Using a Risk Register Tool to Obtain Best Value

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Risk Register Tool for Best Value

- A simple, qualitative risk register, completed by a VM Team, is a useful tool to obtain best value from your project, process, or product.
- Risk needs to be considered in value equation even without a separate risk workshop.
- Learn to complete a qualitative risk register in your VM workshop & what tools are available.
- See actual risk registers & how their development contributed to best value
- The qualitative risk register belongs in your VM toolbox

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Why do we need to consider risk?

- **“No construction project is risk free. Risk can be managed, minimised, shared, transferred, or accepted. It cannot be ignored”**

  Sir Michael Latham, 1994

- **Strong links between the VM process and RM**
  - VM: Enhancement of Value & possible cost savings
  - RM: Cost Avoidance
  - Known risks can lead to Value Enhancement ideas
  - Both VM and RM make Project more cost effective
  - In VM Proposals, must consider risks & their likely cost & time implications over the life of the Project

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Why do we need to consider risk?

- For VM to improve project value, risk must be considered to provide balanced solutions.
- Although VM might implicitly consider risk, explicit reference to risks helps ensure it.
- Risk in VM has value in early stages of project to understand potential risks, identify targets, & enhance brainstorming.
- VM can generate mitigation ideas for risks
- Risk finds “Show Stoppers” VM can help solve

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How do we develop a qualitative risk register?

			No action against Risk				Action against Risk						
RISK NO	RISK	RISK MANAGEMENT	PROB-ABILITY	CONSEQUENC COST	CONSEQUENC TIME	TOTAL	PROB-ABILITY	CONSEQUENC COST	CONSEQUENC TIME	TOTAL	MAXIMUM COST	MAXIMUM WEIGHTED COST	MINIMUM WEIGHTED COST
1	Failure to meet COA requirements - OCWA and EP	Plant designed, built, operated, and maintained well; simple, reliable operation	5	5	1	30	1	2	1	3	$10,000,000	$10,000,000	$800,000
2	Loss of biosolids disposal location	Use thermophilic anaerobic digestio to produce Class A sludge; determi alternate biosolids disposal location	4	5	3	32	2	3	1	8	$300,000	$240,000	$72,000
3	Insufficient odor mitigation	Contain, collect, convey, and treat odour with high degree of care and reliability.	3	5	5	30	1	2	2	4	$600,000	$360,000	$48,000

- **Develop or "borrow" a risk register, most likely an excel spreadsheet (MTO, me)**
  - Number risks in column 1
  - Enter identified risks in column 2 - Define well
  - Enter steps to mitigate risks in column 3

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- **Quantify Risks as next few slides describe**
  - Columns 4, 5, & 6 are for risk with no mitigation
  - Columns 8, 9, & 10 are for risk with mitigation
  - Estimate max cost impact of risk in column 12
  - Columns 7, 11, 13, & 14 are filled by calculation

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How do we develop a qualitative risk register?

- **For each risk, both with and without mitigation, determine by consensus:**
  - Probability (or Likelihood) of occurrence (1 to 5)
  - Consequence (cost & time) / Effect (1 to 5)
- **Assessment automatically calculated:**
  - Probability x Consequence = Assessment
  - e.g. P = 5, C = 4, A = 20 (maximum 25)

  Or
  - Prob x (Cons. (Cost) + Cons. (Time)) = Assessment
  - e.g. P = 5, C_{cost} = 4, C_{time} = 3, A = 35 (maximum 50)

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How do we develop a qualitative risk register?

Probability / Likelihood	Consequence / Effect	Cost / Time
Definite = 5	Catastrophic = 5	100X
Probable = 4	Critical = 4	10X
50/50 = 3	Serious = 3	$X_{Serious}$
Remote = 2	Marginal = 2	X/10
Improbable = 1	Negligible = 1	X/100

The value of $X_{Serious}$ and range of values in column 3 will be very project specific and determined by team

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Different types of risk registers?

- This Risk Register assesses risk using upper & lower cost envelopes & Root Mean Squared analysis - Best used for qualitative risk assessment; quick, easy to use
- Others use upper, median and lower level costs for each risk and the Monte Carlo method – Better for quantitative risk assessment; separate or parallel process
- Although the VM Team "quantifies" risks for the simpler RMS risk register, the results are used qualitatively.

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How does risk assessment help VM?

- The VM need is to recognize risks and how they may effect a project, qualitatively.
- Risk assessment does not need to be exact or extensive to be useful to the VM process.
- Recognizing risks and how they may effect project options, qualitatively, can greatly assist VM when a quantitative level analysis is not available.
- Risks identified as “significant” often yield value target areas and creative ideas.

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Fully Integrated Baggage Screening System, BWI Airport, MD

			No action against Risk				Action against Risk					
RISK NO	RISK	RISK MANAGEMENT	PROB-ABILITY	CONSEQUENCE COST	CONSEQUENCE TIME	TOTAL	PROB-ABILITY	CONSEQUENCE COST	CONSEQUENCE TIME	TOTAL	MAXIMUM COST	MAXIMUM WEIGHTED COST
3	A poor return on investment on the money spent for FIBSS, Fail to achieve full eligibility for federal funding	Spend money wisely, LCC, include features which can boost ROI, VE, commission system properly and include user in process	5	5		25	3	4		12	$18,000,000	$18,000,000
7	Project cost grows too much to go forward	Design cost-effectively; move project along to minimize escalation, LCC	5	5		25	2	2		4	$13,000,000	$13,000,000
8	Potential of BWI is not realized due to baggage limitations	Meet required baggage screening throughput, verify projections	5	5		25	1	1		1	$100,000,000	$100,000,000
9	Sort system fails to get bags where they're supposed to be (as high as 5%?)	Select proper technology, Conduct intensive testing of system to insure it works properly; have system monitored daily	5	5		25	1	1		1	$130,000,000	$130,000,000
12	Contractor does not properly administer project	Performance based construction contracts	3	5		15	2	3		6	$10,000,000	$6,000,000

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Fully Integrated Baggage Screening System, BWI Airport, MD

- Key risk identified as “Sort system fails to get bags where they're supposed to be (as high as 5%?)”.
- Brainstorming by VM Team around this risk generated the idea to strengthen the specifications to require equipment delivering a “failure rate” ≤ 1%.
- In developing VM Proposal around this idea, VM Team found equipment that could meet this specification.
- Client eventually decided to make the necessary additional investment.
- Life cycle cost avoidance estimated at $4,681,000.

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Highway 11: North Bay to New Liskeard

- **VM Study Objectives included:**
  - Develop sustainable corridor management strategy
  - Prioritize improvements for the entire corridor
- **Significant project risks from register:**
  - Deferral due to lack of funding leads to further pavement facility degradation
  - Cost of not accepting existing conditions as reasonable, e.g. spending money to increase design speed of curve from 107 km/hr to 110 km/hr in lieu of fixing degraded pavement.

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Highway 11: North Bay to New Liskeard

- **Focusing on these risks during VM Study led to following VM Team conclusions:**
  - Immediate funding is required for poor pavement areas ($40M).
  - More active preventive program approach is required to ensure a sustainable corridor.
  - A $5M / year strategy would result in higher overall corridor cost (+$30M); a lower quality pavement on average; and highly variable pavement conditions.
- **Risk register led to these important findings**

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Highway 401: Palace Road IC Structure

- **VM Study Objectives included:**
  - Help determine preferred alternative to take forward.
  - Validate and/or improve conceptual design and staging scheme for rehabilitation of twin structures carrying Highway 401 over Palace Road.
  - Provide new perspectives and creative ideas to the Palace Road concept
  - Identify project risks and how they can be mitigated.
- **Most significant project risk from register:**
  - Unknown ultimate configuration for IC leading to throwaway costs

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Highway 401: Palace Road IC Structure

- **This risk essentially defined the sub-factors of our sustainability performance criteria for the VM Workshop as follows:**
  - Relative amount of infrastructure investment to be "thrown away" by ultimate IC where:

    10 = none, 5 = 50%, 1 = 100%
  - Relative amount of existing structure reused:

    10 = 100%, 5 = 50%, 1 = none
  - Flexibility to meet unknown future needs:

    10 = Increased, 5 = Same, 1 = Decreased

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Highway 401: Palace Road IC Structure

- More importantly, this risk led to Scenario 4, the “minimalist approach”, with highest performance, second lowest capital cost, and best value (P/C ratio).
- Although not same level of product as others, Scenario 4 was developed since it addresses largest risk of the project, i.e. what is built now will not suit future requirements, leading to substantial throw away costs.
- Without risk register, “minimalist approach” would likely not be part of considerations.

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Highway 417: Nicholas Street Structure

Estimated Base Project Cost	$1,800,000

Risk Identification					No Action against Risk						Action against Risk							Risk Quantification	
Risk #	Date (Month, Year)	Improvement Type	Risk Breakdown Structure	Detailed Description of Risk Event (Specific, Measurable, Attributable, Relevant, Timebound) [SMART]	Risk Cost (without mitigation)	Probability	Cost Impact	Schedule Impact	Cost Criticality	Schedule Criticality	Risk Mitigation Strategy	Risk Cost if Mitigated	Probability	Cost Impact	Schedule Impact	Cost Criticality	Time Criticality	Weighted Risk Cost without mitigation	Weighted Mitigated Risk Cost
1	Jun-09	Major Widening	Structures and Foundations STG	Structure failure after pier replacement	$10,000,000	2	5	5	M	H	additional detailed design and construction cost	$10,000,000	1	5	5	M	H	$4,000,000	$2,000,000
2	Jun-09	Major Widening	Construction Risk CNS	Structure failure during pier replacement	$10,000,000	3	5	5	H	H	additional detailed design and construction cost and constructibility study	$10,000,000	1	5	5	M	H	$6,000,000	$2,000,000
3	Jun-09	Major Widening	Construction Risk CNS	Significant traffic disruption on Nicholas	$500,000	2	5	1	M	L	traffic management	$40,000	1	3	1	L	L	$200,000	$4,800
4	Jun-09	Major Widening	Construction Risk CNS	Significant traffic disruption on Highway 417	$2,500,000	3	5	2	H	M	traffic and incident management plans	$1,000,000	1	5	2	M	M	$1,500,000	$200,000
5	Jun-09	Major Widening	Construction Risk CNS	Failure to maintain the existing illumination during construction	$500,000	1	5	1	M	L	stand-by power and lights	$50,000	1	3	1	L	L	$100,000	$6,000
6	Jun-09	Major Widening	Construction Risk CNS	Significant disruption to traffic flow on the N-E ramp	$2,000,000	5	5	2	H	M	good signage, as much room as possible, good TM	$500,000	3	5	2	H	M	$2,000,000	$300,000
7	Jun-09	Major Widening	Construction Risk CNS	Existing pier location interfering with new caison placement	$10,000,000	4	5	3	H	H	good investigation and design	$25,000	1	2	1	L	L	$8,000,000	$2,000
8	Jun-09	Major Widening	Construction Risk CNS	Existing piles may not be located as per original design	$1,000,000	4	5	3	H	H	plan for the event	$500,000	4	5	2	H	M	$800,000	$400,000
9	Jun-09	Major Widening	Gov Agencies and Stakeholders GAS	Differential settlement of pavement over existing footings	$50,000	5	3	1	H	L	modified pavement design to provide transition area	$20,000	3	2	1	M	L	$30,000	$4,800
10	Jun-09	Major Widening	Construction Risk CNS	Unknown soil conditions	$500,000	2	5	1	M	L	more complete investigation	$100,000	1	4	1	L	L	$200,000	$16,000
11	Jun-09	Major Widening	Construction Risk CNS	Potential contaminated soils	$100,000	3	4	3	M	M	more complete investigation (ESA)	$50,000	3	3	1	M	L	$48,000	$18,000
12	Jun-09	Major Widening	Gov Agencies and Stakeholders GAS	EA addendum	$1,500,000	1	5	5	M	H	work within the bounds of the EA	$1	1	1	1	L	L	$300,000	$0
13	Jun-09	Major Widening	Construction Risk CNS	Potential damage to existing structure during construction and demolition	$200,000	2	5	2	M	M	prepare specs carefully	$50,000	1	3	1	L	L	$80,000	$6,000
14	Jun-09	Major Widening	Construction Risk CNS	Bridge unable to hold the equipment required to install the new piers	$2,000,000	5	5	4	H	H	use different foundation system for piers	$100,000	1	4	1	L	L	$2,000,000	$16,000
15	Jun-09	Major Widening	Structures and Foundations STG	Steel super structure can't be modified to accommodate the longer central span without significant costs	$2,000,000	5	5	4	H	H	thorough analysis during detailed design	$100,000	1	4	2	L	M	$2,000,000	$16,000

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Highway 417: Nicholas Street Structure

- Used new Risk Register Tool from MTO
- Qualitative risk register places more importance on management of risk than on accuracy of cost allowances, which are largely speculative.
- However, these order-of-magnitude costs clearly showed the VM Team (& project team) which risks need to be mitigated and/or avoided as the structure modifications go forward.

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Highway 417: Nicholas Street Structure

- **The risks shown to be significant included:**
  - Structure failure after pier replacement
  - Structure failure during pier replacement
  - Significant traffic disruption on Highway 417
  - Significant disruption to traffic flow on the N-E ramp
  - Existing piles may not be located as per original design
- Significant number of creative ideas were generated from consideration of these risks.

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Highway 417: Nicholas Street Structure

- **These risks greatly influenced the sub-factors of our various performance criteria for the VM Workshop as follows:**
  - Structures: Future work requirements / maintenance
    Potential for damaging existing elements
  - Foundations: Prob. interference w/existing foundation
    Potential to damage existing elements
  - Constructability: Construction impact on local road network & on Highway 417
  - Sustainability: Time until next major work element required on bridge beyond deck maintenance

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Highway 417: Nicholas Street Structure

- The four performance criteria on the previous page accounted for 59% of the weighting.
- As such, they had a major impact on the selection of the best project solutions.
- Therefore, there was a direct correlation in this VM study between the risks identified as significant from the risk register and the selection of the best project solutions.

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Conclusion and Questions

- **All the foregoing examples demonstrate well why the qualitative risk register belongs in your VM toolbox.**
- **Any questions??**

For Further Information:

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