

Self-Modeling Spreadsheet & Informal Workshop Training

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Accountability

The Questions

- How much will it cost?
- How long will it take?

The Follow-up Questions

- Why does it cost that much?
- Why does it take that long?



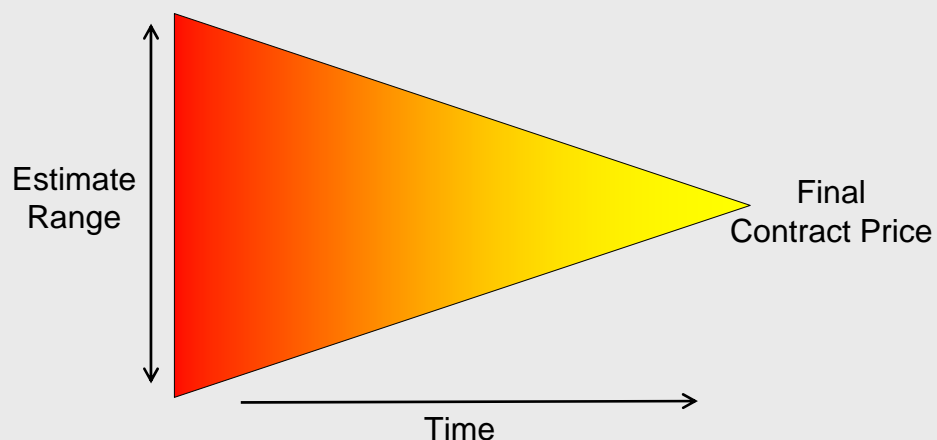
Accountability

An Estimate is not a Number

- Projects are subject to many variables that cannot all be known beforehand
- Cost and schedule estimates represent just one of many possible outcomes of multiple variables
- These variables are not all directly controllable or absolutely quantifiable
- Therefore cost and schedule estimating and the validation process must consider probabilities in assessing estimates and schedule, using a recognized and logical testing process



Estimate Range



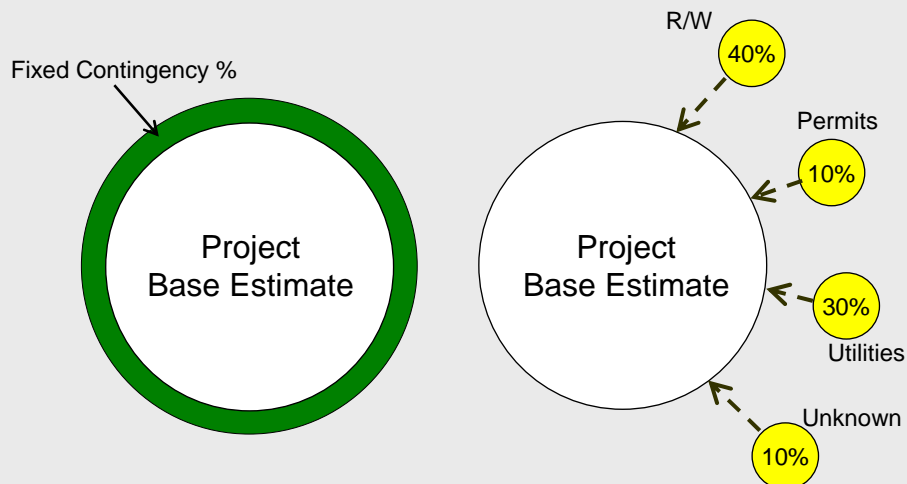
An estimate is like a field goal

- When you kick a field goal it can go left, right, high or low but as long as it goes through the goal posts its still worth 3 points.



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Traditional vs. Risk-Based




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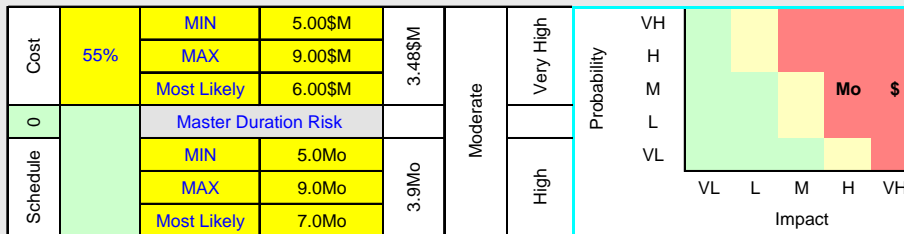
Benefits

- Benefits of using RBE:
 - Better understanding of the project's challenges
 - Crafts the project risk management plan with clear target on how to enhance the project's value
 - Helps in maximizing the project's opportunities and reducing or eliminating the project's threats

Qualitative

Probability	Impact	Risk Matrix
(10)	(11)	(12)
		 <p>Probability</p> <p>H</p> <p>L</p> <p>L H</p> <p>Impact</p>

Quantitative



Definitions

- **Risk** - An uncertain event or condition that, if it occurs, will have a positive or negative effect on a project's objectives
 - A positive consequence presents an opportunity
 - A negative consequence presents a threat

Definitions

- **Risk Analysis** – The use of available information to determine how often events may occur and the magnitude of their consequences.
- **Risk Statement** – A written statement that describes the possible risk event and the impact caused by the event

Definitions

- **Probability** – Likelihood of occurrence
- **Impact** – Added (or reduced) cost, time, or scope to a defined project or loss of goodwill, image, trust, and respect due to a risk event occurring

Definitions

- **Risk Response** – A plan of action designed to reduce the impact once a risk event has occurred
 - **Planning** – Prior to the risk event occurring as though it will occur
 - **Implementation** – Actions to take after the risk event has occurred
 - **Trigger** – Identifies that the risk event has occurred and notifies the team to implement the risk response plan

Definitions

- **CY** – Current Year
- **YOE** – Year of Expenditure
- **Pre-Mitigated** – The results of the risk assessment before any response strategies have been applied
- **Post-Mitigated** – The results of the risk assessment after the response strategies have been applied

Definitions

- **Base Cost** - The base cost represents the cost which can reasonable be expected if the project materializes as planned
- **Inflation** – A persistent tendency for prices and wages to increase. Inflation is measured by the proportional changes over time in a price index
- **Escalation** – The total annual rate of increase in cost of the work or its sub-elements. The escalation rate includes the effects of **inflation plus market conditions** and other similar factors



Executive Order E 1053

The following table provides the minimum risk management process required based on project size. Project managers may use a higher level process than required.

Project Size (M = Millions)	Minimum Risk Management Process Required
\$10 M or less	Qualitative Spreadsheet in the Project Management Online Guide ¹
\$10 M to \$25 M	Informal workshop using the Self-Modeling Spreadsheet ^{1,3}
\$25 M to \$100 M	Cost Risk Assessment (CRA) Workshop ^{1,2}
\$100 M or more	Cost Estimate Validation Process (CEVP®) Workshop ²

¹ In some cases it is acceptable to combine the Value Engineering Study and Risk Based Estimating Workshop.

² Projects \$25 million and over should use the self-modeling spreadsheet in the scoping phase, followed up by the more formal CRA or CEVP® process during the design phase.

³ An informal workshop is comprised of the project team (or key project team members), other participants may be included as the project manager/project team deem necessary.



Informal Workshop

- **Project Manager**
- **Specialty Groups**
 - Construction
 - Bridges and Structures
 - Environmental
 - Real Estate Services
 - Geotechnical
 - Utilities
 - Local Agencies
 - Others depending on the project scope



What information is needed?

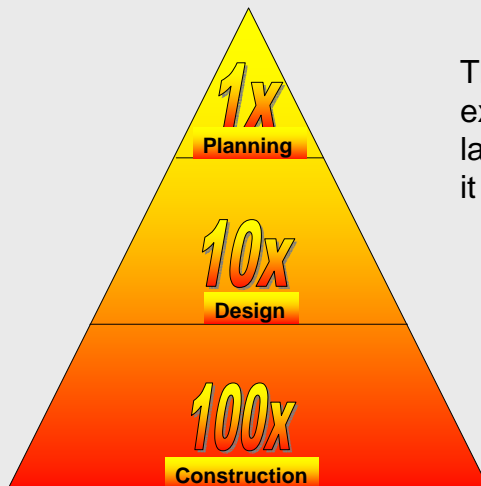
- Ad Date
- Construction Schedule
- Preliminary Engineering Schedule
- Baseline cost estimate for CN in CY
- Estimate for PE
- Estimate for R/W
- Estimate for Utility work

Base Cost and Schedule Validation

- Review the project assumptions
- Review the project cost and schedule based on the information available
 - Update unit price
 - Update quantities
- Capture the unknown cost of misc. items (miscellaneous item allowance)
- Remove some contingencies



When should we start?



The cost to fix an issue exponentially increases the later in the project lifecycle that it is identified and resolved



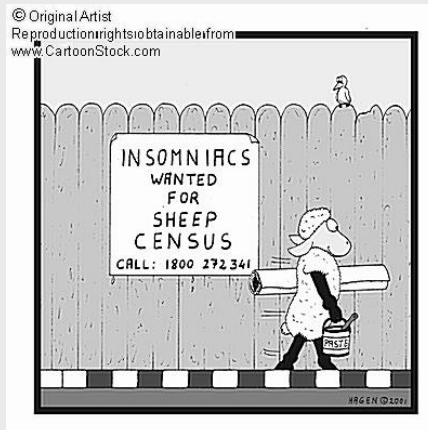
Risks Identification & Quantification

- Focus is on
 - Identify the key events
 - Estimate how likely it is that the event will materialize
 - Estimate by how much events may turn out differently from the base estimate



Elicit Risks

What about the project keeps you awake at night?



Elicit Risks

- Some may call it interrogation – but the goal is elicitation
- Use a list of example risks as a primer in case the team stalls out on ideas
- Do not just look at the **threats** – **opportunities** might exist too

Self-Modeling Spreadsheet

- Excel based self modeling Risk Management Plan (SMSS)
- Developed by WSDOT – Dr. Ovidiu Cretu
- Can download the most recent version of the SMSS at

<http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Information.htm>

Sample Project

- Open the file named **sample project.xls** in the **C:\AAWork\SMSS Training** folder

Limitations of the SMSS

- You can only model a max of 24 risks (**Threats** and/or **Opportunities**)
- Can not create dependencies in schedule on more than two risks

Caution!

- It is **VERY** important that you do not change the names of the worksheet tabs
- **AVOID** cutting and pasting information into the yellow highlighted tabs as there is a danger of deleting or altering the formulas in the cells which could cause the SMSS to crash
- **DO NOT DELETE** any rows, columns or individual worksheets
- **EVERY TIME** you begin a new worksheet go to the web page and download a updated version

Input Sheets

- **Pre-Mitigated** – The **RMP** sheet is used for the first 12 risks and the **RMPSuppl** is used for the next 12 risks
- These two sheets reflect the effect of risk to the project in its existing condition prior to any risk mitigation

Input Sheets

- **Post-Mitigated** – The **RMPM** sheet is used for the first 12 risks and the **RMPSupplM** is used for the next 12 risks
- These two sheets reflect the affect of risk after risk response planning is put into effect

Input Sheets

- **Base** – This is the sheet that you will input the base estimate information.
- **Risk1** to **Risk24** - These are the sheets that you will input the information for each individual risk

Output Sheets

- **Total-Cost (CY)** – This sheet shows the cumulative effect of risk on total project costs in current year dollars
- **PE-Cost (CY)** – This sheet shows the cumulative effect of risk on pre-construction (i.e. design) costs in current year dollars
- **ROW-Cost (CY)** – This sheet shows the cumulative effect of risk on right of way (i.e. real estate) costs in current year dollars
- **CN-Cost (CY)** – This sheet shows the cumulative effect of risk on construction costs in current year dollars



Output Sheets

- **Total-Cost (YOE)** – This sheet shows the cumulative effect of risk on total project costs in year of expenditure (escalated) dollars
- **PE-Cost (YOE)** – This sheet shows the cumulative effect of risk on pre-construction (i.e. design) costs in year of expenditure (escalated) dollars
- **ROW-Cost (YOE)** – This sheet shows the cumulative effect of risk on right of way (i.e. real estate) costs in year of expenditure (escalated) dollars
- **CN-Cost (YOE)** – This sheet shows the cumulative effect of risk on construction costs in year of expenditure (escalated) dollars



Output Sheets

- **Ad Date** – This sheet shows the impact of risk to the project's advertisement date. Risks that impact pre-construction and right of way will potentially impact the Ad Date
- **End Construction** – This sheet shows the impact of risk to the project's construction completion date. Risks that impact pre-construction, right of way and construction will potentially impact this date.
- **EV** – This sheet shows a tornado diagram of your risks

Miscellaneous Sheets

- **Calc** – This sheet is used for running the Monte Carlo analysis. ***Don't Touch!***
- **User Guide** – Additional instructions on the use of the SMSS

Sample Project

- Cost is entered in millions of dollars
- Time is entered in months
- Go ahead and select the **Base** worksheet
- Start by entering your base information
- The areas that need information are highlighted in **Yellow**



Base Tab

Project Title				Value	Variability	Risk Markups	
Estimate Date			Target AD date		10%	Mob	
Project PIN #		The above macro should be activated to generate the final results. Do not stop it if it is running.	Estimated CN Duration		10%	Tax	
Last Review Date			Estimated PE Cost		10%	CE	
Project Manager			Estimated ROW Cost		10%	PE	#DIV/0!
			Estimated CN Cost		10%	C.O.C	4.0%



Base Input Information

- **Project Title** – Enter the name of the project
Sample Training
- **Estimate Date** – Enter the date of the last time the project cost estimate was reviewed (*Inflation is calculated from this date*) *02/15/09*
- **Project PIN**
- **Last Review Date** – What was the last time the SMSS was reviewed *enter today's date*
- **Project Manager** – Enter the name of your project manager: *Your name*



Base Input Information

- **Target Ad Date** – Enter the current anticipated date on which the project will be advertised
12/15/2010
- **Estimated CN Duration** – Enter the anticipated length of construction (*in calendar months*) *36*
- **Estimated PE Cost** – Enter the total anticipated design costs for the project (*in millions of \$*) *4.00*
- **Estimated ROW Cost** – Enter the total anticipated right-of-way costs for the project (*in millions of \$*) *1.25*



Base Input Information

- **Estimated CN Cost** – Enter the total anticipated construction cost for the project (*in millions of \$*) **26.50**
 - This is the base cost of construction
 - Includes mobilization, sales taxes, construction engineering, change order contingencies and below the line items
 - Includes agreement and utility costs not included in PE or R/W costs
 - **Document what you include and exclude from this number**



Base Input Information

- **Variability** – This column is used to indicate the potential fluctuation of the number given for cost and schedule **10**
 - Variability is a different type of uncertainty, but it's not risk since it can be equally positive or negative. Another way of thinking of it is the level of confidence we have in our estimate of cost and schedule.
 - Example – early in design we might assign a variability of 10% to the Ad Date. So, if there were 20 months to the Ad Date, this would mean that the Ad Date could be plus or minus 10% or between 18 and 22 months.



Base Input Information

- **Risk Markups** – You will want to enter in factors that you are using on your project.
 - *Mobilization* – Enter the % of construction mobilization: **8**
 - *Sales Tax* – Enter the local sales tax: **8.5**
 - *Construction Engineering* – Enter the CE from the PPM: **8**
 - *Preliminary Engineering* – PE will be calculated
 - *Change Order Contingency* – no choice **4**



Other Base Information

- **A/B/A Duration** – This is the duration of the Ad/Bid/Award time in months: **2**

A/B/A Duration	2Mo
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Other Base Information

- **Inflation** – Leave this area alone

WSDOT Escalation tables built-in.			Escalation Points	
A/B/A Duration	2Mo		Define escalation point of the activity cost. For example 50% means that the escalation point for that activity is the mid-point activity. 50% is the default value. If it is decided that the escalation point is at three quarters of respective activity you may choose 75%. The model accepts any percentage from 0% to 100%.	
Non-WSDOT rates	YOE			
PE		4.0\$M		
ROW		1.3\$M	Preconstruction activities (ROW and PE)	0.5
CN		27.7\$M	Construction	0.5

The WSDOT inflation tables are used in the model. You can update them as needed by clicking on the button on the RMP worksheet.

Escalation rates update



Quantifying Risk

- Select the **Risk1** tab

Pre-mitigated										
Risk #	Status	Dependency	Project Phase	Summary Description Threat and/or Opportunity	Detailed Description of Risk Event (Specific, Measurable, Attributable, Relevant, Timebound)	Risk Trigger	Type	Probability Correlation	Risk Impact (\$M or Mo)	
(1)	(2)	(3)	(5)	(6)	(7)	(8)	(9)	(10)	[10a]	(11)
			Construction				Cost		MIN	
									MAX	
									Most Likely	
							0		Master Duration Risk	
							Schedule		MIN	
									MAX	
									Most Likely	



Priority

- Generally, it is best to enter the risks from your initial Risk Register into the SMSS from high to low in terms of importance
- However, keep in mind that the relative importance of the risks are likely to change over time
- The order they are entered in will only be important if you have two risks that are dependent on each other

Status

- **(2) Risk Status** – There is a pull down menu in the cell that allows you to select one of three options.
 - **Active** – An active risk is one that is being managed
 - **Dormant** – A dormant risk is one that is currently not active but could develop into an active risk later. The model will treat dormant and active the same.
 - **Retired** – A retired risk is one that no longer exists and will not be managed. The model will ignore risks identified as retired.

Columns D-F

- **(3) Dependency** – This is an advanced feature that will be covered later
- **(5) Project Phase** – If this risk happens, where will the cost or schedule impact occur?
 - **Pre-Construction**
 - **Construction**
 - **Right-of-Way**



Summary Description

- **(6) Summary Description** – Identify whether the risk is a *Threat* or an *Opportunity* by selecting the appropriate description in the upper and yellow menu boxes. The top choice is if the risk impacts the cost and the bottom choice is if the risk impacts the schedule
- Provide a short (2 or 3 word) title for the risk in the white area in-between



Columns H-I-J

- **(7) SMART Description** – (Specific, Measurable, Attributable, Relevant, Timebound) Write a detailed risk description so that someone who knows nothing about the project can understand it
- **(8) Risk Trigger** – How will you know when this risk occurs
- **(9) Type** – This is an advanced feature that we will cover later



Probability

- **(10) Probability/Correlation** – Enter the probability of the risk occurring, expressed as a number between 1 and 99 in the yellow highlighted cell
 - This percentage relates to the “Most Likely” occurrence of this risk
 - The green highlighted cell is an advanced feature we will cover later



Risk Impact

- **(11) Risk Impact** – Enter the quantitative values for the various levels of risk impact.
 - Cost is expressed in \$ millions
 - Schedule impacts are expressed in months

Professional Sophistication

$$\ln\left(\lim_{z \rightarrow \infty} \left(\left(\overline{X}^T \right)^{-1} - \left(\overline{X}^{-1} \right)^T + \frac{1}{z} \right)^2\right) + \sin^2(p) + \cos^2(p) = \sum_{n=0}^{\infty} \frac{\cosh(q) * \sqrt{1 - \tanh^2(q)}}{2^n}$$

$$\ln\left(\lim_{z \rightarrow \infty} \left(1 + \frac{1}{z} \right)^2\right) + \sin^2(p) + \cos^2(p) = \sum_{n=0}^{\infty} \frac{\cosh(q) * \sqrt{1 - \tanh^2(q)}}{2^n}$$

$$\ln(e) + \sin^2(p) + \cos^2(p) = \sum_{n=0}^{\infty} \left(\frac{1}{2} \right)^n$$

Professional Sophistication

$$1 + 1 = 2$$



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Professional Sophistication

“I would rather be approximately right than
precisely wrong.”

Warren Buffet



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Sample Project Risks

- Let's give this a try shall we...
- Enter in the following three risks into the Sample Project

Sample Project – Risk 1

- (1) Risk # - **1**
- (2) Status – **Active**
- (5) Project Phase – **Construction**
- (6) Summary Description – **Threat to Cost & Threat to Schedule, Timber Pile Removal**

Sample Project – Risk 1

(7) SMART Description – Existing creosote treated timber piles might need to be removed to make way for the new bridge structure. The plan is to close cut the timbers at ground level, with the subsurface portion left in. Risks arise if subsurface portion needs to be removed and if locations/methods for disposal are limited.



Sample Project – Risk 1

- (10) Probability – **50**
- (11) Cost Min = **0.1**, Max = **0.5**, Most Likely = **0.2**
- Schedule Min = **0.25**, Max = **1**, Most Likely = **0.5**



Sample Project – Risk 2

- The bridge design for this project calls for steel girders. Steel price has been variable, and is currently only available on a day to day basis. The base cost is on the low side so an increase is possible outside of escalation.
- Based on the amount of steel in the bridge it could be somewhere between \$0.5 M to as much as \$3 M leaning towards the low end.



Sample Project – Risk 3

- The local gas station owner has been very vocal about how the partial acquisition will damage his business well beyond the fair market value. He has hired an attorney. The property may end up in condemnation as he wants us to redesign around his business.
- Based on discussions with the Real Estate office the partial acquisition is worth \$0.5 M, the property owner wants \$2.0 M and if it goes to condemnation it will probably be around \$1.0 M but the added time might cost us missing the Ad Date by up to 4 months.



Run the Model

- Go to the Base worksheet and click on

Update the pre-mitigated base cost
and risks data

– This will transfer the risks to the RMP sheet

- Now go to the RMP worksheet and click on

Click It
when ready

– This will run the worksheet

Don't Forget to Save

- Before we check on the results lets all click the Save button 😊
- As a matter of fact I would click the Save button after each time you enter information or click a button the runs some macros

Results

- Results combining the estimated base cost and the risk impact values are summarized into the cost distribution (range and shape) of all possible outcomes and their relative likelihood of occurrence



Results

- The results are generated into distribution graphs shown on the output worksheets.
 - PE
 - ROW
 - CN
- *Total Cost* **is not** the sum of the other three
- Total Cost for CY and YOY are also displayed in the data column on the RMP worksheet

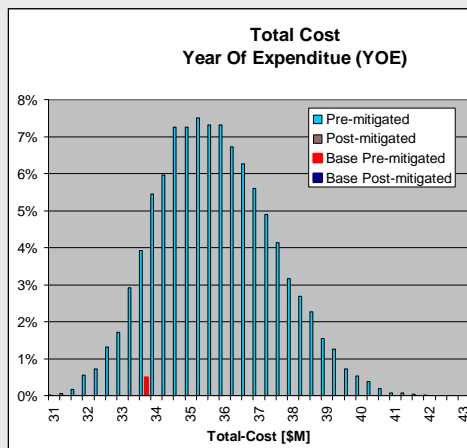


Mine looks different

- Common mistakes
 - Check the **Yellow** boxes
 - Risk not active
 - Project Phase coded incorrectly
 - **Threat** or **Opportunity** not toggled

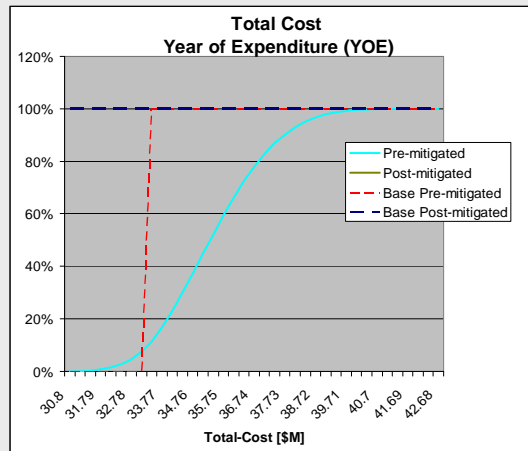
Histograms

- Usually the resulting graph is a bell-curve type of distribution although sometimes you will see spikes.



Cumulative Graph

- This graph is useful for analyzing the relationship between probability and impact.



Advanced Features

- The advanced features are the **green** boxes on the worksheets.
- They are used for providing additional guidance to the model

Dependency

- **(3) Dependency** – this advanced feature allows the model to link relationships of risks together.
 - You must input a subordinate risk on the worksheet following the controlling risk. Use the pull down menu in the upper **green** cell in column (3) for the dependent risk and indicate whether consecutive risks are:
 - **Blank** – This means that there is no dependency of this risk to any other. In this case we leave the cell blank
 - **Dependent Inclusive (DEP-INCL)** – This means that the risk may only occur when the previous risk occurs.
 - **Dependent Exclusive (DEP-EXCL)** – This means that the risk may only occur when the risk above it does not occur.



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Correlation between Risks

- Once it has been determined that two risks have a relationship, in the same column (3) in the lower **green** cell define the correlation between the risk's cost and schedule performance and between two consecutive risks.
- Correlation is an indication of a risk's movement in the same direction (**Positive**) in the opposite direction (**Negative**) or Independently



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Correlation

- **No Correlation** – This means that there is no correlation of this risk to any other. In this case leave it blank
- **Positive** – This means that when the value of the preceding risk is high this risk will be high and that when it is low it will be low
- **Negative** – This means that when the value of the preceding risk is high this risk will be low and that when it is low it will be high

Duration Link

- All odd number risks in this worksheet are Master Duration Risks
- The successor risks (even numbered) can be linked to the master risk that precedes it.
- On the odd numbered risks use the pull down menu in the **green** box in Column (9).
 - Select 1 if the successor duration (the next risk) is to be added to the present duration risk
 - Select 0 if the successor duration is not added to the present duration risk

Cost - Duration Correlation

- If it has been determined that there is a correlation between the cost and schedule performance within an individual risk then use the lower **green** cell in column (10) to define this correlation.
- Use the pull down menu in the **green** box in Column (10).
 - Select **Positive** if the cost and schedule's movement is in the same direction
 - Select **Negative** if the cost and schedule's movement is in the opposite directions
 - Leave blank if there is no correlation



Sample Project – Risks 4-5

- A major realignment may be required due to property owner objections during the Design & Access Hearing comment period.
- This will effect both Pre-construction and Construction, because the design team may need to redesign all or part of the project and it may impact the cost to construct.



Sample Project – Risks 4-5

- Risk 4 – Pre-Construction
 - **10%** probability
 - Min - **\$1** M, Max - **\$2** M, Most Likely - **\$1.5** M
 - Min – **6** Mo, Max – **12** Mo, Most Likely – **9** Mo
- Risk 5 – Construction
 - (3) set to **DEP-INCL**
 - **100%** probability
 - Min - **\$0** M, Max - **\$10** M, Most Likely - **\$3** M



Sample Project – Risks 6-7

- The impacts to a wetland buffer area are becoming very expensive.
- It has been suggested that a longer bridge may be necessary to reduce the impact to the wetland area.



Sample Project – Risks 6-7

- Risk 6 – Impacts to Wetland Buffer
 - 50% probability
 - Min - \$0.25 M, Max - \$1.25 M, Most Likely - \$0.30 M
- Risk 7 – Lengthen bridge by 100'
 - (3) Set to **DEP-EXCL**
 - 100% probability
 - Min - \$0.8 M, Max - \$1.2 M, Most Likely - \$1 M



Sample Project – Risks 8

- The Legislature may move this project forward by one season.
- If this occurs it will take additional \$\$ to complete the PS&E by the new Ad Date.



Sample Project – Risks 8

- Risk 8 – Ad Date
 - 75% probability
 - Cost - **Threat**
 - Min - \$1 M, Max - \$2 M, Most Likely - \$1.75
 - Schedule – **Opportunity**
 - Min – 9 Mo, Max – 12 Mo, Most Likely – 11 M
 - (10) Set to **Positive** correlation



Sample Project – Risks 9-10

- The Environmental Services Office is swamped. There is a risk that the Environmental Documentation will be delayed.
- Looking at the past three bridge over water projects within your region, you have noticed that the environmental permits sometimes take up to a couple of months longer to receive.



Sample Project – Risks 9-10

- Risk 9 – Environmental Documentation
 - 75% probability
 - Min – 1 Mo, Max – 3 Mo, Most Likely – 1.5 M
 - Duration Risk Link - 1
- Risk 10 – Environmental Permits
 - 50% probability
 - Min – 0.25 Mo, Max – 2 Mo, Most Likely – 1 M




Quality Control

- Common mistakes
 - Check the Yellow boxes
 - Risk not active
 - Construction cost coded to PE or ROW
 - Threat or opportunity not toggled



Response Plan

Response Plan					
Risk Response Plan			Monitoring and Control		
Strategy	ACTION TO BE TAKEN including advantages and disadvantages include date	Response Actions include date	Risk Owner	Risk Review Dates	Date, Status and Review Comments (Do not delete prior comments, therefore providing a history)
(16)	(17)		(18)	(19)	(20)
					

Resources

- <http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/>
- <http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Information.htm>

Contacts

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- Blane Long 360-705-7397





Typical Risk Elements

Cost Risk Assessment / Workshop Prep Information

Technical Risks

- Design incomplete
- Right of Way analysis in error
- Environmental analysis incomplete or in error
- Unexpected geotechnical issues
- Change requests because of errors
- Inaccurate assumptions on technical issues in planning stage
- Surveys late and/or surveys in error
- Materials/geotechnical/foundation in error
- Structural designs incomplete or in error
- Hazardous waste site analysis incomplete or in error
- Need for design exceptions
- Consultant design not up to Department standards
- Context sensitive solutions
- Fact sheet requirements (exceptions to standards)
- Others

External Risks

- Landowners unwilling to sell
- Priorities change on existing program
- Inconsistent cost, time, scope, and quality objectives
- Local communities pose objections
- Funding changes for fiscal year
- Political factors change
- Stakeholders request late changes
- New stakeholders emerge and demand new work
- Influential stakeholders request additional needs to serve their own commercial purposes
- Threat of lawsuits
- Stakeholders choose time and/or cost over quality
- Others

Environmental Risks

- Permits or agency actions delayed or take longer than expected
- New information required for permits
- Environmental regulations change
- Water quality regulation changes
- Reviewing agency requires higher-level review than assumed
- Lack of specialized staff (biology, anthropology, archeology, etc.)
- Historic site, endangered species, wetlands present
- EIS required
- Controversy on environmental grounds expected
- Environmental analysis on new alignments is required
- Formal NEPA/404 consultation is required
- Formal Section 7 consultation is required
- Section 106 issues expected
- Project in an area of high sensitivity for paleontology
- Section 4(f) resources affected
- Project in the Coastal Zone
- Project on a Scenic Highway
- Project near a Wild and Scenic River
- Project in a floodplain or a regulatory floodway
- Project does not conform to the state implementation plan for air quality at the program and plan level
- Water quality issues
- Negative community impacts expected
- Hazardous waste preliminary site investigation required
- Growth inducement issues
- Cumulative impact issues
- Pressure to compress the environmental schedule
- Others

Organizational Risks

- Inexperienced staff assigned
- Losing critical staff at crucial point of the project
- Insufficient time to plan
- Unanticipated project manager workload
- Internal “red tape” causes delay getting approvals, decisions
- Functional units not available, overloaded
- Lack of understanding of complex internal funding procedures
- Not enough time to plan
- Priorities change on existing program

- New priority project inserted into program
- Inconsistent cost, time, scope and quality objectives
- Others

Project Management Risks

- Project purpose and need is poorly defined
- Project scope definition is poor or incomplete
- Project scope, schedule, objectives, cost, and deliverables are not clearly defined or understood
- No control over staff priorities
- Too many projects
- Consultant or contractor delays
- Estimating and/or scheduling errors
- Unplanned work that must be accommodated
- Communication breakdown with project team
- Pressure to deliver project on an accelerated schedule
- Lack of coordination/communication
- Lack of upper management support
- Change in key staffing throughout the project
- Inexperienced workforce/inadequate staff/resource availability
- Local agency issues
- Public awareness/support
- Agreements

Right of Way Risks

- Utility relocation may not happen in time
- Freeway agreements
- Railroad involvement
- Objections to Right of Way appraisal takes more time and/or money
- Others

Construction Risks

- Inaccurate contract time estimates
- Permit work windows
- Utility
- Surveys
- Buried man-made objects/unidentified hazardous waste
- Others

Regulatory Risks

- Water quality regulations change
- New permits or new information required

Common Risks from NCHRP Study on Risk Analysis Tools and Management Practices to Control Transportation Project Costs

Design Risks

- Design incomplete
- Unexpected geotechnical or groundwater issues
- Inaccurate assumptions on technical issues in planning stage
- Surveys incomplete
- Changes to materials/geotechnical/foundation
- Bridge site data incomplete to DES
- Hazardous waste site analysis incomplete
- Unforeseen design exceptions required
- Consultant design not up to Department standards
- Unresolved constructability items
- Complex hydraulic features
- Unable to meet Americans with Disabilities Act requirements
- Project in a critical water shortage area and a water source agreement required
- Incomplete quantity estimates
- Unforeseen construction window and/or rainy season requirements
- New or revised design standard
- Construction staging more complex than anticipated

External Risks

- Landowners unwilling to sell
- Local communities pose objections
- Unreasonably high expectations from stakeholders
- Political factors or support for project changes
- Stakeholders request late changes
- New stakeholders emerge and request changes
- Threat of lawsuits
- Increase in material cost due to market forces
- Water quality regulations change
- New permits or additional information required
- Reviewing agency requires longer than expected review time
- Changes to storm-water requirements
- Permits or agency actions delayed or take longer than expected
- New information required for permits
- Environmental regulations change
- Controversy on environmental grounds expected
- Pressure to deliver project on an accelerated schedule
- Labor shortage or strike
- Construction or pile driving noise and vibration impacting adjacent businesses or residents

Environmental Risks

- Environmental analysis incomplete
- Availability of project data and mapping at the beginning of the environmental study is insufficient
- New information after Environmental Document is completed may require re-evaluation or a new document (i.e. utility relocation beyond document coverage)
- New alternatives required to avoid, mitigate or minimize impact
- Acquisition, creation or restoration of on or off-site mitigation
- Environmental clearance for staging or borrow sites required
- Historic site, endangered species, riparian areas, wetlands and/or public park present
- Design changes require additional Environmental analysis
- Unforeseen formal NEPA/404 consultation is required
- Unforeseen formal Section 7 consultation is required
- Unexpected Section 106 issues expected
- Unexpected Native American concerns
- Unforeseen Section 4(f) resources affected
- Project may encroach into the Coastal Zone
- Project may encroach onto a Scenic Highway
- Project may encroach to a Wild and Scenic River
- Unanticipated noise impacts
- Project causes an unanticipated barrier to wildlife
- Project may encroach into a floodplain or a regulatory floodway
- Project does not conform to the state implementation plan for air quality at the program and plan level
- Unanticipated cumulative impact issues

Organizational Risks

- Inexperienced staff assigned
- Losing critical staff at crucial point of the project
- Insufficient time to plan
- Unanticipated project manager workload
- Internal “red tape” causes delay getting approvals, decisions
- Functional units not available, overloaded
- Lack of understanding of complex internal funding procedures
- Priorities change on existing program
- Inconsistent cost, time, scope and quality objectives
- Overlapping of one or more project limits, scope of work or schedule
- Funding changes for fiscal year
- Lack of specialized staff (biology, anthropology, geotechnical, archeology, etc.)
- Capital funding unavailable for right of way or construction

Project Management Risks

- Project purpose and need is not well-defined
- Project scope definition is incomplete
- Project scope, schedule, objectives, cost, and deliverables are not clearly defined or understood
- No control over staff priorities
- Consultant or contractor delays
- Estimating and/or scheduling errors
- Unplanned work that must be accommodated
- Lack of coordination/communication
- Underestimated support resources or overly optimistic delivery schedule
- Scope creep
- Unresolved project conflicts not escalated in a timely manner
- Unanticipated escalation in right of way values or construction cost
- Delay in earlier project phases jeopardizes ability to meet programmed delivery commitment
- Added workload or time requirements because of new direction, policy, or statute
- Local agency support not attained
- Public awareness/campaign not planned
- Unforeseen agreements required
- Priorities change on existing program
- Inconsistent cost, time, scope, and quality objectives

Right of Way Risks

- Utility relocation requires more time than planned
- Unforeseen railroad involvement
- Resolving objections to Right of Way appraisal takes more time and/or money
- Right of Way datasheet incomplete or underestimated
- Need for “Permits to Enter” not considered in project schedule development
- Condemnation process takes longer than anticipated
- Acquisition of parcels controlled by a State or Federal Agency may take longer than anticipated
- Discovery of hazardous waste in the right of way phase
- Seasonal requirements during utility relocation
- Utility company workload, financial condition or timeline
- Expired temporary construction easements
- Inadequate pool of expert witnesses or qualified appraisers

Construction Risks

- Inaccurate contract time estimates
- Permit work window time is insufficient
- Change requests due to differing site conditions
- Temporary excavation and shoring system design is not adequate
- Falsework design is not adequate

- Unidentified utilities

- Buried man-made objects/unidentified hazardous waste
- Dewatering is required due to change in water table
- Temporary construction easements expire
- Electrical power lines not seen and in conflict with construction
- Street or ramp closures not coordinated with local community
- Insufficient or limited construction or staging areas
- Changes during construction require additional coordination with resource agencies
- Late discovery of aurally deposited lead
- Experimental or research features incorporated
- Unexpected paleontology findings
- Delay in demolition due to sensitive habitat requirements or other reasons
- Long lead time for utilities caused by design and manufacture of special components (steel towers or special pipe)

Engineering Services Risks

- Foundations utilizing Cast-In-Drilled-Hole or Cast-In-Steel-Shell pile 30” in diameter or greater may require tunneling and mining provisions within the contract documents and early notification of Cal-OSHA
- Bridges constructed at grade and then excavated underneath may require tunneling and mining provisions within the contract documents and early notification of Cal-OSHA
- Hazardous materials in existing structure or surrounding soil; lead paint, contaminated soil, asbestos pipe, asbestos bearings and shims
- Piles driven into fish habitat may require special noise attenuation to protect marine species
- Special railroad requirements are necessary including an extensive geotechnical report for temporary shoring system adjacent to tracks
- Access to adjacent properties is necessary to resolve constructability requirements
- Existing structures planned for modification not evaluated for seismic retrofit, scour potential and structural capacity
- Foundation and geotechnical tasks (foundation drilling and material testing) not identified and included in project work plan
- Bridge is a habitat to bats or other species requiring mitigation or seasonal construction
- Condition of the bridge deck unknown
- For projects involving bridge removal, bridge carries traffic during staging
- Verify that all seasonal constraints and permitting requirements are identified and incorporated in the project schedule
- Complex structures hydraulic design requiring investigation and planning
- Assumptions upon which the Advance Planning Study is based on are realistic and verification of these assumptions prior to completion of the Project Report
- Design changes to alignment, profile, typical cross section, stage construction between Advance Planning Study and the Bridge Site Submittal
- Unexpected environmental constraints that impact bridge construction