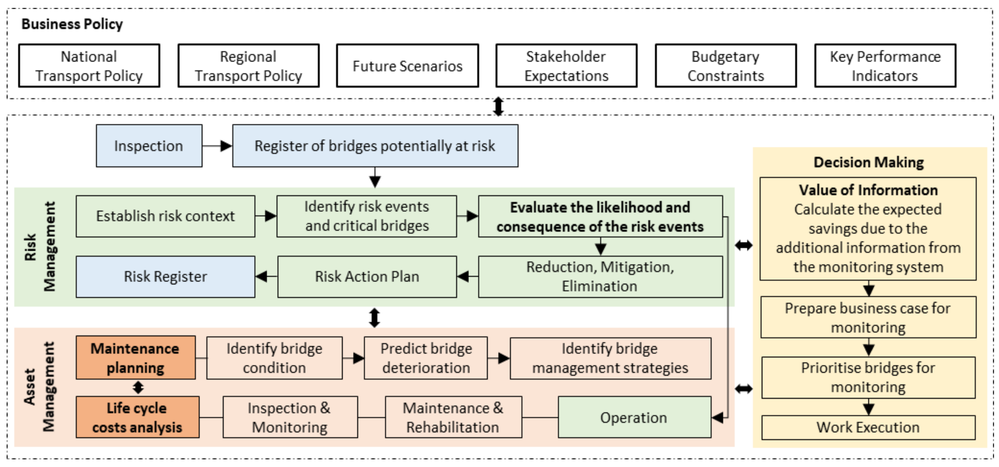
Risk-informed bridge monitoring based on the value of information

Cambridge Centre for Smart Infrastructure & Construction

Risk-informed bridge monitoring

Risk and asset management can effectively support decision making on bridge monitoring:

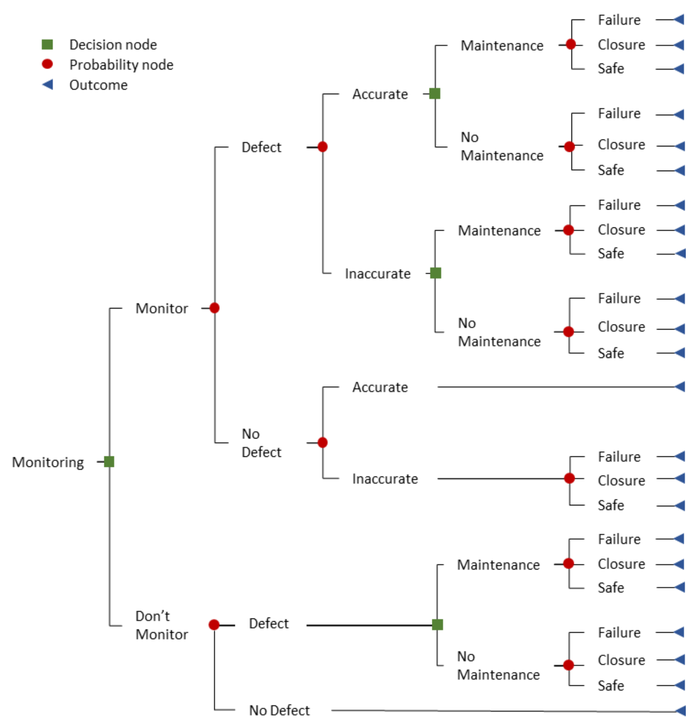
- Risk management provides a risk assessment of critical assets, failure modes and high-risk areas on the network.
- Asset management processes inspect and predict the individual bridge condition and the associated life-cycle-costs to prioritise monitoring.



A conceptual framework for risk-informed bridge monitoring

Value of information (VoI)

VoI is a utility-based metrics related to decision making under uncertainty, and it measures the expected benefit due to the availability of extra information (from monitoring). Life-cycle-cost analysis is key to answering, 'to monitor a bridge or not?' and need to consider not only the maintenance and repair costs, but also the operational impacts of bridge disruptions (e.g., traffic detour, mode shift, environmental emissions, accident risks). The outcomes are based on probability of defect existence, detection accuracy of monitoring system and effectiveness of maintenance.

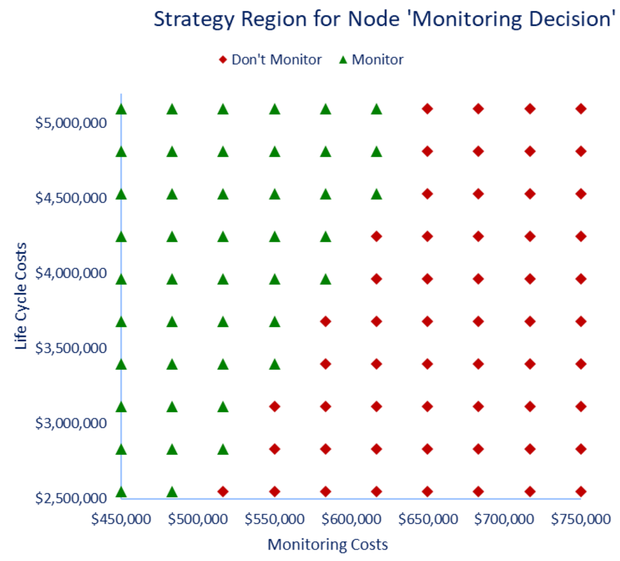


A Value of information decision tree for bridge monitoring

Decision-making

The bridge management process is modelled as sequential decision-making problem where the manager infers and predicts the bridge's deteriorating condition and takes periodic action with the overall goal of maximising the value of the asset. While the benefits of monitoring bridges are fairly understood, securing the resources necessary for their development and installation is often difficult

- The VoI approach provides a transparent and effective tool for choosing monitoring strategies
- It gives the decision maker a thumb rule for prioritising bridges for monitoring when faced with budget constraints



Decision making matrix for monitoring the bridge or not

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