APPENDIX S – Value Engineering Study

1.0 TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

STANDARD LIMITATIONS

This report was prepared by MMM Group Limited (MMM) for the account of The City of Victoria (the Client). The disclosure of any information contained in this report is the sole responsibility of the client, City of Victoria. The material in this report reflects MMM's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. MMM accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this report.

2.0 PROJECT DESCRIPTION

2.1 Introduction

The Johnson Street Bridge is located between the Inner and Upper Harbours of Victoria, connecting the older part of the City on the east side with the more recently developed and traditionally industrial west side of the harbour. Access across the Upper Harbour is also provided by the Point Ellice Bridge which represents a 3 km detour if the Johnson Street Bridge is closed. **Figure 1** shows an aerial photo of the existing Johnson Street Bridge and approaching roads.

Figure 1 - Aerial View of the Site

The existing crossing was constructed in 1924 and is of riveted steel construction. It consists of a railway superstructure and a highway superstructure that share a common cast-in-place concrete substructure. As part of the proposed bridge replacement project, MMM Group was retained by the City of Victoria to develop designs for the replacement of the existing Johnson Street Bridges, including facilitation of a Value Engineering (VE) Workshop.

2.2 Project Background

At the time of the VE workshop, a draft Project Definition Report (PDR) was available as the basis of information regarding the Johnson Street Bridge Replacement Project. The PDR report documents the 30% design process and defines the issues and requirements associated with the project in order to establish the preliminary cost estimate and to guide the development of detailed design and contract documents. **The PDR's 30% design represents the base case scenario for the VE Workshop.**

The PDR report was produced by MMM's Design Team that consists of the following firms:

- MMM Group – design management, structural, roads, drainage
- Wilkinson Eyre Architects – bridge architecture and design
- Stafford Bandlow – Electrical and mechanical engineering for the moveable bridge
- H.W. Lochner – Approach span structural design
- Speirs and Major – Bridge Lighting
- Sharp & Diamond – Landscape architecture
- PBA Engineering – Roadway illumination
- MEG Engineering – Geotechnical engineering reports
- Advicas – Cost estimating and quantity surveyors
- TyPlan – Navigation clearance requirements

2.3 Documents Provided to VE Team

The following information was provided to the VE Team as reference material for the Workshop:

- *Johnson Street Bridge Replacement Project – Project Definition Report (Draft for City Comments),* prepared by MMM Group Limited, November 2011 for the City of Victoria. The report consists of the following four volumes:
    - Volume I – Main Report
    - Volume II – Supporting Documents
    - Volume III – Drawings
    - Volume IV – Historical Documents

3.0 VALUE ENGINEERING PROCESS

3.1 Introduction

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 most efficient cost (capital, staffing, energy, and maintenance) over the life of the project. VE applies a systematic, organized approach to obtain optimum value for each dollar spent. Through a group investigation using an experienced multi-discipline team (VE Team), value and economy are improved by assessing different design concepts, materials, and methods.

This approach has been successfully applied on projects of varying type and magnitude and allows the VE Team to produce meaningful results within a reasonable schedule. VE encourages owner, designer and stakeholder participation in the assessment 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 the ideas presented and the implementation of recommendations.

MMM Group Limited (MMM) was commissioned by the City of Victoria to undertake a VE Study for the bridge replacement project. The overall objectives of the VE Workshop were to add value to the project by investigating alternative designs to the proposed Base Case.

3.2 VE Team

The two-day VE Workshop was held from December 1st to 2nd, 2011, in Vancouver, BC. The VE Study was led by Chris Gauer, A.V.S., P.Eng of MMM who followed the abbreviated VE process described in the following sections. The list of VE participants are shown in **Table 1**.

The VE Team analyzed the project utilizing the VE Job Plan outlined in **Section 2.3**. Each step in the plan plays an important part in achieving results that assure eventual savings to the main stakeholders while maintaining essential project functions at desired levels of performance. It is noted that the VE Team considered the project on its own merits, without consideration of agency responsibility and/or cost apportionment.

Table 1 - VE Study Participants

Name	Company	Title	Email
Chris Gauer	MMM Group Limited	VE Team Leader	gauerc@mmm.ca
Joost Meyboom	MMM Group Limited	Project Manager	meyboomj@mmm.ca
Jan Kocaba	MMM Group Limited	Structural Engineer	kocabaj@mmm.ca
Ken Rebel	MMM Group Limited	Structural Engineer	rebelk@mmm.ca
Sam Young	MMM Group Limited	VE Team Assistant	youngs@mmm.ca
Mike Lai	City of Victoria	Project Director	mlai@victoria.ca
Dwayne Kalnychuk	City of Victoria	Director of Engineering	dkalnychuk@victoria.ca
Bill Larkin	B.Larkin & Associates	President	blarkin@live.ca
John Williams	Stafford Bandlow Engineering	Mechanical Engineer	jwilliams@sbengineering.net
Sebastien Ricard	Wilkinson Eyre Architects	Project Architect	s.ricard@wilkinsoneyre.com
Thor Gaul	Thor Gaul	President	thorsr@connect.ab.ca
John Granger	Advicas Group Consultants	Principal	jgranger@advicas.com

3.3 VE Process

A VE Job Plan was followed during the Workshop portion of the VE Study. A Job Plan is an organized approach for searching out high cost, potential value/performance improvement areas in the design and developing solutions for consideration. The Workshop session followed an agenda (included in **Section 2.4**) which details the Job Plan, and utilizes a multi-discipline team to ultimately arrive at consensus recommendations for implementation.

The VE Job Plan would normally follow seven key steps; however, due to time constraints imposed by a two-day workshop, the Job Plan was condensed to the following four steps:

1. **Information Phase**
2. **Function Analysis Phase** (conducted in part)
3. **Creative Phase**
4. **Evaluation Phase**
5. Development Phase (Not conducted)
6. Presentation Phase (Not conducted)

3.3.1 Information Phase

At the beginning of a Workshop, it is important to understand the project background and decisions that influenced the development of the current design. At the start of the Workshop, Joost Meyboom – MMM Group Project Manager for the Johnson Street Bridge Replacement Project - presented the Base Case for the project to the VE Team. Included in the presentation was discussion concerning the PDR process, as well as key components of the PDR including existing conditions, project requirements, design considerations, construction staging, and the 30% design in relation to architectural and engineering (civil and mechanical), and a cost estimate.

The presentation charged the VE Team with a series of guiding project requirements:

- Replace the Johnson Street Bridge with an architecturally significant (iconic) bridge,
- Provide for a traffic-calmed corridor through the project site at same posted speed,
- Provision of 2 westbound and 1 eastbound lanes of vehicle traffic the width to match existing,
- Provision of a dedicated sidewalk for pedestrians on the south side,
- Provision of a dedicated mixed-use path crossing with a 5 m width on the north side,
- Provision of on-street bike lanes in each direction,
- Design to a life line standard,
- Design in accordance with CSA-S6-06, “Standards and Guidelines for the Conservation of Historic Places in Canada”, “City of Victoria Old Town Guidelines” and other City standards,
- Provide a 100 year service life for the bridge,
- Provide for a navigation channel that is in accordance with today’s standards as set out by the Navigable Waters Protection Act,
- Design for improved accessibility for all modes at the bridge heads,
- Plan for the future integration of the bridge sidewalk with the proposed Harbour Pathway and the Songhees Walkway,
- Retain existing vehicular, marine and cyclist/pedestrian traffic connections during construction,
- Integrate with existing road network on both side of the bridge,
- Introduce treed boulevards where possible,
- Landscaped medians where possible,
- Provide a signal at the Esquimalt Road and Harbour Road intersection,
- Protect a corridor for future rail and
- Integration of Public Art.

These requirements provided an excellent basis for development of the Workshop goals. Chris Gauer then discussed the objectives of the VE Study.

The Workshop included a few participants with little or no VE experience; therefore, it was necessary for the VE Team leader (VETL), Chris Gauer, to give a brief presentation explaining the overall reasons for, and benefits of, the VE process as well as the techniques and expectations of each Job Plan phase. One

of the noted benefits of the Job Plan is its ability to achieve consensus among varied stakeholders with disparate concerns and identify project designs that will satisfy their needs as a whole.

After the presentation and a question and answer session, the VE Team spent time discussing the key project issues and key performance measures, which are discussed in **Section 3**.

3.3.2 Function Analysis Phase

The most important step in the VE Job Plan, which separates Value Engineering from both the normal design process and simple cost reduction, is function analysis. In this phase, the VE Team reviewed the project functions and identified the major elements of the project to set out the 12 value target areas upon which Creative Phase ideas could be brainstormed. These are:

- Design Criteria (DC)
- Utilities (U)
- Structures (S)
- Retaining Walls (RW)
- Traffic Staging (TS)
- Roads and Approaches (RA)
- Trails and Walkways (TW)
- Operations (O)
- Mechanical (M)
- Wheel (W)
- Architectural Metals (AM)
- Process (P)

3.3.3 Creative Phase

Maintaining a positive environment at all times and reserving judgement for the Evaluation Phase, the VE Team brainstormed as many ways as possible to achieve improved value for the target areas. The VE had segmented the study into 12 value target areas and the VE Team was looking for quantity and association of ideas, which would be evaluated in the next phase. The more ideas that were generated, the more likely a “breakthrough” idea would be identified with significant value implications.

Many of the 116 ideas brought forth in the Creative Phase were a result of discussions throughout the Information Phase and Function Analysis Phase. The resulting lists of ideas would be further evaluated for potential use in the project design. The ideas generated by the VE Team in the Creative Phase are included in **Section 4**.

3.3.4 Evaluation Phase

To allow comparison of the ideas resulting from the Creative Phase, the VE Team revisited each creative idea, and as a group identified the ideas with the greatest potential for cost savings and/or value improvement to be explored further.

Care was taken not to discard ideas too easily as some could be viewed in a more favourable light as the Workshop proceeded, or in combination with other ideas. The results of the Evaluation Phase are included in **Section 4**. Although no firm recommendations were made, the general consensus reached by the VE Team on many of the project issues will greatly benefit the project going forward.

3.4 VE Workshop Agenda

The following agenda was provided to VE Team members at the beginning of the workshop.

Thursday December 1, 2011

9:00 am – 9:05 am	**Convene & Caffeine Breakfast**	
9:05am – 9:30am	Welcome & Introductions An Introduction to Value Analysis (VA) Workshop Agenda & Guidelines	**C Gauer**
9:30am – 10:00am	**Information Phase (I)** JSB Goals & Objectives Possible Constraints on Value Analysis Approach Presentation of Project	**J Meyboom**
10:00am – 10:15 am	**Break**	
10:15am – 11:15 am	**Information Phase (continued)** Basis of Design (Current Design Concept) Rationale for Design Choices Review of Design Elements and Major Components Review Cost Model Brainstorm Performance Criteria	 **J Meyboom** TBD **C Gauer**
11:15am – 12:00pm	**Function Analysis Phase (II)** Present "FAST" Diagram and FAST Guidelines Brainstorm FAST Diagram Functions Identify Value Target Functions / Areas	 **C Gauer**
12:00 pm – 12:30pm	**Break for Lunch**	
12:30pm – 2:30 pm	**Creative Phase (II)** Generate ideas according to Value Target Areas	 **C Gauer**
2:30pm – 2:45pm	**Break**	
2:45 pm – 4:00pm	**Continue Creative Phase**	**C Gauer**
4:00 pm – 5:00 pm	**Evaluation Phase (IV)** Weight Performance Criteria Initial Evaluation of Creative Ideas	**C Gauer**
5:00 pm	**Adjourn**	

Friday December 2, 2011

7:45 am – 8:00 am	**Convene & Caffeine Breakfast**	
8:00am – 9:00am	**Evaluation Phase** Select Best Concepts for Development	**C Gauer**
9:00am – 11:00am	**Development Phase (V)** Assign Sub-Teams to Develop Selected Ideas into VE Proposals Prepare VE Proposal Concepts, Estimates, Calculations, etc. Document Advantages, Disadvantages, Added Factors, Benefits Document VE Proposals Performance against Criteria	**C Gauer**
11:00am – 12:00 pm	**Continue Development Phase** Sub-Teams Present VE Proposals to Entire VE Team VE Team Discuss Results, Recommend Modifications	**C Gauer**
12:00 pm – 12:45 pm	**Break for Lunch**	
12:45 pm – 2:30 pm	**Scenario Development Phase** Create Scenarios from Development Results Document Advantages, Disadvantages, Added Factors, Benefits	**C Gauer**
2:30pm – 2:45pm	**Break**	
2:45pm – 3:30pm	**Scenario Development Phase** Document Scenario Scoring on Performance Criteria Measures Document Evaluation Scoring and Discussions Select Recommended Scenario	**C Gauer**
3:30pm – 4:00pm	**Presentation Phase (VI)** Summary of Conclusions Prepare Outline of Presentation of VA Concepts to Client	**C Gauer**
4:00 pm	**Adjourn**	

4.0 PROJECT ANALYSIS

4.1 Cost Model

The project team prepared a Base Case cost estimate – based on the 30% preliminary design work carried out for the PDR – to be used for analysis and evaluation in the VE Workshop. It should be noted that the estimated cost of the project is strongly influenced by steel prices; as such, considerable effort was given to establishing appropriate unit prices for steel supply, fabricate, transport and erection.

The Base Case cost model presented to the VE Team is shown in **Table 2**. A detailed breakdown of the cost model is included in **Appendix 1**. It was communicated to the VE Team that the City of Victoria is seeking cost savings in the range of 5 million dollars from the Base Case cost estimate.

Table 2 – Base Case Cost Model (excluding contingency and public art)

General Conditions	$7,869,800
Existing Bridge Decommissioning	$3,000,000
Approach Span Superstructure	$6,030,607
Bascule Span Superstructure	$19,535,339
Rest Pier	$1,216,864
Counterweight Pier	$5,687,177
Abutments	$3,330,267
Electrical/Mechanical	$7,389,972
Bridge Other Items	$2,194,093
East Side Road Works	$1,459,061
West Side Road Works	$1,342,840
Pedestrian Overpass	$1,000,473
Other	$3,734,000
Total Construction	$63,790,491

4.2 Performance Measures

In order to evaluate the ideas generated in the Creative Phase, the VE Team brainstormed, discussed and finalized a list of performance measures as a basis for comparing the ideas. The following seven performance measures were identified:

- **Safety** – Ability of project to enhance safety of road users including pedestrians, cyclists, vehicles, and marine traffic;
- **Quality** – Ability of project to maintain the overall quality and public perception of the project, including quality of materials used for construction;
- **Aesthetics** – Ability of project to provide an architecturally significant and iconic bridge structure;
- **Constructability** – Ability of project to be constructed using the standard materials and traditional construction methods, where possible;
- **Convenience** – Ability of project to maintain or improve mobility – including mobility for road users, marine users, and maintenance of traffic – during construction;
- **Concept Compatibility** – Ability of project to meet the project expectations as established by the City and the Citizen's Advisory Panel (CAP); and
- **Schedule** – Ability of project to be substantially completed by 2016 in order to receive Federal funding for the project.

5.0 IDEA CREATION AND EVALUATION

5.1 Introduction

During the Creative Phase, the VE Team brainstormed as many ways as possible to improve the performance of the base case for the following value target areas developed in the Function Analysis Phase. The areas of discussion were:

- **Design Criteria** (DC)
- **Utilities** (U)
- **Structures** (S)
- **Retaining Walls** (RW)
- **Traffic Staging** (TS)
- **Roads and Approaches** (RA)
- **Trails and Walkways** (TW)
- **Operations** (O)
- **Mechanical** (M)
- **Wheel** (W)
- **Architectural Metals** (AM)
- **Process** (P)

5.2 Summary of Creative Ideas and Evaluation

Each of the 116 ideas generated were evaluated individually by the VE Team to determine if the idea should be developed, costed and evaluated further during detailed design.

Each idea was judged depending on how well it met the performance measures when compared to the Base Case. Care was taken not to discard ideas that could be viewed in a favourable light in combination with other ideas or as the Workshop continued and provided more detail regarding the design. **Table 3** shows the summary of the ideas.

Following **Table 3**, are **Tables 4** through **15**. These outline the detailed ideas brainstormed in the Creative Phase and all ideas developed.

After the ideas were generated, the VE team reviewed each idea considering the Performance Measures to determine if the idea met the project criteria and had merit for further consideration. Of the 116 Ideas generated in the Creative Phase, 84 were deemed appropriate for further development in the detailed design of the project. As this work will be done in the design of the project, the Development and Presentation Phases of the VE Study were not required.

Table 3 - Overall Summary of Ideas

Value Target Area	No. of Ideas	No. of Ideas Dropped	No. of Ideas for Further Evaluation
Design Criteria (DC)	19	8	11
Utilities (U)	2	2	0
Structures (S)	26	6	20
Retaining Walls (RW)	5	0	5
Traffic Staging (TS)	6	0	6
Roads and Approaches (RA)	3	0	3
Trails and Walkways (TW)	2	0	2
Operations (O)	10	5	5
Mechanical (M)	10	6	4
Wheel (W)	4	2	2
Architectural Metals (AM)	11	5	6
Process (P)	18	0	18
TOTAL	116	34	82

Table 4 – Evaluation Results: Design Criteria

CREATIVE PHASE RESULTS - DESIGN IDEAS

Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: **Design Criteria (DC)**	
Location:	**Vancouver BC**		
Date:	**December 1 - 2, 2011**	Geographic location: N/A	
Client:	**City of Victoria**		

Idea No.	Description	Evaluation		
		Action Required? (Yes/No)	Action By	Estimated Savings ($1,000's)
DC - 1	Review Design Wind Load	Yes	MMM	No Change
DC - 2	Review Design Vehicle (Bus etc.)	Yes	City	
DC - 3	Reduce Pathway Width Sidewalk (from 2.5m)	No		
DC - 4	Reduce Pathway Width Multi-Use Trail (from 5.0m to 4.0m)	Yes	MMM	$190k
DC - 5	Reduce Width of Overpass Pathway	Yes	MMM	
DC - 6	Reduce Width of Pathway Through Wheel (from 2.5m)	No		
DC - 7	Change Barrier Design Criteria (PL1 vs. PL2)	Yes	MMM	$75k
DC - 8	Vehicle Design Speed (from 50km/h to 30km/h)	Yes	MMM	No Change
DC - 9	Reduce East Approach Radius	Yes	MMM	No Change
DC - 10	Eliminate Need for Operator	No		
DC - 11	Lifeline Requirement	No		
DC - 12	Paint vs Weathering Steel	No		
DC - 13	Steel Category (AT vs WT)	Yes	MMM	$670k
DC - 14	Reduce Clear Zone from 2.0m	Yes	MMM	No Change
DC - 15	Decrease Bike Lane Width from 1.8m to 1.5m (everywhere)	No		
DC - 16	Decrease Bike Lane Width from 1.8m to 1.5m (on Bridge)	Yes	MMM	$120k
DC - 17	Split Multi-use Pathway and Wall / Barrier Side	No		
DC - 18	Barrier Offset from Edge Girder	Yes	MMM	No Change
DC - 19	Eliminate Ship Fenders	No		

Legend:
DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

Table 5 – Evaluation Results: Utilities

CREATIVE PHASE RESULTS - DESIGN IDEAS					
Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: Utilities **(U)**			
Location: **Vancouver BC** Date: **December 1 - 2, 2011** Client: **City of Victoria**		Geographic location: N/A			
Idea No.	Description	Evaluation			
		Action Required? (Yes/No)	Action By	Notes	
U - 1	Delete Sanitary Sewer to Operator	No			
U - 2	Delete Water to Operator	No			

Legend:

DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

Table 6 – Evaluation Results: Structures

CREATIVE PHASE RESULTS - DESIGN IDEAS

Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: Structures **(S)**	
Location:	**Vancouver BC**	Geographic location: N/A	
Date:	**December 1 - 2, 2011**		
Client:	**City of Victoria**		

Idea No.	Description	Evaluation		
		Action Required? (Yes/No)	Action By	Estimated Savings ($1,000's)
S - 1	East Span South Side - Straighten Alignment	Yes	MMM	$250k
S - 2	East Span South Side - Straighten + Cantilever Curved Deck	Yes	MMM	$90k
S - 3	East Abutment - Eliminate Inclined Wall	No		
S - 4	East Abutment - Use Friction Piles instead of Rock Socket	Yes	MMM	No Change
S - 5	Reduce Diameter of Piles	No		
S - 6	Reduce Casing Wall Thickness	Yes	MMM	DS
S - 7	Redesign Rebar Cage within Casing	Yes	MMM	DS
S - 8	Reshape Counterweight Pier Box	Yes	WEA	
S - 9	Redesign Counterweight Box Slab with Voided Reaction Support	No		Same as S-8
S - 10	Perform Additional Geotechnical Tests	Yes	MMM	Scheduled
S - 11	Perform Additional Pile Tests - Ostenberg	Yes	MMM	
S - 12	Eliminate Cofferdams - "Sink the Box"	No		CS
S - 13	West Incline Pier Shaft - Use Steel instead of Concrete	Yes	MMM/WEA	No Change
S - 14	West Incline Pier Shaft - Use Precast Concrete	Yes	MMM/WEA	No Change
S - 15	Use Precast Elements in Abutments	Yes	MMM	CS
S - 16	Simplify Maintenance Platform	Yes	MMM	DS
S - 17	Overlaps for Fillets on Boxes	Yes	MMM/WEA	$150k
S - 18	Keep Box Sections the Same All the Way Thru and Expand as Needed	Yes	MMM/WEA	DS
S - 19	Make Wheel a Full Circle Box Section	Yes	MMM/WEA	No Change
S - 20	SF-19 + Add Straight Chord to Wheel	Yes	MMM/WEA	No Change
S - 21	Single Diagonals Within Truss	No		
S - 22	Ortho Deck to Floor Beam Connections	Yes	MMM	No Change
S - 23	Ortho Deck on Approaches	Yes	MMM	No Change
S - 24	Review Wind and Pedestrian Load on Cantilever Decks (Design Suggestion)	Yes	MMM	DS
S - 25	Provide Cantilever of Pile Cap @ East Abutment to Accommodate Future Harbour Path	Yes	MMM	No Change
S - 26	Flip Bridge Bascule with Wheel on West Side	No		

Legend:

DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

Table 7 – Evaluation Results: Retaining Walls

CREATIVE PHASE RESULTS - DESIGN IDEAS

Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: Retaining Walls **(RW)**
Location:	**Vancouver BC**	
Date:	**December 1 - 2, 2011**	Geographic location: N/A
Client:	**City of Victoria**	

Idea No.	Description	Evaluation		
		Action Required? (Yes/No)	Action By	Notes
RW - 1	Eliminate NE Cantilever	Yes	MMM	No change
RW - 2	Reduce NE Cantilever (as Needed by Telus Duct)	Yes	MMM	Done
RW - 3	Extend MSE Wall in Place of Cast in Place Wall (Light Weight Fill)	Yes	MMM	Same as RW - 1
RW - 4	Realign Path to Eliminate Retaining Wall at SW Corner	Yes	MMM/WEA/S&D	Done
RW - 5	Eliminate Stairway @ SE Corner (Due to Jay Walking Concerns)	Yes	S&D	Done

Legend:

DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

Table 8 – Evaluation Results: Traffic Staging

CREATIVE PHASE RESULTS - DESIGN IDEAS

Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: Traffic Staging **(RW)**	
Location:	**Vancouver BC**		
Date:	**December 1 - 2, 2011**	Geographic location: N/A	
Client:	**City of Victoria**		

Idea No.	Description	Evaluation		
		Action Required? (Yes/No)	Action By	Notes
TS - 1	Develop Traffic Operations Plan for Stage 2 Works	Yes	MMM	DS
TS - 2	Schedule Openings for Marine Traffic During Construction	Yes	City	DS
TS - 3	Reduce Laning Requirements from 2 to 1 (Off-Peak Hours During Construction)	Yes	City	No Change
TS - 4	Review Hotel Stage 2 Access	Yes	City	DS
TS - 5	Source Nearby Laydown Property	Yes	City/MMM	DS
TS - 6	Review Options - Field Splice for Wheel Erection	Yes	MMM	DS

Legend:
DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

Table 9 – Evaluation Results: Roads and Approaches

CREATIVE PHASE RESULTS - DESIGN IDEAS					
Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: Roads and Approaches **(RA)**			
Location: **Vancouver BC** Date: **December 1 - 2, 2011** Client: **City of Victoria**		Geographic location: N/A			
Idea No.	Description	Evaluation			
		Action Required? (Yes/No)	Action By	Notes	
RA - 1	Reduce East Side Radius and Design Speed (From R=115m to R=50 to 70m)	Yes	MMM / City	No Change	
RA - 2	Eliminate Signal on West Side Intersection	Yes	MMM / City	NoCchange	
RA - 3	RA-1 + Separate Bike Path from Eastbound Roadway West of Bridge	Yes	MMM	Done with RA-1	

Legend:
DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

Table 10 – Evaluation Results: Trails and Walkways

CREATIVE PHASE RESULTS - DESIGN IDEAS				
Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: Trails and Walkways **(RA)**		
Location: **Vancouver BC** Date: **December 1 - 2, 2011** Client: **City of Victoria**		Geographic location: N/A		
Idea No.	Description	Evaluation		
		Action Required? (Yes/No)	Action By	
TW - 1	Pedestrian Bridge - Decrease width from 5m to 4m	Yes	MMM	$25k
TW - 2	Reduce Balustrade with Plantings	Yes	S&D	DS

Legend:
DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

Table 11 – Evaluation Results: Operations

CREATIVE PHASE RESULTS - DESIGN IDEAS					
Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: Operations **(O)**			
Location: **Vancouver BC** Date: **December 1 - 2, 2011** Client: **City of Victoria**		Geographic location: N/A			
Idea No.	Description	Evaluation			
		Action Required? (Yes/No)	Action By	Notes	
O - 1	Move Control Room On-Shore	Yes	MMM / WEA	No Change	
O - 2	Only Use On-Site CCTV to Monitor Bridge	No			
O - 3	Use Fully Automated System	No			
O - 4	Investigate Secondary Power Supply	Yes	SBE	No Change	
O - 5	Utilize Other Standby Generator (Shared with City Hall)	No			
O - 6	Investigate Reliability of Electrical Breaker Supply Design	No			
O - 7	Consider Intelligent Transportation Systems (ITS) to Limit Storage Needs	No			
O - 8	Install Advance Vertical Clearance Indicator (for Marine Traffic)	Yes	MMM	DS	
O - 9	Install Advance Approach Vertical Scanner (for Marine Traffic)	Yes	MMM	DS	
O - 10	Conduct a Marine Users Group Communication Program Prior to Opening	Yes	MMM	DS	

Legend:

DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

Table 12 – Evaluation Results: Mechanical

CREATIVE PHASE RESULTS - DESIGN IDEAS

Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: Mechanical **(M)**
Location:	**Vancouver BC**	
Date:	**December 1 - 2, 2011**	Geographic location: N/A
Client:	**City of Victoria**	

Idea No.	Description	Evaluation		
		Action Required? (Yes/No)	Action By	Notes
M - 1	Use Hydrostatic Bearing System	No		
M - 2	Reduce Weight On Bridge to Reduce Mechanical Cost	Yes	MMM	See Structures
M - 3	Use Hydraulic System	No		
M - 4	Use Power Monitoring / Warning System for Loads	Yes	SBE	DS
M - 5	Use Open Deck to Reduce Weight	No		
M - 6	Use Light Weight Aluminum Deck	No		
M - 7	Treat Bikeway Differently from Roadway (i.e. Aluminum)	Yes	MMM	DS
M - 8	Talk to DFO Regarding Open Grate System	No		
M - 9	Define Wind Condition Where City Does Not Open Bridge	Yes	All	DS
M - 10	Reduce Rack from 2 to 1	No		

Legend:

DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

Table 13 – Evaluation Results: Wheel

CREATIVE PHASE RESULTS - DESIGN IDEAS

Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: Wheel **(W)**
Location:	**Vancouver BC**	
Date:	**December 1 - 2, 2011**	Geographic location: N/A
Client:	**City of Victoria**	

Idea No.	Description	Evaluation		
		Action Required? (Yes/No)	Action By	Notes
W - 1	Eliminate Pedestrian Link Thru Wheel	No		
W - 2	Add Spokes to the Wheel	No		
W - 3	Add Partial (Bottom) Spokes on Wheel	Yes	MMM / WEA	Done
W - 4	Develop Rationale Approach to Bridge Open Design for Seismic Event	Yes	MMM	Done

Legend:
DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

Table 14 – Evaluation Results: Architectural Metals

CREATIVE PHASE RESULTS - DESIGN IDEAS

Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: Architectural Metals **(AM)**
Location:	**Vancouver BC**	
Date:	**December 1 - 2, 2011**	Geographic location: N/A
Client:	**City of Victoria**	

Idea No.	Description	Evaluation		
		Action Required? (Yes/No)	Action By	Notes
AM - 1	Supplier for Aluminum Deck	Yes	WEA / MMM	DS
AM - 2	Use Stiffened Plate Deck System	Yes	WEA / MMM	DS
AM - 3	Use Fiber Reinforced Plastic (FRP) Deck System	Yes	WEA / MMM	No Change
AM - 4	Use Sandwich Panels	Yes	WEA / MMM	No
AM - 5	Use Carbon Fibre Handrail	No		
AM - 6	Use Anodized Aluminum Handrails	No		
AM - 7	Mesh on Road Side Railings	No		Deleted Idea
AM - 8	Use Vertical or Alternative on Infill of Road Side Railings	Yes	WEA	DS
AM - 9	Use Single Railing instead of Double Railings - Cyclist Height on Cycle Side and Ped Height on Ped Side + Delineate Pathway	No		
AM - 10	Use Single Railing	No		
AM - 11	Visual Quality Standard of Metals	Yes	WEA / MMM	DS

Legend:

DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

Table 15 – Evaluation Results: Process

CREATIVE PHASE RESULTS - DESIGN IDEAS					
Project:	**Johnson Street Bridge Value Engineering**	Value Target Area: Process **(P)**			
Location: **Vancouver BC** Date: **December 1 - 2, 2011** Client: **City of Victoria**		Geographic location: N/A			
Idea No.	Description	Evaluation			
		Action Required? (Yes/No)	Action By	Notes	
P - 1	Prequalification During Design - Hold Commercial Confidential Meetings with Bidders for Construction	Yes	MMM	Done	
P - 2	Same as Idea P-1 but with Alternative Contractor Approaches	Yes	MMM	Done	
P - 3	Flexibility in Details, Remove Uncertainty and Allow Compromise	Yes	MMM	Done	
P - 4	Alternative Technical Concepts (ATC) with Submissions	Yes	MMM	Done	
P - 5	Base Compliant Bid plus ATC's as Accepted	Yes	MMM	Done	
P - 6	Fairness Monitor	Yes	MMM	Done	
P - 7	Declare Design-Bid-Build (DBB) Process and Variations Prior to	Yes	MMM	Done	
P - 8	Market the Job Worldwide	Yes	MMM	Done	
P - 9	Prequalification of General Contractor , and Require Approval of Any Proposed Change	Yes	MMM	Done	
P - 10	Be Aware of Liquidated Damages and Impact on Costs	Yes	MMM	Done	
P - 11	Pre-Arrange Notice to Proceed with City Council	Yes	City		
P - 12	Tender to Meet DFO Window	Yes	City		
P - 13	General Contractor Must Declare Subcontractors in Tender	Yes	City		
P - 14	Establish Legal Basis for Commercial Confidential Information	Yes	City		
P - 15	Value Engineering in Contract	Yes	City		
P - 16	Tender by October 2012	Yes	City / MMM		

Legend:

DS = Design Suggestion (value of suggestion is not quantifiable at time of VE Workshop)
CS = Contractor Suggestion

DC = Design Criteria
U = Utilities
S = Structures
RW = Retaining Walls
TS = Traffic Staging
RA = Roads and Approaches
AM = Architectural Metals
P = Process

City = City of Victoria
MMM = MMM Group Limited
WEA = Wilkinson Eyre Architects
SBE = Stafford Bandlow Engineering Inc.
S&D = Sharp & Diamond

6.0 IMPLEMENTATION ACTIONS

6.1 Post-Workshop Efforts

The anticipated post-workshop portion of the VE Study includes:

- Incorporating findings and decisions from the VE Workshop into a draft VE Study document to be submitted to the City of Victoria.
- For each of the creative ideas recommended to be further evaluated for potential use during detailed design:
    - Develop a cost estimate and assess the amount of potential cost savings to the project; and
    - Assess the value that each idea brings to the project.
- Based on the results based on the above, plan a Technical Implementation Meeting with representatives from the Project Team. The purpose of the meeting is to review the VE recommendations, the technical merits of each idea and the extent of savings in order to make decisions to their disposition and implementation in the detail design. This work will consider the refinement of the overall Cost Estimate based on any savings and how the overall estimated project costs relate to the City of Victoria's budget for the project.

APPENDIX 1 – Base Case Cost Model