Road Asset Management (RAM) Training

10-13 August 2020

Session 3-1: Lifecycle Decision Making and Funding Strategies

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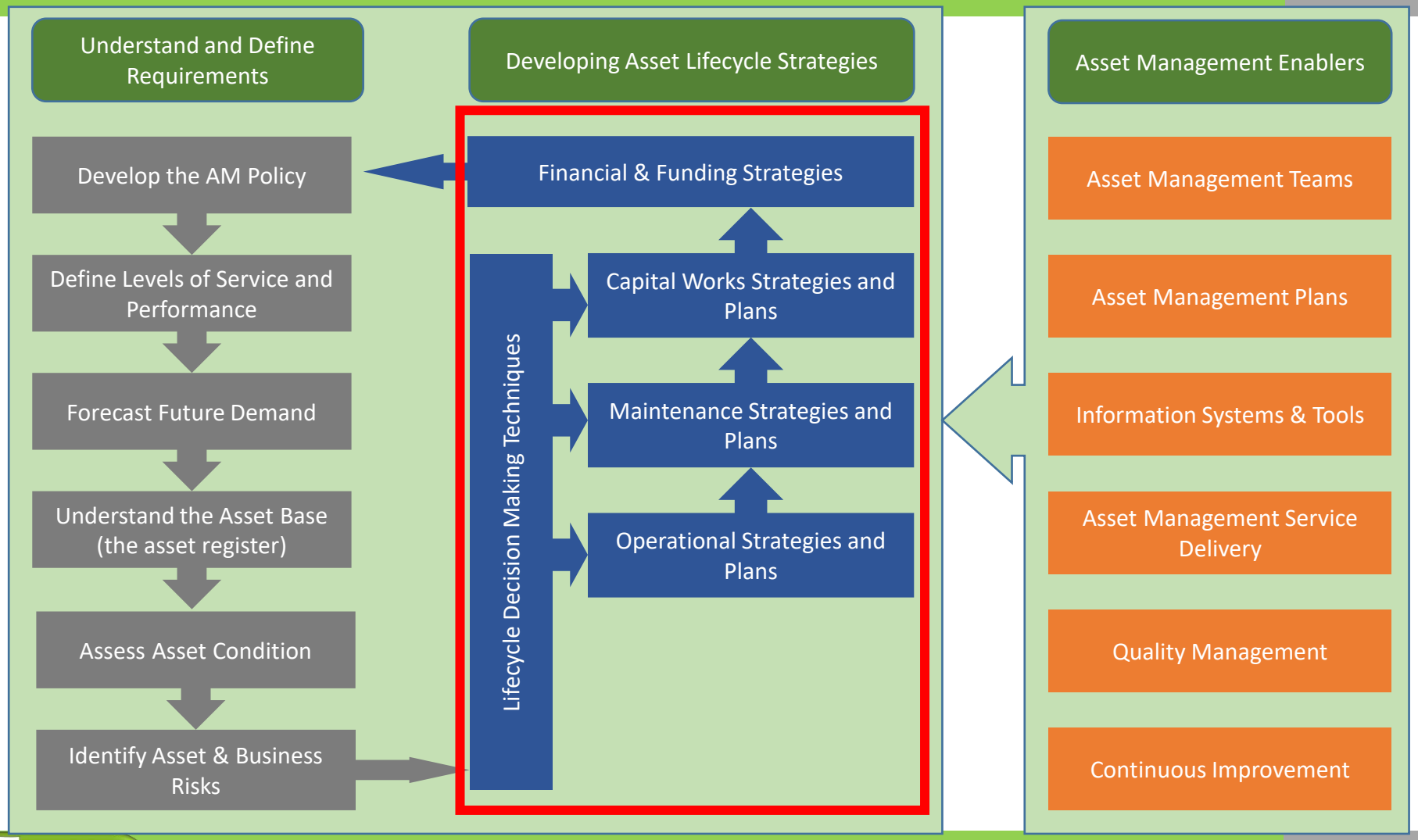
Training Sessions

1. Introduction to Road Asset Management
2. Overview of the Components of RAM
3. Levels of Service and Performance Measures
4. Inventory and Condition Data
5. **Lifecycle Decisions Making and Funding**
6. Asset Valuation
7. Asset Management Plans, Teams and Tools
8. Contracting Models and Impact on RAM

International Infrastructure Management Manual (IIMM) AM Process



What is the right balance of:

- Drain clearing, edge maintenance

  versus the cost of

  flood damage disruption and repair.

- Re-paving

  versus the cost of

  increased patching and pothole repairs

- Lowering the average roughness of the road network

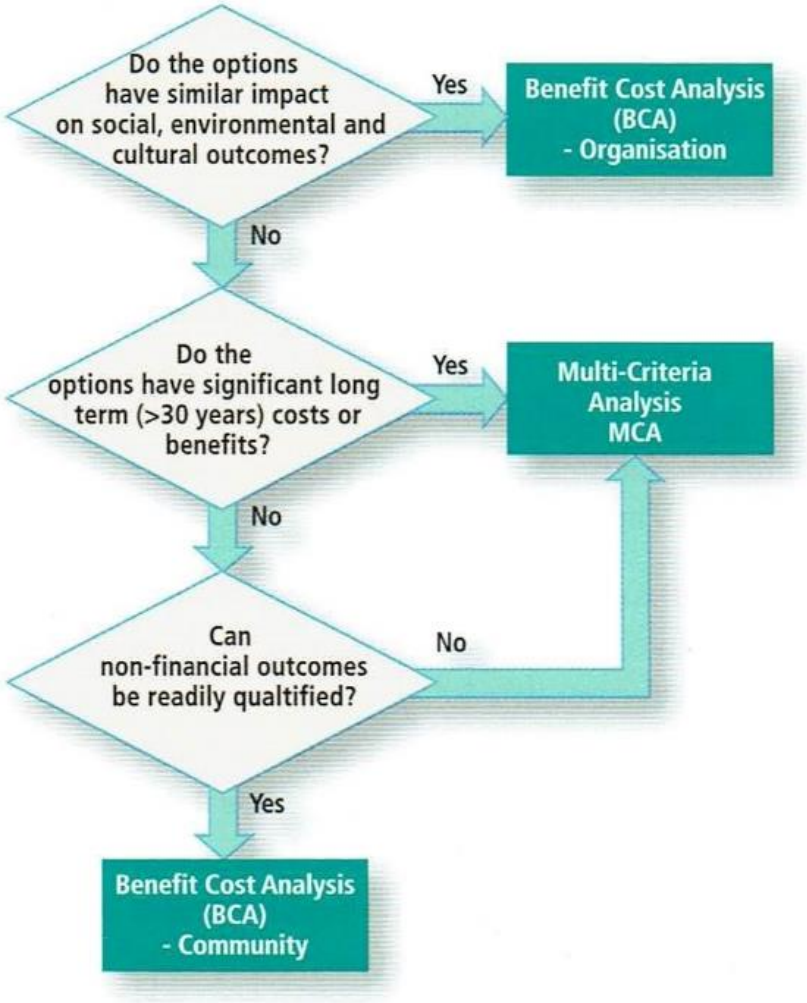
  versus the benefits of

  adding capacity to the network

Lifecycle Techniques

Selecting an Evaluation Framework

- Different decisions will require different evaluation approaches:
  - Maintenance and renewals often BCA (organisation)
  - Realignment of a road often BCA (community)
  - New route selection often MCA



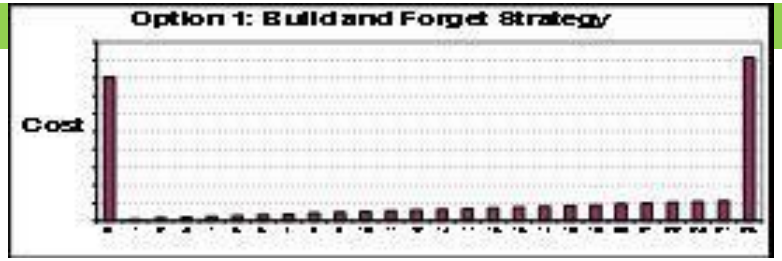
Two Main Methods of Economic Evaluation

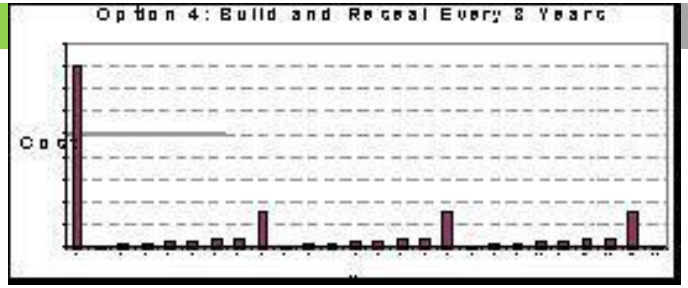
- BCR
  - What return is the country getting on its investment?
  - Typically used for major new investments where the option to do nothing exists
  - In general the Benefit is to the road user, while the Cost is to the Agency
- NPV
  - What is the least life-cycle-cost (LCC) option to the agency?
  - Typically used for maintenance or renewal projects where other impacts are considered neutral, and doing nothing is seldom an option
  - NPV/C = akin to BCR but where the Benefits are savings to the Agency
- If BCR>1 or NPV>0 then a project is regarded as economically viable. BUT that does not mean there is money to fund them!

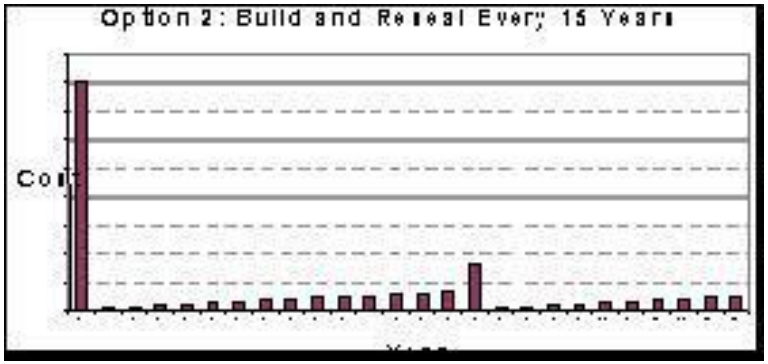
What Is Life Cycle Costing (LCC)?

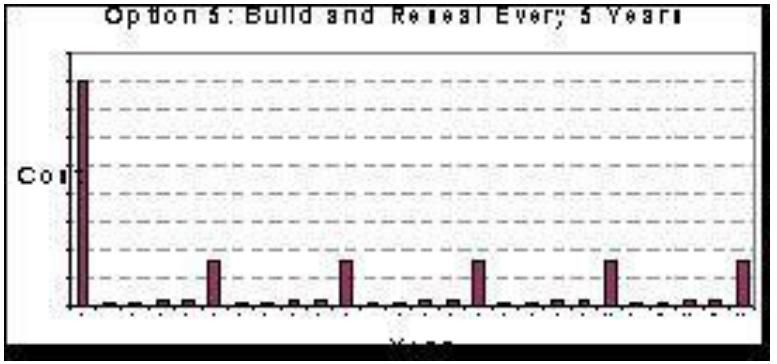
- Consideration of the costs over the full life of the asset
  - Financial rules may require evaluation of more than 50 years for some investment types
  - The cost for a road authority to maintain and renew a length of road over 50 years is often 3 times the initial construction cost for building a new road!
- Avoids short term gain that has long term pain
  - Allows for evaluation of the benefits of a high cost concrete pavement that has lower maintenance costs, against a short life flexible pavement with higher maintenance costs

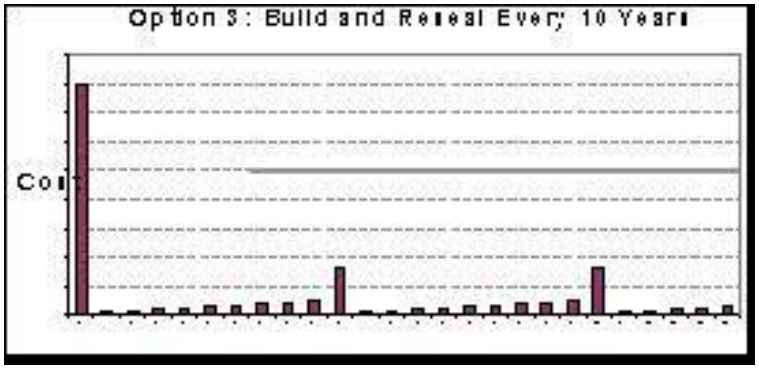
Operational forecasts need to consider the overall lifecycle strategy

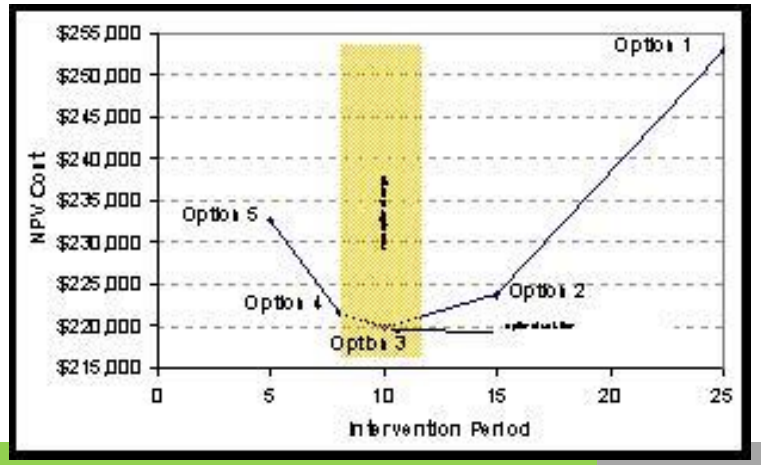












Discounting

- Used to compare costs and benefits that occur in different time periods
- Separate concept from inflation, based on the principle that people prefer to receive goods and services now rather than later
- For individuals, time preference can be measured by the real interest rate on money lent or borrowed
- Society as a whole, also prefers to receive goods and services sooner, and to defer costs to future generations. This is known as ‘social time preference’; the ‘social time preference rate’ (STPR) is the rate at which society values the present compared to the future.

Key Parameters

- Discount rate
- Analysis Period

Year	Discount Rate	PV Factor	PV of 100k	Discount Rate	PV Factor	PV of 100k	Discount Rate	PV Factor	PV of 100k
0	3.5%	1.000	100,000	5.0%	1.000	100,000	10.0%	1.000	100,000
1	3.5%	0.966	96,618	5.0%	0.952	95,238	10.0%	0.909	90,909
5	3.5%	0.842	84,197	5.0%	0.784	78,353	10.0%	0.621	62,092
10	3.5%	0.709	70,892	5.0%	0.614	61,391	10.0%	0.386	38,554
15	3.5%	0.597	59,689	5.0%	0.481	48,102	10.0%	0.239	23,939
20	3.5%	0.503	50,257	5.0%	0.377	37,689	10.0%	0.149	14,864
25	3.5%	0.423	42,315	5.0%	0.295	29,530	10.0%	0.092	9,230
30	3.5%	0.356	35,628	5.0%	0.231	23,138	10.0%	0.057	5,731
35	3.0%	0.355	35,538	5.0%	0.181	18,129	10.0%	0.036	3,558
40	3.0%	0.307	30,656	5.0%	0.142	14,205	10.0%	0.022	2,209
45	3.0%	0.264	26,444	5.0%	0.111	11,130	10.0%	0.014	1,372
50	3.0%	0.228	22,811	5.0%	0.087	8,720	10.0%	0.009	852
55	3.0%	0.197	19,677	5.0%	0.068	6,833	10.0%	0.005	529
60	3.0%	0.170	16,973	5.0%	0.054	5,354	10.0%	0.003	328

Incremental BCR

- Used where project alternatives and options are mutually exclusive
- Determines whether the incremental cost of higher–cost project alternatives and options is justified by the incremental benefits gained (all other factors being equal)
- So just because your project option has a good BCR, it may not be the best option economically speaking
- Incremental BCR tries to stop gold plating.

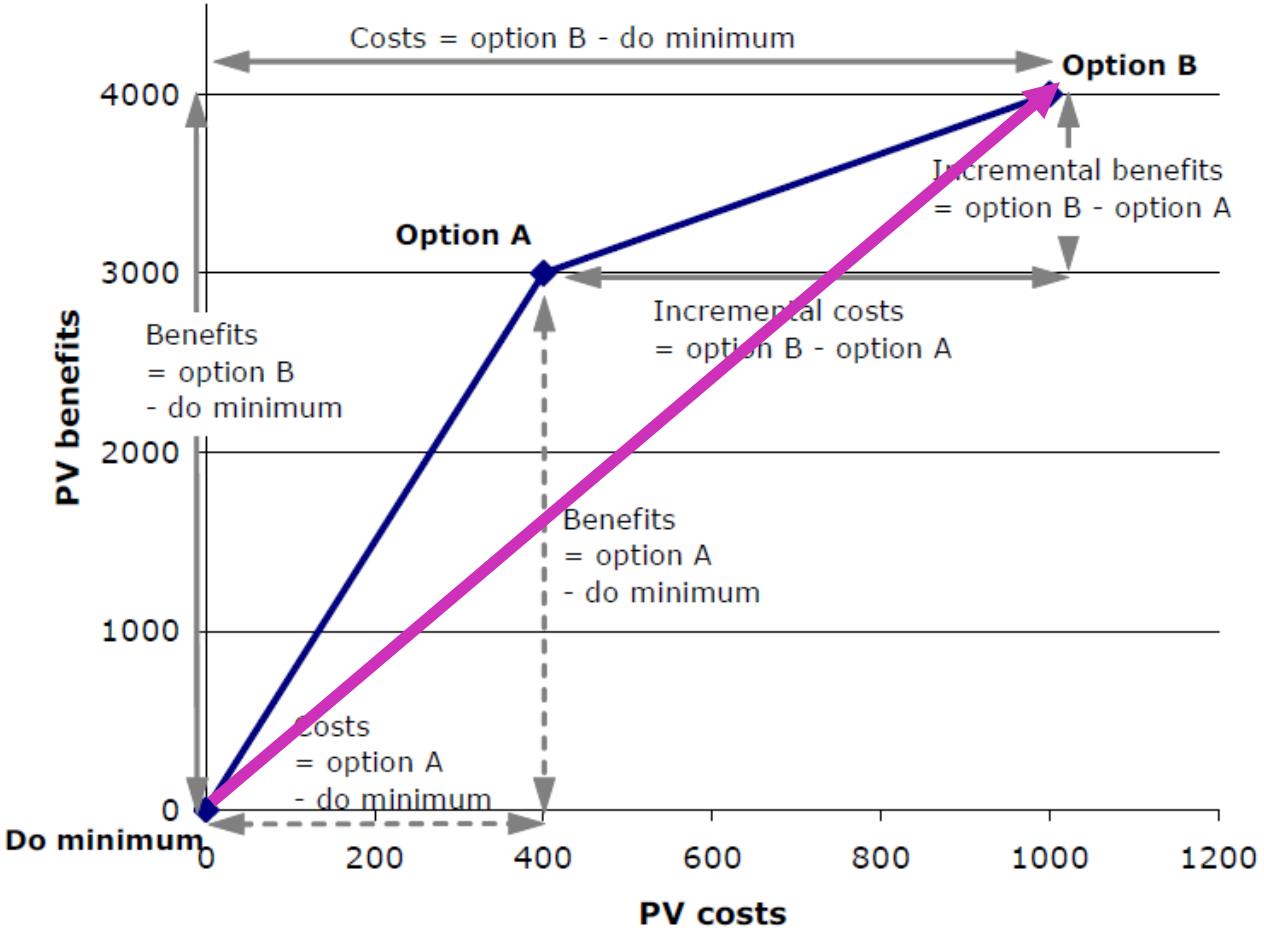
Incremental BCR

- Two mutually exclusive options:
  - Option A: Cost $0.4m, Benefit $3m = BCR of 7.5
  - Option B: Cost $1.0m, Benefit $4m = BCR of 4

  - Inc BCR = (4 - 3) / (1 - 0.4) = 1 / 0.6 = 1.7

- Challenge from a road authority perspective is to make sure that option A is in the list of options evaluated
  - If it wasn't for Option A, Option B would be quite acceptable!

Incremental BCR



Forecasting future operations and maintenance requirements

- Typically 20 years + for long term financial forecast
- Enables organisation to go beyond ‘next year’ thinking and consider sustainable funding levels
- Needs to consider how costs may change over time – for example recognising the release of roads from maintenance periods funded by others
- Needs to consider the ‘whole of life’ cost of the asset and the expected maintenance with consideration of the original construction standard
- Needs to be developed at adequate breakdown to enable analysis of trends / requirements

Operational Strategies and Plans

Operational Strategies

- Look to get the maximum benefit out of the asset, without the need to physically invest into the asset via maintenance or renewal:
  - Travel demand management
  - Peak hour pricing
  - Moveable median barriers
  - Peak time shoulder running
  - Emergency / disaster management
- Over-dimension routes
- New vehicle load limits

Example Incident / Disaster Management

Emergency Plans outline:

- How the organisation will respond
  - Following a warning
  - Immediately after the event – impact assessment
  - Prioritising immediate restoration of services
  - Longer term recover
- Roles and responsibilities
- Escalation points for activating of incident / emergency response teams
- Interaction with other key agencies.

Operations vs Capital Works

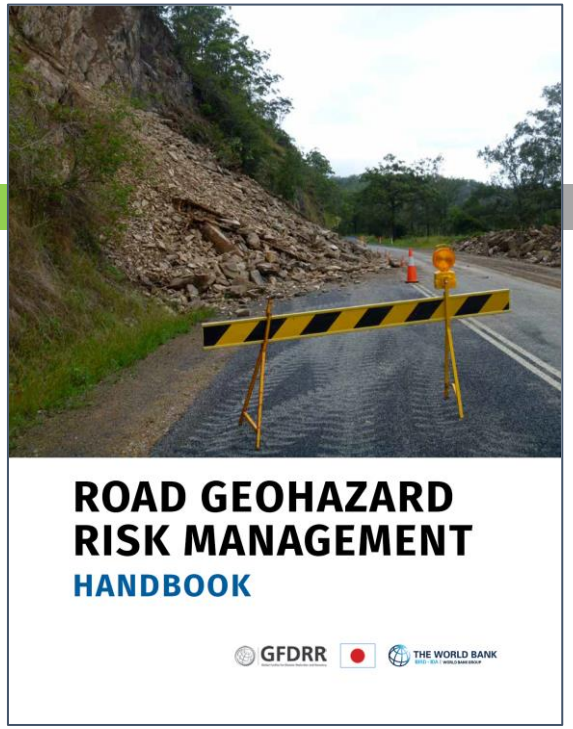
- Section of Auckland motorway submerged under extreme tides
- Rather than spend many $$$ to raise the road, have implemented an operational response
  - Social media
  - Websites
  - Radio
  - Traffic management warning signs

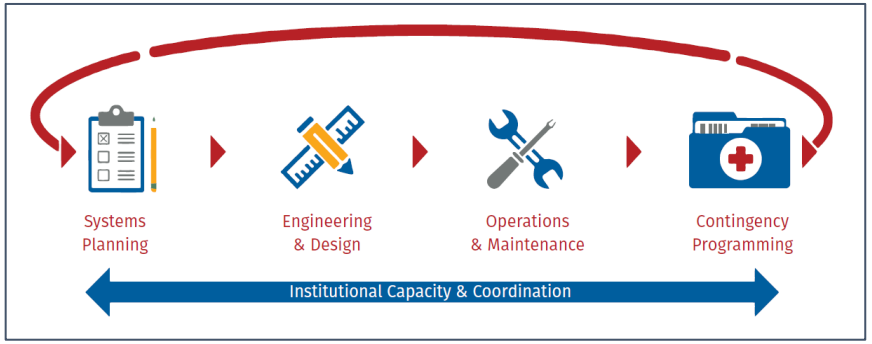
With the result that people avoid the motorway for the peak hour.

Risk Management

- Risk management is a core part of managing the road network
- Lots of guidance documents available
- New (2020) set of documents is specifically related to road networks

1. Road Geohazard Risk Management Handbook
2. Road Geohazard Risk Management Appendix A (Terms of Reference) and Appendix B (Operations Manual)
3. Road Geohazard Risk Management Appendix C: Japan, Serbia and Brazil Case Studies
4. Road Geohazard Risk Management Japan Case Study





Handbook Fully Integrates With RAM

- For each stage of the RAM process, the associated geohazard risk management tasks are identified

Table 5.2: Recommendations for Integrating Geohazard Management into Asset Management

Phase	Step in AM process (refer to Figure 2.1)	Key additional actions
Understand and define requirements	Develop the AM policy	• Specifically address geohazard risk management within the AM policy statement, including what horizon is to be planned for • Have agreements in place on how the damage from major events will be funded and who will be entitled to financial support
	Define levels of service and performance	• Ensure that network resilience measures (for example, restore all major roads within 12 hours of the end of a 1-in-100-year flood) are included into the level-of-service framework • Revise design guides to take into account the changing frequency of climatic events, and ensure that design standards are in place for geohazards
	Forecast future demand	• Future demand forecast such as demographic changes and traffic-loading increases should be integrated with geohazard impacts on the expected performance of infrastructure • Providing for future growth in high-risk areas should be avoided (or at least fully understood ahead of growth being permitted)
	Understand the asset base	• Ensure that data on highway assets and their vulnerabilities or deficiencies are complete and up-to-date • All data collection processes should be geospatially referenced • Road data and information should highlight interdependencies with other infrastructure • Link lifelines and critical interactions between asset groups in the base data
	Assess asset condition	• Data collection should include measuring and recording of specific geohazard risk effects on road networks
	Identify asset and business risks	• Ensure that geohazard risks are recognized as risks to the asset and delivery of services • Risk and vulnerability assessments—already commonly used for geohazard management—should be integrated with risk management from an organizational risk perspective • The integration with asset management risk promises significant efficiency gains
Develop asset life-cycle strategies	Life-cycle decision-making techniques	• Current analytical processes need to incorporate multi-objective capabilities and often need refinement to include risk-based costs • More emphasis on community involvement in decision making is required when bringing geohazard management into the asset management decision making, as often the solution is to reduce the reliability of access
	Operational strategies and plans	• Operational plans should include specific allowance for identifying and addressing deficient adaptation measures, such as making sure drainage structure are cleaned and without blockages • Include retrofitting infrastructure that is found to be significantly deficient • Trial new designs that may offer better life-cycle solutions to common geohazards • Operational procedures should include policies and processes identified for responding to disasters
	Maintenance strategies and plans	• Maintenance strategies and plans should include specific allowance and focus on addressing items that limit the impact from geohazards • Ensure that there is an accurate record of materials removed from geohazards, as these data are needed for the calibration of many geohazard simulation models
	Capital works strategies and plans	• Updating of current design criteria is needed to address the full range of geohazards
	Financial and funding strategies	• Financial and funding strategies should investigate the impacts of different investment scenarios on geohazard mitigation • Financial and funding strategies should be in place for responding to potential disaster events
Leverage asset management enablers	Asset management team	• Effective integration of geohazard management and asset management must be driven from executive management levels within organizations • Appoint someone as the geohazard management champion to drive all these actions through the organization
	Asset management plans	• Ensure that the asset management plan specifically addresses geohazards
	Information management systems and tools	• Information management systems should include the recoding of specific geohazard data for planning purposes • A data residence plan should be in place to respond to disaster planning needs
	Asset management service delivery and procurement	• Legislation and procurement processes should allow for the response to shock events
	Quality management	• Quality management of geohazard measures needs to ensure their sufficient functioning
	Continuous improvement	• Identify improvements necessary for geohazard management, and integrate these into the overall improvement plan for the road authority

Routine Maintenance

Routine Maintenance

- Proactive
  - Scheduled maintenance of tunnel ventilation systems to reduce unscheduled breakdowns
- Reactive
  - Cleaning drains
  - Pothole repairs
- Should be clearly defined maintenance strategies that link to the planned works for the asset
  - i.e. don't undertake high cost maintenance if the road is due for reconstruction soon

Maintenance and the Road User

- Maintenance defects are closely aligned to the road user experience
  - Potholes, overgrown vegetation, faded line markings, litter, blocked drains causing surface flooding
- Yet maintenance is often relegated to a low level of standing in road authorities

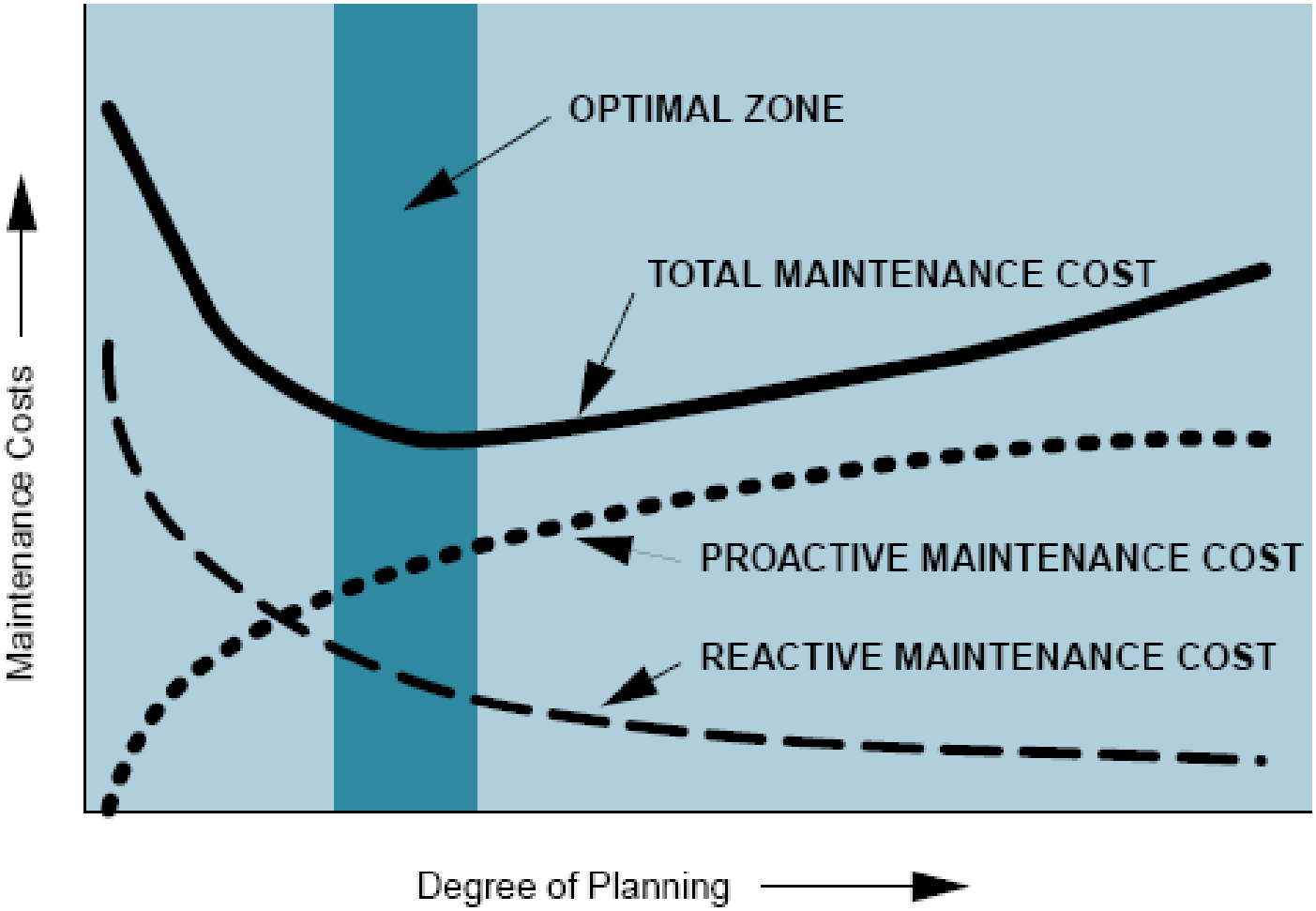
Maintenance

- How do the maintenance standards align with the LOS objectives in your road authority?
  - Do the maintenance standards vary by road hierarchy?
  - If there isn't sufficient funding, then what is not undertaken?

- Economic return for routine maintenance is often 10-20 times greater than any investment in new (capital expansion) works
  - Yet operational & maintenance budgets get cut to enable lower economic return projects to go ahead

- There is generally no greater economic benefit to a road authority, than that of looking after what you have already built
  - Never underfund routine maintenance or renewals

Optimal Zone of LCC



Capital Works

Capital Works

- Typically two aspects:
  - Renewals
    - Quantity estimated through a combination of predictive modelling (HDM-4), historic records, and asset valuation parameters
    - While impacting on the long term durability of the network, many renewals (especially resurfacings) do not impact significantly on the road users experience
  - Expansion works
    - From traffic modelling, road safety investigations or similar

- Will typically impact on different LOS outcomes
  - Budgets generally split at a higher level, such that renewals are funded as a 'bucket of money' that can be further optimised within the funding cycle, while expansion works are funded on a per-project basis.

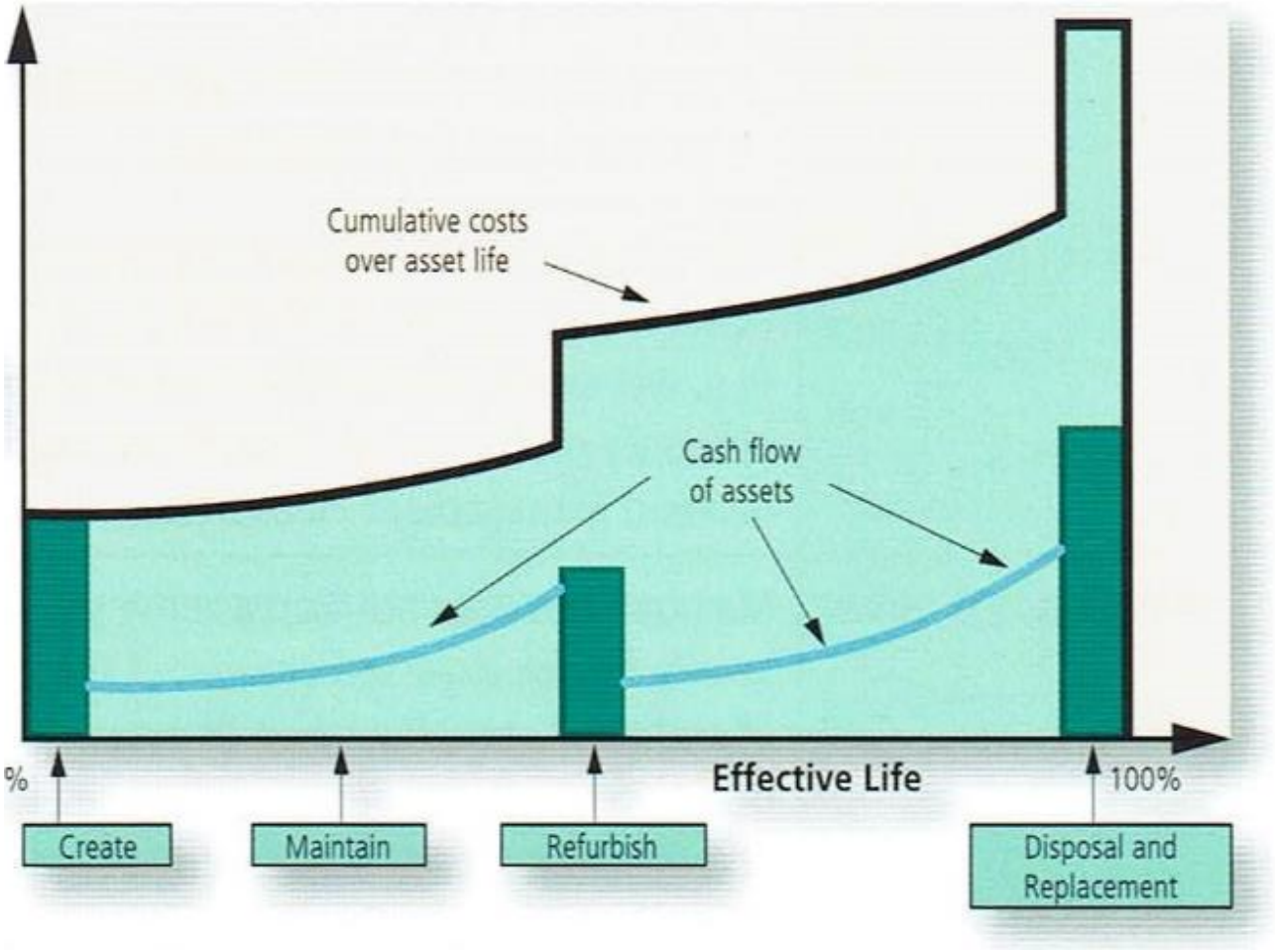
Developing the Renewal Program

- Prioritisation using simple engineering rules
- Optimisation using sophisticated tools such as HDM-4

- Often optimise the total budget for renewals (treatment type and year), while optimising the detailed sub-options for expansion works (eg 2 lanes or 3)

Funding Strategies

Funding is Related to the Life of the Asset



Finance and RAM

- Important that financial and asset management teams are aligned:
  - Asset classifications and hierarchies
    - Can the information for AM purposes be rolled up for financial reporting requirements?
  - Expenditure and capitalisation rules
    - At what stage is a large repair a small rehabilitation?
  - Asset valuation and depreciation calculations
    - Is depreciation an operational expense?
  - Lifecycle costing methodologies and key parameters
    - What discount rate, analysis period and similar are to be used?
  - Risk management and insurances
    - If risks materialise, how will they be funded?
    - Whole of government contingency funding, Road authority contingency budget, contingent projects, insurance?

Link to Asset Valuation

- Some countries legislate the requirement to treat depreciation as an operational expense
- For example:
  - If I have $30Million worth of road pavement base (the cost for me to replace the entire network today)
  - And if the average pavement base will need to be replaced every 30 years
  - Each year, an operational expense of $1Million is funded
    - Either physically in the network or set aside in the budget
  - This ensures there is sufficient funding for replacement of network as required
- More in Session 3-2

Some Considerations in Finance Strategies

Recognise the consumption of service potential
• Generating operating revenue approximately equal to operating expenses.
• Use of accrual accounting to properly differentiate between capital expenditure and operating expenditure, the inclusion of physical assets in the Balance Sheet and to recognise the consumption of the physical assets through depreciation charges.
• Quantification of any backlog of maintenance or renewals.
2. Adequate expenditure categorisation
• Sufficient categorisation of operating expenditure to provide detailed information on the operation and maintenance of assets.
• Sufficient categorisation of capital expenditure to differentiate between asset renewals, changes to levels of service (capability) and capital expenditure incurred through growth demands (capacity).
3. Long-term financial plans
• A long term financial plan- for at least 10 years- to outline the entity's future financial requirements based on all information relating to asset creation, maintenance, renewal and disposals.
• Robust forecasts of each category of operating and capital expenditure in the long term plan, with underpinning assumptions and confidence factors to indicate the reliability of those forecasts.
4. Allocation of costs to assets
• As much as possible, the ability to assign direct costs to asset or network activities rather than allocations of indirect costs.
• The allocation of indirect costs to asset or network activities based on a logical transparent methodology.
5. Cost-effective financing
• Detail of the funding needed to acquire, operate, maintain and renew the assets for a forecast period of at least 10 years.
• Detail of the funding sources, the rationale for each funding source and the timing of the funding sources for the forecast period.
• Holistic management of treasury activities to minimise financing costs. This may include corporate treasury management, utilising reserve funds for internal borrowing, and a portfolio of external borrowings with a mix of short and long term loans at both a fixed and variable interest rate.
6. Ability to report financial performance
• The ability to aggregate detailed financial management information sitting in AM databases to summary information reported in external financial statements.
• Preparation of financial targets, measures or key performance indicators (KPIs) that complement other (non- financial) levels of service and performance measures.

Summary

- Lifecycle costing (LCC) is essential when dealing with long-life assets
- Consider how operations, maintenance and capital works can be best optimised to deliver the LOS
- Need full alignment between financial and asset management teams
- Have in place and agreed evaluation methodology

- There is generally no greater economic benefit to a road authority, than that of looking after what you have already built
  - Never underfund routine maintenance or renewals

Questions?