

CrossRiver*Rail*



22. Hazard and Risk

Cross River Rail

CHAPTER 22

HAZARD AND RISK

JULY 2011

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22 Hazard and Risk

22.1 Introduction

This section addresses Part B Section 6 of the Terms of Reference. It identifies and describes the potential hazards and risks to which people and property would be exposed to if the Project proceeds, including natural events and the implications of climate change.

In accordance with *Australia/New Zealand AS/NZS ISO 31000: 2009 Risk Management – Principles and Guidelines*, a preliminary risk assessment has been undertaken for the construction and operation phases of the Project. This preliminary risk assessment has included an analysis of the consequences of each identified hazard on a safety basis and safeguards to reduce the likelihood and severity of hazards.

The risk of terrorism during the operations phase of the Project has been considered and is addressed throughout this section. In addition, this section provides a description of public health and safety values of the community, workforce and other stakeholders in terms of the environmental factors that can affect human health, public safety and quality of life.

An outline of the proposed integrated emergency management planning procedures is also provided. The emergency management procedures would be further developed during detailed design, construction and operation.

22.2 Methodology

22.2.1 Hazard and risk assessment

The risk assessment methodology applies the principles and guidelines of AS/NZS ISO 31000: 2009. The assessment includes the following components:

- hazard and receptor identification
- risk analysis
- risk evaluation
- risk treatment.

A hazard is something with the potential to cause harm. Risk is the likelihood that the harm will occur from exposure to the hazard. There must be a hazard and a receptor present for a risk to exist (Brecher 1997).

Hazard and receptor identification

Hazard identification was undertaken to identify potential hazards during both the construction and operation phases of the Project. The type and magnitude of exposures relating to these hazards were then identified. For the quantification of an exposure, all potential receptors need to be identified and characterized. Receptors are not restricted to human individuals or communities but can include sensitive environments, including natural habitat, flora and fauna.

Risk analysis

The risk analysis identifies the likelihood of a hazard occurring, ie probability or frequency, and the consequence if the hazard occurs. Risk criteria were developed for the Project, enabling the assessment of the potential likelihood and resulting consequence if each hazard were to occur.

Table 22-1 and **Table 22-2** detail the methodology used to assign likelihood and consequence ratings to each hazard.

Table 22-1 Risk Assessment Methodology (Likelihood)

Risk Element	Rating	Definition
Likelihood	Rare	Probability of occurrence 5% or less
	Unlikely	Probability of occurrence between 6% and 30%
	Possible	Probability of occurrence between 31% and 60%
	Likely	Probability of occurrence between 61% and 90%
	Almost Certain	Probability of occurrence 91% or greater

Table 22-2 Risk Assessment Methodology (Consequence)

Risk Element	Rating	Definition	
		People	Property
Consequence	Insignificant	No injury	No property damage Nuisance not exceeding standards
	Minor	One or more minor injuries	Slight/temporary damage and nuisance to one or more properties Temporary nuisance exceeding standards
	Moderate	One serious injury	Significant but temporary damage to property Nuisance exceeding standards
	Major	2-10 serious injuries	Sustained damage to property lasting many months Nuisance which may not be able to be mitigated
	Severe	One or more fatalities	Long term and possible permanent loss of property Nuisance which cannot be mitigated

The initial risk analysis is based on the assessment of the consequences of the impact if no mitigation measures are taken to manage the consequence and reduce the likelihood of the consequence occurring.

Risk evaluation

The ratings of the risk elements, consequence and likelihood, allows the development of an overall risk rating of the hazard.

Table 22-3 details the corresponding risk rating depending on the likelihood and consequence determined from **Table 22-1** and **Table 22-2**.

Table 22-3 Risk Matrix

Likelihood (frequency)	Consequence (Impact)				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain	Medium	High	High	Extreme	Extreme
Likely	Medium	Medium	High	High	Extreme
Possible	Low	Medium	High	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Medium	Medium	High

The risk rating determines the level of treatment required to manage the risk.

Risk treatment

The resulting risk rating identified during risk evaluation determines the treatment/management level that needs to be applied to the risk. The risk ratings include:

- extreme
- high
- medium
- low.

The general management principles for each risk rating are:

- extreme – excessive risk to people and property. Significant and urgent actions required to reduce the risk.
- high and medium – implement mitigation measures to reduce the risk to as low as practicable
- low – monitor and manage the risk to the extent necessary.

After undertaking the preliminary risk assessment, the risk evaluation is then repeated taking into account the mitigation measure/s applied to the risk with the objective of yielding a reduced risk rating. This residual risk is derived on the assumption that all identified mitigation measures would be effectively implemented.

22.2.2 Risk management requirements

Risk management is relevant to all stages in the life of an activity, function, project, product or asset for the rigorous and consistent management for both potential benefits and potential threats (Standards Australia 2005).

The application of AS/NZS ISO 31000:2009 has provided a framework to identify and document hazards and the assessed risks associated with the Project, in a rigorous and consistent manner that will also enable the ongoing identification of hazards for risk assessment throughout each stage of the Project as it progresses. The hazard and risk register will allow for the hazards and their mitigation measures to be identified, implemented (as appropriate), monitored and audited as part of the performance monitoring and value management assessment that will be conducted throughout each of the Project phases (refer to **Appendix J** for the risk register). The standards relating to transport, handling and use of hazardous materials that will apply to the Project are contained within the following documents:

- AS 1216 Classification, Hazard identification and Information Systems for Dangerous Goods
- AS 1678 Emergency Procedure Guides – Transport
- AS 1940 Storage and Handling of Flammable and Combustible Liquids
- AS 3780 The Storage and Handling of Corrosive Substances
- AS 2809 Road Tank Vehicles for Dangerous Goods
- AS 2931 Selection of Use of Emergency Procedure Guides for Transport of Dangerous Goods
- AS 2187 Explosives – Storage, Transport and Use
- *Dangerous Goods Safety Management Act 2001*
- *Explosives Act 1999*
- *Workplace Health and Safety Act 1995*
- *Environmental Protection Act 1994.*

22.3 Hazard and receptor identification

22.3.1 Hazardous activities or events

Potentially hazardous activities or events which may occur during the construction and operations phases of the Project and which present a risk to people and property are listed below.

Construction

- operation of vehicles and construction equipment on site including in a confined tunnel space
- the storage of dangerous goods, including oils and fuels, in relatively compact construction worksites
- the use of oils, fuels and other dangerous goods including explosives, and their transport to construction areas
- transportation of excavated soil to spoil placement areas offsite
- working with electricity and in close proximity to electricity in the operations rail corridors and facilities
- working within operating rail environments
- construction failures or incidents resulting in tunnel or underground collapse or subsidence, flooding or inundation
- changes to surface road and services networks.

Operations

- train incidents both aboveground and in the tunnel
- maintenance works on the rail line, tunnel and and/or ancillary infrastructure
- acts of terrorism or vandalism, such as acts leading to fires and/or explosions
- collapse, subsidence or failure of tunnel and other structural components
- flooding and inundation from both surface and groundwater sources.

These risks are preliminary and will be reviewed, assessed and quantified progressively as the Project progresses.

22.3.2 Receptors

The study corridor comprises existing Queensland Rail corridors traversing the inner northern and southern suburbs of Brisbane, adjoining car parks, existing roads and pedestrian areas, the Brisbane River and a number of industrial, commercial, greenfield and residential land uses.

The Project will consist of tunnelling work areas, the expansion, upgrade or realignment of rail lines, commuter rail facilities at stations above and below ground, maintenance areas and associated traffic and access works, including temporary and permanent changes to the surface road networks and infrastructure services in some areas.

Receptors within the study corridor that will potentially be subject to hazardous events associated with the Project include:

- residential communities and other sensitive land uses adjacent to the tunnel portals, worksites, surface works locations, transport routes and soil placement areas
- commuters who will use trains and commuter facilities

- motorists, pedestrians and cyclists who will use the road and rail network and footpaths near construction and operation activities
- the construction team physically building the Project
- groundwater and surface water catchments including the Brisbane River, Breakfast Creek and Oxley Creek, as well as smaller watercourses including Moolabin Creek, Stable Swamp Creek and Rocky Waterholes Creek
- ecological communities of the Brisbane River as well as vegetated areas and parks.

22.4 Risk assessment

The hazard and risk register details the risk assessment (refer to **Appendix J**) from hazard identification through to risk treatment via the application of mitigation measures and the re-evaluation of the risks to provide a residual risk rating.

The risk assessment is focused on hazards and associated risks during construction and operation. The risk assessment is based on the assumption that all reasonable and practicable measures have been incorporated into the design to ensure compliance with all relevant and applicable design standards.

The hazard and risk assessment does not constitute a safe design assessment. A safe design assessment would be undertaken during the detailed design phase of the Project.

22.4.1 Construction risks

A significant number of hazards exist during the construction phase of the Project due to the environment in which the Project is being constructed and risks associated with undertaking construction activities. These are identified in the risk register in **Appendix J**.

Construction risks can generally be mitigated through the implementation of appropriate construction methodologies, practices and procedures. Where there is the possibility of a fatality occurring, the consequence cannot be reduced. However, the likelihood of the consequence occurring can be reduced as far as practicable.

22.4.2 Operation risks

The main hazards identified with an original risk rating of 'extreme' result from external influences including acts of terrorism/vandalism, abnormal weather events and unauthorised access to the rail line. Identification of the risks during the design of the Project can allow for these risks to be addressed through design enhancements, for example, the separation of the platforms from the tunnels using sliding platform doors to remove access unless a train is boarding/unboarding.

The operations phase also requires the development and implementation of an effective and coordinated emergency management plan to facilitate evacuation of the infrastructure during an incident occurring due to external influences or an operations failure of the Project. This will include the development of a memorandum of understanding with emergency service authorities for fire and life safety.

22.4.3 Risk management plan

Risk management is a continual process which requires monitoring and review. The Project has committed to an ongoing process of risk management, which will include the development of a risk management plan which identifies the roles and responsibilities of specific personnel during both construction and operation (refer to **Chapter 24 Draft Outline EMP**). This preliminary risk assessment will form the basis of the risk management plan developed during the future stages of the Project. The plan will also identify a schedule for review of the risks in line with the Project activities.

22.5 Health and safety

This section summarises the values of the existing environment and the potential for impacts from the Project related to health and safety and public health. This preliminary health assessment considers environmental factors that have the potential to affect human health, public safety and quality of life, such as air pollutants, odour, worksite lighting, impacts to amenity, dust, noise, vibration and water quality.

22.5.1 Project construction workforce

The health and safety values of the construction workforce are associated with their exposure to and use of safe construction practices. Safe construction practices are critical when the workforce is required to work under the following conditions:

- at heights
- in the vicinity of or operating heavy equipment
- within confined spaces
- within operating rail and road corridors
- with electricity
- with chemicals/dangerous goods
- manual labour, including the use of tools and heavy lifting.

22.5.2 Project operations workforce

The health and safety values of the operations workforce are related to safe working environments and the safe and efficient operation of the Project. As identified in the risk assessment the main risks to people during operation of the Project are associated with:

- collision on the line due to maintenance activity or unknown track obstruction
- an act of terrorism or vandalism
- infrastructure malfunction
- emergency situations, including natural disasters.

22.5.3 Community and stakeholder values

An indication of the existing health and safety values of the community and stakeholders has been identified through the Project community consultation process. These values are listed below and have been categorised according to the primary environmental aspect of the health and safety values identified.

- air quality
- vibration
- noise
- access
- amenity/quality of life
- human and public health.

Air quality

Community values relating to health and safety aspects for air quality are likely to be associated with:

- dust and vehicle particulate emissions
- generation of odours and vapours.

Dust and particulate generation is a potential health and safety issue during construction and operation. Dust, particulate, odour and vapour generation is likely to be more apparent during construction, particularly in the vicinity of worksites, areas of surface works within the rail corridor or associated facilities, road works and spoil transport offsite.

The Project is expected to have net benefits in terms of air quality during operation, as its focus is on the promotion of public transport use. Minor beneficial residual effects are predicted on air quality over the medium term through reductions in motor vehicle use (in comparison to the Project not proceeding) and greenhouse gas emissions, as a result of changed network performance on the South East Queensland road network.

Chapter 15 Air Quality and Greenhouse Gas Assessment details the likely impact to the local air shed and mitigation measures that would be implemented to minimise potential impacts. Monitoring requirements are detailed within the air quality section of the draft outline EMP to minimise impacts to the Project workforce, surrounding community and stakeholders.

Vibration

Community values relating to health and safety aspects of vibration during construction are likely to be associated with:

- TBM operation
- tunnel mining activities at portal locations and underground stations, including drilling and blasting activities
- construction vehicle movements, onsite at worksites, offsite and between worksites
- movement of haulage trucks onsite and offsite
- operation and maintenance activities.

Community values relating to health and safety aspects of vibration during operation are likely to be associated with:

- underground train movements
- operation and maintenance activities.

Vibration impacts are likely to be more prevalent during the construction of the Project due to the physical construction of the underground structures. The likely vibration emitted during construction has been investigated and is detailed in **Chapter 16 Noise and Vibration**. The noise and vibration section of the draft outline EMP provides mitigation measures to alleviate potential vibration impacts and monitoring requirements.

Noise

Community values relating to health and safety aspects of noise are likely to be associated with the timing and duration of:

- tunnel mining activities including TBM and any drill and blast activities
- construction vehicle movements onsite, offsite and between worksites

- movement of haulage trucks onsite and offsite
- operation and maintenance activities.

Increased noise levels will be predominantly associated with the construction phase.

During operation, noise impacts are likely to result from the upgraded rail alignment, resulting in changes to the proximity of rail noise on sensitive receptors and potentially from increased services on the southern section of surface line. Changes to the noise environment have been investigated and are detailed in **Chapter 16 Noise and Vibration**. Mitigation and monitoring requirements are detailed in the noise and vibration section of the draft outline EMP.

Access

The health and safety aspect of access is potentially a high value concern for the community. Access impacts could result from changes to the local and major road network and existing public transport facilities and through reductions or changes in access to residential areas and/or commercial places. Community values include:

- adequate safety measures implemented in the vicinity of schools and other community facilities, including churches during construction
- safe access for pedestrians and cyclists around worksites and stations, particularly relating to the Yeerongpilly worksite and access to the existing Yeerongpilly Station during construction
- traffic congestion, delays and disruptions in the vicinity of worksite access points and haul routes
- safe access to and around existing stations and new stations for commuters
- safe access around rail infrastructure for pedestrians and cyclists
- adequate access for persons with a disability.

The potential impacts to access during construction and operation are detailed within **Chapter 5 Transport, Chapter 20 Social Impact Assessment** and **Chapter 21 Economic Assessment**.

Amenity/quality of life

Community values relating to health and safety aspects of amenity/quality of life due to changes in rail/road networks, station access and operation of worksites during construction are likely to be associated with:

- road network alterations/road closures, both temporary and permanent
- rail network alterations and service disruptions, including temporary station closures
- land clearing, including resumption of property/heritage valued buildings/protected vegetation
- visual impacts of the rail infrastructure, both temporary and permanent
- nuisance resulting from temporary worksite activities
- community severance as a result of temporary impacts on existing footpaths or roads.

Measures to retain and enhance existing characteristics of the areas affected by the Project have been integrated into the Project through urban design. These urban design concepts are explored in **Chapter 10 Visual Amenity and Lighting**. Implementation of mitigation measures identified within the draft outline EMP for traffic and transport management, nature conservation, nuisance generation and social impacts aim to reduce the impact to the amenity of the affected areas and the quality of life of the community.

Human and public health

Community values relating to health and safety aspects of human and public health during construction and operation are likely to be associated with:

- transport, use and offsite disposal of hazardous substances
- waste generation, disposal and treatment
- transmission of disease/vectors within the community and commuter populations.

Consideration of human health issues of the Project will require these matters to be considered through the detailed design process and as part of operational policy and procedure. Issues relating to waste management are described in **Chapter 17 Waste Management**.

22.6 Emergency management plan

Emergency planning and response procedures are to be developed further during detailed design in consultation with state and regional emergency service providers for both the construction and operation phases of the Project. The procedures are to include strategies to address:

- evacuation routes from tunnel and above and underground stations including disabled access
- procedures in the event of a fire, spillage or flooding event
- procedures in the event of a collision within the tunnel
- acts of terrorism
- roles and responsibilities
- effective communication systems/channels in the event of an emergency
- traffic management/control systems
- rail operations/control systems – power signalling and train control

22.7 Summary

This preliminary risk assessment has identified a list of potential hazards to people and property arising from the Project's construction and operation. The application of mitigation measures or safeguards can generally reduce the risk rating of the hazard and lower the residual risk.

The most significant risks identified in this assessment are associated with the need to evacuate the underground tunnel and stations in the event of an emergency.

The risk assessment process is intended to be continuous, carried forward throughout the different phases of the Project. This preliminary risk assessment has provided a framework for further more detailed hazard identification and risk analysis, evaluation and treatment. It is intended that the risk assessment methodology in **Table 22-1** and **Table 22-2** and risk matrix in **Table 22-3** would provide the basis for further risk assessments, without limiting further innovation.

The health and safety values of the community, stakeholders and workforce have been identified and are addressed by the relevant chapters within the EIS. Future detailed assessment of human and public health is required in later stages of the Project delivery.