33/12.136	300	W		KAEO RIV BR	201338030	2/09/2013	Mon	1540	CC	CN1	410A 501A	V	R	D	ON	F		N	C	100	0	0	0
10/33/12.209	410	W		WHANGAROA ROAD	201242371	23/12/2012	Sun	1331	CB	VW1	135A 903		R	D	ON	FS		N	C	100	0	0	0

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## Network Resilience: Detour Calculations

Assumptions:-

- 19 March 2012 Closed from 9:20am to 7:00am due to flooding (21.667 hours)
- 27 June 2013 Closed 11:40am for 1 hour
- 10 July 2014 Closed from 22:00pm to 7:25am due to flooding (9.417 hours)
- 30 Aug 2014 Closed from 10:34am to 21:44pm due to flooding (11.167 hours)
- 17 Jan 2015 re-opened at 20:15pm (assumed 1 hour)
- Total closure time in last 5 years = 44.25 hours => 8.85 hours per annum (36.88% of 1 day)
- Assumed Average Detour = 99.1km, 78.5 mins

Year (1)	AADT (2)	% AADT affected (3)	P (Diversion) (4)	Number of Veh Diverted (5) = (2)x(3)x(4)	Additional Journey Time (6)
2016	2,900	36.88%	1.0000	1069.4119	78.5
2017	2,963	36.88%	1.0000	1092.6063	78.5
2018	3,026	36.88%	1.0000	1115.8375	78.5
2019	3,089	36.88%	1.0000	1139.0688	78.5
2020	3,152	36.88%	1.0000	1162.3000	78.5
2021	3,215	36.88%	1.0000	1185.5313	78.5
2022	3,278	36.88%	1.0000	1208.7625	78.5
2023	3,341	36.88%	1.0000	1231.9938	78.5
2024	3,404	36.88%	1.0000	1255.2250	78.5
2025	3,467	36.88%	1.0000	1278.4563	78.5
2026	3,530	36.88%	1.0000	1301.6875	78.5
2027	3,593	36.88%	1.0000	1324.9188	78.5
2028	3,656	36.88%	1.0000	1348.1500	78.5
2029	3,719	36.88%	1.0000	1371.3813	78.5
2030	3,782	36.88%	1.0000	1394.6125	78.5
2031	3,845	36.88%	1.0000	1417.8438	78.5
2032	3,908	36.88%	1.0000	1441.0750	78.5
2033	3,971	36.88%	1.0000	1464.3063	78.5
2034	4,034	36.88%	1.0000	1487.5375	78.5
2035	4,097	36.88%	1.0000	1510.7688	78.5
2036	4,160	36.88%	1.0000	1534.0000	78.5
2037	4,223	36.88%	1.0000	1557.2313	78.5
2038	4,286	36.88%	1.0000	1580.4625	78.5
2039	4,349	36.88%	1.0000	1603.6938	78.5
2040	4,412	36.88%	1.0000	1626.9250	78.5

## Network Resilience: HPMV Waiting Time

HPMV Waiting Time on SH1 if no HPMV route available

- Last 10 years = 15 closures (RS 104-198)
- Total Closure time = 148.99 Hours
- Average Closure time per year = 14.899 hours
- SH1 RP 119/11.46 AADT = 1085 with 14%HCV
- 150 HCV per year, assumed 50 HPMV (local advice) with 3% growth rate
- EEM TTC Costs, used \$20.1 for driver, \$28.1 for HCV2 = \$48.2

Delay p.a. 14.899 hours

0.620791667 Days

% AADT 100.00%

HPMV (T<sub>0</sub>) 50

Volume (T<sub>0</sub>) 50

Growth 0.03

Delay p.a. 14.899 hours

0.620791667 Days

% AADT 62.08%

## Network Resilience : Layer 2 Benefits

Figures from Network Resilience Business Case (Opus,2013)

- Layer 1 = Traditional EEM Benefits
- Layer 2 = Extended Benefits from wider economy effects
- Layer 2 Benefits were from 48 Hour Closure
- Layer 2 benefits peer reviewed by ASCARI Partners
- Recognising that link severances have wider economy effects, propose to use results from 2013 study

Layer 1 Benefits 63000000

Layer 2 Benefits 15800000

% 25.08% For 48 hour closures

Adjustment 4.62% For 8.85 Hour Closure

TTC Detour Benefits \$ 828,122.28

VOC Detour Benefits \$ 572,433.25

ACC Detour Benefits \$ 150,113.43

Layer 2 Benefits \$ 71,703.06



## Kaeo Alignment Maintenance Costs

### Historical 1997-2016 Costs

RS 33 Length (km)		2.048
Total Costs	\$	131,379.72
Years		18.2724162
Annual Cost	\$	7,190.06
Annual Cost per km	\$	3,510.77

#### Option Lengths (km)

DM		1.702
OPT 90		1.539
OPT 100A		1.525
OPT 100B		1.485
OPT 100C		1.502

#### Option Costs

DM	\$	5,975.33
OPT 90	\$	5,403.08
OPT 100A	\$	5,353.92
OPT 100B	\$	5,213.49
OPT 100C	\$	5,273.18

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## Kaeo Bridge Replacement

### Background Info for Cycling Benefits

2013 Census Meshblock: 500402 Mangapa-Matauri Bay

Dwellings	1014
Population	2688
Persons per dwellin	2.650887574

# of Dwellings from Google Earth

Location	0-400m	400-800m	0.8-1.6km
W of Bridge	6	3	0
S of Bridge	0	1	5
N of Bridge	12	0	3
Subtotals	18	4	8
Est. Population	47.71597633	10.6035503	21.20710059

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## Worksheet A20.1: Cycle Demand Worksheet



## New and existing cyclists

Buffers (km)	<0.4	0.4 to <0.8	0.8 to 1.6	
1 Area (km <sup>2</sup> )				
2 Density per square kilometre				
3 Population in each buffer (3) = (1) x (2)	48	11	22	
4 Total population in all buffers [sum of(3)]		81		
5 Commute share (single value for all)		0.7		%
6 Likelihood of new cyclist multiplier	1.04	0.54	0.21	
7 Row (7) = (3) x (6)	49.92	5.94	4.62	
8 Sum of row (7)		60.48		
9 Cyclist rate (9) = [(5) x 0.96] + 0.32%		0.992		%
10 Total existing daily cyclists (10) = (4) x (9)		0.80352		
11 Total new daily cyclists (11) = (8) x (9)		0.5999616		

Composite Benefit for existing cyclist	\$1.45	Section A20.4
Composite Benefit for new cyclist	\$4.35	Section A20.4
Daily benefit for existing cyclist	\$1.17	
Daily benefit for new cyclist	\$2.61	
Subtotal Daily Cycling Benefits	\$3.04	
Annual Cycling Benefits	\$1,110.63	

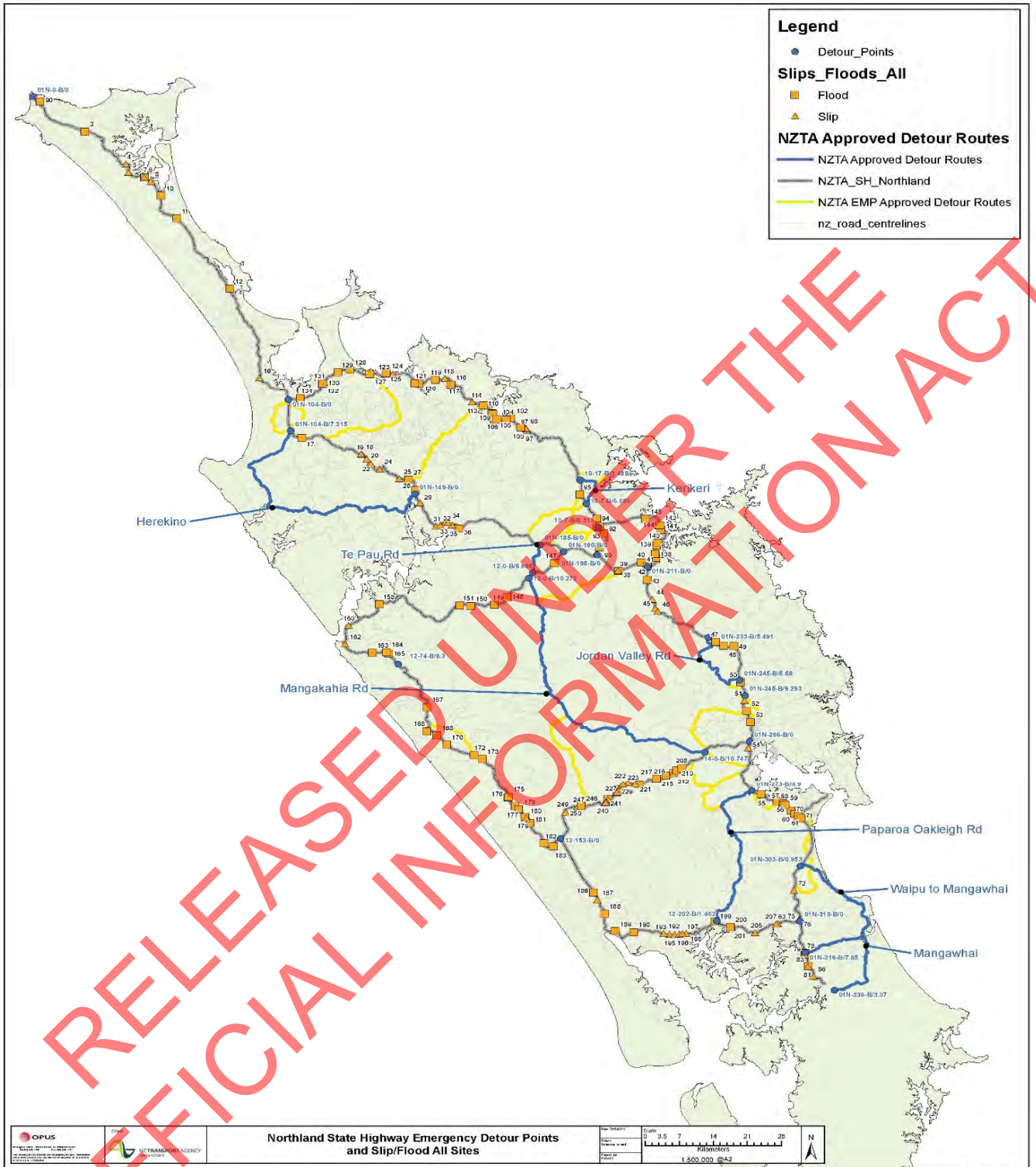
## Matakohe, Replacement of One Lane Bridges Economic Summary

NPV Benefits	NPV \$	Comment
Travel Time Costs - Delays at Bridge	\$ 543,630	Methodology as per "Delays and Conflicts at One Lane Bridges, (Saunders, 1988)
Travel Time Costs - Detours for Closures	\$ 117,639	Detours as per Fig.13 NZTA Approved Detours
Travel Time Costs - New Alignment	\$ 8,707,643	As per EEM
Vehicle Operating Costs - Delays at Bridge	\$ 26,087	Methodology as per "Delays and Conflicts at One Lane Bridges, (Saunders, 1988)
Vehicle Operating Costs - Detours for Closures	\$ 82,173	Detours as per Fig.13 NZTA Approved Detours
Vehicle Operating Costs - New Alignment	\$ 3,402,080	As per EEM
Crash Costs 1-Lane vs 2-Lane	\$ 6,449,152	As per EEM
Crash Costs - Detours for Closures	\$ 38,291	Additional Traffic on network
Crash Costs - New Alignment	\$ 5,218,224	As per EEM
Emissions	\$ 175,517	5% of VOC as per EEM A9.6
Network Resilience	\$ 5,126,570	HPMV Waiting time during SH1 Closures
Wider Economic Benefits of reduced closures	\$ 3,804	Used Results from 2013 Network resilience case
<b>Total Benefits</b>	<b>\$ 29,890,809</b>	
<b>NPV Costs</b>		
Do-Min - New Bridges in Year 20	\$ 2,769,392	Assumed 20 year life in existing bridge
Do-Min - Additional Maintenance Costs	\$ 28,204	
Subtotal: NPV Do-Min Costs	\$ 2,797,596	
Option - New Bridges in Year 0	\$ 11,899,403	
Option - New Alignment	\$ 13,419,647	
Subtotal: NPV Option Costs	\$ 25,319,050	
<b>Net Costs</b>	<b>\$ 22,521,454</b>	
<b>Indicative BCR</b>	<b>1.33</b>	

Matakohe Bridges + Realignment - Site Location, SH12 RP 185/10.87 to 14.31



# NZTA Approved Detours



Matakohe Bridges - SH1 HPMV closures							
#	State Highway	Start Location	End Location	Impact	Description	Event Comments	Event Duration (hh.mm)
70	1N	01N-0261/02.43-D	01N-0261/02.43-D	Road Closed	Crash	Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible.	3.05
30	1N	01N-0261/02.43-I	01N-0261/02.43-I	Road Closed	Crash	Crash On St Hwy 1 In Whangarei At Intersection With Manse Street. Southbound Lane Is Closed At Manse Street Intersection. Diversions In Place On Northbound Lane On St Hwy 1 Which Is Open To Two-way Traffic.	4.04
61	1N	01N-0261/03.89	01N-0261/03.89	Road Closed	Crash	Due To An Incident This Section Of The State Highway Is Closed.	5.53
65	1N	01N-0261/04.25	01N-0261/04.25	Road Closed	Other	Utilities Disruption	0.12
97	1N	01N-0266/00.18	01N-0266/00.18	Road Closed	Other	Otaika Road (sh1) Is Closed Between Maunu Road And Tarewa Road Due To A Gas Leak.	0.2
35	1N	01N-0266/00.34	01N-0266/00.34	Road Closed	Flooding	State Highway01 At The Otaika Road Intersection With Matipo Place In Whangarei Flooding	13.45
71	1N	01N-0266/00.88	01N-0266/00.88	Road Closed	Crash	Police Advise Of A Motor Vehicle Accident In The Area Near Raumanga Valley Road. Caution Is Advised, Take Extra Care, Expect Some Delays.	3.24
104	1N	01N-0266/02.09	01N-0266/02.09	Road Closed	Crash	Road Has Been Reopened	1.23
106	1N	01N-0266/02.29	01N-0266/02.29	Road Closed	Crash	Due To A Serious Incident In This Area The Road Is Closed Southbound. Emergency Services Are On Site. Please Delay Your Journey Or Use An Alternative Route.	1.11
46	1N	01N-0266/03.53	01N-0266/03.53	Road Closed	Crash	Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible.	0.18
64	1N	01N-0266/05.20	01N-0266/05.20	Road Closed	Crash	Due To A Crash Sh1 Is Closed At Otaika In Both Directions. Avoid This Area Or Delay Your Trip	1.26
95	1N	01N-0266/05.73	01N-0266/05.73	Road Closed	Crash	Road Is Now Open.	2.38
66	1N	01N-0266/06.37	01N-0266/06.37	Road Closed	Crash	Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible.	5.04
60	1N	01N-0266/06.47	01N-0266/06.47	Road Closed	Crash	Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible.	0.49
109	1N	01N-0273/03.68	01N-0273/03.68	Road Closed	Crash	Due To A Serious Incident In This Area The Road Is Closed. Emergency Services Are On Site. Please Delay Your Journey Or Use An Alternative Route.	3.15
2	1N	01N-0273/04.57	01N-0273/04.57	Road Closed	Crash	Sh1 Fatal Vehicle Accident Diversions In Place	1.56
117	1N	01N-0273/07.94	01N-0273/09.06	Vehicle Restrictions	Road Works	Call Came Through From Police Asking If The 50km/h Speed Restriction Signs Can Be Removed, As The Roadworks Has Been Completed And Road Has Been Swept. Cones Have Been Pushed To The Side Of The Road.	0.33
103	1N	01N-0292/01.24	01N-0292/01.24	Road Closed	Crash	Due To A Serious Crash This Section Of Highway Is Closed. Expect Delays Or Avoid The Area If Possible.	2.36
73	1N	01N-0292/01.96	01N-0292/01.96	Road Closed	Crash	Due To An Incident, This Section Of The Highway Is Closed. Avoid This Area Or Delay Your Trip If Possible.	6.02
10	1N	01N-0292/10.10	01N-0292/10.10	Road Closed	Crash	Vehicle Accident.	3.44
98	1N	01N-0303/00.00	01N-0303/00.00	Road Closed	Crash	Incident Cleared	3.39
12	1N	01N-0303/00.20	01N-0303/00.20	Road Closed	Crash	Fatal Car Accident - Diversions Needed. Northern Diversion : Waipu Gorge Road. Southern Diversion: Sh12. Needed Asap.	0.37
5	1N	01N-0303/00.29	01N-0303/15.63	Road Closed	Other	Emergency Maintenance Work On Tuesday 21st October From 6.30am To 7.30pm.	13
51	1N	01N-0303/10.13	01N-0303/10.13	Road Closed	Crash	Due To An Incident This Section Of The State Highway Is Closed. Long Delays Are Expected Avoid The Area Or Delay Your Trip If Possible.	3.39
88	1N	01N-0303/12.82	01N-0303/12.82	Road Closed	Resurfacing	Due To Road Surface Improvement Works, On The Southern Side Of The Brynderwyns, Allow An Extra 30-45min Driving Time For The Detours During Overnight Closures. Sh1 Will Be Closed From 6.45pm - 5am Each Night From April 6 To The Morning Of April 10	250.15
89	1N	01N-0303/12.82	01N-0303/12.82	Road Closed	Resurfacing	Sh1, At The Brynderwyn Hills, Will Close Overnight For Surface Improvement Road Works. The Road Will Be Closed Between 6:45pm Tonight And 5am Tomorrow. A Signposted Detour Will Be In Place. For More Info Plus Maps, Visit <a href="http://www.highwayinfo.govt.nz">www.highwayinfo.govt.nz</a>	10.15

Matakohe Bridges - SH1 HPMV closures							
#	State Highway	Start Location	End Location	Impact	Description	Event Comments	Event Duration (hh.mm)
63	1N	01N-0303/12.94	01N-0303/12.94	Road Closed	Crash	Due To A Crash This Portion Of Sh1 Is Closed. Expect Delays. Avoid This Area Or Delay Trip If Possible	5.28
115	1N	01N-0303/13.46	01N-0303/13.46	Road Closed	Maintenance	Due To Road Works In This Area This Section Of Highway Will Be Closed. A Detour Will Be In Place. Follow Instructions From Traffic Management On Scene. Allow An Extra 30 To 45 Minutes To Your Journey.	11
84	1N	01N-0303/14.88	01N-0303/14.88	Road Closed	Crash	Due To An Incident On The Southern Side Of The Brynderwyns The Road Is Now Closed. Expect Delays. Avoid This Area Or Delay Trip If Possible.	3.37
94	1N	01N-0303/15.03	01N-0303/15.03	Road Closed	Crash	The Road Is Now Open.	5.11
17	1N	01N-0303/15.05	01N-0303/15.05	Road Closed	Pavement Repairs	Night Time Closures For A 3 Week Period. Week 1 Road Will Be Closed From Monday To Thursday. Last 2 Weeks Road Will Be Closed From Tuesday To Thursday. Closures Start 9th Nov At 8pm	10
91	1N	01N-0303/15.08	01N-0303/15.08	Road Closed	Crash	Road Now Fully Open.	4.5
26	1N	01N-0303/15.09	01N-0303/15.09	Road Closed	Resurfacing	Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am.	10
86	1N	01N-0303/15.15	01N-0303/15.15	Road Closed	Crash	A Two Vehicle Crash Involving Serious Injury Has Required The Highway To Be Closed.	1.08
24	1N	01N-0303/15.16	01N-0303/15.16	Road Closed	Resurfacing	Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 24th To Thursday 26th And Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am.	10
16	1N	01N-0303/15.24	01N-0303/15.24	Road Closed	Pavement Repairs	Night Time Closures For A 3 Week Period. Tuesday To Thursday Starting 9th November.	10
25	1N	01N-0303/15.24	01N-0303/15.24	Road Closed	Resurfacing	Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 24th To Thursday 26th And Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am.	10
23	1N	01N-0303/15.29	01N-0303/15.29	Road Closed	Resurfacing	Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 24th To Thursday 26th And Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am.	10
27	1N	01N-0303/15.33	01N-0303/15.33	Road Closed	Resurfacing	Night Time Closures. Road Will Be Closed From Tuesday 1st To Thursday 3rd From 8pm And Reopening At 6am.	10
21	1N	01N-0303/15.38	01N-0303/15.38	Road Closed	Resurfacing	Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 17th To Thursday 19th And Tuesday 24th To Thursday 26th From 8pm And Reopening At 6am.	10
20	1N	01N-0303/15.40	01N-0303/15.40	Road Closed	Resurfacing	Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 17th To Thursday 19th And Tuesday 24th To Thursday 26th From 8pm And Reopening At 6am.	10
19	1N	01N-0303/15.42	01N-0303/15.42	Road Closed	Resurfacing	Night Time Closures For A 3 Week Period. Week 1 Road Will Be Closed From Monday To Thursday. Last 2 Weeks Road Will Be Closed From Tuesday To Thursday. Closures Start 9th Nov At 8pm And Reopening At 6am.	10
39	1N	01N-0303/15.70	01N-0303/15.70	Road Closed	Slip	Landslip On Southbound Lane. North Of Wellsford. Hole In The Road, Was Coned Off But Cones Have Been Moved By Members Of The Public.	21.04
22	1N	01N-0303/15.79	01N-0303/15.79	Road Closed	Pavement Repairs	Night Time Closures For A 3 Week Period During November. Road Will Be Closed From Tuesday 17th To Thursday 19th And Tuesday 24th To Thursday 26th From 8pm And Reopening At 6am.	10



Worksheet A1 - Discounting

YEAR	TIME	Growth	2.4%	DM TTC (Delays)				DM TTC (Detours)				DM TTC (HPMV Detours)			
		SPPWF	AADT	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL
2016	0	1	1923	\$ 20,596.23	\$ 20,596.23	1.44	\$ 29,658.57	\$5,685.03	\$ 5,685.03	1.44	\$ 8,186.44	\$ 238,421.35	\$ 238,421.35	1.44	\$ 343,326.75
2017	1	0.943396226	1969	\$ 21,671.89	\$ 20,445.18	1.44	\$ 29,441.06	\$5,821.02	\$ 5,491.53	1.44	\$ 7,907.80	\$ 245,573.99	\$ 231,673.58	1.44	\$ 333,609.95
2018	2	0.88999644	2015	\$ 22,857.69	\$ 20,343.26	1.44	\$ 29,294.30	\$5,957.01	\$ 5,301.72	1.44	\$ 7,634.48	\$ 252,726.63	\$ 224,925.80	1.44	\$ 323,893.16
2019	3	0.839619283	2061	\$ 24,271.09	\$ 20,378.48	1.44	\$ 29,345.01	\$6,093.00	\$ 5,115.80	1.44	\$ 7,366.76	\$ 259,879.27	\$ 218,199.65	1.44	\$ 314,207.50
2020	4	0.792093663	2107	\$ 25,684.50	\$ 20,344.53	1.44	\$ 29,296.12	\$6,228.99	\$ 4,933.95	1.44	\$ 7,104.88	\$ 267,031.92	\$ 211,514.29	1.44	\$ 304,580.57
2021	5	0.747258173	2153	\$ 27,097.90	\$ 20,249.13	1.44	\$ 29,158.75	\$6,364.99	\$ 4,756.29	1.44	\$ 6,849.05	\$ 274,184.56	\$ 204,886.65	1.44	\$ 295,036.78
2022	6	0.70496054	2199	\$ 28,511.31	\$ 20,099.35	1.44	\$ 28,943.06	\$6,500.98	\$ 4,582.93	1.44	\$ 6,599.42	\$ 281,337.20	\$ 198,331.62	1.44	\$ 285,597.54
2023	7	0.665057114	2245	\$ 29,924.71	\$ 19,901.64	1.44	\$ 28,658.37	\$6,636.97	\$ 4,413.96	1.44	\$ 6,356.11	\$ 288,489.84	\$ 191,862.22	1.44	\$ 276,281.59
2024	8	0.627412371	2291	\$ 31,338.12	\$ 19,661.92	1.44	\$ 28,313.17	\$6,772.96	\$ 4,249.44	1.44	\$ 6,119.19	\$ 295,642.48	\$ 185,489.75	1.44	\$ 267,105.24
2025	9	0.591898464	2337	\$ 32,751.52	\$ 19,385.58	1.44	\$ 27,915.23	\$6,908.95	\$ 4,089.40	1.44	\$ 5,888.73	\$ 302,795.12	\$ 179,223.97	1.44	\$ 258,082.51
2026	10	0.558394777	2383	\$ 34,164.93	\$ 19,077.52	1.44	\$ 27,471.62	\$7,044.94	\$ 3,933.86	1.44	\$ 5,664.76	\$ 309,947.76	\$ 173,073.21	1.44	\$ 249,225.42
2027	11	0.526787525	2429	\$ 35,578.33	\$ 18,742.22	1.44	\$ 26,988.80	\$7,180.93	\$ 3,782.83	1.44	\$ 5,447.27	\$ 317,100.40	\$ 167,044.53	1.44	\$ 240,544.13
2028	12	0.496969364	2475	\$ 36,991.74	\$ 18,383.76	1.44	\$ 26,472.61	\$7,316.93	\$ 3,636.29	1.44	\$ 5,236.25	\$ 324,253.04	\$ 161,143.83	1.44	\$ 232,047.11
2029	13	0.468839022	2521	\$ 38,533.41	\$ 18,065.97	1.44	\$ 26,014.99	\$7,452.92	\$ 3,494.22	1.44	\$ 5,031.67	\$ 331,405.68	\$ 155,375.92	1.44	\$ 223,741.32
2030	14	0.442300964	2567	\$ 40,227.79	\$ 17,792.79	1.44	\$ 25,621.62	\$7,588.91	\$ 3,356.58	1.44	\$ 4,833.48	\$ 338,558.32	\$ 149,744.67	1.44	\$ 215,632.33
2031	15	0.417265061	2613	\$ 41,922.18	\$ 17,492.66	1.44	\$ 25,189.43	\$7,724.90	\$ 3,223.33	1.44	\$ 4,641.60	\$ 345,710.96	\$ 144,253.11	1.44	\$ 207,724.47
2032	16	0.393646284	2659	\$ 43,616.56	\$ 17,169.50	1.44	\$ 24,724.08	\$7,860.89	\$ 3,094.41	1.44	\$ 4,455.95	\$ 352,863.60	\$ 138,903.45	1.44	\$ 200,020.96
2033	17	0.371364419	2705	\$ 45,310.94	\$ 16,826.87	1.44	\$ 24,230.70	\$7,996.88	\$ 2,969.76	1.44	\$ 4,276.45	\$ 360,016.24	\$ 133,697.22	1.44	\$ 192,524.00
2034	18	0.350343791	2751	\$ 47,005.33	\$ 16,468.02	1.44	\$ 23,713.95	\$8,132.87	\$ 2,849.30	1.44	\$ 4,102.99	\$ 367,168.88	\$ 128,635.34	1.44	\$ 185,234.89
2035	19	0.33051301	2797	\$ 48,699.71	\$ 16,095.89	1.44	\$ 23,178.08	\$8,268.86	\$ 2,732.97	1.44	\$ 3,935.47	\$ 374,321.52	\$ 123,718.13	1.44	\$ 178,154.11
2036	20	0.311804727	2843	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2037	21	0.294155403	2889	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2038	22	0.277505097	2935	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2039	23	0.261797261	2981	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2040	24	0.246978548	3027	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2041	25	0.232998631	3073	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2042	26	0.219810029	3119	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2043	27	0.207367952	3165	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2044	28	0.195630143	3211	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2045	29	0.184556739	3257	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2046	30	0.174110131	3303	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2047	31	0.16425484	3349	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2048	32	0.154957397	3395	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2049	33	0.146186223	3441	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2050	34	0.137911531	3487	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2051	35	0.130105218	3533	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2052	36	0.122740772	3579	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2053	37	0.115793181	3625	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2054	38	0.10923885	3671	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -
2055	39	0.103055519	3717	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -	\$ -	\$ -	1.44	\$ -

\$ 543,629.52

\$ 117,638.76

\$ 5,126,570.33



Worksheet A1 - Discounting

YEAR	TIME	Growth SPPWF	2.4% AADT	DM VOC (Detours)				DM VOC (Alignment)				OPT VOC (Alignment)			
				COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL
2016	0	1	1923	\$ 5,718.41	\$ 5,718.41	1	\$ 5,718.41	\$ 582,481.16	\$ 582,481.16	1	\$ 582,481.16	\$ 417,969.06	\$ 417,969.06	1	\$ 417,969.06
2017	1	0.943396226	1969	\$ 5,855.20	\$ 5,523.77	1	\$ 5,523.77	\$ 596,460.71	\$ 562,698.78	1	\$ 562,698.78	\$ 428,000.32	\$ 403,773.89	1	\$ 403,773.89
2018	2	0.88999644	2015	\$ 5,991.99	\$ 5,332.85	1	\$ 5,332.85	\$ 610,440.26	\$ 543,289.66	1	\$ 543,289.66	\$ 438,031.58	\$ 389,846.55	1	\$ 389,846.55
2019	3	0.839619283	2061	\$ 6,128.78	\$ 5,145.84	1	\$ 5,145.84	\$ 624,419.80	\$ 524,274.91	1	\$ 524,274.91	\$ 448,062.84	\$ 376,202.20	1	\$ 376,202.20
2020	4	0.792093663	2107	\$ 6,265.56	\$ 4,962.91	1	\$ 4,962.91	\$ 638,399.35	\$ 505,672.08	1	\$ 505,672.08	\$ 458,094.09	\$ 362,853.43	1	\$ 362,853.43
2021	5	0.747258173	2153	\$ 6,402.35	\$ 4,784.21	1	\$ 4,784.21	\$ 652,378.90	\$ 487,495.47	1	\$ 487,495.47	\$ 468,125.35	\$ 349,810.50	1	\$ 349,810.50
2022	6	0.70496054	2199	\$ 6,539.14	\$ 4,609.84	1	\$ 4,609.84	\$ 666,358.45	\$ 469,756.41	1	\$ 469,756.41	\$ 478,156.61	\$ 337,081.54	1	\$ 337,081.54
2023	7	0.665057114	2245	\$ 6,675.93	\$ 4,439.88	1	\$ 4,439.88	\$ 680,338.00	\$ 452,463.62	1	\$ 452,463.62	\$ 488,187.87	\$ 324,672.81	1	\$ 324,672.81
2024	8	0.627412371	2291	\$ 6,812.72	\$ 4,274.39	1	\$ 4,274.39	\$ 694,317.54	\$ 435,623.42	1	\$ 435,623.42	\$ 498,219.12	\$ 312,588.84	1	\$ 312,588.84
2025	9	0.591898464	2337	\$ 6,949.51	\$ 4,113.41	1	\$ 4,113.41	\$ 708,297.09	\$ 419,239.96	1	\$ 419,239.96	\$ 508,250.38	\$ 300,832.62	1	\$ 300,832.62
2026	10	0.558394777	2383	\$ 7,086.30	\$ 3,956.95	1	\$ 3,956.95	\$ 722,276.64	\$ 403,315.50	1	\$ 403,315.50	\$ 518,281.64	\$ 289,405.76	1	\$ 289,405.76
2027	11	0.526787525	2429	\$ 7,223.09	\$ 3,805.04	1	\$ 3,805.04	\$ 736,256.19	\$ 387,850.58	1	\$ 387,850.58	\$ 528,312.90	\$ 278,308.64	1	\$ 278,308.64
2028	12	0.496969364	2475	\$ 7,359.88	\$ 3,657.64	1	\$ 3,657.64	\$ 750,235.74	\$ 372,844.18	1	\$ 372,844.18	\$ 538,344.15	\$ 267,540.55	1	\$ 267,540.55
2029	13	0.468839022	2521	\$ 7,496.67	\$ 3,514.73	1	\$ 3,514.73	\$ 764,215.28	\$ 358,293.95	1	\$ 358,293.95	\$ 548,375.41	\$ 257,099.79	1	\$ 257,099.79
2030	14	0.442300964	2567	\$ 7,633.46	\$ 3,376.29	1	\$ 3,376.29	\$ 778,194.83	\$ 344,196.32	1	\$ 344,196.32	\$ 558,406.67	\$ 246,983.81	1	\$ 246,983.81
2031	15	0.417265061	2613	\$ 7,770.25	\$ 3,242.25	1	\$ 3,242.25	\$ 792,174.38	\$ 330,546.69	1	\$ 330,546.69	\$ 568,437.93	\$ 237,189.29	1	\$ 237,189.29
2032	16	0.393646284	2659	\$ 7,907.04	\$ 3,112.58	1	\$ 3,112.58	\$ 806,153.93	\$ 317,339.50	1	\$ 317,339.50	\$ 578,469.18	\$ 227,712.24	1	\$ 227,712.24
2033	17	0.371364419	2705	\$ 8,043.83	\$ 2,987.19	1	\$ 2,987.19	\$ 820,133.48	\$ 304,568.39	1	\$ 304,568.39	\$ 588,500.44	\$ 218,548.12	1	\$ 218,548.12
2034	18	0.350343791	2751	\$ 8,180.62	\$ 2,866.03	1	\$ 2,866.03	\$ 834,113.02	\$ 292,226.32	1	\$ 292,226.32	\$ 598,531.70	\$ 209,691.86	1	\$ 209,691.86
2035	19	0.33051301	2797	\$ 8,317.41	\$ 2,749.01	1	\$ 2,749.01	\$ 848,092.57	\$ 280,305.63	1	\$ 280,305.63	\$ 608,562.96	\$ 201,137.98	1	\$ 201,137.98
2036	20	0.311804727	2843	\$ -	\$ -	1	\$ -	\$ 862,072.12	\$ 268,798.16	1	\$ 268,798.16	\$ 618,594.22	\$ 192,880.60	1	\$ 192,880.60
2037	21	0.294155403	2889	\$ -	\$ -	1	\$ -	\$ 876,051.67	\$ 257,695.33	1	\$ 257,695.33	\$ 628,625.47	\$ 184,913.58	1	\$ 184,913.58
2038	22	0.277505097	2935	\$ -	\$ -	1	\$ -	\$ 890,031.21	\$ 246,988.20	1	\$ 246,988.20	\$ 638,656.73	\$ 177,230.50	1	\$ 177,230.50
2039	23	0.261797261	2981	\$ -	\$ -	1	\$ -	\$ 904,010.76	\$ 236,667.54	1	\$ 236,667.54	\$ 648,687.99	\$ 169,824.74	1	\$ 169,824.74
2040	24	0.246978548	3027	\$ -	\$ -	1	\$ -	\$ 917,990.31	\$ 226,723.91	1	\$ 226,723.91	\$ 658,719.25	\$ 162,689.52	1	\$ 162,689.52
2041	25	0.232998631	3073	\$ -	\$ -	1	\$ -	\$ 931,969.86	\$ 217,147.70	1	\$ 217,147.70	\$ 668,750.50	\$ 155,817.95	1	\$ 155,817.95
2042	26	0.219810029	3119	\$ -	\$ -	1	\$ -	\$ 945,949.41	\$ 207,929.17	1	\$ 207,929.17	\$ 678,781.76	\$ 149,203.04	1	\$ 149,203.04
2043	27	0.207367952	3165	\$ -	\$ -	1	\$ -	\$ 959,928.95	\$ 199,058.50	1	\$ 199,058.50	\$ 688,813.02	\$ 142,837.74	1	\$ 142,837.74
2044	28	0.195630143	3211	\$ -	\$ -	1	\$ -	\$ 973,908.50	\$ 190,525.86	1	\$ 190,525.86	\$ 698,844.28	\$ 136,715.01	1	\$ 136,715.01
2045	29	0.184556739	3257	\$ -	\$ -	1	\$ -	\$ 987,888.05	\$ 182,321.40	1	\$ 182,321.40	\$ 708,875.53	\$ 130,827.76	1	\$ 130,827.76
2046	30	0.174110131	3303	\$ -	\$ -	1	\$ -	\$ 1,001,867.60	\$ 174,435.30	1	\$ 174,435.30	\$ 718,906.79	\$ 125,168.96	1	\$ 125,168.96
2047	31	0.16425484	3349	\$ -	\$ -	1	\$ -	\$ 1,015,847.15	\$ 166,857.81	1	\$ 166,857.81	\$ 728,938.05	\$ 119,731.60	1	\$ 119,731.60
2048	32	0.154957397	3395	\$ -	\$ -	1	\$ -	\$ 1,029,826.69	\$ 159,579.26	1	\$ 159,579.26	\$ 738,969.31	\$ 114,508.76	1	\$ 114,508.76
2049	33	0.146186223	3441	\$ -	\$ -	1	\$ -	\$ 1,043,806.24	\$ 152,590.09	1	\$ 152,590.09	\$ 749,000.56	\$ 109,493.56	1	\$ 109,493.56
2050	34	0.137911531	3487	\$ -	\$ -	1	\$ -	\$ 1,057,785.79	\$ 145,880.86	1	\$ 145,880.86	\$ 759,031.82	\$ 104,679.24	1	\$ 104,679.24
2051	35	0.130105218	3533	\$ -	\$ -	1	\$ -	\$ 1,071,765.34	\$ 139,442.26	1	\$ 139,442.26	\$ 769,063.08	\$ 100,059.12	1	\$ 100,059.12
2052	36	0.122740772	3579	\$ -	\$ -	1	\$ -	\$ 1,085,744.88	\$ 133,265.17	1	\$ 133,265.17	\$ 779,094.34	\$ 95,626.64	1	\$ 95,626.64
2053	37	0.115793181	3625	\$ -	\$ -	1	\$ -	\$ 1,099,724.43	\$ 127,340.59	1	\$ 127,340.59	\$ 789,125.59	\$ 91,375.36	1	\$ 91,375.36
2054	38	0.10923885	3671	\$ -	\$ -	1	\$ -	\$ 1,113,703.98	\$ 121,659.74	1	\$ 121,659.74	\$ 799,156.85	\$ 87,298.98	1	\$ 87,298.98
2055	39	0.103055519	3717	\$ -	\$ -	1	\$ -	\$ 1,127,683.53	\$ 116,214.01	1	\$ 116,214.01	\$ 809,188.11	\$ 83,391.30	1	\$ 83,391.30
				\$ 82,173.21				\$ 12,045,603.4				\$ 8,643,523.45			



Worksheet A1 - Discounting

YEAR	TIME	Growth	2.4%	DM CO2				OPT CO2				DM ACC (Bridges)		
		SPPWF	AADT	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST	PV COST	UPDATE FACTOR	SUBTOTAL	COST (Andersons)	Cost (Hardies)	PV COST
2016	0	1	1923	\$ 29,484.75	\$ 29,484.75	1	\$ 29,484.75	\$ 20,898.45	\$ 20,898.45	1	\$ 20,898.45	\$ 245,467.70	\$ 30,429.88	\$ 275,897.58
2017	1	0.943396226	1969	\$ 30,193.97	\$ 28,484.88	1	\$ 28,484.88	\$ 21,400.02	\$ 20,188.69	1	\$ 20,188.69	\$ 246,449.57	\$ 30,551.60	\$ 261,321.86
2018	2	0.88999644	2015	\$ 30,903.51	\$ 27,504.01	1	\$ 27,504.01	\$ 21,901.58	\$ 19,492.33	1	\$ 19,492.33	\$ 247,431.45	\$ 30,673.32	\$ 247,512.25
2019	3	0.839619283	2061	\$ 31,613.70	\$ 26,543.47	1	\$ 26,543.47	\$ 22,403.14	\$ 18,810.11	1	\$ 18,810.11	\$ 248,413.32	\$ 30,795.04	\$ 234,428.72
2020	4	0.792093663	2107	\$ 32,323.89	\$ 25,603.55	1	\$ 25,603.55	\$ 22,904.70	\$ 18,142.67	1	\$ 18,142.67	\$ 249,395.19	\$ 30,916.76	\$ 222,033.32
2021	5	0.747258173	2153	\$ 33,034.09	\$ 24,684.99	1	\$ 24,684.99	\$ 23,406.27	\$ 17,490.52	1	\$ 17,490.52	\$ 250,377.06	\$ 31,038.48	\$ 210,290.06
2022	6	0.70496054	2199	\$ 33,744.28	\$ 23,788.38	1	\$ 23,788.38	\$ 23,907.83	\$ 16,854.08	1	\$ 16,854.08	\$ 251,358.93	\$ 31,160.20	\$ 199,164.84
2023	7	0.665057114	2245	\$ 34,454.47	\$ 22,914.19	1	\$ 22,914.19	\$ 24,409.39	\$ 16,233.64	1	\$ 16,233.64	\$ 252,340.80	\$ 31,281.92	\$ 188,625.31
2024	8	0.627412371	2291	\$ 35,164.66	\$ 22,062.74	1	\$ 22,062.74	\$ 24,910.96	\$ 15,629.44	1	\$ 15,629.44	\$ 253,322.67	\$ 31,403.64	\$ 178,640.81
2025	9	0.591898464	2337	\$ 35,874.85	\$ 21,234.27	1	\$ 21,234.27	\$ 25,412.52	\$ 15,041.63	1	\$ 15,041.63	\$ 254,304.54	\$ 31,525.36	\$ 169,182.28
2026	10	0.558394777	2383	\$ 36,585.05	\$ 20,428.90	1	\$ 20,428.90	\$ 25,914.08	\$ 14,470.29	1	\$ 14,470.29	\$ 255,286.41	\$ 31,647.08	\$ 160,222.16
2027	11	0.526787525	2429	\$ 37,295.24	\$ 19,646.67	1	\$ 19,646.67	\$ 26,415.64	\$ 13,915.43	1	\$ 13,915.43	\$ 256,268.28	\$ 31,768.80	\$ 151,734.34
2028	12	0.496969364	2475	\$ 38,005.43	\$ 18,887.53	1	\$ 18,887.53	\$ 26,917.21	\$ 13,377.03	1	\$ 13,377.03	\$ 257,250.15	\$ 31,890.51	\$ 143,694.05
2029	13	0.468839022	2521	\$ 38,716.04	\$ 18,151.59	1	\$ 18,151.59	\$ 27,418.77	\$ 12,854.99	1	\$ 12,854.99	\$ 258,232.02	\$ 32,012.23	\$ 136,077.83
2030	14	0.442300964	2567	\$ 39,427.15	\$ 17,438.67	1	\$ 17,438.67	\$ 27,920.33	\$ 12,349.19	1	\$ 12,349.19	\$ 259,213.90	\$ 32,133.95	\$ 128,863.43
2031	15	0.417265061	2613	\$ 40,138.27	\$ 16,748.30	1	\$ 16,748.30	\$ 28,421.90	\$ 11,859.46	1	\$ 11,859.46	\$ 260,195.77	\$ 32,255.67	\$ 122,029.77
2032	16	0.393646284	2659	\$ 40,849.38	\$ 16,080.21	1	\$ 16,080.21	\$ 28,923.46	\$ 11,385.61	1	\$ 11,385.61	\$ 261,177.64	\$ 32,377.39	\$ 115,556.85
2033	17	0.371364419	2705	\$ 41,560.49	\$ 15,434.09	1	\$ 15,434.09	\$ 29,425.02	\$ 10,927.41	1	\$ 10,927.41	\$ 262,159.51	\$ 32,499.11	\$ 109,425.73
2034	18	0.350343791	2751	\$ 42,271.60	\$ 14,809.59	1	\$ 14,809.59	\$ 29,926.58	\$ 10,484.59	1	\$ 10,484.59	\$ 263,141.38	\$ 32,620.83	\$ 103,618.45
2035	19	0.33051301	2797	\$ 42,982.71	\$ 14,206.35	1	\$ 14,206.35	\$ 30,428.15	\$ 10,056.90	1	\$ 10,056.90	\$ 264,123.25	\$ 32,742.55	\$ 98,118.01
2036	20	0.311804727	2843	\$ 43,103.61	\$ 13,439.91	1	\$ 13,439.91	\$ 30,929.71	\$ 9,644.03	1	\$ 9,644.03	\$ 37,705.76	\$ 37,705.76	\$ 23,513.67
2037	21	0.294155403	2889	\$ 43,802.58	\$ 12,884.77	1	\$ 12,884.77	\$ 31,431.27	\$ 9,245.68	1	\$ 9,245.68	\$ 37,845.41	\$ 37,845.41	\$ 22,264.86
2038	22	0.277505097	2935	\$ 44,501.56	\$ 12,349.41	1	\$ 12,349.41	\$ 31,932.84	\$ 8,861.52	1	\$ 8,861.52	\$ 37,985.06	\$ 37,985.06	\$ 21,082.09
2039	23	0.261797261	2981	\$ 45,200.54	\$ 11,833.38	1	\$ 11,833.38	\$ 32,434.40	\$ 8,491.24	1	\$ 8,491.24	\$ 38,124.71	\$ 38,124.71	\$ 19,961.89
2040	24	0.246978548	3027	\$ 45,899.52	\$ 11,336.20	1	\$ 11,336.20	\$ 32,935.96	\$ 8,134.48	1	\$ 8,134.48	\$ 38,264.36	\$ 38,264.36	\$ 18,900.95
2041	25	0.232998631	3073	\$ 46,598.49	\$ 10,857.39	1	\$ 10,857.39	\$ 33,437.53	\$ 7,790.90	1	\$ 7,790.90	\$ 38,404.01	\$ 38,404.01	\$ 17,896.16
2042	26	0.219810029	3119	\$ 47,297.47	\$ 10,396.46	1	\$ 10,396.46	\$ 33,939.09	\$ 7,460.15	1	\$ 7,460.15	\$ 38,543.66	\$ 38,543.66	\$ 16,944.57
2043	27	0.207367952	3165	\$ 47,996.45	\$ 9,952.93	1	\$ 9,952.93	\$ 34,440.65	\$ 7,141.89	1	\$ 7,141.89	\$ 38,683.31	\$ 38,683.31	\$ 16,043.36
2044	28	0.195630143	3211	\$ 48,695.43	\$ 9,526.29	1	\$ 9,526.29	\$ 34,942.21	\$ 6,835.75	1	\$ 6,835.75	\$ 38,822.96	\$ 38,822.96	\$ 15,189.88
2045	29	0.184556739	3257	\$ 49,394.40	\$ 9,116.07	1	\$ 9,116.07	\$ 35,443.78	\$ 6,541.39	1	\$ 6,541.39	\$ 38,962.61	\$ 38,962.61	\$ 14,381.63
2046	30	0.174110131	3303	\$ 50,093.38	\$ 8,721.76	1	\$ 8,721.76	\$ 35,945.34	\$ 6,258.45	1	\$ 6,258.45	\$ 39,102.27	\$ 39,102.27	\$ 13,616.20
2047	31	0.16425484	3349	\$ 50,792.36	\$ 8,342.89	1	\$ 8,342.89	\$ 36,446.90	\$ 5,986.58	1	\$ 5,986.58	\$ 39,241.92	\$ 39,241.92	\$ 12,891.35
2048	32	0.154957397	3395	\$ 51,491.33	\$ 7,978.96	1	\$ 7,978.96	\$ 36,948.47	\$ 5,725.44	1	\$ 5,725.44	\$ 39,381.57	\$ 39,381.57	\$ 12,204.93
2049	33	0.146186223	3441	\$ 52,190.31	\$ 7,629.50	1	\$ 7,629.50	\$ 37,450.03	\$ 5,474.68	1	\$ 5,474.68	\$ 39,521.22	\$ 39,521.22	\$ 11,554.92
2050	34	0.137911531	3487	\$ 52,889.29	\$ 7,294.04	1	\$ 7,294.04	\$ 37,951.59	\$ 5,233.96	1	\$ 5,233.96	\$ 39,660.87	\$ 39,660.87	\$ 10,939.38
2051	35	0.130105218	3533	\$ 53,588.27	\$ 6,972.11	1	\$ 6,972.11	\$ 38,453.15	\$ 5,002.96	1	\$ 5,002.96	\$ 39,800.52	\$ 39,800.52	\$ 10,356.51
2052	36	0.122740772	3579	\$ 54,287.24	\$ 6,663.26	1	\$ 6,663.26	\$ 38,954.72	\$ 4,781.33	1	\$ 4,781.33	\$ 39,940.17	\$ 39,940.17	\$ 9,804.57
2053	37	0.115793181	3625	\$ 54,986.22	\$ 6,367.03	1	\$ 6,367.03	\$ 39,456.28	\$ 4,568.77	1	\$ 4,568.77	\$ 40,079.82	\$ 40,079.82	\$ 9,281.94
2054	38	0.10923885	3671	\$ 55,685.20	\$ 6,082.99	1	\$ 6,082.99	\$ 39,957.84	\$ 4,364.95	1	\$ 4,364.95	\$ 40,219.47	\$ 40,219.47	\$ 8,787.06
2055	39	0.103055519	3717	\$ 56,384.18	\$ 5,810.70	1	\$ 5,810.70	\$ 40,459.41	\$ 4,169.57	1	\$ 4,169.57	\$ 40,359.12	\$ 40,359.12	\$ 8,318.46

\$ 607,693.19

\$ 432,176.17

\$ 3,750,372.03

NOT USED



**Worksheet A1 - Discounting**

YEAR	TIME	Growth	2.4%	OPT ACC (Method A)		OPT ACC (Detours)		OPT ACC (Alignment)		OPT ACC (Method A)		DM BRIDGE CONSTRUCTION	
		SPPWF	AADT	COST	PV COST	COST	PV COST	COST	PV COST	COST	PV COST	COST	PV COST
2016	0	1	1923	\$ 135,026.02	\$ 135,026.02	\$ -	\$ -	\$ 98,982.68	\$ 98,982.68	\$ 320,120.89	\$ 320,120.89	\$ -	\$ -
2017	1	0.943396226	1969	\$ 135,566.13	\$ 127,892.57	\$ -	\$ -	\$ 99,378.61	\$ 93,753.40	\$ 321,401.38	\$ 303,208.84	\$ -	\$ -
2018	2	0.88999644	2015	\$ 136,106.23	\$ 121,134.06	\$ -	\$ -	\$ 99,774.54	\$ 88,798.98	\$ 322,681.86	\$ 287,185.71	\$ -	\$ -
2019	3	0.839619283	2061	\$ 136,646.34	\$ 114,730.90	\$ -	\$ -	\$ 100,170.47	\$ 84,105.06	\$ 323,962.34	\$ 272,005.03	\$ -	\$ -
2020	4	0.792093663	2107	\$ 137,186.44	\$ 108,664.51	\$ -	\$ -	\$ 100,566.40	\$ 79,658.01	\$ 325,242.83	\$ 257,622.78	\$ -	\$ -
2021	5	0.747258173	2153	\$ 137,726.54	\$ 102,917.29	\$ -	\$ -	\$ 100,962.33	\$ 75,444.93	\$ 326,523.31	\$ 243,997.21	\$ -	\$ -
2022	6	0.70496054	2199	\$ 138,266.65	\$ 97,472.53	\$ -	\$ -	\$ 101,358.26	\$ 71,453.58	\$ 327,803.79	\$ 231,088.74	\$ -	\$ -
2023	7	0.665057114	2245	\$ 138,806.75	\$ 92,314.42	\$ -	\$ -	\$ 101,754.19	\$ 67,672.35	\$ 329,084.28	\$ 218,859.84	\$ -	\$ -
2024	8	0.627412371	2291	\$ 139,346.86	\$ 87,427.94	\$ -	\$ -	\$ 102,150.12	\$ 64,090.25	\$ 330,364.76	\$ 207,274.94	\$ -	\$ -
2025	9	0.591898464	2337	\$ 139,886.96	\$ 82,798.88	\$ -	\$ -	\$ 102,546.05	\$ 60,696.85	\$ 331,645.24	\$ 196,300.31	\$ -	\$ -
2026	10	0.558394777	2383	\$ 140,427.06	\$ 78,413.74	\$ -	\$ -	\$ 102,941.98	\$ 57,482.27	\$ 332,925.73	\$ 185,903.99	\$ -	\$ -
2027	11	0.526787525	2429	\$ 140,967.17	\$ 74,259.75	\$ -	\$ -	\$ 103,337.92	\$ 54,437.12	\$ 334,206.21	\$ 176,055.66	\$ -	\$ -
2028	12	0.496969364	2475	\$ 141,507.27	\$ 70,324.78	\$ -	\$ -	\$ 103,733.85	\$ 51,552.54	\$ 335,486.69	\$ 166,726.61	\$ -	\$ -
2029	13	0.468839022	2521	\$ 142,047.38	\$ 66,597.35	\$ -	\$ -	\$ 104,129.78	\$ 48,820.10	\$ 336,767.18	\$ 157,889.59	\$ -	\$ -
2030	14	0.442300964	2567	\$ 142,587.48	\$ 63,066.58	\$ -	\$ -	\$ 104,525.71	\$ 46,231.82	\$ 338,047.66	\$ 149,518.81	\$ -	\$ -
2031	15	0.417265061	2613	\$ 143,127.59	\$ 59,722.14	\$ -	\$ -	\$ 104,921.64	\$ 43,780.13	\$ 339,328.15	\$ 141,589.78	\$ -	\$ -
2032	16	0.393646284	2659	\$ 143,667.69	\$ 56,554.25	\$ -	\$ -	\$ 105,317.57	\$ 41,457.87	\$ 340,608.63	\$ 134,079.32	\$ -	\$ -
2033	17	0.371364419	2705	\$ 144,207.79	\$ 53,553.64	\$ -	\$ -	\$ 105,713.50	\$ 39,258.23	\$ 341,889.11	\$ 126,965.45	\$ -	\$ -
2034	18	0.350343791	2751	\$ 144,747.90	\$ 50,711.53	\$ -	\$ -	\$ 106,109.43	\$ 37,174.78	\$ 343,169.60	\$ 120,227.34	\$ -	\$ -
2035	19	0.33051301	2797	\$ 145,288.00	\$ 48,019.57	\$ -	\$ -	\$ 106,505.36	\$ 35,201.41	\$ 344,450.08	\$ 113,845.23	\$ -	\$ -
2036	20	0.311804727	2843	\$ 145,828.11	\$ 45,469.89	\$ -	\$ -	\$ 106,901.29	\$ 33,332.33	\$ 345,730.56	\$ 107,800.42	\$ 13,227,500.00	\$ 4,124,397.02
2037	21	0.294155403	2889	\$ 146,368.21	\$ 43,055.00	\$ -	\$ -	\$ 107,297.22	\$ 31,562.06	\$ 347,011.05	\$ 102,075.17	\$ -	\$ -
2038	22	0.277505097	2935	\$ 146,908.31	\$ 40,767.81	\$ -	\$ -	\$ 107,693.15	\$ 29,885.40	\$ 348,291.53	\$ 96,652.67	\$ -	\$ -
2039	23	0.261797261	2981	\$ 147,448.42	\$ 38,601.59	\$ -	\$ -	\$ 108,089.08	\$ 28,297.43	\$ 349,572.01	\$ 91,517.00	\$ -	\$ -
2040	24	0.246978548	3027	\$ 147,988.52	\$ 36,549.99	\$ -	\$ -	\$ 108,485.01	\$ 26,793.47	\$ 350,852.50	\$ 86,653.04	\$ -	\$ -
2041	25	0.232998631	3073	\$ 148,528.63	\$ 34,606.97	\$ -	\$ -	\$ 108,880.95	\$ 25,369.11	\$ 352,132.98	\$ 82,046.50	\$ -	\$ -
2042	26	0.219810029	3119	\$ 149,068.73	\$ 32,766.80	\$ -	\$ -	\$ 109,276.88	\$ 24,020.15	\$ 353,413.46	\$ 77,683.82	\$ -	\$ -
2043	27	0.207367952	3165	\$ 149,608.83	\$ 31,024.08	\$ -	\$ -	\$ 109,672.81	\$ 22,742.63	\$ 354,693.95	\$ 73,552.16	\$ -	\$ -
2044	28	0.195630143	3211	\$ 150,148.94	\$ 29,373.66	\$ -	\$ -	\$ 110,068.74	\$ 21,532.76	\$ 355,974.43	\$ 69,639.33	\$ -	\$ -
2045	29	0.184556739	3257	\$ 150,689.04	\$ 27,810.68	\$ -	\$ -	\$ 110,464.67	\$ 20,387.00	\$ 357,254.92	\$ 65,933.80	\$ -	\$ -
2046	30	0.174110131	3303	\$ 151,229.15	\$ 26,330.53	\$ -	\$ -	\$ 110,860.60	\$ 19,301.95	\$ 358,535.40	\$ 62,424.65	\$ -	\$ -
2047	31	0.16425484	3349	\$ 151,769.25	\$ 24,928.83	\$ -	\$ -	\$ 111,256.53	\$ 18,274.42	\$ 359,815.88	\$ 59,101.50	\$ -	\$ -
2048	32	0.154957397	3395	\$ 152,309.36	\$ 23,601.46	\$ -	\$ -	\$ 111,652.46	\$ 17,301.37	\$ 361,096.37	\$ 55,954.55	\$ -	\$ -
2049	33	0.146186223	3441	\$ 152,849.46	\$ 22,344.49	\$ -	\$ -	\$ 112,048.39	\$ 16,379.93	\$ 362,376.85	\$ 52,974.50	\$ -	\$ -
2050	34	0.137911531	3487	\$ 153,389.56	\$ 21,154.19	\$ -	\$ -	\$ 112,444.32	\$ 15,507.37	\$ 363,657.33	\$ 50,152.54	\$ -	\$ -
2051	35	0.130105218	3533	\$ 153,929.67	\$ 20,027.05	\$ -	\$ -	\$ 112,840.25	\$ 14,681.11	\$ 364,937.82	\$ 47,480.31	\$ -	\$ -
2052	36	0.122740772	3579	\$ 154,469.77	\$ 18,959.74	\$ -	\$ -	\$ 113,236.18	\$ 13,898.70	\$ 366,218.30	\$ 44,949.92	\$ -	\$ -
2053	37	0.115793181	3625	\$ 155,009.88	\$ 17,949.09	\$ -	\$ -	\$ 113,632.11	\$ 13,157.82	\$ 367,498.78	\$ 42,553.85	\$ -	\$ -
2054	38	0.10923885	3671	\$ 155,549.98	\$ 16,992.10	\$ -	\$ -	\$ 114,028.04	\$ 12,456.29	\$ 368,779.27	\$ 40,285.02	\$ -	\$ -
2055	39	0.103055519	3717	\$ 156,090.08	\$ 16,085.94	\$ -	\$ -	\$ 114,423.98	\$ 11,792.02	\$ 370,059.75	\$ 38,136.70	-\$ 13,148,299.73	-\$ 1,355,004.85

\$ 2,260,002.35

\$ -

\$ 1,656,725.70

NOT USED

\$ 5,358,033.55

\$ 2,769,392.17

Worksheet A1 - Discounting									
YEAR	TIME	Growth	2.4%	DM Maintenance Costs		OPT BRIDGE CONSTRUCTION		OPT Alignment Costs	
		SPPWF	AADT	COST	PV COST	COST	PV COST	COST	PV COST
2016	0	1	1923	\$ 2,243.75	\$ 2,243.75	\$ 13,227,500.00	\$ 13,227,500.00	\$ 13,419,647.00	\$ 13,419,647.00
2017	1	0.943396226	1969	\$ 2,243.75	\$ 2,116.75	\$ -	\$ -	\$ -	\$ -
2018	2	0.88999644	2015	\$ 2,243.75	\$ 1,996.93	\$ -	\$ -	\$ -	\$ -
2019	3	0.839619283	2061	\$ 2,243.75	\$ 1,883.90	\$ -	\$ -	\$ -	\$ -
2020	4	0.792093663	2107	\$ 2,243.75	\$ 1,777.26	\$ -	\$ -	\$ -	\$ -
2021	5	0.747258173	2153	\$ 2,243.75	\$ 1,676.66	\$ -	\$ -	\$ -	\$ -
2022	6	0.70496054	2199	\$ 2,243.75	\$ 1,581.76	\$ -	\$ -	\$ -	\$ -
2023	7	0.665057114	2245	\$ 2,243.75	\$ 1,492.22	\$ -	\$ -	\$ -	\$ -
2024	8	0.627412371	2291	\$ 2,243.75	\$ 1,407.76	\$ -	\$ -	\$ -	\$ -
2025	9	0.591898464	2337	\$ 2,243.75	\$ 1,328.07	\$ -	\$ -	\$ -	\$ -
2026	10	0.558394777	2383	\$ 2,243.75	\$ 1,252.90	\$ -	\$ -	\$ -	\$ -
2027	11	0.526787525	2429	\$ 2,243.75	\$ 1,181.98	\$ -	\$ -	\$ -	\$ -
2028	12	0.496969364	2475	\$ 2,243.75	\$ 1,115.08	\$ -	\$ -	\$ -	\$ -
2029	13	0.468839022	2521	\$ 2,243.75	\$ 1,051.96	\$ -	\$ -	\$ -	\$ -
2030	14	0.442300964	2567	\$ 2,243.75	\$ 992.41	\$ -	\$ -	\$ -	\$ -
2031	15	0.417265061	2613	\$ 2,243.75	\$ 936.24	\$ -	\$ -	\$ -	\$ -
2032	16	0.393646284	2659	\$ 2,243.75	\$ 883.24	\$ -	\$ -	\$ -	\$ -
2033	17	0.371364419	2705	\$ 2,243.75	\$ 833.25	\$ -	\$ -	\$ -	\$ -
2034	18	0.350343791	2751	\$ 2,243.75	\$ 786.08	\$ -	\$ -	\$ -	\$ -
2035	19	0.33051301	2797	\$ 2,243.75	\$ 741.59	\$ -	\$ -	\$ -	\$ -
2036	20	0.311804727	2843	\$ 243.75	\$ 76.00	\$ -	\$ -	\$ -	\$ -
2037	21	0.294155403	2889	\$ 243.75	\$ 71.70	\$ -	\$ -	\$ -	\$ -
2038	22	0.277505097	2935	\$ 243.75	\$ 67.64	\$ -	\$ -	\$ -	\$ -
2039	23	0.261797261	2981	\$ 243.75	\$ 63.81	\$ -	\$ -	\$ -	\$ -
2040	24	0.246978548	3027	\$ 243.75	\$ 60.20	\$ -	\$ -	\$ -	\$ -
2041	25	0.232998631	3073	\$ 243.75	\$ 56.79	\$ -	\$ -	\$ -	\$ -
2042	26	0.219810029	3119	\$ 243.75	\$ 53.58	\$ -	\$ -	\$ -	\$ -
2043	27	0.207367952	3165	\$ 243.75	\$ 50.55	\$ -	\$ -	\$ -	\$ -
2044	28	0.195630143	3211	\$ 243.75	\$ 47.68	\$ -	\$ -	\$ -	\$ -
2045	29	0.184556739	3257	\$ 243.75	\$ 44.99	\$ -	\$ -	\$ -	\$ -
2046	30	0.174110131	3303	\$ 243.75	\$ 42.44	\$ -	\$ -	\$ -	\$ -
2047	31	0.16425484	3349	\$ 243.75	\$ 40.04	\$ -	\$ -	\$ -	\$ -
2048	32	0.154957397	3395	\$ 243.75	\$ 37.77	\$ -	\$ -	\$ -	\$ -
2049	33	0.146186223	3441	\$ 243.75	\$ 35.63	\$ -	\$ -	\$ -	\$ -
2050	34	0.137911531	3487	\$ 243.75	\$ 33.62	\$ -	\$ -	\$ -	\$ -
2051	35	0.130105218	3533	\$ 243.75	\$ 31.71	\$ -	\$ -	\$ -	\$ -
2052	36	0.122740772	3579	\$ 243.75	\$ 29.92	\$ -	\$ -	\$ -	\$ -
2053	37	0.115793181	3625	\$ 243.75	\$ 28.22	\$ -	\$ -	\$ -	\$ -
2054	38	0.10923885	3671	\$ 243.75	\$ 26.63	\$ -	\$ -	\$ -	\$ -
2055	39	0.103055519	3717	\$ 243.75	\$ 25.12	-\$ 12,887,195.72	-\$ 1,328,096.64	\$ -	\$ -
				\$ 28,203.82		\$ 11,899,403.36		\$ 13,419,647.00	

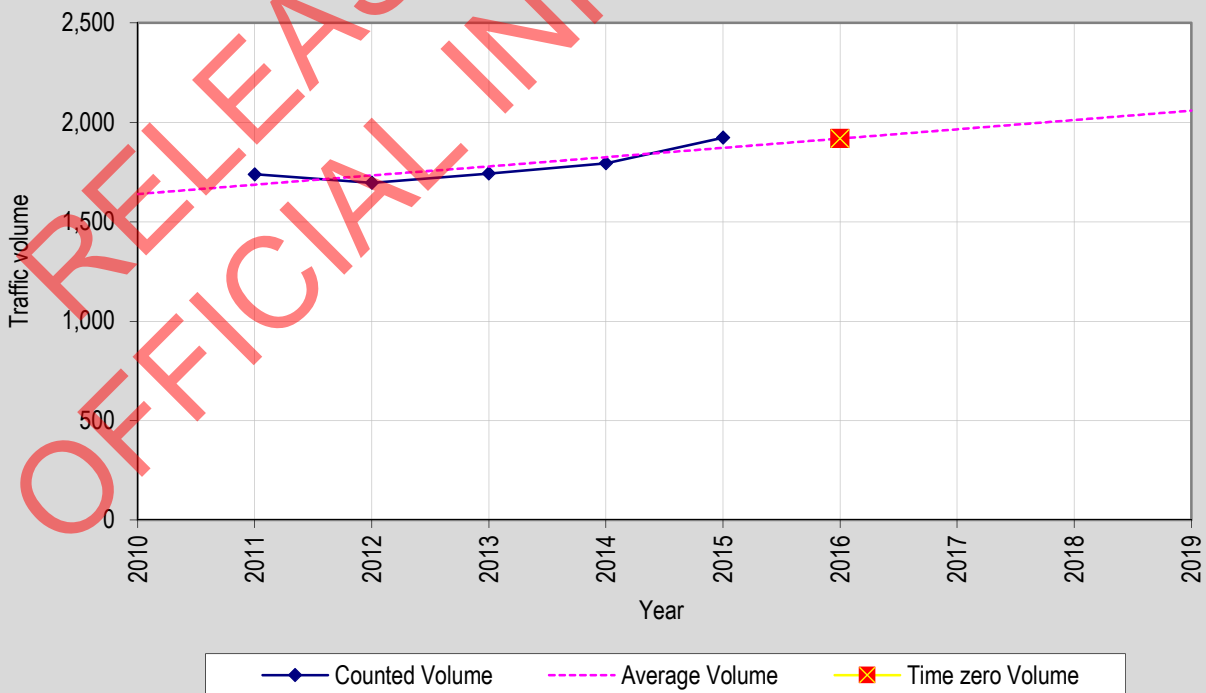
OFFICIAL INFORMATION ACT

## Worksheets A2: Traffic Data

### Worksheet A2.4 - Time zero traffic volume and growth rates

1	Activity option	Count Station 01200198
2	Road/section/movement	SH12 RS 185 RP 14.2: About 1.5km east of Ararua Rd, 1km west of Petley Rd.
3	Time period	2011-2015 Traffic Count Data

Year (4)	AADT or average volume (5)	Regression output		
2010		6	Constant	-92026.8
2011	1739	7	X coefficient	46.6
2012	1696	8	R squared	0.706290249
2013	1743	9	Time zero	2016
2014	1794	10	Time zero traffic volume	1,919
2015	1923	11	Growth rate at time zero	2.4%





Delays & Conflicts at One Lane Bridges						Andersons			Hardies				
Andersons (25m) & Hardies (65m) Bridges						Year	AADT	Delay (mins per day)	Wait (mins per day)	Total Stops	Delay (mins per day)	Wait (mins per day)	Total Stops
Table 3: Total Delay in minutes per day						2016	1923	45.919	4.961	65.303	120.9895	22.152	180.6595
Interpolated figures for 25m & 65m Bridges						2017	1969	48.357	5.283	68.109	127.2685	23.256	188.7785
AADT	1500	2000	2500	3000	3500	2018	2015	51.035	5.62	71.155	134.2	24.525	197.61
20m	18	39	65	93	123	2019	2061	54.209	5.988	74.697	142.48	26.135	207.914
30m	29	61	104	153	220	2020	2107	57.383	6.356	78.239	150.76	27.745	218.218
60m	59	123	208	313	440	2021	2153	60.557	6.724	81.781	159.04	29.355	228.522
80m	76	157	262	390	542	2022	2199	63.731	7.092	85.323	167.32	30.965	238.826
25m	23.5	50	84.5	123	171.5	2023	2245	66.905	7.46	88.865	175.6	32.575	249.13
65m	63.25	131.5	221.5	332.25	465.5	2024	2291	70.079	7.828	92.407	183.88	34.185	259.434
						2025	2337	73.253	8.196	95.949	192.16	35.795	269.738
Table 4: Total waiting time in minutes per day						2026	2383	76.427	8.564	99.491	200.44	37.405	280.042
AADT	1500	2000	2500	3000	3500	2027	2429	79.601	8.932	103.033	208.72	39.015	290.346
20m	1	4	6	8	11	2028	2475	82.775	9.3	106.575	217	40.625	300.65
30m	3	7	13	19	26	2029	2521	86.117	9.668	110.201	226.1515	42.361	312.2875
60m	11	22	38	57	77	2030	2567	89.659	10.036	113.927	236.3405	44.247	325.5125
80m	15	30	52	77	105	2031	2613	93.201	10.404	117.653	246.5295	46.133	338.7375
25m	2	5.5	9.5	13.5	18.5	2032	2659	96.743	10.772	121.379	256.7185	48.019	351.9625
65m	12	24	41.5	62	84	2033	2705	100.285	11.14	125.105	266.9075	49.905	365.1875
						2034	2751	103.827	11.508	128.831	277.0965	51.791	378.4125
Table 5: Total number of stops per day						2035	2797	107.369	11.876	132.557	287.2855	53.677	391.6375
AADT	1500	2000	2500	3000	3500	2036	2843	110.911	12.244	136.283	297.4745	55.563	404.8625
20m	32	55	83	110	133	2037	2889	114.453	12.612	140.009	307.6635	57.449	418.0875
30m	47	85	134	188	247	2038	2935	117.995	12.98	143.735	317.8525	59.335	431.3125
60m	98	181	287	424	589	2039	2981	121.537	13.348	147.461	328.0415	61.221	444.5375
80m	130	234	364	528	726	2040	3027	125.619	13.77	151.214	339.4455	63.188	459.3555
25m	39.5	70	108.5	149	190								
65m	106	194.25	306.25	450	623.25								



## Worksheets A4: Travel time cost savings, continued



## Worksheet A4.1 - Travel time cost savings

Option (1)	Direction (2)	Period (3)	No./Year (4)	Road Category (5)	Period Volume (6)	TT (mins) (7)	TTC (\$/hr) (8)	Congest (\$/hr) (9)	Reliability (\$/hr) (10)	Annual Cost (\$) (11)
DM - Bridge Delays	Both	2016	245	RS	1,923	166.9085	\$25.34	\$4.88	\$0.00	\$20,596
DM - Bridge Delays	Both	2017	245	RS	1,969	175.6255	\$25.34	\$4.88	\$0.00	\$21,672
DM - Bridge Delays	Both	2018	245	RS	2,015	185.2350	\$25.34	\$4.88	\$0.00	\$22,858
DM - Bridge Delays	Both	2019	245	RS	2,061	196.6890	\$25.34	\$4.88	\$0.00	\$24,271
DM - Bridge Delays	Both	2020	245	RS	2,107	208.1430	\$25.34	\$4.88	\$0.00	\$25,684
DM - Bridge Delays	Both	2021	245	RS	2,153	219.5970	\$25.34	\$4.88	\$0.00	\$27,098
DM - Bridge Delays	Both	2022	245	RS	2,199	231.0510	\$25.34	\$4.88	\$0.00	\$28,511
DM - Bridge Delays	Both	2023	245	RS	2,245	242.5050	\$25.34	\$4.88	\$0.00	\$29,925
DM - Bridge Delays	Both	2024	245	RS	2,291	253.9590	\$25.34	\$4.88	\$0.00	\$31,338
DM - Bridge Delays	Both	2025	245	RS	2,337	265.4130	\$25.34	\$4.88	\$0.00	\$32,752
DM - Bridge Delays	Both	2026	245	RS	2,383	276.8670	\$25.34	\$4.88	\$0.00	\$34,165
DM - Bridge Delays	Both	2027	245	RS	2,429	288.3210	\$25.34	\$4.88	\$0.00	\$35,578
DM - Bridge Delays	Both	2028	245	RS	2,475	299.7750	\$25.34	\$4.88	\$0.00	\$36,992
DM - Bridge Delays	Both	2029	245	RS	2,521	312.2685	\$25.34	\$4.88	\$0.00	\$38,533
DM - Bridge Delays	Both	2030	245	RS	2,567	325.9995	\$25.34	\$4.88	\$0.00	\$40,228
DM - Bridge Delays	Both	2031	245	RS	2,613	339.7305	\$25.34	\$4.88	\$0.00	\$41,922
DM - Bridge Delays	Both	2032	245	RS	2,659	353.4615	\$25.34	\$4.88	\$0.00	\$43,617
DM - Bridge Delays	Both	2033	245	RS	2,705	367.1925	\$25.34	\$4.88	\$0.00	\$45,311
DM - Bridge Delays	Both	2034	245	RS	2,751	380.9235	\$25.34	\$4.88	\$0.00	\$47,005
DM - Bridge Delays	Both	2035	245	RS	2,797	394.6545	\$25.34	\$4.88	\$0.00	\$48,700
DM - Bridge Delays	Both	2036	245	RS	2,843	408.3855	\$25.34	\$4.88	\$0.00	\$50,394
DM - Bridge Delays	Both	2037	245	RS	2,889	422.1165	\$25.34	\$4.88	\$0.00	\$52,088
DM - Bridge Delays	Both	2038	245	RS	2,935	435.8475	\$25.34	\$4.88	\$0.00	\$53,783
DM - Bridge Delays	Both	2039	245	RS	2,981	449.5785	\$25.34	\$4.88	\$0.00	\$55,477
DM - Bridge Delays	Both	2040	245	RS	3,027	463.3095	\$25.34	\$4.88	\$0.00	\$57,171

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## Worksheets A4: Travel time cost savings, continued



## Worksheet A4.1 - Travel time cost savings

Option (1)	Direction (2)	Period (3)	No./Year (4)	Road Category (5)	Period Volume (6)	TT (mins) (7)	TTC (\$/hr) (8)	Congest (\$/hr) (9)	Reliability (\$/hr) (10)	Annual Cost (\$) (11)
DM - Diversions	Both	2016	-	RS	1,923	13,461	\$25.34	\$0.00	\$0.00	\$5,685
DM - Diversions	Both	2017	-	RS	1,969	13,783	\$25.34	\$0.00	\$0.00	\$5,821
DM - Diversions	Both	2018	-	RS	2,015	14,105	\$25.34	\$0.00	\$0.00	\$5,957
DM - Diversions	Both	2019	-	RS	2,061	14,427	\$25.34	\$0.00	\$0.00	\$6,093
DM - Diversions	Both	2020	-	RS	2,107	14,749	\$25.34	\$0.00	\$0.00	\$6,229
DM - Diversions	Both	2021	-	RS	2,153	15,071	\$25.34	\$0.00	\$0.00	\$6,365
DM - Diversions	Both	2022	-	RS	2,199	15,393	\$25.34	\$0.00	\$0.00	\$6,501
DM - Diversions	Both	2023	-	RS	2,245	15,715	\$25.34	\$0.00	\$0.00	\$6,637
DM - Diversions	Both	2024	-	RS	2,291	16,037	\$25.34	\$0.00	\$0.00	\$6,773
DM - Diversions	Both	2025	-	RS	2,337	16,359	\$25.34	\$0.00	\$0.00	\$6,909
DM - Diversions	Both	2026	-	RS	2,383	16,681	\$25.34	\$0.00	\$0.00	\$7,045
DM - Diversions	Both	2027	-	RS	2,429	17,003	\$25.34	\$0.00	\$0.00	\$7,181
DM - Diversions	Both	2028	-	RS	2,475	17,325	\$25.34	\$0.00	\$0.00	\$7,317
DM - Diversions	Both	2029	-	RS	2,521	17,647	\$25.34	\$0.00	\$0.00	\$7,453
DM - Diversions	Both	2030	-	RS	2,567	17,969	\$25.34	\$0.00	\$0.00	\$7,589
DM - Diversions	Both	2031	-	RS	2,613	18,291	\$25.34	\$0.00	\$0.00	\$7,725
DM - Diversions	Both	2032	-	RS	2,659	18,613	\$25.34	\$0.00	\$0.00	\$7,861
DM - Diversions	Both	2033	-	RS	2,705	18,935	\$25.34	\$0.00	\$0.00	\$7,997
DM - Diversions	Both	2034	-	RS	2,751	19,257	\$25.34	\$0.00	\$0.00	\$8,133
DM - Diversions	Both	2035	-	RS	2,797	19,579	\$25.34	\$0.00	\$0.00	\$8,269
DM - Diversions	Both	2036	-	RS	2,843	19,901	\$25.34	\$0.00	\$0.00	\$8,405
DM - Diversions	Both	2037	-	RS	2,889	20,223	\$25.34	\$0.00	\$0.00	\$8,541
DM - Diversions	Both	2038	-	RS	2,935	20,545	\$25.34	\$0.00	\$0.00	\$8,677
DM - Diversions	Both	2039	-	RS	2,981	20,867	\$25.34	\$0.00	\$0.00	\$8,813
DM - Diversions	Both	2040	-	RS	3,027	21,189	\$25.34	\$0.00	\$0.00	\$8,949

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## Worksheets A4: Travel time cost savings, continued



## Worksheet A4.1 - Travel time cost savings

Option (1)	Direction (2)	Period (3)	No./Year (4)	Road Category (5)	Period Volume (6)	TT (mins) (7)	TTC (\$/hr) (8)	Congest (\$/hr) (9)	Reliability (\$/hr) (10)	Annual Cost (\$) (11)
DM - HPMV Delays	Both	2016	-	RS	101.51	2923.6200	\$48.20	\$0.00	\$0.00	\$238,421
DM - HPMV Delays	Both	2017	-	RS	104.56	2923.6200	\$48.20	\$0.00	\$0.00	\$245,574
DM - HPMV Delays	Both	2018	-	RS	107.61	2923.6200	\$48.20	\$0.00	\$0.00	\$252,727
DM - HPMV Delays	Both	2019	-	RS	110.65	2923.6200	\$48.20	\$0.00	\$0.00	\$259,879
DM - HPMV Delays	Both	2020	-	RS	113.70	2923.6200	\$48.20	\$0.00	\$0.00	\$267,032
DM - HPMV Delays	Both	2021	-	RS	116.74	2923.6200	\$48.20	\$0.00	\$0.00	\$274,185
DM - HPMV Delays	Both	2022	-	RS	119.79	2923.6200	\$48.20	\$0.00	\$0.00	\$281,337
DM - HPMV Delays	Both	2023	-	RS	122.83	2923.6200	\$48.20	\$0.00	\$0.00	\$288,490
DM - HPMV Delays	Both	2024	-	RS	125.88	2923.6200	\$48.20	\$0.00	\$0.00	\$295,642
DM - HPMV Delays	Both	2025	-	RS	128.92	2923.6200	\$48.20	\$0.00	\$0.00	\$302,795
DM - HPMV Delays	Both	2026	-	RS	131.97	2923.6200	\$48.20	\$0.00	\$0.00	\$309,948
DM - HPMV Delays	Both	2027	-	RS	135.01	2923.6200	\$48.20	\$0.00	\$0.00	\$317,100
DM - HPMV Delays	Both	2028	-	RS	138.06	2923.6200	\$48.20	\$0.00	\$0.00	\$324,253
DM - HPMV Delays	Both	2029	-	RS	141.11	2923.6200	\$48.20	\$0.00	\$0.00	\$331,406
DM - HPMV Delays	Both	2030	-	RS	144.15	2923.6200	\$48.20	\$0.00	\$0.00	\$338,558
DM - HPMV Delays	Both	2031	-	RS	147.20	2923.6200	\$48.20	\$0.00	\$0.00	\$345,711
DM - HPMV Delays	Both	2032	-	RS	150.24	2923.6200	\$48.20	\$0.00	\$0.00	\$352,864
DM - HPMV Delays	Both	2033	-	RS	153.29	2923.6200	\$48.20	\$0.00	\$0.00	\$360,016
DM - HPMV Delays	Both	2034	-	RS	156.33	2923.6200	\$48.20	\$0.00	\$0.00	\$367,169
DM - HPMV Delays	Both	2035	-	RS	159.38	2923.6200	\$48.20	\$0.00	\$0.00	\$374,322
DM - HPMV Delays	Both	2036	-	RS	162.42	2923.6200	\$48.20	\$0.00	\$0.00	\$381,474
DM - HPMV Delays	Both	2037	-	RS	165.47	2923.6200	\$48.20	\$0.00	\$0.00	\$388,627
DM - HPMV Delays	Both	2038	-	RS	168.51	2923.6200	\$48.20	\$0.00	\$0.00	\$395,779
DM - HPMV Delays	Both	2039	-	RS	171.56	2923.6200	\$48.20	\$0.00	\$0.00	\$402,932
DM - HPMV Delays	Both	2040	-	RS	174.61	2923.6200	\$48.20	\$0.00	\$0.00	\$410,085

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Worksheets A4: Travel time cost savings, continued



Worksheet A4.1 - Travel time cost savings

Option (1)	Direction (2)	Period (3)	No./Year (4)	Road Category (5)	Period Volume (6)	TT (mins) (7)	TTC (\$/hr) (8)	Congest (\$/hr) (9)	Reliability (\$/hr) (10)	Annual Cost (\$) (11)
DM - Alignment	Both	24HR	245	RS	1,923.00	2.9486	\$25.34	\$0.00	\$0.00	\$586,695
OPT 11 - Alignment	Both	24HR	245	RS	1,923.00	1.4790	\$25.34	\$0.00	\$0.00	\$294,286

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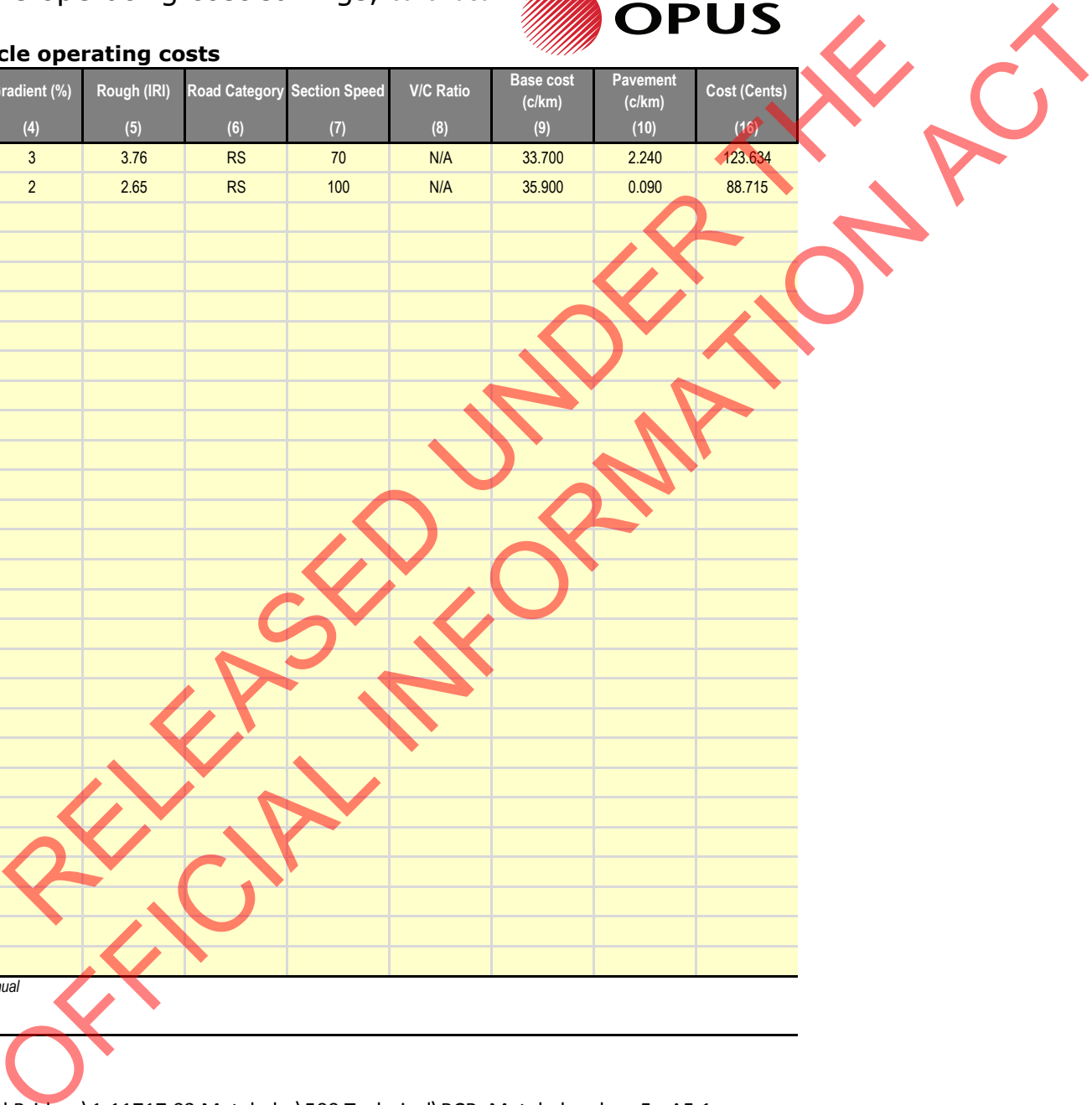
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Worksheets A5: Vehicle operating cost savings, continued



**Worksheet A5.1 - Unit vehicle operating costs**

Option (1)	Direction (2)	Length (km) (3)	Gradient (%) (4)	Rough (IRI) (5)	Road Category (6)	Section Speed (7)	V/C Ratio (8)	Base cost (c/km) (9)	Pavement (c/km) (10)	Cost (Cents) (16)
DM	Both	3.440	3	3.76	RS	70	N/A	33.700	2.240	123.634
OPT 11	Both	2.465	2	2.65	RS	100	N/A	35.900	0.090	88.715



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Worksheets A5: Vehicle operating cost savings



Worksheet A5.2 - Vehicle operating cost savings

Option (1)	Year	Direction (2)	Time units (3)	Period (4)	No./Year (5)	Road Category (6)	Period Volume (7)	Cost (cents) (8)	Annual Cost (\$) (9)
DM	2016	Both	Weekday	24HR	245	RS	1923	123.634	\$ 582,481.16
OPT 11	2016	Both	Weekday	24HR	245	RS	1923	88.715	\$ 417,969.06

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## Additional VOC due to delays

### Assumptions

- Additional VOC due to stops (Cents per speed change cycle), Table A5.41 of EEM
- Additional VOC due to waiting time (Cents per min), Table A5.23 of EEM

Year	Total vehicle stops per day	Additional VOC	Total waiting time (min per day)	Additional VOC (c/min)	Days per year	Annual Cost
2016	245.9625	2.151	27.113	3	245	\$ 1,495.49
2017	256.8875	2.151	28.539	3	245	\$ 1,563.55
2018	268.765	2.151	30.145	3	245	\$ 1,637.94
2019	282.611	2.151	32.123	3	245	\$ 1,725.45
2020	296.457	2.151	34.101	3	245	\$ 1,812.96
2021	310.303	2.151	36.079	3	245	\$ 1,900.46
2022	324.149	2.151	38.057	3	245	\$ 1,987.97
2023	337.995	2.151	40.035	3	245	\$ 2,075.47
2024	351.841	2.151	42.013	3	245	\$ 2,162.98
2025	365.687	2.151	43.991	3	245	\$ 2,250.49
2026	379.533	2.151	45.969	3	245	\$ 2,337.99
2027	393.379	2.151	47.947	3	245	\$ 2,425.50
2028	407.225	2.151	49.925	3	245	\$ 2,513.00
2029	422.4885	2.151	52.029	3	245	\$ 2,608.91
2030	439.4395	2.151	54.283	3	245	\$ 2,714.80
2031	456.3905	2.151	56.537	3	245	\$ 2,820.70
2032	473.3415	2.151	58.791	3	245	\$ 2,926.60
2033	490.2925	2.151	61.045	3	245	\$ 3,032.50
2034	507.2435	2.151	63.299	3	245	\$ 3,138.40
2035	524.1945	2.151	65.553	3	245	\$ 3,244.29
2036	541.1455	2.151	67.807	3	245	\$ 3,350.19
2037	558.0965	2.151	70.061	3	245	\$ 3,456.09
2038	575.0475	2.151	72.315	3	245	\$ 3,561.99
2039	591.9985	2.151	74.569	3	245	\$ 3,667.88
2040	610.5695	2.151	76.958	3	245	\$ 3,783.31

## Additional VOC due to Detours

### Assumptions

- 3 Bridge closure in last 5 years = 60% annual probability of closure
- 4 hour closure to clear site, inspect structure
- Assumed average detour is 89.3km, 70 min (=77km/h)
- VOC cost Table A5.9, 75km/h, 2% grade

Year (1)	AADT (2)	% AADT affected (3)	P (Diversion) (4)	Number of Veh Diverted (5) = (2)x(3)x(4)	Additional Journey Distance (6)	VOC Cost, cents per km (7)	Annual Cost
2016	1,923	16.67%	0.6000	192.30	89.3	33.3	\$ 5,718.41
2017	1,969	16.67%	0.6000	196.90	89.3	33.3	\$ 5,855.20
2018	2,015	16.67%	0.6000	201.50	89.3	33.3	\$ 5,991.99
2019	2,061	16.67%	0.6000	206.10	89.3	33.3	\$ 6,128.78
2020	2,107	16.67%	0.6000	210.70	89.3	33.3	\$ 6,265.56
2021	2,153	16.67%	0.6000	215.30	89.3	33.3	\$ 6,402.35
2022	2,199	16.67%	0.6000	219.90	89.3	33.3	\$ 6,539.14
2023	2,245	16.67%	0.6000	224.50	89.3	33.3	\$ 6,675.93
2024	2,291	16.67%	0.6000	229.10	89.3	33.3	\$ 6,812.72
2025	2,337	16.67%	0.6000	233.70	89.3	33.3	\$ 6,949.51
2026	2,383	16.67%	0.6000	238.30	89.3	33.3	\$ 7,086.30
2027	2,429	16.67%	0.6000	242.90	89.3	33.3	\$ 7,223.09
2028	2,475	16.67%	0.6000	247.50	89.3	33.3	\$ 7,359.88
2029	2,521	16.67%	0.6000	252.10	89.3	33.3	\$ 7,496.67
2030	2,567	16.67%	0.6000	256.70	89.3	33.3	\$ 7,633.46
2031	2,613	16.67%	0.6000	261.30	89.3	33.3	\$ 7,770.25
2032	2,659	16.67%	0.6000	265.90	89.3	33.3	\$ 7,907.04
2033	2,705	16.67%	0.6000	270.50	89.3	33.3	\$ 8,043.83
2034	2,751	16.67%	0.6000	275.10	89.3	33.3	\$ 8,180.62
2035	2,797	16.67%	0.6000	279.70	89.3	33.3	\$ 8,317.41
2036	2,843	16.67%	0.6000	284.30	89.3	33.3	\$ 8,454.20
2037	2,889	16.67%	0.6000	288.90	89.3	33.3	\$ 8,590.99
2038	2,935	16.67%	0.6000	293.50	89.3	33.3	\$ 8,727.78
2039	2,981	16.67%	0.6000	298.10	89.3	33.3	\$ 8,864.57
2040	3,027	16.67%	0.6000	302.70	89.3	33.3	\$ 9,001.36

## Worksheets A6: Accident cost savings



### Worksheet A6.1 - Summary of accident costs

1	Project name:	SH12 Matakoho Bridges RP185/10.87 to 14.31				
2	Historic accident period:	from	2011	to	2015	
3	Summary of accidents					
	Movement category	Number of injury accidents			Number of non-injury accidents	
		Fatal	Serious	Minor		
	Head on	-	1	1	1	
	Lost control off road	-	2	-	3	
	Manoeuvring	-	-	-	2	
		-	-	-	-	
		-	-	-	-	
		-	-	-	-	
		-	-	-	-	
	Total	0	3	1	6	
4	Description of likely causative factors:	Two single lane bridges, tortuous alignment				
5	Description of project options & predicted accident savings	New two-lane bridges High standard realignment 975m of route shortening				
6	Terrain type	Rolling				
7	Traffic volume (time zero)	1,923				
8	Traffic growth rate (time zero)	2.4%				
9	Length of project (km)	Do-minimum	3.44		Option	2.465
10	Exposure (time zero)		2414518.8			1730171.175
11	Injury accidents per year (time zero)		0.8			0.28
12	Accident rate (time zero per 100M VKT)		33.13			16.18
13	Typical accident rate (per 100M VKT)		34			18
14	Summary of annual accident costs					
	Movement category	Do-minimum		Option		
	Head on	\$	616,533.96	\$	127,359.62	
	Loss of control (off road)	\$	620,849.11	\$	308,103.81	
	Crossing (turning)	\$	44,311.79	\$	10,196.31	
		\$	-	\$	-	
		\$	-	\$	-	
		\$	-	\$	-	
		\$	-	\$	-	
		\$	-	\$	-	
	Total	\$	1,281,694.86	\$	445,659.75	

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**Matakohe Bridges Crash History**

#	CRASH ROAD	CRASH DIST	CRASH DIRN	INTSN	SIDE ROAD	CRASH ID	CRASH DATE	CRASH DOW	CRASH TIME	MVMT	VEHICLES	CAUSES	OBJECTS STRUCK	ROAD CURVE	ROAD WET	LIGHT	WTHRa	JUNC TYPE	TRAF CTRL	ROAD MARK	SPD LIM	CRASH FATAL CNT	CRASH SEV CNT	CRASH MIN CNT	PERS AGE1	PERS AGE2	Proposed Crash Reduction	Reason
180	12/185/13.428	770	E		ARARUA ROAD	201135826	17/05/2011	Tue	850	BA	CE1C	301A 341A		R	W	ON	F		G	N	100	0	0	0			80	1-lane bridge gone
175	12/185/12.158	270	E		MATAKOHE EAST ROAD	201201872	8/03/2012	Thu	1607	BA	VE14	301A		R	D	ON	F		G	C	100	0	1	2			80	1-lane bridge gone
176	12/185/12.258	400	S		ARARUA ROAD	201416476	21/07/2014	Mon	1345	BB	TS14	111A 123A 330A		E	W	O	F			L	100	0	0	2			80	1-lane bridge gone
187	12/185/14.153	1000	W		PETLEY ROAD	201203235	22/06/2012	Fri	1713	DA	MW1	102A 131A		M	W	DN	L		N	C	100	0	1	0			50	Superior alignment
170	12/185/11.458	1200	S		ARARUA ROAD	201231254	2/01/2012	Mon	130	DA	CN1	111A 131A	F	S	W	DN	L		N	C	100	0	0	0			50	Superior alignment
184	12/185/13.953	1200	W		PETLEY ROAD	201234853	11/06/2012	Mon	813	DB	TW1	137A 902	V	M	W	BN	L		N	C	100	0	0	0			50	Superior alignment
183	12/185/13.783	1370	W		PETLEY ROAD	201241440	29/11/2012	Thu	2130	DB	CN1	135A 801	E	M	W	DN	H		N	C	100	0	0	0			50	Superior alignment
182	12/185/13.748	1090	E		ARARUA ROAD	201303353	3/02/2013	Sun	215	DB	CW1	101A 131A	F	M	D	DN	F		N	C	100	0	1	0			50	Superior alignment
171	12/185/11.788	100	W		BARLOW LANE	201436424	22/03/2014	Sat	1800	MG	CN1T	371B		R	D	BN	F		G	C	100	0	0	0			80	1-lane bridge gone
178	12/185/12.448	210	W		ARARUA ROAD	201138138	18/06/2011	Sat	130	MO	CW1	103A 129A 929	V	E	W	DN	H	D	N	C	100	0	0	0			5	Improved Shoulders

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## SP3 General Road Improvements continued



## Worksheet 6 - Accident cost savings

Movement category	Head on	Vehicle involvement		Car, van, other
1 Do-minimum mean speed	70	Road category		RS
Posted speed limit	100	Traffic growth rate		2.4%
2 Option mean speed	100			
Do-minimum	Severity			
	Fatal	Serious	Minor	Non-injury
3 Number of years of typical accident rate records	5			
4 Number of reported accidents over period	0	1	0	1
5 Fatal/serious severity ratio (tables A6.2(a) to (c))	0.36	0.64	1.0	1.0
6 Number of reported accidents adjusted by severity (4) x (5)	0.36	0.64	0	1
7 Accidents per year = (6) / (3)	0.072	0.128	0	0.2
8 Adjustment factor for accident trend (table A6.1(a))	1.036			
9 Adjusted accidents per year = (7) x (8)	0.074592	0.132608	0	0.2072
10 Under-reporting factors (tables A6.3(a) and (b))	1	1.9	4.5	18.5
11 Total estimated accidents per year = (9) x (10)	0.074592	0.251952	0	3.8332
12 Accident cost, 100km/h limit (tables A6.4(e) to (h))	\$5,700,000	\$675,000	\$37,000	\$3,300
13 Accident cost, 50km/h limit (tables A6.4(a) to (d))	\$5,400,000	\$650,000	\$35,000	\$2,700
14 Mean speed adjustment - ((1) - 50)/50	0.4			
15 Cost per accident = (13) + (14) x [ (12) - (13) ]	\$5,520,000	\$660,000	\$35,800	\$2,940
16 Accident cost per year = (11) x (15)	\$411,748	\$166,290	\$0	\$11,270
17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury)				589,307.88
Option				
18 Percentage accident reduction	80%			
19 Percentage of accidents 'remaining' [ 100 - (18) ]	20%			
20 Predicted accidents per year (11) x (19)	0.0149184	0.05039104	0	0.76664
21 Accident cost, 100km/h limit (tables A6.21(e) to (h))	\$5,700,000	\$675,000	\$37,000	\$3,300
22 Accident cost, 50km/h limit (tables A6.21(a) to (d))	\$5,400,000	\$650,000	\$35,000	\$2,700
23 Mean speed adjustment - ((2) - 50)/50	1			
24 Cost per accident = (22) + (23) x [ (21) - (22) ]	\$5,700,000	\$675,000	\$37,000	\$3,300
25 Accident cost per year = (20) x (24)	\$85,035	\$34,014	\$0	\$2,530
26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury)				121,578.74
27 Annual accident cost savings = (17) - (26)				467,729.14
28 PV accident cost savings = (27) x DF <sup>AC</sup>				

## SP3 General Road Improvements continued



## Worksheet 6 - Accident cost savings

Movement category	Head on	Vehicle involvement	Truck	
1 Do-minimum mean speed	70	Road category	RS	
Posted speed limit	100	Traffic growth rate	2.4%	
2 Option mean speed	100			
Do-minimum	Severity			
	Fatal	Serious	Minor	Non-injury
3 Number of years of typical accident rate records	5			
4 Number of reported accidents over period	0	0	1	0
5 Fatal/serious severity ratio (tables A6.2(a) to (c))	0.36	0.64	1.0	1.0
6 Number of reported accidents adjusted by severity (4) x (5)	0	0	1	0
7 Accidents per year = (6) / (3)	0	0	0.2	0
8 Adjustment factor for accident trend (table A6.1(a))	1.036			
9 Adjusted accidents per year = (7) x (8)	0	0	0.2072	0
10 Under-reporting factors (tables A6.3(a) and (b))	1	1.9	4.5	18.5
11 Total estimated accidents per year = (9) x (10)	0	0	0.9324	0
12 Accident cost, 100km/h limit (tables A6.4(e) to (h))	\$5,050,000	\$550,000	\$31,000	\$10,300
13 Accident cost, 50km/h limit (tables A6.4(a) to (d))	\$4,150,000	\$460,000	\$28,000	\$7,900
14 Mean speed adjustment - ((1) - 50)/50	0.4			
15 Cost per accident = (13) + (14) x [ (12) - (13) ]	\$4,510,000	\$496,000	\$29,200	\$8,860
16 Accident cost per year = (11) x (15)	\$0	\$0	\$27,226	\$0
17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury)	\$ 27,226.08			
Option				
18 Percentage accident reduction	80%			
19 Percentage of accidents 'remaining' [ 100 - (18) ]	20%			
20 Predicted accidents per year (11) x (19)	0	0	0.18648	0
21 Accident cost, 100km/h limit (tables A6.21(e) to (h))	\$5,050,000	\$550,000	\$31,000	\$10,300
22 Accident cost, 50km/h limit (tables A6.21(a) to (d))	\$4,150,000	\$460,000	\$28,000	\$7,900
23 Mean speed adjustment - ((2) - 50)/50	1			
24 Cost per accident = (22) + (23) x [ (21) - (22) ]	\$5,050,000	\$550,000	\$31,000	\$10,300
25 Accident cost per year = (20) x (24)	\$0	\$0	\$5,781	\$0
26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury)	\$ 5,780.88			
27 Annual accident cost savings = (17) - (26)	\$ 21,445.20			
28 PV accident cost savings = (27) x DF <sup>AC</sup>				

## SP3 General Road Improvements continued



## Worksheet 6 - Accident cost savings

Movement category	Lost control off road	Vehicle involvement	Car, van, other		
1 Do-minimum mean speed	70	Road category	RS		
Posted speed limit	100	Traffic growth rate	2.4%		
2 Option mean speed	100				
Do-minimum	Severity				
	Fatal	Serious	Minor	Non-injury	
3 Number of years of typical accident rate records	5				
4 Number of reported accidents over period	0	1	0	2	
5 Fatal/serious severity ratio (tables A6.2(a) to (c))	0.13	0.87	1.0	1.0	
6 Number of reported accidents adjusted by severity (4) x (5)	0.13	0.87	0	2	
7 Accidents per year = (6) / (3)	0.026	0.174	0	0.4	
8 Adjustment factor for accident trend (table A6.1(a))	1.036				
9 Adjusted accidents per year = (7) x (8)	0.026936	0.180264	0	0.4144	
10 Under-reporting factors (tables A6.3(a) and (b))	1	1.9	4.5	18.5	
11 Total estimated accidents per year = (9) x (10)	0.026936	0.3425016	0	7.6664	
12 Accident cost, 100km/h limit (tables A6.4(e) to (h))	\$4,700,000	\$520,000	\$29,000	\$1,700	
13 Accident cost, 50km/h limit (tables A6.4(a) to (d))	\$5,150,000	\$525,000	\$28,000	\$1,700	
14 Mean speed adjustment - ((1) - 50)/50	0.4				
15 Cost per accident = (13) + (14) x [ (12) - (13) ]	\$4,970,000	\$523,000	\$28,400	\$1,700	
16 Accident cost per year = (11) x (15)	\$133,872	\$179,128	\$0	\$13,033	
17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury)	\$			326,033.14	
Option					
18 Percentage accident reduction	50%				
19 Percentage of accidents 'remaining' [ 100 - (18) ]	50%				
20 Predicted accidents per year (11) x (19)	0.013468	0.1712508	0	3.8332	
21 Accident cost, 100km/h limit (tables A6.21(e) to (h))	\$4,700,000	\$520,000	\$29,000	\$1,700	
22 Accident cost, 50km/h limit (tables A6.21(a) to (d))	\$5,150,000	\$525,000	\$28,000	\$1,700	
23 Mean speed adjustment - ((2) - 50)/50	1				
24 Cost per accident = (22) + (23) x [ (21) - (22) ]	\$4,700,000	\$520,000	\$29,000	\$1,700	
25 Accident cost per year = (20) x (24)	\$63,300	\$89,050	\$0	\$6,516	
26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury)	\$			158,866.46	
27 Annual accident cost savings = (17) - (26)	\$			167,166.68	
28 PV accident cost savings = (27) x DF <sup>AC</sup>					

## SP3 General Road Improvements continued



## Worksheet 6 - Accident cost savings

Movement category	Lost control off road	Vehicle involvement	Motorcycle		
1 Do-minimum mean speed	70	Road category	RS		
Posted speed limit	100	Traffic growth rate	2.4%		
2 Option mean speed	100				
Do-minimum	Severity				
	Fatal	Serious	Minor	Non-injury	
3 Number of years of typical accident rate records	5				
4 Number of reported accidents over period	0	1	0	0	
5 Fatal/serious severity ratio (tables A6.2(a) to (c))	0.13	0.87	1.0	1.0	
6 Number of reported accidents adjusted by severity (4) x (5)	0.13	0.87	0	0	
7 Accidents per year = (6) / (3)	0.026	0.174	0	0	
8 Adjustment factor for accident trend (table A6.1(a))	1.036				
9 Adjusted accidents per year = (7) x (8)	0.026936	0.180264	0	0	
10 Under-reporting factors (tables A6.3(a) and (b))	1	1.9	4.5	18.5	
11 Total estimated accidents per year = (9) x (10)	0.026936	0.3425016	0	0	
12 Accident cost, 100km/h limit (tables A6.4(e) to (h))	\$4,100,000	\$455,000	\$25,000	\$1,800	
13 Accident cost, 50km/h limit (tables A6.4(a) to (d))	\$4,200,000	\$445,000	\$24,000	\$1,800	
14 Mean speed adjustment - ((1) - 50)/50	0.4				
15 Cost per accident = (13) + (14) x [ (12) - (13) ]	\$4,160,000	\$449,000	\$24,400	\$1,800	
16 Accident cost per year = (11) x (15)	\$112,054	\$153,783	\$0	\$0	
17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury)	\$			265,836.98	
Option					
18 Percentage accident reduction	50%				
19 Percentage of accidents 'remaining' [ 100 - (18) ]	50%				
20 Predicted accidents per year (11) x (19)	0.013468	0.1712508	0	0	
21 Accident cost, 100km/h limit (tables A6.21(e) to (h))	\$4,100,000	\$455,000	\$25,000	\$1,800	
22 Accident cost, 50km/h limit (tables A6.21(a) to (d))	\$4,200,000	\$445,000	\$24,000	\$1,800	
23 Mean speed adjustment - ((2) - 50)/50	1				
24 Cost per accident = (22) + (23) x [ (21) - (22) ]	\$4,100,000	\$455,000	\$25,000	\$1,800	
25 Accident cost per year = (20) x (24)	\$55,219	\$77,919	\$0	\$0	
26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury)	\$			133,137.91	
27 Annual accident cost savings = (17) - (26)	\$			132,699.06	
28 PV accident cost savings = (27) x DF <sup>AC</sup>					



## SP3 General Road Improvements continued



## Worksheet 6 - Accident cost savings

Movement category	Lost control off road	Vehicle involvement	Truck		
1 Do-minimum mean speed	70	Road category	RS		
Posted speed limit	100	Traffic growth rate	2.4%		
2 Option mean speed	100				
Do-minimum		Severity			
		Fatal	Serious	Minor	Non-injury
3 Number of years of typical accident rate records		5			
4 Number of reported accidents over period		0	0	0	1
5 Fatal/serious severity ratio (tables A6.2(a) to (c))		0.13	0.87	1.0	1.0
6 Number of reported accidents adjusted by severity (4) x (5)		0	0	0	1
7 Accidents per year = (6) / (3)		0	0	0	0.2
8 Adjustment factor for accident trend (table A6.1(a))		1.036			
9 Adjusted accidents per year = (7) x (8)		0	0	0	0.2072
10 Under-reporting factors (tables A6.3(a) and (b))		1	1.9	4.5	18.5
11 Total estimated accidents per year = (9) x (10)		0	0	0	3.8332
12 Accident cost, 100km/h limit (tables A6.4(e) to (h))		\$4,300,000	\$475,000	\$26,000	\$8,400
13 Accident cost, 50km/h limit (tables A6.4(a) to (d))		\$4,150,000	\$505,000	\$26,000	\$7,000
14 Mean speed adjustment - ((1) - 50)/50		0.4			
15 Cost per accident = (13) + (14) x [ (12) - (13) ]		\$4,210,000	\$493,000	\$26,000	\$7,560
16 Accident cost per year = (11) x (15)		\$0	\$0	\$0	\$28,979
17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury)		\$ 28,978.99			
Option					
18 Percentage accident reduction		50%			
19 Percentage of accidents 'remaining' [ 100 - (18) ]		50%			
20 Predicted accidents per year (11) x (19)		0	0	0	1.9166
21 Accident cost, 100km/h limit (tables A6.21(e) to (h))		\$4,300,000	\$475,000	\$26,000	\$8,400
22 Accident cost, 50km/h limit (tables A6.21(a) to (d))		\$4,150,000	\$505,000	\$26,000	\$7,000
23 Mean speed adjustment - ((2) - 50)/50		1			
24 Cost per accident = (22) + (23) x [ (21) - (22) ]		\$4,300,000	\$475,000	\$26,000	\$8,400
25 Accident cost per year = (20) x (24)		\$0	\$0	\$0	\$16,099
26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury)		\$ 16,099.44			
27 Annual accident cost savings = (17) - (26)		\$ 12,879.55			
28 PV accident cost savings = (27) x DF <sup>AC</sup>					

## SP3 General Road Improvements continued



## Worksheet 6 - Accident cost savings

Movement category	Crossing, turning	Vehicle involvement	Truck	
1 Do-minimum mean speed	70	Road category	RS	
Posted speed limit	100	Traffic growth rate	2.4%	
2 Option mean speed	100			
Do-minimum	Severity			
	Fatal	Serious	Minor	Non-injury
3 Number of years of typical accident rate records	5			
4 Number of reported accidents over period	0	0	0	1
5 Fatal/serious severity ratio (tables A6.2(a) to (c))	0.16	0.84	1.0	1.0
6 Number of reported accidents adjusted by severity (4) x (5)	0	0	0	1
7 Accidents per year = (6) / (3)	0	0	0	0.2
8 Adjustment factor for accident trend (table A6.1(a))	1.036			
9 Adjusted accidents per year = (7) x (8)	0	0	0	0.2072
10 Under-reporting factors (tables A6.3(a) and (b))	1	1.9	4.5	18.5
11 Total estimated accidents per year = (9) x (10)	0	0	0	3.8332
12 Accident cost, 100km/h limit (tables A6.4(e) to (h))	\$5,000,000	\$485,000	\$30,000	\$10,000
13 Accident cost, 50km/h limit (tables A6.4(a) to (d))	\$4,150,000	\$535,000	\$27,000	\$7,800
14 Mean speed adjustment - ((1) - 50)/50	0.4			
15 Cost per accident = (13) + (14) x [ (12) - (13) ]	\$4,490,000	\$515,000	\$28,200	\$8,680
16 Accident cost per year = (11) x (15)	\$0	\$0	\$0	\$33,272
17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury)	\$ 33,272.18			
Option				
18 Percentage accident reduction	80%			
19 Percentage of accidents 'remaining' [ 100 - (18) ]	20%			
20 Predicted accidents per year (11) x (19)	0	0	0	0.76664
21 Accident cost, 100km/h limit (tables A6.21(e) to (h))	\$5,000,000	\$485,000	\$30,000	\$10,000
22 Accident cost, 50km/h limit (tables A6.21(a) to (d))	\$4,150,000	\$535,000	\$27,000	\$7,800
23 Mean speed adjustment - ((2) - 50)/50	1			
24 Cost per accident = (22) + (23) x [ (21) - (22) ]	\$5,000,000	\$485,000	\$30,000	\$10,000
25 Accident cost per year = (20) x (24)	\$0	\$0	\$0	\$7,666
26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury)	\$ 7,666.40			
27 Annual accident cost savings = (17) - (26)	\$ 25,605.78			
28 PV accident cost savings = (27) x DF <sup>AC</sup>				

## SP3 General Road Improvements continued



## Worksheet 6 - Accident cost savings

Movement category	Crossing, turning	Vehicle involvement		Car, van, other	
1 Do-minimum mean speed	70	Road category		RS	
Posted speed limit	100	Traffic growth rate		2.4%	
2 Option mean speed	100				
Do-minimum		Severity			
		Fatal	Serious	Minor	Non-injury
3 Number of years of typical accident rate records		5			
4 Number of reported accidents over period		0	0	0	1
5 Fatal/serious severity ratio (tables A6.2(a) to (c))		0.16	0.84	1.0	1.0
6 Number of reported accidents adjusted by severity (4) x (5)		0	0	0	1
7 Accidents per year = (6) / (3)		0	0	0	0.2
8 Adjustment factor for accident trend (table A6.1(a))		1.036			
9 Adjusted accidents per year = (7) x (8)		0	0	0	0.2072
10 Under-reporting factors (tables A6.3(a) and (b))		1	1.9	4.5	18.5
11 Total estimated accidents per year = (9) x (10)		0	0	0	3.8332
12 Accident cost, 100km/h limit (tables A6.4(e) to (h))		\$4,500,000	\$575,000	\$36,000	\$3,300
13 Accident cost, 50km/h limit (tables A6.4(a) to (d))		\$4,800,000	\$490,000	\$30,000	\$2,600
14 Mean speed adjustment - ((1) - 50)/50		0.4			
15 Cost per accident = (13) + (14) x [ (12) - (13) ]		\$4,680,000	\$524,000	\$32,400	\$2,880
16 Accident cost per year = (11) x (15)		\$0	\$0	\$0	\$11,040
17 Total cost of accidents per year (sum of columns in row (16) fatal + serious + minor + non-injury)		\$ 11,039.62			
Option					
18 Percentage accident reduction		80%			
19 Percentage of accidents 'remaining' [ 100 - (18) ]		20%			
20 Predicted accidents per year (11) x (19)		0	0	0	0.76664
21 Accident cost, 100km/h limit (tables A6.21(e) to (h))		\$4,500,000	\$575,000	\$36,000	\$3,300
22 Accident cost, 50km/h limit (tables A6.21(a) to (d))		\$4,800,000	\$490,000	\$30,000	\$2,600
23 Mean speed adjustment - ((2) - 50)/50		1			
24 Cost per accident = (22) + (23) x [ (21) - (22) ]		\$4,500,000	\$575,000	\$36,000	\$3,300
25 Accident cost per year = (20) x (24)		\$0	\$0	\$0	\$2,530
26 Total cost of accidents per year (sum of columns in row (25) fatal + serious + minor + non-injury)		\$ 2,529.91			
27 Annual accident cost savings = (17) - (26)		\$ 8,509.70			
28 PV accident cost savings = (27) x DF <sup>AC</sup>					

## Worksheets A6: Accident cost savings continued



## Worksheet A6.4a - Accident rate analysis

Option	Matakohe - Do-Min Detour Route Crashes		
Posted speed limit	100km/h near rural	Traffic growth rate	2.4%
Road category	Rural Strategic	Time zero	Jul-15
Accident prediction model			
1	Table used		
2	Parameter $b_0$		
3	Parameter $b_1$		
4	Parameter $b_2$		
5	Lowest or side road AADT ( $Q_{\text{minor}}$ )		
6	Highest or primary AADT ( $Q_{\text{major}}$ )		192.3
7	Typical accident rate (accidents per year), $A_T$ (formula from crash compendium)		
Go to step 8			
Exposure-based accident prediction equation			
1a	Table used		3.1
2a	Coefficient $b_0$ ( $/10^8$ veh-km or $/10^8$ vehicles)	Primary Collector, Winding	34
3a	Cross section adjustment factor from crash compendium table 5 (1.0 for no adjustment)		1.12
4a	Adjusted coefficient (2a) x (3a)		38.08
5a	Exposure at time zero ( $10^8$ veh-km or $10^8$ vehicles)		0.000171724
7	Typical accident rate (accidents per year), $A_T$ (4a) x (5a)		0.006539246
8	Accident trends factor for adjusting typical accident rate (appendix A6.5 method B)		-0.02
9	Adjustment factor for accident trend ( $1 + (8) \times (\text{time zero year} - 2006)$ ) (appendix A6.5 B)		0.82
10	Typical accident rate per year adjusted for accident trends, $A_T$ (7) x (9)		0.005362182
11	Cost per reported injury accident (table A6.5)	\$	570,000
12	Total accident cost per year (10) x (11)	\$	3,056.44

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## Network Resilience: Detour Calculations

Assumptions:-

- 3 Bridge closure in last 5 years = 60% annual probability of closure
- 4 hour closure to clear site, inspect structure
- Assumed Average Detour = 89.3km, 70 mins

Year (1)	AADT (2)	% AADT affected (3)	P (Diversion) (4)	Number of Veh Diverted (5) = (2)x(3)x(4)	Additional Journey Time (6)
2016	1,923	16.67%	0.6000	192.3000	70
2017	1,969	16.67%	0.6000	196.9000	70
2018	2,015	16.67%	0.6000	201.5000	70
2019	2,061	16.67%	0.6000	206.1000	70
2020	2,107	16.67%	0.6000	210.7000	70
2021	2,153	16.67%	0.6000	215.3000	70
2022	2,199	16.67%	0.6000	219.9000	70
2023	2,245	16.67%	0.6000	224.5000	70
2024	2,291	16.67%	0.6000	229.1000	70
2025	2,337	16.67%	0.6000	233.7000	70
2026	2,383	16.67%	0.6000	238.3000	70
2027	2,429	16.67%	0.6000	242.9000	70
2028	2,475	16.67%	0.6000	247.5000	70
2029	2,521	16.67%	0.6000	252.1000	70
2030	2,567	16.67%	0.6000	256.7000	70
2031	2,613	16.67%	0.6000	261.3000	70
2032	2,659	16.67%	0.6000	265.9000	70
2033	2,705	16.67%	0.6000	270.5000	70
2034	2,751	16.67%	0.6000	275.1000	70
2035	2,797	16.67%	0.6000	279.7000	70
2036	2,843	16.67%	0.6000	284.3000	70
2037	2,889	16.67%	0.6000	288.9000	70
2038	2,935	16.67%	0.6000	293.5000	70
2039	2,981	16.67%	0.6000	298.1000	70
2040	3,027	16.67%	0.6000	302.7000	70

## Network Resilience: HPMV Waiting Time

HPMV Waiting Time on SH1 if no HPMV route available

- Last 10 years = 40 closures (RS 261-319)
- Total Closure time = 487.27 Hours
- Average Closure time per year = 48.727 hours
- SH1 RP 292/6.23 AADT = 10928 with 10%HCV
- 1093 HCV per year, assumed 50 HPMV with 3% growth rate
- EEM TTC Costs, used \$20.1 for driver, \$28.1 for HCV2 = \$48.2

Delay p.a.	48.727
	2.030291667 days
% AADT	203.03%
HPMV (T <sub>0</sub> )	50
Tzero	101.5145833
Growth	0.03

## Network Resilience: Layer 2 Benefits

Figures from Network Resilience Business Case (Opus,2013)

- Layer 1 = Traditional EEM Benefits
- Layer 2 = Extended Benefits from wider economy effects
- Layer 2 Benefits were from 48 Hour Closure
- Layer 2 benefits peer reviewed by ASCARI Partners
- Recognising that link severances have wider effects, propose to use results from 2013 study

Layer 1 Benefit	63000000
Layer 2 Benefit	15800000
%	25.08% For 48 hour closures
Adjustment	2.09% For 4 Hour Closure

TTC Detour Benefits	\$ 117,638.76
VOC Detour Benefits	\$ 26,087.11
ACC Detour Benefits	\$ 38,291.05
Layer 2 Benefits	\$ 3,804.06

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## Worksheet 5: First year rate of return



1 Preferred activity option	Option 11				
2 PV of total net cost	\$	22,521,454			
3 Midpoint of first year benefits	1.5				
4 SPPWF of first year of benefits	0.916307417				
Benefit	Annual costs of preferred option (5)	Annual costs of do-minimum (6)	Net annual benefit (at time zero) (7)	Growth rate (decimal) (8)	PV of benefits in first year (9) = [1.0 + (3) x (8)] x (4) x (7)
Travel time savings	\$ 423,771	\$ 1,226,013	\$ 802,241	0.0300	\$ 768,179.23
Vehicle operating cost savings	\$ 417,969	\$ 589,695	\$ 171,726	0.0300	\$ 164,434.72
Accident cost savings	\$ 455,147	\$ 1,284,751	\$ 829,604	0.0300	\$ 794,380.42
Reduced driver frustration		\$ -	\$ -	0.0300	\$ -
Vehicle emission reduction	\$ 15,042	\$ 21,234	\$ 6,193	0.0300	\$ 5,929.71
10 Sum of PV of benefits in first year					\$ 1,732,924.08
11 FYRR = [(10) / (2)]					7.69%

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