

# **Road Building 101**

# Highway Alignment Selection Using Multiple Account Evaluation - MAE

BCEA Expropriation Conference October 27, 2017





# What is MAE?

MAE - Multiple Account Evaluation is a decision making tool

- A method of comparing options
- Provides a balanced view to decision makers
- Helps identify necessary compromises (trade-offs)



# The Dawning of a Project...





# Identify and Define the Problem









# Highway 1 – Eastbound Traffic - Langford





### Trans Canada Highway – Inbound traffic to Victoria





### **Inbound Traffic Destinations**





### Outbound traffic queuing on McKenzie Avenue – Afternoon Peak







### **Outbound Traffic Destinations**



Outbound traffic destinations



# McKenzie Interchange – Why is the project needed?

- Safety
- Congestion
- Reliability





# **Project Goals**

- Reduce frequency and severity of crashes
- Reduce travel time
- Improve transit facilities
- Improve travel time reliability
- Reduce idling and fuel consumption, leading to lower greenhouse gas emissions
- Improve cycling and pedestrian safety



# Multiple Account Evaluation - MAE

# 5 Accounts are commonly evaluated

- Financial
- Customer Service
- Social/Community
- Environmental
- Economic



# Financial





## **Customer Service**





# Social/Community





## Environmental





# Economic







### MAE - Sample

### Exhibit 1.1 Typical Multiple Account Evaluation

OPTION		1	2	3	4	
ACCOUNT	Base	Passing	Pass.Ln.	Staged	Bypass	Option
	Case	Lanes then	converted	4 Lane	Existing	Bypass
		4 lanes	to 4 lanes	Sections	Route	Route
FINANCIAL (millions \$)		n	nillions \$1997			
Capital Cost (PV)	\$1	\$120	\$130	\$125	<b>\$</b> 1	\$200
Annual Maintenance	\$0	\$1	<mark>\$</mark> 1	<b>\$</b> 1	<b>\$</b> 0	\$1
Resurfacing (PV)	\$5	\$7	\$7	\$8	<b>\$</b> 5	\$6
Life Cycle Cost (PV)	\$9	\$132	\$142	\$138	\$22	23
Incremental Cost		\$123	\$133	\$129	\$2´	14
CUSTOMER SERVICE		n	nillions \$1997			
Time (PV)	\$273	\$2 <mark>1</mark> 8	\$218	\$218	\$100	\$119
Accident (PV)	\$146	\$1 <mark>0</mark> 2	\$102	\$102	\$38	\$64
Vehicle Operating (PV)	\$730	\$715	\$715	\$723	\$276	\$319
Total	\$1,149	\$1,036	\$1,036	\$1,043	\$91	17
Incremental Benefit	\$0	\$1 <mark>1</mark> 3	\$113	\$106	\$23	32
Annual Closures (hrs)	80	80	80	60	60	20
· · · · · · · · · · · · · · · · · · ·						
NPV		(\$10)	(\$20)	(\$23)	\$1	8
B/C Ratio		0.9	0.8	0.8	1.	1





### MAE – Sample continued...

SO	CIAL/COMMUNITY						
	Average Daily Traffic	8000	8000	8000	8000	3000	5000
	(noise, pollution)						
	Residences Impacted	166	166	166	166	166	5
	Business/institutional	71	71	71	71	71	0
	Business Takings	0	1	1	I.	0	0
	Residential Takings	0	6	6	7	0	2
	Community Severance	$\odot$	•	•	•	0	•
	Community Plans	$\odot$	0	<b>O</b>	0	•	•
	Business Impact (equity)	$\odot$	•	0	0	•	۲
	Visual Impact	$\odot$	۲	$\odot$	٥	۲	•
EC	ONOMIC DEVELOPMENT			•			
	Provincial Output		(\$9)	<mark>(\$1</mark> 8)	(\$21)	\$	516
	Jobs		-11	-21	-25		19
EN	/IRONMENTAL			•			
	Land Requirements	0.0	5.0	7.0	7.0	0.0	20
	Fuel (million litres)	1,825	1,900	1,900	2.000	800	1,000
	CO (million kg)	456	475	475	500	200	250
	Site Rehabilitation	0	0	0	0	0	•
	Wildlife	0	۲	۲	۲	0	•
	Water Pollution	0	۲	۲	۲	0	•
	Special Areas	none	none	none	none	none	historic site
	KEY	0	Good		PV=Present	Value	
		$\odot$	Fair		NPV = Net P	resent Valu	e
		•	Poor				



# McKenzie Interchange – Victoria Development of Alignment Options







# Option 1 – Diamond Interchange – McKenzie Overpass

### <u>Pros</u>

Best transit, pedestrian and cycling solution Slightly less expensive - \$3 to \$5 million less than Option 2 Least impact on Cuthbert Holmes Park

### <u>Cons</u>

McKenzie Avenue eastbound movement has queuing







# **Option 2 – Partial Cloverleaf**

### <u>Pros</u>

Highest operating efficiency – No queues for Highway 1 and McKenzie

The best traffic safety option

Best long term service – 2038

Meets transit, pedestrian and cycling needs

### <u>Cons</u>

Slightly more expensive - \$3 to \$5 million more than Option 1

Greater impact to Cuthbert Holmes Park



### Option 3: Diamond Interchange With Trans-Canada Highway Over McKenzie/Admirals





# Option 3 – Diamond Interchange – McKenzie Underpass

<u>Pros</u>

Best transit, pedestrian and cycling solution

Least impact on Cuthbert Holmes Park

### <u>Cons</u>

Most costly option

Elevated highway will create more noise and visual impact

Long and costly construction schedule

McKenzie Avenue eastbound movement has queuing





### Summarized Multiple Account Evaluation

## **Option Considerations**

Consideration	Option 1: Diamond Interchange	Option 2: Partial Cloverleaf	
Safety	• \$26 million in savings	• \$30 million in savings	
Travel Time	Comparable – \$188 million in savings		
Transit	Comparable – includes bus-on-shoulder lanes and	does not preclude future light rail transit	
Cyclists and Pedestrians	Comparable – provides safe and separate cycling a	and pedestrian facilities	
Cuthbert Holmes Park	<ul> <li>0.25 hectares of park impacted</li> <li>Impacted lands to be replaced by highway right-of-way</li> <li>All impacted lands would be mitigated</li> </ul>	<ul> <li>1.4 hectares of park impacted</li> <li>Impacted lands to be replaced by highway right-of-way</li> <li>All impacted lands would be mitigated</li> </ul>	
Opening Day (2018)	<ul> <li>No queues for highway traffic</li> <li>Moderate left turn traffic queues on Trans-Canada Highway eastbound off-ramp onto McKenzie, clearing every cycle</li> </ul>	<ul> <li>No queues for highway traffic</li> <li>No queues for left turn traffic onto McKenzie</li> </ul>	
Future Capacity (2038)	<ul> <li>No queues for highway traffic</li> <li>Extended queues for left turn traffic, still contained to ramp</li> </ul>	<ul> <li>No queues for highway traffic</li> <li>No queues for left turn traffic onto McKenzie</li> </ul>	
Construction Management	Comparable – maintain existing commute times		
Cost	\$3–5 million less costly than Option 2	\$3–5 million more costly than Option 1	





### The Selected Option – Partial Cloverleaf







### Elevated cycling route and dedicated transit lane







"Time is Money" – The estimated travel time savings for the McKenzie Interchange Project is \$188 million by 2038.

### **Significant Travel Time Savings for Commuters**

The table below shows the travel time savings the interchange would provide, compared to existing conditions. Options 1 and 2 would provide similar travel time savings, which is estimated to be \$188 million by 2038.



	Route	2016 (mins)	2018 (mins)	2038 (mins)
Morning	A to B	26	7.5	8.0
Peak	A to C	30	8.5	9.5
Afternoon	B to A	25	7.0	7.5
Peak	C to A	25	8.0	8.0

In both Options 1 and 2, in 2018, commuters on the Trans-Canada Highway heading towards downtown Victoria will save an average of 22 minutes in the morning and 17 minutes in the afternoon.

# ...Questions?



# BRITISH COLUMBIA





# Appendix

Acc	L1 Multiple Acc	ount Evaluation
	1.1 Multiple	e Acco

	OPTION		t	2	ŝ	4		
AC	COUNT	Base	Passing	Pass.Ln.	Staged	Bvpass	Option	
		Case	Lanes then	converted	4 Lane	Existing	Bvpass	
			4 lanes	to 4 lanes	Sections	Route	Route	
	VANCIAL (millions \$)		u	nillions \$1997				
	Capital Cost (PV)	\$1	\$120	\$130	\$125	\$1	\$200	
	Annual Maintenance	\$0	\$1	\$1	\$1	\$0	\$1	
	Resurfacing (PV)	\$5	\$7	\$7	\$8	\$5	\$6	
	Life Cvcle Cost (PV)	\$9	\$132	\$142	\$138	\$22	23	
	Incremental Cost		\$123	\$133	\$129	\$2	14	
2	ISTOMER SERVICE		Ľ	nillions \$1997				
	Time (PV)	\$273	\$218	\$218	\$218	\$100	\$119	
	Accident (PV)	\$146	\$102	\$102	\$102	\$38	\$64	
	Vehicle Operating (PV)	\$730	\$715	\$715	\$723	\$276	\$319	
	Total	\$1.149	\$1.036	\$1.036	\$1.043	\$9	1	
	Incremental Benefit	\$0	\$113	\$113	\$106	\$20	32	
	Annual Closures (hrs)	80	80	80	60	60	20	
	ΛdN		(\$10)	(\$20)	(\$23)	\$1	8	
	B/C Ratio		0.9	0.8	0.8	1.	1	
8	DCIAL/COMMUNITY			•	•			-

						,	2
	B/C Ratio		0.9	0.8	0.8		1.1
SO	CIAL/COMMUNITY				•		
	Average Daily Traffic	8000	8000	8000	8000	3000	5000
	(noise, pollution)						
	Residences Impacted	166	166	166	166	166	5
	Business/institutional	71	71	71	71	71	0
	Business Takings	0	<del>.</del>	t	_	0	0
	Residential Takings	0	9	9	7	0	2
	Community Severance	•	•	•	•	0	0
	Community Plans	•	0	0	0	•	•
	Business Impact (equity)	۲	0	0	0	•	٥
	Visual Impact	•	٥	•	•	٥	•
С	ONOMIC DEVELOPMENT						
	Provincial Output		(\$3)	(\$18)	(\$21)	\$	16
	Sdol		-11	-21	-25		19
ЫN	VIRONMENTAL				. )		
	Land Requirements	0.0	5.0	7.0	7.0	0.0	20
	Fuel (million litres)	1.825	1,900	1,900	2,000	800	1,000
	CO (million kg)	456	475	475	500	200	250
	Site Rehabilitation	0	0	0	0	0	0
	Wildlife	0	•	٥	٥	0	•
	Water Pollution	0	۲	٥	٥	0	•
	Special Areas	none	none	none	none	none	historic site

PV=Present Value NPV = Net Present Value

Good Fair Poor

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KΕΥ



### **Option Considerations**

Considerations	Option 1: Diamond With TCH Under McKenzie / Admirals	Option 2: Partial Cloverleaf With TCH Under McKenzie/Admirals	Option 3: Diamond With TCH Over McKenzie / Admirals
Operating Efficiency	•	•	•
Safety	•	•	
Construction Schedule	•	•	0
Traffic Noise	•	•	0
Visual Impacts	•	•	0
Park Encroachment	•	0	
Cost	•	•	0
Transit Operations	•	•	•
Pedestrian / Cycling	•	•	•
Most Effective	Least Effective		