CHAPTER ELEVEN
RISK ANALYSIS

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CHAPTER SUMMARY AND CONCLUSIONS:

- The risk analysis for the CRR Project was completed in accordance with Queensland Government guidance material including the Project Assessment Framework and the Department of Transport and Main Road's Project Cost Estimating Manual.
- The key risks for the CRR Project include:
  - requirements varying following detailed design
  - extra land being required for construction purposes
  - community reaction necessitating changes to portal locations
  - unavailability or delay in connection of utilities necessary for construction
  - industrial action or similar causing delay and additional costs.

11.1 Purpose and Overview of this Chapter

The purpose of this chapter is to identify and assess the risks that might create, enhance, prevent, degrade, accelerate or delay the achievement of the CRR Project objectives and outcomes. This chapter summarises the outcomes of the risk analysis undertaken for the CRR Project, which will inform the risk management strategy required to deliver the CRR Project.

The Queensland Government's Project Assessment Framework requires a detailed risk analysis process to be conducted for the CRR Project and a project risk register to be developed. The methodology and process followed for the risk analysis complies with, and was guided by, the following frameworks and manuals:

- Australian Standard ISO31000:2009 Risk Management – Principles and Guidelines
- National Public Private Partnership Policy and Guidelines
- Department of Transport and Main Roads (TMR) Project Cost Estimating Manual
- Department of Infrastructure and Transport Best Practice Cost Estimation Standard for Publicly Funded Road and Rail Construction.

11.2 Risk Identification and Assessment

Risk identification involves determining what, why, where, when and how events could prevent, degrade, delay or enhance the project outcome.

Project risks include (but are not limited to) the risk categories shown in Table 11.1.

RISK IDENTIFICATION	
PROJECT RISK CATEGORY	**ONGOING RISK CATEGORY**
Site	Operations and maintenance
Design and manufacture (including geotechnical)	Sponsor and financial
Construction and commissioning	Industrial relations
Operations and maintenance	Legislative and government policy
Sponsor and financial	Force majeure
Industrial relations	Asset ownership
Legislative and government policy	
Force majeure	
Market	
Network and interface	
Asset ownership	

Table 11.1: CRR Project Risk Categories

Project risks can be separated into two major categories – planned and unplanned – reflecting their different natures. Planned risks relate to the potential for the 'known' aspects of the project, which are measured in terms of scope, quantity and productivity, to vary over time. Unplanned risks relate to potential changes in circumstances that may impact on the scope or nature of works and, hence, the cost to deliver the project such as weather impacts, industrial issues, safety and design standards.

Together, the planned and unplanned risk assessment profiles represent the risk adjustment to the raw cost profile. When combined, the raw cost profile and the risk adjustment represent the total cost profile of the CRR Project.

11.3 CRR Project Key Risks

11.3.1 Key Risks – Project Implementation

11.3.1.1 Unplanned Risks

Key unplanned risks, and mitigation measures identified to accept, reduce or eliminate the likelihood or consequences of these risks, are outlined in Table 11.2.

RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Design risk	This is the risk that as a result of detailed design, requirements are variant.	Additional cost and time	Develop clear performance requirements with Queensland Rail, including how the possessions schedule in the area is managed that will provide the opportunity for proponents to optimise the staging solution.
Design risk	This is the risk that as a result of detailed design and investigations, such as geotechnical and contamination, cost and timetable vary. This includes variations in cross-sectional area, length of tanking, interchange work, more rock support, increased operational costs and increased maintenance requirements. This also includes discovery of errors and miscalculations from previous works.	Delays and additional costs	Additional investigations shall be identified throughout the procurement phase with tenderers and the CRRDA.
Design risk	This is the risk that the requirements to give emergency services access to the corridor will change the design requirements.	Changes to the design and increased cost	The Queensland Government will engage with emergency services including Queensland Fire and Emergency Services (QFES), Queensland Ambulance Service (QAS) and Queensland Police Service (QPS). This engagement needs to be accurately captured and included in the contract documentation.

RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Site risk	This is the risk of extra land than originally proposed for construction purposes being required. This risk includes compensation (property price and disturbance) costs for additional land to be acquired.	Additional cost and time	Ensure sufficient design and construction planning is undertaken to identify the property extents of the project. Throughout procurement the CRRDA needs to work with tenderers to define property constraints.
Site risk	This is the risk that community reaction causes changes to portal locations, in terms of land acquisition or corridor.	Delays to the project in obtaining approvals due to changed portal locations Cost of acquiring additional land and delays Potential additional cost due to changed conditions of approval to project Infers changes after Coordinator-General's approval Requires a change report process	Use Queensland Government land to the extent possible. Undertake proactive community engagement.
Site risk	This is the risk that there is delay in the connection or unavailability of utilities necessary during construction (including power and water).	Delays and additional costs	Engagement and planning work and design with utility providers needs to be undertaken to understand needs and requirements against available supply. This planning work and design should be tested during procurement with the tenderers to ensure that utility supplies are adequate.
Site risk	This is the risk that during the design and construct phase the contractors cannot obtain reasonable access to the site, including roads, to undertake works in the most efficient manner.	Delays to the project Additional costs to reschedule and additional resources required	Develop access to worksites and identify the cumulative impacts through the approvals process. Engage with BCC and TMR to coordinate local road access.
Construction risk	This is the risk of damage to Queensland Rail infrastructure, impacting on services or community perceptions. Particular issues exist with Queensland Rail's Rail Management Centre.	Cost to repair Queensland Rail infrastructure Delays to the project	Identify sensitive assets to be protected and develop a process for accessing, protecting and repairing Queensland Rail assets. Include this within the contract documentation.

RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Construction risk	This is the risk that there is a lack of integration between the major contracts. This includes integration between design, construction, civil engineering, signalling and mechanical and electrical. It also includes the integration of subcontractors (such as site handovers).	Delays to the project Increased costs to manage process, rectify errors or rework	Project delivery strategy should be developed to minimise the number and complexity of interfaces. The Queensland Government will sufficiently resource to manage the number and complexity of interfaces.
Industrial relations risk	This is the risk of industrial action (including strikes, lockouts, work bans, work-to-rules, blockades, picketing, go-slow action and stoppages) causing delays and costs. This includes the risk of significant employment changes due to industrial action and the risk of industrial action specifically as a result of safety concerns or a major safety incident (issue of ownership of safety case).	Delays and costs to the project	Clearly identify industrial relations requirements in the contract and identify (throughout procurement) how tenderers will successfully engage and manage this risk.

Table 11.2: CRR Project Key Unplanned Risks – Project Implementation

11.3.1.2 Signalling System Risks

While not identified as key risks from a total value perspective, the project risk register includes a number of risks and mitigations for signalling systems design, commissioning and integration within the CRR Project. Examples include:

- technical interfaces/integration risk
- rail signals commissioning risk
- systems interference risk
- interface between the European Train Control System Level 2 and legacy trains risk
- testing and commissioning planning time risk.

11.3.1.3 Planned Risks

The key planned risks were determined to be attributed to the following components and aspects of the project:

- underground stations
  - Boggo Road station
  - Albert Street station
  - Woolloongabba station
  - Roma Street station
- schedule delays
- southern surface stations
- northern portal
- tunnel power (including traction power)
- client costs (the risk that client costs vary from the current estimated baseline leading to larger or smaller owner's team sizes)
- Exhibition station.

There are planned risks identified for construction works that are the result of uncertainties in the known or planned scope. Specifically, this relates to quantities expected for the design, cost of materials, additional unknown utilities for which relocation is required and construction worksite location (if this is not optimally located).

The prominence of Boggo Road station in the rank order of planned risks is the result of its correlation with the southern portal works. The complexity of the southern portal works, combined with the underground station, escalates Boggo Road station to the uppermost planned risk among the underground stations.

11.3.2 Key Risks – Ongoing

11.3.2.1 Unplanned Risks

Table 11.3 presents the key unplanned operating risks for the CRR Project's ongoing costs.

RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Design risk	Operational impact of changes to output specifications. This is the risk that there are changes to the required functionality of the project resulting in a change in the estimated operating costs.	Cost impacts	Engage with Queensland Rail and other related stakeholders to determine the functional requirements of the project.
Operating risk	This is the risk of a major incident constraining operations and subsequently causing loss of revenue. Key issues include tunnel damage requiring repair, consequential impacts on other operators (private and freight), consequential impacts on Queensland Government royalties, effects on fare box revenue, impact on Queensland Rail's service agreement, impact on Queensland Rail's reputation and impact on mode shift for freight (road impacts and market share).	Increased maintenance and repair costs Decreased revenue Loss of reputation Claims from third parties	This is managed through the functional requirements related to maintenance and availability periods. It should also be mitigated through the use of key performance indicators (KPIs) associated with the performance specification.
Operating risk	This is the risk of a major breakdown in equipment. Key issues include: ▪ failure of traction power ▪ failure of signalling ▪ broken rail, ventilation system, substation, switchboards, escalators and lifts ▪ failure at the Rail Management Centre.	Increased maintenance costs Decreased revenue	This is managed through the functional requirements related to maintenance and availability periods. It should also be mitigated through the use of KPIs associated with the performance specification.

RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Operating risk	This is the risk that during operations, permanent infrastructure including the tunnel and stations does not comply with rail safety regulations. Issues such as fire and life safety hazards in the confined space would need detailed escape, evacuation and rescue assessment. The Rail Safety Regulator would also require detailed emergency management procedures from the accredited operator, specifically for the tunnel environment.	Disruption to services Increased cost	The Queensland Government will engage with the Rail Safety Regulator and other relevant stakeholders. Identify management processes within the contract documents and strategies for management through the operating phases.
Operating risk	This is the risk of a fire in the tunnel during operations.	Increased maintenance and repair costs Decreased revenue	The Queensland Government will engage with emergency services including QFES, QAS and QPS. Identify risks through a fire engineering brief (set out in the International Fire Engineering Guidelines) of suitable strategies for managing fire events.
Asset ownership risk	This is the risk that the system technology is no longer supported by the original or any other manufacturer. It also includes a required change from an external system that requires a change to the CRR systems, causing an issue in implementation.	Cost to replace system with new technology	Engage with Queensland Rail and other related stakeholders to determine the functional requirements of the project.
Industrial relations risk	This is the risk of industrial action (including strikes, lockouts, work bans, work-to-rules, blockades, picketing, go-slow action and stoppages) causing delays and costs. This includes the risk of significant employment changes due to industrial action and the risk of industrial action specifically as a result of safety concerns or a major safety incident (issue of ownership of safety case).	Delay and costs to the project	Clearly identify industrial relations requirements in the contract and identify (throughout procurement) how tenderers will successfully engage and manage this risk.

RISK CATEGORY	DESCRIPTION	CONSEQUENCES	MITIGATION
Legislative and government policy risk	This is the risk associated with federal, state or local government changes to policy or regulation, impacting on the project. These changes in law or policy cannot be anticipated when the contract is signed. (This excludes planning at federal, state, local government levels and tax legislation. It also applies to operations and maintenance only.)	Cost impacts	Engage with the relevant levels of government to clearly identify policy in the contract documents. Clearly articulate the management process within contract documents for dealing with legislative change.

Table 11.3: CRR Project Key Unplanned Risks – Ongoing

11.3.2.2 Planned Risks

In addition to the key unplanned risks presented in Table 11.3, other significant planned risk drivers may impact on the CRR Project objectives, particularly cost or schedule.

The key ongoing planned risks were determined to be attributed to the following components and aspects of the CRR Project:

- Station operations and maintenance – underground: This is the risk that the costs attributed to the operation and maintenance of the underground stations (including routine maintenance, inspection and repairs) vary from the estimated amount. The variance is largely characterised by changes in underground station design (floor area, platform screen doors, lighting requirements, artworks etc.), changes in maintenance crew size or build-up, sizing of station electrical equipment (including cost of power) and waste disposal and cleaning costs.
- Capital replacement – signalling: This is the risk that the costs of capital replacement for the signalling equipment vary, which can be characterised largely by the quantity of signalling equipment, cost of equipment and maintenance interval of equipment.
- Operational overhead – underground: This is the risk that the operational overheads required to maintain the underground stations change as a result of an alteration to the functional requirements of the station.
- Station operations and maintenance – surface: This is the risk that the costs attributed to the operation and maintenance of the surface stations (including routine maintenance, inspection and repairs) vary from the estimated amount. The variance is largely characterised by changes in surface station design (floor area, platform screen doors, lighting requirements, artworks etc.), changes in maintenance crew size or build-up, sizing of station electrical equipment (including cost of power) and waste disposal and cleaning costs.