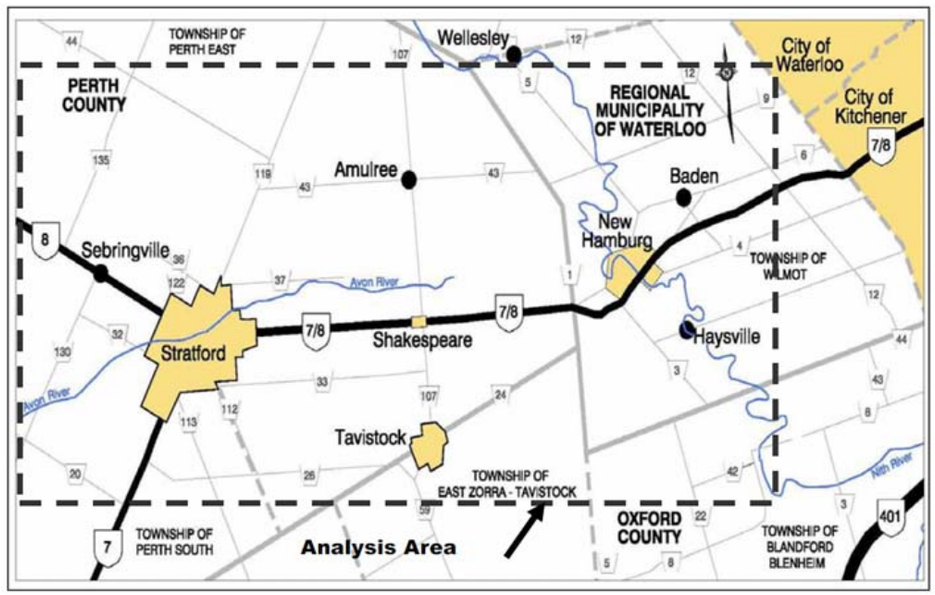
Ontario

Highway 7/8 Value Engineering Study

From Stratford to New Hamburg

December 2011

MTO Group Work Project #13-00-00



FINAL REPORT

HDR | iTRANS

December 22, 2011

Project # 6324

Mr. Charles Organ, C.E.T.
Senior Project Manager
Ministry of Transportation, West Region
659 Exter Road
London, ON N6E 1L3

Dear Sir:

Re: Value Engineering Study – Final Report
Highway 7/8 from Stratford to New Hamburg

HDR | iTRANS, in association with Faithful+Gould, is pleased to submit our Final Value Engineering (VE) report for the Highway 7/8 VE study.

This report documents the process and the results of the Highway 7/8 VE study that consisted of pre-workshop preparation activities, a five-day workshop in Stratford, Ontario from March 7-11, 2011 and post-workshop activities including a VE presentation to the Ontario Ministry of Transportation's MTO West Region's Senior Management team held on March 25, 2011 in London, Ontario.

The intent of this VE study was creative in nature and was not intended to bind the Highway 7/8 EA study team to a limited set of alternatives, but rather to provide input to the Highway 7/8 EA Study team for their consideration in the next phase of the Highway 7/8 Environmental Assessment Study. Numerous alternatives to enhance the value of the project were generated and are presented herein. The report describes the various scenarios developed by combining a variety of ideas to achieve maximum value. These scenarios provide the Ministry with a range of options available, all of which improve the overall performance of the project.

We sincerely thank the MTO and Municipal participants who contributed to the VE Study. And, we thank the MTO for the opportunity to conduct this VE Study.

Yours truly,
HDR Corporation

Joseph Arcaro, P.Eng.
Vice President

HDR | iTRANS
HDR Corporation

100 York Boulevard
Suite 300
Richmond Hill, ON L4B 1J8
Canada

Phone: (905) 882-4100
Fax: (905) 882-1557
www.hdrinc.com

TABLE OF CONTENTS

Appendices

A. VE Proposals

- NH – 2 Nafziger Road - parclo A-2
- NH – 5 Nafziger Road - tight diamond north, wider ramps on south
- NH – 27 Bleams/Hamilton – Roundabout; Close Victoria Street
- NH – 34 Upgrade to complete freeway with interchanges at Nafziger, Peel and Regional Rd 1
- NH – 42 Roundabout at Peel
- NH – 45 Peel Street: Bucksaw IC with Flyover to West
- NH – 54 Huron Street – Realign with Interchange at Highway 7/8
- NH – 62 Freeway/Arterial Combination – Signalized Intersections
- NH – 62A Freeway/Arterial Combination – Roundabouts
- NH – 63 Roundabout at Highway 7/8, Huron and Wilmot Easthope
- RA – 15 Median directional intersections on existing Highway 7&8 at Perth Line 102, 104 and 106
- RA – 18 Perth Line 108 to flyover new Highway 7/8 with no connections
- RA – 22B Median directional intersections on existing Highway 7&8 at Perth Line 108
- RA - 23D WB Perth 33 and NB Perth 110 merge and Tie into New Highway7/8 at Signalized Intersection; 110 continues NB as 4th leg of intersection.
- RA – 23E WB Perth 33 and NB Perth 110 merge and Tie into New Highway7/8 at Roundabout; 110 continues NB as 4th leg of Roundabout.
- RA – 30 Perth Line110 under new 7/8; WB Perth Line 33 under new 7/8; EB directional ramp to 33; 33/110 IS stop control
- RA – 39 Perth Line 111 connects to New Highway 7/8 as Signalized Intersection
- RA – 40 Perth Line 111 connects to New Highway 7/8 at a Roundabout
- RA – 43 At-grade Perth Road 109 with railway and traffic signals on the preferred route. Interconnect with railway crossing signals.
- SH – 5 Shakespeare east – Westbound access only (Split off to right)
- SH – 12 Grade separate Perth Road 107 from Railway; Connect with roundabout on the preferred route.
- SH – 13 Grade separate Perth Road 107 from Railway and connect with signalized intersection on the preferred route
- SH – 23 Grade separate Perth Road 109 from Railway; Connect with roundabout on the preferred route.
- SH – 24 Grade separate Perth Road 109 from Railway and connect with signalized intersection on the preferred route
- SE – 1 Modern Roundabouts at Romeo Street and Downie Street; possibly at Erie Street
- SE – 1A Median from east of Road 111 to Erie Street
- SE – 13 Quadrant Link between Highway 7/8 and Erie Street - Roundabouts
- SE – 14 Quadrant Link between Highway 7/8 and Erie Street – Traffic Signals

- SE – 15 Packham Road/Embro Road – Roundabout
- SE – 23 Road 29/Gibb Road – Roundabout
- SE – 24 Road 29/Gibb Road – Traffic Signals
- SW – 5 Roundabout at St. Vincent, re-align as required to the west
- SW – 6 Signalized Intersection at St. Vincent, re-align as required to the west
- SW – 12 Oval Roundabout at Wright and Queensland
- SW – 13 Coordinated Split Phase Traffic Signal at Wright and Queensland
- SW – 20 Realign Wright to Freeland with Traffic Signals, (assuming traffic signals at Queensland)
- SW – 20A Realign Wright to Freeland with Roundabout, (assuming a roundabout at Queensland)
- SW – 22 Highway 7 at Road 122 - roundabout
- SW – 26A Roundabout, option for high-speed east to north right turn channelization
- SW – 27A Signalized intersection, option for high-speed east to north right turn channelization
- SW – 36 Roundabout with high-speed west to south right turn channelization
- SW – 38 Signalized intersection with high-speed west to south right turn channelization

B. VE Evaluation
C. VE Workshop Agenda
D. VE Workshop Attendance

Tables

Exhibits

1. EXECUTIVE SUMMARY

1.1 Introduction

This Value Engineering (VE) Study Report summarizes the results of the VE Study conducted for MTO West Region by HDR | iTRANS, with VE team leadership provided by Faithful+Gould.

The subject of the study is the Highway 7/8 Transportation Corridor Planning and Environmental Assessment (Class EA) Study from Greater Stratford to New Hamburg. The MTO West Region and the EA Study team have requested and initiated this VE Study as a tool to assist with the generation and development of reasonable access and typical cross-section alternatives for the next phase of the EA Study. At the time of the VE study, the EA team had not advanced to a point in the study where preliminary design alternatives were developed. In the absence of preliminary design alternatives, the VE Team was required to assume a base case. This assumed base case was needed to develop the various options presented in the report. **The intent of this VE study is creative in nature and is not intended to bind the EA study team to a limited set of alternatives, but rather to provide input to the EA Study team for their consideration.**

The VE Study consisted of pre-workshop activities including several information gathering conference calls; a five-day VE workshop in Stratford from March 7 – 11, 2011, and post-workshop activities including this VE Study Report and a separate Implementation Meeting at the West Region MTO offices in London. The overall objectives of the VE Study include:

- Gathering and using the excellent mix of disciplines, expertise, and community stakeholders gathered for the VE Study to evaluate the assumed base case road and community connections planned for the preferred route for the Highway 7/8 corridor.
- Providing new perspectives and creative ideas to the planning process for these important connections, focusing on crossing road treatments and community access.
- Developing VE Proposals to retain and improve community access while minimizing community and environmental impacts, obtaining sustainable solutions, and achieving the functional requirements of the project with respect to traffic operations and road user safety.
- Comparing VE Proposals for specific intersections against their assumed base case and each other to determine their relative performance.
- Comparing combinations of VE Proposals for appropriate segments of the corridor, where applicable, against the assumed base case for each segment and each other to determine their relative performance.
- Developing a range of access alternatives for the Stratford area, the Shakespeare area, and the New Hamburg area.
- Providing MTO and the EA Study team with a basket of viable alternatives, whether for an individual connection or as part of a segment scenario, from which they can create a preferred alternative for the entire corridor to carry through the EA process.

A multi-disciplined team was formed to analyze the project utilizing the VE job plan. Each step plays an important part in achieving results, i.e. maintaining essential project functions at desired levels of performance and assuring eventual savings to MTO and the Province.

1.2 VE Team and Process

The five-day VE Workshop portion of the study was led by Scot McClintock, PE, CVS-Life of Faithful+ Gould and followed the process described in **Section 8**. The VE Team included participants from MTO West Region, the AECOM EA Study team, and the various municipalities involved in the EA process as shown in **Table 1**. Part time participants are indicated by (PT). The VE Team members provided by HDR | iTRANS, IBI Group and Faithful+Gould are also shown.

Table 1: VE Team

MTO and Consultant	HDR | iTRANS and Sub-Consultants
Charles Organ, VE Project Manager	Scot McClintock F+G, VE Team Leader
Frank Hochstenbach, VE Coordinator (PT)	Joseph Arcaro, VE Project Manager
James Corcoran, Environmental Specialist	Mark Mis, VE Team Assistant
Ken Teasdale, Corridor Management (PT)	Joseph Arcaro, Highway Planner
Roger Ward, Planning and Design	Greg Perry, Highway Design Specialist
Brenda Jamieson, EA PM, (PT), AECOM	Don Cleghorn, Traffic Specialist
Fred Leech, EA Environmental Planner, (PT)	Greg Junnor, Safety Specialist
	Donald Moore, Structures, IBI
Municipal Participants	
Geoff Vander Booren, Perth County (PT)	Harold O'Kafra, Twp. of Wilmot (PT)
Geoffrey Keyworth, Region of Waterloo	Dennis O'Neil, Twp. E. Zorra-Tavistock (PT)
Wes Kuepfer, Twp. of Perth East (PT)	Darrell Reis, Twp. of Perth East (PT)
Larry McGreigor, Twp. of Perth South (PT)	Glenn Schwendinger, Twp. of Perth East (PT)
Ray Nothdurft, Stratford	Grant Whittington, Twp. of Wilmot (PT)

1.3 Project Analysis

Several VE tools were used by the VE Team to analyze the project including:

1. Scale developed for Capital Cost, Maintenance Cost, and User Cost indices to help the VE Team evaluate the cost implications of various ideas, given the planning nature of the VE Study and the lack of a cost estimate.

2. FAST diagram was created with two basic functions and nine higher order functions to place the "bucket of alternatives" in the context of overall improvements to the Highway 7/8 corridor.
3. Set of draft performance criteria and measures that were derived at the beginning and improved throughout the workshop for use in evaluation of design scenarios developed in the workshop. Finally, the Performance Criteria were weighted to further guide the evaluation process.

Based on the above project analysis, five value target areas were selected for VE Team consideration.

1.4 VE Proposals

During the Creative Phase, the VE Team brainstormed as many ways as possible to achieve the Highway 7/8 corridor's objective in the value target areas, generating 234 creative ideas. The entire list of creative ideas is presented in **Section 5** while **Table 2** shows the breakdown by Value Target Area.

Table 2: No. of Ideas by Value Target Area

Value Target Area	Identifier	No. of Ideas
New Hamburg	NH	64
Rural Areas	RA	51
Shakespeare	SH	46
Stratford East	SE	26
Stratford West	SW	47
Total		**234**

After further evaluation of these 234 ideas, the VE Team selected 43 ideas to be developed as VE Proposals, as listed in **Section 4**, and 8 design suggestions for consideration by the EA team going forward. The workbooks that were prepared for the VE Proposals are included in **Appendix A**. **Table 3** shows the breakdown of the number of VE Proposals by Value Target Area.

Table 3: No. of VE Proposals

Value Target Area	No. of VE Proposals
New Hamburg	10
Rural Areas	9
Shakespeare	5
Stratford East	7
Stratford West	12
Total	**43**

1.5 Evaluation of Alternatives

The preceding VE Proposals were developed as alternatives to the assumed base case for 20 different intersections or segments of the Highway 7/8 corridor for potential consideration during the EA Process. For each such intersection or segment, the VE Team compared the alternatives to the assumed base case and each other via the Performance Criteria and Measures described in **Section 6**. The location of the respective intersections or segments are briefly described in **Section 3**, followed by their comparison using the weighted performance criteria and their respective units of measurement in an evaluation matrix. The evaluation matrix includes a brief description of the assumed base case and each alternative; their performance scores for each performance criteria, their overall Performance score (P); their Cost Index (C); and their Performance/Cost Index (P/C) or Value based on the following formula:

$$\text{VALUE} = \frac{\text{WORTH}}{\text{COST}} = \frac{\text{FUNCTION}}{\text{COST}} = \frac{\text{BENEFIT}}{\text{COST}} = \frac{\text{PERFORMANCE SCORE}}{\text{COST INDEX}} = \frac{P}{C}$$

Following the 20 evaluation matrices for each of the 20 different intersections or segments of the Highway 7/8 corridor, **Section 3** also briefly discusses the results of the evaluation matrices. While in some cases the best alternatives seem obvious, in others there are multiple good alternatives that could potentially be carried forward through the EA process.

When analyzing an Evaluation Matrix, the P/C ratios are usually the first indicators that are checked since they are a measure of value. It should be noted that on this project, the term C is actually a normalized cost index, factoring in Capital Cost, Maintenance Cost, Collision Cost, and User Cost indices. Then the reviewer should turn to the performance scores (P) since, depending on the circumstances, better performance may be worth the additional costs.

1.6 Final Considerations and Observations

The objective of this VE Study is to identify the best value road connections from the preferred route and connections identified in the planning study to the communities of New Hamburg, Shakespeare, and Stratford based on a weighted performance criteria evaluation. Therefore, the results of this VE Study, as summarized on an intersection or segment of Highway 7/8 basis in **Section 3**, are best considered input for the Highway 7/8 EA process going forward in lieu of any firm recommendations. We offer the following observations:

- The 43 VE Proposals and 8 design suggestions contained in this VE Study Report can be considered in numerous other combinations to further increase the "bucket of alternatives" for the betterment of the Highway 7/8 corridor
- The Highway 7/8 EA Team is not precluded from considering ideas listed in **Section 5** that are marked as "NR" (not recommended due to issues discovered during development)
- Context Sensitive Design is a key issue in the development of access recommendations within the built-up areas of New Hamburg

- There are several combinations and permutations of sideroad treatments through Shakespeare, i.e. road closures and maintaining access to the provincial highway network. A significant issue is keeping sideroads open to permit agricultural operations across the provincial highway
- Road 109 improvements may need to be considered if it serves as a high order connection between existing Highway 7/8 and the new section of Highway 7/8
- City of Stratford staff was receptive to the consideration of roundabouts within its municipality
- The selection of access solutions to the communities along Highway 7/8 will assist in the development of the (interim and ultimate) typical section along each segment of the Highway 7/8 corridor
- Wilmot Township staff stressed the importance of maintaining a highway connection to New Hamburg at the Peel/Haysville St. intersection
- Shakespeare emergency services station requires access to the preferred route.

2. IMPLEMENTATION ACTION

2.1 Introduction

The results of the Highway 7/8 VE Study, as contained in this report, were presented to West Region MTO Senior Management for review on March 25, 2011 at MTO's London office. Due to the nature of this study, a decision has not been made on the disposition of alternatives. The Summary and Disposition of VE Proposals sheet found in **Exhibit 1** is provided to record future implementation decisions.

At the Implementation Meeting the Ministry requested that a separate VE proposal be prepared for the following:

- A roundabout network through New Hamburg (NH-62A)
- A four-legged roundabout at Wilmot Easthope Road and Huron Street at Highway 7/8 (NH-63).

2.2 Implementation Plan and Responsibilities

The VE Study Report presents the VE Team's findings and recommendations. In the future, MTO decision-makers will use disposition sheets as a place to record comments on the various proposals. An Implementation Meeting will be held to discuss the individual VE Proposals. This is a critical step in the process since a VE Proposal is only as successful as its implementation. The responsibility for implementation will then fall to the MTO staff as the project proceeds.

2.3 VE Recommendation Approval Form and Implementation Action

Exhibit 1 provides the Recommendation Approval Form. Given that the VE study was creative in nature and not intended to bind the EA study team to a limited set of alternatives, implementation action items were not identified.

Exhibit 1: Value Engineering Recommendation Approval Form

Idea No.	Recommendation	Qualitative Performance Measures				*Cost Savings/ Avoidance	**Approval	Comments
		E	O	C	D			
NH-2	Nafziger Road - parclo A-2		X			N/A		▪
NH-5	Nafziger Road - tight diamond north, wider ramps on south		X			N/A		▪
NH-27	Bleams/Hamilton – Roundabout; Close Victoria Street	X				N/A		▪
NH-34	Upgrade to complete freeway with interchanges at Nafziger, Peel and Regional Rd 1		X			N/A		▪
NH-42	Grade Separated Roundabout at Peel	X				N/A		▪
NH-45	Peel Street: Bucksaw IC with Flyover to West		X			N/A		▪
NH-54	Huron Street – Realign with Interchange at Highway 7/8		X			N/A		▪
NH-62	Freeway/Arterial Combination – Signalized Intersection		X			N/A		▪
NH-62A	Freeway/Arterial Combination – Roundabout		X			N/A		▪
NH-63	Roundabout at Hwy 7/8, Huron and Wilmot Easthope		X			N/A		▪
RA-15	Median directional intersections on existing Highway 7&8 at Perth Line 102, 104 and 106					N/A		▪
RA-18	Perth Line 108 to flyover new Highway 7/8 with no connections		X			N/A		▪
RA-22B	Median directional intersections on existing Highway 7&8 at Perth Line 108					N/A		▪
RA-23D	WB Perth 33 and NB Perth 110 merge and Tie into New Highway7/8 at Signalized Intersection; 110 continues NB as 4th leg of intersection.		X			N/A		▪

Exhibit 1: Value Engineering Recommendation Approval Form

Idea No.	Recommendation	Qualitative Performance Measures				*Cost Savings/ Avoidance	**Approval	Comments
		E	O	C	D			
RA-23E	WB Perth 33 and NB Perth 110 merge and Tie into New Highway7/8 at Roundabout; 110 continues NB as 4th leg of Roundabout.		X			N/A		▪
RA-30	Perth Line110 under new 7/8; WB Perth Line 33 under new 7/8; EB directional ramp to 33; 33/110 is stop control		X			N/A		▪
RA-39	Perth Line 111connects to New Highway 7/8 as Signalized Intersection		X			N/A		▪
RA-40	Perth Line 111connects to New Highway 7/8 at a Roundabout		X			N/A		▪
RA-43	At-grade Perth Road 109 with railway and traffic signals on the preferred route. Interconnect with railway crossing signals.		X			N/A		▪
SH-5	Shakespeare east-Westbound access only (Split off to right)					N/A		▪
SH-12	Grade separate Perth Road 107 from Railway; Connect with roundabout on the preferred route.		X			N/A		▪
SH-13	Grade separate Perth Road 107 from Railway and connect with signalized intersection on the preferred route		X			N/A		▪
SH-23	Grade separate Perth Road 109 from Railway; Connect with roundabout on the preferred route.		X			N/A		▪
SH-24	Grade separate Perth Road 109 from Railway and connect with signalized intersection on the preferred route		X			N/A		▪

Exhibit 1: Value Engineering Recommendation Approval Form

Idea No.	Recommendation	Qualitative Performance Measures				*Cost Savings/ Avoidance	**Approval	Comments
		E	O	C	D			
SE-1	Modern Roundabouts at Romeo Street and Downie Street; possibly at Erie Street	X	X		X	N/A		▪
SE-1A	Median from east of Road 111 to Erie Street	X	X			N/A		▪
SE-13	Quadrant Link between Highway 7/8 and Erie Street - Roundabouts	X	X	X	X	N/A		▪
SE-14	Quadrant Link between Highway 7/8 and Erie Street – Traffic Signals	X	X	X	X	N/A		▪
SE-15	Packham Road/Embro Road – Roundabout	X	X	X	X	N/A		▪
SE-23	Road 29/Gibb Road – Roundabout	X	X	X	X	N/A		▪
SE-24	Road 29/Gibb Road – Traffic Signals			X	X	N/A		▪
SW-5	Roundabout at St. Vincent, re-align as required to the west		X			N/A		▪
SW-6	Signalized Intersection at St. Vincent, re-align as required to the west		X			N/A		▪
SW-12	Oval Roundabout at Wright and Queensland		X			N/A		▪
SW-13	Coordinated Split Phase Traffic Signal at Wright and Queensland					N/A		▪
SW-20	Realign Wright to Freeland with Traffic Signals, (assuming traffic signals at Queensland)		X			N/A		▪
SW-20A	Realign Wright to Freeland with Roundabout, (assuming a roundabout at Queensland)			X		N/A		▪
SW-22	Highway 7 at Road 122 - roundabout	X				N/A		▪
SW-26A	Roundabout, option for high-speed east to north right turn channelization	X	X			N/A		▪

Exhibit 1: Value Engineering Recommendation Approval Form

Idea No.	Recommendation	Qualitative Performance Measures				*Cost Savings/ Avoidance	**Approval	Comments
		E	O	C	D			
SW-27A	Signalized intersection, option for high-speed east to north right turn channelization	X	X			N/A		▪
SW-36	Roundabout with high-speed west to south right turn channelization	X	X			N/A		▪
SW-38	Signalized intersection with high-speed west to south right turn channelization	X	X			N/A		▪
Sum of Columns		0	0	0	0	N/A		

Performance Summary:			
Number of Accepted Recommendations:	0	Number of Recommendations:	0
Number of Recommendations Accepted with Modifications:	0	Number of Design Suggestions:	0
Number of Recommendations Studied Further:	0	Capital Cost Savings/Avoidance:	0
Number of Recommendations Rejected Because of Mutual Exclusivity:	0	Value Added:	
Number of Rejected Recommendations:	0	Net Cost Savings / Avoidance:	0

Legend:

A = Accept
M = Accept with Modifications
FS = Further Study
ME = Mutually Exclusive
R= Reject

E = Reduced Environmental Impact
O = Enhanced Operational Performance
C = Reduced Construction Impacts
D = Expedited Project Delivery

*Cost Savings and Avoidance is not applicable as a cost estimate for the preferred concept has not been developed

**No decision has been made on the preceding alternatives. However, when the MTO makes a decision, given the nature of the study, the range of responses will include either A – Accept, FS – Further Study, R – Reject.

3. EVALUATION OF ALTERNATIVES

3.1 Introduction

The VE Team developed one or more VE Proposals as alternatives to the assumed base case for 20 different intersections or segments of the Highway 7/8 corridor for potential consideration during the EA Process. For each such intersection or segment, the VE Team compared the alternatives to the assumed base case and each other using the Performance Criteria and Measures described in **Section 6**. The location of the respective intersections or segments will be briefly described in this section, followed by the comparison using the weighted performance criteria and their respective units of measurement in an evaluation matrix. The evaluation matrix will include a brief description of the assumed base case and each alternative; their performance scores for each performance criteria, their overall performance score (P); their Cost Index (C); and their Performance/Cost Index (P/C) or Value based on the following formula:

$$\text{VALUE} = \frac{\text{WORTH}}{\text{COST}} = \frac{\text{FUNCTION}}{\text{COST}} = \frac{\text{BENEFIT}}{\text{COST}} = \frac{\text{PERFORMANCE SCORE}}{\text{COST INDEX}} = \frac{P}{C}$$

3.2 Description of Intersections or Segments

3.2.1 Nafziger Road

Nafziger Road connects to existing Highway 7/8 at a signalized intersection on the east end of New Hamburg. Nafziger Road serves a section of New Hamburg that is designated for future growth and serves the new and expanding community/recreation complex. Highway 7/8 is four lanes through New Hamburg and classified as a staged freeway. The assumed base case was to maintain the at-grade signalized intersection.

Exhibit 2: Nafziger Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR NAFZIGER ROAD	Weight →	13	13	11	25	21	17			
Assumed Base Case - At grade signalized intersection	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1.00	474.00
Alternative 1 - NH-5: Tight Diamond on North, Diamond or Loops on the South	Rating 1-10	5.3	5.9	5.0	5.8	5.4	7.0			
	Sub Total	69	77	55	145	113	119	578	1.15	502.61
Alternative 2 - NH-2: Parclo A-2	Rating 1-10	5.8	5.9	5.0	5.7	7.0	8.0			
	Sub Total	75	77	55	143	147	136	633	1.16	545.34
SEEK THE BEST - NOT PERFECTION										

As seen in **Exhibit 2**, VE Proposal NH-2 (the Parclo A2 interchange) received the best performance score by far – 33% higher than the assumed base case and 9% higher than a tight diamond interchange to the north (VE Proposal NH-5). As a result, this alternative has the best P/C ratio (15% higher than the assumed base case and 9% higher than a tight diamond interchange to the north) in spite of the highest cost index.

3.2.2 Hamilton Street

In the assumed base case, Hamilton Street will tie into existing Highway 7/8 at an at-grade signalized intersection. Hamilton Street is a key access point to the New Hamburg community, connecting to residential and industrial areas to the north of the highway and to Bleams Road to the south.

Exhibit 3: Hamilton Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR HAMILTON STREET	Weight →	13	13	11	25	21	17			
Assumed Base Case - At grade signalized intersection	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1.09	434.86
Alternative 1 - NH-27: Roundabout	Rating 1-10	2.8	5.0	5.0	4.3	6.2	9.0			
	Sub Total	36	65	55	108	130	153	547	1	547.10
SEEK THE BEST - NOT PERFECTION										

Exhibit 3 shows that VE Proposal NH-27 (roundabout at Hamilton) performed over 15% better and with a lower, more favourable cost index the P/C ratio value is over 25% higher than the assumed base case.

3.2.3 Peel Street

In the assumed base case, Peel Street will connect to existing Highway 7/8 at an at-grade signalized intersection just to the west of the Highway 7/8 bridge over the Nith River. Peel Street is also a key access point to New Hamburg, connecting across the Nith River in the center of New Hamburg to the northern portion of the municipality.

Exhibit 4: Peel Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR PEEL STREET	Weight →	13	13	11	25	21	17			
Assumed Base Case - At grade signalized intersection	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1.09	434.86
Alternative 1 - NH-42: Grade separated roundabout	Rating 1-10	2.8	5.2	4.5	5.0	6.2	9.0			
	Sub Total	36	68	50	125	130	153	562	1.00	561.70
Alternative 2 - NH-45: Bucksaw IC with Flyover to West	Rating 1-10	2.9	2.8	4.0	4.7	3.8	6.0			
	Sub Total	38	36	44	118	80	102	417	1.53	272.81
SEEK THE BEST - NOT PERFECTION										

Exhibit 4 shows that VE Proposal NH-42 (at-grade roundabout at Peel Street) clearly has the best performance and the best P/C ratio. This value exceeded the assumed base case and a bucksaw interchange with poor performance and a higher (worse) cost index, by 29% and over 105%, respectively.

3.2.4 Huron Street

The assumed base case at Huron Street on the far west of the New Hamburg area will be an at-grade signalized intersection joining existing Highway 7/8 at less than a 45 degree angle. Huron Street, also known as Regional Road 1, is the main access to New Hamburg from the west.

Exhibit 5: Huron Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR HURON STREET	Weight →	13	13	11	25	21	17			
Assumed Base Case - At grade signalized intersection	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1	474.00
Alternative 1 - NH-54: Realign Huron with Interchange at Highway 7/8	Rating 1-10	6.7	3.7	5.0	4.0	8.2	9.0			
	Sub Total	87	48	55	100	172	153	615	1.17	525.98
Alternative 2 - NH-63: Roundabout at Huron and Wilmot Easthope	Rating 1-10	2.7	5.8	5.0	4.5	7.0	9.0			
	Sub Total	35	75	55	113	147	153	578	1	578.00
SEEK THE BEST - NOT PERFECTION										

As seen in **Exhibit 5**, VE Proposal NH-54 (a realignment of Huron Street with an interchange at Highway 7/8) received the best performance score (30% over the assumed base case and 6% over NH-63). However, its cost was higher than the other two alternatives. NH-63 had the best P/C ratio, which was 22% higher than the assumed base case and 10% higher than NH-54.

3.2.5 Complete New Hamburg Section of Corridor

In the assumed base case, Highway 7/8 will be widened through New Hamburg to 6 lanes where appropriate and will remain classified as a staged freeway. There will be at-grade signalized intersections at Nafziger Road and at Hamilton, Peel, and Huron Streets.

Exhibit 6: New Hamburg Evaluation

Page 1 of 1	EVALUATION MATRIX									
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR COMPLETE NEW HAMBURG SECTION OF CORRIDOR	Weight →	13	13	11	25	21	17			
Assumed Base Case - At grade signalized intersections	Rating 1-10	3.0	5.0	5.0	5.0	5.0	4.0			
	Sub Total	39	65	55	125	105	68	457	1.11	411.71
Alternative 1 - NH-34: Upgrade to complete freeway with interchanges at Nafziger, Peel and Regional Rd 1	Rating 1-10	4.8	4.7	4.5	2.7	7.0	9.0			
	Sub Total	62	61	50	68	147	153	541	1.16	465.95
Alternative 2 - NH-62: Freeway/Arterial Combination with IC at Nafziger and Signalized Intersections at Hamilton and Peel	Rating 1-10	3.1	5.4	4.5	4.8	6.2	7.0			
	Sub Total	40	70	50	120	130	119	529	1.09	485.50
Alternative 3 - NH-62A: Freeway/Arterial Combination with IC at Nafziger and At-grade Roundabouts at Hamilton and Peel	Rating 1-10	2.7	6.0	5.0	4.5	7.0	9.0			
	Sub Total	35	78	55	113	147	153	581	1	580.60
SEEK THE BEST - NOT PERFECTION										

Exhibit 6 demonstrates that VE Proposal NH-62A (Alternative 3) received the best performance score, the most favourable cost index and, as a result, the best P/C ratio. Compared to the assumed base case, as well as Alternative 1 and Alternative 2 (as described in the above evaluation matrix), Alternative 3 exceeded performance by 27%, 7%, and 10%,

respectively. More significantly, Alternative 3 exceeded the P/C ratios by 41%, 25%, and 20%, respectively.

3.2.6 East of Shakespeare

The assumed base case at the east end of Shakespeare is a pure bypass, with no connection between new Highway 7/8 and old Highway 7/8 at that location. Currently, existing Highway 7/8 passes straight through Shakespeare.

Exhibit 7: East of Shakespeare Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR EAST OF SHAKESPEARE	Weight →	13	13	11	25	21	17			
Assumed Base Case - No Connection between New Highway 7/8 and Existing Highway 7/8	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1	474.00
Alternative 1 - SH-5: Westbound access only (Split off to right) to Old Highway 7/8	Rating 1-10	3.7	6.8	5.0	6.3	5.0	4.0			
	Sub Total	48	88	55	158	105	68	522	1	522.00
SEEK THE BEST - NOT PERFECTION										

As seen in **Exhibit 7**, VE Proposal SH-5 (westbound access only with a ramp splitting off of new Highway 7/8 to the right directly onto old Highway 7/8) received the best performance score and the best P/C ratio, both 10% higher than the assumed base case. Old Highway 7/8 would remain a direct access to Shakespeare from the east.

3.2.7 Perth Lines 102, 104 and 106

The assumed base case at Perth Lines 102, 104 and 106 will be at-grade stop control intersections. These three lines are north-south access roads to and from Highway 7/8 and agricultural properties along the highway.

Exhibit 8: Perth Lines 102, 104 and 106 Evaluation

Page 1 of 1	EVALUATION MATRIX									
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR PERTH LINE 102, 104, and 106	Weight →	13	13	11	25	21	17			
Assumed Base Case - At-grade Stop Control Intersections at Perth Line 102, 104 and 106	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1.06	447.17
Alternative 1 - RA-15: Median directional intersections on existing Highway 7&8 at Perth Line 102, 104 and 106	Rating 1-10	3.7	6.5	5.0	5.7	5.4	7.0			
	Sub Total	48	85	55	143	113	119	563	1.00	562.50
SEEK THE BEST - NOT PERFECTION										

Exhibit 8 shows that VE Proposal RA-15 (the provision of median directional intersections on new Highway 7/8 at Perth Lines 102, 104 and 106) will result in a 19% improvement in performance compared to the assumed base case, and a 26% increase in P/C ratio.

3.2.8 Perth Line 107 (County Road 59)

Perth Line 107 is a comparatively busy north-south route which passes through the center of Shakespeare at a signalized intersection. The assumed base case will also be an at-grade signalized intersection, relocated to the new Highway 7/8 alignment south of Shakespeare and the railroad. The railway crossing on Line 107 will remain at-grade and there will be an interconnection between the traffic and railway signals.

Exhibit 9: Perth Line 107 Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR PERTH LINE 107 (COUNTY ROAD 59)	Weight →	13	13	11	25	21	17			
Assumed Base Case - At-grade Signalized Intersection	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1	474.00
Alternative 1 - SH-13: Grade separate Perth Road 107 from Railway and connect with signalized intersection on the preferred route	Rating 1-10	2.7	7.6	5.0	6.5	4.2	9.0			
	Sub Total	35	99	55	163	88	153	593	1	592.60
Alternative 2 - SH-12: Grade separate Perth Road 107 from Railway; Connect with roundabout on the preferred route.	Rating 1-10	2.7	7.4	4.5	6.7	3.0	7.0			
	Sub Total	35	96	50	168	63	119	530	1.12	473.48
SEEK THE BEST - NOT PERFECTION										

As seen in **Exhibit 9**, VE Proposal SH-13 results in the best performance and highest value alternative. This alternative is an at-grade signalized intersection with new Highway 7/8 and a grade separation between Perth Line 107 and the railroad, thereby avoiding the need for an interconnection between the traffic and railway signals. This alternative outperforms the assumed base case and a roundabout plus railway grade separation by 25% and 12%, respectively, and provides 25% better value than both.

3.2.9 Perth Line 108

The assumed base case at Perth Line 108 will remain an at-grade intersection with stop control, simply relocated to the 4-lane cross section of new Highway 7/8. No left turn lanes are planned on the Highway 7/8 mainline. Perth Line 108 is a low volume north-south route that primarily serves the agricultural community.

Exhibit 10: Perth Line 108 Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR PERTH LINE 108	Weight →	13	13	11	25	21	17			
Assumed Base Case - At-grade Stop Control Intersection	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1.13	419.47
Alternative 1 - RA-22B: Median directional intersections on New Highway 7/8 at Perth Line 108	Rating 1-10	3.7	6.5	5.0	5.3	5.4	9.0			
	Sub Total	48	85	55	133	113	153	587	1	586.50
Alternative 2 - RA-18: Perth Line 108 to flyover new Highway 7/8 with no connections	Rating 1-10	10.0	6.4	4.5	4.0	10.0	10.0			
	Sub Total	130	83	50	100	210	170	743	1	742.70
SEEK THE BEST - NOT PERFECTION										

Exhibit 10 illustrates that VE Proposal RA-18 (Perth Line 18 to flyover new Highway 7/8 with no connections) received the best performance score by 57% over the assumed base case and 27% over a median directional intersection. With regard to value, the P/C ratio of the flyover is a substantial 77% higher than the assumed base case and 27% higher than the median directional intersection.

3.2.10 Perth Line 109

Just like Line 108, the assumed base case at Perth Line 109 will remain an at-grade intersection with stop control, simply relocated to the 4-lane cross section of new Highway 7/8. No left turn lanes are planned on the Highway 7/8 mainline. However, Perth Line 109 is a critical access connection for traffic destined for Stratford's east end commercial node, downtown and north side residential areas, and will also make the bypass more desirable for

Stratford (westbound) and Kitchener (eastbound) traffic in lieu of going through Shakespeare.

Exhibit 11: Perth Line 109 Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR PERTH LINE 109	Weight →	13	13	11	25	21	17			
Assumed Base Case - At-grade Stop Control Intersection	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1.09	434.86
Alternative 1 - RA-43: At-grade Perth Road 109 with railway and traffic signals on the preferred route. Interconnect with railway crossing signals.	Rating 1-10	2.7	7.0	5.0	5.7	5.0	8.0			
	Sub Total	35	91	55	143	105	136	565	1	564.60
Alternative 2 - SH-24: Grade separate Perth Road 109 from Railway and connect with signalized intersection on the preferred route	Rating 1-10	2.7	7.4	5.0	5.0	4.2	9.0			
	Sub Total	35	96	55	125	88	153	553	1.09	506.88
Alternative 3 - SH-23: Grade separate Perth Road 109 from Railway; Connect with roundabout on the preferred route.	Rating 1-10	2.7	7.6	4.5	5.2	3.0	7.0			
	Sub Total	35	99	50	130	63	119	495	1.22	406.07
SEEK THE BEST - NOT PERFECTION										

Exhibit 11 shows that VE Proposal RA-43 received the best performance score and the best P/C ratio. Compared to the assumed base case, as well as Alternative 2 and Alternative 3 (as described in the above evaluation matrix), Alternative 1 exceeded performance by 19%, 2%, and 14%, respectively. More significantly, Alternative 1 exceeded the P/C ratios by 30%, 11%, and 39%, respectively.

3.2.11 Perth Lines 110 and 33

Perth Line 110 is a north-south route for primarily agricultural purposes while Perth Line 33 is an east-west route providing access to and from Stratford. The assumed base case will feature Perth Line 33 connecting to the 4-lane cross section of new Highway 7/8 via a T-intersection with stop control.

Exhibit 12: Perth Lines 110 and 33

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR PERTH LINES 110 AND 33	Weight →	13	13	11	25	21	17			
Assumed Base Case - Perth Line 33 connects to Highway 7/8 at stop control tee (No left turn lane on Highway 7/8); Cul-de-sac Perth Line 110 from north; Connect Perth Line 110 south to Perth Line 33.	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1.12	423.21
Alternative 1 - RA-23D: WB Perth 33 and NB Perth 110 merge and Tie into New Highway7/8 at Signalized Intersection; 110 continues NB as 4th leg of intersection.	Rating 1-10	2.7	7.5	4.5	5.0	4.2	9.0			
	Sub Total	35	98	50	125	88	153	548	1	548.30
Alternative 2 - RA-23E: WB Perth 33 and NB Perth 110 merge and Tie into New Highway7/8 at Roundabout; 110 continues NB as 4th leg of Roundabout.	Rating 1-10	2.7	7.5	4.5	5.3	4.2	7.0			
	Sub Total	35	98	50	133	88	119	522	1.06	492.26
Alternative 3 - RA-30: Perth Line110 under new 7/8; WB Perth Line 33 under new 7/8; EB directional ramp to 33; 33/110 IS stop control	Rating 1-10	8.2	7.3	5.0	6.0	7.4	9.0			
	Sub Total	107	95	55	150	155	153	715	1.18	605.85
SEEK THE BEST - NOT PERFECTION										

As shown in **Exhibit 12**, the best performing and best value Alternative for Perth Lines 110 and 33, despite the least favourable cost index, is VE Proposal RA-30. In RA-30, Perth Line110 will pass under new Highway 7/8; westbound Perth Line 33 will also pass under new Highway 7/8 and tie in with a ramp; an eastbound directional ramp will connect new Highway 7/8 to Perth Line 33; and Perth Lines 110 and 33 will meet at a stop control intersection. Compared to the assumed base case, Alternative 1, and Alternative 2 (as

described in the above evaluation matrix), Alternative 3 significantly exceeded performance by 51%, 30%, and 37%, respectively, while also providing P/C ratios that are higher by 43%, 10%, and 23%, respectively.

3.2.12 Perth Line 111

While Perth Line 111 primarily serves as a north-south route for agricultural vehicles, it also provides access into Stratford via Perth Line 33 today and new Highway 7/8 in the future due to its proximity. In the assumed base case, Perth Line 111 will connect at-grade to a 4-lane cross section on new Highway 7/8 with stop control on Perth Line 111. No left turn lanes will be provided on Highway 7/8.

Exhibit 13: Perth Line 111 Evaluation

Page 1 of 1	EVALUATION MATRIX									
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR PERTH LINE 111	Weight →	13	13	11	25	21	17			
Assumed Base Case - At-grade Stop Control Intersection	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1.12	423.21
Alternative 1 - RA-39: Perth Line 111connects to New Highway 7/8 at At-grade Signalized Intersection	Rating 1-10	2.7	8.8	5.0	5.2	5.0	9.0			
	Sub Total	35	114	55	130	105	153	593	1.00	592.50
Alternative 2 - RA-40: Perth Line 111connects to New Highway 7/8 at a Roundabout	Rating 1-10	2.7	8.6	4.5	5.5	3.8	7.0			
	Sub Total	35	112	50	138	80	119	533	1.06	502.55
SEEK THE BEST - NOT PERFECTION										

Exhibit 13 shows that VE Proposal RA-39 (connecting Perth Line 111 to New Highway 7/8 at a signalized intersection with turning lanes on Highway 7/8) received a performance score 25% better than the assumed base case and 11% better than a roundabout. Similarly, RA-39 achieved a P/C ratio 40% higher than the assumed base case and 18% higher than a roundabout.

3.2.13 Romeo, Downie and Erie Streets

The 2031 assumed base case for new Highway 7/8 entering Stratford along Lorne Avenue East from west of Road 111 to east of Erie Street (Highway 7 south) will be a transition from a 4-lane cross-section with rural attributes to an urbanized 5-lane cross-section with a centre 2-Way Left Turn Lane. Romeo Street is currently a T-intersection with stop-control on the north and west approaches although traffic signals are assumed for the 2031 assumed base case. Both Downie and Erie Streets have 4-legged intersections with traffic control signals, which is assumed to still be the case in 2031. All three streets provide significant access within the Stratford community.

Exhibit 14: Romeo, Downie, and Erie Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR STRATFORD EAST: ROMEO, DOWNIE, AND ERIE	Weight →	13	13	11	25	21	17			
Assumed Base Case - At-grade Stop Control Intersection at Romeo and signalized intersections at Downie and Erie	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1.2	395.00
Alternative 1 - SE-1 (Alt.2): Modern Roundabouts at Romeo Street and Downie Street; possibly at Erie Street	Rating 1-10	4.9	2.9	4.5	4.7	6.2	9.0			
	Sub Total	64	38	50	118	130	153	552	1	551.60
Alternative 2 - SE-1A (Alt.4): Modern Roundabouts at Romeo Street, Downie Street, TBD, and Erie Street with Raised Median from West of Road 111 to Erie Street	Rating 1-10	5.4	3.2	5.5	4.3	6.6	10.0			
	Sub Total	70	42	61	108	139	170	588	1.09	539.82
Alternative 3 - SE-13 (Alt.3A): SE-1 Plus Quadrant Link between Highway 7/8 and Erie Street – Traffic Signals	Rating 1-10	4.9	5.3	4.5	5.0	7.4	10.0			
	Sub Total	64	69	50	125	155	170	633	1.04	608.17
Alternative 4 - SE-14 (Alt.3B): SE-1 Plus Quadrant Link between Highway 7/8 and Erie Street – Roundabouts	Rating 1-10	3.0	5.7	4.5	4.8	6.2	5.0			
	Sub Total	39	74	50	120	130	85	498	1.26	395.08
SEEK THE BEST - NOT PERFECTION										

As seen in **Exhibit 14**, the best performing, best value alternative for the combination of Romeo, Downie, and Erie Streets is VE Proposal SE-13 (signalized intersections at all three streets plus a quadrant link between Highway 7/8 and Erie Street). Compared to the assumed base case, as well as Alternative 1, Alternative 2, and Alternative 4 (as described in the above evaluation matrix), Alternative 3 exceeded performance by 33%, 15%, 8%, and 27%, respectively, while also providing P/C ratios higher by 54%, 10%, 13%, and 54%, respectively.

3.2.14 Packham Road/Embro Road

Highway 7, south of Highway 7/8, will have a 5-lane cross-section (centre 2-Way Left-Turn Lane) to south of Road 29/Gibb Road. Packham Road/Embro Road is currently controlled by traffic control signals, as it will be in the assumed base case.

Exhibit 15: Packham Road/Embro Road Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR STRATFORD EAST: PACKHAM/EMBRO	Weight →	13	13	11	25	21	17			
Assumed Base Case - At-grade Signalized Intersection at Packham/Embro	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1.28	370.31
Alternative 1 - SE-15: Modern Roundabouts at Packham/Embro and Highway 7	Rating 1-10	4.9	5.3	4.5	5.0	5.8	10.0			
	Sub Total	64	69	50	125	122	170	599	1.00	598.90
SEEK THE BEST - NOT PERFECTION										

Exhibit 15 shows that VE Proposal SE-15 (a modern roundabout at Packham Road/Embro Road and Highway 7) would outperform the assumed base case by 26% and, due to a much more favourable cost index, would provide a higher value (P/C ratio) by 62% compared to the assumed base case.

3.2.15 Gibb Road/Road 29

As with Packham Road/Embro Road, Highway 7 will have a 5-lane cross-section (centre 2-Way Left-Turn Lane). Unlike Packham Road/Embro Road, however, Gibb Road/Road 29 is currently a stop controlled intersection as it will be in the assumed base case. The alternatives considered below would not be implemented until warranted by traffic conditions at Gibb Road/Road 29.

Exhibit 16: Gibb Road/Road 29 Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR STRATFORD EAST: GIBB/29	Weight →	13	13	11	25	21	17			
Assumed Base Case - Stop Controlled Intersection at Gibb/29	Rating 1-10	3.0	5.0	5.0	5.0	5.0	4.0			
	Sub Total	39	65	55	125	105	68	457	1.29	354.26
Alternative 1 - SE-23: Modern Roundabout at Gibb/29 and Highway 7 when warranted	Rating 1-10	4.7	6.0	4.5	5.0	5.0	7.0			
	Sub Total	61	78	50	125	105	119	538	1.07	502.43
Alternative 2 - SE-24: Traffic Signals at Gibb/29 and Highway 7 when warranted	Rating 1-10	4.8	6.5	5.0	4.8	5.0	9.0			
	Sub Total	62	85	55	120	105	153	580	1.00	579.90
SEEK THE BEST - NOT PERFECTION										

Exhibit 16 illustrates that VE Proposal SE-24 (traffic signals at the intersection of Gibb Road/Road 29 and Highway 7 when warranted) received the best performance score, which is 27% over the assumed base case and 8% over a roundabout. Traffic signals also yielded the best P/C ratio, which is 64% higher than the assumed base case and 15% higher than a roundabout.

3.2.16 St. Vincent Street

The assumed base case at St. Vincent Street will be a 'cul-de-sac'. St. Vincent Street provides access to the developed lands to the north of Lorne Avenue. With a need to consider implications of the rail grade separation on the intersection, the alternatives considered here provide realignment of St. Vincent Street through the park to allow for greater separation between the T-intersection and the railroad grade separation.

Exhibit 17: St. Vincent Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR STRATFORD WEST:ST.VINCENT	Weight →	13	13	11	25	21	17			
Assumed Base Case - 'cul-de-sac'	Rating 1-10	3.0	5.0	5.0	5.0	5.0	4.0			
	Sub Total	39	65	55	125	105	68	457	1.23	371.54
Alternative 1 - SW-6: Signalized Intersection at St.Vincent, re-align as required to the west	Rating 1-10	4.8	3.9	4.5	4.8	5.0	9.0			
	Sub Total	62	51	50	120	105	153	541	1.00	541.00
Alternative 2 - SW-5: Roundabout at St.Vincent, re-align as required to the west	Rating 1-10	4.7	3.5	4.5	5.0	5.0	7.0			
	Sub Total	61	46	50	125	105	119	505	1.03	490.29
SEEK THE BEST - NOT PERFECTION										

Exhibit 17 shows that VE Proposal SW-6 (a signalized intersection at St. Vincent Street with a realignment as required to the west) received the best performance score, 18% higher than the assumed base case and 7% higher than a roundabout. Traffic signals also yielded the best P/C ratio, which is 46% higher than the assumed base case and 10% higher than a roundabout.

3.2.17 Queensland Street, Wright Boulevard, and Freeland Drive

In the assumed base case, Queensland Street, Wright Boulevard, and Freeland Drive are all T-intersections with Highway 7/8 (Lorne Avenue) with side road stop conditions, just as they are today. Highway 7/8 will be 3 lanes in the assumed base case. Wright Boulevard provides access to Stratford from the rural area to the south while Queensland Street and Freeland Drive serve the residential areas north of Lorne Avenue.

Exhibit 18: Queensland Street, Wright Boulevard, and Freeland Drive Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR STRATFORD WEST: QUEENSLAND, WRIGHT, AND FREELAND	Weight →	13	13	11	25	21	17			
Assumed Base Case - Stop conditions at Wright, Queensland and Freeland	Rating 1-10	3.0	5.0	5.0	5.0	5.0	4.0			
	Sub Total	39	65	55	125	105	68	457	1.23	371.54
Alternative 1 - SW-12: Oval roundabout connecting both Wright and Queensland with Lorne (Hwy 8)	Rating 1-10	2.7	2.6	4.5	5.0	5.4	7.0			
	Sub Total	35	34	50	125	113	119	476	1.10	432.55
Alternative 2 - SW-13: Coordinated Split Phase Traffic Signal at Wright and Queensland	Rating 1-10	4.7	3.5	5.0	5.5	4.6	9.0			
	Sub Total	61	46	55	138	97	153	549	1.00	548.70
Alternative 3 - SW-20: Realign Wright to Freeland with Traffic Signals, (assuming traffic signals at Queensland)	Rating 1-10	4.8	3.3	4.5	4.2	3.8	9.0			
	Sub Total	62	43	50	105	80	153	493	1.00	492.60
Alternative 4 - SW-20A: Realign Wright to Freeland with Roundabout, (assuming a roundabout at Queensland)	Rating 1-10	4.9	2.9	4.0	4.7	4.2	7.0			
	Sub Total	64	38	44	118	88	119	470	1.10	427.36
SEEK THE BEST - NOT PERFECTION										

As seen in **Exhibit 18**, the best performing alternative with the highest value for the combination of Queensland Street, Wright Boulevard, and Freeland Drive is VE Proposal SW-13, a coordinated split phase traffic signal at Wright and Queensland. Freeland Drive will remain as a side road stop condition. Compared to the assumed base case, as well as Alternative 1, Alternative 3, and Alternative 4 (as described in the above evaluation matrix), Alternative 2 (VE Proposal SW-13) exceeded performance by 20%, 15%, 11%, and 17%, respectively, while also providing higher P/C ratios by 48%, 27%, 11%, and 28%, respectively. Note that Alternative 3 (VE Proposal SW-20: Realign Wright to Freeland with Traffic Signals plus traffic signals at Queensland) also scored well, with only 11% lower performance and 11% lower value.

3.2.18 Perth Line 122

The assumed base case at Perth Line 122 will be a 3-lane Highway 8 cross-section from the east; a median island on the west approach to limit Bannerd Drive access to right-in, right-out; an eastbound left-turn lane; north-south left and right-turn lanes as required; and traffic control signals. Perth Line 122 provides access to Stratford from the rural south and continues north along the west edge of Stratford as O'Loane Avenue.

Exhibit 19: Perth Line 122 Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR STRATFORD WEST: ROAD 122	Weight →	13	13	11	25	21	17			
Assumed Base Case - Signalized intersection with Bannerd right in, right out with median	Rating 1-10	3.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	39	65	55	125	105	85	474	1.24	382.26
Alternative 1 - SW-22: Roundabout on Highway 7 at Road 122	Rating 1-10	4.9	3.2	4.5	5.2	5.8	9.0			
	Sub Total	64	42	50	130	122	153	560	1.00	559.60
SEEK THE BEST - NOT PERFECTION										

Exhibit 19 shows that VE Proposal SW-22 (a roundabout on Highway 8 at Perth Line 122) outperforms the assumed base case by 18%. Thanks to a 24% more favourable cost index, the P/C ratio for the roundabout is 46% better than the assumed base case. As an added value, the roundabout could serve as a gateway feature and rural-to-urban transition for eastbound traffic entering Stratford.

3.2.19 Perth Line 125

In the assumed base case, new Highway 8 (Lorne Ave) will turn north on a channelized right turn lane to Perth Line 125. Stop control on the east-west approaches will give priority to N-E movement on new Highway 8. Perth Line 125 is a north-south route just beyond the western edge of the Stratford urban area.

Exhibit 20: Perth Line 125 Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR STRATFORD WEST: ROAD 125	Weight →	13	13	11	25	21	17			
Assumed Base Case - New 8 (Lorne Ave) turns north on channelized right turn lane to Perth Line 125. Stop control on east-west approaches give priority to N-E movement on new Highway 8	Rating 1-10	3.0	5.0	5.0	5.0	5.0	4.0			
	Sub Total	39	65	55	125	105	68	457	1.25	365.60
Alternative 1 - SW-27: Signalized Intersection at Highway 8 (Lorne Ave) and Road 125	Rating 1-10	6.1	6.8	5.0	4.8	6.2	9.0			
	Sub Total	79	88	55	120	130	153	626	1.02	613.63
Alternative 2 - SW-27A: Signalized Intersection at Highway 8 (Lorne Ave) and Road 125 with high speed right turn channelization for E-N movement	Rating 1-10	6.1	6.8	5.0	4.8	6.2	9.0			
	Sub Total	79	88	55	120	130	153	626	1.06	590.47
Alternative 3 - SW-26: Single lane roundabout at Highway 8 (Lorne Ave)and Road 125	Rating 1-10	5.8	6.3	4.5	4.8	6.6	8.0			
	Sub Total	75	82	50	120	139	136	601	1.00	601.40
Alternative 4 - SW-26A: Single lane roundabout at Highway 8 (Lorne Ave) and Road 125 with high speed right turn channelization for E-N movement	Rating 1-10	5.8	6.3	4.5	4.8	6.6	8.0			
	Sub Total	75	82	50	120	139	136	601	1.07	562.06
SEEK THE BEST - NOT PERFECTION										

Exhibit 20 illustrates that a signalized intersection at new Highway 8 (Lorne Ave) and Perth Line 125, with (VE Proposal SW-27A) or without (VE Proposal SW-27) a high speed right turn channelization for E-N movement, exceeds the performance of the assumed base case by 37%. The best P/C ratio is found in the signalized intersection without channelization, 68% above the assumed base case but only 4% above the channelized case. However, it should be noted that both roundabout alternatives were only outperformed by 4% and the roundabout without channelization also had an excellent P/C ratio, only 2% below the signalized intersection without channelization. In short, all of the alternatives to the assumed base case at this location scored very well.

3.2.20 New Highway 8 at Old Highway 8

In the assumed base case, the eastbound improved Highway 8 alignment will turn south on a channelized right turn lane to new Highway 8 (existing Perth Line 125). Stop control will be provided on north-south approaches to provide service for the larger east-west movement along the existing Highway 8, which is the main access into Stratford from the west.

Exhibit 21: New Highway 8 at Old Highway 8 Evaluation

Page 1 of 1	EVALUATION MATRIX										
1. HOW WELL DOES THE ALTERNATIVE SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) FROM RESPECTIVE SCORING SHEET. 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Human Factors Assessment	Sustainability	Natural Environment	Community Impacts	Traffic Operations	Roadway User Safety	Total Performance (P)	Cost Index (C)	P/C
ALTERNATIVES FOR STRATFORD WEST: NEW HIGHWAY 8 AT OLD HIGHWAY 8	Weight →	13	13	11	25	21	17			
Assumed Base Case - EB New Highway 8 turns south on channelized right turn lane to Perth Line 125. Stop control on north-south approaches favours larger E-W movement on existing Highway 8	Rating 1-10	3.0	5.0	5.0	5.0	5.0	4.0			
	Sub Total	39	65	55	125	105	68	457	1.23	371.54
Alternative 1 - SW-38: Signalized intersection with high speed right turn channelization for west to south movement	Rating 1-10	6.1	6.5	5.0	4.8	6.2	7.0			
	Sub Total	79	85	55	120	130	119	588	1.16	506.90
Alternative 2 - SW-36: Single lane roundabout with high speed right turn channelization for west to south movement	Rating 1-10	5.8	6.3	4.5	4.8	6.6	9.0			
	Sub Total	75	82	50	120	139	153	618	1.00	618.40
SEEK THE BEST - NOT PERFECTION										

As seen in **Exhibit 21**, the best performing alternative with the highest value at this location is a single lane roundabout with a high speed right turn channelization for west to south movement (VE Proposal SW-36). This alternative performed 35% better than the assumed base case and has a P/C ratio that is 66% higher than the assumed base case. While the single lane roundabout only performed 5% better than signalized intersection with channelization, its P/C ratio (value) was 22% higher.

4. VE PROPOSALS

4.1 Introduction

The results of the Highway 7/8 VE Study Development Phase are presented as 43 independent VE Proposals, which are individual alternatives for individual intersections or segments of the corridor. These proposals are documented in **Appendix A** and were developed from selected creative ideas as discussed in **Section 5**. In addition, there are 8 design suggestions for which definitive proposals could not be made or quantified. These suggestions are included in the Creative Idea Listings in **Section 5**, designated under VE Team Action as DS, and are also included in **Appendix A**. The number of VE Proposals and Design Suggestions by Value Target Area are shown in **Table 4**.

Table 4: VE Proposals and Design Suggestions by Value Target Area

Value Target Area	VE Proposals Developed	Design Suggestions
New Hamburg	10	0
Rural Areas	9	3
Shakespeare	5	0
Stratford East	7	3
Stratford West	12	2
Total	**43**	**8**

Developed as proposals during the Workshop but designated as Design Suggestions during the Implementation Meeting

4.2 Development of VE Proposals

The VE Team developed selected ideas and documented them as VE Proposals using specialized VE forms. The individual responsible for each proposal was charged with capturing the input of the entire VE team. The subject idea was developed as far as time and resources would allow. Development consisted of preparing a recommended design with verbal descriptions of the assumed base case and the alternative, advantages and disadvantages of the alternative, discussion/justification, implementation considerations, qualitative performance, and sketches. The present design was also documented with verbal descriptions and sketches, where appropriate, for comparison. As discussed in **Sections 6** and **8**, capital cost savings were not determined since no cost estimate was available for the Highway 7/8 project. In addition, since the objective of the VE Study was to generate a "bucket of alternatives" for planning purposes in the continuing EA process, it was agreed that detailed cost estimates for the many expected options was not the best use of the VE Team's time.

The complete VE Proposal Documentation is included in **Appendix A**. **Table 5** shows a Summary of all VE Proposals.

Table 5: Summary of all VE Proposals

Idea No.	Description
NH – 2	Nafziger Road - parclo A-2
NH – 5	Nafziger Road - tight diamond north, wider ramps on south
NH – 27	Bleams/Hamilton – Roundabout; Close Victoria Street
NH – 34	Upgrade to complete freeway with interchanges at Nafziger, Peel and Regional Rd 1
NH – 42	Grade Separated Roundabout at Peel
NH – 45	Peel Street: Bucksaw IC with Flyover to West
NH – 54	Huron Street – Realign with Interchange at Highway 7/8
NH – 62	Freeway/Arterial Combination
NH – 62A	Freeway/Arterial Combination – Roundabouts
NH – 63	Roundabout at Highway 7/8, Huron and Wilmot Easthope
RA – 15	Median directional intersections on existing Highway 7&8 at Perth Line 102, 104 and 106
RA – 18	Perth Line 108 to flyover new Highway 7/8 with no connections
RA – 22B	Median directional intersections on existing Highway 7&8 at Perth Line 108
RA - 23D	WB Perth 33 and NB Perth 110 merge and Tie into New Highway7/8 at Signalized Intersection; 110 continues NB as 4th leg of intersection.
RA – 23E	WB Perth 33 and NB Perth 110 merge and Tie into New Highway7/8 at Roundabout; 110 continues NB as 4th leg of Roundabout.
RA – 30	Perth Line110 under new 7/8; WB Perth Line 33 under new 7/8; EB directional ramp to 33; 33/110 is stop control
RA – 39	Perth Line 111connects to New Highway 7/8 as Signalized Intersection
RA – 40	Perth Line 111connects to New Highway 7/8 at a Roundabout
RA – 43	At-grade Perth Road 109 with railway and traffic signals on the preferred route. Interconnect with railway crossing signals.
SH – 5	Shakespeare east – Westbound access only (Split off to right)
SH – 12	Grade separate Perth Road 107 from Railway; Connect with roundabout on the preferred route.
SH – 13	Grade separate Perth Road 107 from Railway and connect with signalized intersection on the preferred route
SH – 23	Grade separate Perth Road 109 from Railway; Connect with roundabout on the preferred route.
SH – 24	Grade separate Perth Road 109 from Railway and connect with signalized intersection on the preferred route
SE – 1	Modern Roundabouts at Romeo Street and Downie Street; possibly at Erie Street
SE – 1A	Median from east of Road 111 to Erie Street
SE – 13	Quadrant Link between Highway 7/8 and Erie Street - Roundabouts
SE – 14	Quadrant Link between Highway 7/8 and Erie Street – Traffic Signals
SE – 15	Packham Road/Embro Road – Roundabout
SE – 23	Road 29/Gibb Road – Roundabout

Idea No.	Description
SE – 24	Road 29/Gibb Road – Traffic Signals
SW – 1	Reroute Monteith along upgraded Patterson
SW – 5	Roundabout at St. Vincent, re-align as required to the west
SW – 6	Signalized Intersection at St. Vincent, re-align as required to the west
SW – 12	Oval Roundabout at Wright and Queensland
SW – 13	Coordinated Split Phase Traffic Signal at Wright and Queensland
SW – 20	Realign Wright to Freeland with Traffic Signals, (assuming traffic signals at Queensland)
SW – 20A	Realign Wright to Freeland with Roundabout, (assuming a roundabout at Queensland)
SW – 22	Highway 7 at Road 122 - roundabout
SW – 26A	Roundabout, option for high-speed east to north right turn channelization
SW – 27A	Signalized intersection, option for high-speed east to north right turn channelization
SW – 36	Roundabout with high-speed west to south right turn channelization
SW – 38	Signalized intersection with high-speed west to south right turn channelization

5. IDEA CREATION AND EVALUATION

5.1 Introduction

During the Creative Phase, the VE Team brainstormed in as many ways as possible to achieve the Highway 7/8 project's value target areas, generating 234 creative ideas. These creative ideas were then evaluated via the evaluation process discussed below. A Summary of Creative Ideas and Evaluation, grouped by value target area, is provided in **Table 7** through **Table 11**.

5.2 Initial Evaluation Process

Keeping the performance criteria in **Section 6** and their weights in mind, the VE Team ranked the creative ideas by consensus from 1 (worst) to 10 (best), selecting the ideas scoring an 8 or above for development. On some ideas, consensus was only gained after much discussion. As a result of the evaluation phase, those ideas representing the greatest potential for cost savings and/or value improvement were selected for further development in the workshop. Care was taken not to discard ideas too easily as some could be viewed in a more favourable light as the workshop proceeded. As a result of the evaluation process, 43 ideas were considered to have potential for cost savings and/or value improvement. These ideas were developed further by the VE Team and resulted in 43 VE Proposals and 8 Design Suggestions for consideration of the MTO West Region going forward. A summary of the above is presented in **Table 6**. Each idea's "rank" and the VE Team's Action are included in the Summary of Creative Ideas in **Table 6** and Evaluation in **Table 7** through **Table 11**.

Table 6: Summary of Creative Ideas

Value Target Areas	No. of Ideas Generated	No. of Ideas Dropped	No. of Ideas Developed as VE Proposals	No. of Design Suggestions	No. of Ideas Combined With Others	No. of Ideas Already Being Done
New Hamburg	64	53	10	0	1	0
Rural Areas	51	37	9	3	0	2
Shakespeare	46	41	5	0	0	0
Stratford East	26	15	7	3	0	1
Stratford West	47	27	12	2	1	3
Total	**234**	**173**	**43**	**8**	**2**	**6**

Table 7: Creative Ideas and Evaluation – Value Target Area: New Hamburg

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
NH - 1	Nafziger Road - parclo A-4	8	NR
NH - 2	Nafziger Road - parclo A-2	8	P
NH - 3	Nafziger Road - Maintain existing signalized at grade intersection with improvements	7	X
NH - 4	Nafziger Road. - Roundabout	6	X
NH - 5	Nafziger Road - tight diamond north, wider ramps on south	9	P
NH - 6	Nafziger Road - tunnel	1	X
NH - 7	Nafziger Road - grade separation only	2	NR
NH - 8	Nafziger Road - SPUI	8	P
NH - 9	Nafziger Road - right in - right out with grade separation	7	X
NH - 10	Nafziger Road - button hook to service road (Gingerich)	4	X
NH - 11	Bleams Road realigned through to Nafziger, close Hamilton at 7/8	5	X
NH - 12	Nafziger Road - At grade with J turns	2	X
NH - 13	Elevated Highway	1	X
NH - 14	Side street overpass	2	X
NH - 15	Create another access point midway between Nafziger and Hamilton Road. Connecting Bleams Road to a new location of Hwy 7 where there would be a new connection into NH. Close Hamilton - Flyover Nafziger. See sketch	7	X
NH - 16	Extend Future Street across Nith River	2	X
NH - 17	NH 15+ flyover at Nafziger (same as 15)	1	wNH15
NH - 18	NH 17 + flyover from Bleams to Hamilton	2	X
NH - 19	Extend Future Street from Nafziger to Downtown (bridge), Close Victoria, Flyover Hamilton, IC at either Nafziger or midblock between Hamilton and Nafziger (see sketch)	2	X
NH - 20	Build east-west connection from Hamilton to Nafziger with a button hook to Hwy 7/8 for westbound traffic and parclo B for eastbound traffic. Flyover Nafziger.	3	X
NH - 21	NH 10 plus service road through Hamilton road (flyover) with a button hook to the north side service road.	3	X
NH - 22	NH 21 + service road on south side with button hook west of Hamilton and west of Nafziger.	3	X

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
NH - 23	Structure at Bleams Road across 7/8 and Nith River.	4	X
NH - 24	Hamilton flyover (assumes connection remains at Nafziger)	6	X
NH - 25	Hamilton - flyover (connected) with right in - right out	7	X
NH - 26	Hamilton - Tight diamond	3	X
NH - 27	Hamilton - Roundabout	7	P
NH - 28	Hamilton - signalized intersection with improvements	8	NR
NH - 29	Hamilton - no connection right in - right out	3	X
NH - 30	Hamilton - J turn at grade	3	X
NH - 31	60 km/hr speed limit with at grade intersections through New Hamburg	1	X
NH - 32	Roundabouts at Hamilton, Victoria, Nafziger, Peel	4	X
NH - 33	NH 32 - close Victoria	5	X
NH - 34	Upgrade to complete freeway with 3 interchanges (Nafziger, Peel and Waterloo Rd 1 includes flyovers at every other intersection)	9	P
NH - 35	Change staged freeway designation to arterial designation btw Foundry and Waterloo Road 1	1	X
NH - 36	Close Victoria Street	8	NR
NH - 37	Victoria right in - right out (with median barrier)	6	X
NH - 38	Parclo AB at Peel St.	8	NR
NH - 39	Signalized intersection with improvements at Peel	8	NR
NH - 40	SPUI at Peel	3	X
NH - 41	Tight urban diamond at Peel	8	NR
NH - 42	Grade separated roundabout at Peel	8	P
NH - 43	grade separation - no access at Peel	1	X
NH - 44	grade separation with right in - right out at Peel	3	X
NH - 45	Bucksaw IC (west side) with a new flyover with a right in right out at Peel	8	P
NH - 46	SW quadrant intersection with flyover (Peel)	5	X
NH - 47	Use of Walker road to supplement Peel St.	2	X
NH - 48	Walker - right in / right out with median	8	NR
NH - 49	Walker - close it (if improvements at Peel)	8	NR
NH - 50	Walker - roundabout	5	X
NH - 51	Walker - signalize intersection	5	X
NH - 52	Walker - flyover	3	X
NH - 53	Walker - flyover with intersection to east (full movement)	3	X

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
NH - 54	Huron - realign with IC at 7/8	9	P
NH - 55	Huron - signalize intersection with improvements	8	NR
NH - 56	Huron - roundabout (5 legged)	6	X
NH - 57	Huron - double roundabout (one at each intersection)	5	X
NH - 58	Huron - realign with signalized intersection	4	X
NH - 59	Huron - southwest quadrant intersection with flyover	4	X
NH - 60	Huron - diamond on the north, A4 on the south (sketch)	2	X
NH - 61	Huron – Buttonhook IC	8	NR
NH - 62	Freeway/Arterial Combination – Signalized Int.	8	P
NH – 62A	Freeway/Arterial Combination – Roundabout	8	P
NH – 63	Roundabout at Highway 7/8, Huron/Wilmot and Easthope	8	P

VE Team Action Legend:

P = Proposal
DS = Design Suggestion (value of suggestion is not quantifiable at time of workshop)
w = Developed together with
NR = Not recommended due to issues discovered during development
X = Dropped from consideration as infeasible or not recommended
ABD = Already part of assumed base case design

Table 8: Creative Ideas and Evaluation – Value Target Area: Rural Areas

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
RA - 1	Service road along the railway with flyovers	2	X
RA - 2	Over build shoulder for farm vehicles	9	DS
RA - 3	Every flyover requires button hook style access	2	X
RA - 4	traffic signals with detection on the side roads	5	X
RA - 5	Beacon used to indicate agricultural vehicles on Hwy	3	X
RA - 6	Roundabout option	2	X
RA - 7	Right in - Right out with flyovers with 1 metre flush median	1	X
RA - 8	Operating agreements with agricultural businesses that they do not cross at peak hours	8	DS
RA - 9	leave assumed base case with left turn lanes - unsignalized intersections	8	ABD
RA - 10	Right in - Right out with flyovers with median barrier	3	X
RA - 11	Close 102 + 106 and direct to 104	2	X
RA - 12	Close 104 and direct 102 + 106	2	X
RA - 13	Flyover at 102 + 106 and direct to 104	2	X
RA - 14	Flyover at 104, and direct to 102 + 106	2	X
RA - 15	Median directional intersection for 102, 104, 106 (see 11/17 sketch)	8	P
RA - 16	108, 109 and/or 111 - provide emergency services with remote/breakaway gates (in conjunction with closing or fly over)	8	DS
RA - 17	108 and/or 109 - close	9	X
RA - 18	108, 109, and/or 111 - fly over	9	P
RA - 19	108, 109, and/or 111 - right in, right out	2	X
RA - 20	108, 109, and/or 111 - int - stop n/s	8	ABD
RA - 21	108, 109, and/or 111 - int - signal	2	X
RA - 22A	108, 109, and/or 111 - roundabout	2	X
RA - 22B	108, 109, and/or 111 - Median directional intersection (see 11/17 sketch)	8	P
RA - 23A	110/33 - direct connection Perth 33 to 110/33 north, tee 110/33 south into curve (flyover)	3	X
RA - 23B	110/33 - direct connection Perth 33 to 110/33 north, tee 110/33 south into curve (stop control int)	2	X
RA - 23C	110/33 - direct connection Perth 33 to 110/33 north, tee 110/33 south into curve (roundabout)	7	X
RA - 23D	110/33 - direct connection Perth 33 to 110/33 north,	8	P

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
	tee 110/33 south into curve (signals)		
RA – 23E	WB Perth 33 and NB Perth 110 merge and Tie into New Highway7/8 at Roundabout; 110 continues NB as 4th leg of Roundabout.	8	P
RA - 24A	110/33 - swing 110/33 to west, tee Perth 33 into 110/33 to south (flyover) see sketch	3	X
RA - 24B	110/33 - swing 110/33 to west, tee Perth 33 into 110/33 to south (stop control int) see sketch	2	X
RA - 24C	110/33 - swing 110/33 to west, tee Perth 33 into 110/33 to south (roundabout) see sketch	6	X
RA - 24D	110/33 - swing 110/33 to west, tee Perth 33 into 110/33 to south (signals) see sketch	7	X
RA - 25	110/33 - direct connection to Perth 33 east, 110/33 north flyover 7/8 alignment tee into Perth 33.	3	w23
RA - 26	110/33 - bucksaw/button hook	3	X
RA - 27	110/33 - grade separation over alignment and connection btw 110/33 and Lorne with signals, and realigning 33 into signals (see sketch)	3	X
RA - 28	110/33 - interchange, new 7/8 grade separation over at-grade 110/33 w/ direct access to P33 and tight diamond to north (see sketch)	3	X
RA - 29	110/33 - Perth 33 continuous access east/west and partial westbound access from 110/33 north, partial eastbound access 110/33 south	2	X
RA - 30	110 flyover new 7/8, 33 westbound under new 7/8 and connect, eastbound direct off ramp to 33 (include sub options as described above) see sketch.	8	P
RA - 31	110 terminated north of new 7/8, 33 westbound under new 7/8 and connect, eastbound direct off ramp to 33 (include sub options as described above) see sketch.	7	X
RA - 32	110 flyover new 7/8, with a tee from Perth 33 to new 7/8 (includes sub options from above)	4	X
RA - 33	new 7/8 over 110, Perth terminates west 110, connect Perth 33 to new 7/8	4	X
RA - 34	111 - with flyover, with signalized quadrant intersection in south west or northeast corners.	6	X
RA - 35	111 - with flyover, with right in, right out, quadrant intersection in south west and northeast corners.	7	X
RA - 36	111 - fly over	3	X
RA - 37	111 - right in, right out	2	X

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
RA - 38	111 - int - stop n/s	2	X
RA - 39	111 - int - signal	8	P
RA - 40	111 - roundabout	8	P
RA - 41	111 - Median directional intersection (see 11/17 sketch)	4	X
RA - 42	111 - Realign to the east with bucksaw interchange.	7	X
RA - 43	109 - At grade int with signals coordinate with railway signals, and upgrades to existing 7/8 int	8	P

VE Team Action Legend:

P = Proposal
DS = Design Suggestion (value of suggestion is not quantifiable at time of workshop)
w = Developed together with
NR = Not recommended due to issues discovered during development
X = Dropped from consideration as infeasible or not recommended
ABD = Already part of assumed base case design

Table 9: Creative Ideas and Evaluation – Value Target Area: Shakespeare

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
SH - 1	East - Tee connection (stop control) from 7/8 to SH Bypass	2	X
SH - 2	East - Roundabout from 7/8 to SH Bypass	8	NR
SH - 3	East - Signalized intersection from 7/8 to SH Bypass	8	NR
SH - 4	East - SH 3 with a directional ramp	9	NR
SH - 5	East - Westbound access only (split off)	8	P
SH - 6	East - Westbound (split off) with eastbound over/underpass	7	X
SH - 7	East - Full moves Trumpet	2	X
SH - 8	East - Right in - right out intersection with or w/o left turn median move	2	X
SH - 9	East - SH bypass tees into 7/8	1	X
SH - 10	East - Partial trumpet	6	X
SH - 11	106 at grade roundabout and tie into the new alignment to the east.	1	X
SH - 12	59 - Roundabout with grade separated tracks (59 with railway)	8	P
SH - 13	59 - Signalized intersection with grade separated tracks (59 with railway)	8	P
SH - 14	59 - highway 7/8 over/under 59	2	X
SH - 15	Swinging the alignment further south for signalized at grade intersection at 59. No grade separation at tracks.	6	X
SH - 16	Bypass, westbound east button hook (right in - right out - cross the rail line), west button hook (right in - right out cross the rail line), eastbound direction partial diamond (see sketch)	5	X
SH - 16A	Bypass, westbound button hook, eastbound direction partial diamond (see sketch)	8	NR
SH - 17	59 - 2 button hooks (right in - right out), and a local realignment 7/8 over 59	3	X
SH - 18	7/8 grade separated over 59, quadrant connection - signalized tee intersection	5	X
SH - 18A	7/8 grade separated over 59, quadrant connection - signalized tee intersection (right in, right out)	7	X
SH - 19	7/8 diversion to allow for a full interchange A2, A4	6	X
SH - 20	Rotary interchange with grade separation (as per I135 and 1st st. in Newton Kansas, US 75 at northwest 46 st. in Topeka Kansas)	3	X
SH - 21	Close 59	1	X

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
SH - 22	59 - J turn (right in - right out on 7/8)	2	X
SH - 23	109 - Roundabout with grade separated tracks (109 with railway) improvements required existing 7/8	8	P
SH - 24	109 - Signalized intersection with grade separated tracks (109 with railway) improvements required existing 7/8	8	P
SH - 25	109 - highway 7/8 over/under 109	3	X
SH - 26	Swinging the alignment further south for signalized at grade intersection at 109. No grade separation at tracks.	6	X
SH - 27	Bypass, westbound east button hook (right in - right out - cross the rail line), west button hook (right in - right out cross the rail line), eastbound direction partial diamond	2	X
SH - 28	109 - 2 button hooks (right in - right out), and a local realignment 7/8 over 109	3	X
SH - 29	7/8 grade separated over 109, quadrant connection - signalized tee intersection	2	X
SH - 30	7/8 diversion to allow for a full interchange	8	NR
SH - 31	Rotary interchange with grade separation (as per I135 and 1st st. in Newton Kansas, US 75 at northwest 46 st. in Topeka Kansas)	3	X
SH - 32	Close 109	1	X
SH - 33	109 - J turn (right in - right out on 109)	1	X
SH - 34	New connection between the old 7/8 and new alignment (to from the west only) - partial trumpet	3	X
SH - 35	West - Tee connection (stop control) from 7/8 to SH Bypass	2	X
SH - 36	West - Roundabout from 7/8 to SH Bypass	4	X
SH - 37	West - Signalized intersection from 7/8 to SH Bypass	4	X
SH - 38	West - eastbound split off, and westbound tee	4	X
SH - 39	West - westbound access only (split off)	4	X
SH - 40	West - Eastbound (split off) with westbound over/underpass	4	X
SH - 41	West - Trumpet	4	X
SH - 42	West - Right in - right out intersection with or w/o left turn median move	4	X
SH - 43	SH bypass tees into new alignment	2	X
SH - 44	Partial trumpet	2	X

VE Team Action Legend:

P = Proposal
DS = Design Suggestion (value of suggestion is not quantifiable at time of workshop)
w = Developed together with
NR = Not recommended due to issues discovered during development
X = Dropped from consideration as infeasible or not recommended
ABD = Already part of assumed base case design

Table 10: Creative Ideas and Evaluation – Value Target Area: Stratford East

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
SE - 1	Romeo, Downie, Erie, - roundabout	9	P
SE - 1A	Romeo, Downie, Erie, - roundabout with median	9	P
SE - 2	Romeo, Downie, Erie - signalized intersection	8	ABD
SE - 3	Romeo, Downie, Erie - signalized with permissive U-turns with median (at intersections)	5	X
SE - 4A	7/8 midblock U-turns	5	X
SE - 4B	7/8 parallel service roads	7	X
SE - 5	Local Residential and Local Industrial: Morgan, Home, Scott St., Mowat, Humber, Oak, Boyd, Dunlop, Dufferin, Railway Ave. - Close as appropriate with assumed base case	8	DS
SE - 6	Local Residential and Local Industrial: Morgan, Home, Scott St., Mowat, Humber, Oak, Boyd, Dunlop, Dufferin, Railway Ave. - right in, right out as appropriate with median options	8	DS
SE - 7	Local Residential and Local Industrial: Morgan, Home, Scott St., Mowat, Humber, Oak, Boyd, Dunlop, Dufferin, Railway Ave. - signalized intersection	2	X
SE - 8	Local Residential and Local Industrial: Morgan, Home, Scott St., Mowat, Humber, Oak, Boyd, Dunlop, Dufferin, Railway Ave. - roundabout (not all - select best location)	8	DS
SE - 9	Crane (along Erie) - roundabout	2	X
SE - 10	Crane (along Erie) - signalized intersection	3	X
SE - 11	Crane (along Erie) - signalized with permissive U-turns with median (at intersections)	4	X
SE - 12	Crane (along Erie) - right in, right out with median	7	X
SE - 13	Roundabout Lorne at Dufferin, and new connection to Erie with roundabout bypassing the intersection	9	P
SE - 14	Sig. Int Lorne at Dufferin, and new connection to Erie with sig. int. bypassing the intersection	8	P
SE - 15	Packham and Embro - roundabout	8	P
SE - 16	Packham and Embro - signalized intersection	8	NR
SE - 17	Packham and Embro - signalized with permissive U-turns with median (at intersections)	3	X
SE - 18	Gibb/29 - flyover no access	1	X
SE - 19	Gibb/29 - close both	1	X
SE - 20	29 - Close	1	X
SE - 21	Gibb - Close	1	X

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
SE - 22	Gibb/29 - right in, right out	3	X
SE - 23	Gibb/29 - roundabout	8	P
SE - 24	Gibb/29 - signalized intersection	8	P

VE Team Action Legend:

P = Proposal
DS = Design Suggestion (value of suggestion is not quantifiable at time of workshop)
w = Developed together with
NR = Not recommended due to issues discovered during development
X = Dropped from consideration as infeasible or not recommended
ABD = Already part of assumed base case design

Table 11: Creative Ideas and Evaluation – Value Target Area: Stratford West

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
SW - 1	Linton, Monteith Close as appropriate	9	P
SW - 2	Linton, Monteith - Right in, right out -	3	X
SW - 3	Linton, Monteith one way couplets	3	X
SW - 4	Retain at grade crossing of railway	8	NR
SW - 5	St. Vincent - Roundabout	8	P
SW - 6	St. Vincent - Signalized Intersection	8	P
SW - 7	St. Vincent - Maintain stop condition	8	ABD
SW - 8	Roundabout above railway tracks connecting Monteith and Linton	1	X
SW - 9	Service Road connecting Monteith and St. Vincent	1	X
SW - 10	Service Road connecting Monteith and St. Vincent and Queensland	1	X
SW - 11	Raise Lorne over railway, take Linton and Monteith under structure to service Lorne	1	X
SW - 12	Queensland, Wright Blvd, - two roundabouts (as appropriate)	8	P
SW - 13	Queensland, Wright Blvd, - signalized intersection	7	P
SW - 14	Queensland, Wright Blvd, - oval roundabout connecting the two	2	X
SW - 15	Queensland, Wright Blvd, - right in, right out	3	X
SW - 16	Freeland - Close	1	X
SW - 17	Freeland - right in, right out	7	X
SW - 18	Freeland - signalized intersection	7	X
SW - 19	Freeland - roundabout	8	NR
SW - 20	Realign Wright to Freeland intersection	9	P
SW – 20A	Realign Wright to Freeland with Roundabout, (assuming a roundabout at Queensland)	8	P
SW - 21	122 - signal	8	ABD
SW - 22	122 - roundabout	9	P
SW - 23	122 - maintain stop condition	1	X
SW - 24a	Bannerd Drive - close	9	P
SW - 24B	Bannerd Drive - right in, right out,	8	P
SW - 25	Same as 26A	9	w26A
SW - 26	125 - roundabout	8	NR
SW – 26A	125 - roundabout with east/north bypass	8	P
SW - 27	125 - signal	8	NR
SW - 27A	125 - signal with high speed east/north channelization	9	P
SW - 28	125 - direct connection Lorne to 125, tee 125 to	5	X

Idea No.	Description	Evaluation Rank 10 = Best	VE Team Action
	alignment, tee 32 to 125 south		
SW - 29	125 - direct connection Lorne to 125, tee 32 into realignment, tee 125 south to 32	6	X
SW - 30	125 - direct connection Lorne to 125, direct connection from 125 south to 32, tee connection btw to realignments	4	X
SW - 31	125 - unsignalized with east/north channelization	8	ABD
SW - 32	Add traffic calming measures as approaching urban Stratford	8	DS
SW - 33	125 at rail crossing - protect property	8	DS
SW - 34	125 at rail crossing - defer	2	X
SW - 35	125 and 8 - roundabout	7	X
SW - 36	125 and 8 - roundabout with west/south bypass	8	P
SW - 37	125 and 8 - signal	7	X
SW - 38	125 and 8 - signal with high speed west/south channelization	8	P
SW - 39	125 and 8 - direct connection 125 to Huron, tee 125 to Huron, tee Huron to new 8	5	X
SW - 40	125 and 8 - tee Huron to 125, tee 125 to new 8	3	X
SW - 41	125 and 8- direct connection Huron to 125, direct connection from 125 south to 8, tee connection btw to realignments	1	X
SW - 42	125 and 8 - unsignalized with west/south channelization	1	X
SW - 43	125 and 8 - direct connection 125 south to 8 west, tee Huron road into curve. Tee 125 north in west of curve.	1	X

VE Team Action Legend:

P = Proposal
DS = Design Suggestion (value of suggestion is not quantifiable at time of workshop)
w = Developed together with
NR = Not recommended due to issues discovered during development
X = Dropped from consideration as infeasible or not recommended
ABD = Already part of assumed base case design

6. PROJECT ANALYSIS

6.1 Summary of Analysis

The following value analysis tools were used to analyze the Highway 7/8 project:

- Capital, Maintenance and User Cost Indices
- FAST Diagram
- Performance Criteria and Measures
- Performance Criteria Weighting

The results of these analyses led to a clearer understanding of the project and are detailed later in this chapter.

Due to the early stage of the EA process, there was no cost estimate available for the Highway 7/8 project for use in creating a Pareto Cost Analysis or a detailed parametric cost model. In addition, since the objective of the VE Study was to generate a "bucket of alternatives" for planning purposes in the continuing EA process, it was agreed that detailed cost estimates for the many expected options was not the best use of the VE Team's time. As a result, a scale was developed for Capital Cost, Maintenance Cost, and User Cost indices to help the VE Team in evaluating the cost implications of various ideas.

The FAST Diagram shows two basic functions for the Highway 7/8 project, as described in the detailed discussion below. A total of nine higher order functions are included in the FAST Diagram to place the "bucket of alternatives" in the context of overall improvements to the Highway 7/8 corridor.

The VE Team developed project specific Performance Criteria and Measures based on the project information and much discussion. The Performance Measures were refined several times during the workshop and the final version is presented in this section. The Team then weighted the Performance Criteria as shown herein. These criteria were used informally during the initial evaluation of ideas and formally through the Evaluation Matrix during the Scenario Development Phase.

All of the above analyses guided the overall VE Team to the selection of the following Value Target Areas prior to moving on to the Creative Phase:

- New Hamburg
- Rural Areas
- Shakespeare
- Stratford East
- Stratford West

6.2 Capital, Maintenance and User Cost Indices

To help evaluate the cost implications of various alternatives generated during the VE Study in the absence of a cost estimate, the following scales for Capital, Maintenance and User Cost indices were developed for the use of the VE Team. The Capital, Maintenance and User Cost indices were used as described below under Performance Criteria and Measures to evaluate alternatives against each other.

Table 12: Determination of Capital, Maintenance and User Cost Indices

Description (Assumes basic traffic lanes are in place)	Range of Costs	Capital Cost* Index	Maintenance Cost Index	User Cost** Index
Assumed Base Case: At-grade signalized intersection with minor improvements	$0.15M - $0.25M	10	7	3
At-grade signalized intersection with moderate improvements	$0.25M - $0.45M	9	6	4
At-grade signalized intersection with turn lanes or other major improvements OR One lane roundabout	$0.45M - $0.65M	8	5 for signal, 10 for 1-lane roundabout	5
Two lane roundabout	$0.65M - $1M	7	9	5
Three lane roundabout	$1M - $1.5M	6	8	5
Partial interchange	$1.5M - $3M	5	5	6
Tight diamond interchange	$3M - $4.5M	4	4	7
Parclo A-2 Interchange	$4.5M - $5.5M	3	3	8
Parclo A-4 Interchange	$5.5M - $6.5M	2	2	9
Parclo A-4 IC + additional thru lane	>$6.5M	1	1	10

* If concept adds a median to one of the above descriptions, **reduce** Index by 1.

If concept adds a thru lane to one of the above descriptions, **reduce** Index by 1.

If concept reduces thru lanes by one from the above descriptions, **increase** Index by 1.

**For User Cost Index only:

If concept changes intersection retained in assumed base case to right in, right out, **reduce** Index by 1.

If concept closes a side road that the assumed base case does not, **reduce** Index by 1 or 2 depending on the significance of the side road.

If concept changes intersection closed in assumed base case to right in, right out, **increase** Index by 1.

If concept leaves a side road open that the assumed base case closes, **increase** Index by 1 or 2 depending on the significance of the side road.

NOTE: Where an idea has several intersections linked together, simply score each intersection and then average the scores to find the overall Index.

6.3 FAST Diagram

The Function Analysis Systems Technique (FAST) Diagram shown in this section documents the results of the function analysis performed by the VE Team on the Highway 7/8 project. Function analysis helps the VE Team clearly understand the relationships of the functions to one another, and how they work together to satisfy the requirements of the project. A FAST diagram graphically illustrates the interrelationships of the project functions and is often invaluable in accomplishing this understanding.

Guidelines for arranging functions logically into a FAST diagram are included below to assist the reader in understanding the FAST diagram which follows.

1. Two vertical dashed lines, known as Scope Lines, define the scope of the project and the VE Study. The scope lines are usually near the left and right margins.
2. The FAST diagram has a "critical path of functions" going from left to right across the scope lines. A bold line represents the critical path.
3. The critical path contains only the basic function(s) (immediately to right of left scope line) and required secondary functions. Higher order functions (related goals beyond the scope of the VE Study) are sometimes included on the critical path, to the left of the basic function(s). The critical path can have parallel branches.
4. Required secondary functions are to the right of the basic function.
5. All other secondary functions, which can be supporting functions, aesthetic functions or unwanted functions, are either above or below the critical path.
6. Functions that "happen at the same time" and/or "are caused by" a function on the critical path are placed below the related critical path function.
7. Functions which happen "all the time", such as an aesthetic function, are placed above the critical path function to the extreme right of the diagram.
8. Specific "design objectives" are placed above the basic functions or required secondary functions on the left side of the diagram.
9. Proper arrangement and relationships of the functions in the FAST diagram can be confirmed with the how-why logic test as follows:
    a. Ask the question of any function, "How do I *verb-noun*?" The answer should be the function to the immediate **right**.
    b. Ask the question "Why do I *verb-noun*?" The answer should be the function to the immediate **left** i.e., "So that I can *verb-noun*."
    c. A function that does not pass the how-why test is either described improperly or is in the wrong place. The answer must make sense.
10. Our prime concern when constructing a FAST diagram is the essential function. All functions on the critical path must occur to accomplish the basic function. All other functions on the FAST diagram are subordinate to the critical path function and may or may not have to take place to accomplish the basic functions. These functions are often the source for VE targets and resulting savings.

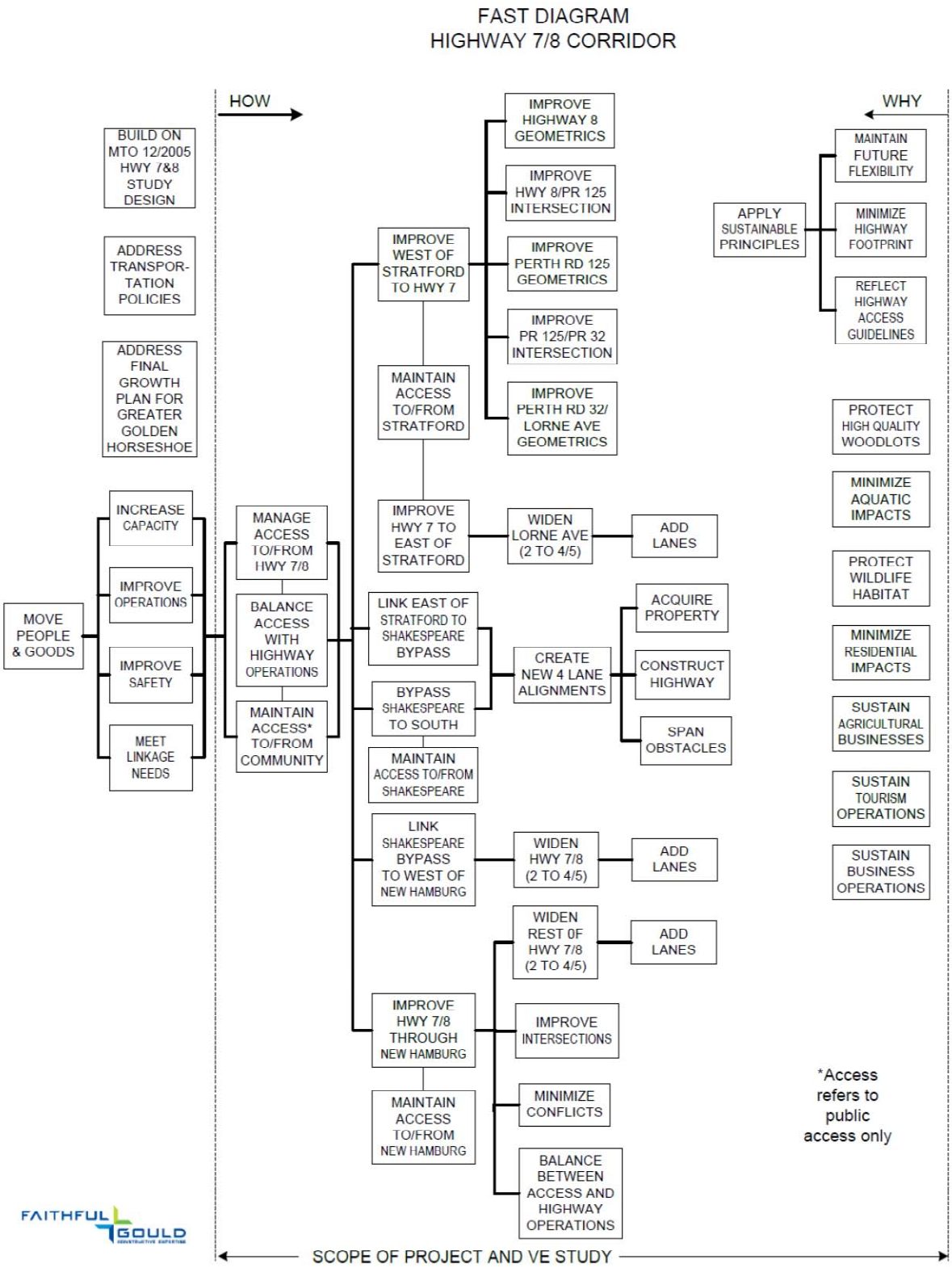
The VE Team Leader prepared a draft FAST diagram for the Highway 7/8 project prior to the workshop and presented it to the VE Team during the workshop for discussion. During discussion, the VE Team added some additional functions and redefined other functions until participants agreed on the resulting FAST diagram.

The FAST Diagram identifies two basic functions for the Highway 7/8 project: **Manage Access To/From Highway 7/8** and **Maintain Access To/From Community**. These basic functions are of equal importance and joined by a common design objective to **Balance Access with Highway Operations.** A total of nine higher order functions are included in the FAST Diagram to place the "bucket of alternatives" in the context of overall improvements to the Highway 7/8 corridor. Of the four higher order functions just "upstream" of the basic functions, three (**Increase Capacity, Improve Operations and Improve Safety)** relate primarily to **Manage Access** and one (**Meet Linkage Needs)** relates primarily to **Maintain Access**. The FAST Diagram clearly showed the VE Team that both of these basic functions must be considered throughout not only the VE Study, but also the entire EA process.

It is important to note that the FAST Diagram represents the improvements to the Highway 7/8 corridor as envisioned by the EA planning work to date. As long as the two basic functions are provided, all of the other functions identified in the FAST Diagram are subject to change and even elimination if warranted.

The VE Team's consensus FAST Diagram for the Highway 7/8 project is presented in **Exhibit 22**.

Exhibit 22: FAST Diagram



6.4 Performance Criteria and Measures

Draft project Performance Criteria and Measures were developed pre-workshop by HDR | iTRANS personnel. The Performance Criteria and Measures provide a tool to compare alternatives generated in the VE Study against each other and the assumed base case for each intersection or segment of the corridor, as appropriate. The VE Team refined the Performance Criteria and Measures upon presentation during the workshop, yielding some significant improvements including specifically how the measures would be scored.

When determining the measures, it was decided that a high score is a "better" score. Thus, for each performance criteria, a high score would represent an idea with many benefits and few negative impacts. The performance criteria and their measurements are listed and explained on the following pages (**Exhibit 23** through **Exhibit 29**).

Exhibit 23: Human Factors Assessment Performance Criteria and Measurement

<table>
<tr>
<td>Human Factors Assessment</td>
<td>A measure of the ability for drivers to safely and efficiently traverse the facility. There are three components:
• A = Driver Expectancy
o Road design and traffic operations should conform to driver expectancies (e.g. freeway exits on right, standard intersection configuration)
• B = Driver Workload related to Geometry and Cross-Section
o Workload demands generated by the road and traffic environment (lane changing, speed reduction, curve negotiation, sight distance).
• C = Driver Workload related to Navigation
o Decisions at choice points based on verbal directions, past experience, guide signs and landmarks

There are two components of the design at each location which are considered separately, and each is given an individual relative weight. These are:

<table>
<tr><th>Location (L)</th><th>Relative Weight (W_L)</th></tr>
<tr><td>ML – Mainline of Hwy 7/8</td><td>2</td></tr>
<tr><td>SR – Intersecting Sideroad under consideration</td><td>1</td></tr>
</table>

<table>
<tr><th></th><th>A</th><th>B</th><th>C</th></tr>
<tr><td></td><td>Driver Expectancy</td><td>Driver Workload- Geometry and Cross Section</td><td>Driver Workload - Navigation</td></tr>
<tr><td>1</td><td>Significantly less consistent with</td><td>Significantly worse than assumed base</td><td>Significantly worse than assumed base</td></tr>
</table>
</td>
<td>HFAI</td>
</tr>
</table>

	prior section or usual design compared to assumed base case	case with respect to sight distance, weaving, lane changing, speed changes, cross section, etc	case with respect to signage and navigation
3	No change in predictability from assumed base case	No change in workload from assumed base case	No change in workload from assumed base case
10	More consistent with prior section or usual design than assumed base case	Significantly better than assumed base case with respect to sight distance, weaving, lane changing, speed changes, cross section, etc	Significantly better than assumed base case with respect to signage and navigation

This score reflects the degree to which demands of the driving task can be easily handled by the driver.

Calculation:

$HFAI = [2HFAI_{ML} + HFAI_{SR}] / 3$

Where:

- $HFAI_{ML} = (A_{ML} + B_{ML} + C_{ML})/3$
- $HFAI_{SR} = (A_{SR} + B_{SR} + C_{SR})/3$

Exhibit 24: Sustainability Performance Criteria and Measurement

Sustain-ability

A measure of the overall sustainability of the facility, assumed base case and various scenarios, evaluated based on the following:

Factor	Relative Weight (W_L)
FF – Future Flexibility	2
HF – Highway Footprint	1
HA – Highway Access Guidelines	2

Overall Sustainability Index (SI) Calculation:

$$SI = [2\ SI_{FF} + SI_{HF} + 2\ SI_{HA}\ ]/\ 5$$

Where,

(FF) Future Flexibility: A measure of the effect of the facilities provided by the alternative/scenario on the future flexibility of the transportation infrastructure beyond the planning horizon (2031). Scenarios that lead to less restriction on future decisions and/or will have less throwaway when future expansions occur will receive higher scores.

Location (L)	Relative Weight (W_L)
ML - Mainline	2
SR – Sideroad under consideration	1

Future Flexibility Calculation:

$SI_{FF} = (2FF_{ML} + FF_{SR})/3$

Where FF_L = 1, if less future flexibility than the assumed base case
5, if no change in future flexibility over the assumed base case
10, if more future flexibility than the assumed base case

(HF) Highway Footprint: A measure of how much land is covered with pavement or otherwise rendered useless by the "highway footprint". Generally, the smaller the footprint, the more sustainable.

Highway Footprint Calculation:

$HF = 10\ (\ HF_{min} / HF_{actual})$ where, HF is the measured highway footprint

(HA) Compliance to Highway Access Guidelines: A measure of how well the facility meets the Highway Access Guidelines, i.e. intersection location relative to interchanges; 400m minimum, 800m desirable.

SI

Highway Access Calculation:

$HA = [2\ HA_{ML} + HA_{SR}] / 3$

Where, mainline (**please use the following criteria depending on the location of the alternative**):

HA_{ML} = New Hamburg - Staged Freeway / Principle Arterial

- 3.0 – 8.0 Km Desirable – 10
- 2.0 – Minimum – 7
- > 2.0 Minimum – 1

= Shakespeare - Rural Arterial

- 1600 m desirable – 10
- 800 m minimum – 2
- Subtract 1 for each 100 m below 1600 m
- Below 800 doesn't meet – 1

= Stratford - Urban Arterial

- 900 m desirable – 10
- 400 m minimum – 2
- Subtract 2 for each 100 m below 800 m
- Below 400 doesn't meet – 1

Where, side road:

HA_{SR} =

- 1, below 250 m, doesn't meet minimums
- Start with 10 and subtract 1 for each 15 m below 400, between minimum and desirable
- 10, spacing 400 m or greater, meets or exceeds desirable

Exhibit 25: Natural Environment Performance Criteria and Measurement

<table>
<tr>
<td>Natural Environment</td>
<td>A measure of each alternative/scenario's impact on the natural environment

Natural Environment Index (NEI) Calculation:

$NEI = [A_{NE} + B_{NE}]/ 2$

Where,

<table>
<tr><th></th><th>A_{NE}
(Wt = 1)</th><th>B_{NE}
(Wt = 1)</th></tr>
<tr><td></td><td>Wildlife Habitat/ Vegetation Communities/ High Quality Woodlots</td><td>Aquatic Resources</td></tr>
<tr><td>1</td><td>Greater impact than assumed base case</td><td>Greater impact than assumed base case</td></tr>
<tr><td>5</td><td>Not significantly different from assumed base case</td><td>Not significantly different from assumed base case</td></tr>
<tr><td>10</td><td>Less impact than assumed base case</td><td>Less impact than assumed base case</td></tr>
</table>

Wildlife (Sensitive/Regulated Species) Habitat and High Value Woodlots are measured by changes in the number of species or extent of habitat/high quality woodlots affected. The option that affects fewest sensitive species or least amount of habitat/woodlot receives the highest score based on the area (ha) or length of habitat affected. The impact is measured in hectares (ha) by changes in encroachment on:

• significant wetland areas
• areas with known sensitive vegetation communities
• areas with known regulated wildlife habitat
• areas with identified high quality woodlots

Aquatic Resources is measured by the number of watercourses crossed and the length of watercourses directly affected.</td>
<td>NEI</td>
</tr>
</table>

Exhibit 26: Community Impacts Performance Measurement and Criteria

<table>
<tr>
<td>Community Impacts</td>
<td>A measure of each alternative/scenario's impact on the local community.

Community Impact Index (CII) Calculation:

CII = [$\mathbf{A_{CI}}$ + 2 $\mathbf{B_{CI}}$ + 2 $\mathbf{C_{CI}}$ + $\mathbf{D_{CI}}$]/ 6

Where,
<table>
<tr><th></th><th>$\mathbf{A_{CI}}$
(Wt = 1)</th><th>$\mathbf{B_{CI}}$
(Wt = 2)</th><th>$\mathbf{C_{CI}}$
(Wt = 2)</th><th>$\mathbf{D_{CI}}$
(Wt = 1)</th></tr>
<tr><td></td><td>Residences</td><td>Community Connectivity</td><td>Businesses, including Agricultural Operations</td><td>Noise and Air Quality</td></tr>
<tr><td>1</td><td>Greater impact than assumed base case</td><td>Greater impact than assumed base case</td><td>Greater impact than assumed base case</td><td>Greater impact than assumed base case</td></tr>
<tr><td>5</td><td>Not significantly different from assumed base case</td><td>Not significantly different from assumed base case</td><td>Not significantly different from assumed base case</td><td>Not significantly different from assumed base case</td></tr>
<tr><td>10</td><td>Less impact than assumed base case</td><td>Less impact than assumed base case</td><td>Less impact than assumed base case</td><td>Less impact than assumed base case</td></tr>
</table>
Residential Impacts is measured by the changes in extent of encroachment on communities or changes to community connections. Options that result in the least encroachment on community (number of residences displaced) are favoured.

Community Integrity/Connections is measured by the change in extent of encroachment on communities or change to community connections for all modes (includes pedestrians and cyclists). The option that results in the least number of connections affected receives the highest score.

Businesses including Agricultural Operations is measured by changes in business operation viability. The option that affects the fewest number of businesses and/or results in the least encroachment on Class 1 agricultural land receives the highest score.

Noise and Air is measured by proximity to sensitive receivers. Options that affect the fewest number earn the highest score.</td>
<td>CII</td>
</tr>
</table>

Exhibit 27: Traffic Operation Performance Criteria and Measurement

Traffic Operations

Traffic Operation will be evaluated for each alternative based on the following factors:

Factor	Relative Weight (W_L)
AI – Access	2
TO – Traffic Operations	2
RW – Railway Impacts on Traffic Operations	1

Overall Traffic Operations Calculation:

$$TOI = [2\ TOI_{AI} + 2\ TOI_{TO} + TOI_{RW}\ ] / 5$$

Where:

	AI (Wt = 2)	TO (Wt = 2)	RW (Wt = 1)
	Access to Hwy 7/8	**Traffic Operations**	**Railway Impacts on Traffic Operations**
1	Number of conflicts (lane changes, turns) for the movement is increased over the assumed Base Case	Impedance Worst than assumed Base Case	Impedance Worst than assumed Base Case
5	No change in number of conflicts (lane changes, turns) for the movement over the assumed Base Case	Impedance Same as assumed Base Case	Impedance Same as assumed Base Case
10	Fewer conflicts (lane changes, turns) for the movement than in the assumed Base Case	Impedance Better than assumed Base Case	Impedance Better than assumed Base Case

TOI

Exhibit 28: Roadway User Safety Performance Criteria and Measurement

<table>
<tr><th>Criteria</th><th>Definition</th><th>Scale</th></tr>
<tr><td>Roadway User Safety</td><td>A measure of the impact of the various scenarios on roadway user safety based on the considered locations as shown:

For each alternative the score for Expected Collision Frequency and Expected Severity of Collisions using the following table as a guide:

<table>
<tr><th></th><th>A</th></tr>
<tr><th></th><th>Expected Frequency/Severity of Collisions</th></tr>
<tr><td>1</td><td>Significant increase in the Weighted Number of Collisions compared to the assumed Base Case (2 times or greater)</td></tr>
<tr><td>5</td><td>No relative change in Weighted Number of Collisions compared to the assumed Base Case.</td></tr>
<tr><td>10</td><td>Significant decrease in the Weighted Number of Collisions compared to the assumed Base Case (less than half)</td></tr>
</table>

<u>Expected Collision Frequency/Severity</u>
• The intent is to compare the Weighted Number of Collisions of the Alternative to the assumed Base Case based on expected collision rate determined from projected traffic volumes and applicable Operational Performance Functions for the facility under consideration, and the application of Accident Modification Factors related to the alternative.
• The Weighted Number of Collisions will include all collisions with greater weighting given to fatal (F) and personal injury (PI) collisions than property damage only (PDO) collisions.

RUSI = PDO + 4.375 PI + 100 F</td><td>RUSI</td></tr>
</table>

Exhibit 29: Cost Index Performance Criteria and Measurement

Criteria	Definition	Scale
Cost Index	A measure of the relative cost of an alternative considering capital cost , maintenance costs, collision costs, and user costs over the life cycle of the project where: • Capital Cost (CC) • Maintenance Cost (M) • Collision Cost (COL) • User Costs (U) **Overall Cost Index Rating:** (2CC + M + 2COL + U) / 6 where: **CC** = **Capital Cost Factor**, Weight = 2 **CC** = Graduated scale from 1 to 10 (Best) as determined from "Determination of Capital, Maintenance and User Cost Indices" table **M** = **Maintenance Cost Factor**, Weight = 1 **M** = Graduated scale from 1 to 10 (Best) as determined from "Determination of Capital, Maintenance and User Cost Indices" table **COL** = **Collision Cost Factor**, Weight = 2 **COL** = 10(Lowest Alternative RUSI / Alternative RUSI) **U** = **User Cost Factor**, Weight = 1 **U =** Graduated scale from 1 to 10 (Best) as determined from "Determination of Capital, Maintenance and User Cost Indices" table	**CI**

6.5 Performance Criteria Weighting

The VE Team used the 100 Point Allocation Method to weight the overall performance criteria. Each member of the overall VE Team was given 100% points that they could "spend" on the Performance Criteria as they saw fit. The weights of each performance criteria using this method are shown in **Table 13**.

Table 13: 100 Point Allocation Method

Performance Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Average
Human Factors	12	12	10	15	10	15	18	10	16	10	2	15	15	15	**13**
Sustainability	15	12	15	5	5	15	12	15	12	20	3	15	25	10	**13**
Natural Environment	6	15	5	10	20	5	6	15	12	5	20	10	10	15	**11**
Community Impacts	33	23	20	35	20	25	24	20	20	30	25	20	20	40	**25**
Traffic Operations	17	25	25	15	30	25	25	20	15	25	25	20	20	10	**21**
Roadway User Safety	17	13	25	20	15	15	15	20	25	10	25	20	10	10	**17**
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

After much discussion, the VE Team agreed by consensus that the Average Assigned Weights in the table above were representative of the relative importance of the criteria and would be used to compare project alternatives.

7. PROJECT DESCRIPTION

7.1 Introduction

The Ministry of Transportation (MTO) is undertaking a Highway 7/8 Transportation Corridor Planning and Class Environmental Assessment (Class EA) Study, from Greater Stratford to New Hamburg area. The study includes:

- Development of a plan that addresses:
  - Capacity, operation and safety needs along the 2-lane and 4-lane sections of Highway 7/8 between Stratford and the New Hamburg area and through the urban centres (Stratford, Shakespeare and New Hamburg) along Highway 7/8 for the movement of people and goods; and
  - Linkage needs between the analysis area and transportation corridors serving other regions in the province.
- Preparation of a preliminary design for the provincial roadway components of that plan; and
- Documentation of the work in a Transportation Environmental Study Report for public review at study completion.

The purpose of the Value Engineering study is to identify the best value road connections between the existing road network and the preferred Highway 7/8 alignment as presented at Public Information Center (PIC) #4 and shown in **Exhibit 30**.

At the time of the VE study, the EA team had not advanced to a point in the study where preliminary design alternatives were developed. In the absence of preliminary design alternatives, the VE Team was required to assume a base case. This assumed base case was needed to develop the various options presented in the report. **The intent of this VE study is creative in nature and is not intended to bind the EA study team to a limited set of alternatives, but rather to provide input to the EA Study team for their consideration.**

7.2 Project Description

The Preferred Route alternative is presented in **Table 14** and is described in the sections that follow.

Exhibit 30: Preferred Alternative

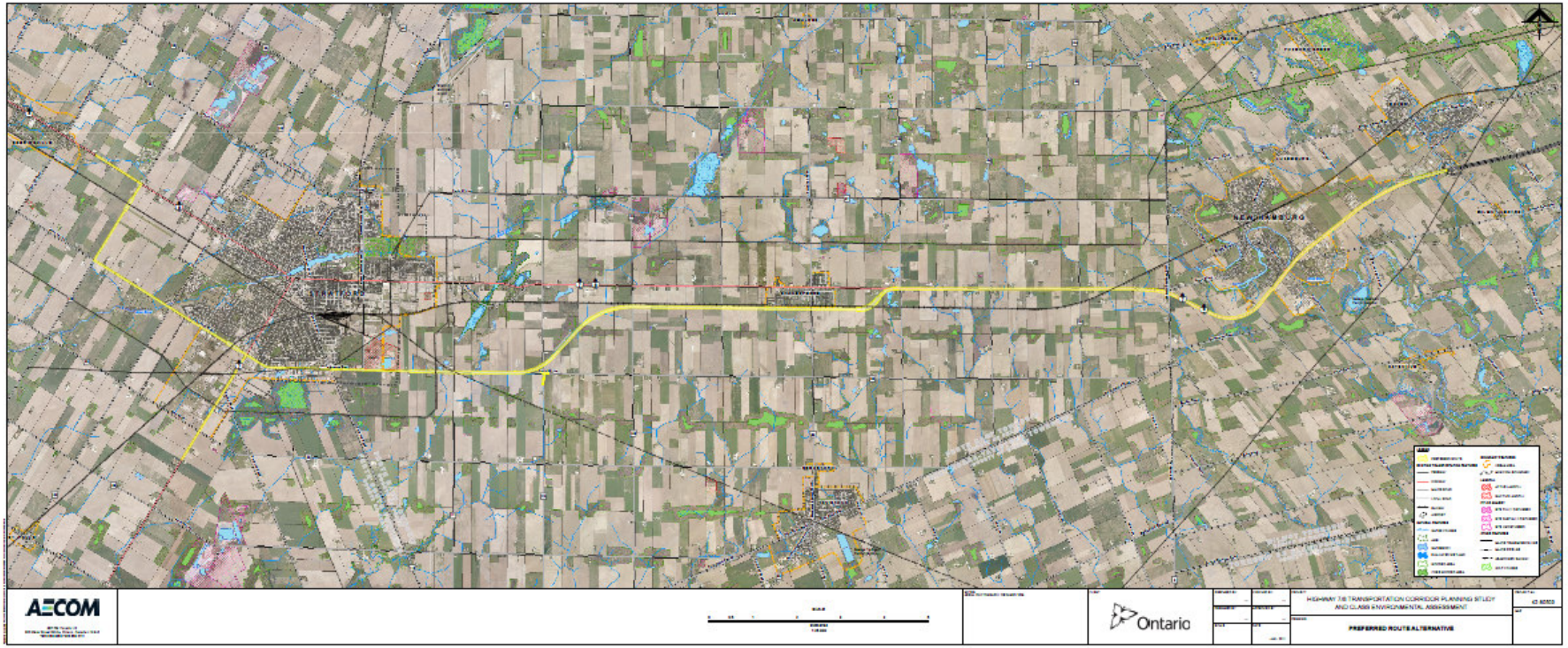


Table 14: Assumed Base Case Cross Sections and Intersections

Section	Assumed Cross Section	Highway 7/8 at:	Assumed Intersection
New Hamburg	• Modification of Highway 7/8 through New Hamburg with median barrier	Nafziger Rd.	at-grade sig. intersection
		Hamilton Rd.	at-grade sig. intersection
		Victoria St.	at-grade, stop control
		Peel St.	at-grade sig. intersection
		Walker Rd.	at-grade, stop control
		Wilmot Easthope Rd.	at-grade sig. intersection
Rural Areas and Shakespeare	• Widen Highway 7/8 from 2 to 4/5 lanes from existing 4-lane section immediately west of Wilmot–Easthope Road to railway structure • A new 4-lane southerly bypass of Shakespeare.	Perth Line 102	at-grade, stop control
		Perth Line 104	at-grade, stop control
		Perth Line 106	at-grade, stop control
		Perth Line 107	at-grade, stop control
		Perth Line 108	at-grade, stop control
		Perth Line 109	at-grade, stop control
		Perth Line 110 and 33	connects to 7/8 at stop control tee
		Perth Line 111	turn lane on Highway 7/8); Cul-de-sac Perth Line 110 from north; Connect
Stratford East	• Widen Lorne Avenue from 2 to 4/5 lanes from Perth Road 111 to Highway 7	Romeo St.	Perth Line 110 south to Perth Line 33.
		Downie St.	at-grade, stop control
		Erie St.	at-grade, stop control
		Morgan St., Home St., Scott St., Mowat St., Humber St., Oak St., Boyd St., Dunlop Pl., Dufferin St., Railway Ave.	at-grade sig. intersection
		Packham Rd./Embro Rd.	at-grade sig. intersection
		Gibb Rd.	at-grade, stop control

Section	Assumed Cross Section	Highway 7/8 at:	Assumed Intersection
Stratford West	• 2/3-lane Perth Line 32/Lorne Avenue to Highway 7. • 2-lane Perth Road 125 • 2-lane Highway 8 from mid-way between Perth Roads 130 and 125 to Perth Road 125;	Linton Ave. Monteith Ave. St. Vincent St.	at-grade sig. intersection
		Wright Blvd., Queensland Blvd., Freeland Dr.	at-grade, stop control
		Rd. 122	at-grade, stop control
		Bannerd Dr.	at-grade, stop control
		Rd. 125	at-grade sig. intersection
		Old Highway 8	right in, right out, with median

7.3 Documents Provided to the VE Team

The following information was provided to the VE Team as reference material during the workshop:

- **General Description of Current Highway 7/8 Corridor**
  - *Highway 7&8 Transportation Corridor Planning and Class EA Study From Greater Stratford to New Hamburg Area (MTO Group Work Project # 13-00-00) Draft Report B: Overview of Transportation, Land Use and Economic Conditions within the Analysis Area*, June 2007, prepared by TSH (Section 8.0 General Description of Current Highway 7&8 Conditions)
- **Existing Environmental Conditions**
  - *Highway 7&8 Transportation Corridor Planning and Class EA Study From Greater Stratford to New Hamburg Area (MTO Group Work Project # 13-00-00) Draft Report F (Part 2): Working Paper – Environmental Conditions and Constraints, July 2009, prepared by AECOM. Existing Environmental conditions exhibits indicating:*
    - Fisheries Map of Stream Sensitivity and Thermal Regime within the Preferred Corridor
    - Map of Land Use and Select Community Facilities within the Preferred Corridor
    - Significant Natural Heritage Designations
    - Municipal Land Use
    - Community Facilities
    - Agricultural Soils
    - Potential Contaminant Areas and Locations
    - Registered Archaeological Sites and Areas of Historic Settlement
    - Built Heritage Resources
- **Aerial Photographs**
  - An aerial photograph provided by MTO indicating the Urban Fringe Limits from 1955-2006 in the Stratford, Shakespeare & New Hamburg Region of Highway 7/8
- **Business Data**
  - An inventory of all businesses within the Highway 7/8 study area, provided by MTO.
- **Highway Classification Reference Documents**
  - A Functional Classification Map of Southern Ontario, June 2007, provided by MTO.
  - *Geometric Design Standards for Ontario Highways, 1985, Ministry of Transportation Ontario (*Chapter A: Highway Classification)
  - *Geometric Design Guide for Canadian Roads, September 1999, Transportation Association of Canada (*Chapter 1.3 Design Classification)
- **MTO Access Management Guidelines**
  - A document outlining the MTO Access Management guidelines, provided by MTO.
  - A presentation of Access Management for the Highway 7/8 Transportation Corridor Planning and Environmental Assessment (EA) Study – New Hamburg to Stratford – Value Engineering Study, provided by MTO.
- **Engineers Canada Guideline on Environment and Sustainability**
  - *National Guideline on Environment and Sustainability, 2006, Canadian Council of Professional Engineers*

8. VALUE ENGINEERING PROCESS

8.1 General

Value Engineering (VE) is a creative, organized effort, which analyzes the requirements of a project for the purpose of achieving the essential functions at the lowest total cost (capital, staffing, energy, and maintenance) over the life of the project. VE is a systematic, organized approach to obtain optimum value for each dollar spent. Through a group investigation, using experienced, multi-disciplined teams, value and economy are improved through the study of alternate design concepts, materials, and methods.

This approach has been used successfully on projects of all types and magnitudes and allows the VE Team to maintain a responsive turnaround while producing meaningful results. The approach also encourages owner and designer participation in the study effort in order to take advantage of their experience and knowledge. Application of the VE methodology and coordination of the study activities significantly increases the value of ideas presented and the implementation of recommendations.

A VE study was commissioned for the Highway 7/8 Transportation Corridor Planning and Environmental Assessment (Class EA) Study from Greater Stratford to New Hamburg to identify the best value road connections from the preferred route and connections identified in the planning study to the communities of New Hamburg, Shakespeare, and Stratford based on a weighted performance criteria evaluation. As will be further discussed below, the VE Study consisted of pre-workshop activities including several information gathering conference calls; a five-day VE workshop in Stratford from March 7 – 11, 2011, and post-workshop activities including this VE Study Report and a separate Implementation Meeting at the West Region MTO offices in London. The overall objectives of the VE Study included:

- Using the excellent mix of disciplines, expertise, and community stakeholders gathered for the VE Study to evaluate the assumed base case road and community connections planned for the preferred route for the Highway 7/8 corridor.
- Bringing new perspectives and creative ideas to the planning process for these important connections, focusing on crossing road treatments and community access.
- Developing VE Proposals to retain and improve community access while minimizing community and environmental impacts, obtaining sustainable solutions, and achieving the functional requirements of the project with respect to traffic operations and road user safety.
- Comparing VE Proposals for specific intersections against their assumed base case and each other to determine their relative performance.
- Comparing combinations of VE Proposals for appropriate segments of the corridor, where applicable, against the assumed base case for each segment and each other to determine their relative performance.

- Developing a range of access alternatives for the Stratford area, the Shakespeare area, and the New Hamburg area.
- Providing MTO and the EA Study team with a basket of viable alternatives, whether for an individual connection or as part of a segment scenario, from which they could potentially create a preferred alternative for the entire corridor to carry through the EA process.

A multi-disciplined team was formed to analyze the project utilizing the VE job plan, as outlined on the following pages. Each step plays an important part in achieving results, i.e. maintaining essential project functions at desired levels of performance for the local communities, the MTO and the Province.

The VE Study was organized into three distinct parts: (1) Pre-Workshop Preparation; (2) VE Workshop; and (3) Post-Workshop Efforts. The agenda for the workshop is presented at the end of this section.

8.2 Pre-Workshop Preparation

The success of a VE Study is largely dependent on proper preparation and coordination. The success of the Highway 7/8 VE Study was largely due to the excellent coordination between MTO, HDR | iTRANS, and Faithful+Gould in the weeks prior to the workshop. Pre-workshop activities included:

- Numerous teleconferences were held between MTO, HDR | iTRANS and Faithful+Gould to organize the VE Study, discuss the issues of this project, and determine MTO's objectives;
- All participants were briefed on their role and responsibility during the study;
- A Pre-Workshop Information Package (PWIP) was prepared from documents provided by MTO, AECOM, and HDR | iTRANS distributed to the team prior to the site visit to prepare for their area of study.
- HDR | iTRANS personnel prepared a simple parametric cost model for use in the workshop since no cost estimate was available for the Highway 7/8 project at this stage. This cost model was used by the VE Team to determine where the various alternatives generated during the workshop fell within the ranges of a Capital Cost Index.
- The VE Team Leader (VETL) from Faithful+Gould prepared a draft FAST Diagram for the Highway 7/8 project, which benefited from meaningful adjustments by the VE Team throughout the workshop.
- Although draft project performance criteria and measures were developed pre-workshop by HDR | iTRANS personnel, the VE Team refined the performance criteria and measures throughout the workshop, yielding some significant improvements.

8.3 Value Engineering Workshop

During the workshop portion of the VE study, the Job Plan was followed. The Job Plan is an organized approach for searching out high cost and potential value improvement areas in the planning concepts and developing alternate solutions for consideration. The workshop session followed an agenda (attached at the end of this section) which details the Job Plan and utilizes a multi-discipline team to ultimately arrive at the VE Team's consensus "bucket of alternatives" for further consideration.

The Job Plan utilized in this workshop followed six key steps:

- Information Phase
- Function Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation Phase

The six key steps are described in the following sections.

8.3.1 Information Phase

At the start of the five-day workshop, MTO Project Manager Chuck Organ presented the Ministry's goals and objectives for both the project and the VE study. In addition, Chuck reminded the VE Team that the preferred route was selected through the EA process and that concerns regarding the preferred route and the preferred access management strategy will be addressed through the EA process.

AECOM design team Project Manager Brenda Jamison presented the EA Study Process including the status, background, the preferred route alternative, the key design criteria, key issues and considerations, and next steps. Participants from each municipality then discussed their existing and planned land uses and the issues and concerns that their city, township, county, or regional municipality have with respect to the Highway 7/8 EA Study. Finally, Ken Teasdale of MTO's Corridor Management Office reviewed MTO's Access Guidelines for the benefit of the VE Team's consideration.

HDR | iTRANS Traffic Engineer Don Cleghorn addressed the existing and projected traffic volumes and destination information for the corridor. HDR | iTRANS Highway Safety Engineer Greg Junnor then reviewed safety assessment considerations for the corridor, including road user safety and human factors. Finally, HDR | iTRANS' Joe Arcaro and Greg Perry shared the parametric cost model they prepared pre-workshop for the Highway 7/8 project for review and comments.

8.3.2 Function Analysis Phase

The most important step in the VE Job Plan, which separates VE from both the normal design process and simple cost reduction, is function analysis. Function analysis reveals the key functional relationships of the project and provides a greater understanding of the total project. The VETL presented the FAST diagram for the project he had drafted pre-workshop based on available project information. After a lengthy discussion, some additional functions were added and some functions were rearranged until participants agreed on the resulting FAST diagram included and further discussed in **Section 6**.

Armed with a greater project understanding from the FAST diagram, the VE Team discussed the draft performance criteria and measures proposed to evaluate various project alternatives to be developed during the workshop. Each of the draft performance criteria and measures were explained individually and then revised as required by consensus of the VE Team. These performance criteria and measures would be reviewed and refined several more times before their use at the end of the Development Phase. The final project performance criteria and measures are shown in **Section 6**.

At this point, the VETL led the VE Team through an identification of Value Target Areas. After further discussion of the FAST diagram and the project issues, the VE Team decided to use the following five Value Target Areas as the subject of the Creative Phase:

- New Hamburg
- Rural Areas
- Shakespeare
- Stratford East
- Stratford West

8.3.3 Creative Phase

During this phase, the VE Team brainstormed as many ways as possible to achieve improved value for the target areas, whether it be cost savings, improved functionality, risk reduction, and/or constructability improvement. During the creative phase, a positive environment for brainstorming was maintained at all times, reserving all judgment of the ideas until the evaluation phase. “Be+” buttons were distributed to all VE Team members as a constant reminder to insure no idea would go unsaid. The VE Team was looking for quantity and association of ideas, which would be evaluated in the next phase of the study. The more ideas generated, the more likely a “breakthrough” idea would be identified with significant value implications. Many of the ideas brought forth in the creative phase were a result of work done on the risk register and in the function analysis phase. The resulting lists included ideas that would be further evaluated and recommended for potential use in the project design. Listings of the creative ideas are included in **Section 5**.

8.3.4 Evaluation Phase

To remind the VE Team what to keep in mind while judging ideas resulting from the creative phase, performance criteria were weighted at the beginning of the evaluation phase. The VE Team weighted the performance criteria via the 100% allocation method, and the resulting weights are shown in **Section 6**. Then, keeping the performance criteria and their weights in mind, the VE Team ranked the creative ideas by consensus from 1 (worst) to 10 (best), selecting the ideas scoring an 8 or above for further development. On some ideas, consensus was only gained after much discussion. As a result of the evaluation phase, those ideas representing the greatest potential for cost savings and/or value improvement were selected for further development in the workshop. Care was taken not to discard ideas too easily as some could be viewed in a more favourable light as the workshop proceeded. Results of the evaluation phase are presented in **Section 5**.

8.3.5 Development Phase

VE Team members volunteered to develop selected ideas and document them as VE Proposals, using VE forms customized jointly by F+G and HDR | iTRANS and adopted by the overall VE team. The developer was charged with capturing the input of the entire VE team. The subject idea was developed as far as time and resources would allow. Development consisted of preparing a recommended design with verbal descriptions of the assumed base case and the alternative, advantages and disadvantages of the alternative, discussion/justification, implementation considerations, qualitative performance, and sketches. There is a VE Proposal form for each developed idea including a tabular comparison of the initial costs and resulting savings. The completed VE Proposal Documentation is included in **Appendix A** for the use of MTO in implementation.

During this phase, the VE Team worked together to score all of the VE Proposals according to the performance criteria and measures discussed in the function analysis phase and refined throughout the workshop. The VE Proposals for specific intersections, and where appropriate, combinations of VE Proposals for appropriate segments of the corridor, were then compared against their assumed base case as well as each other to determine their relative performance using an evaluation matrix. The scenarios were then evaluated against the modified assumed base case design, using the weighted performance criteria and their respective units of measurement, in an evaluation matrix.

8.3.6 Presentation Phase

On March 11, 2011, the last day of the workshop, VE Team members responsible for development of respective VE Proposals presented the results of their development to the entire VE Team and AECOM Project Manager Brenda Jamieson. All disciplines and stakeholders on the VE Team then had an opportunity to comment on and improve on various aspects of the VE Proposals. There is no substitute for the direct communication of an idea to decision-makers. The alternatives, the rationale that went into their development,

and a summary of key impacts were presented and discussed. A lively question and answer session followed.

8.4 Post-Workshop Efforts

The post-workshop efforts included:

- Preparation and submittal of a Draft VE Study Report by HDR | iTRANS and the VETL, documenting the efforts of MTO, stakeholder municipalities and the overall VE Team in the workshop.
- Preparation of a PowerPoint presentation of the results of the VE Study.
- A PowerPoint presentation of the results to the MTO project team and senior regional personnel at an Implementation Meeting at the West Region MTO offices in London.
- Incorporation of comments and implementation decisions from the Implementation Meeting into the documentation.
- Preparation and submittal of a Final VE Study Report by HDR | iTRANS and the VETL, documenting the efforts of MTO, stakeholder municipalities and the overall VE Team in the workshop and Implementation Meeting to obtain a wide range of alternatives for consideration in the EA process for the Highway 7/8 project.