Monetised benefits and costs manual

Introductory workshop Oct 2024

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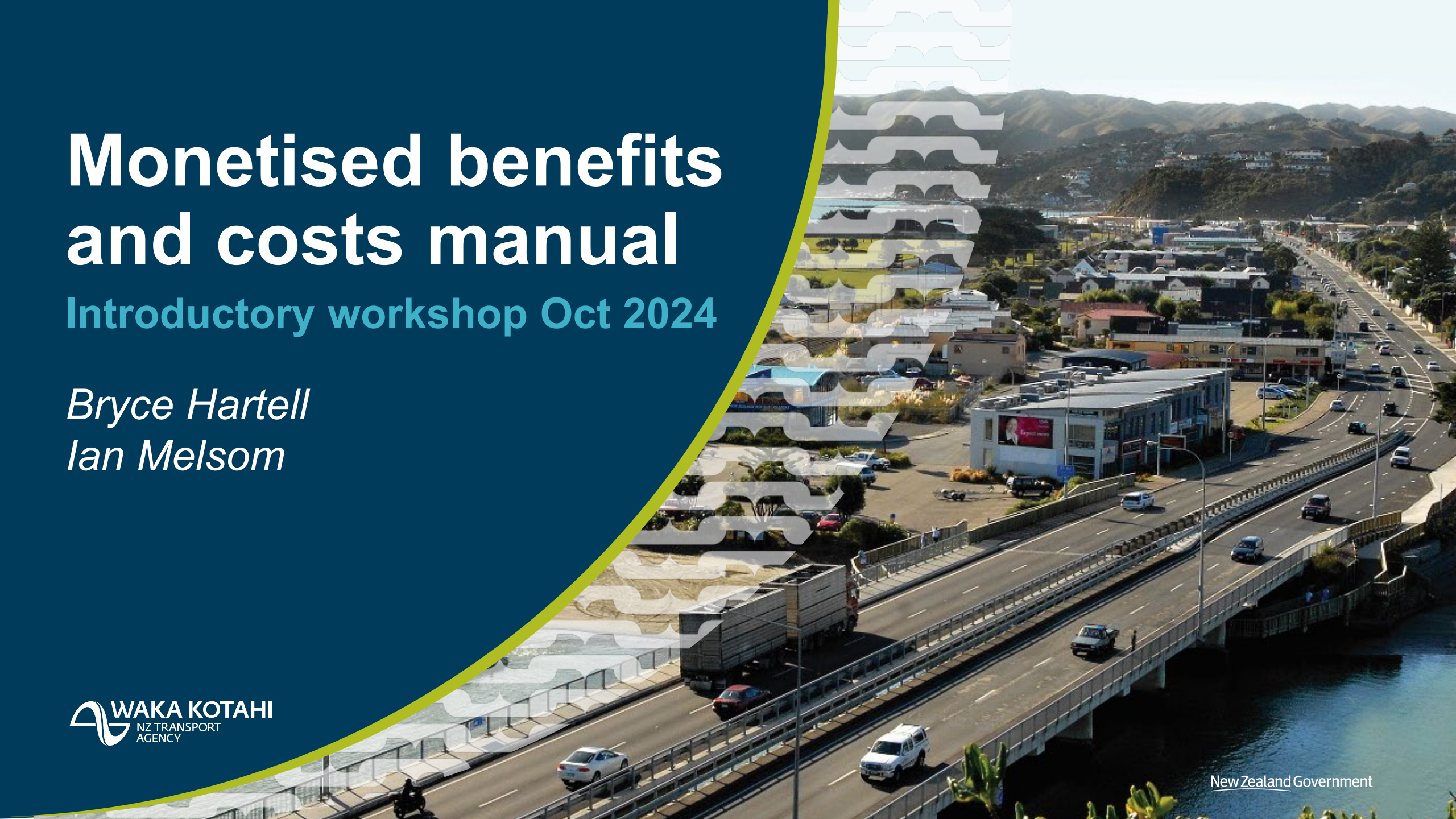


WAKA KOTAHI
NZ TRANSPORT AGENCY

New Zealand Government

Learning outcome

This workshop is intended for those who are new to:

- The monetised benefits and costs manual (MBCM)
- The NZ Transport Agency Waka Kotahi (NZTA)
- Economic assessment
- Transport economics

Transport economic assessment

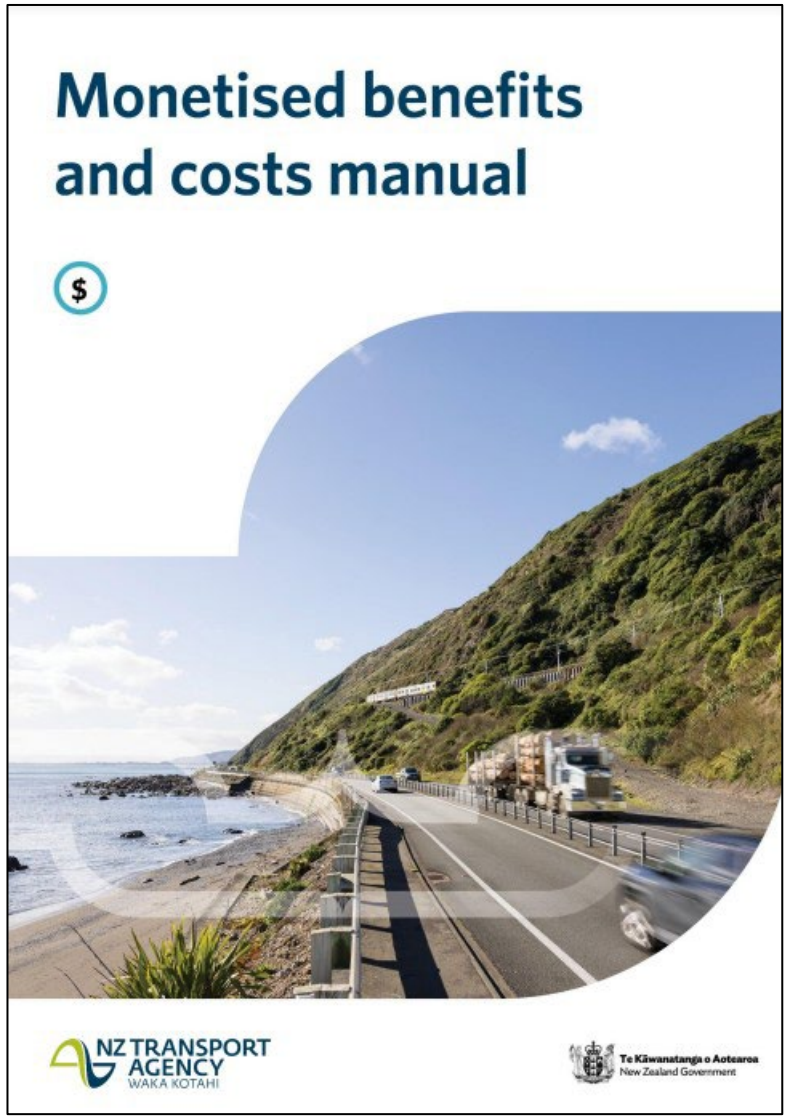
Introduction

- Business case:
  - Strategic case
  - **Economic case**
  - Commercial case
  - Financial case
  - Management case

Transport economic assessment

Economic case

- Used to assess the **value for money** of various investment options and to help choose the preferred option
- LTMA requires NZTA to make “efficient” investments
- Analysis methods can include:
  - **Cost-benefit analysis (CBA)**
  - Multi-criteria analysis (MCA)
  - Cost-effectiveness analysis (CEA)



Transport economic assessment

Thought experiment

- Which of these potential investments is the “best”?

Option A	
Pros	**Cons**
Prevents 3 deaths	One-off $10m from Govt
Prevents 200 serious injuries	All new cars become $500 more expensive

Option B	
Pros	**Cons**
Decreases carbon emissions by 10Mt per year	$2m from Govt every year for 10 years
Reduces premature death from harmful emissions by 5%	Increases every commuter’s travel time by 5 minutes per day

Option C	
Pros	**Cons**
Saves every commuter 10 minutes per day	Increases carbon emissions by 5Mt per year
Reduces vulnerability to natural disasters	$1m from Govt every year for 15 years

Transport economic assessment

Cost-benefit analysis (CBA)

- **Strengths:**
  - Quantifies all benefits & costs into a common unit of comparison ($)
  - Good for assessing value for money
  - Produces relatively easy-to-understand results
- **Weaknesses:**
  - Some benefits and/or costs are difficult to estimate and/or monetise
  - Poor at assessing equity
  - Can be hard to understand (a so-called “black box”)

Transport economic assessment

Typical CBA process

1. Identify the expected benefits and costs of each option
2. Model the counterfactual
3. Estimate the benefits and costs of each option and the counterfactual
4. Monetise the estimated benefits and costs
5. Discount the benefits and costs to a “present value”
6. Perform sensitivity analysis
7. Analyse the results

Transport economic assessment

CBA process explained

1. **Identify expected benefits and costs**
   - Think of all possible societal benefits and costs (excluding “transfers”)

2. **Model the counterfactual**
   - Project the current situation forward (based on trends or expectations)

3. **Estimate benefits and costs**
   - Use assumptions to model the options and compare these to the counterfactual

Transport economic assessment

CBA process explained

4. **Monetise the estimated benefits and costs**
   - Convert the estimated benefits and costs into monetary values

5. **Discount the benefits and costs**
   - Discount future benefits and costs to recognise time preference

6. **Perform sensitivity analysis**
   - Assess how “sensitive” the estimated benefits and costs are to changes in assumptions

Transport economic assessment

CBA process explained

7. Analyse and interpret the results

Benefit-cost ratio (BCR)

- BCR = Benefits / Costs
- BCR measures “value for money” i.e. how much economic benefit is delivered per dollar of economic cost

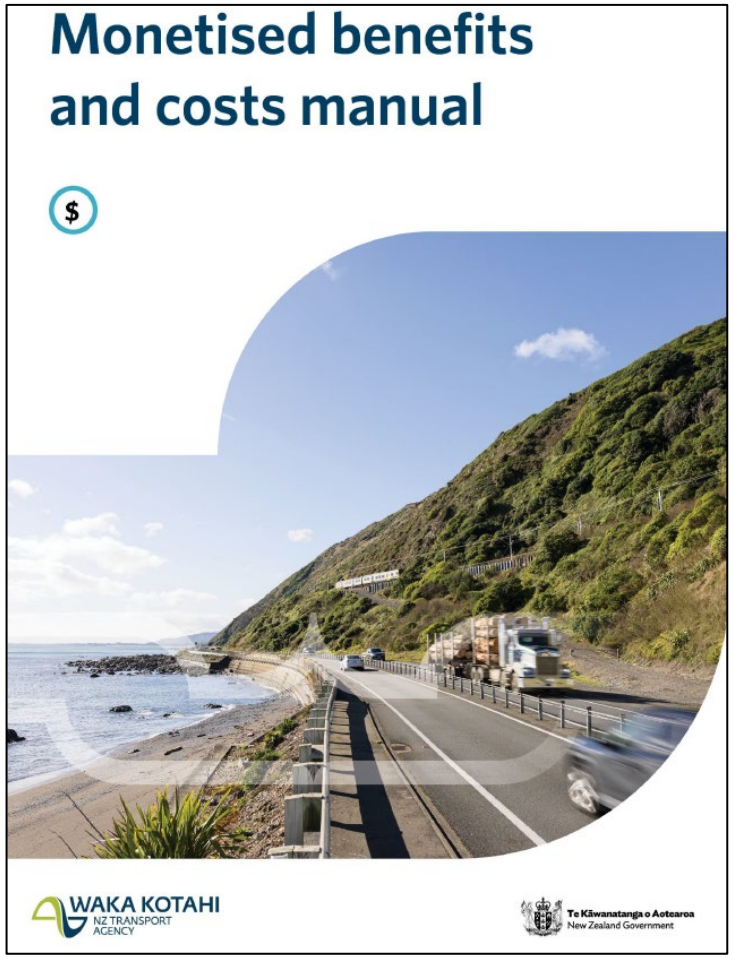
Net present value (NPV)

- NPV = Benefits – Costs
- Measures the overall benefit to society

Monetised benefits and costs manual (MBCM)

Purpose of the manual

- Guidance to assess monetised benefits and costs of proposed investments in land transport
- Robust approach to enable consistency, transparency and comparability between activities
- In-line with international best practice
- Updated regularly and available online
- Previously published as the Project Evaluation Manual (PEM) and then the Economic Evaluation Manual (EEM)



Monetised benefits and costs manual

Structure of the manual

- Basic concepts
- Demand estimation and mode share
- Monetised parameter values
- Evaluation procedures
- Benefit Cost Ratios
- Sensitivity tests and risk analysis
- Worked examples provided in appendices

Note that guidance on non-monetised benefits is available in the “Land Transport Benefits Framework Measures Manual”

Monetised benefits and costs manual

Basic concepts

- Period of analysis – over which benefits and costs are measured and discounted
  - Standard period of 40 years
  - Shorter periods can be used sometimes (e.g. for travel behaviour change activities)
  - Maximum period of 60 years (for long lived physical assets)
- Indicators of value for money and optimal timing:
  - Benefit Cost Ratio
  - Net Present Value
  - First Year Rate of Return
  - Break-even point

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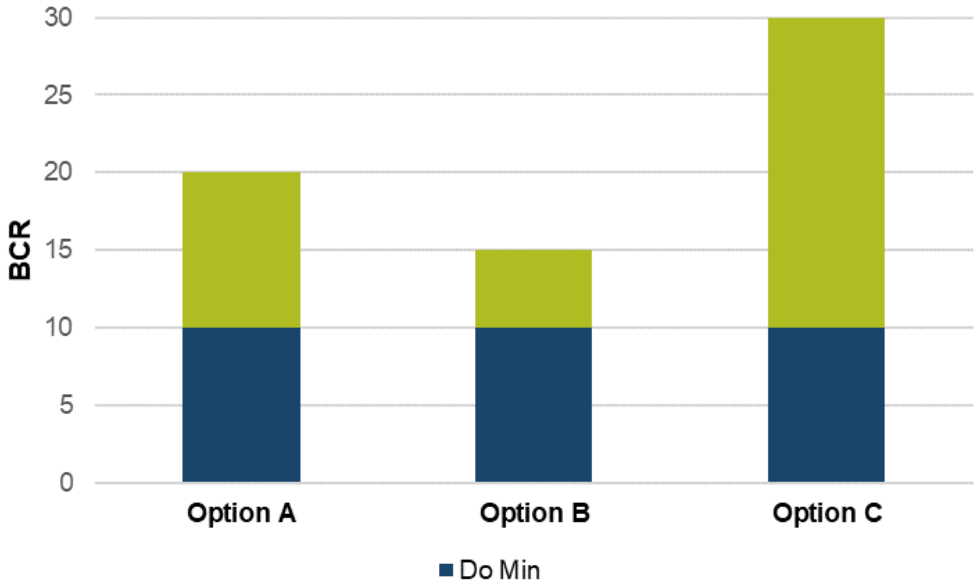
Counterfactual

- Counterfactual can be “do nothing” or “do minimum”
- Can be influenced by changes to legal/regulatory requirements
- Counterfactual should be the lowest-cost “option”



	Past/Historic information	Future/Predicted information
Status quo	2022, 2023, 2024	2025, 2026, 2027
Proposed option		2025, 2026, 2027

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Transport benefits

While the costs of an investment are in $ values, the “benefits” need to be converted into monetary values to enable comparison.

Monetised transport impacts include:

- Network productivity and utilisation (i.e. travel time savings and vehicle operating costs)
- Resilience
- Travel time reliability
- Social cost of deaths and serious injuries
- Greenhouse gas emissions
- Health (i.e. harmful emissions and noise)

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Demand estimation

- Transport models forecast
  - Transport demand
  - Changes in transport demand and transport use as a result of an activity
- Types of models
  - Simpler models (spreadsheets)
  - Complex models, across multiple modes, and incorporating land use changes
- Factors that influence demand, eg:
  - Travel time
  - Travel costs – including fares or tolling
  - Comfort of facilities or the mode
- Transport demand is used to calculate the benefits from changes to the transport system

Different ways to value input parameters

Monetised benefits are valued in different ways

Parameter values:

- Resource costs – e.g. vehicle operating costs
- Willingness to pay values – e.g. injury costs, non-work travel time values
- Shadow prices – e.g. CO2, environmental impacts
- Derived values – e.g. health costs

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Evaluation procedures

- Simplified procedures and full procedures
- Covers all modes, facilities and outcomes

Monetised benefits and costs manual (MBCM)

Simplified Procedures (less than $15m, lower risk, lower complexity)

- Road renewals
- Structural bridge renewals
- General road improvements
- Seal extensions
- Isolated intersection improvements
- Freight transport services
- New public transport services
- Existing public transport services
- Walking and cycling facilities
- Travel behaviour change
- Road safety promotion
- HPMV route improvements

Monetised benefits and costs manual

Full procedures (over $15m, higher risk, higher complexity)

Includes:

- Road improvement activities
- Public transport services
- Travel demand management
- Walking and cycling
- Education, promotion and marketing
- Freight activities
- Private sector financing and road tolling
- Wider economic benefits

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Monetised benefits - examples

Land Transport Benefits Framework

June 2023

Note that measures can be used as evidence for more than one benefit, not only for the primary association provided in this table. For more information about the Land Transport Benefits Framework, see Benefits management guidance on the Waka Kotahi website.

Transport outcome	Benefit cluster	Benefit Benefits marked $ are monetised. For more information see the *Monetised benefits and costs manual*	Quantitative and qualitative benefit measures (primary associations) Measures marked # are quantitative, and those marked * are qualitative. For more information see the *Land Transport Benefits Framework measures manual*			Monetised benefits Value proxy and measure of changes in option compared to do-minimum
			No.	Measure name	Measure	
Healthy and safe people	1. Changes in user safety	1.1 Impact on social cost of deaths and serious injuries$	1.1.1	Collective risk (crash density)#	Average annual fatal and serious injury crashes per kilometre of road section	$ crash costs by crash type and severity
			1.1.2	Crashes by severity#	Number of crashes by severity	
			1.1.3	Deaths and serious injuries#	Number of deaths and serious injuries	
			1.1.4	Personal risk (crash rate)#	Average annual fatal and serious injury crashes per 100 million vehicle-kilometres	
		1.2 Impact on a safe system	1.2.1	Road assessment rating – roads#	Infrastructure risk rating	
			1.2.2	Road assessment rating – state highways#	KiwiRoad Assessment Programme (KiwiRAP) star rating (for state highways)	
			1.2.3	Travel speed gap#	Difference between safe and appropriate speed (SAAS), and actual speed (under development)	
	2. Changes in perceptions of safety	2.1 Impact on perceptions of safety and security	2.1.1	Access – perception#	Perception of safety and ease of walking and cycling	
	3. Changes in human health	3.1 Impact of mode on physical and mental health$	3.1.1	Physical health benefits from active modes*	User to describe	- $/pedestrian * 1km of a new facility - $/conventional cyclist *3km of a new facility - $/electric assisted cyclist *3km of a new facility
		3.2 Impact of air emissions on health$	3.2.1	Ambient air quality – NO_2#	Concentration of NO_2 in µg/m³	$ damage cost/tonne of pollutant * number of people exposed
			3.2.2	Ambient air quality – PM_{10}#	Concentration of PM_{10} in µg/m³	
		3.3 Impact of noise and vibration on health$	3.3.1	Noise level#	Noise level in dB $L_{Aeq(24h)}$	$/dB noise level per household or person affected per year

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Parameter values - examples

Injury values ($2021)		
Fatal	Serious	Minor
12.5m	660,100	68,000

Vehicle and PT occupants, pedestrians, cyclists	Equalised travel time values ($2021) for economic assessment		
	Work purpose	Commuting	Other non-work
Uncongested conditions ($/hr/person)	37.92	19.53	18.91
Increments for congestion ($/hr/person)	26.34	16.65	14.83

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Parameter values - examples

Emission damage cost ($/tonne – 2021)			
Pollutant	Urban cost ($/t)	Rural cost ($/t)	National cost ($/t)
$PM_{2.5}$	853,824	49,075	530,676
NOx	865,797	24,040	325,312
CO	4.87	0.19	2.99
SO_2	39,334	1,546	24,160
Volatile organic compounds	1,545	61	949

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Sources of parameter value information

- WTP research on safety and travel time values
  - Injury values for fatal, serious, and minor injuries
  - Travel time values for commuting, other non-work travel, travel in congested conditions
- Treasury CBAx guidelines – try to align with MBCM
  - Shadow price of carbon
- Health and Air Pollution in NZ report (HAPINZ 3.0)
- UK WebTAG information on equalised values for non-work travel time

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Wider Economic Benefits (WEBs)

- Productivity/agglomeration
- Employment impacts
- Imperfect competition

- Static and dynamic WEBs

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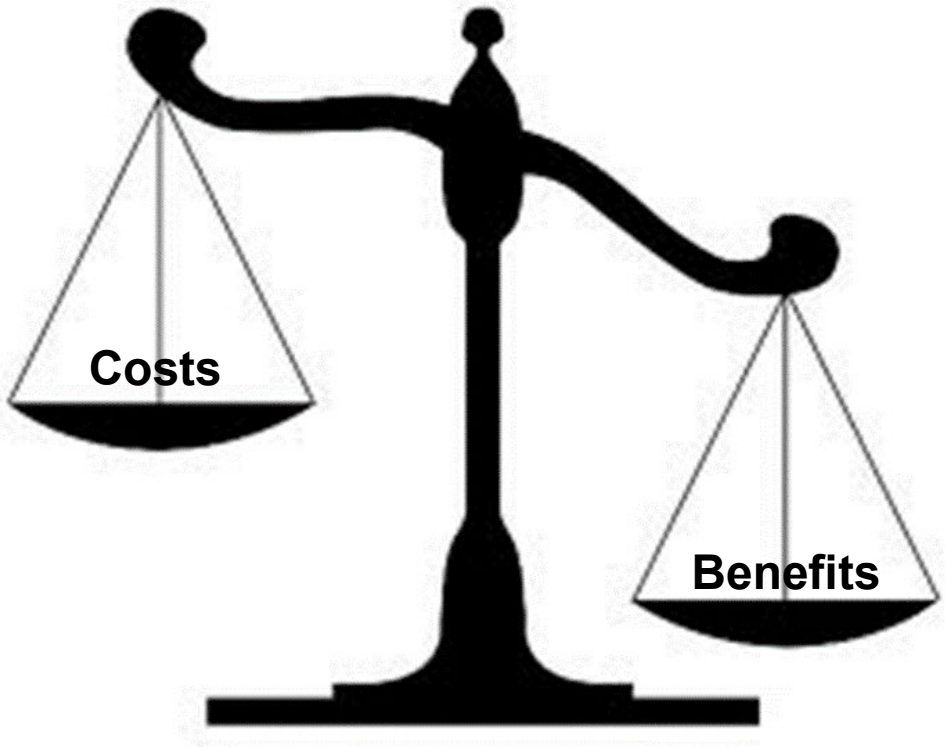
BCRs

Note, negative impacts are treated as disbenefits

- National BCR_N
- Government BCR_G
- Incremental BCR



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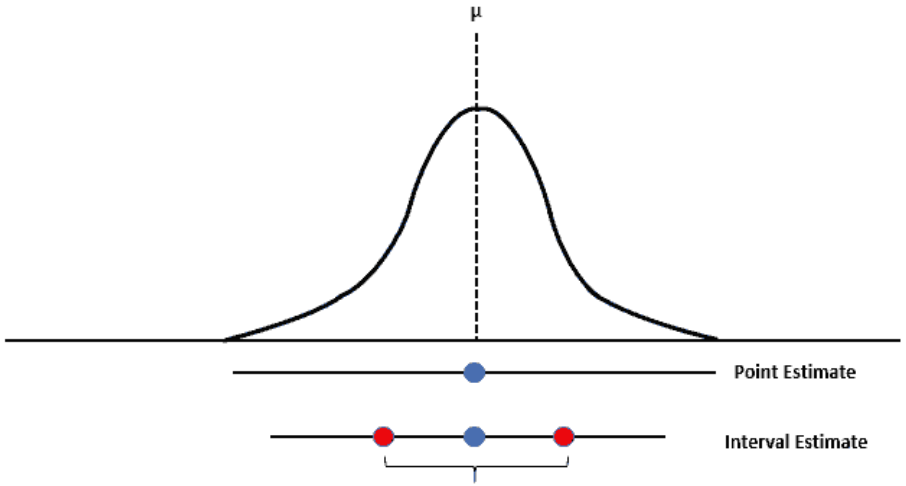
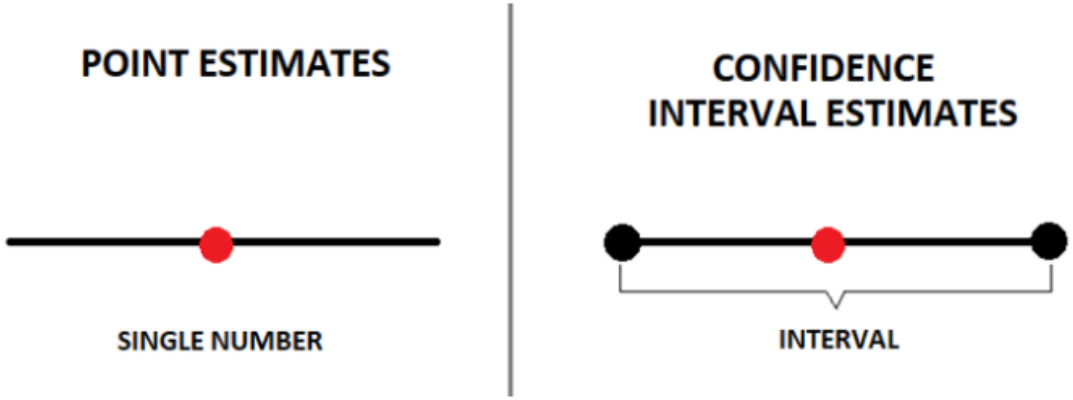
Sensitivity testing

- Discount rate
- Demand estimation
- Benefit assumptions
- Cost assumptions





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Risk analysis

- Consequence
- Likelihood

Table 108: Risk matrix

	INSIGNIFICANT	MINOR	MODERATE	SEVERE	EXTREME
ALMOST CERTAIN	Low	Medium	High	Critical	Critical
LIKELY	Low	Medium	High	Critical	Critical
POSSIBLE	Low	Medium	Medium	High	Critical
UNLIKELY	Low	Low	Medium	Medium	High
RARE	Low	Low	Low	Low	High

Monetised benefits and costs manual

What is the MBCM used for?

- Initial stages to calculate rough order BCRs for option consideration
- BCRs refined as new information becomes available
- BCRs finalised during preparation of detailed economic case
- Incremental analysis used for selection of (economic) preferred option
- BCRs and other economic information used for:
  - preparation of RLTPs
  - prioritisation of activities for inclusion in NLTP

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Useful tools and references

- Land Transport Benefits Framework Measures Manual
- Cost estimation manual (SM014)
- Transport Model Development Guidelines (TMDG)
- Crash Estimation Compendium
- Vehicle Emissions Prediction Model (VEPM)
- Treasury's Guide to social cost benefit analysis
- Climate Assessment of Transport Investment
- Induced demand prototype tool
- ISO 31000 Risk management

Q&A

Thank you

If you wish to be added to our mailing list for future updates to the Monetised benefits and costs manual, please email: MBCM@nzta.govt.nz