Risk Adjusted Programme Management

By Chris Young





Introduction

- The NZ Transport Agency are the asset owner of the national State highway network.
- The network is around 12,000 km long, and enables 50% of all vehicle kilometers travelled (VKT) , and 70% of freight VKT.
- Each length of highway is classified based on its form and functions, and the level of service provided is relative to the classification.
- At date of writing, there are around 700 current projects either in progress or planned across the NLTP. These vary in size from <\$1M to >\$1bn.
- The number of projects is fluid as new projects continuously emerge following either completion of a Programme Business Case, Corridor Management Plan, or following the approval of a new emergency works, or resiliance based event.
- We invest around \$1.5bn per year improving the network



The portfolio is complex with many moving parts

- With such a significant number of projects either in progress or planned, a portfolio view is critical.
- Only through a 'top down' approach can we maximise our investments, and deliver the promised benefits in an optimal manner.
- Through adjusting for risk (and opportunity), we are able to deliver a more predictable programme and balance individual time and cost risks. These include:
 - Cost Risks:
 - Uncertain scope
 - Uncertain quantities
 - Uncertain rates
 - Unknown mitigation

- Time risks:
 - Delayed start
 - Uncertain durations
 - Rework
 - Disruption
 - Emerging activities



Risk based estimates

- Our approach to cost estimation is risk based, and we expect our estimates to become more refined as projects proceed through the lifecycle (as certainty increases, and risk decreases)
- Ideally, the 'expected estimate' remains reasonably constant, with Outer ranges moving towards the centre
- All projects are funded at the expected level (50th percentile), and therefore we expect half of our projects to complete under budget, and half over budget.





Risk Adjusted Cost Estimates Terminology



- 5th percentile: Little to no risk, and minimum quantities (5% confidence level)
- Expected estimate: 'Most likely' risk and quantities (50% confidence level)
- 95th percentile: Almost all risks occur, maximum quantities (95% confidence level)

- Base estimate: 'Most likely' quantities x rates
- Contingency: provision added to the base estimate for modelled risk



Major Projects have a significant effect

 Major projects (such as the Waterview Connection and East West Link) can have a noticable impact on the entire programme if they exceed their expected estimate, or move outside of the stated cost range.





There are also certain key time related risks that make our progress uncertain

Through adding an assessment of risk to a schedule, we can consider the impact of risk and uncertainty on project timescales. We can consider:

- Delayed start
- Uncertain durations
- Rework
- Disruption
- Emerging activities





Modelling of time risks allows variable scenarios to be presented

 A 'fuzzy' gantt displays the risk and uncertainty relating to the each task, based on modelled risks. It allows a more accurate picture of our intentions at the projects outset, shows what might happen or could happen, and sets realistic & achievable expectations



				Remaini	2019	2020	2021	2022	2023	
ID	'rogramme	Project	Description	Duratio						
001671	SH29	Te Poi to Summit	Complete DBC Parts A & B							1
001681	SH29	Te Poi to Summit	Gain approval for business case (BUDM							Ι
001691	SH29	Te Poi to Summit	MIL: Detailed Business Case - Complete			8 <mark>1</mark> 2019				1
001701	SH29	Te Poi to Summit	Pre Implementation	4		1				1
001711	SH29	Te Poi to Summit	Apply for and receive Implementation fun							İ
001721	SH29	Te Poi to Summit	Tender and award PS Contract (Pre-imp							Î
001731	SH29	Te Poi to Summit	Complete specimen design	2						t
001741	SH29	Te Poi to Summit	Lodge NoR and gain designation	1						t
001751	SH29	Te Poi to Summit	Apply for and receive Resource Consents	1						t
001771	SH29	Te Poi to Summit	Complete peer reviews & safety audit							t
001781	SH29	Te Poi to Summit	Design estimate review and approval							t
001791	SH29	Te Poi to Summit	Gain approval for pre-implementation ph							t
001801	SH29	Te Poi to Summit	MIL: Pre Implementation - Complete							t
001811	SH29	Te Poi to Summit	Property	6						ł
001821	SH29	Te Poi to Summit	Puchase all properties (assume compul	6					-	ł
001831	SH29	Te Poi to Summit	MIL: Property - Complete							╢
001841	SH30	Te Poito Summit	Construction Implementation	10				2011/2021		
001041	31123	re Porto Summit	construction/implementation	10						
001851	SH29	Te Poi to Summit	Apply for and receive construction fundi							ł
001861	SH29	Te Poi to Summit	Obtain approval to commence constructi				7			Ť
001871	SH29	Te Poi to Summit	Tender and award PW contract (D&C)	1						t
001874	SH29	Te Poi to Summit	Detailed Design	1						Ť
001876	SH29	Te Poi to Summit	Construction Start						18/92/2023	t
001881	SH29	Te Poi to Summit	Construction Period	6						1



Inter-regional projects have been schedule risk adjusted to determine their most likely progress

• Construction start milestones show time variability (risk)

Programme	Drojact	Description	F	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Auckland Accelerated	East Mest Connection - Section 5	Construction Start												
		Construction Period		·		_								
		Construction Period		y										
Pokeno to Mangatarata	Section B	Construction Start		T										
		Construction Period			D									
Pokeno to Mangatarata	Section E	Construction Start												
		Construction Period												
Pokeno to Mangatarata	Section A	Construction Start												
		Construction Period							1					
Pokeno to Mangatarata	Section C&D	Construction Start												
		Construction Period							٦					
Auckland Accelerated	East West Connection - Section 182	Construction Start				rt -			-					
		Construction Period								-				
ATAP/TFUG	SH16 Squadron Drive Interchange	Construction Start												
		Construction Period												
Auckland Accelerated	East West Connection - Section 384	Construction Start												
		Construction Period												
Cambridge to Piarere	Cambridge to Piarere	Construction Start					<u> </u>							
		Construction Period												
SH1 - Auckland to Whangarei	Whangarei to Northport	Construction Start												
		Construction Period					0							
ATAP/TFUG	SH1 Southern Motorway, South of Papakura	Construction Start												
		Construction Period					0							
SH29	Piarere to Te Poi	Construction Start												
		Construction Period												
ATAP/TFUG	SH16 to SH18 connection	Construction Start												
		Construction Period						<u> </u>					<u>i</u>	
SH1 - Auckland to Whangarei	Northport to Te Hana (Inc Bryderwyn Bypa	Construction Start							4					
		Construction Period												
SH29	Summit to Tauriko	Construction Start												
		Construction Period									<u> </u>			
SH29	Te Poi to Summit	Construction Start												
		Construction Period												
South West Auckland and Airp	SH20B Widening	Construction Start												
		Construction Period												
										1	1	1	1	



Portfolio composition also affects risk

- The composition or the portfolio also affects overall risk, and our resultant tactics
- A portfolio of many small and medium sized projects allows many trade-off's with minimal impacts
- Conversely, fewer, major projects are difficult to trade off, and 'overs and unders' do not work to the same extent.
- Our portfolio has evolved over time, and has been cyclical

2005-2009 Pre-RoNS. Small and medium sized projects – plenty of trade-off opportunities 2009-2015 RoNS construction. Fewer larger projects – reduced trade-off opportunities 2015-2019 – Between RoNS and ATAP / Inter-regional construction. More trade-off's available

2019 + - ATAP and Inter-regional construction. Reduced trade-off opportunities



Overall programme risk exposure

- We are able to bring time and cost risk together through our portfolio model, and look at scenarios.
- These can involve increase/decreases to costs, and the impact of time risks
- Our project teams forecast cost and time on a monthly basis, based on 'most likely (50th percentile) time and cost, and we can then run scenarios





Scenario examples (shown cumulatively)

a. Base Case (50th percentile)



c. Plus SH29 programme at 95th %ile cost



b. plus East West Link at 95th %ile cost



d. plus SH29 at 95th %ile time





Summary

- With many moving parts, all subject to time and cost risk and opportunity, a portfolio view is critical is we are to successfully manage the programme
- Taking account risk in our future planning increases the predictability of programme delivery
- Over a number of years, this approach has allowed us to deliver great results, and make optimum use of funds, delivering the right benefits to customers
- We continue to make improvements to the way we manage the portfolio, and there is great opportunity as we move into the new operating model

