How the FTA controls budget and schedule for funding for transit projects through cost and schedule risk contingency.

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Parsons Brinckerhoff

Topic Overview

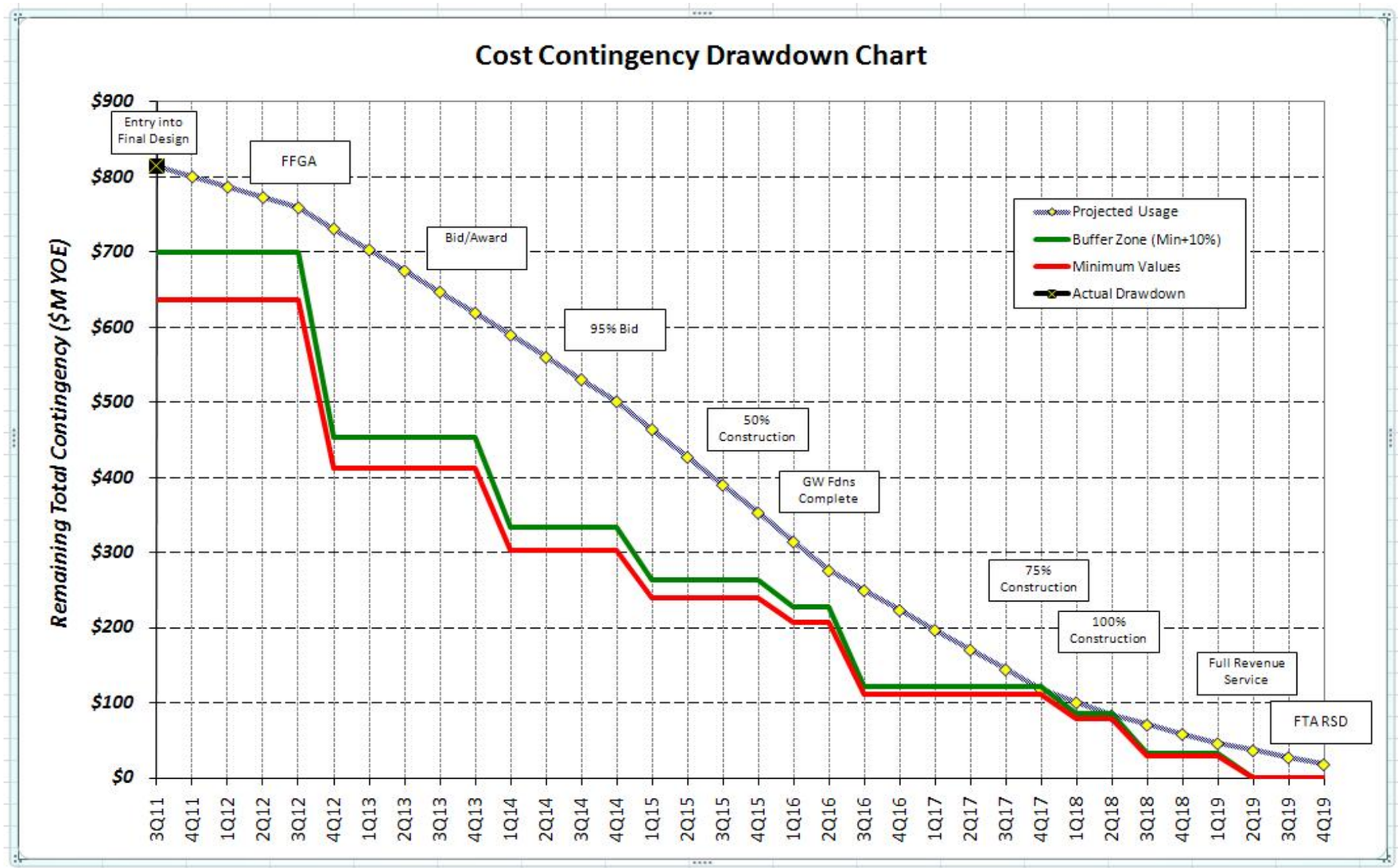
The Federal Transit Administration has been working diligently over the last 10 years in developing an effective risk management process to ensure applications for Federal New Start Funds are appropriately audited and reviewed as to their robustness in budget and schedule contingency provision. However, an Grantee's compliant application in line with guidance at the time of an assessment by the FTA is of little benefit if there is no mechanism to manage and provide visibility to those responsible for oversight as the project progresses. The FTA has now implemented through its latest guidance a robust execution plan in the form of a Risk and Contingency Management Plan [RCMP]. We will outline the structure and input required to this RCMP and the benefits derived to both a funding Agency and the project as a whole in management and control of risk and contingency.

Topic Overview

- *what the problem was…*
  - *Cost over runs*
  - *Schedule over runs*
  - *Not recognizing when contingency was being expended faster than project could with strand*
  - *Not recognizing what contingency was required to complete the project given outstanding risks*
  - *Not having a mechanism to measure outstanding risk*
  - *Not have a commitment from recipients of grants to manage and control risk*

Topic Overview

- *what I will learn…*
  - *What this means*

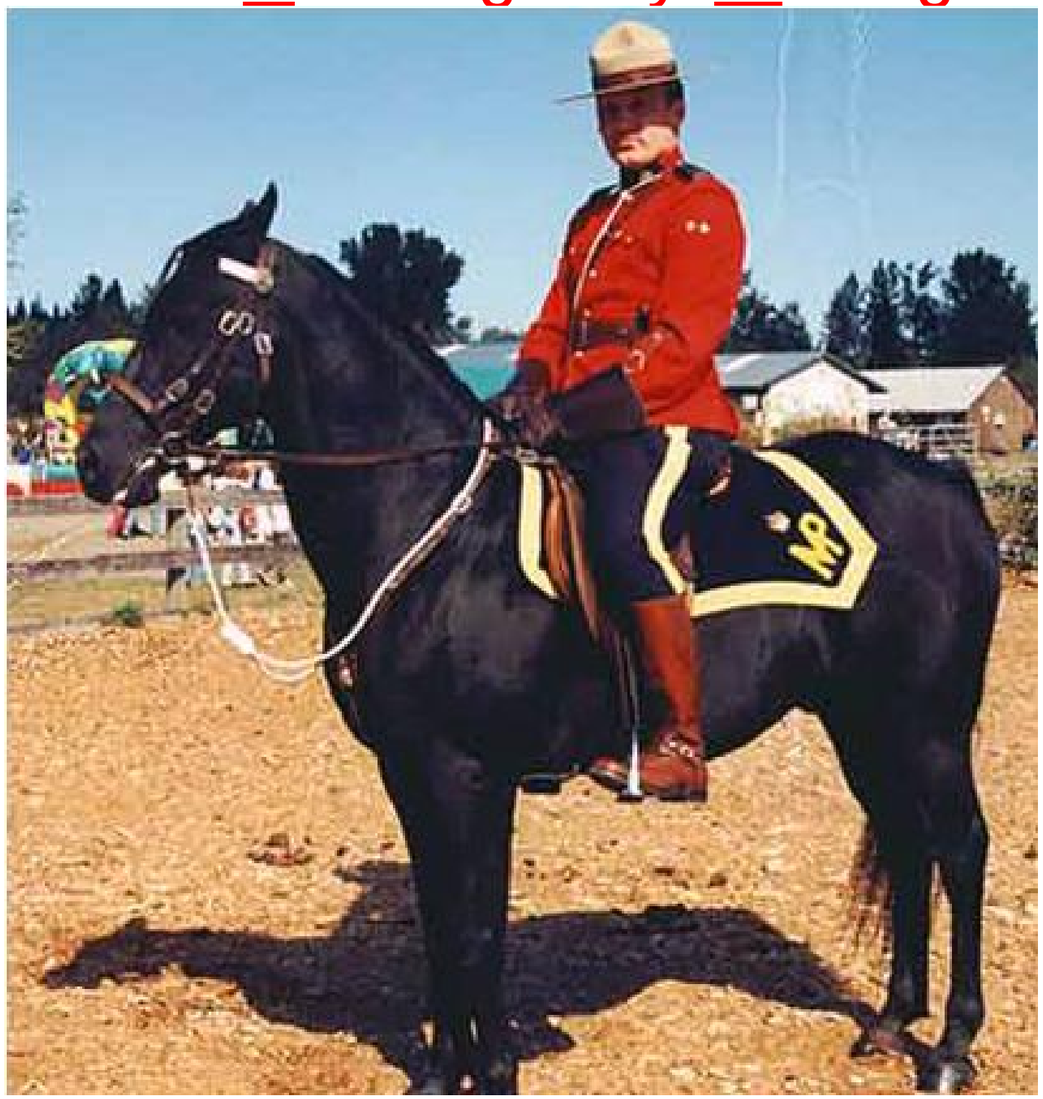


The Risk and Contingency Management Plan

All Federally Funded Major Capital Projects require a Project Management Plan (PMP)

- The PMP needs the RCMP.

The Risk and Contingency Management Plan



RCMP

Big emphasis on:

- *identification of risk into project delivery cycle*
  - *Requirements, Design, Market, Construction, Operations*
  - *Note...A package could be **'bid'** but still have **'requirements'** issues unresolved*
- *forcing identification of risk mitigation*
- *risk management plans*
- *regular review of risks*
- *tracking and updates*
- *management reporting*
- *relationship with project procedures and*
- *tying cost and schedule updates and trend system to minimum contingency values*

Third-Party Disclaimer
Exclusions and Assumptions
Acronyms and Abbreviations
1 Executive Summary
1.1 Risk Identification
1.2 Cost Risk Analysis
1.3 Schedule Risk Analysis
1.4 Recommendations for Secondary Risk Mitigation
2 Project Details
2.1 Project Status
2.2 Project Description
2.3 Project Budget
2.4 Project Schedule
3 Characterization of Project Scope, Cost, Schedule, Technical Capacity, and Capability
3.1 Introduction
3.2 Line Capacity
3.3 Technical Capacity and Capability
3.4 NEPA
3.5 NFPA130 Fire Life Safety
3.6 Contract Packaging Plan
3.7 Scope Baseline
3.8 Cost Baseline
3.8.1 General
3.8.2 Allocated Contingency by Contract Package
3.8.3 SCC Codes 10 through 50 (Construction)
3.8.4 SCC 60 ROW Acquisition Costs
3.8.5 SCC 70 Vehicles
3.8.6 SCC 80 Soft Costs/Design/Management
3.8.7 SCC 90 Unallocated Contingency
3.9 Schedule Baseline
4 Risk Identification and Assessment
4.1 Preface
4.2 Methodology for Identification and Ranking of Risks
4.3 Risk Identification Baseline
4.3.1 Workshop Attendees
4.3.2 Introduction and Presentation on Process
4.3.3 Baseline Scope, Cost and Schedule
4.3.4 Updating the Project Risk Register
4.3.5 Value and Risk Targets

Risk Report leads to RCMP

Risk Report

Contents

4.4 Identified Risks
4.4.1 Summary
4.4.2 Analysis of Identified Risks
4.4.3 Discussion on Risk Identification

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5.2.2 Removal of Allocated Contingency
5.2.3 Removal of Latent Contingency
5.2.4 Adjustments
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5.3.1 Summary Results
5.3.2 Top Down Cost Analysis
5.3.3 Bottom-Up Monte Carlo Analysis

6 Schedule Analysis
6.1 Methodology for Schedule Risk Analysis
6.2 Schedule Risk Model Development
6.3 Schedule Risk Model Results

7 Minimum Project Contingency Capacity and Execution Plan
7.1 Preface and Introduction to Minimum Contingency Capacity
7.2 Cost Minimum Contingency Capacity
7.3 Schedule Minimum Contingency Capacity

8 Risk Mitigation and Risk Management Plan
8.1 Risk Management Plan
8.2 Risk Mitigation

Step 1 - Set baseline - Project details

2 Project Details .....
2.1 Project Status .....
2.2 Project Description .....
2.3 Project Budget .....
2.4 Project Schedule .....

Purpose:

- *set the baseline*
- *communications re Budget and Schedule to all stakeholders*

Risk impacts constantly change – important to have audit trail on basis of assessment

Step 2 – Identify risks

Purpose:

- *communicate uncertainty related to estimate schedule baseline assumptions*
- *identification of risk into project delivery cycle*
- *Quantify risks using a 'risk matrix' typically likelihood, cost impact and schedule impact*
- *Rank risks and agree 'greatest potential risks to project'*

Legend	Low (1)	Med (2)	High (3)	Very High (4)	Significant (5)
Probability	< 10%	10 >< 50%	> 50%	75% >< 90%	>90%
Cost	< $250K	$250K >< $1M	$1M >< $3M	$3M >< $10M	>$10M
Schedule	< 1 Mths	1 >< 3 Mths	3 >< 6 Mths	6 >< 12 Mths	> 12 Mths
Rating	<=3	3.1-9.49		>=9.5	

Step 3 – Quantify risks

Score	Low (1)	Med (2)	High (3)	Very High (4)	Significant (5)	Risk Score P*(C+T)/2
Probability (P)	< 10%	10-50%	50-70%	75-90%	> 90%	>= 10
Cost Impact (C)	< $250K	$250K - $1M	$ 1 - 3 M	$ 3 - 10 M	> $10M	3 - 10
Time Impact (T)	< 1 Mth	1 - 3 Mths	3 - 6 Mths	6 - 12 Mths	> 12 Mths	<= 3

Milestone

Identification					Assessment					Management				
Risk ID	Risk Description	Risk Type	SCC Code	FTA Milestone	Date Assessed	Cost	Time	Prob	Risk Score	Risk Owner	Mngt Strategy	Action Items	Action By	Due Date
FEIS														
278	Final design requirements of additional support facilities (e.g. car wash, test track, cleaning platform etc.) at yard increase the base assumption for the size of yard and lead to additional requirements that may affect yard operability.	D	30	FEIS	8/16/2011	4	1	3	7.5	Engineering	Mitigate	1. Determine final support facilities at yard during ACE/PE 2. 3.		
386	Programmatic agreement delay and leads to delay in Final EIS/EIR publication.		80	FEIS	8/25/2011	1	2	2	3	Metro/		1. 2. 3.		
8	Late community consensus in segments that deviate from City street alignments delays completion of NEPA/FEIS process and final ROD	D	80	FEIS	12/8/2010	1	1	2	2	Metro	Mitigate	1. 2. 3.		
377	Availability of FTA/PMOC resources to review multiple FEIS documents from WSE, RC Crenshaw and other projects at the same time may delay FEIS approval and ROD.	D	80	FEIS	7/29/2011	1	1	1	1	Metro	Accept	1. FTA coordination 2. 3.		
Record of Decision														
37	Final LPA alignment at crossing of geologic faults (SM Fault and WBHL) from Century City to UCLA may require additional ROW.	D	60	Record of Decision	4/19/2011	4	3	4	14	Engineering	Mitigate	1. Complete Geotechnical investigation to determine position and nature of Fault and tunnel alignment. 2. Finalize Century City station location. 3. Complete design and determine ROW requirements.		
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375	Final decision of provision of portals at Rodeo Station could increase project cost.	D	20	Record of Decision	3/1/2011	5	3	3	12	Engineering	Mitigate	1. Work with City and local community to agree portal requirements. 2. Station report to be issued on 8/17/11 for Metro review and Board approval. This will solidify the final station portal entrances. 3.		

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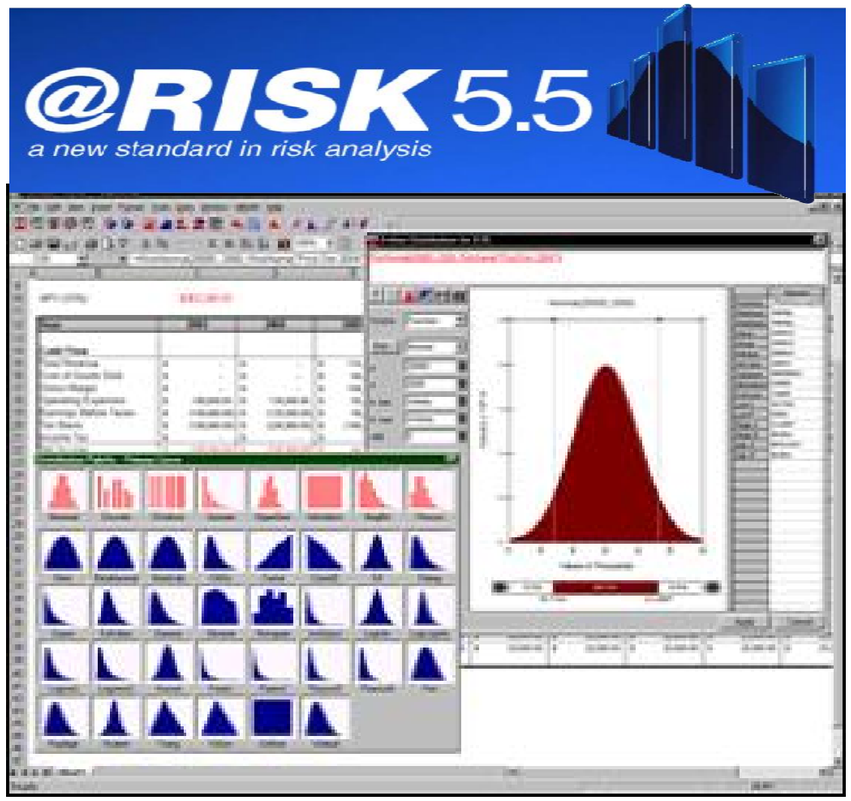
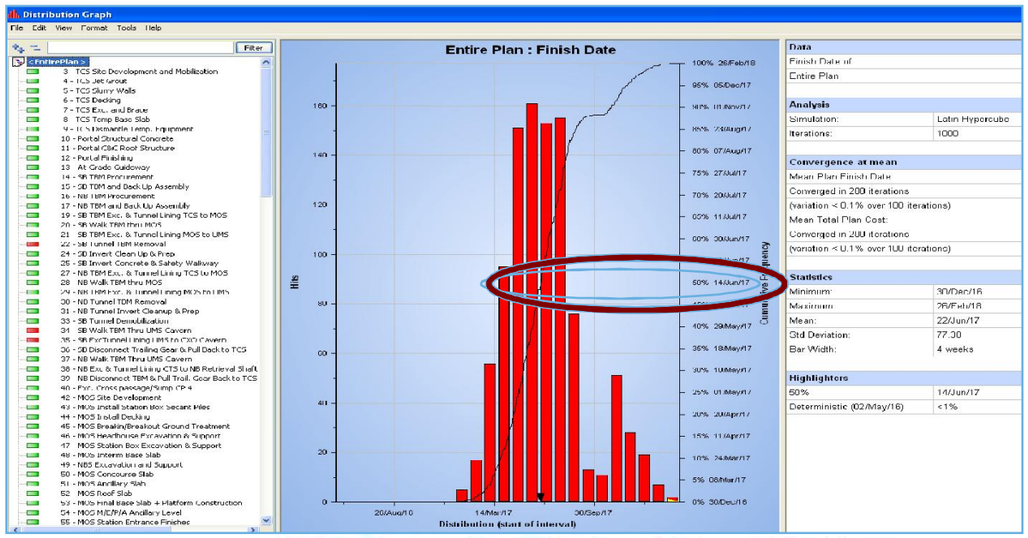
Step 4 – Produce quantitative analysis by applying risks to cost and schedule

Monte Carlo Simulations using:

- @Risk for Excel for Cost
- Primavera Risk Analysis (formerly Pertmaster) for Schedule





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PRIMAVERA RISK ANALYSIS

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Step 4 – Produce quantitative analysis by applying risks to cost and schedule

Cost BETA model

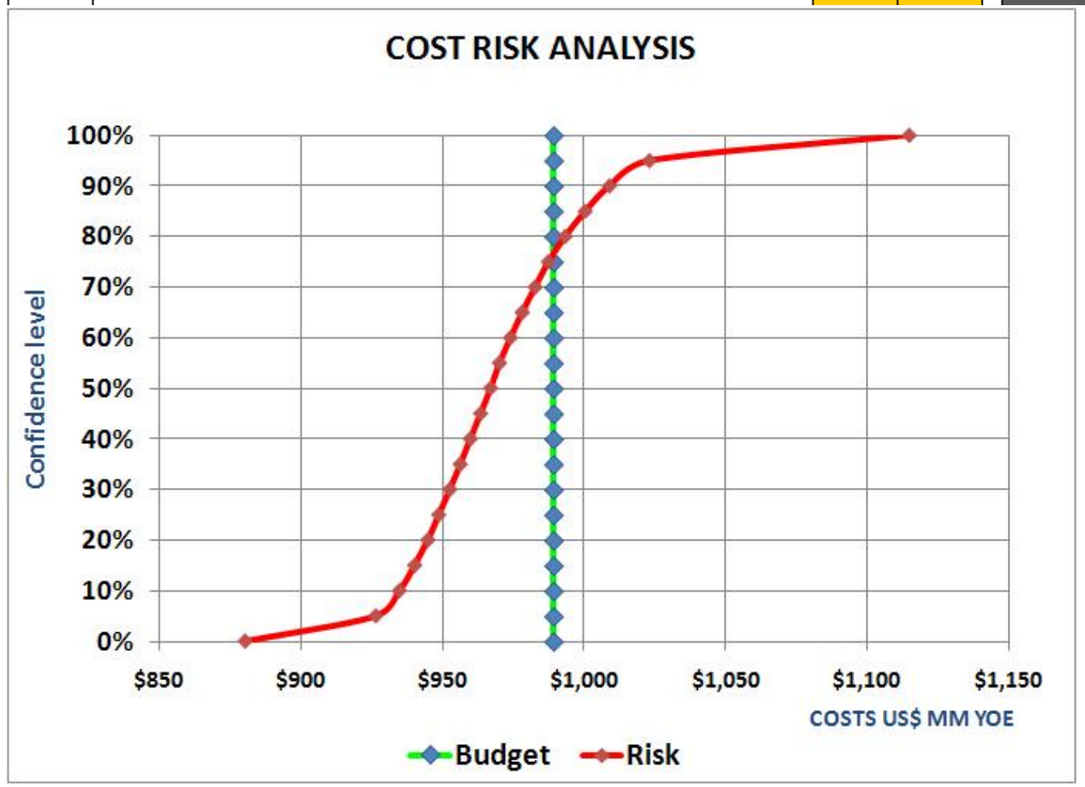
SCC	Category	P10	Req'ts Beta	Dsgn Beta	Mkt Beta	Constr Beta	Post Constr Beta	Total Beta	P90
SCC 10	Guideway								
10.01	Guideway: At-grade exclusive right-of-way	0	0.00	0.50	0.25	0.70	0.05	2.50	0
10.02	Guideway: At-grade semi-exclusive (allows cross-traffic	11,440,499	0.10	0.40	0.25	0.70	0.05	2.50	28,601,247
10.03	Guideway: At-grade in mixed traffic	0	0.00	0.50	0.25	0.70	0.05	2.50	0
10.04	Guideway: Aerial structure	36,802,410	0.50	0.50	0.25	0.70	0.05	3.00	110,407,229
10.05	Guideway: Built-up fill	10,847,105	0.00	0.00	0.00	0.60	0.05	1.65	17,897,724
10.06	Guideway: Underground cut & cover	6,399,425	0.00	0.25	0.25	0.70	0.05	2.25	14,398,706
10.07	Guideway: Underground tunnel	0	0.00	0.50	0.25	0.70	0.05	2.50	0
10.08	Guideway: Retained cut or fill	34,820,691	0.30	0.50	0.25	0.70	0.05	2.80	97,497,935
10.09	Track: Direct fixation	0	0.00	0.50	0.25	0.70	0.05	2.50	0
10.10	Track: Embedded	2,846,197	0.00	0.50	0.25	0.70	0.05	2.50	7,115,492
10.11	Track: Ballasted	24,094,903	0.00	0.50	0.25	0.70	0.05	2.50	60,237,258
10.12	Track: Special (switches, turnouts)	3,931,064	0.30	0.50	0.25	0.70	0.05	2.80	11,006,979
10.13	Track: Vibration and noise dampening	1,006,862	0.00	0.50	0.25	0.70	0.05	2.50	2,517,156

Input is a stripped and adjusted base cost estimate

Step 4 – Produce quantitative analysis by applying risks to cost and schedule

Risk ID #	Risk Description	Prob	Cost
1	Relocation of facility causes delays	2	3
2	May need to purchase more land	2	3
3	Agreements not yet signed off with Rail roads	2	3

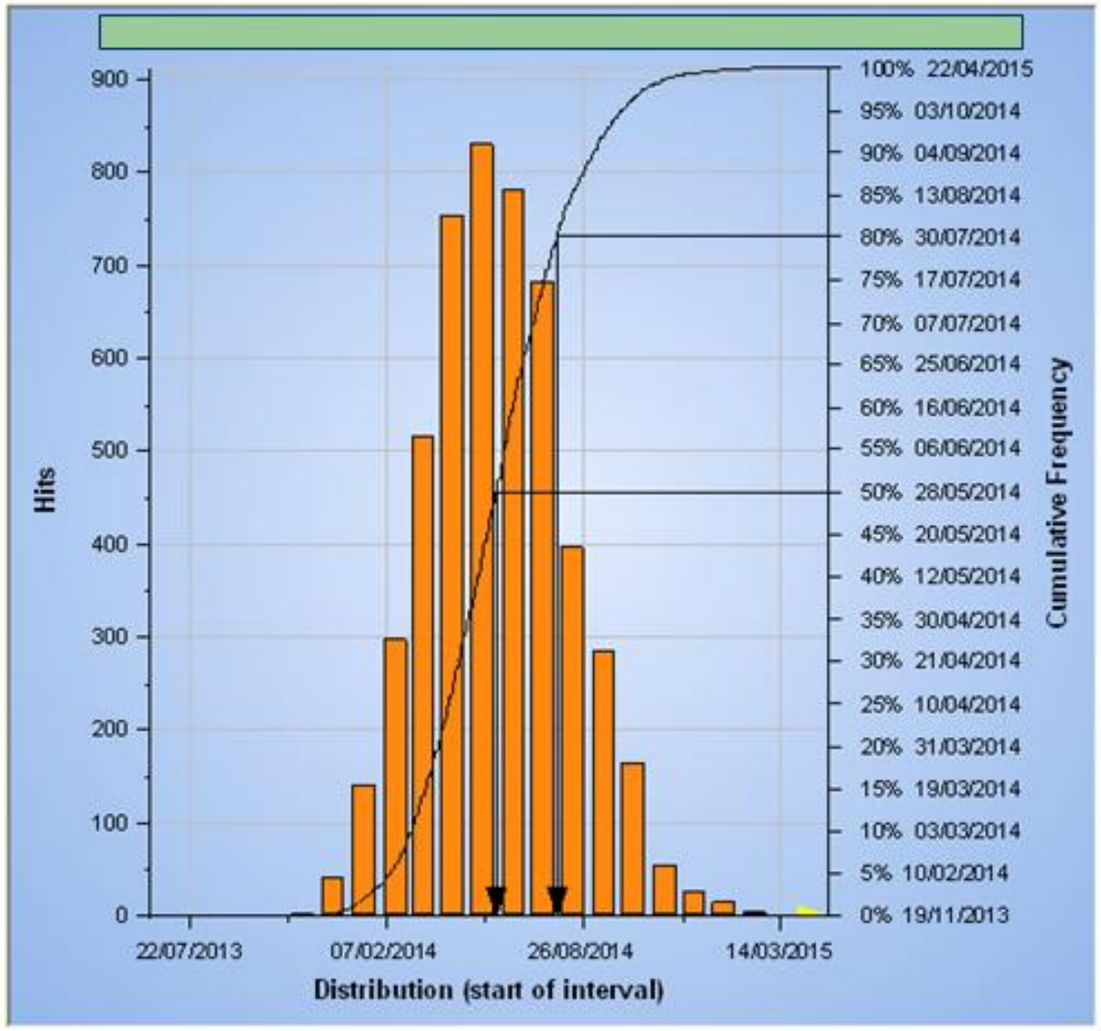
Prob	0%	10%	25%	50%	75%	90%	100%
SDF							
90%	$ 2.00	$ 2.25	$ 2.50	$ 2.75	$ 3.00	$ 4.00	$ 5.00
50%	$ 1.00	$ 2.00	$ 3.00	$ 5.00	$ 7.00	$ 10.00	$ 25.00

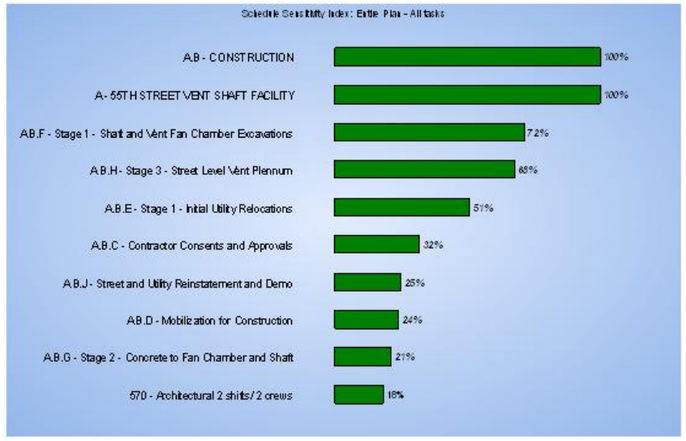


Risk Register to Monte Carlo Cost Model

Step 4 – Produce quantitative analysis by applying risks to cost and schedule

Schedule Monte Carlo model





Sensitivity analysis

Step 5 – Results & comparison with Targets

Confidence Level	Budget	Risk	Delta [Required additional $]
0%	$ 517.64	$ 407.49	$ (110.15)
5%	$ 517.64	$ 464.82	$ (52.82)
10%	$ 517.64	$ 476.41	$ (41.23)
15%	$ 517.64	$ 484.53	$ (33.11)
20%	$ 517.64	$ 491.47	$ (26.17)
25%	$ 517.64	$ 497.46	$ (20.18)
30%	$ 517.64	$ 502.79	$ (14.85)
35%	$ 517.64	$ 508.53	$ (9.11)
40%	$ 517.64	$ 513.86	$ (3.78)
45%	$ 517.64	$ 519.10	$ 1.46
50%	$ 517.64	$ 523.87	$ 6.23
55%	$ 517.64	$ 528.91	$ 11.27
60%	$ 517.64	$ 534.07	$ 16.43
65%	$ 517.64	$ 539.42	$ 21.78
70%	$ 517.64	$ 546.24	$ 28.60
75%	$ 517.64	$ 553.68	$ 36.04
80%	$ 517.64	$ 561.03	$ 43.39
85%	$ 517.64	$ 571.22	$ 53.58
90%	$ 517.64	$ 584.42	$ 66.78
95%	$ 517.64	$ 603.84	$ 86.20
100%	$ 517.64	$ 710.09	$ 192.45
Budget	$ 357,863,874		
Current Contingency	$ 159,775,347		
	45%		

FTA operating guidance states at entry into FD:

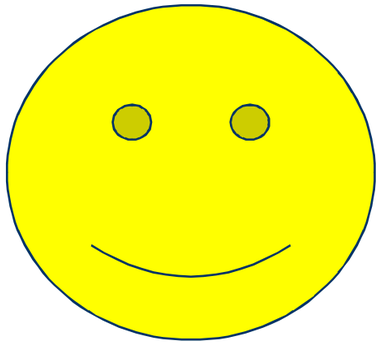
Cost = SABCE + 20%

Schedule = 20% Float from FD to Rev Op Date at 100% Bid

Likelihood	Date	Delta from Plan
Plan	**August 6th 2012**	**< 1%**
10%	October 2nd 2012	2 months late
50%	November 19th 2012	3 ½ months late
80%	December 21st 2012	4 ½ months late
90%	January 8th 2013	5 months late
100%	March 28th 2013	8 months late

Step 6 – Mitigation Recommendations

- Satisfy targets for minimum contingency
- Identify secondary mitigation items
- Agree Top Risks
- Develop Actions Plans
- Assign risk owners and actions
- Write Mitigation Plans
- Grant awarded



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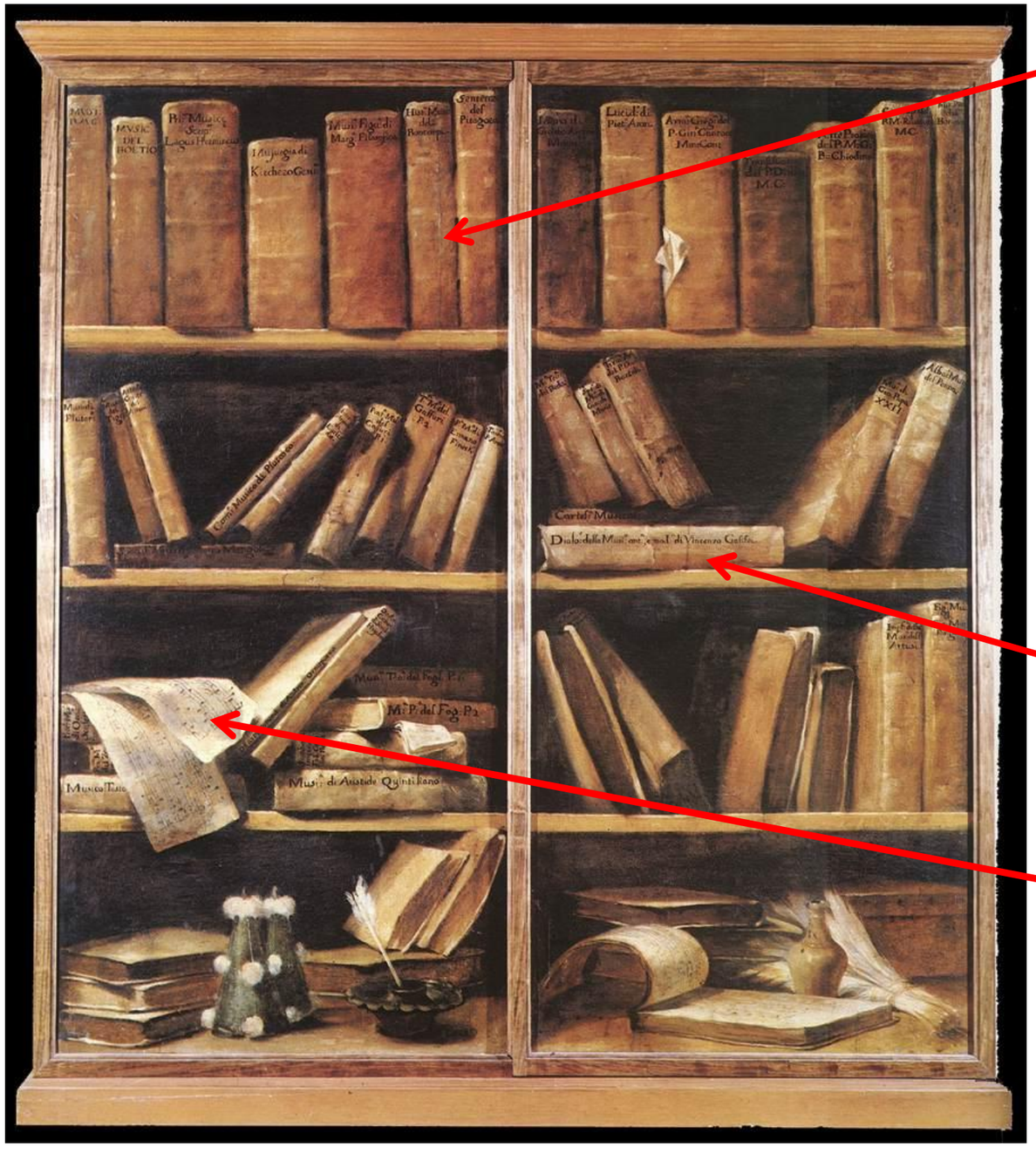
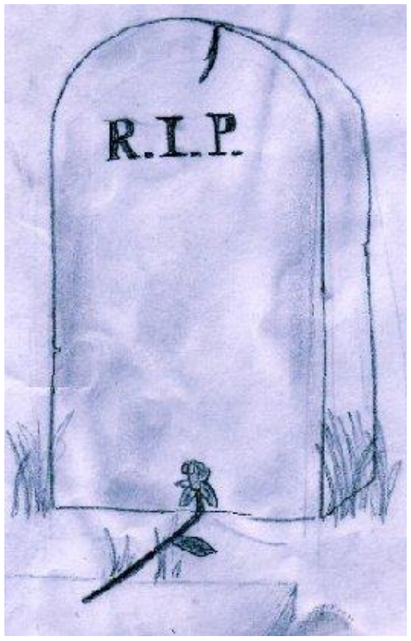
Step ? – What happened



Risk report



Risk Register

Mitigation Plans

RCMP

Project Execution Plan

Risk and Contingency Management Plan

RCMP

Contents

1 Overview
- 1.1 Introduction
- 1.2 Purpose
- 1.3 Scope
- 1.4 Definitions
- 1.5 Responsibilities
- 1.6 Risk Review Cycle
- 1.7 Actionable Items – PMP
- 1.8 Actionable Items – Risk Events
- 1.9 Updates to the RCMP

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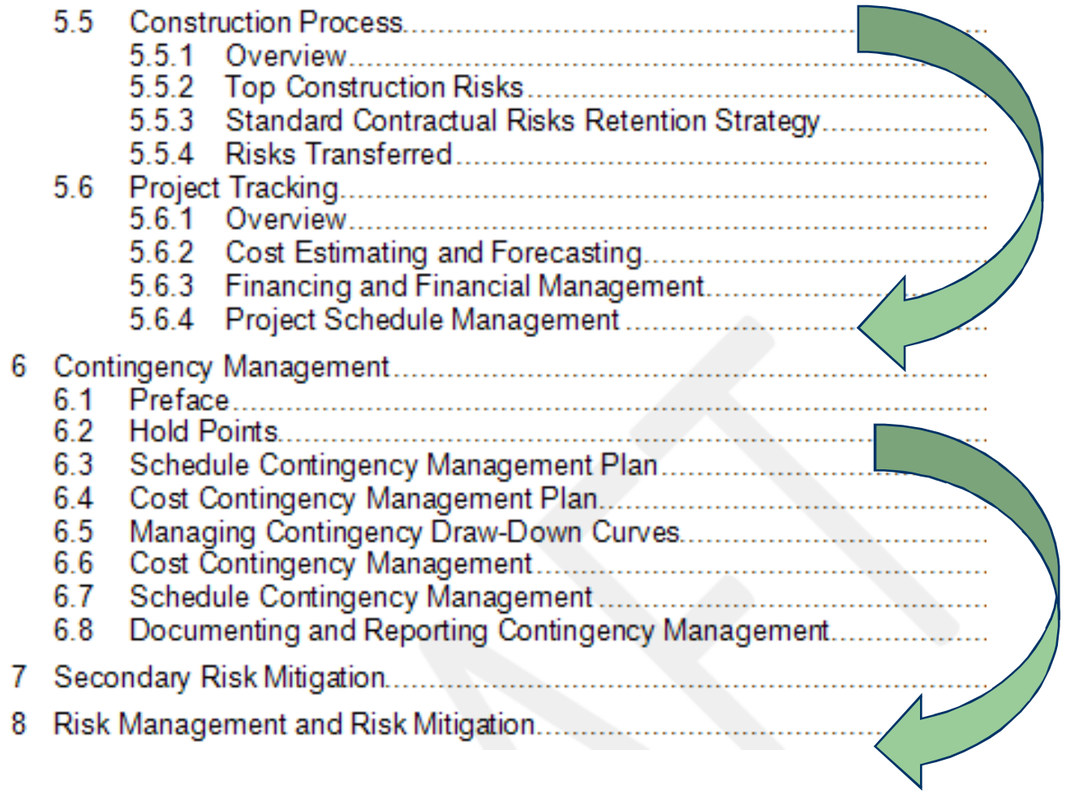
- 2.1 Introduction
- 2.2 Major Goals and Objectives of the RCMP
- 2.3 Goals to be Accomplished Prior to the Next Stage in the FTA Approvals Process

3 Risk Review Process
- 3.1 Procedures Used to Develop RCMP
- 3.2 Cross References for RCMP
- 3.3 Process for Identification and Management of Risk
  - 3.3.1 Risk Management Process
  - 3.3.2 Risk Management Plan
  - 3.3.3 Risk Assessment
  - 3.3.4 Project Risk Register
  - 3.3.5 Project Risk Register Numbering System
  - 3.3.6 Risk Mitigation Plans

4 Insurance
- 4.1 Introduction to Insurance Provisions
- 4.2 Insured Risk Events and Policy and Coverage

5 Primary Mitigation
- 5.1 Overview
- 5.2 Technical Capacity and Capability (TCC)
  - 5.2.1 Top TCC Risks
- 5.3 Project Scoping and Design
  - 5.3.1 Top Requirements Risks
  - 5.3.2 Top NEPA Risks
  - 5.3.3 Top Design Risks
  - 5.3.4 Risk Reduction Arising from Value Engineering
- 5.4 Contracting and Delivery Methods
  - 5.4.1 Introduction
  - 5.4.2 Top Market Risks
  - 5.4.3 Delivery Methods and Strategies for Contractual Risk Allocation



5.5 Construction Process
5.5.1 Overview
5.5.2 Top Construction Risks
5.5.3 Standard Contractual Risks Retention Strategy
5.5.4 Risks Transferred
5.6 Project Tracking
5.6.1 Overview
5.6.2 Cost Estimating and Forecasting
5.6.3 Financing and Financial Management
5.6.4 Project Schedule Management
6 Contingency Management
6.1 Preface
6.2 Hold Points
6.3 Schedule Contingency Management Plan
6.4 Cost Contingency Management Plan
6.5 Managing Contingency Draw-Down Curves
6.6 Cost Contingency Management
6.7 Schedule Contingency Management
6.8 Documenting and Reporting Contingency Management
7 Secondary Risk Mitigation
8 Risk Management and Risk Mitigation

Risk Report leads to RCMP

Risks come from the ‘risk register’

Score	Low (1)	Med (2)	High (3)	Very High (4)	Significant (5)	Risk Score P*(C+T)/2
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2.2 Project Description
2.3 Project Budget
2.4 Project Schedule

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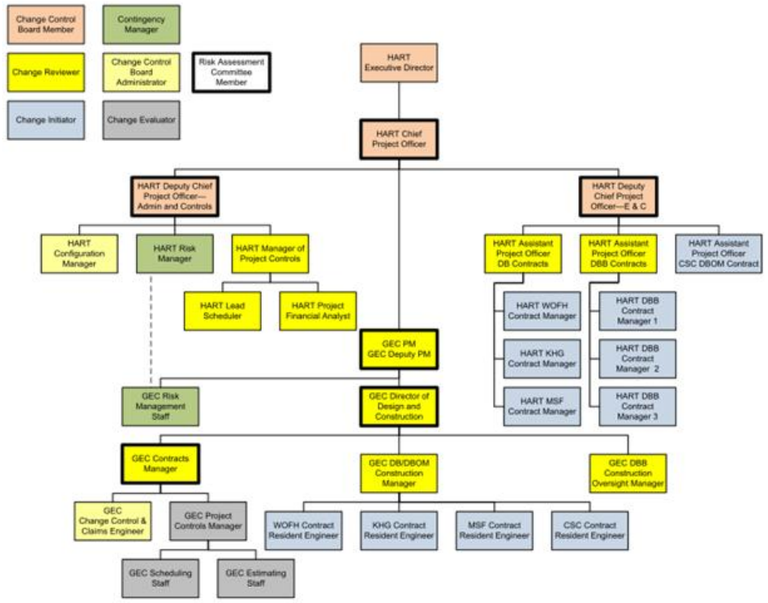
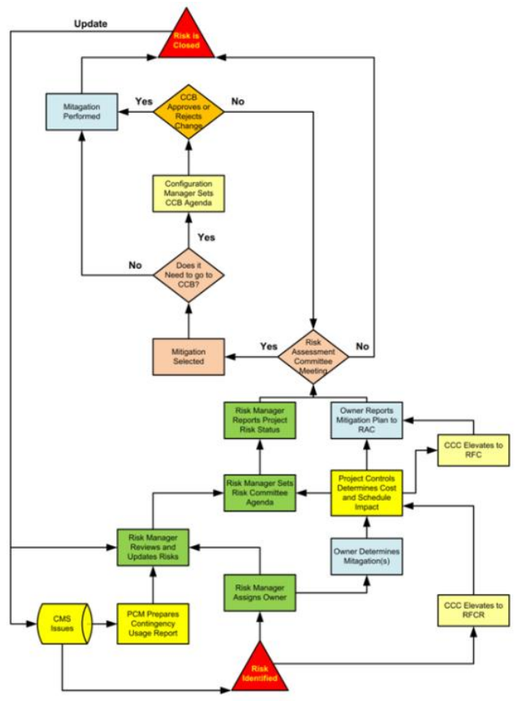
The RCMP….

- Sets out organizational structure for management and review of risks
- Describes risk review process
- Cross references procedures in PMP
- Provides secondary mitigation capacity
- Establishes commitment to manage risk and contingency

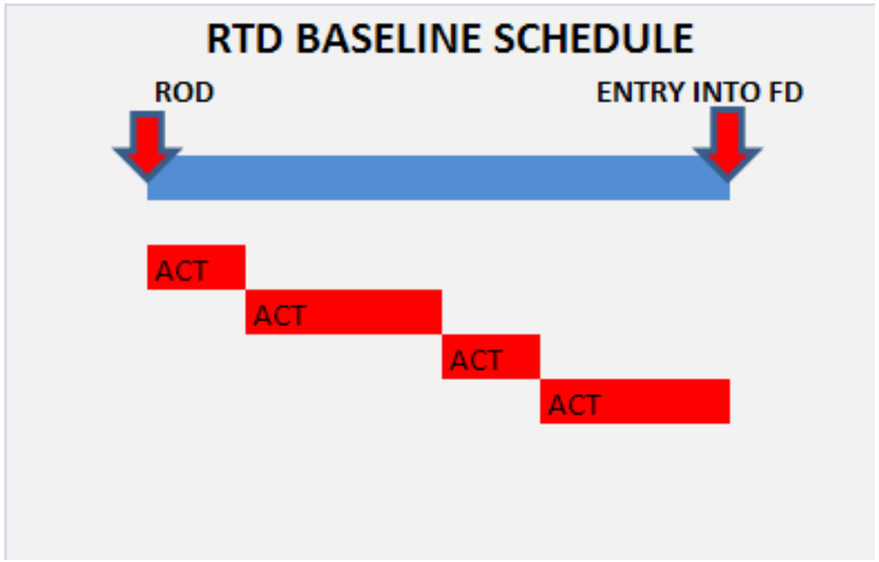


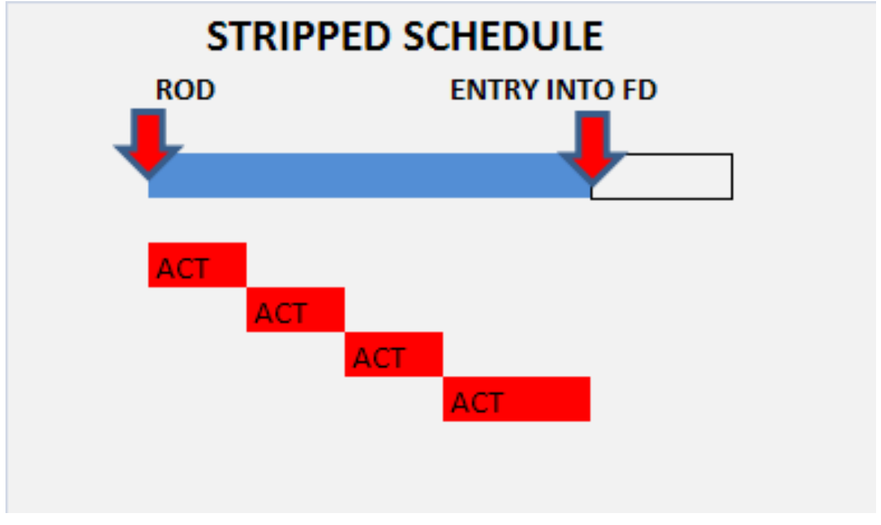


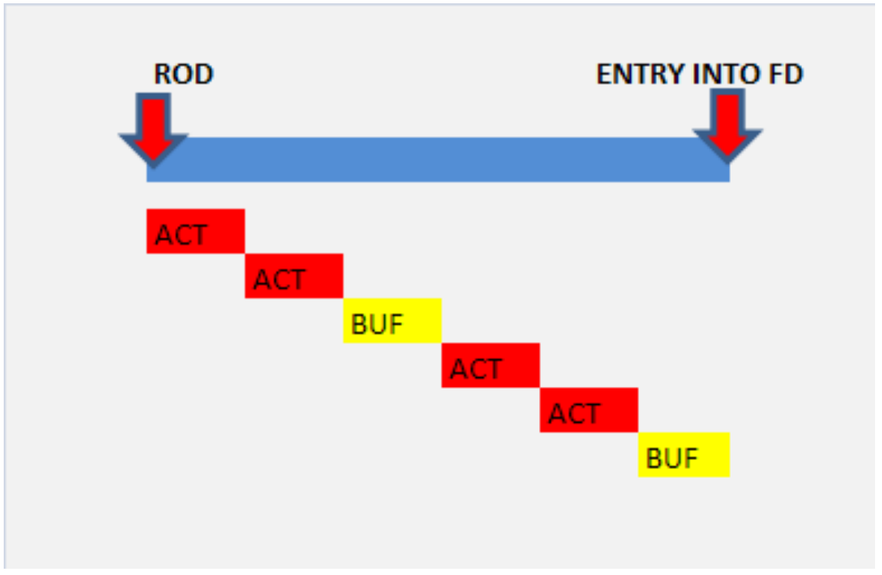
The RCMP….

- Establishes schedule buffer float
- Defines ‘Hold Points’
- Sets minimum schedule float at each ‘Hold Point’
- Sets minimum cost capacity at each ‘Hold Point’

Buffer Float

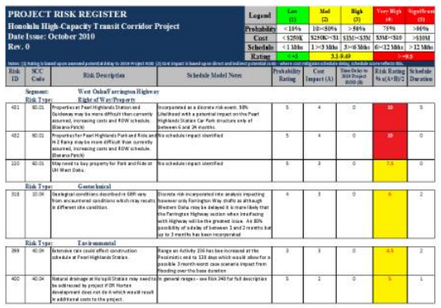




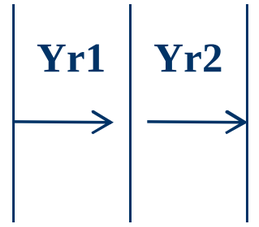


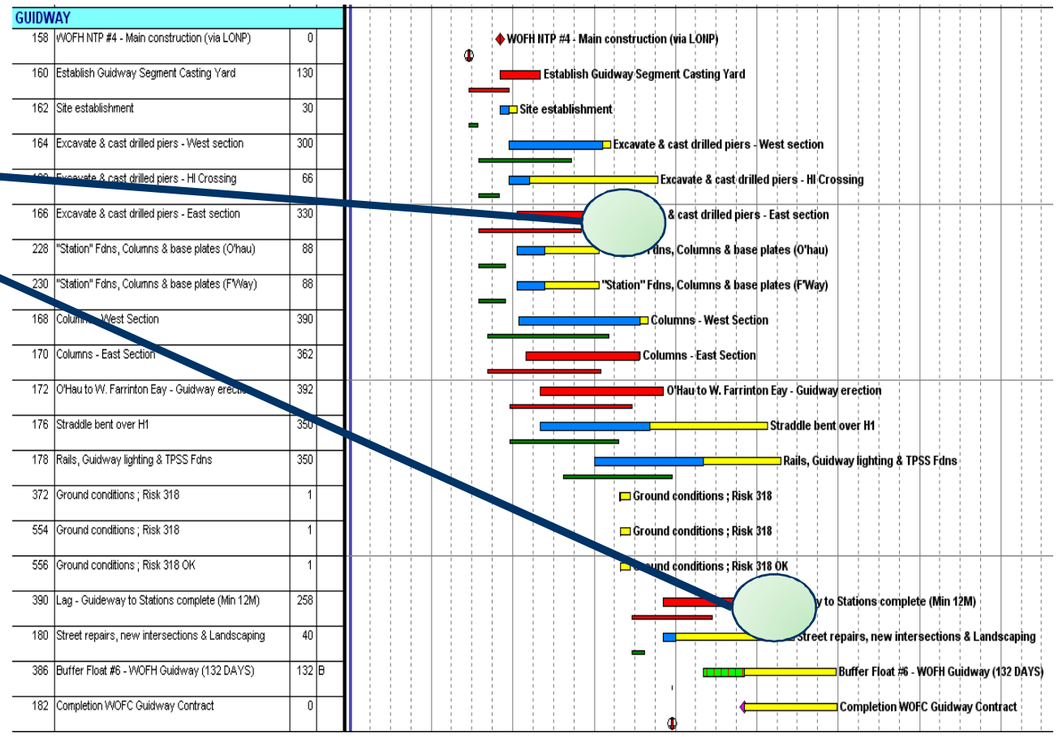
Hold Points

Hold Points identified along schedule



Hold Points typically annually



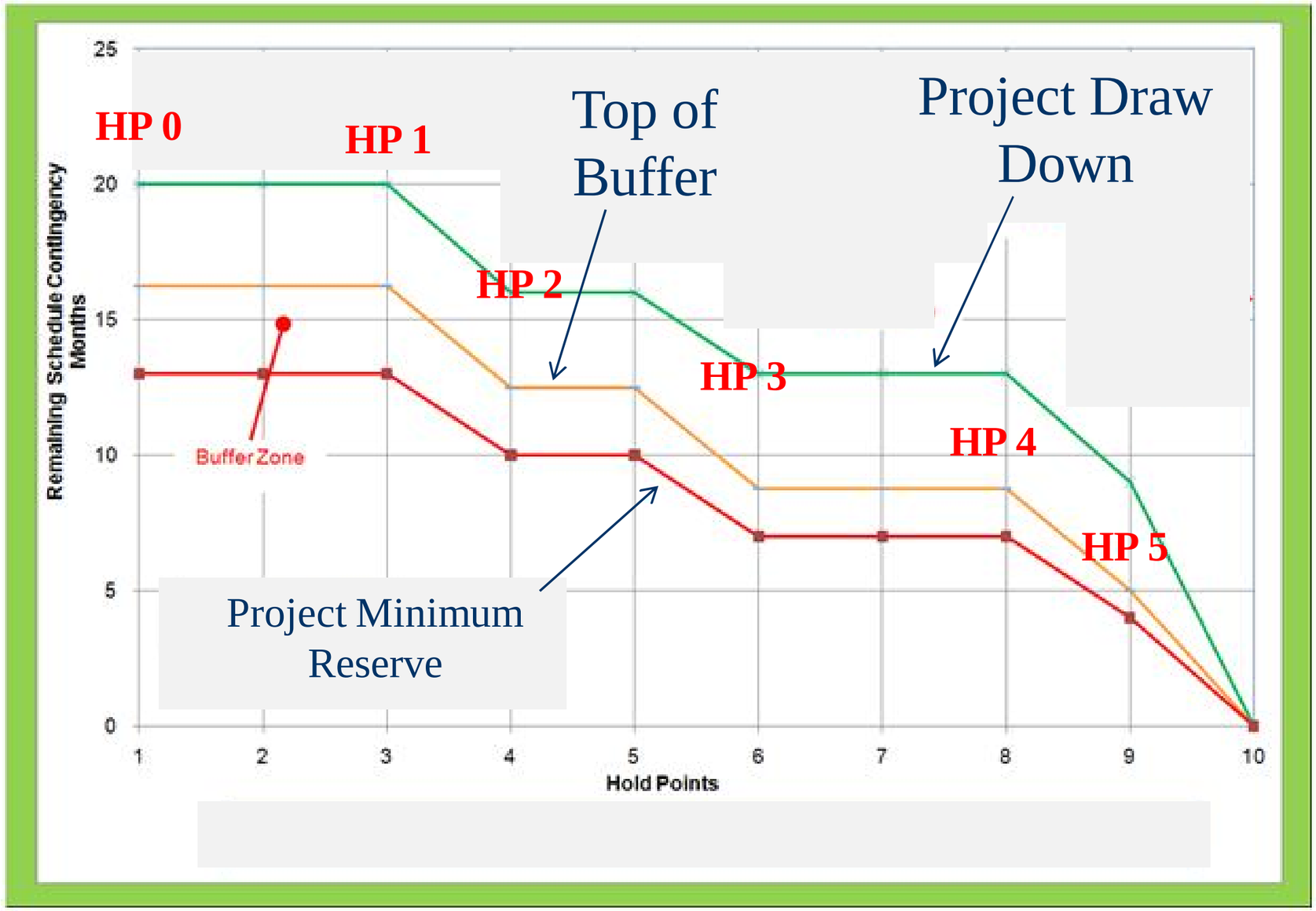


Align risks

Eg

1. Civil package awarded
2. ROW purchased / Access acquired
3. Blasting completed
4. Structures completed
5. Pavement completed

Schedule contingency minimum balance curve



Commitment to minimum Capacities at Hold Points

	Hold Points	Schedule with Buffer Float	Planned Contingency (Months)		
			Planned Float Draw Down	Buffer Zone	Minimum Float Values
1		3Q 2011	20	16	13
2		3Q 2012	20	16	13
3		4Q 2013	20	16	13
4		4Q 2014	16	13	10
5		4Q 2015	16	13	10
6		2Q 2016	13	9	7
7		4Q 2017	13	9	7
8		2Q 2018	13	9	7
9		1Q 2019	9	5	4
10		4Q 2019	0	0	0

Hold Point descriptions

Risk Mitigation Plans	Date July 29, 2011	Risk Owner	Rating Current: 4.5 Prior: 7.5

Risk ID	Description
126	Properties Station and Guideway may be more difficult than currently assumed, increasing costs and ROW schedule.
Section Right of Way	

Risk Mitigation Actions

#	Action Description	Deliverable	Due Date	Action By	Status
1	Make offers to property owners of Banana Patch.	Offers Made	5/10/2011	ROW Team	Complete except for property with environmental issues.
2	Continue aggressive efforts to relocate families.	Properties turned over to contractor	4/1/2012	ROW Team	Ongoing
3	Meet with property owner of remaining property to discuss remediation.	Meeting	8/3/2011	Jerry Iwata	Upcoming
4	Make decision on how to advance acquisition of remaining property.	Offer to property owner	8/30/2011	ROW Team	Upcoming

July 29, 2011	Monthly Status Report	#4
9 of the 10 properties have accepted offers. City owns 5 of the 10 properties. 4 properties are in escrow and should be acquired by October 2011. 1 family has relocated and another is scheduled to move to new home by end of August. Another family has closed on replacement property and is in process of constructing new home and expected to move by Jan. 2012.		

June 24, 2011	Monthly Status Report	#3
8 of the 10 properties have accepted offers. In discussion with property owner concerning environmental issues. Decision to be made by owner if they will remediate site at their own expense. Believe that negotiations will conclude with remaining properties by the end of June.		

Measured risk reduction

Risk Mitigation Plan

Topic Overview

- *Closing statement…*

  - *Failing to recognize risk denies mitigation*
  - *Failing to be realistic about risk exposure results in incorrect delivery strategy / design / procurement solutions*
  - *Having a back-up plan [secondary mitigation] from the outset provides confidence to funders*

Last Slide

- Contact info

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- References for further help
  - FTA Operating Guidance Specifically OG40