

Ministerial Building Standard MBS 011

Additional requirements for designated Tunnel Protection Overlay Areas

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**Government of
South Australia**

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1 SCOPE AND APPLICATION

- 1.1 This Standard is published as a Ministerial Building Standard as part of the *Building Rules* under the *Planning, Development and Infrastructure Act 2016* (the Act) and must be read in conjunction with the requirements of the Act and the *Planning, Development and Infrastructure (General) Regulations 2017* (the Regulations).
- 1.2 This Standard contains provisions for loading changes and clearance requirements for *development* and *building work* within a *Designated Tunnel Protection Overlay Area* to protect the structural integrity and performance of planned and existing tunnel assets.
- 1.3 For the purposes of this Standard, *development* or *building work* is within a *Designated Tunnel Protection Overlay Area* if it is proposed to be undertaken in an area to which the Tunnel Protection Overlay applies as defined in the South Australian Planning and Design Code and designated on South Australian Planning and Property Atlas (*SAPPA*).

2 CONTEXT

- 2.1 The design of tunnels incorporates allowances for existing surrounding *development* and potential future *development* in accordance with zoning policy at the time of tunnel design, subject to managing changes in loading and clearances for *development* and *building work* in a *Designated Tunnel Protection Overlay Area*.
- 2.2 This Standard is complemented by policies in the Planning and Design Code, which seek to:
 - a) identify proposed *development* which has the potential to impact on planned or existing tunnel assets early in the development assessment process; and
 - b) ensure input from the *Commissioner of Highways* to provide early design guidance to applicants to mitigate risks to tunnels.
- 2.3 Where a proposed *development* is unlikely to meet the Deemed-to-Satisfy provisions of this Standard, applicants are encouraged to contact the *Commissioner of Highways* prior to lodging applications to discuss design options.
- 2.4 Generally, the *Commissioner of Highways* owns the substratum land on which transport tunnels are constructed. Applicants should contact the *Commissioner of Highways* where proposed *ground intruding activities* or *excavation* exceed 10 metres Australian Height Datum (*AHD*) below the *natural surface of the ground*, as approval will be *required* if works are undertaken on land owned and/or under the care, control and management of the *Commissioner of Highways*.

3 PERFORMANCE REQUIREMENTS

- 3.1 In a *Designated Tunnel Protection Overlay Area*, *development* or *building work* (including *ground intruding activity* and *excavation*) must:
 - a) preserve the integrity of tunnels and associated underground infrastructure;
 - b) not cause any excessive loading or unloading to the tunnels and associated underground infrastructure; and
 - c) not pose a risk of intruding into a *Tunnel Exclusion Area*.

4 DEEMED-TO-SATISFY PROVISIONS

4.1 *Development or building work* satisfies the performance requirements if:

- a) it is a new building or temporary *structure*, or an alteration of or extension to an existing building, which does not:
 - i) have a *total loading* over the *building* footprint imposed at the *foundation level* greater than 45 kPa or 4.6 tonnes per square metre; or
 - ii) exceed 3 levels above the *Regulated Surface Level*; and
- b) it does not:
 - i) impose a *surcharge loading* at the *Regulated Surface Level* of more than 20 kPa or 2 tonnes per square metre; or
 - ii) involve *filling of land* or *earthworks* that build up the *Regulated Surface Level* by more than one metre; or
 - iii) involve *temporary stockpiling* or *storage of material or equipment* over an area greater than 100 square metres; and
- c) it does not involve *excavation* or *ground intruding activity* (including *foundations*) that:
 - i) is greater than a depth of 2.5 metres below the *Regulated Surface Level*; or
 - ii) involves an underground drain, pipe, cable, conduit, tunnel, passageway or audit with an outer diameter or dimension exceeding 1.5 metres; and
- d) inclusive of *excavation* or *ground intruding activity*, it does not intrude into a *Tunnel Exclusion Area*.

4.2 To demonstrate that the *development or building work* meets the provisions at 4.1, a *Building Certifier* must be provided with the following to assess the development for building consent:

- a) calculations undertaken by a *professional engineer* in respect of an assessment against the provisions of Australian Standard AS1170.1 Structural design actions, Part 1: Permanent, imposed and other actions, and the calculation methodologies outlined below, to assess the loading impact of the *development or building work* upon the tunnels; and
- b) information demonstrating the depth of *ground intruding activities* and *excavation* using the calculation methodologies outlined below.

Calculating Loading Changes

4.3 Calculating Loading Changes - General

4.3.1 The loading allowance is for the net sum of all components of the *development or building work* that would apply additional pressure at the *Regulated Surface Level* or *foundation level* as specified in the Performance Requirements. Components of the *development or building work* could include, but are not limited to:

- a) buildings and *structures*, including poles, flags and retaining walls;
- b) *excavation* and/or *filling of land* changing ground surface levels;
- c) skin friction transfer and end bearing pressures from any piles carrying vertical loads; and/or
- d) pressures from *pad or strip footings*.

4.3.2 The interim stages in the sequence of unloading and loading must be considered as well as the final state. This could mean, for example, that the initial unloading effects from *excavation* will be considered on their own for review against the *excavation* allowances before applying loading cases.

4.4 Calculating Loading - *Building*

4.4.1 The total load of a *building* can be calculated with a knowledge of the structural elements of the *building* and the loads that it would be carrying, defined as its overall weight divided by its footprint area. These are set out in the Australian Standard AS1170.1.

4.4.2 To assess performance requirement 4.1(a)(i), the total *building* load in units of *kN* (approximately 0.1 tonne), without the application of any load factors, would be divided by the footprint area of the *building* in square metres to arrive at an average pressure applied by the *building* at the level of its foundations. 45 *kPa* is approximately 4.6 tonnes per square metre.

4.5 Calculating Loading - *Surface Loading*

4.5.1 The change to *surface loading* from *storage of material or equipment* or *temporary stockpiling of materials* for *earthworks*, *building work*, construction or landscaping can be calculated either similar to a *building* (i.e., total weight divided by the loaded area) for a relatively uniform loading or by taking the maximum loading and dividing it by the area where it applies. 20 *kPa* is approximately 2 tonnes per square metre.

Clearances for *Excavation* and *Ground Intruding Activities*

4.6 Clearances - *Tunnel Exclusion Area*

4.6.1 The *Tunnel Exclusion Area* is an envelope or area surrounding the tunnels that has a minimum dimension of 5 metres from the outer edge of the tunnels, as illustrated in Figure 4.1. For the majority of the tunnel length, the *Tunnel Exclusion Area* is located more than 10 metres below the *Regulated Surface Level*, with the exception being locations in the vicinity of the tunnel portals which may be closer to the *Regulated Surface Level*.

4.6.2 The *excavation* and *ground intruding activity* depth can be calculated by taking points on the *Regulated Surface Level* in reference to the *AHD* and subtracting the level of the base of *excavation* or *ground intruding activity*.

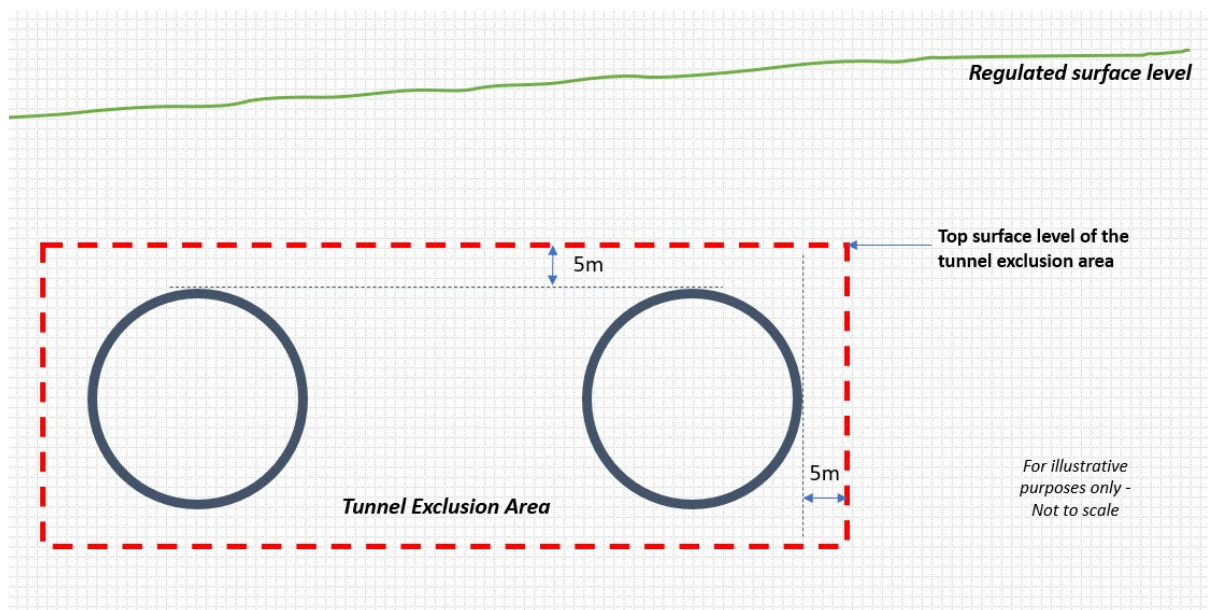


Figure 4.1 – *Tunnel Exclusion Area*

5 VERIFICATION METHOD

- 5.1** *Development* or *building work* that does not meet the Deemed-to-Satisfy provisions may use the following Verification Method to demonstrate to the *Commissioner of Highways* that the proposed *development* or *building works* achieves the Performance Requirements of this Standard with respect to changes in loading limits, *excavation* depth and clearances.
- 5.2** Where *development* does not meet the requirements at 3.1, the *Building Certifier* will provide the application and calculations undertaken by *professional engineer* as set out at 4.2, as well as calculations of clearance of foundations set out at 5.6, to the *Commissioner of Highways* for technical assessment of impacts on the tunnels and advice as to whether the performance requirements are met.
- 5.3** Within 10 working days of receipt of the application and calculations, the *Commissioner of Highways* will provide the building certifier with an outcome of the review, which will advise whether the proposed *development* or *building work* achieves the performance requirements of this Standard. This timeframe does not include the time taken to seek additional information from an applicant necessary to undertake the review of the assessment.
- 5.4** The *professional engineer* undertaking the calculations and the *Commissioner of Highways* may seek further information that will allow for a more detailed review of the *development* or *building work*. The additional information sought may include, but is not limited to:
- a) details of the structural design of the proposed *development*, including site plans, sections and elevations, loading distribution and types and levels of the foundations;
 - b) topographical survey of the site which shows the relationship of the tunnels and/or the *Tunnel Exclusion Area* to the ground surface features and the proposed *development*;
 - c) interpretation of ground condition from the results of ground investigations and tests;
 - d) details of any temporary or permanent changes in loading;
 - e) calculations, modelling and statements of the predicted effects of the works regarding changes in stresses, changes in ground movement, distortion of the proposed *structure* or tunnels, ground-borne vibration and noise, and changes in groundwater regime;
 - f) appropriate sensitivity analysis to evaluate the predicted effects against variations in input parameters and conditions that may occur during all construction stages;
 - g) assessment of risks and risk mitigation measures associated with the construction methodology and specific construction technique being considered; and/or
 - h) proposals for limitation and mitigation of the effects identified, especially on structural integrity, watertightness and safety aspects of tunnel operations.
- 5.5** The *building consent* prepared by the *Building Certifier* will include the outcome of the review by the *Commissioner of Highways*.
- 5.6** Clearance Requirements for Foundations
- 5.6.1** If foundations exceed a depth greater than 2.5 metres below the *Regulated Surface Level*, a *Building Certifier* must also be provided with calculations undertaken by a *professional engineer* in respect to the clearance of foundations from the tunnels.
- 5.6.2** For the purposes of undertaking the calculations *required* at 5.6.1, the levels of the relevant tunnels are available from the *Commissioner of Highways* upon request from the *applicant* or *Building Certifier*.

5.6.3 The *required* minimum clearance for *foundations* from the tunnels is shown in Figure 4.2 for *pile foundations*, *pad footings* and *strip footings*.

5.6.4 When not provided explicitly, the length of a pile can be calculated by taking the level of the underside of the pile cap (where the pile meets the *structure*) in reference to *AHD* and subtracting the level of the toe (base) of the pile. If the pile length is provided, the level of the toe can be calculated by subtracting the pile length from the level of the underside of the pile cap. Comparison with the criterion should be made using the pile toe closest to the outer edge of the tunnel.

5.6.5 The offset distance from the pile toe to the tunnel can be measured from a scale drawing or digital file/model or calculated using trigonometry to determine the distance from the pile toe to the outer edge of the tunnel for comparison with the criterion.

5.6.6 The clearance for *pad footings* and *strip footings* can be calculated by taking the level of the base of the footing in reference to *AHD* and subtracting the level of the outer edge of the tunnel immediately below the footing for comparison with the criterion.

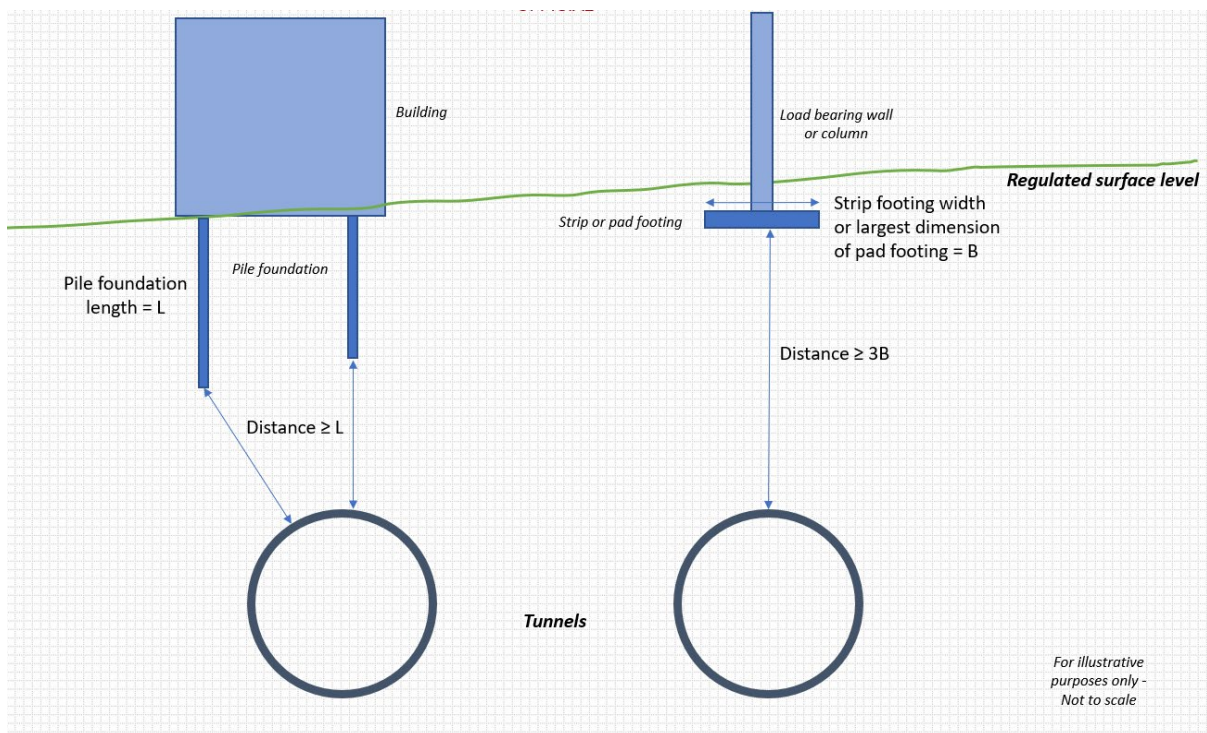


Figure 4.2 – Foundation Clearance Requirements

APPENDIX A – INTERPRETATION/DEFINITIONS

Act means the *Planning, Development and Infrastructure Act 2016*.

AHD means Australian Height Datum and is expressed in metres.

Building has the same meaning as defined in Section 3 of the *Act*.

Building Certifier has the same meaning as defined in Section 92 of the *Act*.

Building consent has the same meaning as defined in Section 3 of the *Act*.

Building Rules has the same meaning as defined in Section 3 of the *Act*.

Building work has the same meaning as defined in section 3 of the *Act*, as follows:

means work or activity in the nature of-

- a) the construction, demolition or removal of a *building* (including any incidental *excavation* or *filling of land*); or
- b) any other prescribed work or activity,

but does not include any work or activity that is excluded by regulation from the ambit of this definition as defined in Section 3 of the *Act*.

Commissioner of Highways has the same meaning as defined in the *Highways Act 1926*.

Designated Tunnel Protection Overlay Area means the area to which the Tunnel Protection Overlay applies as defined in the South Australian Planning and Design Code and designated on the South Australia Property and Planning Atlas (SAPPA).

Development has the same meaning as defined in Section 3 of the *Act* and *Regulations* applicable to work undertaken in the Tunnel Protection Overlay under the Planning and Design Code.

Earthworks means alteration of the contours of the land by moving, placing or replacing earth, soil, rock or other ground materials from within or outside of a site, including by *excavation*, cutting, *filling of land* or backfilling.

Excavation means to dig out and remove soil, rock or other materials from the ground on a temporary or permanent basis.

Filling of land means to bring gravel, sand, soil or other natural or man-made materials from within or outside a site in order to build up the ground surface level.

Foundation level means the base of the foundation.

Ground intruding activity has the same meaning as defined in Section 3 of the *Regulations*, as follows:

means an activity that intrudes the ground for the purposes of construction or other activity comprising—

1. *building* foundations and footings comprising pile foundations, *pad footings* or *strip footings*;
2. an underground drain, pipe, cable or conduit;
3. a tunnel, underground passageway or audit;
4. ground reinforcing elements, including ground anchors, soil nails, rock bolts; or mechanical stabilising elements as part of a retaining *structure*.

kPa means kilopascal and is a unit of pressure measurement defined as one *kN* per square metre.

kN means kilonewton or 1000 *newtons*.

Natural surface of the ground has the same meaning as defined in Section 3 of the *Regulations*, as follows:

a reference to the natural surface of the ground, in relation to proposed *development*, is a reference to the existing ground level before the *development* is undertaken (disregarding any preparatory work or related work that has been (or is to be) undertaken for the purposes of the *development*).

Newton means the International System of Units derived unit of force and is approximately 0.1 kg m/s².

Pad footing means an isolated shallow foundation which carries and spreads concentration load such as that of a column, pier or stump; it may be square, rectangular or round in shape.

Professional engineer has the same meaning as defined in the *Building Code*.

Regulated Surface Level has the same meaning as defined in Section 3 of the *Regulations*, being the measured ground surface level within the boundaries of the Tunnel Protection Overlay at the time of commencement of the Tunnel Protection Code Amendment, which is available on SAPPA.

Regulations means the *Planning, Development and Infrastructure (General) Regulations 2017*.

Required means required by this Standard or by the *Building Code*.

SAPPA means the online 'South Australian Property and Planning Atlas' (www.sappa.sa.gov.au) tool as updated from time to time.

Strip footing means a rectangular footing without a grid of beams, whose length is much greater than its width. A *strip footing* typically supports a wall or a row of columns.

Structure includes a fence or wall as defined in Section 3 of the *Act*.

Surcharge loading means any load such as fill, machinery, construction vehicles or storage of goods or materials on a site that exerts a vertical pressure on the ground, defined as the weight of the load divided by its area and is expressed in *kPa*.

Total loading means the total load applied by a *building* in the form of vertical pressure at the *foundation level*, defined as its overall weight divided by its footprint area, and is expressed in *kPa*.

Tunnel Exclusion Area means an envelope or area surrounding the tunnels that has a minimum dimension of 5 metres from the outer edge of the tunnels, as illustrated in Figure 4.1.

NOTE:

Referenced Standards A reference in this Standard to an Australian Standard is to the edition that is current at the time an application for *building consent* is made.