

DISTRICT COUNCIL OF  
COOBER PEDY

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Guidelines for the  
Construction of  
underground buildings  
in Coober Pedy

## **GUIDELINES FOR THE CONSTRUCTION OF UNDERGROUND BUILDINGS IN COOBER PEDY**

### **SCOPE**

These guidelines apply to underground dwellings, classified as Class 1 buildings in accordance with the *Building Code of Australia* (BCA), constructed within the area of the District Council of Coober Pedy. Construction of a Class 1 building in accordance with the *acceptable construction practice* in these Guidelines are deemed-to-satisfy *Performance Requirements* P2.1 Structure, P2.2.1 Surface water, P2.4.5(a) Ventilation and SA2.1 Energy Efficiency of the Building Code of Australia, volume 2.

Applications for Building Rules Consent for underground dwellings must also comply with any other relevant *Performance Requirements* of the BCA.

Nothing in these guidelines preclude the relevant authority from accepting alternative methods of construction to the acceptable construction practice in these Guidelines. As an *Alternative Solution* under the BCA, adequate documentation for an alternative method of construction will need to be provided by the applicant. The Council, or Committee of Council pursuant to Section 41 of the Local Government Act will need to be satisfied that an alternative method of construction complies with the *Performance Requirements* set out in these Guidelines.

These Guidelines have been written relying on geotechnical engineering reports and based extensively on judgement and opinion. The design of any proposed underground dwelling should not deviate beyond that for which these Guidelines are intended.

On completion of the tunnelling the applicant/owner must either provide satisfactory evidence from a geotechnical engineer that the ground is structurally sound, or rely on a determination by council appointed experts. Satisfactory evidence is certification of the surface exposed for the completed tunnelling.

Despite the conservative nature of the deemed to satisfy provisions of these Guidelines, owners and applicants must acknowledge that uniformity in the rock and sub-surface conditions may vary making the excavation unacceptable for a dugout dwelling.

In the event any weak or potentially unstable rock is exposed the tunnelling excavation must cease or deviate into sound and competent rock. Provisional Building Rules Consent will not be granted if the ground is deemed to be unsatisfactory by a geotechnical engineer or Council Committee.

Additionally the owner has a responsibility to maintain frequent inspections of the rock surface to ensure no signs of deterioration occur. Coatings of a suitable sealing agent,

which complies with the Australian Paint Approval Scheme, Approved Product, must be applied to walls and ceilings and maintained to prevent fretting.

The Coober Pedy Development Plan identifies appropriate locations for underground dwellings and outlines the Principles of Development Control, which must be considered in assessing an application for Development Plan Consent.

Underground buildings classified as Class 2 to 9 buildings, are outside the scope of this Specification and must comply with the relevant performance requirements of the Building Code of Australia. Applications will be assessed against the structural performance requirements of the Building Code of Australia on an individual case-by-case basis. As there are no prescriptive technical requirements for these buildings in the BCA or Australian Standards, a geo-technical engineer's report on preliminary tunnelling investigations must be included with the building rules application.

## **INTERPRETATION**

**Roof overlay** refers to the thickness or depth of ground above the highest point of the ceiling of the underground dwelling and the lowest point of the natural ground level above.

**Pillar** refers to a freestanding pillar where the longer horizontal dimension is no greater than four times the shorter horizontal dimension. If this dimension is exceeded, the element will be regarded as a wall.

## **OBJECTIVES**

For the purpose of these Guidelines, the relevant *Objectives* of the Building Code of Australia (BCA96) are applicable to all underground buildings.

The objectives of these Guidelines are to

- (a) safeguard people from injury caused by structural failure; and
- (b) safeguard people from loss of amenity caused by structural behavior; and
- (c) protect other property from physical damage caused by structural failure, and
- (d) safeguard occupants from illness or injury and protect a building from damage caused by surface water entering the building, and
- (e) protect other property from damage caused by redirected surface water; and
- (f) safeguard people from illness or injury due to inadequate lighting in paths of travel to exits; and
- (g) safe guard occupants from illness or loss of amenity due to lack of air freshness; and
- (h) facilitate efficient use of energy in a building to minimize greenhouse gas emissions.

## **FUNCTIONAL STATEMENT**

For the purpose of these Guidelines, the relevant *Functional Statements* of the Building Code of Australia (BCA96) are applicable to all underground buildings.

## **PERFORMANCE REQUIREMENT**

For the purpose of these Guidelines, the relevant *Performance Requirements* of the Building Code of Australia (BCA96) are applicable to all underground buildings.

These Guidelines identify the following *Performance Requirements*, which are specific to construction of underground dwellings in Coober Pedy and which relate to Clauses 1 to 6 of the *Acceptable construction practice* provisions in the Building Code of Australia Volume 2 (Housing Provisions) -

### **P1 Structure (BCA P2.1)**

A building or structure including its materials and components must be capable of sustaining at an acceptable level of safety and serviceability-

- (a) the most adverse combination of loads (including combinations of loads that might result in a potential for progressive collapse); and
- (b) other actions, to which it may be reasonably subjected.

### **P2 Surface water (BCA P2.2.1)**

- (a) Surface water, resulting from a storm having an *average recurrence interval* of 20 years and which is collected or concentrated by a building or *sitework* must be disposed of in a way that avoids the likelihood of damage or nuisance to any *other property*.
- (b) Surface water, resulting from a storm having an *average recurrence interval* of 100 years must not enter the building.
- (c) A drainage system for the disposal of surface water must –
  - (i) convey surface water to an appropriate outfall; and
  - (ii) avoid the entry of water into a building; and
  - (iii) avoid water damaging the building.

### **P3 Ventilation (BCA P2.4.5(a))**

A space within a building used by occupants must be provided with means of ventilation with outdoor air, which will maintain adequate air quality.

### **P4 Emergency lighting**

A level of illumination at floor level, adequate for safe evacuation in an emergency must be provided in a building, appropriate to the building use, building floor area and the travel distance to an exit.

**P5 Egress**

Exits must be provided from a building to allow occupants to evacuate safely, with their number, location and dimensions being appropriate to the travel distance and whether the path of travel is from above or below ground level.

**P6 Energy efficiency (BCA SA2)**

A building must have an adequate level of thermal performance to ensure efficient use of energy for internal heating and cooling.

**P7 Light (BCA P2.4.4(b))**

A level of illuminance appropriate to the function or use of each room of a dugout dwelling to enable safe use and movement by occupants must be installed.

## **ACCEPTABLE CONSTRUCTION PRACTICE**

General compliance with the following acceptable construction practice provisions satisfies the Performance requirements P1 to P7 in these Guidelines.

Any deviation from the approved details or identification of weak or potentially unstable ground, which may result in the development not complying with these Guidelines, the applicant must lodge satisfactory amended details with Council prior to any further works being undertaken.

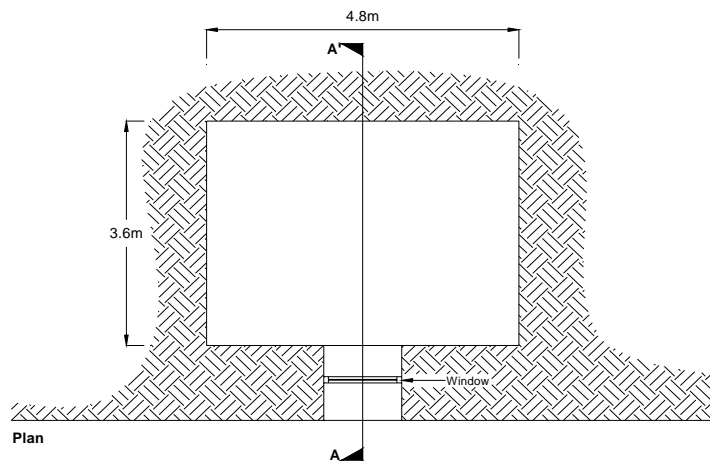
### **1 Structure**

- 1.1** The ratio of the minimum ceiling span to the thickness of ground above must not exceed a ratio of 1:0.625.

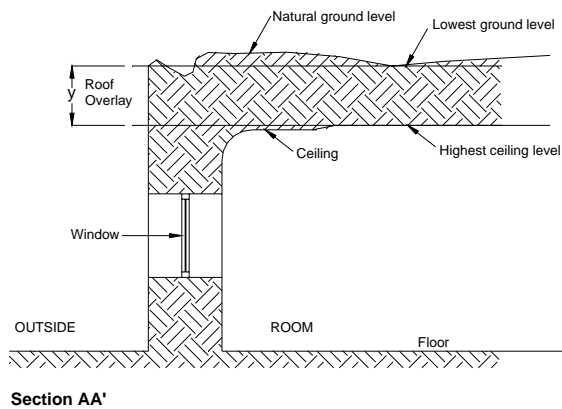
**1.2** The *roof overlay* of an underground dwelling must not be less than 2.5 metres.

**Explanatory information**

For example:-if the width of a room is 3.6m with the ratio 1:0.625 (3.6 x 0.625) then the *roof overlay* is 2.25m. (Where the resulting dimension is less than 2.5m, Clause 1.2 takes precedence). See Figure 1.1 (a) and 1.1 (b).



**Figure 1.1a** (refer clause 1.1)



**Figure 1.1b** (refer clause 1.1)

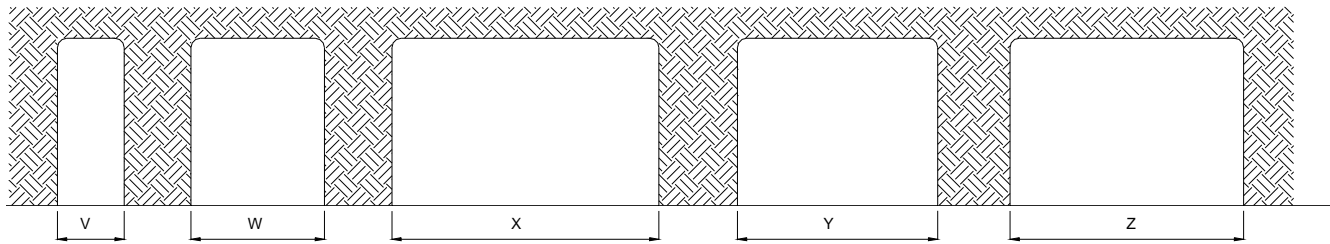
**1.3.** The thickness of internal walls of underground dwellings must be not less than 1.5 metres and the thickness of walls between any room and an allotment boundary must be not less than 1 metre.

**1.4** The combined span of an opening either side of a supporting internal wall of an underground dwelling must not exceed a ratio of six times the thickness of the wall.

**Explanatory information**

The ratio of the combined width of tunnelled rooms to the width of the dividing wall must not exceed 6:1. For example, the width of wall dividing two rooms each with a 3.6m width would be based on  $7.2\text{m}/6 = 1.2$  metres. (Clause 1.3 takes precedence in the case of a conflict with this requirement). See Figure 1.4

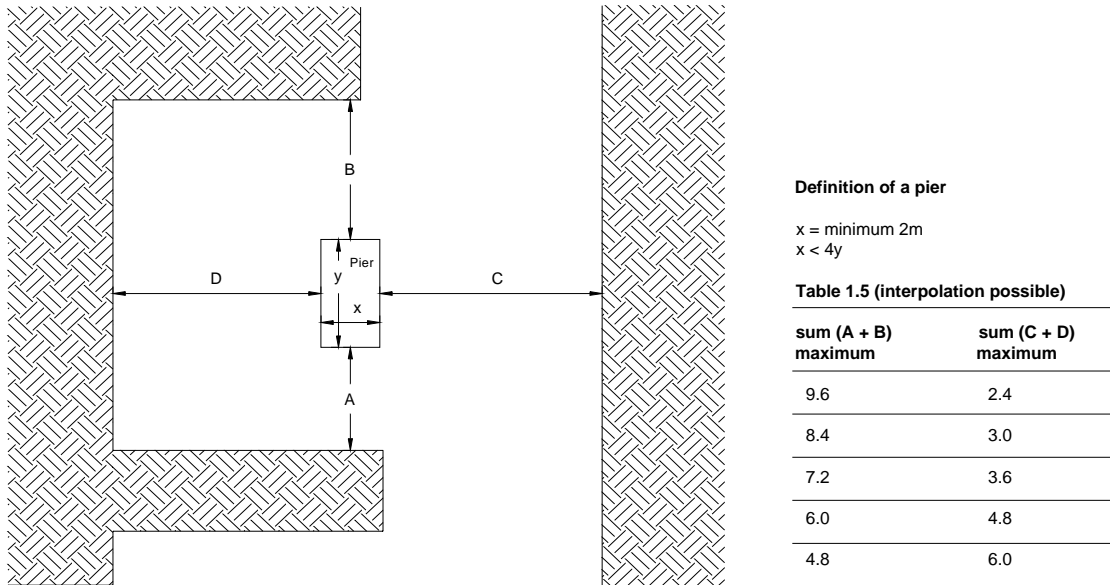
Minimum width of wall between rooms:		
v and w	$\frac{v+w}{6} = \frac{3.6}{6} = 0.6$	(1.5m required refer Clause 1.3)
w and x	$\frac{w+x}{6} = \frac{7.2}{6} = 1.2$	(1.5m required)
x and y	$\frac{x+y}{6} = \frac{8.4}{6} = 1.4$	(1.5m required)
y and z	$\frac{y+z}{6} = \frac{7.8}{6} = 1.3$	(1.5m required)



**Section**

**Figure 1.4** (refer clause 1.4)

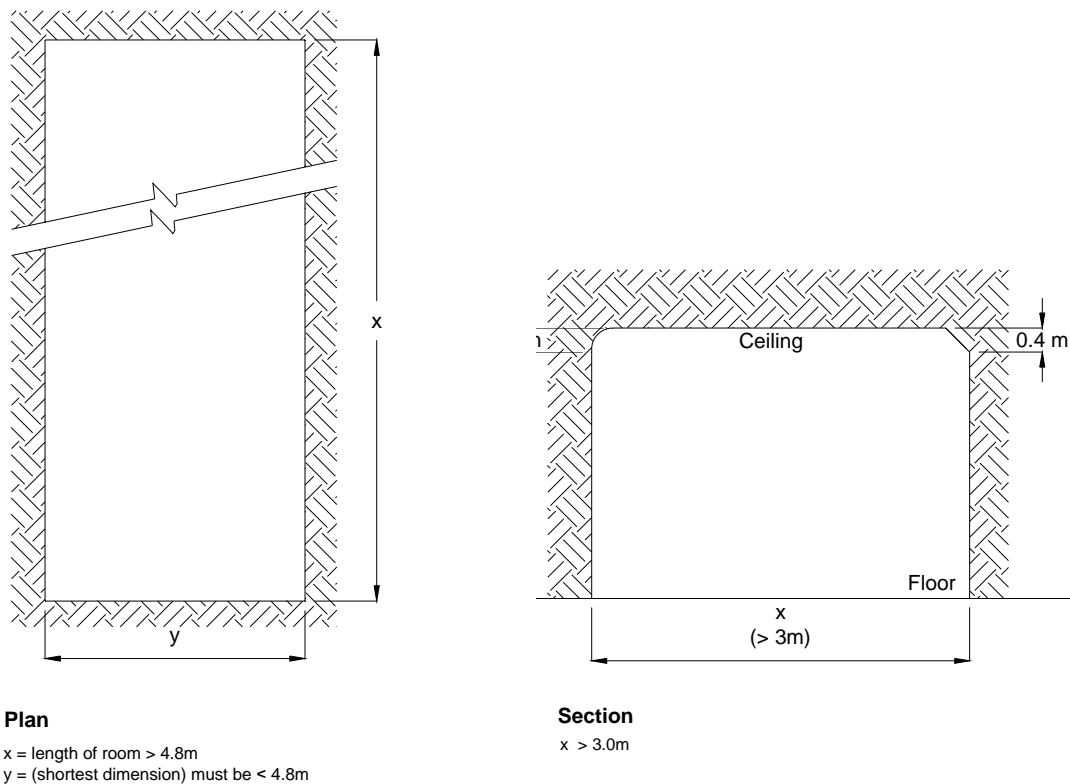
**1.5** Any pier contained within an underground dwelling must have a minimum dimension of not less than 2 metres. The **minimum** width of tunneled rooms or openings surrounding a pier must comply with Figure 1.5 and Table 1.5.



**Figure 1.5** (refer clause 1.5)  
 Maximum span shown in table 1.5

**1.6** Where the length of an excavation tunnel exceeds 4.8 metres and where the ceiling spans more than 3 metres in width, the junction of the ceiling and any supporting piers or wall must be rounded or chamfered at least 0.4 metres from the junction. Refer to Figure 1.6 (a) and 1.6 (b).





**Figure 1.6a** (refer clause 1.6)

**Figure 1.6b** (refer clause 1.6)

## 2 Surface water

- 2.1. Surface water must be prevented from entering an underground dwelling by a verandah or carport attached to the opening of the excavation for the dwelling that
  - (a) extends not less than 10 metres across the frontage of the underground dwelling and also extends not less than 2.4 metres from the face of the excavation; and
  - (b) provides shelter and shade to the entrance of the underground dwelling; and
- 2.2. Water tanks must be placed in a position that will prevent water ponding or seeping on ground above the dugout dwelling, should any tank or pipes connected to the tank leak.
- 2.3. Where the entrance to any underground dwelling is lower than nearby ground that ground must be graded to a sump or similar which will collect any surface water.

### **3 Ventilation**

- 3.1** Underground dwellings must be provided with an appropriate number of vent shafts to provide for adequate air circulation. Each room of a dugout dwelling must have a vent shaft with a cross-sectional area of at least 3500mm<sup>2</sup> for every square metre of floor area of the room it ventilates or openings as prescribed in Clause 3.8.5 of the BCA Volume 2.

### **4 Emergency lighting**

- 4.1.** Emergency exit lighting must be provided such that in the case of a power failure the exits and paths of travel to those exits are easily distinguishable.

### **5 Egress**

- 5.1** Underground dwellings must provide at least two exits, not less than 9 metres travel distance apart.

### **6 Energy efficiency**

- 6.1** Underground dwellings are deemed to achieve the equivalent of a 5 star rating or deemed to satisfy provisions of the BCA Volume 2, providing any external window is protected from unwanted solar gain by a verandah or adjustable shading device.

### **7. Light**

- 7.1** All rooms of a dugout dwelling must be provided with artificial lighting at a rate of not less than one light fitting per 16m<sup>2</sup> of floor area or in accordance with AS 1680.