



# **Sydney Metro – Technical Services**

Sydney Metro At Grade and Elevated Sections  
Corridor Protection Guidelines

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## Contents

<b>Executive Summary .....</b>	<b>1</b>
<b>1. Context and Scope.....</b>	<b>2</b>
<b>2. Reference Documents .....</b>	<b>3</b>
<b>3. Railway Environment and Corridor Protection Zone .....</b>	<b>4</b>
3.1 Corridor Protection .....	4
3.2 Rail Corridor .....	4
3.3 Rail Corridor Protection Zone and Reserves .....	5
3.4 Stratum Boundaries and Tree Exclusion Zones .....	9
<b>4. Development in or Adjacent to the Rail Corridor .....</b>	<b>12</b>
4.1 Legislative Framework - NSW Infrastructure SEPP (2007) .....	12
4.2 TfNSW ASA Standard T HR CI 12080 ST - External Developments .....	12
4.3 Rail Authority and Operator.....	12
4.4 Development Applications.....	12
4.5 Staged or Phased Developments .....	13
<b>5. Technical Considerations .....</b>	<b>14</b>
5.1 Rail Safety .....	14
5.2 Engineering Investigations and Assessments .....	14
<b>6. Performance Requirements .....</b>	<b>16</b>
6.1 General.....	16
6.2 Structural Integrity .....	17
6.3 Imposed Loading.....	17
6.4 Induced Movement.....	17
6.5 Excavation and Groundwater.....	18
6.6 Piling Works .....	19
6.7 Noise and Vibration.....	19
6.8 Stray Currents and Electrolysis.....	20
6.9 Protection of the Traction Power, HV & LV Power Systems and Earthing System .....	20
6.10 Utilities .....	20
6.11 Electro Magnetic Interference .....	20
6.12 Environmental Protection .....	21
6.13 Operations and Maintenance, and Emergency Evacuation Access Zones.....	21
6.14 Tree Exclusion Zone .....	21
6.15 Vandalism.....	21
6.16 Independent Verification .....	22
<b>7. Construction Requirements .....</b>	<b>23</b>
7.1 General.....	23
7.2 Dilapidation Report.....	23
7.3 Construction Risk Assessment .....	23
7.4 Services Search .....	23

7.5	Demolition Works and Construction Impacts.....	24
7.6	Excavation Works.....	24
7.7	Railway Structure Monitoring .....	25
7.8	Drainage .....	26
7.9	Noise and Vibration.....	26
7.10	Use of Cranes, Drilling or Piling Rigs and other Construction Equipment.....	26
7.11	Contaminants and Hazardous Materials.....	28
7.12	Rail Corridor Security .....	28
7.13	Post Construction Completion.....	28
<b>8.</b>	<b>Permit to Carry out Works Within the Rail Corridor .....</b>	<b>29</b>
8.1	General.....	29
8.2	Application for Permit .....	29
8.3	Commencement of Work .....	29
8.4	Completion of Work.....	29

**Appendix A. ISEPP Concurrence Checklist**

**Appendix B. Glossary**

## Executive Summary

This guideline document covers the specific requirements and provides technical and procedural guidelines to be followed for new developments near existing and future Sydney Metro rail at grade and elevated infrastructure during development planning, designing, construction and operating stages. In the context of this guideline document, future infrastructure is defined as infrastructure that has yet to be constructed but has an established rail corridor in accordance with the Infrastructure SEPP or an approved metro rail corridor.

This guideline document primarily covers the developments near the following existing, under construction and future Metro lines:

- Sydney Metro Northwest
- Sydney Metro converted Epping to Chatswood Rail Line (ECRL)
- Sydney Metro City & Southwest and
- Sydney Metro West.

The document explains the definitions and requirements of the railway environment, the rail corridor protection zone, development in or adjacent to the rail corridor, and specific technical considerations. Details of a range of performance requirements that need to be satisfied for any DA related application and a general outline for permit to undertake any works within the rail corridor are provided.

A summary checklist of documentation requirements for Development Application submissions is provided in Appendix A.

## 1. Context and Scope

Developments near existing Metro rail infrastructure and the rail corridor (such as viaducts, station precincts, embankments and cuttings) have the potential to have an adverse impact on the structural stability and operations of this infrastructure. Similarly, developments proposed near planned Metro rail infrastructure have the potential to impact on the feasibility of future Metro construction.

Sydney Metro Authority (SMA) has an obligation to review the development applications of projects near to the Metro rail infrastructure, both planned and existing, on a case-by-case basis to ensure that their consequential impacts are appropriately assessed and managed.

The purpose of this guideline document is to assist external developers in the planning, design and construction near Metro rail infrastructure and the rail corridor. This guideline supports the key objective of the State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) to protect the safety and integrity of key transport infrastructure from adjacent developments.

This guideline document has been developed specifically for the elevated and at-grade corridor sections to provide the requirements and technical guidance to assist developers in design and their assessment of development induced effects and the associated risks. This document also provides the technical requirements to assess and manage the risks associated with developments near existing and future Metro rail infrastructure and the rail corridor. This document is based and builds on the ASA Standard T HR CI 12080 ST External Developments.

This guideline document covers the specific requirements and provides guidelines to be followed for new developments near existing and future Sydney Metro rail at grade and elevated infrastructure during development planning, designing, construction and operating stages. In the context of this guideline document, future infrastructure is defined as infrastructure that has yet to be constructed but has an established rail corridor in accordance with the Infrastructure SEPP or an approved metro rail corridor.

This guideline document primarily covers the developments near the following existing, under construction and future Metro lines:

- Sydney Metro Northwest
- Sydney Metro converted Epping to Chatswood Rail Line (ECRL)
- Sydney Metro City & Southwest and
- Sydney Metro West

It applies to new developments near Sydney Metro infrastructure such as: viaducts, station precincts, operational services buildings, emergency evacuation points, at-grade sections and embankments and cuttings. Information regarding existing and planned new Metro infrastructure can be sourced from SMA Authority.

A Glossary of terminology and definitions used within this document is provided in Appendix B.

## 2. Reference Documents

The following documents have been referenced to prepare this document:

### Transport for NSW standards (Assets Standards Authority)

- T HR CI 12080 ST External Developments.
- T HR EL 12002 GU Electrolysis from Stray DC Current
- T HR EL 00004 ST Buildings and Structures under Overhead Lines
- T HR CI 12100 ST Geotechnical Risk Assessment and Hazard Management
- T HR CI 12105 ST Vegetation Hazard Management in the Rail Corridor
- T MU CI 12140 GU Geotechnical Instrumentation and Monitoring Guidelines
- T HR CI 12075 ST Airspace Developments

### Legislation and guidelines

- The Environmental Planning and Assessment Act 1979
- The Heritage Act 1977
- State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP)
- Development Near Rail Corridors and Busy Roads 2008 – Interim Guidelines – Department of Planning, NSW Government
- Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects - Department of Environment and Climate Change NSW – April 2007
- Sydney Metro Underground Corridor Protection – TfNSW Sydney Metro – Oct 2017

### Other reference documents

- Code of Practice for Railway Protection - Singapore LTA – Oct 2004
- Guide to Carrying Out Restricted Activities within Railway Protection and Safety Zones - Singapore LTA – May 2009
- Guide to Development in a Transport Environment: Rail – Queensland Government, Transport and Main Roads - June 2015
- Guidelines for New Development in Proximity to Railway Operations - The Railway Association of Canada – May 2013

***A Glossary of terminology and definitions used within this document is provided in Appendix B.***

## 3. Railway Environment and Corridor Protection Zone

### 3.1 Corridor Protection

The NSW Infrastructure SEPP (2007) Part 3 Division 15 Railways is the primary legislative document for referral of proposed Development applications that may impact on the infrastructure, operations and maintenance of the Sydney Metro.

TfNSW and SMA under delegation has referral rights under the Planning Assessment (DA) processes and may also have registered constraints on Title, particularly for instances where Development Approval is not required by the landowner. Necessary constraints which may be applied include;

- Constraints on land use in proximity to the rail corridor;
- Constraints on the erection of structures which could prevent Sydney Metro access to their assets;
- Constraints on the erection of structures which facilitate unauthorised access to the rail corridor;
- Constraints on activities which could damage Sydney Metro infrastructure (e.g. excavation near ground anchors or pier foundations);
- Constraints on vegetation heights in proximity to the corridor.

These constraints are further defined in the following Sections with relevant diagrams.

### 3.2 Rail Corridor

The NSW Infrastructure SEPP (2007) defines the 'Rail Corridor' as;

*Rail corridor means land:*

*(a) that is owned, leased, managed or controlled by a public authority for the purpose of a railway or rail infrastructure facilities, or*

*(b) that is zoned under an environmental planning instrument predominantly or solely for development for the purpose of a railway or rail infrastructure facilities, or*

*(c) in respect of which the Minister has granted approval under Part 3A or Division 5.2 or (before its repeal) Division 4 of Part 5 of the Act, or consent under Part 4 of the Act, for the carrying out of development (or for a concept plan for a project comprising or including development) for the purpose of a railway or rail infrastructure facilities.*

Clause 86 of the SEPP defines a 'Protection Zone' related to excavation in, above, below or adjacent to rail corridors as being '*within 25m (measured horizontally) of a rail corridor*'.

Clause 88 of the SEPP applies to development that is:

*(a) on the land shown as "Zone A" on a rail corridors map and has a capital investment value of more than \$200,000, or*

*(b) on the land shown as "Zone B" on a rail corridors map and:*

*(i) involves the penetration of ground to a depth of at least 2m below ground level (existing), or*

*(ii) has a capital investment value of more than \$200,000 and involves the erection of a structure that is 10 or more metres high or an increase in the height of a structure so that it is more than 10m.*

"Zone A" on the rail corridors maps is defined for above ground including cut and cover tunnel, and



“Zone B” on the rail corridors maps is defined for underground tunnel.

The non-published SEPP maps for Interim Rail Corridor - North West Rail Link indicate a 40m wide “Zone A” and a 60m wide “Zone B”. The 40m wide “Zone A” on these maps does not correspond to the Clause 86 definition.

The Transport for NSW Standard T HR CI 12080 ST External Developments defines the Rail Corridor as being ‘*between the outer face of opposing boundary fences. If no boundary fences are present, the extent of the rail corridor shall be taken as 15 m from the centre-line of the outermost rail*’.

### 3.3 Rail Corridor Protection Zone and Reserves

The Sydney Metro North West rail infrastructure consists of the following;

- a) Elevated viaducts with a general width of 12m – ie; 6m either side of dual track centre,
- b) At Grade embankments and cuttings within a fenced or walled boundary, with a general width of between 14m to 16m – ie; 7m to 8m either side of dual track centre,
- c) Station precincts, operational services buildings, emergency evacuation points, all with specific boundary limits.
- d) The Sydney Metro Train Maintenance Facility at Tallawong.

For the purpose of this document the Rail Corridor Protection Zone is defined for the above infrastructure elements as follows;

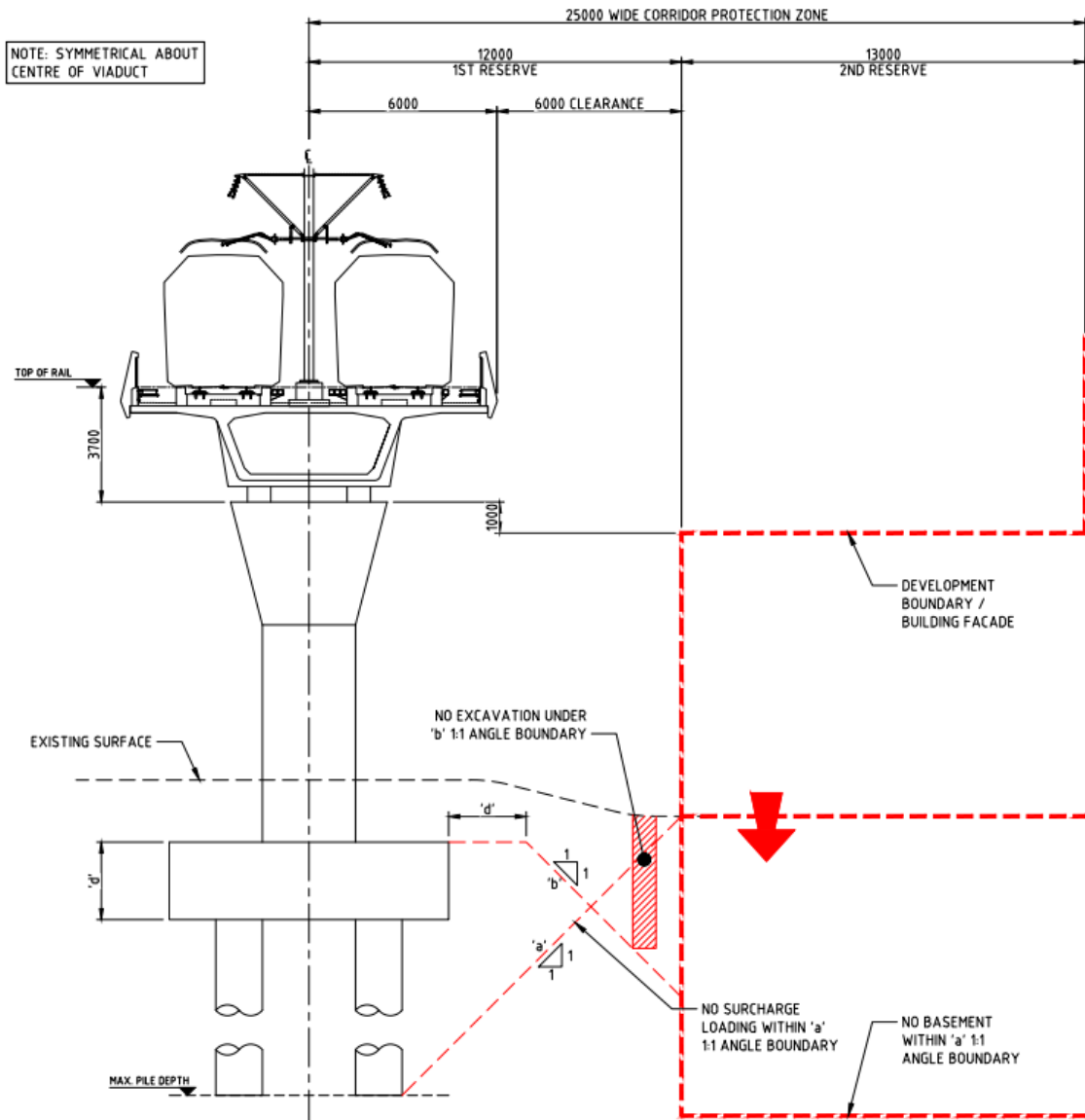
- a) Elevated viaduct - 25m from the centre line of the dual track structure.
- b) At Grade embankments and cuttings within a fenced or walled boundary - 25m from the centre line of the dual track structure.
- c) For other infrastructure the protection zone shall be assessed based on the adjacent proposed development.

The Protection Zone is further categorized as either the 'first reserve' or 'second reserve'. Figures 3.1 to 3.3 represent the zones that form the first reserve and the second reserve around Metro at grade and elevated infrastructure.

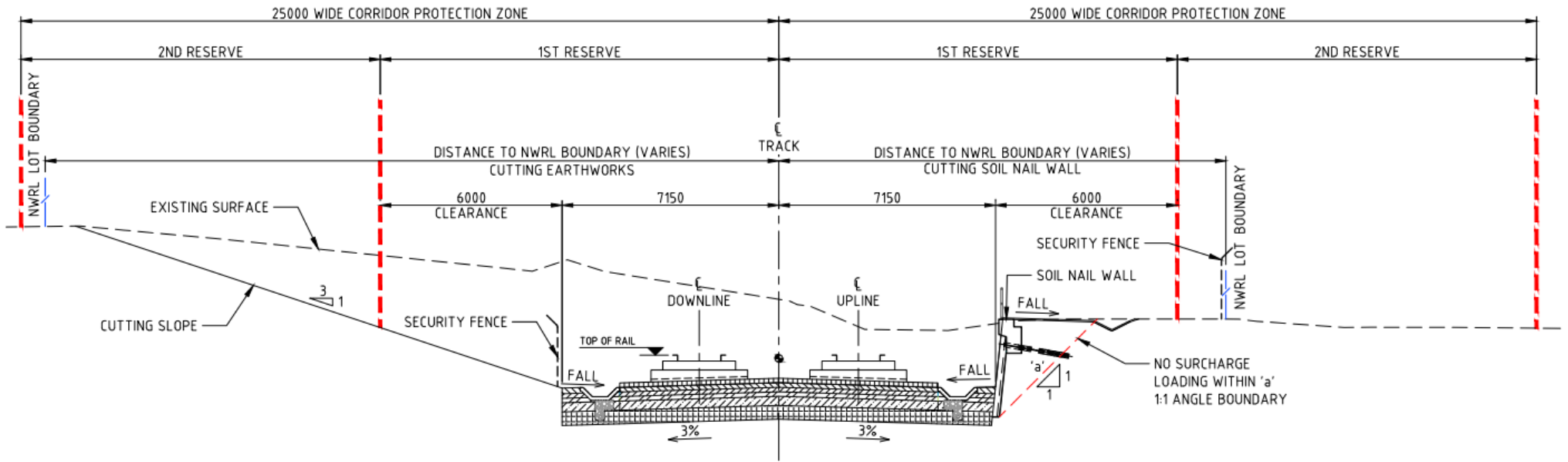
The first reserve is defined as being the overall width 6m external to each face of a viaduct structure, or boundary fence / wall adjacent to an at grade embankment or cutting. This zone represents the area that must not be encroached upon by any future development and its construction, with exception of approved minor works under the elevated viaduct sections. In addition, there are restrictions on excavations and development ground loading that may extend beyond the first reserve.

The second reserve is between the first reserve and limit of the Rail Corridor Protection Zone. The second reserve zone surrounds the first reserve and covers the areas where development works have the potential to adversely impact on the performance of the support elements of at grade and elevated infrastructure, Metro operations or the feasibility of planned Metro infrastructure. Any developments that take place within the second reserve require an engineering assessment of the works to predict their effects on the at grade and elevated rail infrastructure.

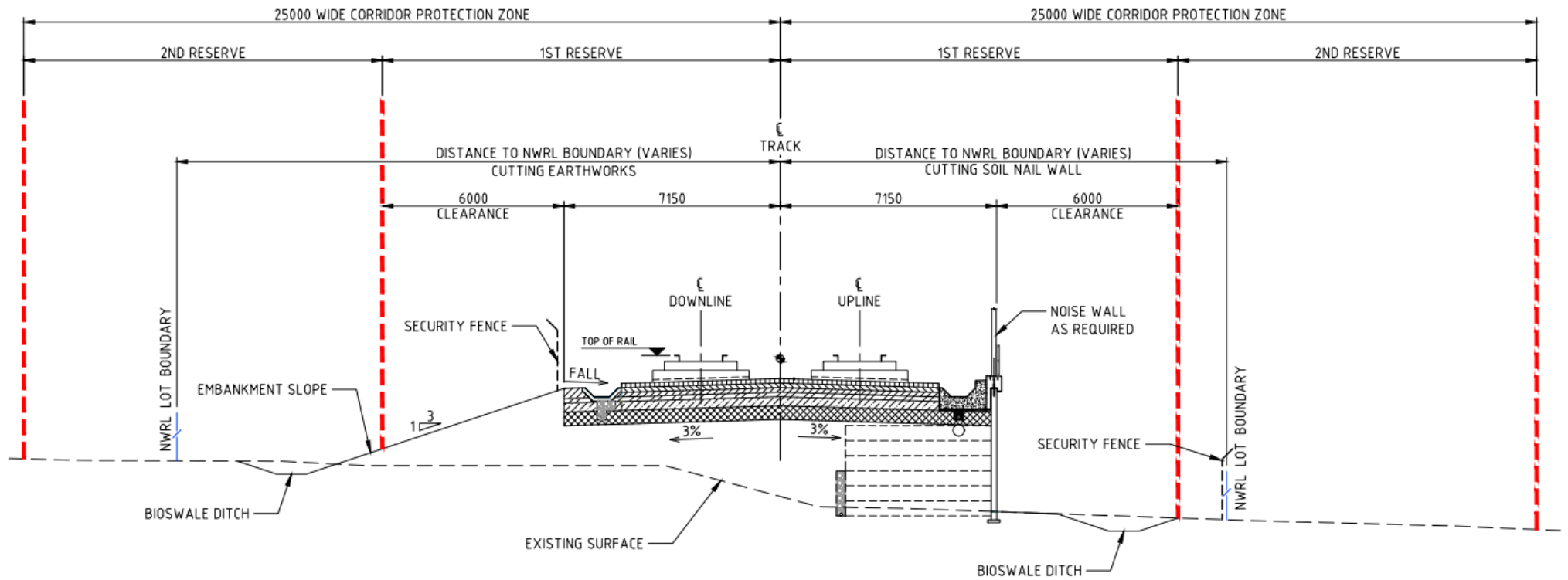
Additionally, the Sydney Metro North West land Lot boundary may limit the extent of any Development Works. Developers must establish the reserve zones based on the requirements provided within this document and ensure that the design and construction meet the stated requirements.



**FIGURE 3.1 – ELEVATED VIADUCT PROTECTION ZONE (NTS)**



**FIGURE 3.2 – SECTION IN CUTTING PROTECTION ZONE (NTS)**



**FIGURE 3.3 – SECTION EMBANKMENT / REINFORCED EARTH WALL PROTECTION ZONE (NTS)**

### 3.4 Stratum Boundaries and Tree Exclusion Zones

Sydney Metro have ownership of land along, adjacent to and in the vicinity of the rail corridor, including stratum and air rights. Subject to operational requirements, Sydney Metro may seek to minimise the impact on the affected land parcels to make better public use of the land space, particularly under the elevated viaduct sections, including to;

- Minimise the impact of property acquisition;
- Minimise the area to be maintained and associated property maintenance costs;
- Encourage development and use of land around the corridor such that it doesn't divide the landscape;
- Maximise the potential for development of land owned by Sydney Metro and other parties;
- Encourage recreational uses adjacent to the corridor

However, specific requirements for maintenance and operational access, and exclusion zones for vegetation and tree growth have required a minimum set of stratum boundary conditions to be defined that are different from the Development Application Corridor Protection conditions identified in Sections 3.1 to 3.3 above. This allows for clear public access within the defined 'rail corridor' around and under the viaduct structure based on specific clearance conditions. This does not permit any Development Works, which are still determined as defined in Sections 3.1 to 3.3 and Section 4 of this Guideline document. Any physical Works required for third party maintenance within the shaded stratum boundaries and tree exclusion zones still require consent from SMA and a permit to carry out Works within the rail corridor as defined in Section 8.

These boundary conditions are defined in Figures 3.4 to 3.8 below.

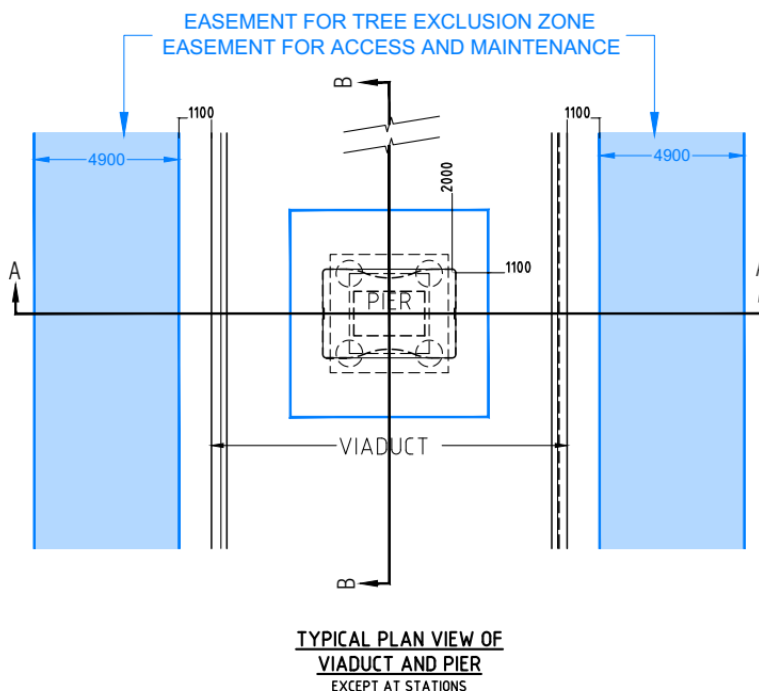
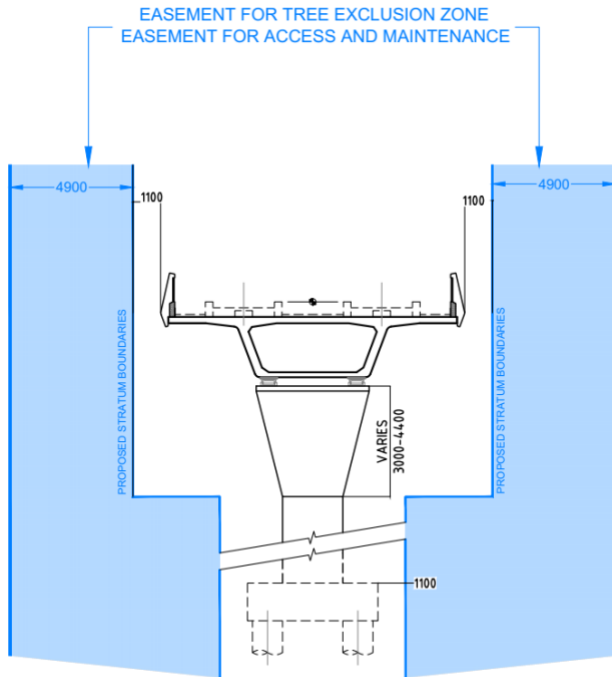
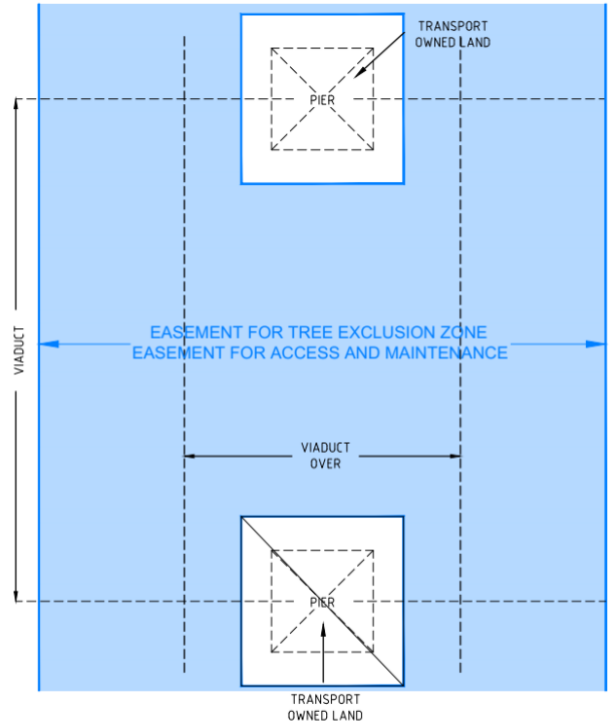


FIGURE 3.4



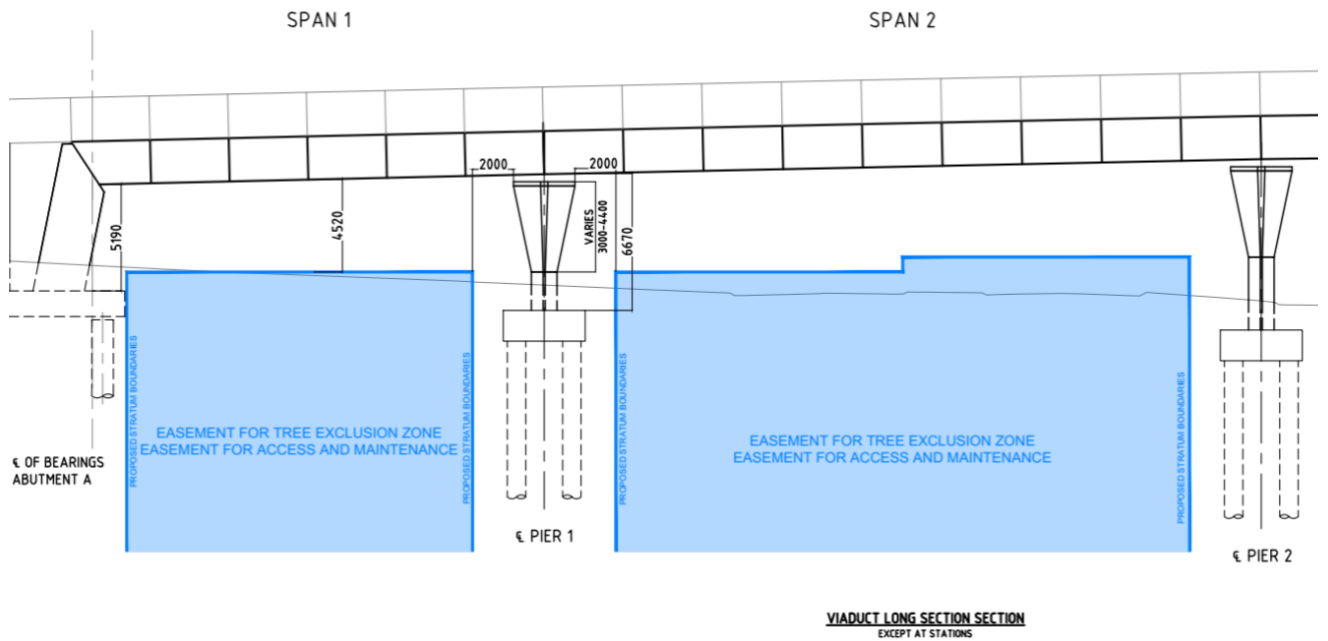
**TYPICAL CROSS SECTION THROUGH VIADUCT  
SECTION A-A  
EXCEPT AT STATIONS**

FIGURE 3.5



**TYPICAL PLAN VIEW OF  
LAND UNDER VIADUCT  
EXCEPT AT STATIONS**

FIGURE 3.6



**VIADUCT LONG SECTION SECTION  
EXCEPT AT STATIONS**

FIGURE 3.7

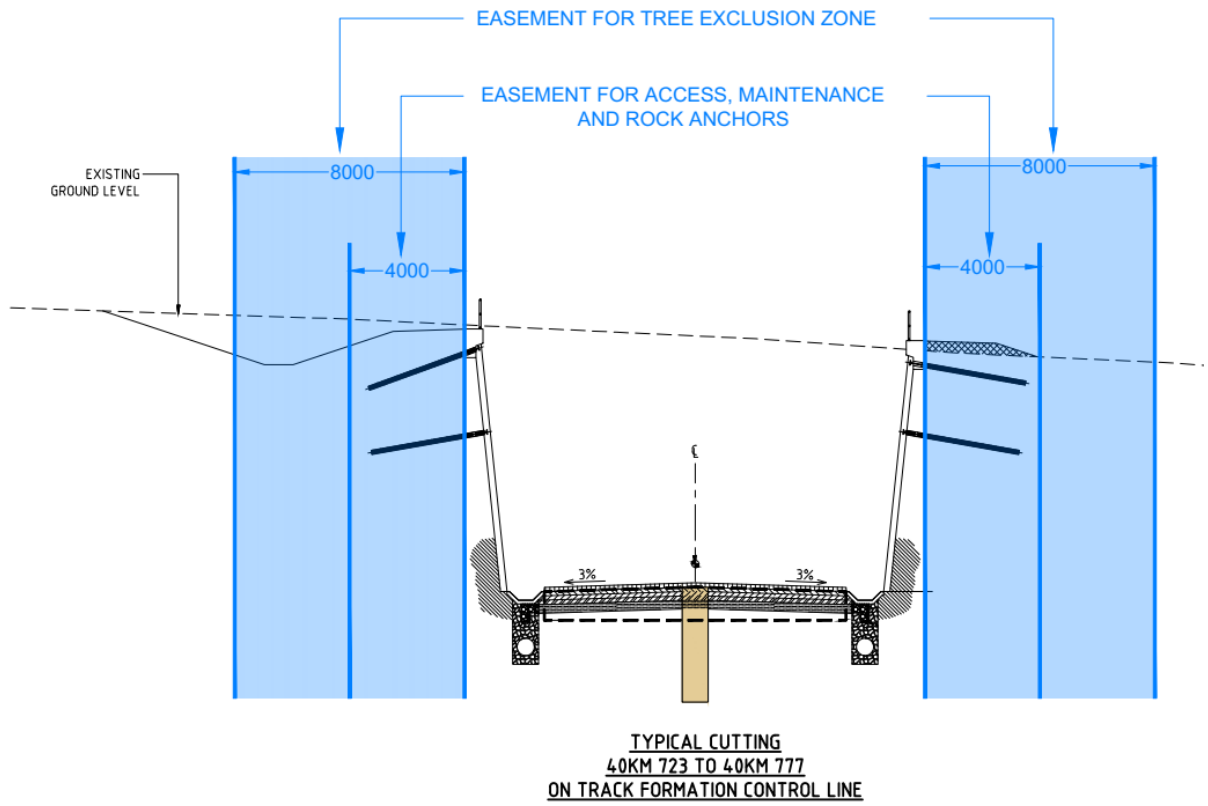


FIGURE 3.8

## 4. Development in or Adjacent to the Rail Corridor

### 4.1 Legislative Framework - NSW Infrastructure SEPP (2007)

The NSW Infrastructure SEPP (2007) Part 3 Division 15 Railways is the primary legislative document for referral of proposed Development applications that may impact on the infrastructure, operations and maintenance of the Sydney Metro. Several key Clauses for reference include;

- Clause 78 - Definitions
- Clause 85 - Development adjacent to rail corridors
- Clause 86 - Excavation in, above, below or adjacent to rail corridors
- Clause 87 - Impact of rail noise or vibration on non-rail development
- Clause 88 - Development within or adjacent to interim rail corridor
- Clause 88B - Development near proposed Metro stations

The Infrastructure SEPP requires the Developer to consult with and obtain concurrence from the rail authority for any aspect of the Development covered by the above.

It is recommended that the proponent of any Development that may impact the infrastructure, operations and maintenance of the Sydney Metro refer to the above requirements in advance of any prior consultation with SMA.

### 4.2 TfNSW ASA Standard T HR CI 12080 ST - External Developments

The TfNSW ASA Standard T HR CI 12080 ST - External Developments provides specific technical requirements for the interface with external developments adjacent to the rail corridor and applies to new developments and to upgrades of existing developments.

The requirements specified within this TfNSW ASA Standard are applicable to the Sydney Metro Corridor Protection Technical Guidelines (this document).

It is recommended that the proponent of any Development that may impact the infrastructure, operations and maintenance of the Sydney Metro refer to this Standard in advance of any prior consultation with SMA.

### 4.3 Rail Authority and Operator

The NSW Infrastructure SEPP (2007) Clause 78 and Clause 88 define the Rail Authority for the Sydney Metro as the Secretary of the Department of Transport, NSW.

The Operator of the Sydney Metro is obligated by contractual requirements and a Project Deed with Sydney Metro to act as the rail transport Operator with applicable obligations under the Rail Safety National Law and Rail Safety Regulations. SMA may refer to the Operator for review and comment on any Development application and impose specific conditions on the Developer to interface with the Operator if required.

### 4.4 Development Applications

Any new construction above, below or alongside the existing or future Metro infrastructure, that is located within the protection reserves, are considered developments that fall within the scope of this guideline document. Any new development design and construction that is located outside these protection reserves, but still has the potential to cause design and construction related safety, engineering, maintenance and



operational impact on the at grade and elevated Metro infrastructure is considered a development that falls within the scope of this guideline document.

Developments near Metro infrastructure must be planned, designed, constructed and maintained to ensure the protection of existing and future Metro infrastructure. These developments must not affect the Metro operations including either the operational capacity or the efficiency of the network during any stage of the life cycle of that development.

Development near rail corridors can impact on the structural integrity of the transport infrastructure and its engineered structures. Poorly designed and implemented earthworks can cause subsidence, deterioration of existing structures, alter existing loading profiles and other engineered features and, in a worse-case scenario, cause structural failures and collapse. For electric railways there are significant additional safety issues associated with risks of electrocution as well as risks related to the accelerated corrosive effects of electrolysis on metal surfaces.

The key objectives of the provisions of the NSW Infrastructure SEPP (2007) and the TfNSW ASA Standard T HR CI 12080 ST - External Developments are to:

- protect the safety and integrity of key transport infrastructure from adjacent development;
- protect the safety of the public and staff using the transport infrastructure and any interface with the external development, and
- ensure that adjacent development achieves an appropriate acoustic amenity by meeting the internal noise criteria specified in the Infrastructure SEPP.

Proposed development which triggers the Infrastructure SEPP will require concurrence from SMA. Different documentation is required at different stages to enable SMA to assess the potential impact on the operating and future rail corridors.

To assist SMA with their assessment, documentation must be provided at the planning stage and development application stages. Depending on the finding of the assessment by SMA documentation and supporting information may also need to be provided at the design, construction and operation stages of the development.

SMA have developed a minimum set of documentation criteria that should be submitted with any DA in relation to the NSW Infrastructure SEPP (2007) requirements for development proposals adjacent to the rail corridor. The preparation and submission of these documents will assist the Rail Authority, and SMA, to quickly and appropriately assess the planning, technical, safety and operational impacts of the DA proposals.

The documentation is identified in Appendix A as a concurrence checklist for submission.

## 4.5 Staged or Phased Developments

It is recognised that certain developments may be planned in stages or different phases, for instance a residential masterplan may include for eventual completion of six blocks of apartments with linked underground car parking. However, the masterplan may indicate that the development will be split into 3 different phases of two apartment blocks each, with the timing of construction delayed for each phase over a number of years. It is essential that the full technical and design requirements be prepared and submitted with the initial DA, along with documentation that defines how the phased construction period will be managed, including a design change process for concurrence of potential future design changes.

## 5. Technical Considerations

### 5.1 Rail Safety

Developments near at grade and elevated Metro infrastructure must address the following aspects of safety in respect of the Metro and its operation at any stage of the life cycle of that development:

- structural safety and integrity of the Sydney Metro rail infrastructure
- operational safety
- fire safety,
- flood protection, and
- inspection and maintenance

These aspects must be addressed in the DA submission documentation as defined in Appendix A.

Consideration must be given to maintenance and to future users of the development. Importantly, new development must not obstruct emergency access to Metro infrastructure and any maintenance access requirements.

Approvals from SMA are required prior to entry to any Metro assets for dilapidation survey, installation of instruments, monitoring and visual inspections. Persons carrying out these activities must be accompanied by safety personnel from SMA and / or the Operator and / or from the Operator approved organisations when entering the rail corridor. This will also require prior authorisation from the Operator and may require specific rail safety induction. Refer also to Section 8.

### 5.2 Engineering Investigations and Assessments

The developer must prepare the following documentation in support of their DA:

- geotechnical investigation report
- structural and engineering impact assessment report
- hydrology report
- noise and vibration assessment report
- electrolysis report
- fire life safety assessment report
- risk and hazard analysis report
- operational management plan for any areas that fall within the first reserve area to ensure that access is available for railway activities when required

Details of the above DA submission documentation are defined in Appendix A.

The main aim of these assessments and investigations is to demonstrate that there will be no adverse effects arising from the proposed development within the defined protection reserves. The acceptability of the effects predicted (as determined through investigation and assessment) must be viewed against the performance requirements described in Section 6 of this guideline document, as well as compliance with relevant standards and codes.

The developer should approach SMA for information that defines the extent of existing and future Metro infrastructure to undertake these investigations and assessments.



Geotechnical and Structural assessments should be undertaken by suitably qualified professional engineers with a minimum of 5 years working experience as a geotechnical or structural engineer or engineering geologist advising on building and excavation works and associated geotechnical issues.

## 6. Performance Requirements

### 6.1 General

The design and construction of the development must be carried out with full recognition of the potential effects that could be imposed on the performance of the existing Metro or the feasibility of the future Metro. As an overarching principle the development must not affect the stability and integrity of the Metro infrastructure and its safe operation. Broadly, the developer must ensure that the development and its construction do not adversely affect the performance of Metro infrastructure in respect of the following:

- amenity
- aesthetics
- structural integrity
- durability
- function
- user/customer benefits
- safety during construction and operation and
- environmental performance.

It should be noted that throughout the developer's activities, the developer must monitor the actual effects of construction against design predictions and in accordance with the project-specific construction phase monitoring requirements. Refer also Section 7.7 below.

Aspects of the development and its construction which could adversely affect the Metro infrastructure include the following:

- loading or unloading from the development
- ground deformation resulting from excavations, tunnelling, thrust boring / pipe jacking and external loading
- induced vibrations during construction and operation
- ground borne noise impacts
- discharge of stormwater from the development
- changes to groundwater levels affecting design assumptions
- loss of support to any at grade or elevated rail structure (including rockbolts and anchors)
- load from anchors
- temporary structures
- electrolysis from earth leakage currents
- protection of the traction power, HV & LV power systems and earthing system
- electro-magnetic interference
- environmental management of the development, and
- operations and maintenance, and emergency evacuation access zones

This section details the design and performance requirement that must be adhered to by the developer in order to address these issues.

## 6.2 Structural Integrity

Development induced load and displacements must not have any adverse effects on the support structure or system of Metro infrastructure in both the short and long-term conditions.

Structures that are proposed to be constructed over and/or adjacent to Metro at grade or elevated structures must be suitably designed to take into account the presence of the existing Metro infrastructure and future construction of Metro infrastructure. Construction work methods must be developed as part of the design process.

The effects on Metro support elements and other Metro infrastructure at any stage of the whole life cycle of the development must be assessed to ensure that the works must remain compliant with relevant standards. These structural elements include, but not limited to:

- i. viaduct girders, columns, footings and piled foundations;
- ii. rail infrastructure facility buildings;
- iii. excavation support structures in cuttings, including permanent rock anchors (or bolts), piled and shotcrete walls, and related drainage systems;
- iv. earth or reinforced earth wall embankment structures, including retaining walls and related drainage systems;
- v. track slabs,
- vi. drainage structures,
- vii. trackside infrastructure, rail services cable support systems, fencing and gates.

## 6.3 Imposed Loading

Any temporary or permanent works adjacent to the Metro could be subject to the influence of train loading and as such will need to be assessed in accordance with AS 5100 for live load surcharge. Parts of the development that could be affected must be designed to comply with T HR CI 12070 ST Miscellaneous Structures, T HR CI 12075 ST Airspace Developments and T HR CI 12080 ST External Developments.

Supports for structures positioned within 20 metres of the centre-line of the railway track shall comply with the collision protection provisions of AS 5100 Bridge Design, whether within TfNSW or SMA owned land or not. For at-grade railway infrastructure, including embankments, an assessment of the need to provide additional train derailment collision protection measures at the boundary of the proposed Development is required and assessed in accordance with AS 5100.

Permanent works adjacent to the existing or future Metro rail corridor must take into account the design actions resulting from any proposed future Metro construction. SMA will provide advice in relation to planned future Metro infrastructure.

The proposed development structure design must allow for the effects due to movement that may occur as a result of the future removal of the ground adjacent to the rail corridor boundary (to a level no lower than the lowest building basement level) and a 20 kPa surcharge applied at ground level.

The foundations for the proposed development structure shall not rely on passive earth pressure from within the boundary of any TfNSW or SMA owned land or within the railway corridor land.

## 6.4 Induced Movement

Displacement of Metro infrastructure as induced by the development must not affect the operational functionality and durability of the affected rail infrastructure. Also, the developer must consider the possibility that future Metro construction may induce movement on the development.

The design and construction of any development or building works must make adequate provisions to check and ensure that the Metro system structures and tracks are not subjected to deformation and changes that will not allow trains to operate at the maximum design speed;

The following allowable movement limits apply:

- i. Viaduct structure – total settlement of 10mm vertical, +/- 5mm horizontal at pier head or 1:1000 whichever is lesser, and differential settlement between piers of 10mm or 1:1000 whichever is lesser. This is subject to tolerance of viaduct bearings against further movements including settlement;
- ii. Embankment structure – total movement in any direction of 10mm and differential movement in any plane of 10mm or 1:1000 whichever is lesser;
- iii. Cutting or excavation support structure - total movement in any direction of 10mm and differential movement in any plane of 10mm or 1:1000 whichever is lesser;
- iv. Track distortion – twist / change in cant of 1.5mm measured over 3m or 1:2000, vertical dip or peak of 5mm measured over a 5m chord and change in horizontal versine of 6mm measured over a 16m chord;
- v. Rail corridor land adjacent to the development - 10mm vertical and +/- 10mm horizontal;

## 6.5 Excavation and Groundwater

Excavation for the development and all associated retaining works (along with other ground disturbance works associated with the proposed development) must not affect the safety and operational integrity of the Metro or cause the destabilisation of Metro infrastructure. The methods of excavation employed are of particular relevance in this regard, especially where methods employ chiselling, percussive pile driving or similar methods. Importantly, explosives must not be used for the splitting and removal of rock and excavation.

Typical issues associated with excavation works include slippage, slumping, creation of fissures or cracks, rock or earth falls, exacerbated ground movements, water inflows, cracking the supporting structural elements and in extreme cases structural failure. Excavation works must be undertaken in a manner that minimises the risk of such occurrences. This includes for underground tunnelling or thrust boring / pipe jacking construction.

Sections of temporary shoring installed to support excavations for the development must have a minimum service life of 10 years, if their stability has the potential to affect Metro infrastructure, excluding considerations of any support from the permanent structure. Shoring systems must be designed by an approved design organisation and verified by an independent qualified person. Allowance should be provided for minimum unplanned excavation in accordance with CIRIA C580 Embedded Retaining Walls, Guidance for Design, 2003.

Temporary or permanent ground anchors or soil nails are not allowed within the boundary of any TfNSW or SMA owned land or within the railway corridor first reserve zone. Any ground anchors or soil nails within the second reserve zone must be assessed for their effect on Metro at grade or elevated infrastructure. Anchors or soil nails must not be tested in cases where this testing could cause collapse or failure, or both, in the surround soil and rock structure.

Assessment of Metro infrastructure from development excavation must also consider the loading that cranes (including their foundation anchorage) will impose within the excavation on Metro infrastructure.

Construction near Metro at grade or elevated infrastructure can also impact the local groundwater regime. These impacts have the potential to cause adverse loading or settlement impact of the infrastructure, not contemplated and thus designed for over the design life of the Metro. Critically, the groundwater regime must not be adversely affected or damaged.

The developer must carry out an engineering assessment of the impact of any changes to the groundwater regime that the development could cause. Issues of concern that have the potential to impact on Metro infrastructure include the following:

- The development and its construction could create a water barrier that dams groundwater flow adjacent to at-grade rail infrastructure, leading to saturation of embankment foundations and potential slip conditions, or water ingress into the rail cutting impacting the track formation support system;
- Groundwater ingress into excavations associated with the development can cause dewatering of the local water table. Importantly, dewatering must not commence without prior approval from SMA.

The stability of the Metro at grade and elevated structures adjacent to/ below any development excavation shall be checked against the effect of buoyancy, uplifting, slope stability, etc.

The design of temporary works for any development excavation shall ensure adequate factor of safety against basal heave, hydraulic uplift of the base, toe-stability of retaining walls, material failure, strut failure, etc.

The engineering assessment must also address any temporary dewatering (at any stage of the development) to demonstrate that effects on at grade or elevated Metro infrastructure are acceptable.

Surface water run-off from the development area is not permitted into the rail corridor or into the SMA stormwater drainage or track drainage systems.

## 6.6 Piling Works

Piling works including the construction of foundation piles, temporary or permanent earth retaining walls and any other drilling works in the railway protection zone are not allowed within the boundary of any TfNSW or SMA owned land or within the railway corridor first reserve zone. Any piling works proposed within the second reserve zone must be assessed for their effect on Metro at grade or elevated infrastructure, with conditions on the type of piling as follows;

- Use of percussively driven concrete piles, steel H-piles, sheet-piles or tanalised timber piles is not acceptable;
- Use of drilling fluid in the drilling of piles shall be carefully controlled to prevent an increase in the piezometric head in the railway protection zone;
- Limits on unsupported open pile excavation and depth of load bearing piles adjacent to the Metro at grade and elevated structure foundations are indicated in Figures 3.1 to 3.3 and require to be assessed within the DA design documentation.

## 6.7 Noise and Vibration

The noise from construction and rail operation must be considered against statutory and project noise vibration limit requirements. SMA does not accept liability for the generation of noise and vibration from normal railway operations (including track maintenance), or for its transmission into developments above or adjacent to the at grade or elevated rail infrastructure.

When designing developments above or adjacent to at grade or elevated Metro rail infrastructure (existing or planned), consideration must be given to operational and construction vibration; as well as ground or structure borne noise emissions in accordance with Developments Near Rail Corridor and Busy Roads – Interim Guideline, Department of Planning, NSW Government 2008.

In planning the development, the following requirements apply.

Any development that occurs within a screening distance of 25 m horizontally from first reserve must consider the vibration on the Metro infrastructure with the following assessment criteria of maximum peak particle velocity (PPV):

- The peak particle velocities at any Metro at grade or elevated structures resulting from demolition works, driving or withdrawal of piles or any other construction activities which can induce vibration shall not exceed 15 mm/sec.

It is important to note that more stringent limits may apply if rail equipment, that is sensitive to vibration, has the potential to be affected by the development and its construction.

During development construction vibration monitoring may be required of the at grade and elevated Metro supports, such as viaduct girders and embankments. This monitoring must be conducted based on the selection of appropriate trigger levels.

If the vibration levels exceed tolerable limits, then the developer must modify the construction methodology in such a way that the vibration limits are satisfied.

The Developer shall submit a Noise and Vibration Assessment Report at DA stage, for both airborne and ground borne noise and vibration, to determine the effects on the proposed Development from the railway operations (and during construction of the proposed railway), to comply with Clause 87 of the State Environmental Planning Policy (Infrastructure) 2007 (the 'Infrastructure SEPP').



## 6.8 Stray Currents and Electrolysis

When designing developments above or adjacent to at grade or elevated Metro infrastructure consideration must be given to operational stray currents that may be present. The risk assessment must also consider the potential presence of stray currents.

SMA does not accept liability for the generation of stray currents from an operating electrified railway.

The potential effects of stray electrical currents and electrolysis in the electrified area of the Metro network must be considered in accordance with T HR CI 12080 ST External Developments and T HR EL 12002 GU Electrolysis from Stray DC Current during the design of the development.

A suitable test program must be established during the early design phase to quantify a stray current signature for the development site prior to undertaking enabling works. Suitable stray current mitigation strategies must be integrated into the design of the development.

Following construction, stray current testing must be carried out to verify that electrolysis mitigation strategies are proven to be effective, which includes undertaking a comparison with the pre-development stray current signature. This information must also be used to establish maintenance baselines for the life of the development.

The Developer shall submit an Electrolysis Report at DA stage, prepared by a suitably qualified consultant, to assess the requirements for electrolysis effects on the Development infrastructure and to address whether preventative measures are required.

## 6.9 Protection of the Traction Power, HV & LV Power Systems and Earthing System

Potential disruption to the Metro operating electrical and earthing systems is a major rail safety risk and likely to cause significant disruption to the Metro passenger operations and any emergency response activities. It is essential that any proposed development utilities and construction trenching activity is coordinated and planned at the initial design stage to avoid impacting the Metro operating electrical and earthing systems. This will form part of the engineering assessment by SMA at the DA stage and may require close coordination with SMA through the ongoing design and construction stages.

## 6.10 Utilities

The location of existing underground, aerial and surface utilities/services, including transmission lines, cables and pipelines are identified and considered in the design of the works.

The Developer shall undertake a services search with the relevant Authorities, including SMA, to identify the location of all underground services to ensure that clearance requirements for any underground high voltage, low voltage, signalling and other services cables are met. This shall be submitted with the DA documentation.

## 6.11 Electro Magnetic Interference

Potential interference to the Metro rail signalling and communications systems shall be assessed at the initial design stage. The design of external developments shall not introduce electro-magnetic interference (EMI) to railway signalling and telecommunications systems.

Potential line of sight disruption to train radio or microwave communication systems shall be assessed for operational risk, and the mitigation required shall be identified at the initial design stage.



## 6.12 Environmental Protection

The construction and operation of any proposed development adjacent to the Metro rail infrastructure shall not result in any increased environmental risk, including statutory environmental noncompliance within the rail corridor.

The developer must take into account the environmental impacts that can affect the Metro with a view to minimising any effects during the whole life cycle of development. Typical considerations for developments in the urban environment are as follows:

- stormwater management
- noise and vibration
- air quality, particularly dust
- traffic impacts
- visual impact and amenity
- ability and ease to maintain and 'retro-fit' improvements over time
- disposal and re-use at life cycle end
- ecological impact due to draw-down
- groundwater contamination and
- construction materials to be as low toxicity as possible.

These issues should be addressed within the Statement of Environmental Effects report to be issued with the DA documentation. In addition, a site contamination assessment to identify the impact of any existing potential contamination or hazardous materials and any required remedial measures, shall be included in the DA documentation as identified in Appendix A.

In addition, the storage of potential contaminants and hazardous materials within the protection reserves is prohibited.

## 6.13 Operations and Maintenance, and Emergency Evacuation Access Zones

The development design and construction must ensure that the Metro Operations and Maintenance inspection rail corridor access areas are free from permanent obstructions. The Metro rail corridor also has a number of emergency response access and passenger evacuation points that require to be permanently free from obstruction. It is recommended that the Developer seek assistance from SMA to ensure these areas are identified and appropriate measures allowed for in the design stage.

The Developer shall provide a plan of how future maintenance of the development facing the rail corridor is to be undertaken. The maintenance plan is to be submitted to SMA prior to the issuing of the Construction Certificate.

## 6.14 Tree Exclusion Zone

The Developer shall submit a landscape plan with the DA submission. No trees are to be planted within the Rail Corridor Protection Zone without the approval of SMA. Trees with a full-grown height less than 5m may be permitted and shall only be located within the second reserve zone.

## 6.15 Vandalism

Measures should be considered at the design phase to minimise risks from vandalism involving objects being thrown onto passing trains, or into the rail corridor. This action can have safety implications for rail passengers and rail authority staff. There are also repair costs associated with infrastructure damage coupled with transport delays as facilities are repaired and, in worst case scenarios, as accidents are cleared.

Recommended measures to avoid vandalism include:

- Consider measures at the design stage to minimise opportunities for vandalism.

- Pedestrian bridges, walkways, open balconies and windows should preferably be a minimum of 20 metres from rail lines
- Where pedestrian bridges, walkways, open balconies and windows are less than 20 metres from a rail line AND face the rail line:
  - a) design pedestrian bridges and walkways with high degree of surveillance or railings to limit opportunity for vandalism
  - b) enclose balconies
  - c) install louvred windows or restricted window openings
  - d) restrict all opening windows to maximum of 80 millimetres.

## 6.16 Independent Verification

Depending on the details of the proposed development and the proximity of planned or future Metro infrastructure, SMA may request that an independent verification of the engineering analysis and impact assessment be carried out. If required, the independent verification must be arranged by the Developer.

The independent verification must be carried out by an organisation that is independent of the organisation that prepared the engineering analysis. The independent verification organisation will be subject to the approval of SMA.

The independent verification must include detailed engineering proof checking of all aspects of the engineering analysis and impact assessment including any proposed temporary works.

The independent verification organisation must prepare a report that describes its verification activities and includes certification that the proposed development will produce no unacceptable adverse effects on existing metro infrastructure. The independent assessment report must be submitted to SMA with the engineering assessment report.

## 7. Construction Requirements

### 7.1 General

All Metro property must be fully protected during construction of the development and all site work (including clearances to Metro tracks and protection reserves) must comply with the requirements outlined in this guideline document, as well as other relevant TfNSW standards relating to air space developments, external developments, at grade and elevated rail infrastructure, and safe working requirements.

All construction carried out on Metro property or within the rail corridor must comply with the requirement of the relevant authorities and legislation including workplace health and safety (WHS) requirements and environmental requirements.

In the event that concurrence is provided by SMA the construction requirements described in this section apply.

### 7.2 Dilapidation Report

Before construction of the development can commence and an occupation certificate can be issued, a joint inspection of the existing Metro at grade and elevated infrastructure near the proposed development may be requested by SMA. If requested the survey must be carried out by representatives of the developer and SMA. The existing condition of the Metro infrastructure must be agreed and recorded. Additional joint inspections may be required during construction.

The extent of Metro infrastructure that must be surveyed will be determined by SMA. Condition surveys to be undertaken shall include physical surveys of the Metro structures and rail corridor infrastructure to be carried out by a registered land surveyor.

Detailed dilapidation reports must be submitted to SMA describing conditions before commencement of works and after completion of works.

The dilapidation report must include the following as a minimum:

- details of existing defects
- dimensions and mapping of existing cracks
- survey of any subsidence, settlement, movement or heave
- photos of defects with labels that indicate their locations and
- signs of deterioration from existing defects.

### 7.3 Construction Risk Assessment

Prior to commencing any Works, the risk assessment report issued in support of the DA must be updated based on the detailed design at construction. The updated risk assessment report must take into account any modifications to the design and the impact these may have on identified risks.

Safe work method statements must also be prepared that include, as a minimum, the following:

- detailed work methods including the incorporation of the controls as stated in the risk assessment plan and
- an emergency response plan.

The developer must submit the safe work method statements and updated risk assessment report to SMA for approval.

### 7.4 Services Search

Prior to the issue of a Construction Certificate the applicant shall request a service search from SMA to establish the existence and location of any rail services. Where rail services are identified within the rail corridor in close proximity to the subject development site, the Developer must ensure that all required

clearances (e.g. electrical clearances) are observed at all times during the undertaking of works. Where rail services are identified within the subject development site the Developer must discuss with SMA as to whether these services are to be relocated or incorporated within the development site.

Adequate protection measures shall be provided for protection of any rail services that may be in the vicinity of any excavation or loading zones for the development works.

The Principal Certifying Authority shall not issue the Construction Certificate until written confirmation has been received from SMA confirming that this condition/s has been satisfied.

(Note: the works component of this condition cannot be satisfied until the construction certificate has been issued).

## 7.5 Demolition Works and Construction Impacts

The demolition of any existing buildings or basements must be planned in such a way that no adverse risk is imposed on existing Metro at grade or elevated infrastructure. The developer is required to take every possible action to minimise imposed risks and is required to meet the costs of any protection of the Metro infrastructure and any incurred disruption to Metro rail operations.

The impact of any proposed underground demolition work (including de-stressing, unloading and resulting ground vibrations) must be assessed to ensure that there are no adverse effects on Metro infrastructure. If large-scale demolition works are involved, then the developer is required to install a vibration monitoring system to monitor vibration levels near adjacent Metro infrastructure.

Any development that occurs within a screening distance of 25 m horizontally from first reserve must consider the vibration on the Metro infrastructure with the following assessment criteria of maximum peak particle velocity (PPV):

- The peak particle velocities at any Metro at grade or elevated structures resulting from demolition works, driving or withdrawal of piles or any other construction activities which can induce vibration shall not exceed 15 mm/sec.
- Hydraulic rock breakers must not be used within the first reserve zone of any existing Metro infrastructure.
- Explosives must not be used for any demolition works.

It is important to note that more stringent limits may apply if rail equipment, that is sensitive to vibration, has the potential to be affected by the development and its construction.

The developer is required to arrange a structural investigation by appropriately qualified person to address the impacts.

## 7.6 Excavation Works

The developer must submit the following for SMA approval prior to commencing excavation for the development:

- An engineering assessment report which through the use of numerical modelling techniques (if required) demonstrates that the excavation will not cause any adverse effect on the at grade and elevated Metro infrastructure.
- Design reports that detail the shoring system that support excavations must be provided to SMA prior to construction and must include evidence of independent verification certification.
- Risk assessment and contingency plans.
- Detailed work method statements which include hold points at various stages of excavation and are linked to the acceptable monitoring results.
- Details of any excavations adjacent to any SMA rail infrastructure utilities, power cables, etc. No excavation or boring within 2m (horizontal) of high voltage electrical underground cables and within 1m (horizontal) of low voltage / signalling / other underground electrical cables is permitted.

The following requirements apply to excavation and piling works at construction:

- The position of at grade and elevated Metro infrastructure and protection reserves must be marked clearly on the ground for easy identification.
- All piling contractors must be made aware of the existing buried Metro structural elements adjacent to construction site.
- SMA must be informed of the progress of piling and excavation works daily.
- The results of field monitoring undertaken during excavation or piling works must be assessed by a suitably qualified person and reported to SMA at an agreed frequency.

Depending on the project complexity and potential impact on Metro infrastructure, SMA can require the developer to engage a geotechnical consultant during the time of excavation process for visual verifications of substrata as identified during investigation, geological mapping where required and an assessment of monitoring results.

The developer must submit the monitoring results together with geotechnical consultant's assessment to SMA at agreed frequencies and stages of construction. A SMA nominated observer may be involved with the monitoring.

## 7.7 Railway Structure Monitoring

The Metro rail structures and tracks shall be monitored if the development and building works have implications on the integrity of the Metro rail infrastructure and its operation.

The developer must submit the following for SMA approval prior to commencing excavation or building works for the development:

- A detailed monitoring plan for structural or earthworks movements, ground deformation, stress, crack width monitoring, vibration monitoring, response regime, contingency plan and reporting protocol for each party.
- An instrumentation proposal prepared and endorsed by a professional Structural or Geotechnical Engineer. This shall include:
  - a comprehensive monitoring system to monitor the behaviour of the existing Metro rail infrastructure and the ground adjacent to it;
  - layout plans and relevant cross-sections indicating the locations of proposed instruments relative to the existing Metro rail structures;
  - Details of the instruments or equipment, including the types, function of instruments, depth of installation, etc.;
  - Frequency of monitoring;
  - Valid calibration certificates for the instruments proposed, where applicable; and
  - Schedule for instrument installation works within the premises of Metro rail infrastructure indicating the number and frequency of access required.

Where the cumulative movement of the at-grade or elevated Metro structure is expected to exceed 5 mm, an automatic remote-control monitoring of the structures shall be provided. At least four monitoring cycles of results shall be provided for the entire monitoring zone within a period of 24 hours. Where automatic monitoring is provided, manual survey shall be provided to countercheck all the monitoring points and control points. This shall be carried out at least once a month.

The at-grade Metro track system is supported on ballast and sub-ballast. Where the proposed works have implications on these structures, there shall be additional monitoring to check that there is no differential settlement between the sub-ballast and the sub-soil below it, as this may cause derailment of a train.

Control and reference points shall be located outside the zone of influence of the proposed works and such that they do not impact on the accuracy of monitoring results. At least two numbers of control points on opposite ends of site shall be provided. In addition, control points must be located on very stable structures which would not be affected by the adjacent development.

Initial readings must be stabilised before commencement of work.

Monitoring must continue until construction of the building structure or superstructure is complete. With prior agreement of SMA, monitoring frequencies may be decreased when the basement construction is completed. Monitoring must continue after the completion of the construction activities until no changes occur in three consecutive monitoring cycles. SMA must be informed before termination of the monitoring activities.

## **7.8 Drainage**

During construction, water shall not collect and pond on or near the railway infrastructure. No run-off from the development shall discharge onto TfNSW or SMA owned land, the Sydney Metro rail corridor, into the Sydney Metro stormwater system or into the track drainage system during construction.

## **7.9 Noise and Vibration**

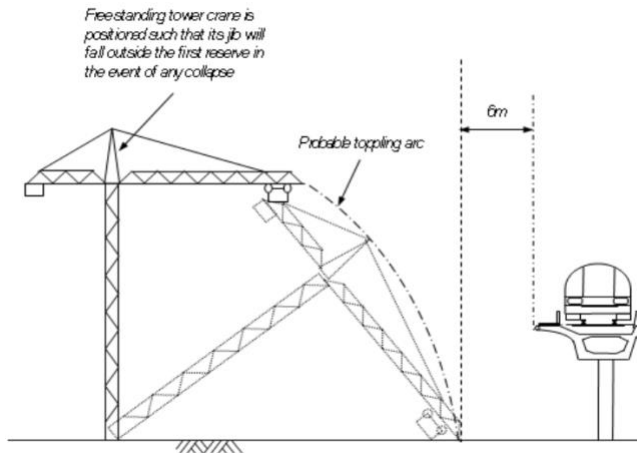
The effects of noise and vibration on existing Metro infrastructure and on the development, must be considered as part of the design and construction of developments.

The construction of the development must be carried out such that the effects of noise and vibration on nearby Metro structures and facilities are minimised. Prior to construction, an acoustic and vibration assessment report, including a vibration monitoring plan, must be prepared by a qualified person and submitted to SMA. This assessment must cover acoustic and vibration levels arising from the proposed development during construction and its operation after completion (including any machinery causing heavy vibration levels). The assessment must also determine the effects of noise and vibration on the Metro infrastructure and its operations.

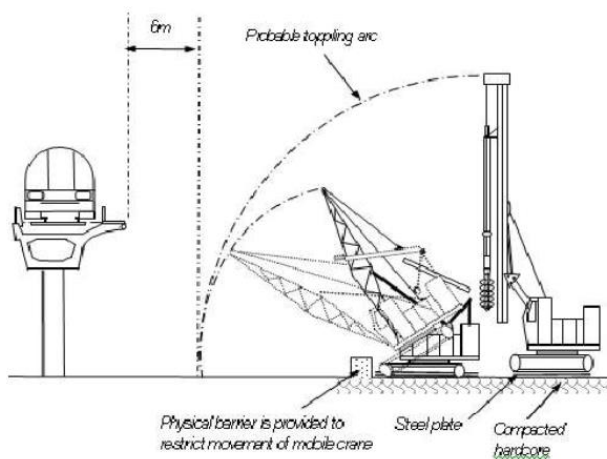
## **7.10 Use of Cranes, Drilling or Piling Rigs and other Construction Equipment**

The movement or operation of any crane, whether fixed or mobile, drilling or piling equipment, excavator or any other mechanical equipment or vehicle in the vicinity of the at grade and elevated Metro structures is a restricted activity, subject to the following requirements;

- The location of any fixed tower crane shall be positioned at a distance equal to the boom length from the first reserve such that potential collapse cannot impact the viaduct structure or at-grade rail structure.



- The location of any mobile crane or mobile piling rig must be restricted to a distance equal to the operating maximum extended boom length from the first reserve such that potential collapse or overturning cannot impact the viaduct structure or at-grade rail structure.



- Lifting of materials / equipment may only be carried out in the Corridor Protection Zone subject to approval of SMA, and then must not be carried out in the first reserve zone.
- Install a series of elevated warning flag / tape along the first reserve zone boundary for visual observations.
- The use of cranes and other construction equipment such as, excavators, concrete pumps and access equipment, shall not intrude into the rail corridor without prior approval of SMA. A detailed method statement and proposed work schedule for any work required to be undertaken is required to be submitted as part of this approval process.
- Submit appropriate temporary work design certification for use of any tower crane and foundation
- When not in operation, cranes should not 'weathervane' into the rail corridor.
- Metallic equipment such as scaffolding, ladders, etc are not permitted within the Corridor Protection zone, unless approved by SMA, and then must not be located in the first reserve zone.



### 7.11 Contaminants and Hazardous Materials

The storage of potential contaminants and hazardous materials within the protection reserves is prohibited.

### 7.12 Rail Corridor Security

The security of fencing along the rail corridor is essential to prevent unauthorised entry. Given the frequency and speed of trains, particularly in built up areas, unauthorised entry is a key safety risk and has the potential to disrupt services.

Where construction activity occurs near existing rail-side fencing, provisions should be made to prevent damage to fencing. In instances where new metallic rail-side fencing is proposed, it could be affected by electrolysis (refer Section 6.8). The function of the rail corridor fence should also not be compromised by placement of plant, materials or structures in close proximity to the fence which could be climbed to gain entry to the rail corridor.

### 7.13 Post Construction Completion

SMA may request the following documentation from the developer, after completion of the construction:

- one set of as-built structural and foundation plans signed by qualified person
- one set of as-built drawings for any ground anchors and other support details near the affected metro infrastructure
- monitoring summary report
- copy of the geotechnical mapping report carried out during excavation works
- dilapidation survey report conducted after construction completion (refer to Section 7.2)
- structural safety report
- operational safety report and
- stray current mitigation verification report, including maintenance base line measurements referenced to measured locations (refer to Section 6.8)



## 8. Permit to Carry out Works Within the Rail Corridor

### 8.1 General

This section stipulates the procedures and requirements for obtaining a permit to commence any engineering works required within the rail corridor. An application for a permit to commence any works for which the plans have been approved under the SEPP Legislation shall be made by the Developer to SMA.

Approvals from SMA are required prior to entry to any Metro assets for dilapidation survey, installation of instruments, monitoring and visual inspections. Persons carrying out these activities must be accompanied by safety personnel from SMA and / or the Operator and / or from the Operator approved organisations when entering the rail corridor. This will also require prior authorisation from the Operator and may require specific rail safety induction as directed by the Operator.

Developers should note that authorised access to many operational areas would only be possible during maintenance shutdown periods and there could be significant time periods involved in arranging such access.

### 8.2 Application for Permit

The process for a permit to carry out works within the rail corridor is subject to review and approval from SMA and the Operator and specific restrictions not otherwise mentioned within this Corridor Protection Guideline document may be applied.

An application for permit to commence a specific phase of engineering works shall be submitted by the qualified person appointed for supervision and accompanied by the following items:

- i. Plan for engineering works, including physical protection measures of the Metro structures;
- ii. Engineering evaluation report;
- iii. Construction schedule for the proposed development;
- iv. Permit Form (to be submitted once only),
- v. Relevant documentation to confirm that the qualified person appointed for supervision has the appropriate level of rail safety induction and will be present during the Works, and
- vi. Relevant documents indicating planning approval from the competent authority.

### 8.3 Commencement of Work

SMA will issue the permit to commence works in writing if the following requirements are complied with:

- i. Qualified person has complied with the requirements of Section 8.2 above and that all items submitted are in order; and
- ii. Qualified person has fully demonstrated that the proposal satisfies the technical requirements of Sections 5 to 7 of this guideline document.

### 8.4 Completion of Work

Upon completion of building works within the rail corridor, the qualified person shall make an application to SMA to issue clearance for the release of the certificate of statutory completion.

An application for clearance of certificate of statutory completion shall be accompanied by one set of the as-built building, structural and foundation plans signed by the qualified person.

SMA will issue clearance for the release of certificate of statutory completion in writing if the qualified person has complied with the above requirements and that all items submitted are in order.

## Appendix A. ISEPP Concurrence Checklist

<b>State Environment Protection Policy (Infrastructure) 2007 (ISEPP)</b>		
<b>Development near a Metro Corridor - ISEPP Concurrence Checklist</b>		
<b>Development Application - SMA Assessment</b>		
<b>Purpose:</b>		
<p>This checklist is a <b>guide</b> about documentation which could be required for submission to Sydney Metro for assessment of a development application requiring an ISEPP concurrence.</p> <p>SMA has a statutory obligation to assess proposed development, where the whole or part of the site is within a rail corridor which includes a protection zone*, in accordance with the following requirements of Clause 86(4) of the ISEPP:</p> <ul style="list-style-type: none"> <li>a) the potential effects of the development (whether alone or cumulatively with other development or proposed development) on: <ul style="list-style-type: none"> <li>i. the safety or structural integrity of existing or proposed rail infrastructure facilities ** in the rail corridor, and</li> <li>ii. the safe and effective operation of existing or proposed rail infrastructure facilities** in the rail corridor, and</li> </ul> </li> <li>b) what measures are proposed, or could reasonably be taken, to avoid or minimise those potential effects.</li> </ul> <p>* The zone is anywhere within 25 metres of an existing Sydney Metro corridor or a Sydney Metro corridor approved under the Environmental Planning &amp; Assessment Act.</p> <p>** Rail infrastructure facilities include a wide range of infrastructure associated with train and station operations. Some of these extend beyond the apparent rail corridor. See clause 78 of the ISEPP for a full definition.</p>		
<p>In order to fulfil its statutory obligations, SMA could require, at a minimum, the provision of the information in the checklist below. It is strongly recommended that you consult SMA as early as possible during the preparation of the development application.</p>		
<b>Item</b>	<b>Description</b>	<b>Check</b>
<b>General</b>		
1	Suburb, Address, Lot and DP number(s)	<input type="checkbox"/>
2	Project Summary - short description of the proposed development including intended uses.	<input type="checkbox"/>
<b>Survey</b>		
3	Site survey, prepared by a registered surveyor, including at a minimum, Lot and DP number(s), site dimensions, reduced levels to AHD (RL's), existing basements, contours and, adjoining (surface, below and above ground) rail infrastructure facilities.	<input type="checkbox"/>
4	Copy of the current land title including all easements (including rights of way), covenants and caveats.	<input type="checkbox"/>

ISEPP Concurrence Checklist		
<b>Architectural and Engineering Drawings</b>		
6	Architectural and Structural Drawings (plans, elevations and cross sections with dimensions, RL's and zones of influence) showing the development, including excavation and structures, in relation to the railway corridor, rail infrastructure facilities and ISEPP protection zone.	<input type="checkbox"/>
7	Civil Drawings for roadworks, stormwater drainage, wastewater drainage, utilities, earthworks, retaining walls and fencing (plans, elevations, long sections, cross sections with dimensions, RL's and invert levels), including relationship to the railway corridor, rail infrastructure facilities and ISEPP protection zone.	<input type="checkbox"/>
<b>Engineering Reports</b>		
8	<p>Geotechnical Investigation Report to include at least:</p> <ul style="list-style-type: none"> <li>i. description of the site soil profile and geological mapping;</li> <li>ii. rock and soil properties, laboratory and in situ test results;</li> <li>iii. groundwater levels and conditions;</li> <li>iv. geotechnical design parameters including at least, excavation methods, temporary and permanent ground support and foundations, recommended footing design, slope stability analysis and methods of shoring;</li> <li><i>Temporary or permanent soil or rock anchors which extend into the rail corridor are not permitted.</i></li> <li>v. assessment of possible risks and effects on rail infrastructure facilities due to excavation and associated excavation methods;</li> <li>vi. and, if boreholes are required a borehole plan, borehole logs with photographs;</li> <li>vii. and, if there are significant risks to rail infrastructure facilities a finite element analysis.</li> </ul> <p><b>Note:</b> No boreholes are allowed in the first reserve. Approval is required from SMA to enter any TfNSW or SMA owned land and for any boreholes within the second reserve.</p>	<input type="checkbox"/>              <input type="checkbox"/>              <input type="checkbox"/>              <input type="checkbox"/>
9	<p>Structural and Engineering Impact Assessment Report to include for:</p> <ul style="list-style-type: none"> <li>i. proposed earthworks, embankments, cuttings, and excavations;</li> <li>ii. temporary and permanent ground support;</li> <li>iii. foundation designs and loadings;</li> <li>iv. predicted displacements, stresses and structural actions as imposed on the structural support of Metro infrastructure at various stages of construction, namely pre-construction (including demolition), excavation, development construction and post-construction;</li> <li>v. proposed design and construction methods to prevent potential adverse effects on rail infrastructure facilities;</li> <li>vi. an engineering assessment of the settlement and displacements of the development structure(s);</li> <li>vii. impact of hydrological design.</li> </ul>	<input type="checkbox"/>

<b>ISEPP Concurrence Checklist</b>		
10	Hydrology Report - existing and proposed drainage, ground cross falls, flow directions and overland run off. (No additional run off is permitted into the rail corridor.)	<input type="checkbox"/>
11	Noise and Vibration Assessment Report for airborne and ground borne noise and vibration to determine the effects on the Development from the railway operations (and during construction of the proposed railway), to comply with Clause 87 of the State Environmental Planning Policy (Infrastructure) 2007 (the 'Infrastructure SEPP').	<input type="checkbox"/>
12	Electrolysis Report, prepared by a suitably qualified consultant, to assess the requirements for electrolysis effects on the Development infrastructure and to address whether preventative measures are required.	<input type="checkbox"/>
13	Fire Life Safety Assessment Report to show that Development proposals; <ul style="list-style-type: none"> <li>i. Do not impact the railway operations safe passenger egress route and capacity;</li> <li>ii. Provide adequate protection against the spread of fire from any of the development or building works;</li> <li>iii. Ensure there is no re-circulation of smoke into the rail system in the event of fire from any development or building works;</li> <li>iv. Ensure that the provision of fire-fighting measures for the railway systems is not compromised.</li> </ul>	<input type="checkbox"/>
14	Risk and Hazard Analysis Report of the impacts that the design, construction, maintenance and demolition of the proposed development may have on the Railway Corridor, Facilities and Infrastructure, including structural safety, operational safety, fire safety, flood protection and inspection and maintenance.	<input type="checkbox"/>
<b>Other Documents</b>		
15	A site contamination assessment to identify the impact of any existing potential contamination or hazardous materials and any remedial measures required.	<input type="checkbox"/>
16	For at-grade railway infrastructure, including embankments, an assessment of the need to provide additional train derailment collision protection measures at the boundary of the proposed Development.	<input type="checkbox"/>
17	Utilities services search to identify clearances to any rail infrastructure underground utilities / services / cables in the vicinity of the Development.	<input type="checkbox"/>
18	An operational management plan for any areas that fall within the first reserve area to ensure that access is available for railway activities when required	
<b>Additional Information (depending on impact assessment, or prior to construction)</b>		
19	Monitoring rail infrastructure facilities interface(s)	<input type="checkbox"/>
20	Dilapidation surveys of rail infrastructure facilities	<input type="checkbox"/>
21	Engineering report for inspection of all bearings within the influence zone of the development to assess the capacity of these bearings to tolerate further movements	<input type="checkbox"/>
22	Balcony design (safety impacts due to proximity to rail corridor)	<input type="checkbox"/>
23	Fencing requirements	<input type="checkbox"/>
24	Construction method statement	<input type="checkbox"/>
25	Crane plans, locations of crane and temporary works design certification	<input type="checkbox"/>
26	Assessment of electro-magnetic interference and line of sight radio equipment	<input type="checkbox"/>

## Appendix B. Glossary

Sydney Metro	A new standalone railway that will deliver 31 metro stations and more than 66 kilometres of new metro rail line. Refer <a href="https://www.sydneymetro.info/">https://www.sydneymetro.info/</a>
Sydney Metro Authority (SMA)	NSW Government statutory authority created, and effective from 1 <sup>st</sup> July 2018, to deliver Sydney Metro and is part of the Transport for NSW cluster.
TfNSW	Transport for New South Wales
Operator	The rail transport operator for Sydney Metro with applicable obligations under the Rail Safety National Law and Rail Safety Regulations.
Infrastructure SEPP (ISEPP)	State Environmental Planning Policy (Infrastructure) 2007.
Developer	The person or organisation responsible for the new construction and/or alteration works.
Development	The term “Development” in this document means new construction and/or alteration works that change the existing asset configuration and could affect existing or future at grade and elevated metro infrastructure. These works may include demolitions, alterations of existing structures, building works, utility construction, basements, foundations, anchors, temporary and permanent groundwater drawdown, pipe jacking, site investigations, earthworks, tunnel and retaining wall constructions.
Rail Corridor	Refer Section 3.2 of this document
Rail Corridor Protection Zone	Refer Section 3.3 of this document
Stratum	Land owned for the Metro which is limited in either height or depth or width or all. This is also referred as stratum land.
Easement	A right to use for a specific purpose land owned by others. The easement can be limited in either height or depth or width or all. This is also referred as easement land.
Qualified Person	A person who is registered as a professional engineer or an architect or a surveyor under any law relating to the registration of engineers or architects or surveyors, as the case may be, and who under law is allowed to practice or carry on the business of a professional engineer or an architect or a surveyor.
Principal Certifying Authority (PCA)	The PCA oversees a Development’s construction phase and completes mandatory building inspections. This may be a local council or a licensed independent party.
Permit to carry out Works	Refer Section 8 of this document.
Stray Current and Electrolysis	For DC rail transit systems such as Sydney Metro, the running rails are usually used as a return conductor for traction current. Low electrical resistance between the return rails and the ground may cause stray current leakage. This may cause or accelerate electrolytic corrosion of metallic objects / structures located in the vicinity of the rail system (this is also termed electrolysis). A specialist engineering assessment is usually required for input to any Development Application referred to SMA.