# Future Development Loading – Summary

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# 1. Introduction

Suburban Rail Loop (SRL) is a transformative, city-shaping program of investments and policy initiatives that would change the way people move around Melbourne, boost productivity and deliver urban renewal outcomes for Greater Metropolitan Melbourne. SRL would contribute to the Victorian Government's vision of a 90 km orbital rail loop connecting every major metropolitan train line from Cheltenham to Werribee to link priority growth precincts as well as major health, education and employment centres and catalyse urban renewal across Melbourne's middle suburbs.

Given the significant scale of SRL, it is proposed to be developed in multiple stages. The first stage (SRL East) will provide a rapid rail service between Cheltenham and Box Hill (the Project) with the rest developed in subsequent stages.

As the Project includes large sections of underground infrastructure, a mechanism within the local planning schemes has been implemented via Planning Scheme Amendment (PSA) GC197 to protect the structural integrity of this infrastructure from potential future development. The requirements of this new infrastructure protection planning control are set out in the SRL East Infrastructure Protection Incorporated Document, August 2022 (the Incorporated Document) and the land affected by this planning control is included in the Specific Controls Overlay - Schedule 15 (SCO15) under the Bayside, Kingston, Monash and Whitehorse Planning Schemes. The SCO15 and associated Incorporated Document is in place to protect the tunnels, stations and other infrastructure during the construction and operation of the Project from future development that could cause damage if not designed appropriately.

## 1.1. Background and purpose of SCO15

Given the nature of the location of the Project station locations, it is likely that future development both within the station precincts (subject to future strategic planning and approvals processes), and on nearby land, will occur. Constraints on future development might be required to ensure that there are no adverse impacts on the SRL East Project infrastructure. The constraints created by the Project for future developments constructed in its vicinity fall into the following five broad types:

- Avoiding direct contact with, and providing a safe working clearance around, Project infrastructure.
- Avoiding loading onto Project infrastructure that might lead to structural damage with an associated reduction of structural capacity, damage detrimental to the serviceability of the structures (leading to effects such as increased leakage of groundwater into the underground structures), and displacement of Project infrastructure to the detriment of operations.
- Avoiding excavations or other types of unloading effects (e.g. removal or demolition of buildings) of the ground around the Project's underground infrastructure that would generate unfavourable changes in the stresses in the ground, leading to structural, serviceability, or operational damage of the Project's assets, analogous to the aforementioned loading case.
- Avoiding construction or operations in the development that would generate unacceptable levels of vibration in Project infrastructure and equipment.
- Avoiding new development works that rely upon direct structural support from Project infrastructure unless specifically envisaged in the Project design.

The SCO15 is defined in the publicly accessible overlay maps ensuring the planning control is transparent and easily identifiable. This ensures proponents of future development that might affect underground Project infrastructure would become aware of the potential issues through normal planning processes and vendor statements and can plan development accordingly. SCO15 and its associated Incorporated Document work in conjunction with easements, title acquisition and strata acquisition.

The Incorporated Document requires a planning permit for certain buildings and works within the SCO15. If a permit is required under the SCO15, the responsible authority would need to refer the application to the Suburban Rail Loop Authority (SRLA) as a Determining Referral Authority under the schedule to Clause 66.04, in accordance with Section 55 of the Planning & Environment Act 1987. This ensures SRLA as the referral authority has an opportunity to assess and ensure the proposed development does not adversely affect or put at risk the construction, integrity, or operation of the Project infrastructure.

In cases where a development had an existing planning approval when the SCO15 took effect, the Project infrastructure has been designed for the additional loading effects of that development. Resolution of any concerns arising around clearances or direct contact would need to be further discussed between SRLA and the development's proponent.

The clearances and loads described in Section 2 have been derived from the technical requirements for protecting the structural integrity of Project infrastructure. The existence of strata titles and easements might lead to the imposition of

additional constraints, as might the operational characteristics of the Project, for example the generation of ground borne noise and vibration or electromagnetic interference (EMI). The possible effects of the operation of the Project on adjacent development are not considered further in this Guide.

# 2. Issues to be considered for future development

The underground structures of the Project, which include the tunnelling and cut-and-cover works, have been designed based on known surrounding conditions during the detailed design phase. Future developments can be in many forms and, given the planned long life of the Project, would be beyond the foreseeable future. Hence, general design allowances have been made for future developments. These allowances are expected to accommodate many but, possibly, not all future changes.

## 2.1. Clearances allowed for around Project infrastructure

The physical clearance to be maintained between the constructed elements of proposed developments and the Project infrastructure depends upon the risks of damage, and so it depends as much upon the degree of control applied as the type of construction itself. Furthermore, the proximity of some elements such as footings and piles could also be controlled by the limits of additional loading on Project infrastructure.

A second consideration, particularly with respect to bulk excavations, is the amount of ground remaining adjacent to the tunnel to support the redistributed vertical loading (arching) over the structure. If this ground is overstressed, it could apply excessive loads onto the Project infrastructure as well as the development, or lead to unacceptable settlements. At the same time, the ground movements associated with the adjacent development excavations would affect the stresses in the linings of the Project's structures, and so the unloading effects would need to be considered along with the physical clearances.

Land divested as Project Land might also affect the areas available for some components of a development's building such as, for example, piled foundations.

The clearances around tunnels are shown schematically in Figure 2-1.

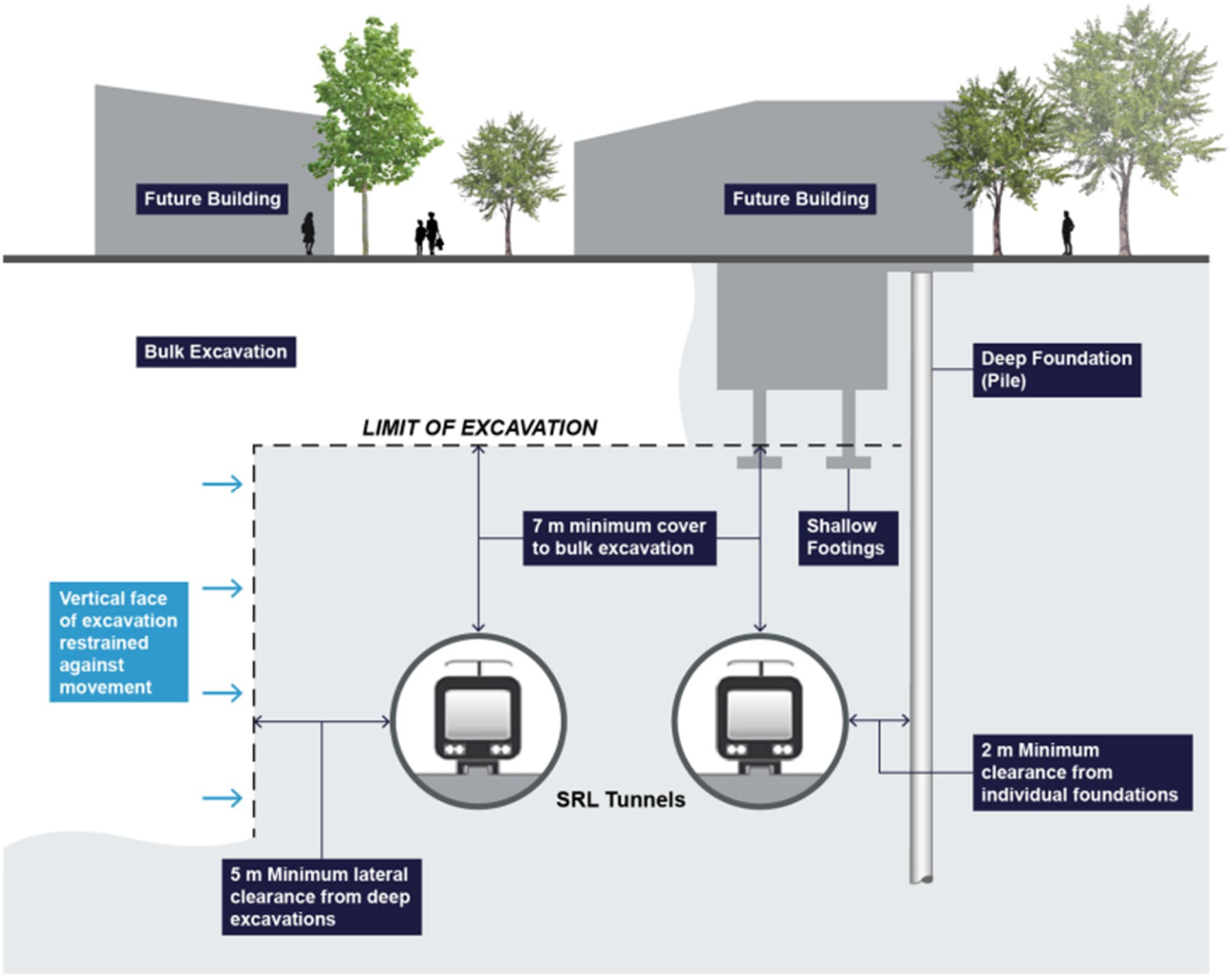



**FIGURE 2-1 TYPES OF CLEARANCES FROM FUTURE DEVELOPMENTS CONSIDERED IN THE PROJECT DESIGN**

There are no clearance allowances to future developments included explicitly in the design of the Project's cut and cover structures such as station boxes and shafts. However, buffer zones should be provided around Project's assets to protect them from construction processes and to allow for construction tolerances. The extent of the buffer zone would be dependent on what type of development structure is being proposed, e.g. depth of basement, types of footing, and the load from the building.

The activities and structures of potential future developments that were considered in the detailed design of the Project infrastructure comprise:

- Individual piled foundations bored adjacent to the Project.
- Individual piled or spread footing excavated over the Project.
- Bulk excavation adjacent to the Project, including retention systems comprising secant piles, diaphragm walls or similar.

The clearances that were adopted for use in the detailed design of the Project were based on the following considerations:

- Typical construction methods for excavation.
- Typical construction tolerances for the position of piles down to the greatest depth of the Project infrastructure together with a clearance of a pile diameter from a typical large pile.
- Potential for clashes with redundant rock bolts, dowels or cables and their consequences for the Project.

These clearances, adopted for the detailed design of the Project, would not necessarily define the minimum clearances that would be acceptable for future development within the SCO15 in all circumstances. Clearances less than the allowances included in the design might be agreed to if the developer is able to demonstrate that the risk to the Project and the development can be maintained at acceptable levels. The developer's submissions to the referral authority would need to include details of how this would be achieved. The following are general examples of what might need to be shown to gain acceptance of smaller clearances:

- Specific and more rigorous than usual construction controls would be applied effectively.
- Local loadings on Project infrastructure from footings or piles in close proximity are acceptable.
- Local unloadings on Project infrastructure from excavations, such as for a large diameter pile, are acceptable.
- Ground movement from excavations in close proximity to the Project would not have detrimental effects.
- Acceptable measures would be applied if redundant rock bolts of the Project are encountered during the construction of the development to avoid damage of the permanent Project lining, and particularly the waterproofing.
- The stability of the narrower rock pillar between the Project and the bulk excavation, carrying the loads from the structure and the loads arching through the rock above, is maintained.
- Land divested for the Project, but demonstrating meeting other clearance and loading conditions.

## 2.2. General loading allowances for future development

Additional loading (such as due to future building foundation loads) and load relaxation (such as reduction of ground stress due to future building basement excavations) need to be considered at all locations within the SCO15 boundaries. These loads might be applied at any time during the design life of the structure and would rely upon the Project infrastructure retaining its design capacity, consistent with its 100-year design life.

Typical design requirements for the underground tunnel structures as shown in Figure 2-2 would include allowances for future developments, defined as:

- A vertical loading case, expressed in units of pressure, Kilopascal (kPa), representing new building loads, or other changes that occur in the vicinity of Project infrastructure
- A vertical unloading case (defined by depth and representing bulk excavation over the Project's assets)
- A lateral release defined by the allowable ground movement at the face of the excavation (representing a deep excavation beside the Project's underground structures).

As an indication, the increase in building load from future developments for underground structures such as tunnels would be generally 50 kPa, which is equivalent to the average loading immediately beneath a typical three to five storey building. The pressures would reduce from those immediately under a building's foundation as the loading disperses through the ground with depth and offset.

The unloading case, again in isolation from other effects, would represent an excavation for two basement levels above tunnels, provided that a minimum cover is maintained over the Project's structure.

These effects could be considered in combination, where compensating effects would allow additional loading from one stage of development to be considered when determining likely acceptable values of another. For example, once the tunnels are constructed and where basements were excavated, reducing the load on the Project infrastructure, additional building loading could be applied, compared with a building with no basement, before the same net loading is reached. However, the excavation staging, and re-loading would have to be appropriately modelled to make sure that there were no problems associated with the interim stages.

Future developments must be assessed for their own effects together with any other cumulative effects that would have occurred following the completion of the Project's infrastructure, so that changes in ground stress or deformation can be considered in comparison with conditions existing at the time that construction of the Project's structures had been completed in the vicinity of the development.

The referral authority might agree to a proposed future development adjacent to the Project's tunnels or stations which at preliminary assessment appears to exceed the Project's design loading requirements. A submission to demonstrate acceptability could include:

- Development of structural options to divert ground loading away from the Project's infrastructure

- Assessment of specific load changes on the Project and demonstrated acceptability at the particular position based upon loading history and geological conditions – the assessment must consider both structural integrity and preservation of serviceability of the Project.
- Demonstration of the stability of a narrower rock pillar between the Project's infrastructure and the excavation carrying the loads from the Project's structures and the loads arching through the rock above.

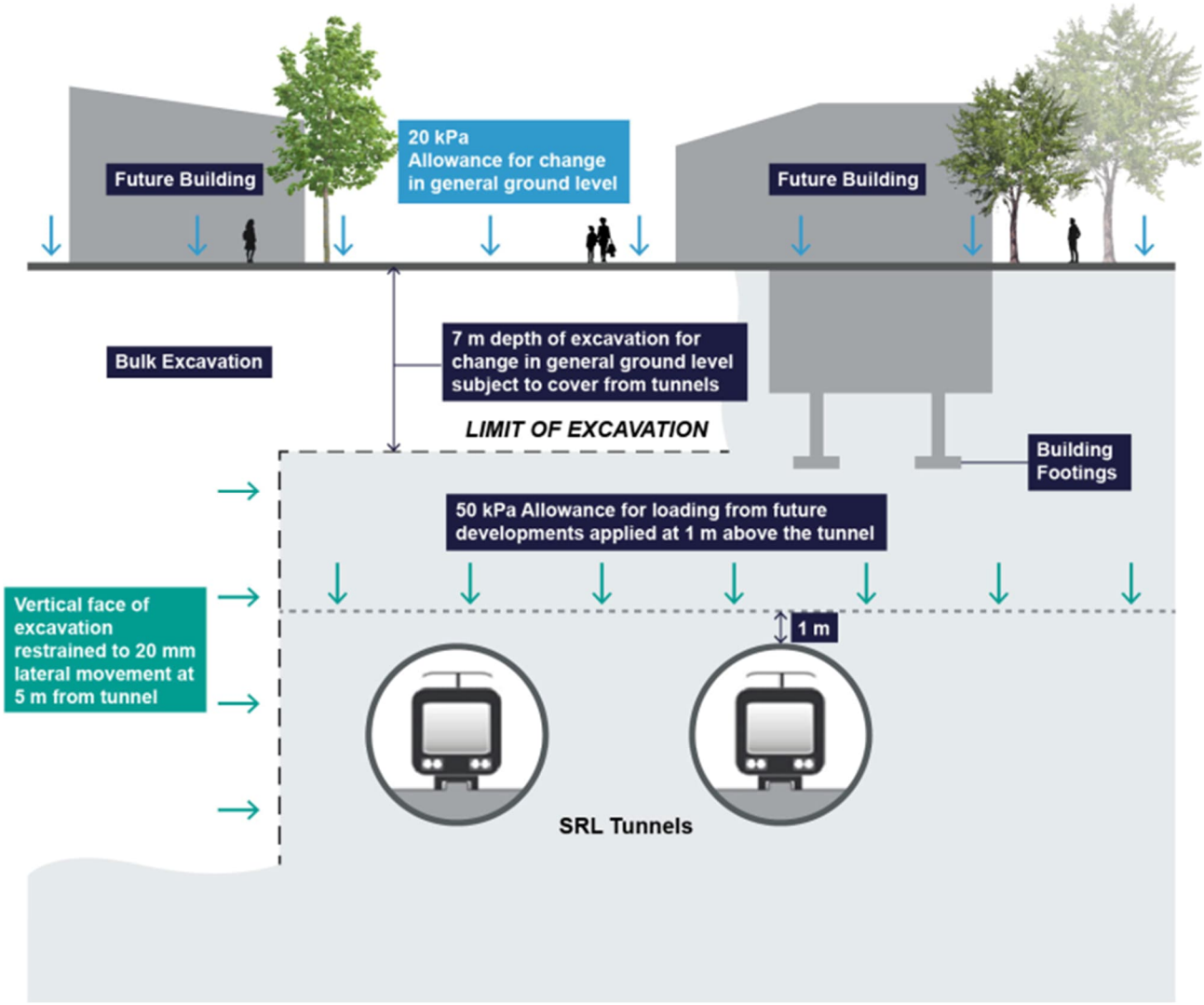
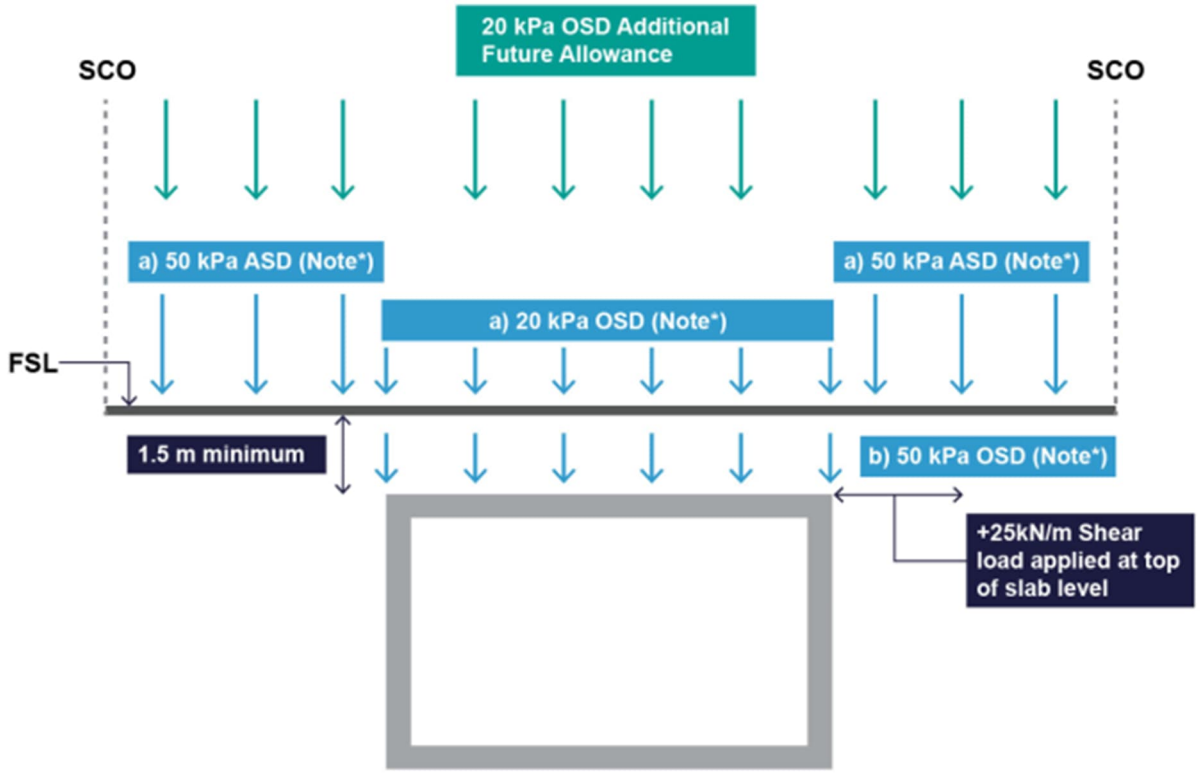



**FIGURE 2-2 TYPICAL TYPES OF LOADS FROM FUTURE DEVELOPMENTS CONSIDERED IN THE PROJECT'S TUNNEL DESIGN**

Figure 2-2 shows the proposed loading allowances that would be applied to TBM tunnels including the cross passages.

Figure 2-3 and Figure 2-4 show loading allowances proposed for cut and cover structures, such as shafts that are constructed from the surface.




Note* : The greater of a) and b) must apply.
Allowance b) assumes removal of the ground above the underground structure

**FIGURE 2-3 DESIGN ALLOWANCES FOR FUTURE DEVELOPMENT LOADINGS AT SRL BURIED CUT AND COVER STRUCTURES**

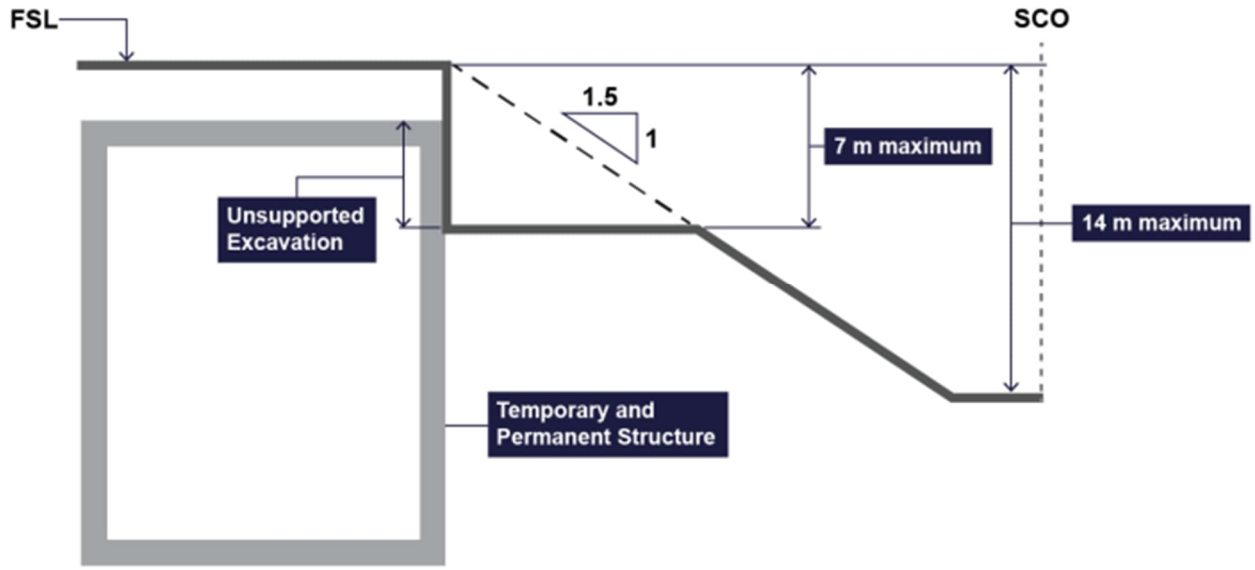



**FIGURE 2-4 DESIGN ALLOWANCES FOR FUTURE DEVELOPMENT Excavations AT SRL BURIED CUT AND COVER STRUCTURES**

The loading allowances shown in this section are a summary, and indicative of the typical types of effects that have been considered. The allowances at a particular development site should be confirmed with SRLA.

## 2.3. Mitigations and future development approvals

Where the effects from a proposed development are likely to exceed the Project's design allowances, mitigation measures might need to be included in the development to reduce the risk to Project infrastructure and itself. These could include modifications such as changing the levels of its foundations, adopting stiffer supports for excavation works, changing the sequence of excavation and buildings, and including additional structural systems to limit the change of stress or displacement in the ground around Project infrastructure. In some cases, the presence of Project infrastructure might require the development to span over specified areas and to limit the extent of excavations over, or adjacent to, Project infrastructure.

This technical guide has been prepared to assist developers in identifying and addressing potential issues under SCO15 for permit applications referred as required by the schedule to Clause 66.04 and in accordance with Section 55 of the *Planning and Environment Act 1987*.

### 2.3.1. Referral reviews

The referral authority will review the proposed developments based on the following staged process:

- If the proposed development lies outside the SCO15 boundaries, no referral or assessment would be required;
- When a proposed development is within the SCO15, its details would be checked to determine if the development triggers a permit and therefore a referral;
- For those developments which do trigger a permit and referral, the initial assessment would be made by comparing the effects of the proposed development against the design allowances that have been included in the design of the Project infrastructure. For cases where the developments effects are clearly within the design allowances, the referral authority would support the application for planning approval;
- For those developments which create effects clearly in excess of the design allowances, SRLA, as a determining referral authority under Clause 66.04, would object to the granting of a permit; and for those developments where the effects on the Project infrastructure are too close to the design limits to provide certainty that they do not provide an unacceptable risk, the developer would be asked to provide further details or undertake further analysis in consultation with the referral authority to confirm or otherwise that the risks are acceptable.

### 2.3.2. Results of Assessment of proposed developments

It is anticipated the review process would provide:

- The right of the relevant referral authority to impose any other requirements that are deemed necessary for safeguarding of Project infrastructure and the development
- Measures by the relevant referral authority to verify that the design and construction of the proposed development comply with the stipulated requirements or conditions, such as specific design reports or construction hold points.
- Confirmation that the developer has conducted an appropriate risk assessment of construction in the vicinity of the Project's underground infrastructure.
- Confirmation that the proposed development would not cause the assets of the Project to be stressed beyond acceptable structural limits.
- Confirmation that deep foundations, secant pile walls, contiguous bored pile walls, sheet pile walls, diaphragm walls, ground anchors or similar are not within a zone that would create unacceptable risk for Project infrastructure, including within divested land.
- Measures to verify that the developer undertakes its works to the satisfaction of the relevant referral authority and in accordance with the mitigation measures identified in its risk assessment.
- When assessing the effects of an individual development, the cumulative effects of all buildings or other works completed after the construction of the Project would also be considered.