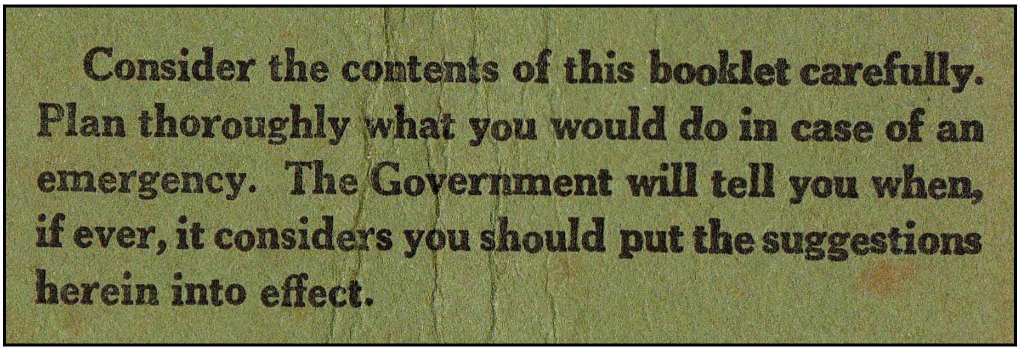
Gimme Shelter:

Archaeology and the Social History of Structural Defence in Adelaide 1941-1943


Consider the contents of this booklet carefully. Plan thoroughly what you would do in case of an emergency. The Government will tell you when, if ever, it considers you should put the suggestions herein into effect.

Martin Wimmer

A thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

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Abstract

The underlying premise of this research is that civilian air raid shelters reflect aspects of our past society that other forms of material culture do not. This thesis concerns itself with the archaeological interpretation of the civilian structural response to an anticipated Japanese aerial bombardment of Adelaide in South Australia during World War II.

Analysis incorporates archival research, archaeological fieldwork, the testimony of eyewitnesses and contemporary early twentieth century psychological research into the effects of aerial bombardment, in order to help understand 547 Adelaide metropolitan and 39 South Australian country air raid shelters. It provides a typology for the range of responses recorded, identifies the social contingencies attributable to each type, and tests the depth of social data stored in these structures. This thesis also introduces the notion of the 'psychology of fabric' as an additional cultural attribute of material remains that were purposely developed and positioned in the landscape to elicit a behavioural change in a fearful community awaiting a catastrophe.

Across Adelaide, air raid shelters were built by people from diverse backgrounds and with varied economic means. The largest, most expensive and best fortified, however, were not owned by the wealthiest people in society, but instead by those with ties to the food and construction industries. Those employed in the building/construction industries tended to over-engineer the structural components of their shelters, greatly enhancing their personal protection. Men with previous military experience favoured a particular type of shelter, and whilst some single women dug trenches for themselves, they took little part in

constructing other shelter types beyond making the initial decision to install one. Analysis showed that 89.3% of domestic shelters that could be properly characterised had overhead protection and that the local Code for Shelter Construction was, for the main, observed. This, to some extent, vindicates government policy which encouraged people to make their way home during an air raid under the assumption that they could procure better protection for themselves than could be provided for them in the public arena.

The phenomenon of shelter building was a short-lived event, and largely occurred in Adelaide over an eighteen month period beginning on December 7, 1941. This thesis, therefore, is also an archaeology of social recency. It deals with a very concise time period during a significant world event. As such, it precisely maps social trends and patterning in the cultural landscape of an Australian wartime community. It is an archaeology of real and identifiable people who are largely unrepresented in official documentation, but who made decisions about their own protection and invested considerable time, energy and physical resources in doing the best they possibly could for themselves, their families and their neighbours.

The dividend of this investment lies in their material legacy to us—a unique cultural landscape, the interpretation of which, seventy years on, allows us to finally document a very real moment in their lives.

Declaration of Candidate

I certify that this work does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Martin Wimmer

31 January 2014

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Finally, thank you to all those who managed to get through World War II without being bombed and who wanted desperately to tell me exactly how they did it!

Acronyms and Abbreviations

ARP	Air Raid Precautions
CBD	Central Business District
CCA	Cement and Concrete Association (UK)
CT	Certificate of Title
FFCF	Fighting Forces Comforts Fund
GPR	Ground Penetrating Radar
ICRC	International Committee of the Red Cross
LTO	Land Titles Office
NSW	New South Wales
NT	Northern Territory
QLD	Queensland
RAF	Royal Air Force
RC Pipes	Reinforced Concrete Pipes
SA	South Australia
TLP	Thematic Listing Program (UK)
UK	United Kingdom
USSBS	United States Strategic Bombing Survey
VIC	Victoria
WA	Western Australia
WWI	World War I
WWII	World War II

Linear Measurement Conversions

All physical dimensions of air raid shelters were archaeologically recorded using the metric system. These were also converted to values in the imperial system and appear in brackets after the metric measurement so that they could be more effectively compared to contemporary building advice and materials. Imperial linear measurements sourced from historical documents, such as, the Codes for shelter construction, were not converted to metric values, nor were those relating to air raid shelters which were recorded from testimonial sources.

Imperial to Metric Conversion

One inch	=	2.54 centimetres
12 inches (one foot)	=	0.3048 metre
Three feet (one yard)	=	0.9144 metre
1760 yards (one mile)	=	1.6093 kilometres

Metric to Imperial Conversion

One centimetre	=	0.3937 inch
One metre	=	39.37 inches or 3.2808 feet
One kilometre	=	0.621 mile

Chapter One

Think for a Moment

How much unlook'd-for is this expedition.
By how much unexpected, by so much
We must awake endeavour for defence;
For courage mounteth with occasion:
Let them be welcome, then;
We are prepar'd

Shakespeare (King John, Act II: Scene I)

1.1 Think for a moment…

Think, for a moment, of structures which embody notions as diverse as defence, statecraft, architecture, social stratification, gender and fear. Now think of structures which exist today mainly in individual and social memory, despite their continuing physical presence in the community. All of these structures are World War II (WWII) civilian air raid shelters. This paradox presents itself because the original meaning of a whole genre of wartime 'Brutalist' architecture is lost to, or cloaked from, a modern day society which is now removed by up to three generations from the everyday realities of WWII. Air raid shelters, as passive by-products of war, are no longer linked to conflict by the general community in the same way as more obvious war-like material culture, such as a tank or a bomber from the same era, and whose original use, reflected in their form, is still obvious.

For the main, air raid shelters are not recognised by the Australian community as symbols of the fear of aerial attack, or of the hardships and restrictions faced by their forebears during WWII. While there may be some recognition of these structures three generations later, they seem to have little more than curiosity value to their current owners. Today, air raid shelters are more likely to be marketed as desirable home improvements (along with a north/south facing lawn tennis court—see Figure 1-1) than a direct reflection of the very real fears of wartime. Up until WWII, civil defence played no part in Australia's colonial or national defensive posture (see Chapter Two), and is largely un-represented in dedicated or themed Australian historical and archaeological studies[1] (see Chapter Four). The opposite is true for the military defence of Australia (see, for

[1] One exception to this observation, however, can be found in Nicolas Grguric's (2008) study of colonial era homesteads of the Australian frontier which were fortified against Indigenous attack.

example, Oppenheim 2005), leaving an obvious gap in our knowledge and understanding of a key facet of WWII. How did ordinary people in a far-flung city respond domestically to the tide of fear generated by the changing nature of war in the early twentieth century?

Figure 1-1: Less bang for your dollar!
(realestate.com.au 2008)

Australia's official military response to the Japanese threat is well documented, but the civilian shelters speak of those folk typically absent from archival sources, the ordinary people in society "whose lives and whose involvement in world events [were not] closely documented" (Schofield 2002b: 145). They speak of how the different social classes protected themselves, the resources available to them, the mental health of society and gendered responses to the threat of aerial bombardment. The shelters are not isolated structures, nor are they mute monoliths. Instead, they constitute an intriguing cultural landscape—a wartime civilian landscape of fear. Some members of the generation who built and intended to cower in the shelters are still with us today. Their testimony can help interpret these structures, but the depth of that testimony is diminishing as that generation dies and their individual (and collective) experience disappears. Heritage value is measured variously from platforms of significance and meaning, ranging from the tangible (rarity of type) to the intangible (remembrance through previous personal interaction). This means that, eventually, without the recorded testimony of the generation of shelter builders the structures will have less significance and heritage value for future generations – they will constitute nothing more than a typology of physical responses to threat rather than being endowed with verifiable social attributes.

Belonging to a period that is still within living memory, Adelaide's WWII air raid shelters are particularly significant as places of commemoration and remembrance. They are storehouses of emotion and have the ability to elicit certain responses from individuals depending on their previous interactions with them. Archaeology alone can contribute empirical data to the available testimony, giving it credibility and resonance in understanding the society of wartime Adelaide. The presence of air raid shelters in an un-bombed cityscape presents an opportunity for archaeologists to contribute to a greater understanding of the mental health and material reactions of communities (and in Adelaide's case, a remote community) anticipating an attack.

Archaeology is also able to contribute information regarding the more complex social stratification of such communities, for it was not only fear that dictated the type and frequency of shelters, but also factors such as an absent male work force, economic constraints and the limited resources faced by many families. Further, archaeology can identify and interpret the social positioning associated with different types of shelter. Wiessner (1990: 107) argued that stylistic behaviour is an important facet of identity formation. Consequently, the style of a shelter may have communicated certain messages, gaining the owner recognition as belonging to a certain group or class.

1.2 Archaeology and social recency

Recent military remains provide the opportunity to add a more personal, social veneer to an understanding of conflict, for when "combined ideally with the testimony of those involved – [it gives] archaeologists the opportunity to 'turn the dead silence into an eloquent statement of experience'" (Carman 1997: 2). "This is a past with real people whose lives can be investigated through documents, testimony and places" (Schofield 2002b: 145). Such studies are already well-advanced in the United Kingdom (UK) (see section 4.3) where one of its chief proponents, John Schofield (2002a: 2), noted that the twentieth century was "characterised by warfare and particular (and new) types of warfare at that". More people were exposed to war in the twentieth century than in any other era (directly or indirectly through various media), and because of its recency, many people can still calibrate some of their life experiences to at least one of the conflicts that characterised it, such as WWII.

Consequently:

> …recent military sites often evoke a depth of feeling rarely seen on other types of site (excepting perhaps the scenes of industrial disasters)…Although recent military remains have been of interest to amateur archaeologists over at least 40 years, a professional concern and popular support for the physical remains of twentieth-century conflict has developed only more recently (Schofield 2009a: 21).

Roberta Gilchrist (2003: 2) claimed that for some archaeologists the emotional connection to twentieth century conflict is more personal:

> …many of the key proponents of the archaeology of twentieth-century conflict had fathers or grandfathers who fought in the war. This particular strand of warfare studies offers a personal commemoration and catharsis, comparable perhaps to the pursuit of family history, and is connected more to contemporary currents than to theoretical narratives.

Air raid shelters represent the highest expression of civilian responses to fear, contemporary with a specific twentieth century wartime technological innovation—aircraft. Their very existence involved great individual investment in research, decision making (for instance, whether to build one, what type to build, where to build it, and how to procure the material and labour to do it), time and wealth. They are products of deliberate and complex thought processes by people who acted to protect themselves against something they feared their government and armed forces could not effectively stop, and they represent the best option available to each individual or family at that precise moment in history. Australia's air raid shelters were almost wholly constructed and maintained over a period of only eighteen months, beginning on 7 December 1941 and ending in August 1943. They converge, therefore, at a precise point in time in the continuum of twentieth century global militarism, and intersect with a more localised Imperial Japanese expansion into South East Asia. The archaeological study of such short and concise time periods fits with the archaeology of catastrophic events, of which war is one, but also includes the archaeology of shipwrecks (*Mary Rose* 1545), earthquakes (Port Royal 1692) and volcanic eruptions (Pompeii and Herculaneum 79AD).

Each of these calamitous events has captured a moment in time, and the material culture associated with them tells us much of their respective society at that precise moment. In the same way, the material remains relating to the initiation and intensification of civil defence construction in Australia constitute one of the richest, but most under-valued, sources of archaeological and social data from the early 1940s. Because of their recency, contemporary archaeologies are not limited to the event; they can draw on a wider range of resources and social issues to help interpret material remains (see Bapty and Yates 1990: 12). This research contributes to the increasing body of archaeological work being undertaken on the contemporary past (see papers in: Harrison and Schofield 2009 and 2010; Schofield *et al.* 2002; and Schofield 2009a) and to public debate on the viability of such temporal studies. Harrison and Schofield (2009: 198) argued that the archaeology of the contemporary past:

> …can touch people's lives, and has social relevance and meaning, in ways that may not exist for archaeologies of earlier time periods.

Further, archaeologies of the contemporary past link closely to contemporary heritage values, making them vital agencies in interpreting and distilling those values for modern day stakeholders.

There is now growing recognition of the heritage value of the materiality of twentieth century warfare and its associated landscapes, especially in the UK.

Unfortunately, this enthusiasm is not reciprocated to the same extent in Australia. People living in England at the time of the German offensive who are still alive today can directly relate their experience during the *Blitz* (an event which has reached almost mythical and iconic status in the English community) to the surviving structures from that time. Similar civil defence structures to those in the UK were also built in Adelaide as in other Australian cities, but were ultimately never used for their intended purpose. For Adelaide and most of the populated regions of Australia where the bombers never reached, people still behaved as if they would, and the structures survive as symbols and reminders of that fear and expectation. The Australian version of this civil defence landscape presents quite a different model of behaviour to that in the UK, allowing us to understand how ordinary citizens reacted to the expectation of international aggression in isolated communities.

This study carries what is known of air raid shelters beyond the realm of concrete explanation and a mere record of their modern day existence to provide insights into an ingenious, fearful and commodity-scarce wartime society. In doing so, and despite Gilchrist's implication, it is argued that such landscapes do in fact connect to a wide range of potential theoretical narratives and contribute to an understanding of a unique material resource. To begin to understand this unique resource, however, one needs first to understand the nature of warfare and how this has changed over time, leading to the need for civil defence.

1.3 The nature of warfare

The nature of warfare is such that tacticians have long looked to weapons or techniques of terror as a means of undermining the enemy's morale and gaining the upper hand in conflict. The ability to administer such a psychological blow is intimately tied to the available technology of any particular time, ranging from the stories of the Mesopotamian king, Barsamia, and the citizens of Hatra filling clay pots with poisonous insects and flinging them into the Roman positions with catapults in AD 198-99 (Mayor 2004: 182-186), to the introduction of poisonous gas to the battle field in World War I (WWI), and the arrival of the V-weapons on English soil from the night of 12-13 June 1944[2]. For most of the twentieth century, however, aircraft (affordable, reliable and mass produced) became the terror weapon of choice in all major theatres of conflict. This choice ensured that the aerial bombing of civilian targets became the characterizing feature of WWII, reaching its climax with the dropping of atomic bombs on Hiroshima and Nagasaki (Schofield 2002b: 149). As Australian historian Geoffrey Blainey (1999: 56) observed:

> By the end of the First World War the aircraft had become pervasive. In the Second World War they would be decisive.

As new technology in the early twentieth century, aircraft were largely untested entities in military application. The theatres of conflict in WWII, however, became proofing grounds for determining and extending their tactical, logistical and psychological capabilities, possibilities that had only been hinted at in WWI. Experimentation with, and deployment of, military aircraft against civilian targets during the late 1930s and early 1940s was to become an everyday occurrence for many warring nations. This blurred the traditional spatial notions of the frontier by creating a dynamic (shifting) frontline, and flew against international jurisprudence and conventions of warfare. The traditional battlefront was no

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[2] Hitler's 'secret weapons' – the V-1 was a flying bomb and the V-2 a long range rocket. 'V' stood for *vergeltungswaffe* (vengeance weapon) which was intended as a retaliatory response to the incessant bombing of German cities by the Allies and the D-Day landings in Normandy a week earlier, on 6 June.

longer capable of containing or limiting the extent of physical military aggression. Dennis Gojak (2002: 160-161) discerns that evolving scientific technologies of war combined research in fields such as metallurgy, chemistry, electricity, and advanced physics and mathematics. In effect, it was a militarisation of science and of knowledge. By coupling the outcomes of this scientific research with mass production, previous armaments technologies were rendered obsolete and enabled conflict to be waged on a global scale. 'Total War' referred not only to the enlistment of non-military personnel (including women) and the co-option of civil infrastructure for war production, but also to direct attacks on the civilian population and a subsequent disappearing cosmopolitan population. The threat of hostile aircraft over civilian exclaves forced civil and military planners of the time to look at ways of protecting their citizens and of bolstering the morale of a voting public, as well as fortifying essential services and public utilities.

So serious was the threat from aircraft that over one billion pounds was spent on civil defence during WWII in the UK alone (O'Brien 1955: 691). This spending was spread across many jurisdictions and founded on an unwieldy bureaucracy. Yet, despite the enormity of infrastructure developed for civilian protection, and given the vast numbers of civilians that were affected by some aspect of it, there are many absences (or omissions) in present day knowledge and understanding of not only air raid shelters, but also the processes involved in creating this emergency services network and its various components. For instance, Robin Woolven's (2002: 23-25) study identifies many gaps in the civil defence literature for the London region alone. These include a lack of detailed accounts of the formulation and implementation of Air Raid Precautions (ARP) policy, the general un-preparedness at the time of the Munich Crisis (September 1938) and the disparity in ARP performance across the various boroughs during the *Blitz*.

Air raid shelters, one solution to the new threat against civilians, became common and familiar urban features. Lord Baker, scientific advisor to the Design and Development Section of the Ministry of Home Security (1939-1943) and designer of the Table 'Morrison' Indoor Shelter[3], noted that:

> … from 1939 to 1945 air raid shelters were of great interest to most people in Britain and were of importance in maintaining the morale of the civilian population, (but) no complete account of their development is available (Baker 1978: ix).

An underlying premise of the present study is that shelters were also of great interest to people in Australia, becoming, in effect, a barometer of public attitudes. Australia mirrored Britain not only in echo and image (see Blainey 1971: 328), but also in the fact that it too kept no complete account of shelter development.

In no other era in Australian history has this phenomenon of intensive shelter construction been replicated. Ordinarily, WWII air raid shelters in an urban landscape would inform the observer that an attack took place, as they do in London and many other cities of Europe. However, in the case of Adelaide they inform us of the fear evident in that community (see Cunliffe 1974: 63). Cultural landscape studies extend to those landscapes which have been deliberately altered by fear. Yi-Fu Tuan's (1979) work on the many forms that 'landscapes of

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[3] There had been a tradition to name shelters designed by staff of the Ministry of Home Security after the incumbent Minister. For example, the Sectional Shelter (formed from arched sections of heavy corrugated sheet steel) and popularly known as the 'Anderson Shelter', was designed by William Paterson and Oscar Kerrison, but named after the Lord Privy Seal, Sir John Anderson, the first Minister for Home Security. The Table Indoor Shelter (a box-like steel and spring design of roughly kitchen table dimensions), or 'Morrison Shelter', had been designed by Sir John Baker and named after the second Minister for Home Security, Herbert Morrison (see Anstey 2009: 3 and Baker 1978: 58-59).

fear' can take (from penal landscapes to those deliberately altered by the fear of disease or natural disaster) demonstrates how such studies can tell us much of society at a particular point in its history. Tuan's landscapes encompass both psychological states and the physical world, and point to a presentiment of danger in the environment (see section 3.3).

The hundreds of shelters constructed in Adelaide bear witness to the psychological health of the local community at that time, and are reflective of a wider Australian condition. This observation is especially true for those regions in Australia that experienced bombing and strafing incidents (such as Darwin and Broome see Map 1-1), and is also true of other places in Australia, such as Adelaide, which prepared for an attack even though it never materialised. In a sense, then, Adelaide's landscape of fear is closer to the fear manifest in the urban landscapes of the Cold War when much of the civilised world expected a nuclear attack and built shelters to protect themselves from the atom bomb, than they are to those of the bombed cities of WWII. Saunders (2001: 476-477) has observed that modern conflicts:

> …can be considered wars of matériel… [and] the study of materiality sees objects as possessing important and variable social dimensions beyond (as well as including) their original design purpose. Objects may be small (e.g. a bullet or a dog tag), intermediate (e.g. a tank, aeroplane or bunker) or large (e.g. a trench system or a whole battlefield landscape).

Saunders' observation has clear application to the study and understanding of war-related civil defence *matériel* and its associated social dimensions. This thesis extends Saunders' observation to a country that has few, if any, of the WWII battlefields which typify Europe. Yet, a testament to the global nature of twentieth century warfare is that Australia, as remote as it is, does have representative *matériel* specific to that conflict which fits Saunders' model of object classification, and which also possess social dimensions beyond their original design purpose. This includes, but is not limited to, air raid shelters.

Map 1-1: Location of Adelaide in relation to areas of Japanese attacks
(URL: http://www.awm.gov.au/encyclopedia/air_raids/)

1.4 Landscape as cultural flux

The trajectory of Adelaide's WWII civil defence landscape, from conception to abandonment and re-use, is schematically illustrated in the model below (see Figure 1-2). Gilchrist (2003: 4) noted that more "holistic" approaches to the social archaeology of warfare, such as the archaeology of fear, reveal a "broader interpretation of the impact and meaning of war than studies that have focused on violence and battlefields".

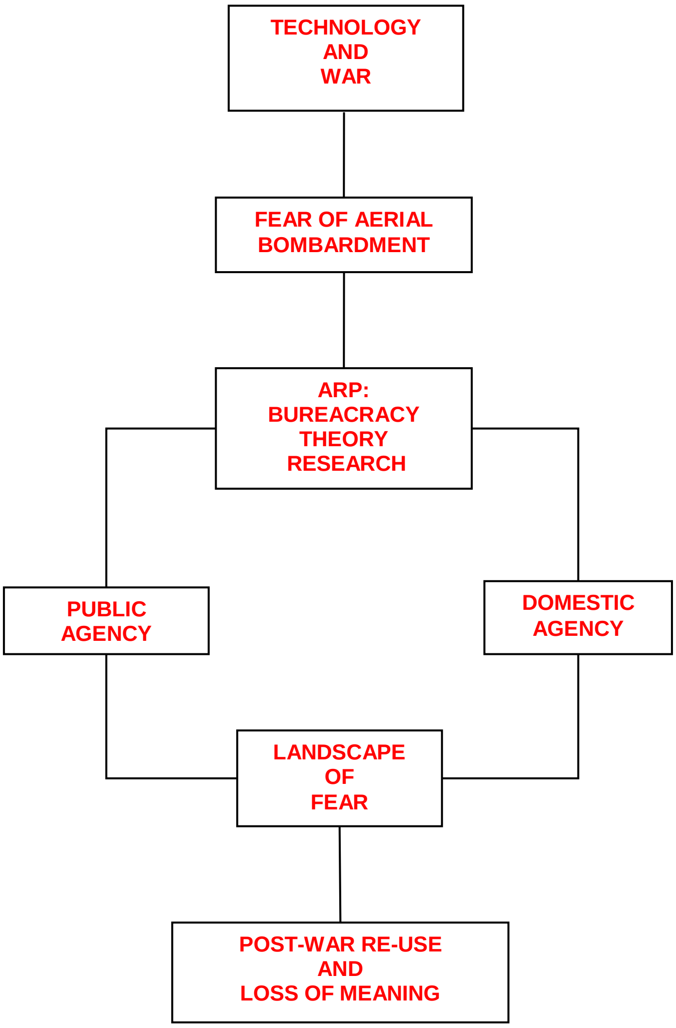

Figure 1-2: The genesis and trajectory of a WWII civilian landscape of fear

Figure 1-2 depicts how advancing war technologies in the early twentieth century created fear amongst the governments and civilian populations of belligerent nations. The fear and uncertainty generated by technical innovation, particularly the use of aircraft as weapons delivery systems, fostered research into different ways of minimising casualties and neutralising the negative psychological effects of civilian bombardment. The results of this research led to the creation of unique landscapes of fear that were superimposed on peacetime urban vistas. The model demonstrates how these fearful landscapes were created via two distinct sets of processes—public and domestic. Public agency refers to the local authorities and business entities which placed various structures and infrastructure in the public domain for the protection of their constituents. Domestic agency acknowledges the civilians who effected structural precautions around their homes in order to protect themselves and their families. The resultant landscape is connected via the passage of time to the lowest tier of the model, which represents the post-conflict discard and re-uses stage of the structural elements within the landscape. As more time passes since these features were built, loss of meaning accrues to subsequent generations. Nicholas Saunders (2003: 8) observed that:

> …[t]he re-ordering of landscapes by total war represents a merging of industrialised technology with a 'natural landscape' which is itself a layering of cultural matter past and present. Here, new social identities were (and still are) explored and constructed, and new forms of war commemoration created.

1.5 Research questions and aims

Wartime documents and photographs have shown that despite Adelaide's isolation and its great distance from the Axis centres of power (7,643 km from Tokyo and 13,826 km from Berlin), the local community seemed to have displayed a disproportionate reaction to a distant threat compared to previous historical invasion scares (see Chapter Two). This threat was also anticipated throughout mainland Australia, including regions and towns of country South Australia (SA), such as Peterborough, Kangaroo Island and Barmera where air raid shelters were likewise built. The precise range of forms that this physical reaction to anticipated bombardment took, and which are sporadically alluded to in the documentary records and secondary histories, have never been adequately quantified or qualified, much less examined materially nor has the range of responses been explicitly linked to fear.

The starting point of this research is founded on answering some basic questions: what types of shelters were constructed, by whom and when? How many were constructed? Where were they placed? These questions are directed at uncovering both public and domestic agency in an attempt to understand the overall frequency and pattern of shelter construction. A further obvious question is determining where the designs of Adelaide's shelters originated. Previously, Adelaide had no need for shelters and was assumed to lack a body of associated research in this field. Many shelters, however, were built in a very short time by a wide range of people, so an investigation of the range of influences on these designs was imperative.

This leads to a suite of more abstract questions relating to the domestic agency of shelter construction, for example, why were particular types of shelters chosen over others? Were there any links between their building materials, location and construction? Were there any links between who built them and why? These questions help to understand and interpret the individual shelter builder's place in society, and the choices that each made as a result of personal, social and economic constraints. Questions relating to decisions made by individuals depend more on variables such as economic means, gender, past military experience, or utilisation of a particular style of specific material culture as a display of their individual identity, rather than just a need to erect some form of protection. The sum of these individual 'Adelaide stories' can provide us with a local and unique social history of structural defence and, in doing so, contribute to wider understandings of Australian society between 1939 and 1945.

It is argued that the study of shelters gives archaeologists access to the psychology of wartime. This research will directly link fear with shelter building by testing the hypothesis that fear was a major driver in shelter manufacture leading ultimately to the creation of a landscape of fear in Adelaide. Fear will be investigated variously through the following aims:

- An archaeological analysis of the strength of specific types of domestic shelter and their placement in certain areas (for example adjacent to wartime manufacturing precincts or the expected directions of attack) and comparing this data with those built (or not built) away from the same high risk areas. It is hypothesised that people living in probable target zones would be more fearful of attack than those not living there and consequently build stronger shelters.
- Scrutinising the very visible placement of shelters by the authorities in public spaces as a method of alleviating public skittishness.
- Investigating shelter building by groups of friends and neighbours as examples of solidarity in Adelaide's society where the community gained strength and overcame their fear by uniting against a common enemy.

The results of these investigations will also be linked to contemporary wartime psychological studies into how aerial bombardment affected behaviour and what scared people the most about being bombed.

One outcome of this research is the development of a typology which links to social contingencies for this unique Australian cultural resource and which can ultimately be used as a management tool for assessing the heritage significance of this type of material culture. A further outcome is that our understanding of the material responses to threat will be greatly enhanced.

1.6 Constructing the argument

Chapter Two briefly outlines historical defence schemes in Australia with particular reference to SA. Chapter Three demonstrates how the construction of the particular landscape of fear in WWII Adelaide was intimately tied to technological advances in aircraft design and a resulting shift in the geographical location of the battlefront, with civilians now becoming the targets of hostile nations. Chapter Four summarises the literature on the archaeology of Australia's home front passive defence and demonstrates the paucity of themed research in this area. Chapter Five outlines the methods employed in piecing together the history of Adelaide's air raid shelters, locating historically known and extant examples, recording them and also recording the oral histories associated with them. Chapter Six outlines the historical results derived from archival research. It discusses the impact of the *Emergency Powers Act, 1941*[4], and the Code for Air Raid Shelters, 1942[5], on the local landscape, and provides a typology of civilian structural defences common in Adelaide during WWII. Chapter Seven presents the archaeological results. These are derived from an analysis of the fabric of existing shelters and of the oral histories relating to extant and demolished structures. Included is data retrieved from archival sources which contribute information relating to the physical aspects of the shelters, such as dimensions and materials used. Chapter Eight discusses the spatial distribution of the shelters against the wartime landscape of Adelaide, highlighting the spread of each Type. It also profiles the shelter builders and the associated division of labour linking the shelters to wealth, previous combat experience, occupation and gender. Chapter Nine expands the notion of the psychology of fabric. It demonstrates how shelters are endowed with psychological attributes and how these can inform us of the mental health of the society that built them. It also links the range of responses to the level of fear experienced adjacent to target areas and expected directions of attack. Chapter Ten concludes the study by detailing the fate of each Type and discussing the heritage reality for wartime

[4] The *Emergency Powers Act, 1941*, referred to as the Act henceforth, enabled the establishment of civil defence infrastructure and the disbursement of funds for the protection of South Australian civilians during any future Commonwealth war.
[5] The Code for Air Raid Shelters, 1942, referred to as the Code henceforth, established minimum standards for shelter construction in South Australia.

shelters today. It outlines the importance and potential of this research and identifies possible comparative studies worthy of investigation for future research.

Chapter Two

A Shifting Frontier

Sometimes in military history, technological break-throughs can mark a change in the way warfare is approached…Other times, it is not so much the technological improvements as such which change the way things are done, but the manner in which existing technologies are combined to produce a weapon of hitherto unheard of capabilities.

Hill and Wileman 2002: 183

2.1 A legacy of perceived international aggressors

Throughout the eighteenth and nineteenth centuries both the Colonial Office in London and the inhabitants of the Australian colonies perceived their biggest external threat to come from an aggressive international force. This anxiety was variously demonstrated in constant suspicions of the intention of rival sovereign states, including France (from 1788), America (1839, 1862), Russia (1870s, 1880s), Japan (1890s, 1941) and Germany (1914, 1939). From 1859, the British military and naval presence in Australia reinforced the entity known to the Admiralty as the 'Australia Station', and prioritised the provision of a safe re-coaling port for the Royal Navy in Australasia (Bach 1986; Nicholls 1995: 1-15; Oppenheim 2005: 64). The British Admiralty maintained a chain of such stations within steaming distance of each other between England and Australia, all of which were heavily defended (Jervois 1880: 18-20).

Such facilities gave Britain an enormous tactical advantage over her rivals and ensured her dominance as a naval and policing power in the Asia-Pacific region[6]. Enemy fleets without access to re-coaling ports needed to include colliers (ships used for carrying coal) in their flotilla, greatly limiting the range and size of the warships operating away from their main bases. This worked to Australia's advantage in the late nineteenth century, for it was considered by contemporary military tacticians that nothing larger than a cruiser (a fast, but lightly armoured warship) could approach and threaten the Australian coastline (Bach 1986: 187;

[6] Early in WWII this chain of ports also enabled the Admiralty to send out their merchantmen sailing to and from Australia with only enough fuel to get from one to another. This thwarted the possibility of their capture in the Indian Ocean by German commerce raiders, such as the *Pinguin* (*Hilfskreuzer* 33), and then being sailed on to Germany as prize ships (Brennecke 1955[1954]: 133-134).

Oppenheim 2005: 183-184; Denis Gojak 2005, pers. comm. 3 June, Historical Archaeologist, Banksia Heritage).

Certain shortcomings in the operation and administration of the British Army following the Crimean War (1853-1856) and Indian Mutiny (1857), however, led to the implementation of numerous reforms, including the withdrawal of British troops from its self-governing colonies (1869). In 1870, and as one consequence of these reforms, the last British troops stationed in Australia were withdrawn after an unbroken presence of eighty-two years. This perceived abandonment left a huge hole in the morale of the colonists, as well as in local defences. It also led to a general panic, resulting in an ill-considered and un-coordinated defence strategy. A flurry of coastal defence construction followed, as well as poor investments in outdated military technology.

The history of SA was no different to other colonies in this regard. At settlement (1836), SA had been largely defenceless. A quarter-guard of Royal Marines had arrived in the Colony aboard Her Majesty's Ship *Buffalo* with Governor Hindmarsh, but its function was that of a regal guard and not a provincial defence force (Zwillenberg 1979: 14). When approving settlement in the early 1830s, the Imperial government "made it clear that it had no intention of providing troops for the service of the province, considering it to be a non-penal colony" (Harris 1997: xiii). This implied that international aggression was also not a considered likelihood so soon after the defeat of Napoleon. By the 1840s and 1850s, SA's economic viability finally became apparent through its copper and agricultural products, as well as its growing importance in the transportation of gold from Victoria (VIC). A permanent military force of artillery was established in 1880.

That local defence was a topic of much debate in the Colony of South Australia is evident by the large number of Parliamentary Papers on the subject, with one per year tabled between 1854 and 1876. Most of the discussion and debate centred on the merits of investing in either naval vessels or land based defences to protect Glenelg (at that time Adelaide's second port), Port Adelaide (Adelaide's main port) and the Semaphore anchorage (the main anchorage off Adelaide). Since it shared no common border with a foreign power and had no navy to use as its main line of defence, the principal threat to the Colony of South Australia in the nineteenth century was seen as coming from the sea.

Sir William Jervois, Governor of SA from 1877 until 1883, promoted a defence plan for the colony to protect its main port. During the late 1870s and early 1880s, Jervois constructed two massive fortifications—one at Taperoo (Fort Largs) and the other at Semaphore Park (Fort Glanville). Fort Glanville was built of "400,000 best Melbourne hard bricks, 15,000 yards of lime concrete and over 30,000 cubic feet of assorted timber" (Colwell 1973: 72). The battery included two Armstrong 10 in. rifled muzzle loading guns, whose 6,500 yd (10.5 km) arcs of fire could keep the light cruisers of the day well back and out of range (Fort Glanville Historical Society 1996: 11).

Accessories to these forts included a solitary cruiser (Her Majesty's Colonial Ship *Protector* - 1884) and a military road (named with typical military understatement—Military Road) connecting the forts to Glenelg, where a third fortification was planned, but never built. It had long been argued that a military road would enable "a battery of light field guns…well horsed to move rapidly along the coast, under the sand hills…these guns would probably be able to prevent the landing of troops and seamen from boats" (Wiseman 1866: n.p.). A torpedo station guarded the entrance to Port Adelaide via a cable of sea mines (known as torpedoes in colonial times) stretching across the Port Adelaide River at Hindmarsh Reach and having provision for the launching of a torpedo boat adjacent to the North Arm (Wimmer 2008: 14).

Jervois's planned defences represented nineteenth century notions of a defendable colonial frontier conceptualised around the insular nature of the Colony of South Australia. By the late nineteenth century, and largely as a result of the increased sophistication and power of artillery which was, by then, able to breach most masonry structures (as demonstrated by the Prussian siege of Paris in 1870), frontier defences were often chains of forts incorporating features such as iron cupolas and massive concrete sections. In Adelaide, these forts were positioned in such a way as to be able to provide cover for each other with their respective heavy guns.

With Federation in 1901 and the creation of the Ministry of Defence, jurisdiction over each colony's defence assets passed to the Commonwealth. Within a year of Federation there existed two arms of the Australian defence force—the Commonwealth Military Forces and the Commonwealth Naval Forces. Within the first decade of Federation an elaborate system of compulsory military training had begun for all males aged 12-25 (Dawes & Robson 1977: 5). The Ministry of Defence instituted a series of over-reaching Defence Schemes for each state (SA being 'District 4'), with further military sub-divisions within each state so that, for example, there was a dedicated Port Adelaide Defence Scheme as part of a larger Defence Scheme for SA.

These schemes were put into place to meet probable requirements at two levels—a precautionary stage and a war stage. They included, amongst other things, lists of available vehicles and horses, train timetables for moving troops to the border, states of readiness of the troops in each military district and so on, copies of which were also lodged with the Commonwealth. The schemes were, from time to time, subjected to a 'dress rehearsal' to check the mobility and preparedness of troops allotted to specific areas. For example, the Port Adelaide Defence Scheme was tested on 4 October 1913, with a memo from the Major, General Staff, to the Officer Commanding, Royal Australian Garrison Artillery, to "leave no stone unturned to make this mobilisation a success" (NAA: D848,1908/9). In this instance, the precautionary stage was tested in the morning and the war stage in the afternoon.

By 1914, the industrialisation and mechanisation of the armaments industry had reached such an extent that all aspects of Western social structure and infrastructure could be mobilised for war. Indeed, the 'dress rehearsals' of various defence schemes in Adelaide and Australia a year before the commencement of WWI seem little more than a street pageant when compared to the massive movement of men and machinery in Europe during the first year of war. By that time, enemy troop movements such as these could be observed and attacked by aircraft, as could every other aspect of a nation's war economy, including its workers. By the end of WWI, aircraft had made a mockery of all previous defence practice and had, within two decades of that conflict ending, forced Australian governments to consider and construct structural defences for their respective civilian populations.

2.2 Edwardian future past: Flight and social destruction

> It is curious how the final boom of flying began. It was like the coming of a breeze on a quiet day; nothing started it, it came.
>
> Wells 1921 [1908]: 177

In 1907, only four years after *Wright Flyer 1* made the world's first heavier-than-air powered flight, and seven years ahead of WWI, H.G. Wells wrote his prophetic *The War in the Air*. In it, Wells provided a glimpse of a global conflict fuelled by air-borne war machines. He theorized how German airships could be used to attack a naval fleet and bomb a major city, inflicting immense damage and reducing an organised government to capitulation in the shortest time. He described the confusion and carnage on the ground, the rubble of the bombed buildings, and the charred, often still living bodies of girls and women being carried out of the destruction by emergency services personnel. He proclaimed that "catastrophe was the logical outcome of the situation created by the application of science to warfare. It was unavoidable that great cities should be destroyed" (Wells 1921 [1908]: 278) and that "war [will become] perforce a universal guerrilla war, a war inextricably involving civilians and homes and all the apparatus of social life" (Wells 1921 [1908]: 300). Forty-five years later, Gunther Bloemertz (1954: 72), a German WWII fighter pilot, recounted in his memoirs how just such visions of destruction gave him the courage to attack the impenetrable formations of American Boeing B-17G bombers heading for Germany over France:

> … [t]he fighters are diving down from all directions on to their prey – trying to think of them as beasts who trample women and children under their hooves!

Wing Commander Ira "Taffy" Jones (1955: 15) recounted that:

> THE ROYAL FLYING CORPS, Naval and Military Wings, was formed on May 13, 1912, with a strength of seven aircraft and even fewer qualified pilots… [but] like most new weapons, the aeroplane was greeted with little enthusiasm by any general or admiral…. Wedded to the horse and the battleship, the "top Brass" could see no future for this man-made, clumsy imitation of a bird.

By the time of the formation of the Royal Flying Corps, Wells' "futuristic romance" had already predicted that it was possible for flying machines to alter the character of war. In 1916, Wells travelled to the Western Front as an observer and witnessed firsthand the salience of his fervent mind. In the 1921 preface to a post-WWI edition of his earlier work, he noted that war was no longer an affair of "fronts" and had come to mean social destruction instead of victory because of it. War had become total and all consuming (Wells 1921: 167).

In the first half of the twentieth century, it was unknown exactly how aircraft would be used in future wars, but the potential of their destructive power was perceived to be immense. This perception underwrote the 'Air Clauses' of Part V. Section III, Articles 198-202 of the Treaty of Versailles, which forbade the armed services of Germany from having any military or naval aircraft and dirigibles after 1 October 1919. It also led to the creation of a separate set of guidelines for the regulation of air warfare by the international community that attempted to restrict such warfare to purely military targets. In principle, these guidelines corresponded to the treaties regulating war on land and sea. Part II of the 1922/23 Geneva Convention, which governed the use of aircraft in warfare, consisted of 62 articles. Although never adopted in legally binding form, Articles XXII to XXVI related directly to bombardment and was largely concerned with the safety of the innocent civilians of belligerent nations, as well as the protection of their monuments and cultural heritage. Of particular relevance to this study, and one that seemed to have been abused by all participants, is Article XXII of *The Hague Rules of Air Warfare* which stated:

> Aerial bombardment for the purpose of terrorizing the civilian population, of destroying or damaging private property not of a military character, or of injuring non-combatants is prohibited (International Committee of the Red Cross [ICRC] 2005).

As early as 1925, a sub-committee reporting to the Home Office on its investigations into air raid precautions concluded that *The Hague Rules of Air Warfare*:

> …provided no appreciable protection for a civil population against air attack… [and that] targets recognised as legitimate in these *Rules* would normally be situated so close to populous centres that even a discriminating enemy could not avoid injuring civilians and their property (cited in O'Brien 1955: 18).

Countless published personal recollections (on both sides) from the war years bear witness to such abuses of the Convention's articles. *Daily Mail* war correspondent with the Royal Air Force (RAF) in France, Noel Monks (1941: 235), described the navigation of German pilots carrying out the night raids on Britain in September 1940 as "putrid, even though they have only a twenty minutes' hop across the Channel from France… [But] their bomb aiming is worse. That is, if they aim at all". Monks colours his accounts with adjectives such as, "murderous attacks", "Hunnish brutality", and "barbarous brutishness" when recounting the German raids against England.

He singles out a raid on London on the night of 7 September 1940 for special attention, when a gigantic fire at London's docks lit up the whole of the city:

> Never would night bombers have better opportunities to do some real damage to real military targets. It was like daylight. But apart from an odd warehouse or two, a slightly damaged power-station, and a few bombs near a railway station, the Nazi murderers let all their bombs go in thickly populated areas, on hospitals, churches, and other purely non-military localities…. It was the foulest bit of military bombing ever recorded (Monks 1941: 235-236).

Retaliatory raids against targets of no obvious strategic value were a common phenomenon during the war, with the most famous being the German response to the Allied bombing of the medieval cities of Lübeck and Rostock. These became known as the Baedeker Raids, where it is reputed that the Germans used the pre-war Baedeker tourist guide book of Great Britain to bomb picturesque cities (such as Bath and York) that had been given a three star rating in the guide. The Allies were to eventually repay the Germans ten-fold. Air Chief Marshal of the RAF, Sir Arthur "Bomber" Harris, wrote in his memoirs of the strategic bombing of Germany during the Second World War:

> It must be emphasised that in no instance, except in Essen, were we aiming specifically at any one factory during the Battle of the Ruhr; the destruction of factories, which was nevertheless on an enormous scale, could be regarded as a bonus. The aiming-points were usually right in the centre of the town (cited in Galland 1955 [1953]: 295).

Strategic bombing is an umbrella term encompassing the two arms of precision and area bombing. Precision bombing was a technique used to surgically target specific enemy plants and installations and was normally carried out in daylight raids. Area bombing (also known as 'de-housing theory' in the UK) was generally conducted at night against large cities and was "designed to spread destruction over a large area ... [such raids] were intended to primarily destroy morale" (USSBS 1976b [1946b]: 71). English cities had suffered just such a fate, as was evidenced by the huge numbers of homeless people produced by the London *Blitz* (Woolven 2002: 209). Sir Ernest Gowers, Senior Regional Commissioner for the London Region, in statements made at the House of Commons, 6 February 1941 (see Woolven 2002: 295 - Annex A, for the full transcript), claimed:

> It was our over-insurance against damage to the person and under-insurance against damage to homes that early presented us with the grave problem of looking after the unwounded people who had lost their homes and the lesser problem of repairing those homes. The homeless reached a peak figure of about 26,000 on the 26th September [1940].

It is a strange quirk of history that evolving technology enabled the development of tactics such as strategic bombing, while such tactics were also shaped by the limits of technology at any given time. The Butt report of 1941 (see Longmate 1988: 120-121) had shown that aircraft navigational and guidance systems were insufficiently advanced to allow precision bombing at night, leading instead to the concept of area bombing[7]. 'De-housing theory', another example of the speculative character of this type of warfare and the need for some type of quantitative data, had developed from a 1942 analysis of the German raids on English cities. This showed that "one ton of bombs dropped on a built-up area demolishes 20-40 dwellings and turns 100-200 people out of house and home" (Longmate 1988: 131). This figure was factored into a formula which included the tonnage of bombs each aircraft could carry, how many sorties it could expect

[7] It was only in early 1944 that 617 Squadron, under the leadership of Leonard Cheshire V.C., developed the tactic of low level marking, at a height of only 400 feet, of targets with flares enabling bombing runs of surgical precision against small and dispersed targets (Braddon 1956: 118-139). Brickhill (1953: 13) described 617 Squadron tactics as "pointing a way towards the end of "carpet" bombing of cities, that dreadfully inescapable feature of recent war."

to conduct and the number of inhabitants living in the largest German towns. The calculation showed that the exercise would leave approximately one-third of the German population homeless by mid 1943. The investigation further showed that: “having one’s home demolished is most damaging to morale… [and] there seems little doubt that this would break the spirit of the people” (Longmate 1988: 131). By the end of the war, 20% of Germany’s total residential units had been destroyed or heavily damaged and 7,500,000 people had been rendered homeless (USSBS 1976b [1946b]: 72).

This situation led directly to the development and implementation of a suite of civil air defence initiatives by the various combatants that became known collectively in the Commonwealth as ARP, and from late 1941 as Civil Defence. Sir Keith Hancock (1955: xiii), editor of *History of the Second World War*, expressed the view that:

> The advent of a fourth Service, ‘Civil’ by designation yet destined in all probability to take permanent place alongside the three Fighting Services, is an historical theme of great importance.

These precautions were designed and implemented in such a way as to off-set the negative psychological effects of civilian bombardment in both European and Australian contexts.

2.3 The UK genesis of ARP

ARP theory and practice traces its origins back to WWI when German *Zeppelins* and *Gotha* bombers (see Cole & Cheesman 1984) conducted 103 bombing raids over the British Isles (O’Brien 1955: 11; Titmuss 1976: 4). O’Brien (1955:10) noted, however, that “[w]hat is of more interest to this narrative is the development from the summer of 1917 of greater public nervousness under attack or the threat of attack". Some observers, such as J.B.S. Haldane (1938: 41), pointed out that the number of casualties sustained in those early raids was extremely small:

> …in fact vastly fewer than the numbers killed by motor-cars or measles during a similar period… [yet] in view of the fact that people tolerate fast motor-cars, and readily preventable diseases, their great objection to being bombed from the air is an interesting psychological fact.

From this time on, it was clear that the morale and fighting spirit of a civilian population were considered as much a resource as the economic assets of the enemy (Best 1994: 199) and, as such, warranted destruction. Baker (1978: 1) wrote that:

> … [n]o attempt had been made to provide anything more than emergency shelters then [during WWI] but the attacks were sharp enough to be remembered and as early as May 1924 an Air Raids Precautions Committee was set up by the Government.

During the inter-war years, and given the lessons of 'Total War' learned between 1914 and 1918, there was much ministerial and departmental planning and discussion in England about the character of the next war and how it would affect the civilian population. In 1921, Ferdinand Foch (Marshal of France) realised that "the potentialities of aircraft attack on a large scale are almost incalculable" (cited in Tecton Architects 1939: I). In 1932, Stanley Baldwin declared in the House of Commons that "no power on earth can prevent the man in the street from being bombed…the bomber will always get through" (cited in Jones *et al*. 2004: 465; see also Churchill 1964[1948](a): 120-144). Baker (1978: 1) noted that as early as 1924 "[t]he first of many committees to examine the problem of future air attack reported that the moral effect of air-attack is out of all proportion to the material affect which it can achieve". As a result, "[t]he primary aim of ARP services …was not the protection of individuals and property from destruction, but the maintenance of the morale of the people" (Jones *et al*. 2004: 466).

In April 1935, the Air Raid Precautions Committee (sitting since 1924) had evolved into the Air Raid Precautions Department of the Home Office. Woolven (2002: 53) observed that this was a major step in civil defence thinking for "the public was now conscious that a bombing threat existed and that the Government was taking precautions to protect them". In December 1937, the ARP Bill received Royal Assent. It came into force on 1 January 1938. Early initiatives to educate the public in ARP included the publication and distribution of numerous handbooks and memoranda on civil defence, as well as ARP-related ephemera. This included collectors cards highlighting aspects of ARP which were freely distributed in cigarette packets such as those produced by WD & HO Wills, Churchman and Ogdens, and which the Home Secretary, Samuel Hoare, termed "cigarette cards of national importance" (The London Cigarette Card Co. Ltd. 2013). Such cards were also placed in sweet packets in Australia, including those of Allen's Butter Menthols[8] (Figure 2-1).

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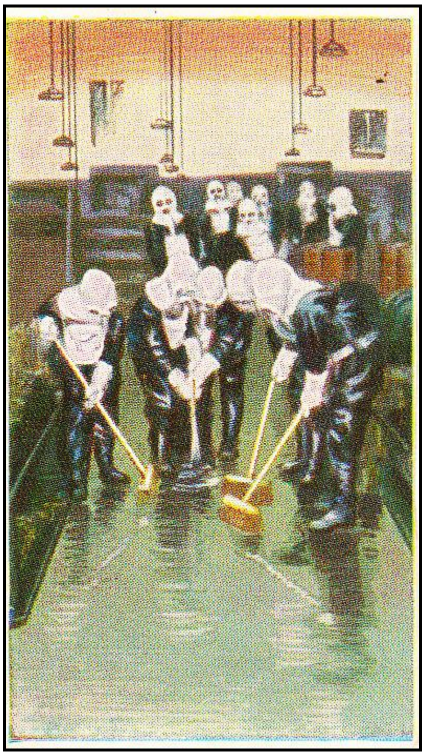
[8] In Adelaide, all school children carried a small cloth bag during the war which contained bandages, ointment, a blood group disc, a rubber cork for biting down on during bombardment, and barley sugar or Butter Menthol (both which had to continually be replenished). Moya Moore (Moore ED00017: 1) recalled "eating at least three packets [of Butter Menthol] a week". With the inclusion of Butter Menthol in the First Aid bags, parents and school children alike would have been exposed to the educational value of ARP collectors' cards.



ALLEN'S

BUTTER MENTHOL COUGH DROPS

3d. *Per Packet*

Butter Soothes the Throat
Menthol Clears the Head

Series Two.
No. 69

ANTI-GAS REALISM.

Coventry is giving the Empire a lead in many directions with its air-raid precautions. At least one factory has its own anti-gas squad fully equipped and trained to deal with any emergency.

Figure 2-1: ARP card issued with Allen's Butter Menthol Cough Drops
(Author's collection)

It was the general view at this time that public confidence would be bolstered through supplying sufficient technical information to reassure them of the adequacy of proposed protective measures, particularly if they could use this information to help themselves. Lieutenant-Colonel Veale (1939a: 15), City Engineer and Surveyor of Adelaide, and also co-ordinator of ARP plans and schemes in SA, claimed in an ARP lecture given to the Australian Institute of Engineers in Adelaide in 1938 that “[i]n a crisis ignorance breeds fear, whilst knowledge breeds confidence”. Further, by actively engaging civilians in their own protection and enlisting them to help construct air raid shelters and the like, it gave them a sense of feeling that they were in control and militated against a feeling of helplessness (Jones *et al*. 2004; 2006).

Consequently, it was advocated that:

> … the publication of all the data relative to air-raid technique and protection is therefore an absolutely essential factor in maintaining morale…it would also allow technicians to study the most efficient and economical means of protection (Tecton Architects 1939: 2-3).

The *Air Raid Precautions Act* (1937) made it compulsory for local British authorities to plan and initiate adequate defensive precautions, yet little progress had been made by September 1938. Adequate ARP was a crucial question "as some assumed (with reference to Baldwin's remark) that no defence against air attack was possible, while others … supported by the Cement Makers Association [sic], demanded deep underground shelters" (Woolven 1998: 54). Not surprisingly, it was the Cement and Concrete Association (CCA) (n.d.a: 7) who claimed that "to remain unprepared is to invite aggression, and to ignore the risk of attack from the air…is to neglect a necessary part of our defensive organisation". In a broadcast on 14 March 1938, Samuel Hoare, the Home Secretary, stressed the value of ARP and general preparedness as a "deterrent to an enemy contemplating the strategy of an aerial knock-out blow" (cited in O'Brien 1955: 120). However, as Meisel (1994: 313) indicated, there was still a real fear in the government that supplying deep shelters for the general public would instil in them a shelter mentality, and interrupt essential production by keeping the population of workers underground each time the enemy feinted an attack. The 'Munich Crisis' of September 1938 saw "millions of gas masks …issued to the public...miles of trenches dug…in the public and Royal Parks; [and] sandbags …used to protect public buildings…" (Woolven 1998: 56). The 'Crisis' served to highlight the virtual non-existence of civil defence in England and provided the push to better prepare for war.

Up to this point there had been a long standing policy of dispersal, with the belief that "the chief protection available to most citizens would be that afforded by their homes" (O'Brien 1955: 170). An alternative and somewhat more sinister explanation for this policy of dispersal hinged on the fact that shelters also had a social dimension that allowed people to congregate and exchange ideas. This was of great concern to civil defence planners, who feared it would be impossible to control a mob affected by panic and mass hysteria—the predicted mass-psychological effects of aerial bombardment. Dispersal was thus one way of ensuring the social *status quo* (Meisel 1994: 318). With the appointment of Sir John Anderson as the Lord Privy Seal in October 1938 and his announcement of the 'shelter programme', the UK Government substantially upgraded their support for citizens. In official circles it was considered that "some form of shelter in the home [was] an important factor in assuaging individual anxieties about the war" (Meisel 1994: 314).

> The invention of a practical household shelter [the corrugated iron Anderson shelter]…had transformed the possibilities hitherto envisaged for protection of homes against air attack. The Government had undertaken to supply these shelters, as well steel fittings for strengthening basements, free to some 2 ½ million families. They would also give more positive help over the provision, as a subsidiary means of protection, of public shelters (O'Brien 1955: 187).

Meisel (1994: 317) saw the Anderson shelter as an instrument through which the government could deflect criticism over its approach to ARP:

> In socio-psychological terms the government's ARP measures, especially the Anderson shelter, provided each household with the illusion that it had the means to defend itself against the effects of war, and that, in the era of aerial bombing of civilians, the home could still be a castle… since the provision of this [psychological] comfort was aimed at the individual household, official policy shrewdly or intuitively eroded the basis for mass discontent over ARP.

An example of the propaganda value of the Anderson comes from a Prime Ministerial letter dated 26 June 1940. In it, Winston Churchill (cited in Churchill 1964[1948]b: 152) instructed the Minister of Information not to publish "[p]hotographs showing shattered houses…unless there is something very peculiar about them, or to illustrate how well the Anderson shelters work" (see Figure 6-6).

In 1939, Tecton Architects published *Planned A.R.P.*, a text based on a feasibility study of structural air raid protection in the London Metropolitan Borough of Finsbury. Produced by technicians instead of the usual troupe of bureaucrats and ministries (most shelter work had previously been carried out by the Research and Experiments Branch of the Ministry of Home Security [Baker 1978: ix]), the text incorporated the contemporary theory and practice of terror bombing, and outlined strategies for minimising its effect on the population of Finsbury by constructing a series of 15 deep underground concrete shelters accommodating either 12,300 or 7,600 people each. It was estimated that these 15 structures could shelter a daytime population of 132,000 people (100,000 more than the residential population). Tecton had also identified flaws in English ARP, claiming: "the present chaotic state of this country's A.R.P. is due to the fact that there has been no *planned* policy, but rather a spontaneous growth" (Tecton Architects 1939: 123 – italics in original text).

2.4 ARP in Australia: No longer "girt by sea"

In October 1938, Lieutenant-Colonel Veale presented a paper to the Adelaide division of the Australian Institution of Engineers entitled *Air Raid Precautions Concerning the Civil Population*. In it, he summarized the preparations and completeness of ARP schemes overseas and pointed out that in England "intensive training with respect to air raids [was] being carried out, and complete organisations [were] ready to function" (Veale 1939a: 15). In Australia, just as in Britain, the prime objective of ARP had been to prevent panic and ensure that the essential services of the country were maintained in full operation. Unlike Britain, however, something far less extensive had been advocated to achieve this for civil defence in Australia. Veale (1939a: 26) was of the opinion that "[t]he degree of preparedness or the extent of the measures to be taken in Australia…need not approach the completeness of the British schemes". He observed that both the official and general view in Australia (even at this time of heightened international tension) was that civil defence work seemed unnecessary. Instead, Australian States were to rely on "paper schemes" and theoretical outcomes until an "International Emergency" presented itself.

> The general principle to follow should be to concentrate on planning with respect to essentials, to have proper schemes and organisations complete to the last detail, together with accurate and detailed schedules of quantities and specifications for the execution of the necessary constructional work to be undertaken when the "National Emergency" period has been declared" (Veale 1939a: 16).

These paper schemes were pinned to the presumed division of ARP responsibility across Federal, State and local government: 'presumed' because there had been no official ‘pronouncement’ in Australia as to where funds for stratified ARP would be sourced. Nor would the States acquiesce with Federal proposals regarding the same. For instance, in May 1935 the Defence Committee had proposed that State Governments accept financial responsibility for protecting their civilian constituents against gas attack, supported by technical advice from the army. However, it was the opinion of the Premiers of VIC, Queensland (QLD) and SA that:

> …responsibility for organising and training and for all expenditure should be accepted by the Commonwealth… [Whilst] the Premier of New South Wales said that the organisation would be undertaken by the State …“on the understanding that the Commonwealth accepts financial responsibility”. Western Australia and Tasmania had not replied [to the proposal] (Hasluck 1965:126).

The issue was partially settled at a conference between Federal and State Ministers on 26 August 1936 in Adelaide, when it was agreed that the States would take responsibility for protecting their respective civilian populations in conjunction with technical advice provided by the Commonwealth. Even with this agreement in place, questions were still left regarding the finer details of financial liability between State and local government, issues which were not resolved until the Emergency Powers Acts were eventually passed through the parliaments of each State. These problems had been foreseen in the UK by 1929 when the Office of Works realised that: “[t]he amount of bricks, mortar and concrete needed to build adequate shelters and the cost of providing these would… be far too large to be viewed as practical possibilities” (cited in Baker 1978: 2). In England, the ARP ‘burden’ of limited resources of manpower, money and materials had been spread as widely as possible across civil departments, local government, industrial employers, and citizens enrolled as members of the ARP services (O’Brien 1955: 284).

This issue was largely resolved in the UK because the organisation of ARP through the *Air Raid Precautions* Act, 1937, centred on local government. However, the functions of local government in Australia differed greatly from those abroad. For instance, in the 1930s and 1940s, State Government in Australia controlled many of the functions under local government jurisdiction in Britain (such as sewerage, waterworks, tramways and hospitals amongst others). This made it difficult to apply the British template for ARP directly to Australian society. The theory and methods of precaution affecting public utilities, emergency services and civilians were basically the same in both countries, but the responsibility for carrying them through, whether it lay with a municipality or the State, was not yet clearly defined in Australia (Veale 1939a: 17).

A 1938 snapshot of Veale's theoretical framework of ARP obligations across the hierarchy of Australian government reveals the following divisions and responsibilities: "[t]he general planning of the whole scheme of air raid precautions for Australasia…[t]he provision of necessary information relative to air raid precautions…[t]he provision of air raid precautionary measures with respect to Federal departments and…[t]he provision of gas masks and protective clothing to the States" belonged to the Federal Government. "The co-ordination of the numerous schemes with respect to [State] government departments, local government, air raid precautions areas, [and] industrial undertakings", as well as casualty services, fell under the jurisdiction of the State. Finally, schemes regarding "[r]escue work…Repair services…construction of first aid posts…Public air raid shelters for emergency and exceptional cases [and] decontamination of [public] personnel" were the responsibility of Local Government (Veale 1939a: 17).

Veale's views as Director of ARP for SA seem grounded in the official stand on national planning and general preparedness which was outlined in the *Commonwealth War Book* and compiled by the Defence Department, rather than in any original thought. Hasluck (1965: 133) noted that all States had been handed a copy of this document by March 1939. Chapter VIII of the *War Book* dealt with "Civil Defence (Air Raid Precautions)", and its sub-headings not only indicated the lines along which planning should proceed, but also the matters which the planners then, and subsequently, saw as being problems of civil defence. For example, Chapter VIII/4 was titled 'Protection of the Public'; with part (a) covering air raid shelters (Hasluck 1970: 636). The *War Book* not only covered the precautionary measures to be taken when war was imminent, but also those to be taken immediately after the outbreak of war, and was modelled on the *United Kingdom War Book*. Copies of the UK version had been supplied to the Federal Government in the early 1930s following a general desire at the 1930 Imperial Conference to adopt a standard form throughout the British Commonwealth of Nations (Jones 1995: 32). The Australian edition focused on Federal cooperation both with and between the State Governments, and encompassed preparations for both military and civil defence, including all aspects of ARP.

As England had been the main supplier of arms, and of defence theory and technology to Australia since 1788 (Wimmer 2008), it comes as no surprise that ARP handbooks and memoranda published by His Majesty's Stationery Office, London, and the CCA, London, found their way to the Antipodes. The CCA was an advocate of the use of concrete as a substitute for other traditional building materials and published a number of brochures on air raid protection. These included advice and recommendations for the home as well as factories, offices and open spaces. The CCA brochures were often issued in advance of the Government sanctioned ARP handbooks, with a disclaimer making it clear that the content of their publications did "not necessarily represent the forthcoming official recommendations" (CCA n.d.c: 3).

This position was highlighted by the CCA's (n.d.b: 11) estimation of 4 ft 6 in. of concrete as being adequate for overhead protection against 500 lb bombs, 6 in. less than the eventual lower-end standard in ARP Handbook 5A. The CCA gave advice on using concrete to bomb-proof and fire-proof attics, strengthen basements, and also on various domestic and communal shelter designs. The CCA seems to have obtained its technical data on the destructive power of bombs and designs for bomb resistance from continental sources, including official Italian and German publications, the French Ministry of Interior (CCA n.d.c: 23-24) and from the experience gained in the use of high explosive bombs in Barcelona (CCA n.d.b: 11). CCA brochures started arriving in Australia by at least mid 1938; they are un-dated, but the State Library of South Australia's accession date on CCA n.d.a is 1 June 1938, and CCA n.d.b, 20 June 1939.

Tecton's book was also cited in Australian ARP publications (see, for instance, A Group of Australian Scientists 1940: 36; and Fuchs 1942: 10-11 [although not referenced in this article]) and was available in SA at Allans Book Sellers of 51 Rundle Street, Adelaide, where a copy was purchased by Russell S. Ellis, a local architect, in 1939/40 (now *ex libris* Central Library, Flinders University). Tecton Architects outlined the different types of shelter and their construction (or reinforcement if an existing structure was to be re-used). They also provided guidelines as where best to situate them in order to maximise catchment of a permanent or floating population of pedestrians (for instance, adjacent to public transport, factories and hospitals) and for their proximity to utilities such as water, gas and electricity.

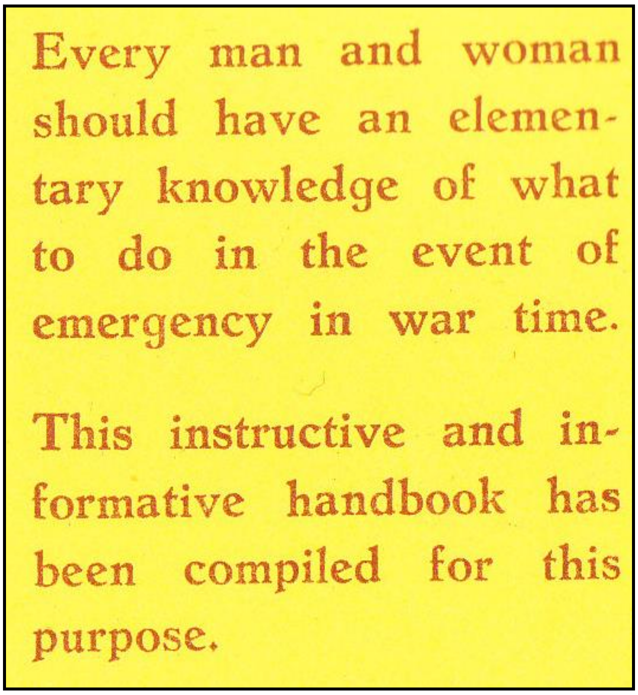
Information of this kind was not new to the public in 1939, but it did provide a more extensive suite of recommendations than previous publications. It was also supplied by qualified structural engineers, scientists and architects who felt a moral obligation to protect the population from direct hits by bombs and not just the blast of a near miss, which until this point, had been the crux of official policy (see Meisel 1994). Consequently, and given that this sort of advanced technical information was available locally in Adelaide by 1939, it is reasonable to assume that English ARP theory and practice was also, to some extent, embraced by the Australian public before Australian codes and standards regulating shelter construction and placement were ratified, and may have also helped frame local Australian codes.

Concurrently, and quite independently of these official bureaucratic schemes, segments of the Australian public had taken ARP matters into their own hands because of the increasing availability and access to information and publications on the subject. By 1936, journal articles on gas warfare began appearing in Australian publications, for example *The General Practitioner; Journal of the Institution of Engineers, Australia;* and *The Australasian Journal of Pharmacy* (see also the bibliography in Brooksbank 1940). In some instances, English ARP handbooks (for instance, #8 *The Duties of Air Raid Wardens*) were re-written with: "instructions set out [so as to] apply to South Australian conditions" (Veale 1939b: preface). Original, local ARP pamphlets and handbooks were also produced, sponsored and distributed by various State authorities, as well as independently by groups such as the Blind Self-Aid Society of Australia and the

Australian Mutual Provident Society (AMP). Local titles included: *Be Prepared! City of Prospect A.R.P. Warden's Handbook and Guide* (Williamson 1942); *Handbook of Advice for Civilians in War Time* (Blind Self-Aid Society of Australia n.d.) (see Figure 2-2); *Know Your Enemy and Improvise Your Own Defence* (Bartlett n.d.); and *A.R.P. Air Raid Precautions for Australians, H.E. – Fires – Gas: Civilians' Guide* (Brooksbank 1940). The latter had a preface beginning:

> … [t]he cheerful message I wish to convey in this constructive booklet is that the menace to health and life of air raids can be reduced by sensible precautions that do not involve much expenditure of money. It need only be in the exceptional case that Australian civilians are at the mercy of any warfare weapon….The plans outlined herein are non-aggressive. They amplify an existing civilian life saving organization, to be managed by civilians for civilians (Brooksbank 1940: 4-6).

As their titles suggest, these booklets advised all manner of do-it-yourself civilian defensive schemes, and provided charts of aircraft markings and silhouettes, diagrams of domestic dwelling fortification and home repair, as well as sketches on how to bandage wounds. These cheap (ranging in price from as little as a penny [2 cents] to a shilling [10 cents]) and readily available guides enabled the civilian populace, if they chose, to make some preparations for their own defence.



Every man and woman should have an elementary knowledge of what to do in the event of emergency in war time.

This instructive and informative handbook has been compiled for this purpose.

Figure 2-2: Inside front cover of *Handbook of Advice for Civilians in War Time* (Blind Self-Aid Society of Australia, Melbourne n.d.)

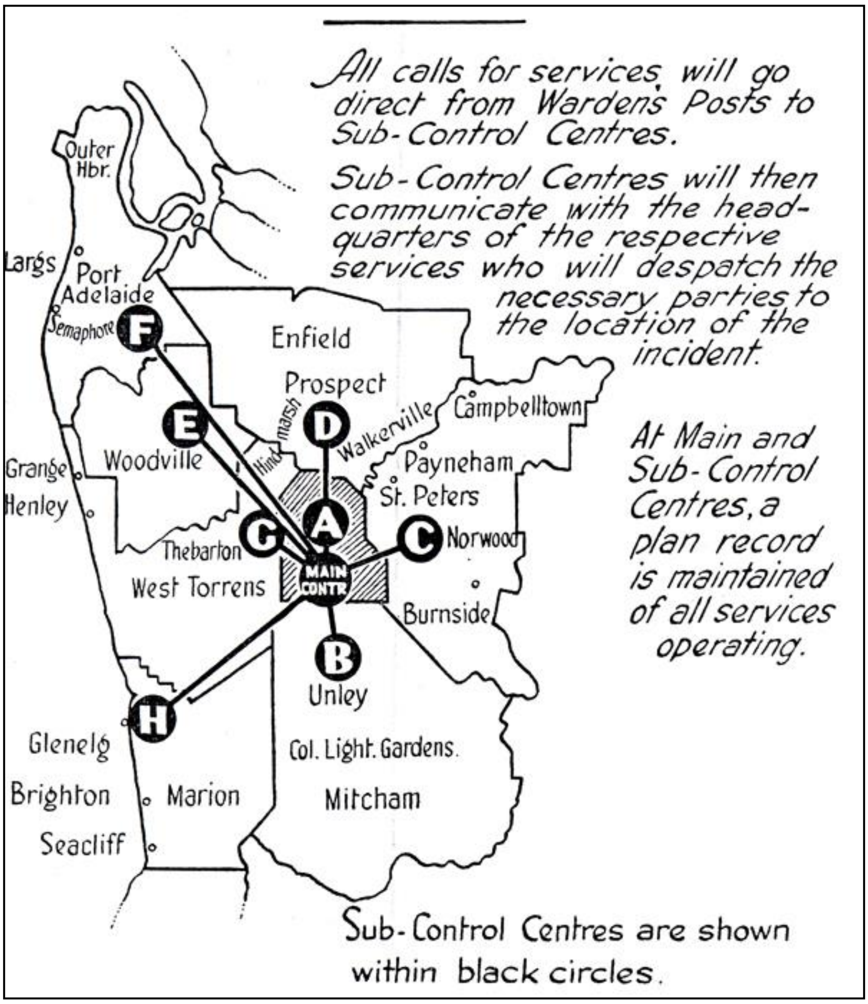
2.5 ARP in South Australia

According to Hasluck (1970: 638), SA preparations for civil defence had begun in August 1937. By the time of Veale's address to the Australian Institute of Engineers in October 1938, eleven South Australian Government services had prepared air raid precautions schemes, including the Adelaide City Council, the South Australian Harbours Board, the Engineering and Water Supply Department and the South Australian Gas Company, with another three, including the Fire Brigades Board, in the process of preparing their schemes. Up until 1939, schemes had only been considered for the metropolitan area, with one exception being the Port Pirie Smelters[9].

[9] Port Pirie is 202 km north of Adelaide.

Veale stressed that it was not important for each municipality to have its own scheme, but instead favoured the creation of ten air raid precautions districts across Adelaide designated around population size, location and the physical size of adjoining municipalities. Veale's plan for the sub-division of metropolitan Adelaide may have also been influenced by the fact that unlike Melbourne and Sydney, only some of the local councils in Adelaide employed an engineer. This may have meant that many councils lacked the competency to carry out, examine and maintain certain (especially structural) aspects of ARP in their own right. Hence, it may not have been feasible for most to enforce the Code in their jurisdiction (Angwin 1942).

In the end, eight, not ten, ARP districts (officially known as 'Sub-Control Areas') were developed, and in fact were drawn up on existing city corporations. These Sub-Control Areas were coded Area A through Area H (see Map 2-1).



Map 2-1: The positioning of the eight Sub-Control Areas of Adelaide
(GRG 9/28/28)

Area A covered the City of Adelaide and comprised the high density, low income residential area of the CBD, as well as the more affluent suburb of North Adelaide. Area B encompassed the City of Unley which incorporated the Mitcham and Colonel Light Gardens councils. Unley was one of the most heavily populated and moderately wealthy areas of Adelaide. Area C was the City of Norwood which incorporated the councils of Burnside, St Peters, Payneham and Campbelltown. Like Unley, Norwood was wealthy and heavily populated. Area D, the City of Prospect, included Walkerville, Enfield and a portion of Hindmarsh.

It had the smallest population of all Sub-Control Areas and its western edge fell in the industrial precinct of Adelaide. Area E, Woodville and Area F, Port Adelaide (which included Semaphore, Largs Bay and Outer Harbour), were the low income belt and main industrial areas of Adelaide with major haulage infrastructure running its length to the port. Area G, Thebarton (incorporating West Torrens, Grange and Henley Beach), had a small population and was largely swamp and market gardens. Area H, Marion, had a large population and included the wealthy beachside suburbs of Glenelg and Brighton as well as Seacliff.

Of all Australian States and Territories, Veale (1939a: 18-19) noted that SA was the best prepared for an attack against its constituents:

> … [i]t may confidently be claimed that the work already performed with reference to paper schemes [in this State] will … materially contribute to the reduction of panic in time of a possible crisis. The whole of this work has been performed without any publicity or without any alarmist idea as to its necessity…

This is an interesting point given that it was made two years before the *Emergency Powers Act*, 1941, was passed through the South Australian State Parliament (see *Acts of the State Parliament of South Australia - 1941,* 1942: 8-11). South Australia was, in fact, one of the last States to adopt such measures. Similar legislation (variously known as *Air Raid Wardens Act*; *Civil Defence Act*; or *Civil Defence* [*Emergency Powers*] *Act*) had already been passed in QLD and Tasmania in 1939, and WA and VIC in 1940. The fact that provision for the physical aspects of civil defence (and not just funding) to the general population had not yet been mandated in SA may well be another reason why preparations had, by and large, proceeded no further than Veale's paper schemes, but it does not explain why other States were so far behind SA given that they had legislated earlier.

Independently, and well in advance of these official undertakings, the South Australian Defence Society had become the first organisation in Australia to arouse public interest in and teach ARP (PRG 925/1/1). It was founded and presided over by Adelaide woman Natalia Davies[10] who, fearful that a war with Germany and Japan was inevitable, addressed the first meeting of the Society on 25 February 1933 (almost seven years before Hitler invaded Poland and nine years before Japan's attack on Pearl Harbour) and declared: "the necessity of preparing for warfare on civilians by securing gas masks and building fortifications" (PRG 925/1/6). The Society networked with the British Home Office, obtaining the latest information on developments in ARP and disseminating it through public lectures on air-raid and poison-gas precautions (Jones 1993: 584). Classes composed predominantly of women also taught first aid, home nursing, aero engineering, motor engineering, elementary electrical work and fire drill. During the war, the Society, a member of the Women's War Service Council from July 1941, was allocated special war activities, including training women in the handling of firearms. It taught hundreds of women how to shoot and maintain a rifle and extended this activity to pistol shooting (PRG 925/1/1: 1-2; Jones 1993: 584).

Once underway, ARP in Australia could well have been a double-edged sword, in that the very public precautionary measures advocated and undertaken by various authorities actually may have compounded the population's fear of attack.

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[10] A teacher in girls' technical schools, Natalia Davies became the sole female civil defence area officer in Adelaide and advised the Education Department in civil defence matters.

Stanley (2008: 139-140) explained that:

> ARP volunteers, their instructions, exhortations and exercises, reminded all Australians that they could soon be facing ruin from the air [and that]…Air-raid shelters…provide a rough indication of the degree of anxiety Australians felt.

After Japan entered the war in 1941, the 'National Emergency' finally manifested. Campbell (1985: 94) noted:

> …The people of Adelaide…expected the first Japanese attacks [to come] from the air, as had occurred in Broome and Darwin. The digging of air raid shelters—trenches—became a high priority in late 1941 and early 1942.

2.6 A fearful domestic familiarity

A fear of invasion coupled with differing theories of defence and changing technology largely determined where the frontier was perceived to be from decade to decade. In colonial times, it seemed to be an accepted fact of life that the frontier was never more than a few miles away. Even in the last decades of the nineteenth century, there was still a large, threatening Indigenous population beyond the settled districts, whilst the main armament of the coastal forts provided a protective cordon of little more than a few kilometres out to sea. With Federation in 1901, and the establishment of an Australian Navy in the following years, the frontier was pushed off the coastline and out to the horizon. In the Victorian and Edwardian eras, and despite their distance from England, colonists and military planners alike found some comfort in the fact that Australia was also a long way from anywhere else. This security ended abruptly only a little more than a decade after Federation.

Australia's geographical isolation was an artefact, almost entirely, of its colonial era. Globally, the advancing technology and evolving psychology of warfare in the early twentieth century meant that battles were no longer played out in distant fields, but were commonly fought in (and above) densely populated areas, forcing a shift in the traditional defensive postures of belligerent nations. The frontier of the Industrial Age no longer demarcated the edge of the known world where undesirable elements could be contained, but instead assumed a fearful domestic familiarity. The new frontier seemed to have no spatial limit, nor could it be effectively policed by international treaties on warfare. This situation was to impact greatly on the psyche of civilians during WWII. Sociologist, Jackie Orr (2006: 67) observed that:

> Panic in the field of battle – once limited to the threat of rout among combat soldiers, or the terror of civilians facing an invading army – now includes the potential psychological reactions of civilians on the "home front" faced with the rapid, radio beamed dissemination of news of military defeat, or the more immediate threat of invasion from the air by enemy planes capable of immense destruction.

Frontiers and frontier studies are normally associated with expanding colonialism (Farry 2005), yet in this case the Australian frontier collapsed in on itself as the frontier of Japanese imperialism expanded. Sawer (1942: 17) observed: "[t]here was now no practical distinction between the Australian home front and the Pacific war zone", leading to the realisation that "Australia flanked the Pacific and Indian Oceans rather than the English Channel" (Blainey 1971: 332).

The concept of a dynamic frontier helps us to understand the character of the historical defence landscapes of SA, and the eventual inclusion of public and domestic civil defence as a new cultural landscape category during the lead up to the Second World War. Prior to WWII, passive civil defence constituted an untheorised and unnecessary branch of municipal and domestic infrastructure in SA, with the local community being entirely reliant on their physical isolation, in addition to British and local terrestrial and naval forces, for their security. However, the advancing technology of aeronautical engineering, shortened distances and neutralised border obstacles, giving rise to the notion of 'Total War'. Schofield (2004:1-2) identified this as one of the defining characteristics and strategic themes of twentieth century warfare: it was also a characteristic that brought the frontier to every household in the settled regions of Australia.

Chapter Three

Understanding the Psychology and Landscape of Fear

3.1 By-products of war

Two vital yet often over looked by-products of conflict are the psychological effects of war on the civilian population and their relation to a landscape deliberately altered as a response to the fear of attack and invasion. Walker (1952: 706) wrote that "[w]ar experience has emphasised…the need for keen appreciation of the importance of mental health to individuals, to groups and to nations". Behavioural specialists, specifically psychologists and psychiatrists, are typically and historically, the custodians of research in this field. Such research, it seems, is normally only undertaken when an attack is expected, or as a direct consequence of an attack, for instance, during the bombing raids of WW II, the arms race of the Cold War, or the global terrorist threat of the twenty-first century.

> In the aftermath of 11 September [2001]… the threat of terrorist attack has become very real. How civilians might respond to a major offensive remains an open question but one which may reflect the morale and behaviour of people exposed to air raids, as was the case during the Second World War (Jones *et al*. 2004: 463).

Psychologists specialising in diverse fields have investigated all manner of social and individual phobias. Fear and anxiety have continually played an important part in the psychological theorising of human personality. Janis (1971: 111) provided examples of the diverse suite of approaches and studies related to this genre, citing the classical psychoanalytical theory of Freud and his followers, the neo-Freudian theories of Erich Fromm, Karen Horney and Harry Stack Sullivan, the phenomenological theories of Kurt Lewin and Carl Rogers, and the learning theories of John Dollard, Neal Miller, Hobart Mowrer and B.F. Skinner.

From the early twentieth century, studies of fear and anxiety began to incorporate the effects of aerial warfare on civilians and combatants, with a massive amount of data becoming available to researchers during, and immediately after WWII (see Glover 1940; United States Strategic Bombing Survey [USSBS] 1976a [1946a] &1976b [1946b]; Janis 1951, 1971 and 1982 and Harrison & Madge 1986 [1939]). This data was accumulated from varied sources, including direct observation of victims by trained medical staff in psychiatric out-patient departments within major hospitals during the war years; via official questionnaires sent out to medical practices (such as by the USSBS which had been commissioned to assess the success of the air war against Axis industry and morale); and the domestic work of government departments (such as the Ministry of Information in the UK) which were ultimately tasked with assessing and maintaining civilian morale (McLaine 1979: 3; Jones *et al*. 2006: 59-60).

During WWII, random sampling techniques were also employed by an organisation called Mass-Observation in order to gauge the fear present in a given group of people. Richard Hillary (1956 [1942]: 59) had observed that "[t]he Government's appeal to the people to stay put and not to evacuate, printed on the front page of every newspaper, roused England to the imminence of disaster. It could actually happen". Typical of the responses recorded by Mass-Observation was that from a 35 year-old English woman on Saturday 2 September 1939, the day after Germany attacked Poland. When asked about her thoughts on the international situation, she responded by claiming that she: …"[w]oke up at 3 and lay waiting for bombs 'til time to get up" (Mass-Observation 1945: 9). Given the random nature of the sampling technique, this anecdote implies that the fear of attack was a very real thing across English society right from the earliest days of the War, even though England had not yet been targeted. Another example of this uncertainty comes from the biography of Douglas Bader, RAF Group Captain, who recollected that "[t]he day after Hitler marched into Poland he sent Thelma [his wife] away to join her parents in the country for a few days in case masses of bombers came over when the whistle went" (cited in Brickhill 1954: 145).

Janis, a social psychologist and key researcher in this field, had himself fought in WWII and witnessed firsthand the reactions evoked by disruptive external wartime events. His mid twentieth century research, based on studies of WWII reactions to aerial bombardment, was pivotal in understanding how people could react during a nuclear attack in the second half of that century. It also provides the context for understanding era specific psychological research into the fear of aerial bombardment and its implications for civil defence in WWII.

Early twentieth century research in this field was based on data gathered principally from civilian bombing victims in China (Shanghai), Spain (Barcelona), Britain, Germany, Japan and, to a lesser extent, America (from the single event of Pearl Harbour). There was also a re-assessment of the psychiatric observations of victims previously made during WWI. This research largely attempted to extract 'sound empirical generalizations' rather than culturally specific details, for a degree of cultural bias was assumed to underlie reactions to certain catastrophic stimuli. This meant, for example, that if a type of behaviour was observed in a British sample only, then it was considered characteristically or uniquely British, and not typical of the general human condition.

Research anomalies of this kind were used in population-specific reports, rather than as part of cross-cultural comparisons (Janis 1951: 68-69). However, the use of a culturally inclusive research design would enable the psychological recommendations distilled from it to be applied to Australian conditions as well, and would present a valid starting point for the retrospective analysis of the phenomenon of shelter building in Australia, despite the lack of similar victimisation studies here.

At the beginning of the war some medical practitioners, such as Glover (1940:26-27), argued that there were two main problems to consider during air raids:

> First, what to do about the bombs dropped by the enemy from above and, second, what to do about those human bombs that inhabit the houses and streets underneath….remember that when the enemy attacks the civilian population, he is not just wantonly flouting the laws of civilised warfare. He is making a deliberate attempt to damage the morale of civilians. By throwing civilians into states of disorder or panic the enemy hopes to cause widespread confusion, and in this way hamper the efficiency of the civil and military authorities.

Given that aerial bombardment can evoke severe fear reactions amongst the victims, it was also recognised to have negative effects upon wartime morale:

> The arousal of intense fear [during aerial bombardment] generally heightens the motivation to escape further attacks and, in extreme cases, may result in defeatist attitudes, willingness to surrender, and personal demoralization (Janis 1951: 126).

English WWII fighter pilot, Richard Hillary (1956 [1942]: 107), described his experience in an air raid shelter during a German raid on his base:

> The air was thick with dust and the shelter shook and heaved at each explosion, yet somehow held firm. For about three minutes the bedlam continued and then suddenly ceased. In the utter silence which followed nobody moved. None of us wished to be the first to look on the devastation which we felt must be outside.

Hillary also noted the thoughts of a fellow pilot sharing the same shelter with him who exclaimed “Praise God…I’m not a civilian. Of all the bloody frightening things I've ever done, sitting in that shelter was the worst. Me for the air from now on!" Given this admission from trained servicemen who regularly faced death in combat, it is not hard to imagine how much more severe the civilian reaction to this sort of event might have been.

The USSBS made extensive studies of the reaction of German people to air attack and especially city raids. It found that:

> …the morale of the German people deteriorated under aerial attack. The night raids were feared far more than daylight raids. The people lost faith in their leaders and in the promises and propaganda to which they were subjected… [and] if they had been at liberty to vote themselves out of the war, they would have done so well before the final surrender (USSBS 1976a [1946a]: 4).

Under interrogation, and referring to the Royal Air Force's (RAF) 1000 plane raids on German urban centres in 1942, Albert Speer, the German Minister of Armaments during WWII, claimed to have reported "…to the Fűhrer that if these aerial attacks continued, a rapid end of the war might be the consequence" (USSBS 1976a [1946a]: 3). This view was also taken by Bourke (2005: 224) who noted that in wartime Britain:

> …public officials, politicians and psychologists predicted that Britons would panic… [and there was] the possibility that if an enemy power attempted an aerial 'knock out blow'…the resultant 'panic and riot' might force the home government to accept unfavourable peace.

In fact, as early as 1925 the ARP Committee's First Report stressed:

> …[i]t has been borne in upon us that in the next war it may well be that the nation whose people can endure aerial bombardment the longer and with greater stoicism, will ultimately prove victorious (cited in O'Brien 1955: 19).

As a direct result of these concerns, wartime researchers initiated clinical studies based on the heightened anxiety evident in subjects either anticipating an attack or experiencing actual aerial bombardment, as well as long term studies into the sustained effects of exposure to wartime dangers. Table 3-1 is typical of the kinds of information produced by this research.

Table 3-1: 1945 survey of 4,222 American soldiers and the relationship between proximity to combat dangers and anxiety (Abridged from Janis 1971: 25)

Amount of exposure to combat dangers	**% with high anxiety**
Never under enemy fire (n=917)	**35**
Under long-range fire only: Air raids, buzz-bomb attacks (n=793)	**38**
Under close-range fire: Rifles, mortars, artillery (n=615)	**42**
In front-line combat (n=1897)	**48**

Although the results are based on a study of enlisted servicemen, these statistics give an idea of the range of reactions experienced under similar conditions by civilians without military training. The fourth analytical variable, "In front-line combat", was applicable to civilians because the frontline had become an urban feature as a result of the theory and practice of strategic bombing. Consequently, one would expect a greater percentage of civilians to experience anxiety and display its associated symptoms if exposed to the charted variables, compared to the sample of soldiers who had been habituated to the intense stimuli of battle.

Janis (1951: 115) qualified this by arguing:

> …so far as the personal involvement factor is concerned, the studies of war neurosis [from exposure to combat] are in essential agreement with the observations of civilian reactions to air attacks.

3.2 Strategies for containing fear

Wartime research showed that, to some extent, fear during aerial bombardment could be contained by the community's ability to:

> …minimize the disorganizing and fear-arousing effects of air raids [through] the availability and efficiency of rescue operations, medical facilities, and social-service and welfare organisations… severe emotional reactions are often aggravated, and in some cases precipitated, by lack of adequate social organisation during the period following a heavy air raid, e.g., delay in rescue work, disruption of social services, inadequate welfare arrangements, etc. (Janis 1951: 118).

For example, it was found that the sight of casualties in the community (the wounded, the dying and the dead) led to adverse psychological disturbances among witnesses. Prompt removal of casualties to emergency centres before large numbers of people emerged from their homes and shelters tended to minimize these negative reactions (Janis 1951:117). The civilian population also became more relaxed at the mere sight of emergency services personnel in the streets and at their posts. Browne (1941: 10) noted that "[i]t was found in London that the very presence of A.R.P. officials does much to maintain civilian morale at such a high level during actual raids".

A lack of purposeful action was observed as a further contributor to fear and ebbing morale:

> It is a generally accepted principle that people who face danger tend to feel less fearful if they are able to engage in some form of useful overt activity. [But] there is so little data pertinent to the effects of various types of assigned tasks and to overt activities on reactions to air raids (Janis 1951: 120).

Writing some years after the war, Titmuss (1976: 347) suggested that the absence of an increase in neurotic illness among the civilian population during the Second World War was connected with the fact that, to many people, the war brought useful work and an opportunity to play an active part in the community, especially following the recent huge unemployment and poverty of the Great Depression. One possible way to boost morale through work may have been to initiate a program of shelter building, instilling a sense of solidarity in the community by exposing individuals to the notion that the situation was one of common purpose.

People also seemed better able to face danger when they were with others. Woolven (2002: 118) described how during WWI many citizens of London's East End sought refuge in large buildings or under railway arches and in the London Underground, and that: "East End popular culture caused people to feel safer if they crowded, and suffered, together with their families and neighbours". Janis (1958: 90) similarly revealed that "[i]n wartime, especially at moments when people are suddenly faced with the imminent danger of being injured or killed, they show a tremendous upsurge of interest in interpersonal contacts…"

In October 1940, Charles Key MP, Member for Bromley and Bow (cited in Woolven 2002: 172), explained that:

> …the reason that some people did go to public shelters was not to seek greater safety but because our people like to get together and talk when there is anything going on as it helps them forget what is going on and underground shelter reduces the noise which people found trying.

Air raid shelters in the UK became not only places of refuge and safety, but also a fascinating microcosm of positive human interaction, and generated a unique range of associated material culture. One example of this can be seen in the production and popularity of war content 'Penny-type' books. These were 2½" x 3" (6 cm x 9 cm) in size and no more than 32 pages long:

> …[t]his series… had its origin in the early days of the war, and was intended to provide a suitable diversion during air-raid alerts. Handy little books like these could be carried in the pocket and handed on from one reader to another in the shelters. At the same time, by their small size, the books made the most of the very limited quantities of paper then available (Raphael Tuck & Sons Ltd. nd.: 2 cover).

In many examples of shelters in the UK there is evidence of artistic expression in the form of graffiti, cartoons and doodling on the walls signifying confinement and defiance (see for instance Cocroft et al 2004). This form of material culture is not evident in extant South Australian shelters indicating they were used very differently to those shelters in the UK.

British research during the *Blitz* had found that people who went to communal shelters felt more secure than those in private ones: "they obtained more sleep, gained weight, and lost anxiety symptoms which had developed at home" (Janis 1951: 160). The same may also apply to the construction phase of communal shelters when friends and strangers sharing a common threat worked together for some greater good. Once again, an understanding of the psychological aspects attributable to human reactions to fear can help with the archaeological interpretation of these types of structure. Shelters such as these not only represent times of fear and danger, but may also elicit happier social memories for those who interacted with them. This point was aptly demonstrated in wartime Adelaide, where civilians and armed forces personnel were having so much fun in the shelters placed in public domains that many complaints were lodged with the local authorities regarding shelter abuse (see, for instance, section 6.3.3.1).

Higher levels of fear were also often found to correlate proportionally to the type of bomb that was used in an air raid. Before August 1945, the types of air-borne weapon commonly available for civilian targets (aside from machine guns) were bombs of four main types: chemical (bacterial/gas); incendiary (flammable); fragmentation (anti-personnel); and high explosive (demolition), with a fifth device—armour piercing—normally only used against ships and fortifications (*SALT* 1942: 18). Had a 500 lb semi-armour piercing bomb been used against civilian targets, it would have penetrated any building constructed in the Commonwealth prior to WWII (Veale 1939a: 19). The public were also made painfully aware of the destructive potential of bombs through advertisements placed in popular literature (see Figure 3-1).

Figure 3-1: Fear as a selling tool
(*Australian Home Beautiful* 1943, 22(7): 44)

Since 1929, there had been "a clear, and apparently irreconcilable conflict between the need to send the public underground for protection against high explosive and the need to keep them above ground for protection against gas" (Baker 1978: 2). In the inter-war years (and despite the number of signatories to the Geneva Gas Protocol of 1925) the greatest fear in Britain had been of a gas attack, so much so that "[f]ive of the eight handbooks and memoranda issued by the [ARP] Department in 1935-6 were concerned with some aspect of gas defence" (Titmuss 1976: 6). This skewed interest may also be explained in another way. Baker (1978: 2) identified that not only could practical experiments in protection against gas be conducted more cheaply than experiments into the destructive power of high explosives, but:

> …the concentration of pre-war effort on the protection of the population against possible attack with poisonous gas was a shrewd political move since it enabled every member of the community to be issued with a protective device, the gas mask, at a cost of not much more than two shillings per head.

This point helped to focus public criticism on the Government's anti-gas measures. Woolven (2002: 72) claimed that at the time of the Munich Crisis "[a]cross London there were shortages of small sized masks and no masks at all …for babies and children under four". Haldane (1938: 104) lamented that: "[t]he British respirator is the cheapest and simplest type in existence…every other kind, whether for soldiers or civilians, which is issued in any other country, has two valves, an inlet valve [for inhaling]…and an outlet valve which allows the expired air to leave the mask". The British mask had only one valve; this was used for inspiring, whilst a flap near the cheek opened for exhaling and required proper training for successful use. Further, Haldane (1938: 105) pointed out that this type of mask did not work equally well on all people, particularly someone "whose cheeks have fallen in through loss of teeth, or who wears her hair in such a way as to favour leakage".

Despite this huge interest in gas protection, as early as November 1934, Winston Churchill told the House of Commons that "[t]he most dangerous form of air attack is the attack by incendiary bombs" (cited in Titmuss 1976: 7). Churchill's claim was backed a few years later with a study of the Spanish Civil War when the Incendiary Bombs Committee "decided that the small incendiary bomb was [indeed] likely to be the enemy's most dangerous weapon and that the public should be trained to deal with it" (cited in O'Brien 1955: 591). In fact, the highest number of fatalities in individual bombing events was a result of fire (or fire storms) caused initially by incendiary devices. Ton for ton, incendiary devices were between four and five times as destructive as high explosives (USSBS 1976a [1946a]: 15). Extreme examples of incendiary events come from later in the war and include Hamburg on 27 July 1943 (45,000 dead), Dresden on 13 February 1945 (35,000 dead) and Tokyo on 9 March 1945 (120,000 dead).

Regardless of the potential danger posed by this type of weapon, which had been trialled early in the war against England by the Germans during the Coventry *Blitz* on 14 November 1940 and the London *Blitz* on 29 December 1940, most civilians exposed to an air raid had a greater fear of high explosives than fire. Responses from those interviewed indicated that they thought it was harder to protect themselves against injury or death, and impossible to minimize damage from high explosives. One need only view the following confronting image to understand the power of high explosive devices and the fear associated with their use.

Figure 3-2: Double-decker bus blown into a private residence in London (Browne 1941: 35)

Further to this “the frightening effects of the explosion itself, particularly the noise, were also commonly mentioned [as being linked to increasing anxiety]” (Janis 1951: 122). “People in London preferred to shelter in strutted basements [rather than concrete surface shelters], where noise of bombs and anti-aircraft guns was not so loud and thus not so frightening” (Browne 1941: 42). Some of the Boroughs in the London Region were acutely aware of this. For example, by October 1940 the Borough of Poplar had issued 144,000 sets of ear-plugs to the populace to alleviate the problem (Woolven 2002: 172).

The English policy throughout the war had been to construct large numbers of shelters to protect people even though they were not secure against a direct hit. Baker (1978: 2) quotes T.H. O’Brien (author of the official history of civil defence in the UK), who noted that the ARP Committee “were not sanguine about the prospect of modern buildings withstanding direct hits from bombs… but they thought that adequate protection should be possible against fragments and near misses”. This contrasted dramatically with the German practice of building concrete bunkers both above and below ground which were designed to absorb direct as well as remote hits. Some of these were of enormous size, with one example in Hamburg able to shelter 60,000 people (USSBS 1976a [1946a]: 15). On 8 February 1941, the *Daily Herald* (cited in Woolven [2002: 185]) reported that public shelters were available for 1,377,500 inhabitants of the London Region and domestic shelters for 4,461,000 people. Post-1941 changes to British ARP shelter design, which included a minimum 9 in. reinforced concrete roof, protected entrances, narrow windows set high up under the eaves and deep projecting eaves (Thomas 2007, pers. comm. 17 September, Military Support Officer, English Heritage), may well have been influenced to some extent by research into what scared people the most during the earlier air raids, as well as research into the technical aspects of shelter building. It seems the ARP measures that had been put in place by early 1941 were having a positive psychological effect on London's inhabitants. Serge Vaculik (1954: 95), a member of the *Forces Françaises Libres* (Free French Forces) training in England in January 1941, was astounded at what he saw in London at the time:

> Everyone seemed to have the same calm and confident air, and they were all going about their usual affairs without worrying much about anything. I had thought to find London half destroyed and its inhabitants weeping amidst the ruins, but although there were plenty of ruins around, no one was weeping and the grimy old town seemed very much alive.

Psychological attempts at minimising fear and stabilising morale during an aerial attack can be seen in the "official" language adopted during conflict. In Britain, the word "incident" became the official designation for what took place when a bomb fell on a street. Strachey (1941: 20) observed rather sarcastically that:

> …[p]otential allies may have been spurned, inevitable enemies aggrandised, deep shelters denied, parity in the air promised and unachieved. But whatever the grumblers may say, one thing, at any rate, had been foreseen. The senior Civil Servants had foreseen the need for an official description for the effects of a bomb.

This inert noun was intended to mask, to some extent, the terror associated with terms such as "bombing" or "air raid". Consequently, for every civil defence worker, and on every official pro-forma, a bombing became an "incident":

> It cannot indeed be held to convey very graphically the consequences of a bomb. Just the contrary. The word is wonderfully colourless, dry and remote; it touches nothing which it does not minimise. And this may be what recommended it conclusively to the authorities. It formed an important part of their policy of reassurance. For while anyone might be frightened of a bomb, who could be frightened of an incident? (Strachey 1941: 20-21)

The press were also co-opted into lowering public anxiety after air raids. On 26 June 1940, Winston Churchill (in Churchill 1964[1948]b: 152) wrote to the Minister of Information suggesting that:

> The Press and broadcast should be asked to handle air raids in a cool way and on a diminishing tone of public interest. The facts should be chronicled without undue prominence or headlines. The people should be accustomed to treat air raids as a matter of ordinary routine…It must be clear that the vast majority of people are not at all affected by any single air raid, and would hardly sustain any evil impression if it were not thrust before them.

London, Hamburg, Dresden, Tokyo and many other cities that experienced aerial bombardment during WWII, have contributed empirical psychological data towards an understanding of generic human reactions to such catastrophes. Even though such data could have been used to predict how people in Australia may have reacted to the threat of aerial attack during WWII, there is still a vast amount of un-researched and, to date, unrecorded data relating to societal and individual reactions to wartime experience. This data can tell us something of the reality of how people actually did react, rather than the expectations placed upon them by others. This is especially true for those communities that waited many years for an attack to happen without that expectation being realised, as did the people in Adelaide, SA. With no contemporary SA psychological studies on the effect on civilian bombings available for scrutiny, what little contemporary testimony there is about the fear of an attack from the air is mainly anecdotal. An example comes from Betty Ashton, a resident of Mitcham, SA, during WWII who recalled: “[w]e really did expect Japanese aircraft would be coming, because they used to say they would” (cited in Phillips 1994: 25).

Studies such as the current investigation, conducted in communities which were relatively unscathed during WWII and which combine testimony with material remains, may in fact be more beneficial for predictive modelling of fear and reactions to bombing threats than re-working old data already recorded from bomb victims. Given the reach and destructive power of twenty-first century armaments, even the most isolated regions of the world are now potential targets. How civilians react and cope in battle situations is now well understood, but how civilians react to, and cope with, the anticipation of an approaching 'frontline' on a local or regional scale can be better determined by studying the relevant cultural landscapes of communities that have already lived through such an ordeal and interpreting their material reactions to such threats.

3.3 Cultural landscape theory: Landscapes of fear and social stratification

Cultural landscapes are those which bear traces of physical human interaction and manipulation, but at the same time are also complex notional entities. To Gold and Revill (2000: 11), the notion of landscape "denotes a contentious, compromised product of society"; it means many things to many people, often at the same time and across time. Landscape, in this sense, is an entity in continual flux, retaining and reflecting the spectrum of human toil (achievement or failure), psyche and social stratification. Knapp and Ashmore (1999: 1-2) insist that:

> …the most prominent notions of landscape emphasize its socio-symbolic dimensions: landscape is an entity that exists by virtue of its being perceived, experienced, and contextualized by people…Study of these landscapes is hampered by ambiguity in material clues to social meaning:… [And] meaning in a landscape is not directly related to how obtrusively it has been marked in material, archaeologically detectable ways.

The complex social stratification of cultural landscapes often includes elements of class, gender, ethnicity and race, but rarely do these elements appear as concepts separate from each other. Orser (2004: 257-258) argued that archaeologists and other social scientists separate these notions for convenience, allowing them to organise their analyses and frame their interpretations. In society, such separation has no grounding in reality. The landscape of this particular study has obvious spatial and material merit, but this materiality is the product of specific (and often ambiguous) human conditions and constructs, and not just physical dictates such as the availability of resources, depth of the water table or the presence of a codified defence plan.

Because of this, the fabric of the early 1940s civil defence landscape of Adelaide is a portal back to the unique social makeup of its community of shelter builders. This particular cultural landscape is a social record of mental health, economic means and social circumstance, as well as a canvas for the technology, defence theory and aesthetics of the time. By studying cultural landscapes, social traits and trends are able to be tracked across space and time. For instance, there may be a relationship between affluence and the incidence, or type, of structural defence recorded, or the presence of able-bodied men and the construction of particular kinds of shelter. Such a study may also contribute to the wartime demographic information of Adelaide by identifying concentrations of shelters in public areas as markers of population density.

Constant re-use and concurrent multiple use endow a landscape with different meanings for each individual or group who interacted with it. Greater urban landscapes are constructed of multiple elements, such as recreation, education, gastronomy, defence and wealth. All of these seemingly individual ‘vistas’ are interconnected and overlap in many ways. However, when we use a specific kind of landscape, such as a ‘landscape of fear’, to describe particular defensive aspects of the urban environment, we privilege certain facets of that landscape over others. This principle is utilised by Tuan (1979) in his study of fear across a number of specifically created cultural landscapes. Tuan’s ideas are important for archaeology because his:

> …‘landscape of fear’ was an enabling metaphor, facilitating study of imaginative landscapes from children’s fairy tales to the perception of natural hazards. He focused on landscape because it drew together human attitudes, values and our physical responses and interventions in the world… (Gold & Revill 2000: 9-10).

Tuan (1979: 3) observed that “in every study of the human individual and of human society, fear is a theme—either covert as in stories of courage and success or explicit as in works on phobias and human conflict”. Certainly, his observation is pivotal to this study. Fear, for Tuan (1979: 5), is:

> …a complex feeling of which two strains, alarm and anxiety, are clearly distinguishable. Alarm is triggered by an obtrusive event in the environment, and an ... instinctive response is to combat it or run. Anxiety on the other hand, is a diffuse sense of dread and presupposes an ability to anticipate... Anxiety is a presentiment of danger when nothing in the immediate surroundings can be pinpointed as dangerous. The need for decisive action is checked by the lack of any specific, circumventable threat.

Humans are fearful of many things. Tuan (1979) showed how this condition can manifest itself in different ways and in various landscapes. Specific and identifiable civilian landscapes created by a fear of disease, punishment and natural calamity were included in his study. But such studies can also include landscapes purposely altered by the fear of attack during times of international tension, such as WWII, and as a consequence of ARP practice. Cunliffe (1974:

63) suggested that “evidence for defence prompts us to look for evidence of attack”, but where there was no attack, evidence for defence can also prompt us to look for evidence of fear or the expectation of attack. For Tuan (1979: 6), “landscape” is just as much a construct of the mind as it is a physical and measurable entity. His ‘landscapes of fear’ refers to both psychological states and to tangible environments. Metaphors like Tuan’s ‘landscapes of fear’ enable archaeologists to distil specific human behaviour from a landscape that has been continually re-used through time. This filtering effect allows archaeologists to determine patterning in the material record specific to that metaphoric landscape. “Archaeologists usually have a reasonably clear idea of what constitutes evidence for war and violence” (Carman 1997: 222), because “[w]hile warfare and conflict seem like they are chaotic affairs, they are behaviors [sic] that leave behind patterned evidence” (Scott 2005: 259).

Archaeological studies focussing on such landscapes can provide an insight into the resilience of a threatened population coping with its isolation (whether this is a spatial reality or spatial perception) and the emergence of significant self-reliance in defence matters:

> If one can select any year which marks Australia’s transition from its traditional role as echo and image of Britain…the year which stands out is 1941. One can go further and select 7 December 1941, when Japanese planes bombed an American fleet at Pearl Harbour…or alternatively select 10 December – three days later – when the British battle cruisers *Prince of Wales* and *Repulse* went down off the Malayan coast. (Blainey 1971: 328)

Australia’s isolation and initial reliance on English defence measures had provided both a real and a psychological boost to civilian security and morale throughout the nineteenth century. By the twentieth, however, a reliance on the

UK was gradually superseded during WWII by a general shift to American aid and technology, stated clearly in the Right Honourable John Curtin's proclamation after the Japanese attack on Pearl Harbour that "Australia looks to America, free of any pangs as to our traditional links or kinship with the United Kingdom" (cited in Searle 1993: 554). With improved aircraft technology, the advent of terror bombing and the initial successes of the Axis forces in Europe and the Pacific region, Australia's previously secure isolation now contributed to its inhabitants' fear of attack and invasion, leading to a sequence of independent defensive reactions.

Some of these local reactions can be read in the extant material remains from that time. Keen (1986: 16) wrote of a consensual paranoia where "enemy making and warfare are social creations rather than biological imperatives", in much the same way as sex and gender are seen as being biological fact and social construct respectively. Keen (1986: 19) further argued that the logic of paranoia dictated that "certain archetypes of the enemy must necessarily recur, no matter what the historical circumstances". This observation certainly seems to fit the Australian experience where there appears to have been a fundamental subconscious fear of attack by foreign powers throughout its settled history. The surviving tangible evidence for this can be found in the remains of defensive infrastructure from successive historical periods (such as Adelaide's WWII air raid shelters) put in place to protect the country or, for the purposes of this study, its inhabitants from real and imagined threat. From this platform, Adelaide provides an opportunity to construct a model of socially stratified material reactions to the threat of attack which can have further application to other communities throughout Australia, whilst also providing researchers worldwide with comparative material.

In the context of the present study, Tuan's definition of the dualism of fear is readily applicable to the Australian experience. The Australian population was obviously alarmed by the intentions and acts of hostile governments. Yet it was unknown exactly where, when or how this threat would be realized on the Australian mainland, forcing the population to 'dig in' where it stood. This confusion was demonstrated by Jack Felstead (MW1-08: 4), an ex-serviceman who recounted how during 1942 he was sent to New South Wales (NSW) as part of the Armour Division and trained in the use of 2.8 in. anti-tank guns. No sooner was his training in this type of defence completed than he was re-assigned to anti-aircraft defence and re-trained to use 40 mm Bofors anti-aircraft guns, after which he was posted to Miginew, Western Australia (WA). It seems that the threat to Australia was originally thought to come through an amphibious attack and the landing of troops and armour along the northern and eastern coasts, but was later revised to guard against an air-borne attack from the west. Defence of the home front (potentially the battlefront in most modern theatres of war) is expressly tied to the anxiety associated with this presentiment of danger among the population. Because Australia was not physically attached to another foreign country, the direction of attack was not obvious or calculable. This fact, coupled with the size of its coastline and its relatively small defensive force stretched thinly across many strategic points, led to a heightened fear and paranoia among the population. Australia's perceived tactical indefensibility led to a condition among its populace which pulsed with every major hostile wartime event and was exacerbated by the advance of war technologies, specifically those relating to military aircraft.

3.4 A dynamic frontier: Global warfare and local war fear

Despite SA being one of the southern-most States of Australia, its vulnerability as a result of improved armaments technology was demonstrated to its inhabitants in June and July 1941, when a number of German anti-ship mines washed up on beaches and became snagged in fishing nets at Beachport, Robe and Cape Jaffa in the State's south-east (Figure 3-3). At Beachport, on 14 July 1941, two Able Seamen died whilst attempting to disable one of the mines, becoming the first casualties of WWII on mainland Australia.

Prior to this, Australians had been exposed to news and newsreel footage depicting the destruction of Guernica in 1937 during the Spanish Civil War, the Japanese subjugation of Manchuria and the war in Europe. In the age before television, G. Clement Cave (1948: 53), editor of *Pathé News*, wrote: "A great newsreel public was built up during the war, when the reels had great and vivid pictures to show and stories of great daring to tell". Images from the European theatre included those of the German *Blitzkrieg* (rapid mechanised warfare) and of bombers (elements of the German *Luftwaffe*) targeting London on an almost daily basis from September 1940 to May 1941 (Jones et al. 2006: 61). This could only have added to the panic and realisation of what might be coming. Orson Welles' 1938 broadcast of an adaptation of H.G. Wells' *War of the Worlds* demonstrated the panic and mass hysteria that such depictions could have on the social imagination of a terrified public. Bourke (2005: 229) noted that "it was usual for people to find the anticipation of danger much more frightening than actual disaster".

Figure 3-3: German anti-ship mine, Main Street, Robe
(Wimmer 2006)

Often portrayed in popular culture (most recently in the 2004 German language movie *Der Untergang* [Downfall]), some of the most dramatic, iconic and myth-generating WWII landscapes of fear include bunkers and air raid shelters, even if only by virtue of their massive construction and subterranean aspect. Adelaide's surviving air raid shelters can be described as: "expressions of war beyond conflict" and have the potential to revitalise "meanings and [create] new engagements between people and things" (Saunders 2004: 6).

3.5 The archaeology of context

The importance and relevance of early-twentieth century psychological research into the fear associated with aerial bombardment lies in its context. It follows that understanding an era-specific psychology of fear (in this case that of WWII) will contribute to an understanding of its material consequences. The reverse is also necessarily true, where an understanding of the material consequences of responses to threat will contribute to an understanding of that specific fear. The model below demonstrates this notion (see Figure 3-4). This inclusive approach to archaeological research synthesizes archaeology with other social sciences in a manner reminiscent of the *Annales*' technique of piecing together complex historiographies (see Braudel 1975 for the best example of this). In such a model, structuralism is favoured over functionalism as a method of analysis and interpretation, with a *raison d'être* of reflecting cognitive characteristics, or organising principles, of the material under scrutiny.

Archaeological research can contribute an independent voice to existing studies of civilian fear during wartime by examining the past and contemporary meanings of civil defence technology through its material remains, and assessing its relation to a specific threat regardless of whether it was well or ill-defined.

> The psychologist and the military man both have a specialized and limited view of anxiety, fear, and panic. Both…are concerned with such questions as: does anxiety lead to fear and then panic? Must persons be under stress to experience fear? And most important for the military, is it possible to teach or condition a person to be less anxious and less fearful so that he can function under stress? (Ondishko 1972: 58)

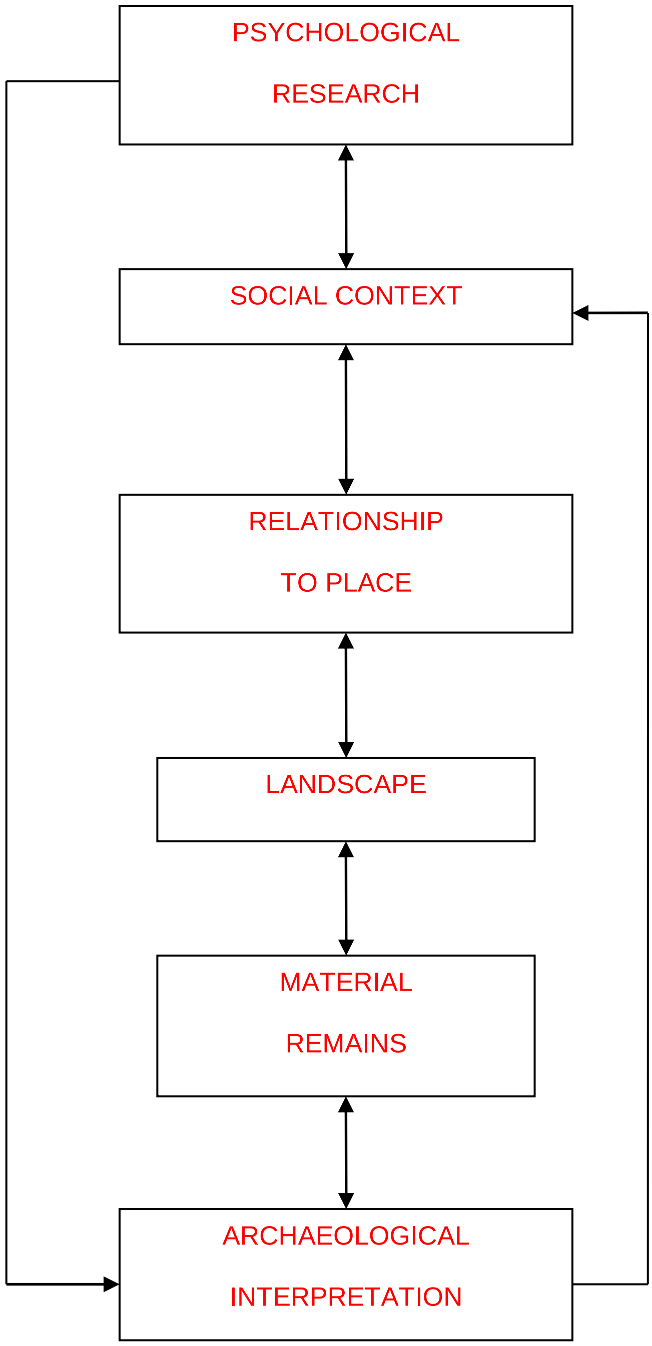


Figure 3-4: Psychology as an agency in creating and understanding the material remains of Adelaide's air raid shelters

As well as providing new information to augment known histories of warfare, archaeological analysis can also provide civil and military planners with another interpretation of fear by studying the fabric, or material, of war. Archaeology concerns itself with the material manifestations of people's decisions and focuses on what people actually did, rather than what they were predicted and expected to do. Archaeology can also provide a unique window on quantitative (the physical extent of the response) and socio-economic (types of response directly linked to wealth) reactions to fear. The variety and extent of individual responses to fear were not fully documented during or after the war, but the footprint of these responses still exist in our community as archaeological remains, and it is these that can be interpreted by archaeologists. Archaeology can demonstrate how the different classes responded to threat, as well as demonstrate the inventiveness of a population facing severe wartime shortages. By analysing the material remains of civil defence, archaeology contributes to an understanding of the range of individual responses and economic means available to counter the threat, facets that have not been thoroughly documented by any other means.

Such archaeology of the recent past owes much to the development of contemporary archaeology as a field of endeavour, perhaps best described by Harrison and Schofield (2009: 186) as being:

> …of places and events that relate to the period of recent or living memory…[a field] which engages critically with what it means to be 'us', [and] with the politics of late modernity.

For Cornelius Holtorf (2009: 66), contemporary archaeology is

> …not only a new field of study investigating and appreciating broadly twentieth century remains, but it is also a new approach more generally, emphasising the contemporary world and in particular any affected communities. Its questions and approaches can best be developed regarding twentieth century material but they are subsequently also applicable to other archaeological subjects. Archaeologies of the recent past and the contemporary world thus have the potential not only to make us see the past and present in a different light but also to affect contemporary people in new ways.

Many contemporary archaeological studies encompass the very recent past. For instance, the archaeologies of genocide (see Jarvis 2002 and Crossland 2002), nuclear testing grounds (Beck 2002) and associated peace camps (Schofield *et al.* 2009), Cold War architecture (Johnson 2002), and the Berlin Wall (Dolff-Bonekämper 2002), have clearly defined temporal parameters in terms of historical start and finish points, and relate to specific and identifiable events. So too, do the civil defence structures of WWII. In Adelaide's case, the objects of this study were constructed over a very tightly defined period of a little more than eighteen months.

Chapter Four

Gimme Shelter in the Literature

4.1 Sheltering outside the literature: Air raid shelters have no writes

This chapter summarises the literature on the archaeology of Australia's WWII civil defence and demonstrates the absence of themed archaeological or heritage research in this area. To date, there has been no interest in understanding these structure's social underpinnings, or interpreting them as markers of larger cultural landscapes. Individual studies indicate that air raid shelters are recorded as they are 'stumbled upon', but no attempt has been made to discover the actual size of the resource, determine the location of remaining examples, characterise types, or interpret and understand their social contexts.

In the late twentieth and early twenty-first centuries, the functional forms and simple aesthetics of WWII civilian air raid shelters seem to have largely escaped dedicated higher level cultural discourse and archaeological interpretation, both in this country and abroad. Those shelters which have been recorded through heritage studies are often treated only as adjuncts to wider and more general themes of WWII (for example, Pearce 2009). Australian heritage reports typically note a shelter's location, physical dimensions (sometimes with images supplied), a brief history, condition, re-use and a statement of significance. The most accessible of the Australian reports appear on heritage databases, although most local municipal registers are difficult to access remotely because, for the main, they are not on-line (one exception to this is Victoria, whose local council registers are searchable through Heritage Victoria's database). Heritage assessments are required to do little more than document the physical aspects of this structure type and tie their significance to their relationship to WWII and ARP, their relative and general rarity or representativeness, or their history in terms of being surviving examples of a particular engineer's or architect's work (see, for example, the criterion attributed to the Wickham Park Air Raid Shelters, Queensland Heritage Register 2009). This is the standard model for assessing cultural significance, but ultimately it contributes little to our understanding of their context. The sum of these records adds up to no more than an inventory of assets which at some time in the future may be used as a management tool, especially if they are on a heritage register. However, the efficacy of such a tool depends absolutely on the presence of wider contextual and themed studies, without which there can be no understanding of why they should be managed in one way rather than another. The very absence of contextual or themed studies also begs the question of how an assessment of value can be carried out, especially when criteria such as rarity or representativeness are unknown. This study will provide a platform for allowing competent heritage assessment of this structure type.

Contextual and themed studies focussing on civil defence are gaining some interest among archaeologists and historians working in Australia (see, for example, Newport 2007 and Grguric 2008). Nicolas Grguric's (2008) study investigated colonial era landscapes of fear by analysing the architectural techniques used in four frontier dwellings constructed between 1847 and 1885, in an attempt to identify defensive strategies used by early settlers as a precaution against aggressive elements of the Indigenous population. Grguric found that these dwellings incorporated a mix of passive and active defensive elements, ranging from undersized windows and thickened walls to embrasures (rifle slits built into the walls) providing overlapping and covering arcs of fire. But, to date, only historian Tanya Newport (2007) has addressed the appearance of air raid shelters in suburban Australia, and their wider meaning and place in society. No other Australian study has been located which addresses air raid shelters and what they can tell us of their contemporary societies in their own right.

4.2 Sheltering in the literature: Air raid shelters in their own write

Newport (2007: 1) noted that the “difference in protection between public and private realms, the varied experiences of those who built their own shelters, or the changing cultural meanings of shelter space” are some of the issues largely absent in our understanding of the home front experience. Newport (2007: 2) attempted to address some of these issues by considering “the development of civil defence in Perth, WA, between 1935 and 1945, with a particular focus on the role of air raid shelters”. The WA study is divided into two chronological parts, referencing Paul Hasluck’s (1965 and 1970) comprehensive Australian social and political history and arguing that Australians saw WWII as two separate wars (the European war and the Pacific war) as an explanation for the dichotomy in war preparedness in WA before and after Pearl Harbour. Newport (2007:7) found that in WA (as in SA) the “local authorities were hesitant to take up organisational and financial responsibility for substantial air raid precaution measures, particularly air raid shelters”, but there were also other issues similar to those in SA impacting on the introduction of a shelter policy. These included the magnitude of the perceived threat of attack, a national division over planning priorities and the actual purpose of shelters. Newport mentioned class, gender, age, support networks, general attitudes to war and personal opinion as various means of understanding the choices made (and options available) in the construction of different types of shelter by private householders. Written within the discipline of history, Newport’s dissertation was based wholly on archival research and the analysis of previously recorded oral histories which had been collected in 2006 as part of a local history initiative (the Northbridge History

Project, Perth). Newport did not consider or interpret the location (or fabric) and cultural landscape of pre-existing and remaining structures to strengthen her arguments. In fact, no extant shelters were uncovered in her Perth-based research. Newport pointed to extensive shelter removal throughout 1944 and 1945 as a possible reason for this (which has similarities to the SA experience), creating a situation which has made air raid shelters relatively invisible in the modern urban landscape. Newport (2007: 47-48) concluded that one consequence of this is that:

> ...they do not feature as physical reminders of the fear of attack, or the restrictions imposed on civilians in everyday life...shelters remain a strong part of individual memories. However, in the collective memory, they are vulnerable. With no, or at least limited, physical presence, shelters can exist only in memory, photographs, reconstructions, or histories.

Newport's study of structural defence in WA provides an interesting comparison to the SA experience because, unlike SA, some towns in WA (although not Perth) were bombed, adding to the fear present in that State. This study, which does consider fabric, will corroborate Newport's observations to some extent, but will further demonstrate that it is not only the demolished shelters that have taken their meaning with them. The same loss of recognition of what shelters are, and what they represent, has been conferred on extant shelters and often shrouds them in myth.

4.3 A themed approach to heritage: The United Kingdom

Until quite recently, vague interest has been shown in the material remains of the Second World War in Australia. From a material point of view, this passing interest seems purely historical and particularist, with a focus on collecting and studying the hardware of war (such as small arms, armoured vehicles and aircraft), or items relating to regimental exploits and histories. This is evidenced by the number of dedicated military themed and army museums throughout Australia (in Adelaide see, for example, the Military Vehicles Museum, Aviation Museum and Keswick Barracks Army Museum). The reality with these sorts of assemblages is that the public need only visit one repository to see a range of war-related material.

The Second World War is considered monumental and historic internationally, but because of its recency its structural material remains are seldom thought of as being historical, much less archaeological. The reality is that we have little understanding of how rare or unusual remains from this period are, nor are the complex social issues surrounding their construction and past human interactions with them fully appreciated. This problem was also recognised in the UK where a vast acreage of decaying infrastructure from the war represented an unknown and unquantified heritage asset. During the mid-1990s there was a realisation that “recent military heritage from the twentieth century, like industrial heritage, was under-represented in the schedule and lists [and] poorly recorded” (Cherry & Chitty 2009: 16). In 1986, English Heritage introduced the Monuments Protection Program as an initiative to gain a fuller understanding of the recent defence heritage resource in England. Dobinson *et al*. (1997: 288) claimed that English forts of the Roman period and seventeenth century defences of the Civil War were well researched and recorded nationally. However, for recent periods (post-1660) an understanding of the monuments of war was generally poor, with the remains never being subjected to a systematic review.

Tied to this initiative was the Thematic Listing Program (TLP), the mechanism of which covered all existing examples of nominated types and enabled a rapid assessment of deteriorating sites and those threatened by re-development (see

HELM 2008). The TLP involved assigning recent military sites to a specific class (for example, anti-aircraft gun emplacements, coastal artillery, radar and civil defence, amongst others). These were then further characterised to develop a typological framework that allowed sites to be identified in the field for each class. Schofield *et al*. (2006: 58) explained that "characterisation…refers to a way of ordering information for the sites in question in an attempt to recognise the features characteristic of a particular site-type or place". For instance, in Australia, air raid shelter types can include trenches, dug-outs, pipe shelters, bunkers, pre-fabricated shelters or structurally modified buildings. These can be then further classified as covered or open trenches, lined or un-lined trenches, and so on. Once characterisation was complete, archival research of primary documents was used to determine how many of each type had originally been proposed for construction during the war. This information was then verified by checking post-war aerial photographs of intended locations to see whether any structures had actually been installed. Field-work involved re-locating and recording the remains of those sites. The resulting database was used to tag rare and endangered sites for conservation and protection through appropriate legislation.

A number of 'themed' publications resulted from these surveys containing details of the historical context of site types, typology, chronology, plans and images, the number of sites, and grid references of all locations. Anti-invasion measures and civil defence sites from WWII proved too numerous to be accurately recorded through primary record searches, so research was based on a representative sample only (Schofield 2009a: 28). However, despite this enthusiasm in the UK, civil defence aspects of the war still appears to have a low priority, as it does in Australia. In *The Review of Past and Present Thematic Programs*, Cherry and

Chitty (2009: 18) indicated that "[t]he proposed Civil Defence evaluation study [in the UK] was seemingly never commissioned" with civil defence being flagged in the same review as having a "Low/Medium" current relevance in the summary of assessed projects[11].

4.4 A themed approach to heritage: Australia

Australia seems to be at least twenty years behind the UK in recognising the importance and heritage value of structures relating to WWII. However, in the last few years, various Australian heritage bodies have also adopted a thematic approach for nominating and listing items and places to various heritage registers, but with a very different goal to that of the UK model. For example, NSW has a thematic listing program which, in 2009/10, focused on four key themes: Aboriginal Heritage; Convicts; Governor Macquarie; and WWI and WWII. At first glance, a theme focusing on WWII would seem a positive initiative for recognising the importance of air raid shelters in Australian communities, but in this instance, the NSW Heritage Branch (2009) defined this theme as acknowledging the important contribution of servicemen and women during both wars and the seventieth anniversary of the beginning of WWII. There is no mention of the importance of these conflicts to civilians or to civil defence. Celebrating the anniversary of the beginning of a war also seems to contradict the reasons that people march in ANZAC Day parades around Australia. This argument is supported, to some extent, by the fact that the domestic front is under-represented by comparison and, *ipso facto*, under-valued in heritage registers, giving a skewed view of war and the period. For example, a key-word search for "military" in the Australian Heritage Places Inventory (see footnote 12)

[11] Here, 'Low' relevance indicates a project that has been substantially completed, or one that did not satisfactorily achieve its objectives. 'Medium' relevance refers to assets that are not under critical threat or are of a lesser priority to English Heritage than other types of material culture (Cherry & Chitty 2009: 5).

returns 100 hits ranging from search light batteries to prisoner detention centres, ammunition bunkers and vehicle repair shops. A key-word search for “air raid shelter”, however, returns 20 hits including domestic, public and industrial types.

Strangely, and despite the NSW Heritage Branch definition, there is mention of listing a civilian air raid shelter in the minutes of a State Heritage Register Committee meeting under the heading: “8.1 *Progress of World War I and World War II Listings Theme*” (Heritage Council of New South Wales 2009: 7). A “priority list” of 25 sites and items was tabled at the meeting, with “civilian air raid shelter TBA” (no location provided) being the lowest priority. There is no category for civilian air raid shelters in the NSW Heritage Office schedule of heritage places, but a category for air raid shelters does appear under the theme of “Military” (see NSW Heritage Office 1999: 32 and NSW Heritage Office 2001: 6). Further, the linear hierarchy of National and State themes, which includes a category for air raid shelters, runs from a broad theme of “Governing” at a National level down to a “Defence” theme at a lower tiered State level. Again, however, only military examples are cited (see NSW Heritage Office 2001: 14; Heritage Council of New South Wales 2001: 7; and New South Wales Heritage Office 2006: 16). Perhaps it is the case that in NSW, air raid shelters, whether for civilian or military use, are automatically considered “military’ because of their relationship to war. Regardless, it is considered that these structures are deserving of more than purely military interpretation.

The motivation for Australian thematic listing programs (or at least that of NSW) seems very different to the English model where there was a great concern for the endangered and vanishing cultural heritage of modern armed conflict. In Australia, the underlying motivation seems to be one of two things: either to have a representative example of each type of site included (in NSW it seems that it is not so much the case of there being an endangered shelter that needs protection, so much as an appropriate example having not yet been found to fill the gap), or to make the listing process easier by limiting nominations to representative examples within various themed parameters.

4.5 Australian heritage listed air raid shelters

Whether thematically listed or not, a number of air raid shelters (civilian and military) appear on Australian heritage lists, and some are also included in wider defence-related heritage reports (see, for example, Pearce 2009).

Unfortunately, many of these shelters are embedded in the listings of larger heritage properties making them difficult to detect in searches of the various databases (see, for example, Calthorpe's House, Department of Territory and Municipal Services 2006). In a sense, they are still camouflaged and subsequently lie beneath the radar of researchers. Very little data is available on shelters that are noted as accessories to significant properties; more often than not, they are only mentioned as part of the chronological building phase with no separate, physical description provided. Occasionally, shelters do have some individually attributable significance which fits a listing criterion. An example of this comes from Quamby Flats, Toorak, VIC (Australian Heritage Database 2008), where: "[t]he inclusion of an air raid shelter in the development [of the flats] reflects the concerns of wartime Australia (Criterion A.4) (Historic theme: 8.12 Living in and around Australian homes)". No other information about the shelter is provided, a common occurrence across heritage databases.

Not only are records of listed shelters difficult to locate, it is possible for the same shelter to be listed on more than one database and under a different name, with each listing having varying degrees of data recorded. In Australia, heritage can be listed at Federal, State and Local Government levels simultaneously, meaning there is potential for significant overlap in the way places are nominated and gazetted. Consequently, many sites feature on multiple lists and summaries of lists, ultimately confusing and congesting the registers on which they appear (see Table 4-2). This phenomenon occurs with the Sicree Family Air Raid Shelter in St Kilda, VIC. It is listed twice on the same page in the Australian Heritage Places Inventory (2009): once under the Register of the National Estate where it is called simply "Air Raid Shelter"; and then again under the Victorian Heritage Register where it shows up as "Sicree Family Air Raid Shelter". The depth of information provided in the Register of the National Estate listing is greater than the Victorian Heritage Register, making it difficult to determine whether they are, in fact, the same shelter.

Table 4-1 summarizes the results of a survey of Australian heritage databases for civilian air raid shelter listings, whilst Table 4-2 depicts the spread of those shelters across diverse heritage databases. Six States and two Territories were surveyed and a total of 51 shelters were located. Because of the difficulty in locating shelters embedded in the listings of larger heritage properties, Table 4-1 and Table 4-2 do not necessarily reflect either the importance, or absolute numbers, of listed shelters.

Table 4-1: Number of civilian air raid shelters listed on heritage databases in Australia States

REGION	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
SHELTERS	1	10	0	29	2	1	6	2

WA, the Northern Territory (NT) and QLD were all subjected to aerial bombardment during WWII, but clearly QLD is the most pro-active (or sentimental) when it comes to its civilian air raid shelters, with 29 listed (five of these are in Brisbane and the rest scattered throughout regional QLD). It is curious that no NT shelters are listed, given that it suffered the most as a result of Japanese bombing activity with more bombs falling on Darwin than Pearl Harbour. South Australia has only two listed shelters, despite the general fear evident in the community as gauged by the extent of its ARP preparedness. One is State listed and the other local, but neither are domestic shelters.

Table 4-2: Distribution of shelter listings across various heritage databases in Australia

	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
Local/Municipal		4			1			1*
National Trust		1						
State Register	1	2		25	1		1	
Register of the National Estate		8		7*			6	1
Commonwealth Heritage List		3						
National Heritage List		2				1	1	
Australian Heritage Places Inventory[12]				17	1		1	
Australian Heritage Database[13]		9		5		1	6	1

*contains removed or uncertain listings

[12] The Australian Heritage Places Inventory (URL: http://www.heritage.gov.au/ahpi/) is a summary of places listed on Commonwealth, State and Territory heritage lists.

[13] The Australian Heritage Database (URL: http://www.environment.gov.au/heritage/ahdb/) includes places on the World Heritage List, the National Heritage List, the Commonwealth Heritage List, the Register of the National Estate and Overseas Places of Historic Significant to Australia.

The former ARP Sub-Control Station (now the Australian Society for Magician's Offices) on South Road, Torrensville, is the only SA listed air raid shelter (Place #14477). The *Twentieth Century Heritage Survey of South Australia Stage Two 1928-1945* (Bell *et. al* 2008) re-assessed the structure's significance against the criteria of the *Heritage* Act 1993, and subsequently the *Heritage Places* Act 1993. The accompanying statement of heritage value revealed that it:

> …stands as an indication of the perception of the threat from enemy attack during the Second World War, namely the fear of bombing, even as far south as Adelaide. It shows the extent of measures taken to maintain essential services in the case of disaster….This is one of few such secondary defence structures remaining in the State (Bell *et al.* 2008: 219).

The second shelter, the former Oxford Terrace Civilian Relief, Wardens, and Emergency Communications Headquarters in Unley (now housing the air conditioning plant for the local civic centre), has local government listing only (DPLG #3905). Under section 23, *Development* Act 1993, it was deemed to:

> a – [display] historical, economic or social themes that are of importance to the local area.
>
> b – [represent] customs or ways of life that are characteristic of the local area.
>
> Planning in South Australia 2010

When comparing Table 4-1 with Table 4-2, the extent of cross listing heritage properties becomes evident. For example, the ten NSW shelters appear 29 times across seven Australian heritage databases and summaries. It is obvious from these diverse lists that some shelters possess not only local, but also national significance. However, there has been no dedicated research that has been conducted into their actual extent, the range of types, their deeper social meanings, or the forms of public memory that accompany or complement them. Until this situation is addressed and the resource quantified, statements of significance attached to listings can never be anything more than general remarks, such as “one of few such secondary defence structures remaining” (Bell *et al.* 2008: 219), because nobody knows exactly how many there actually are.

It seems strange that structures which are relatively recent additions to the Australian cultural landscape, and are already appearing on lists of national merit, have no dedicated body of work underlying their role or significance. The NT, which lists many military bunkers and associated structures, but not structures associated with civil defence, seems almost to trivialise the impact of war on domestic society by keeping these structures out of their heritage registers. However, although these simple concrete structures seem to invite only simple concrete explanation, this does not detract from, or belittle, their ability to reveal important information about the Australian communities who felt a need to construct them and develop some supporting ARP infrastructure around them.

Chapter Five

Methods:

Detection and Recording

I have not been in a battle; nor near one, nor heard one from afar, nor seen the aftermath. I have questioned people who have been in battle...

Keegan 1978: 13

5.1 Understanding public and domestic agency

The research questions underpinning this thesis required locating and documenting the public and domestic WWII air raid shelters of suburban Adelaide. The questions further required detailed recording of their archaeological traces, the collection of oral histories relating to the construction of these facilities, an evaluation of the relationship between these and the wider public consciousness of an attack, a comparison of the patterning surrounding shelter construction, location and types between different residential areas, and their proximity to factories or other industrial assets.

It is possible to piece together the theory of mid twentieth century civil defence from surviving contemporary documentation. The practical manifestation of these theories in the public domain can be found scattered throughout sources such as council records, local and State archives and newspapers. It is also broadly documented in published histories (for instance, see Cornwall 1997; Campbell 1985; and Sumerling 2011). While the surviving archaeological remains in the public arena can be traced through existing written records, the theory and practice of the domestic agency relating to this phenomenon, however, lacks a reciprocal body of documentation. Consequently, it exists only in memory, both individual and social.

5.2 Investigating public agency

5.2.1 Municipal agencies: Archival searches

The Act and Code applied to local municipalities as the mandated entities liable for the protection of their constituents in time of war. Many SA municipalities have deposited their historical documents with State Records of South Australia. These cover all manner of council business, and can include council minutes, correspondence about public works including shelter construction, notes on local ARP activities, public enquiries regarding ARP matters, and claims relating to accidents involving ARP infrastructure.

Some municipalities also retain abstracts of their council activities for each financial year in the form of mayoral summaries. These contain details of major council works (such as the construction of air raid shelters) and subsequent expenditure. For example, the annual City of Unley 'Mayor's Report' for the period ending 30 June 1942 proved most useful to this study for providing information about the total number of public shelters (n=91) installed throughout the municipality in that financial year, and also some shelter positions, dimensions and costs associated with their construction. However, what these summaries lacked was more detailed information on their precise locations, construction methods and materials, as well as diagrams and images.

Adelaide City Council maintains its own archive, with a number of themed files of correspondence relating to air raid shelters in the CBD. The files cover the initial and ongoing wartime municipal research into different types of shelter, shelter codes, plans for proposed shelters, locations of proposed and installed shelters, as well as associated costing. They also detail the ultimate fate of many of the public shelters. Files relevant to this study included: HPO925:01: Corporation of the City of Adelaide Air Raid Precautions Activities 1935-1945; SPF233Q:01: The War: Concrete Pipes for Air Raid Shelters; TCDKT 1942/1539:01: Acting City Engineer: Air Raid Shelters, Wellington Square; CEDKT1942/1121A: Air Raid Shelters; and CEF [1942]027: Air Raid Shelters. Codes.

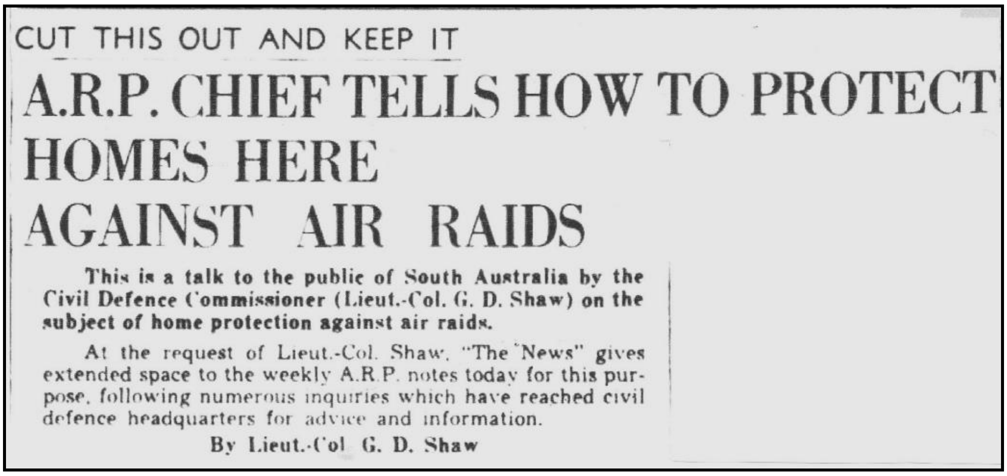
5.2.2 State and Federal agencies: Archival searches

State Records also curate many other documents that were equally relevant to this study and, surprisingly, also house some ARP objects, including a gas mask, ARP tin hat and various ARP badges and enamelled signs. Documents at State Records consulted during this research included a number of official ARP Handbooks[14], correspondence regarding ARP matters within municipalities, files from the Home Office Security Department and Civil Defence Commission (see, for instance, the contents of GRG 9/1/1725/1942 Box 55), and oral history transcripts of interviews with wartime architects (for example, GRG 138/4 Interview with Jack Cheesman). Some documents, despite their age, were still classified as secret and needed clearance before they could be brought out of storage for public viewing, simply because no other researcher had shown an interest in them. Clearance was obtained in all cases.

The State Library of South Australia also holds a number of Home Office ARP Handbooks and related publications from the war era, including pamphlets published by the CCA. It also has complete sets of contemporary newspapers, magazines and journals with ARP content. Local newspapers, such as the *Advertiser* and *News*, not only provided a veneer of social comment regarding ARP, but also gave the locations of some public and private air raid shelters and

[14] Unfortunately, no archive had the complete set of ARP Handbooks.

reported on related precautionary work (for instance, school dispersal plans). Newspapers also serialised various ARP procedures (see Figure 5-1), demonstrating blacking out windows and snuffing out incendiary devices. Older Australian architectural journals, such as *Salon* and *Architecture*, detail the gradual 'domestication' of concrete in Australia from the early twentieth century and its adaptation to small scale defensive works during WWI. These provided a context for the use of concrete in home defence during WWII. The Mortlock Library and the Australian War Memorial have a number of contemporary photographs of shelters in place around the Adelaide CBD.



CUT THIS OUT AND KEEP IT

A.R.P. CHIEF TELLS HOW TO PROTECT HOMES HERE AGAINST AIR RAIDS

This is a talk to the public of South Australia by the Civil Defence Commissioner (Lieut.-Col. G. D. Shaw) on the subject of home protection against air raids.

At the request of Lieut.-Col. Shaw, "The News" gives extended space to the weekly A.R.P. notes today for this purpose, following numerous inquiries which have reached civil defence headquarters for advice and information.

By Lieut.-Col G. D. Shaw

Figure 5-1: Cut this out and keep it!
(*News*, February 1941:2)

The National Archives had no records relating to local and domestic ARP matters, but was useful in providing information on the historical background to national defence schemes. No domestic journals or correspondence relating to ARP were located in the archives other than enquiries to official bodies, such as wardens posts or councils, although the next section details how some of this private memorabilia was obtained through private avenues.

5.2.2.1 Private memorabilia

Other sources of ARP-related 'ephemera' were second-hand bookstores, antiquarian shops and public estate auctions. Although rare in bookshops, ARP handbooks (some are pamphlets of no more than a dozen pages) retail for approximately $25.00 each, whilst an auction lot of eight different ARP handbooks and pamphlets have a hammer price of around $40.00. Estate auctions have regular lots of varied ARP ephemera and objects, including gas masks ($30.00), tin hats, wardens' badges ($45.00 for two) and identity cards, as well a map of a warden's patrol area in Hazelwood Park ($30.00). The map (see Map 8-8) was particularly useful in helping to understand the segregation of Adelaide into defensive districts and units. It also gave a visual sense of the different layers of defence available to civilians, especially at the lowest domestic level in houses that were covered by a network of patrolling air raid wardens. This lowest level of civil defence is at the core of this research and is data that is generally unavailable in the archives. Data from the higher level, where wardens reported to the district Sub-Control Stations who, in turn, relayed information to headquarters in the CBD via telephone and dispatch riders, is commonly available in the archives and includes much correspondence between the warden's districts and municipalities. Online auctions generally have a varied mix of authentic and reproduction items with ARP handbooks retailing for approximately $20.00 (plus postage and handling).

The most common booklet available at a retail level is Bartlett (n.d.), with four copies sighted during the study period. Other common ARP handbooks were those detailing wardens' duties and first aid practice, with those relating to structural defence being much rarer. This phenomenon could relate directly to the huge number of air raid wardens patrolling Adelaide streets and the amount of informative literature they required, as opposed to the considerably fewer persons involved in designing and building shelters. Antiquarian stores also had a varied range of ARP material, such as helmets, webbing and badges, and complete sets of educational ARP cigarette cards ($75.00). Generally, these sources provided a greater and more diversified range of material than the archives for researching the background of ARP, and consequently contributed to a better understanding of the enormity of public participation in ARP initiatives and the blanket effect that ARP had on the whole of Adelaide.

The current availability and high price of this sort of material gives an indication of the public's interest in the topic (from both a collector's and retailer's point of view), as well as its ephemeral nature and rarity, since most printed material was released on poor quality paper due to wartime restrictions and possibly has not survived in great numbers as a result. It further reveals something of the emotive power that items relating to the fear of aerial bombardment during the Second World War continue to have for those who have held onto the material for approximately seventy years. The fact that ARP-related material has appeared frequently at estate auctions in the last four years is also an indication of the passing of that generation and its vanishing testimony or an awareness of the collectability of this material with current owners wishing to capitalise on this desirability.

5.2.3 Corporate archives: Archival searches

Many long-lived corporations have substantial private archives that are accessible to researchers through an in-house librarian or archivist. The best example of this is NEWS Ltd, a newspaper conglomerate which, in the post-war years, has taken over many previously independent daily publications and their photo libraries. Typically, a photo journalist will take many photographs of the same subject of local interest in the same photo-shoot, but only one or two of these images will be used in a story. NEWS Ltd consequently has a vast library of photographs, many previously unpublished. These images are slowly being scanned into a modern database, but those not yet scanned are archived using the Dewey decimal classification. Images of WWII air raid shelters and those of ARP content not yet digitally archived can be found in the NEWS Ltd library under G940.53. Another example of a corporate resource utilised for this research is John Lysaght (now trading as BlueScope Steel). Lysaght was a wartime steel producer and the manufacturer of Anderson sectional shelters in Australia.

5.2.4 Aerial photography: Archival searches

MAPLAND is the Department of Environment and Heritage's retail outlet for information, science and technology. It has an archive of historical aerial surveys of Adelaide dating from 1949. Even though the earliest aerial imagery dates from four years after the war ended, it was possible that it could still reveal the position of former air raid trenches in the photographs. This was used both to locate the position of undocumented trenches and to verify the locations of trenches noted in the literature. Aerial photography was also used to view and precisely re-locate a now demolished ARP Sub-Control Station in Arthur Street, Unley. English Heritage (see Schofield *et al*. 2006: 58) used a similar technique in their survey of WWII structures in the UK when trying to determine how many of each type of structure had actually been constructed.

The suite of 1949 aerial photographs of suburban Adelaide was taken in January – the height of summer in SA. Fortunately, this meant that most vegetation (especially the grasses) growing on parks and other open spaces had died off, making it easier to locate the patterning of trench systems on the bare, earthen surfaces. A total of eight images (0007 0025; 0007 0059; 0007 0075; 0007 0076; 0007 0105; 0007 1016; 0007 0120; and 17 0049) were procured, covering the Adelaide CBD and North Adelaide, the foreshore area around Brighton and Glenelg, the south eastern section of Adelaide between Glenelg and the CBD (Marion and Plympton), the wartime industrial region to the west of Adelaide which stretches from just outside the city mile to Port Adelaide, and the Unley area. These images did not cover all of Adelaide, but were considered to be areas of high shelter building activity because of their large floating populations, diverse manufacturing industries and wealth.

There were problems associated with using historical aerial photographs. As the images were taken over sixty years ago, and as the landscape has changed so much through urban development since then, it was difficult to relocate some of the specific points. This problem was solved, to some extent, by using a street directory in tandem with the aerial data and following the main arterial roads to the general point of interest. Further, the maximum magnification available for viewing the images was 1000x, which did not allow for extreme close-up inspection of suspect areas to properly identify features within them. This was most obvious when trying to discern straight trenches which could easily be confused with paths or tracks and other garden design features. For example, the five city squares of the Adelaide CBD contained almost 11,000 linear feet of trenches by June 1942, yet none could be located and positively identified from the 1949 aerial photographs, despite many obvious straight lines criss-crossing the open areas of the city squares. The CBD squares are heavily manicured and well trodden; this may have quickly eroded or distorted the trench outlines in the four years between the end of the war and the aerial survey. These are also parks which were regularly watered and did not display the grass die-off characteristic otherwise typical in summer. On the other hand, zigzag trenches, such as the six arm example west of the Pier Hotel on the Glenelg foreshore (see Figure 7-4), proved the easiest type of trench system to identify because of their obvious saw-tooth pattern.

5.3 Investigating domestic agency

5.3.1 Oral testimony

> History is not what you thought. *It is what you can remember.* All other history defeats itself.
>
> Sellar & Yeatman 1932: vii (italics in original text)

This thesis concerns itself with historical events of the recent past. As such, the accompanying research was able to access information which is archived in living memory through the process of conducting oral history interviews with eyewitnesses of those events. Formal and informal interviews were conducted during the course of this research in order to locate existing and previously existing air raid shelters, and to access individual memories of the fear and civil precautions taken during WWII.

As with written sources, there is a certain bias present in oral testimony. Jan Vansina (cited in Stielow 1986: 23; see also Vansina 1972: 164) noted that:

> Oral traditions are conditioned by the society in which they flourish. It follows therefore that no oral tradition can transcend the boundaries of the social system in which it exists. It is spatially limited to the area circumscribed by the geographic boundaries of the society in question, and limited in time to that society's generation depth… the factor which most imparts bias and imposes limitations is the political system.

The oral traditions referred to by Vansina are simply defined as messages transmitted beyond the generation that gave rise to them (Vansina 1997: 13). In the current study, that distance may be as much as three generations. As this research targets individuals in a specific geographic area (Adelaide) and seeks to understand the range of local and unique reactions to a perceived or actual threat to that community, Vansina's geographical bias would seem to have little effect on the results and would, in all probability, favour the research design. Further, it is possible that the results of this research may be extrapolated to help understand reactions to the same event within a wider Australian society, again with little effect of spatial bias, because the target population represents a community united under one political system. However, on a macro level, and because oral histories were not collected from every Adelaide suburb, there is a possibility that some micro-spatial bias may be present in the results. This could be the case if, for example, more people from certain socio-economic backgrounds were interviewed and those results used as a broad analogy of society as a whole, rather than as a gauge of the range of individual reactions to hostile stimuli.

The strength of oral history is that different people witness the same historical event from a variety of social platforms throughout a stratified society. Consequently, sampling and interviewing people from diverse backgrounds about their recollections of the same event exposes the uniqueness of each individual's experience, and, when combined provides us with a broader social history of people and places written from the bottom up. The information provided by this living resource allows archaeologists to access the patchwork of smaller, local events that are embedded in the tapestry of national and global dynamics. Michelle Charest (2009: 419) argued that such a particularised approach "through the examination of numerous individuals, as well as general observations about the everyday within a particular society… [also informs] the overall research goal".

Of greater relevance to this study is Vansina's suggestion that generation depth within a society can affect results. Generation depth and the pool of human testimony diminish according to the chronological distance between the generation who witnessed the event and the event itself. Not only are there fewer eyewitnesses to recount their experiences, but the orally-retrievable information which is cognitively stored can be corrupted by lapses of memory, externally suggested memories, or the 'event age' of survivors. The seven people who were formally interviewed for this study ranged in age from two[15] to eighteen years when the general war in Europe began in 1939. Today, fewer people remain alive, or are lucid in their recollections, that were old enough to be digging trenches or building shelters as compared to people who were children during the same period. Therefore, the majority of witnesses surviving into the early twenty-first century were children during WWII and thus have limited and

[15] While children as young as two years can form memories of particular events, recall is fragmentary and disorganised, and mostly non-existent in adult years (Schneider and Pressley 1997). Language is critical to the development of autobiographical memory. Adult autobiographical memory generally begins "...around 3 or 4 years of age, but it develops slowly over the subsequent years with only a few memories from each year until school age" (Nelson and Fivush, 2004: 503). This means that the memories of adults in this sample who were older when WWII commenced are likely to be more reliable than those who were younger at the time.

specific memories of that time. The survivors (whether they were adults or children during the war) have also lived their lives in the post-modern era, and have been continually exposed to masses of information about the war. This information has come to them through various channels of multi-media and has taken many forms, including documentaries, newspaper articles, cinematic movies, historical books, novels and the internet. Processing this information forces the eyewitnesses to think differently about the past, especially when confronted with different versions of events (Loftus 2003: 868). In short, access to this vast amount of information may have altered the recollections of the participants, and those people may no longer feel the same about the events of the past as they did seventy years ago. Given the advanced age of the eyewitnesses, Elizabeth Loftus's (1997: 7) observation that "[m]emories are more easily modified…when the passage of time allows the original memory to fade" is a point which cannot be overlooked in Adelaide's sample of testimonies. These observations manifested themselves to varying degrees, and in different ways, in the testimonies that were collected in this study.

Certain anomalies aligning with Vansina's and Loftus's observations were recorded during the interview process. Included was an interviewee who confused his present age by as much as ten years at the start of the interview. This cast some doubt on the veracity of his other recollections. Other interviewees who were children during the war years remembered clearly that there were provisions of condensed milk, barley sugar and Vegemite in the shelters, but had only vague memories of other less child-friendly food stores. Another example comes from the separate testimony of a number of individuals all having different recollections of the same park which, oddly, also had its identity confused since the war years in street directories and local histories. This makes a fascinating case study in its own right.

In a later work, Loftus (2003: 867) also describes how her research on memory distortion:

> …has shown that postevent [sic] suggestion can contaminate what a person remembers. Moreover, suggestion can lead to false memories being injected outright into the minds of people. These findings have implications for police investigation, clinical practice and other settings in which memory reports are solicited [such as oral history interviews].

Loftus's research further demonstrated how an interviewer can manipulate replies to specific questions by loading those questions with verbs which will lead responses in a certain and predictable way. For example, a group of people were shown films of traffic accidents, after which one group was asked if they noticed how fast the cars were going before they 'smashed'. A second group was asked the same question, but with the verb 'hit' substituted for 'smashed'. More subjects responding to the 'smash' scenario falsely recalled seeing broken glass when there was none (Loftus 2003: 868). During the interview process of this study, an attempt was made to direct the interviewees rather than coach or lead them. This was achieved by asking very specific and, where possible, open ended questions in order to elicit data-rich responses to the research questions. Interviewees were also often asked by the researcher to elaborate on specific points of their memory by re-using the words. It was common for interviewees to talk off topic as other memories were rekindled during the interview process, and they often needed to be respectfully brought back to the subject. For example, a couple living in Sydney at the time of the Japanese midget submarine attack frequently returned to the events of the night of the submarine attacks during their interview, because it was their most overwhelming memory of the war (see Stafford MW3-07: 2, 5 and 7).

Ethics approval was obtained from the Flinders University Social and Behavioural Ethics Committee to collect the oral histories. Approval for this project (SBRE 3897), which had an original working title of *Archaeology of Defence: the Sum of All Fears*, was granted on 20 July 2007 and allowed for 20 participants to be interviewed (see Appendix 1). Two forms were developed as part of the ethics approval process. One was an information sheet for oral history participants (see Appendix 2). This briefly described the project, how recorded data would be used, and how the interview would be conducted. The second was the consent form for interview which required participants to disclose whether they wished to remain anonymous or have their names attached to the thesis (see Appendix 3).

A MARANTZ PMD660 professional solid state digital recorder was used to record the interviews. The data was then directly downloaded and stored as separate sound files. On completion of the research project, the recordings were transferred for storage to the Map Room in the Department of Archaeology, Flinders University. Complete transcripts of each interview were made, and all interviewees were provided with a copy of their transcript which they were able to edit prior to inclusion in this thesis. Only one participant asked that changes be made to their transcript. These changes were requested on issues of privacy, where street numbers were deleted to protect the new owners of wartime addresses mentioned. Seven interviews were recorded between 2007 and 2010. Four of these interviews were with people who had been small children aged from two to seven when the war began, and who had limited recollection of events outside the household or school. As the study progressed and research questions refined, it was found that short, specific questions could be asked to elicit the desired data. Consequently, formal interviews were largely abandoned for the more informal, personal communications with target individuals, and the responses recorded manually rather than with a digital recorder. Questions that were asked in both phases (formal and informal) of the interview process included:

- What is your name and age?
- Where did you live?
- Did you have an air raid shelter at your house?
- Can you describe it?
- Were there any furnishings or provisions placed in it?
- What happened to it after the war?
- Were there other shelters in your street?
- Were there shelters at your school?
- What can you remember of the feeling at the time?
- Were people fearful of attack?
- What sort of work did your parents do?
- Was your father in the First World War?

Potential interviewees were located in a number of ways. In September 2007, the Department of Archaeology at Flinders University conducted an excavation at a former military hospital, the General Repatriation Hospital, Daw Park, with a view to relocate wartime air raid trenches and other shelters dug in the hospital grounds. By way of public outreach, the pending excavation was widely publicised, and members of the public with some former association to the hospital, or with recollections of the shelters and their locations, were encouraged to attend. The project was run as an archaeological field school (ARCH3303/ARCH8304). Students were required to conduct oral history interviews as a facet of their instruction and were supervised by the researcher in this aspect of the field school. Although a military site and, therefore, not relevant to this study, the excavation attracted many 'civilians', and several visitors to the site had valid recollections of the fear and civil defence preparations during WWII. Full transcripts of the seven interviews are included in Appendix 5 and can be found on the accompanying CD.

5.3.2 Local history associations

Other interviewees were approached through local history associations, such as the Mitcham Heritage Research Centre, the Port Adelaide Historical Society, the Holdfast Bay History Centre, the Prospect Local Historical Group, the Walkerville Historical Society, the Brighton Historical Society and the Unley Museum, all of which have a large number of elderly volunteers and considerable historical resources relating to their individual municipalities. Many of the volunteers at these centres have good local history knowledge, including memories of air raid shelters which they were willing to talk about. Some volunteers also offered personal photographs and one even a home movie of a backyard shelter being constructed (see Figure 7-12). These specific history associations were chosen because they represented the areas where most of the population of Adelaide resided during the war years and constituted a range of diverse socio-economic backgrounds (see Map 8-1 for more information). Port Adelaide is a working class area. Mitcham has traditionally been a white collar, middle class area, with many residents having office jobs and some disposable income. Holdfast Bay (Glenelg), with many grand homes, is Adelaide's premier seaside location and still attracts wealthy residents, as well as a huge floating population in the summer and on weekends. Unley is one of Adelaide's wealthiest municipalities and was considered a prime location for locating extant, well built shelters. Prospect and Walkerville, in ARP Sub-Control Area D and reputed as being the best organised of the eight Adelaide civil defence districts (Lampshed n.d.: 87), was considered because it was thought that evidence of this outstanding organisation may survive with the local history groups. Port Adelaide was also important to include because of its status as a high risk target area, with its docks and slips, warehouses, oil storage facilities, rail junctions and proximity to wartime manufacturing.

Unfortunately, this method did not cover all of suburban Adelaide. Some municipalities had no historical groups, and some, like Burnside, had no information at all about the shelters which may have been in their area, an unfortunate situation given that three of the archaeologically recorded domestic shelters were in the Burnside prefecture and within two kilometres of the town hall. The quality of information obtained from the various historical groups also differed depending on individual experience and memory, and the types of records kept by the respective organisation. For instance, the Unley museum had cross-referenced archives of photographs, newspaper clippings and mayoral summaries which made it easy to access specific information from a number of sources, whereas Port Adelaide had mainly published broad histories of the various suburbs within the municipality, with members having very little recollection or specific knowledge of shelters.

5.3.3 Public appeal for information: Schools

Aside from the publicity surrounding the excavation at the General Repatriation Hospital, several other forms of public appeal were trialled in an attempt to locate other interviewees and extant shelters. One method used was to place the following request for information into school newsletters with the researcher's contact details.

World War II Air Raid Shelters

> Martin Wimmer, an archaeologist from Flinders University, is researching World War II air raid shelters in Adelaide.
>
> Martin would like to hear from you if you think you still have one in your back yard or under your house or if you know of anyone that does.

Two schools were chosen to trial this technique (Mitcham Primary School and Seymour College) because both are located in the more affluent suburbs of Adelaide. Ultimately, four of the eight domestic shelters recorded were in these suburbs. Useful data was collected from some parents and teachers at these schools and one extant shelter—Griff (section 7.6.2.3)—was located and archaeologically recorded.

5.3.4 Public appeal for information: Radio interviews

Another type of public appeal was delivered by way of a radio interview. On 15 June 2010, the author was interviewed by Sonja Feldhoff, the 'Drive Time' (1600-1800hrs) presenter of 891 ABC Adelaide, about the air raid shelters of Adelaide. The interview aired during a high captive audience period (the drive home from work) and was also made available for download from the station's website. The interview lasted approximately 21 minutes and incorporated a talk-back feature which encouraged listeners to call the station and engage the archaeologist in conversation about their air raid shelter experiences. Many listeners took advantage of this offer, with 10 being given the opportunity to speak. Others sent text messages, one of which was read out during the interview. A number of potentially new air raid shelter sites were offered during the segment, but no contact details were recorded by the radio station for follow-up by the researcher. The researcher's email address and home phone number were left with the radio station, and this information was aired immediately after the interview with a request for listeners to contact the researcher directly if they had any relevant information relating to this study.

Only one person who heard the interview subsequently contacted the researcher via email with shelter information. This information proved very useful, and led to an extant shelter and oral history being recorded in Peterborough, 260 km north of Adelaide. Although outside the initial geographic boundary of this research, Peterborough presents an interesting comparative case study because of its vast distance from a major city, and the number of shelters constructed there (for more information see Chapman in section 7.6.2.1).

A follow-up interview on the same radio program was aired on 23 September 2010. This lasted approximately five minutes and involved no talk-back. The radio segment was intended purely to inform the public of pending geophysical survey work in Soutar Park, Goodwood, on 24 September 2010 relating to the shelter research (see section 5.6) and to invite them to attend. Six listeners ultimately accepted the invitation. Three (one of whom had heard both radio interviews) contributed data to this research by way of recollections of wartime shelter locations, but no new extant shelters were discovered.

5.3.5 Public appeal for information: Print media

A general press release by Flinders University relating to the geophysical survey of Soutar Park and inviting members of the press to attend was picked up by the *Advertiser*, a state-wide tabloid, and appeared in that paper on 25 September 2010. A member of the public who saw the article contacted the researcher with new information relating to another wartime public shelter in the Goodwood area. The Messenger Press *Eastern Courier*, a weekly suburban newspaper, also followed up the press release, resulting in an article on the air raid shelter research and the researcher's contact details appearing 6 October 2010 (page 18). The article included a direct request for all members of the public who were aware of shelters to contact the researcher. The highest number of extant backyard air raid shelters had been located in the eastern suburbs of Adelaide, the area serviced by the *Eastern Courier*. It was considered that strategically placing the article here would lead to more data being generated for the research. Copies of the press release and newspaper article are included in Appendix 6 on the accompanying CD and are located in the Geophysics folder.

In total, testimonial data was collected from 67 individuals: 60 (89.6%) of these were interviewed informally, and where their testimony is incorporated into the text of this thesis, they are cited as personal communications. Of the 67 interviewees, 65.7% (n=44) were male and 37.3% (n=25) female. Thirty-five (52.2%) interviewees were alive during WWII and contributed firsthand information regarding shelter locations, construction methods and insights into the fear and hardships experienced during the war years. Of these, 91.4% (n=32) were children or teenagers (18 or below) during the war, and 8.6% (n=3) were adults. Of the total sample interviewed, 50.8% (n=34) provided second hand information that largely concerned the location of shelters. For instance, these individuals knew of their grandparents constructing a shelter, or had lived somewhere that had one at some stage, but had no direct connection to its construction, nor had they interacted with it during the war years.

5.3.6 Public appeal for information: Museum exhibition

In late 2012, the Unley Museum hosted a three month exhibition of the primary source material (ARP related ephemera and objects) collected during the course of this research. The exhibition was advertised via the Unley Council's website and monthly newsletter, the *SA Local Museum's* bulletin and a museum flyer (see Figure 5-2). Those attending were invited to leave comments and wartime recollections with the museum curator who passed them onto the researcher. The result was that two extant shelters—Lamberton's (section 7.6.2.2) and Harley's (section 7.6.2.3)—were located and archaeologically recorded and the details of two others (now demolished) were noted and included in the database.

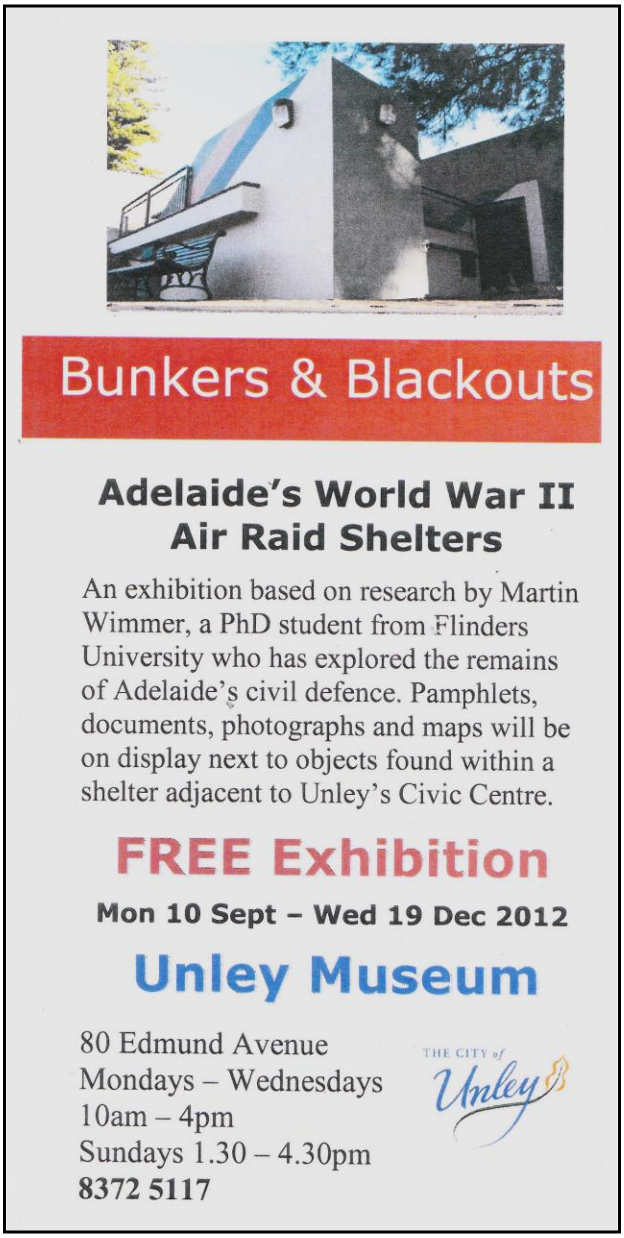


Figure 5-2: Unley Museum flyer of the air raid shelter exhibition

5.3.7 Public appeal for information: Conference presentations

During the term of this research project, three conference papers were presented explaining the research goals, progress and findings. Details of these papers are as follows:

- 'Air Raid Shelters: notional explanations for concrete structures'. In a Global Context: Australasia's Archaeological Evidence of the Globalisation Process. ASHA/AIMA Conference, Launceston, Tasmania, 24–26 September 2009.
- 'A Fearful Legacy: Adelaide's WWII Civilian Air Raid Shelters'. Legacies of War. Narratives of War Symposium, Adelaide, South Australia, 29-30 September 2011.
- 'A Fearful Ephemera: Written Traces of WWII Civil Defence'. Traces of War. Narratives of War Symposium, Adelaide, South Australia, 20-22 November 2013.

One extant shelter—Pierce's (section 7.6.2.4)—was located and archaeologically recorded as a result of these presentations and details of six others (now demolished) noted and included in the database.

5.4 Determining wartime wealth and status of shelter builders

Searches of Certificates of Title (CT) were conducted at the Land Titles Office (LTO) for all private residences that had shelters recorded during this research, and whose current occupants were not residents during the war years. These titles contain historical information of varying quality, such as the owner's name and spouse's name, when the property was purchased or sold, the owner's occupation, who held the mortgage and whether the property was ever sub-divided. These searches were initiated primarily to discover the occupation of the wartime property owner and to assess that person's wealth or position in society, and then link this information to the type of shelter constructed. Further, one extant shelter was on the property of a house that dated from approximately forty years after the war. The entrance of this shelter faced a much older house on the other side of the boundary fence, and it was considered that the block had been sub-divided at some stage, rather than an older house having been demolished and a newer one constructed. A Certificate of Title search proved that the block had been subdivided and that the shelter was now part of a new property. Where information regarding a person's occupation was not noted in the CT, this could often be obtained in the Sands and McDougall *South Australian Directory*. This directory, much like a modern day telephone directory, was issued each year and listed addresses, phone numbers and occupations as well as the core business of many Adelaide workplaces.

5.5 Recording standing structures

Most photographic images of extant air raid shelters were recorded using a Canon IXUS V digital camera with a Canon zoom lens (5.4-10.8 mm/ 1:2.8-4.0), and a Panasonic LUMIX DMC-TZ30 with a Leica zoom lens (DC VARIO-ELMAR 1:3.3-6.4/4.3-86 ASPH.). A 3 m telescopic range pole with 20 cm red and white increments was used as a photographic scale.

Internal dimensions of extant air raid shelters were recorded using a PREXISO[16] and a Bosch PLR50[17] laser distance meter. A laser was found to be more reliable than a standard tape measure. Laser distance meters enable one person to conduct a rapid survey of the internal dimensions of structures without needing an assistant to hold the other end of a tape measure. They also allow a number of measurements to be taken from each point without having to move. The laser also has the potential to reach into normally inaccessible corners. For structures with corrugated ceilings, a measurement was taken to the highest central point in the trough of the corrugation to ascertain its maximum internal height.

[16] This device has a range of up to 40 m and a measuring accuracy of ± 3 mm.
[17] This device has a range of up to 50 m and a measuring accuracy of ± 2 mm.

External measurements were recorded using standard 6 m and 50 m measuring tapes. All measurements were annotated on mud maps and later drawn to scale on graph paper being later transferred to tracing film and inked. In many cases, it was not possible to record the thickness of exterior walls, especially those portions which lay below ground level. Further, it could not be assumed that the width of the walls below ground matched that seen above ground in partially buried structures, because the contemporary British technical manuals[18] stated a requirement for thicker underground walls to neutralise the increased effects of bombs exploding in the soil near the foundations of shelters (Home Office 1939c: 2). Some of the underground shelters had shelves/alcoves built into the walls and the depth of these was recorded, but these are considered and interpreted as minimum dimensions only, since all alcoves still had a rear concrete wall of unknown thickness. The distance from the shelter entrance to the back door of the residence was also recorded and, in the case of homes with modern extensions, the distance to the original back door. In one case, a residence with a shelter located in an industrial area had a large wartime factory over its back fence, and the distance between the two was also recorded. The bearing of each shelter was taken with a hand-held magnetic compass (SUNTO A30). Bearings were taken to determine whether orientation indicated the direction of the oncoming attack.

[18] This requirement does not appear in the local SA Code, but some local builders, engineers and architects may have used the British recommendations which were available in SA, as evidenced by the Griff Type V (see section 7.6.2.3).

Figure 5-3: Martin Wimmer recording the Peterborough Type V shelter
(Kylie Lower 2010)

5.6 Geophysics

Archival research revealed that the shelters at Soutar Park, Goodwood, were left in place after the war and mounded over (Unley Museum n.d.). The mounds now appear as landscaped features in the park and adjoining playground. Geophysics was employed here to determine the location and extent of any structural archaeological remains under the mounds.

The mounded area of the park was physically divided into two distinct parts – an enclosed playground and a larger open area. The park had various live underground utilities, such as an irrigation system and electrical cables for lighting. As well, there were also derelict sub-surface iron water pipes dating from an early twentieth century drinking fountain formerly situated south of the mounds, and remnants of assorted concrete slabs and concrete filled post holes. There were a number of picnic tables, barbeques and rubbish bins fixed to reinforced concrete slabs in the vicinity of the mounds, and also a concrete path bisecting them. The playground had various types of play equipment constructed of diverse materials (metal, plastic and rubber) surrounded by a metal fence. All of these items had the potential to interfere with the data recorded at the site.

Two ground penetrating radar (GPR) and a magnetometer were utilised in the survey. The GPR instruments were a GSSI SIR3000 with a 270 MHz antenna and a Ramac/Mala X3M with a 250 MHz antenna, whilst the magnetometer used was a Geometrics G-856AX Proton Precession tuned to 60,000 nanotesla (nT). The mounded area was surveyed as two distinct quadrants divided by the playground fence. The playground quadrant constituted an area of 12 m x 15 m, and the quadrant outside the playground 25 m x 35 m (see aerial imagery, Figure 5-4). Each quadrant was divided into 2 m wide corridors along which the GPR instruments were run, and included 2 m station spacing for the magnetometer survey (see Appendix 6 on the accompanying CD for images of this survey in the Geophysics folder).

Figure 5-4: Survey grids at Soutar Park, Goodwood, 24 September 2010
(Image URL: www.nearmap.com)

It was considered that the magnetometer might be able to detect any metal associated with the sleepers recorded as forming the walls, but unfortunately it could also detect all the non-associated metal in the region as well. This interference was more prolific in the playground quadrant. A site plan indicating the location of all the extraneous metal objects was drawn so that these could be filtered out of the survey results. An automatic level survey showed that the three mounds were between 0.945 m and 1.115 m high. Because of the considerable density of the soils used to backfill the amphitheatre and create the mounds (most likely the Red-Brown Earths [RB Earths] or 'Bay of Biscay clay' of the Adelaide Plain), the two radar antennae employed in the survey could only penetrate one metre. This meant that at the top of the highest mounds the radar could not penetrate the natural surface level below the mounds, but elsewhere along the slope, off the high points, it could produce sub-surface images.

5.7 Summary of unearthing tools

Unearthing information about shelters now gone and locating and recording extant structures was achieved by employing a diverse tool kit of research methods and archaeological technique and included:

- Consulting primary source documents such as ARP Handbooks and codes for shelter construction.
- Evaluating archival material housed in various research facilities such as State Records, the LTO, the State Library of South Australia as well as corporate archives (for instance those of NEWS LTD and BlueScope Steel).
- Scrutinising historical aerial surveys.
- Public appeals for information including invitations to attend archaeological fieldwork, radio broadcasts, presentations and a museum exhibition based on the research project.
- Oral history interviews with members of the public who had some knowledge of the shelters whether first or second hand.
- Geophysical surveys including magnetometer and GPR.
- Recording shelter dimensions with laser distance measures and tape measures and recording architectural features with photography.

These methods were developed in order to answer the research questions and ultimately led to the creation of a typology of shelters that enabled easy characterisation and identification of types recorded during this research.

Chapter Six

Shelter Typology:

An Archaeology of Sorts

6.1 A context for shelter types

This chapter details the theoretical background and practical development to the range of shelter types constructed across Adelaide between December 1941 and August 1943. It demonstrates that initial research into air raid shelters, and the types utilised in Australia, had their origins on the European mainland and in the British Isles. This research was later transferred to Australia through various official publications and communications between English and Australian government departments and civil defence groups. It was then passed on to the general public via the local ARP infrastructure in the various Australian States (including SA), where it was subsequently adapted to local conditions.

Two pieces of SA legislation, the *Emergency Powers Act, 1941*, and for air raid shelters, the Code in 1942, provided the context for shelter construction in Adelaide. The Act mandated institutional and public defence, whilst the Code provided the standards and guidelines for the form that structural defence was to take in the public arena, and for providers of shelters for domestic consumption. Before the Act was passed, municipalities and institutions (eg. schools and large businesses) were loath to invest in structural defence, but once responsibility was directed at these organisations by the official instrument, civil defence proceeded at a rapid pace.

On 18 December 1941, regulations regarding the administration of the Act (which had been assented to on 28 August) were gazetted in SA. Section 34/1(c) of 'Regulations as to Administration' of the Act, regarding the powers of municipal and district councils, stated that they may:

> …with the approval of the Minister, do or execute any act, matter, work or thing and make any arrangements and enter into any transactions, for the purpose of protecting the civil population against danger or damage from enemy action (*South Australian Government Gazette* 1942b: 1502).

This Act put the responsibility for protecting constituents and the daily transient population within their jurisdiction squarely on the shoulders of each municipality, and encouraged a culture of research, risk assessment and shelter construction in order to comply with the new regulations. Section 2 (2) (h) of the Act also empowered the State to take possession "whether by agreement or compulsory procedure" of any property required for administering the regulations of the Act.

On 26 February 1942, only seven days after the first Japanese air raid on Darwin, a code for air raid shelter design in SA was gazetted. This code was:

> …published for the guidance of persons providing air raid shelters and plant pursuant to orders made by the Hon. The Premier or directions given by, or arrangements made with the Commissioner of Civil Defence (*South Australian Government Gazette* 1942a: 358).

The Australian codes for shelter construction gave "reasonable protection against the effects …of high explosive bombs bursting in the vicinity, but not, of course, against direct hits" (Pettifer 1941: 9). They also protected against penetration by machine gun bullets, anti-aircraft ammunition fragments and incendiary bombs. South Australia's municipalities as mandated providers of air raid shelters to the general public were, consequently, entities to whom this new legislation applied. Conrad Hamann, Deputy Chief Engineer, British Ministry of Home Security, on a visit to Adelaide noted that although less stringent than the Commonwealth Code, the local State Code was seen as being appropriate for Adelaide because of the city's lower vulnerability to aerial attack (Hamann 1943).

The institution of the Code resulted in an obvious dichotomy in the range of structural defence appearing in the SA landscape. Once the Code was available, public shelters constructed prior to February 1942 were considered inadequate and relegated to supplementary emergency use only, whereas the later regulated structures provided proper emergency protection for Australian conditions. After February 1942, shelter construction in Adelaide shifted from a haphazard and unregulated 'blue sky' building phase (where adequate overhead protection was largely ignored) to a strict scientific regime insisting on minimum lateral and overhead dimensions.

The Code applied to people such as architects, drafts persons, builders and specialist concreting businesses commissioned to design and install shelters for clients. It equally applied to entities such as local councils, businesses and landlords (with 30 or more employees or persons congregating) that had a liability and duty of care to provide shelter. Municipalities were also often called upon to help with shelter advice and installation at schools and churches in their jurisdiction, while parents and parishioners provided much of the labour. An example of this can be found in the Unley mayoral report of June 1942, which states that trench shelters were laid out and partly constructed at a number of public, as well as three private, schools in the municipality, pending completion by voluntary labour (Bentzen 1942: 31). Among them was Walford House Girls' School where 40 fathers and elder brothers dug trenches to accommodate 300 students and teachers. These had been marked out by the Unley City Engineer (Mr Rogers) and council employees (*News* 28 February 1942: n.p.). Local architects, such as H.T. Griggs, were appointed as ARP investigators to ensure the Code was being adhered to, and to offer advice on aspects of ARP.

Those civilians who preferred to construct their own shelters, rather than employ a professional to provide them with one, lay outside the mandated parameters of the Code. It seemed an impossible task for the ARP investigators to inspect and certify everything that individuals did at home to protect themselves and their families. Consequently, the introduction of the Code had little bearing on how individuals went about protecting themselves in private.

6.2 A South Australian typology of air raid shelters

No existing typology of air raid shelters was uncovered during the literature review accompanying this research. However, from an exhaustive review of the historical literature and testimonials recorded during this research it became evident that six broad categories of public and domestic air raid shelter were used by various municipalities, commercial enterprises and individuals in Adelaide during WWII. Based on their physical attributes and the grade of protection each provided, the following typology was developed for this research:

- Type I: trench shelters – open and covered
- Type II: dug-outs
- Type III: sectional shelters
- Type IV: pipe shelters
- Type V: bunkers – structures of concrete, stone, brick or steel
- Type VI: structurally modified rooms.

This typology best reflects the local variability of built forms and the consequent level of protection each offered. Type I: trench shelters were the simplest types of deliberately constructed structural defence, requiring few implements and minimal outlay to manufacture. In the public arena, they represented an immediate and emergency response to the Japanese threat. On the domestic front, they could also represent limited resources or a limited knowledge of structural protection. Type II: dug-outs were more complex earthworks than trenches. Typically, these structures were room sized with thick overhead protection, and were also outfitted with rudimentary furniture and emergency provisions. This type of structure was often called a bunker in various international theatres of war, but is considered a separate and unique type in this Australian study. Type III: sectional shelters, although variants of the trench shelter in the UK (see Baker 1978: 4 and 42), are considered to be a separate type because they were purchased as pre-fabricated, portable and self-contained structures. Type IV: pipe shelters were a response to the codification of shelter design in Adelaide which recommended monolithic structures with sound lateral and overhead protection for the public domain. Not originally designed for air defence, they were opportunistically employed in large numbers for this role. Type V: bunkers were purpose-designed hardened structures constructed of concrete, stone, brick and/or steel. Many bunkers display built-in features, such as shelving, drains and sumps, breather pipes, bunk alcoves and even open fire places. Type VI: fortified rooms consisted of structurally modified rooms in an existing dwelling, commercial premises or public building. They could be basements or above ground internal rooms set aside as a refuge, and could display additional bracing to the ceilings and walls, and employ thickened walls and sandbagging. Some were supplemented with Morrison Table Shelters.

This section characterises each type of shelter, as well as their origins, factors affecting their construction and the pitfalls associated with constructing certain types of shelter. By providing a typology, it also creates a model for identifying and comparing the range of defensive structures uncovered during field work, and sets up a framework for analysing the archaeological data in Chapter Seven.

6.3 Type I: trenches

In a linear hierarchy of defensive structures, earthworks represent the simplest forms, and survive in the archaeological record as testaments to the antiquity of human social organisation. Defensive earthworks of the twentieth century in the form of trenches survive in individual and social memory, with the trenches of the First World War battlefront becoming iconic symbols of that conflict through the aid of countless grainy images (photographs, moving pictures, sketches and paintings), official dispatches and citations, poetry and popular fiction (see, for example, Remarque 1963 [1929] or the war poems of Wilfred Owen and Siegfried Sassoon). Those of the Second World War home front have also become reminders of the fear and hardships experienced by individuals and society at the time (see Newport 2007 and Wimmer 2012).

Trenches are excavated forms of structural defence and have very little lateral reinforcement other than their natural earthen surrounds, although some use shoring to prevent the walls from slumping. In the UK, once the German offensive had begun, trenches were also lined with concrete panels to increase the grade of protection offered, but this was not pursued in SA beyond a research phase because of its expense and adverse reports from the UK. Trench shelters are typically narrow pits of varying depth and length. They can have straight, zigzag or any number of intersecting arms, and can be divided into two main sub-groups:

- Type I(a): open trench
- Type I(b): covered trench

The open trench was the most basic and simplest form and was often referred to as a slit or emergency trench. Open trenches were so named because they had no covering, and consequently, provided no overhead protection from direct aircraft attack, falling anti-aircraft ammunition, tumbling debris from nearby war damaged buildings or even, as Fuchs (1942: 10) pointed out, the weather. They did, however, offer good lateral protection from blasts and against splinters from bombs exploding at ground level in their vicinity. Lateral protection was one of the two absolute prerequisites for all air raid shelters (the other being overhead protection), as specified in various Australian codes for shelter construction from 1941 onwards (see *South Australian Government Gazette* 1942a: 359 and Pettifer 1941: 2). In contrast, the covered trench had a roof which typically consisted of timber bearers covered with sheets of corrugated iron, over the top of which was placed the excavated earth. These structures greatly improved occupant safety and comfort compared to an open trench.

6.3.1 Background

During WWII, Type I structures became regular features of backyards, parks, playgrounds and school ovals. The Home Office Air Raid Precautions Department (1938: 1) professed "[w]here space is available as in a garden, a trench provides excellent protection except against direct hits". The subterranean corridors which began appearing *en-masse* in Adelaide's public domains at the end of 1941 were largely the product of official powers granted to the municipal and district councils in Section 34/1(c) of the Act (see *South Australian Government Gazette* 1942b: 1502). Conversely, those domestic trench type structures that scarred private backyard lawns and gardens were often the result of limited economic means or limited availability of materials, as well as a policy of 'dispersal' rather than 'stand fast', as civilians and school children were encouraged to make their way to their own homes rather than rely on government infrastructure for protection.

The Department of Home Security (1943: 1) claimed that the types of bomb commonly used in lower density areas were the anti-personnel and impact fuse varieties which had little demolition value, but which produced great lateral blast and splinter effects. The best protection was to get below the level of the lateral effects, for instance, into a trench. It was more difficult to protect the civilian population of heavily built-up cities where general-purpose demolition bombs were the weapon of choice, since slit trenches offered no protection against the amount of debris such bombs would throw into the air. Wartime Adelaide was considered a low density city, with only a few buildings (among them the Verco Building at 178-179 North Terrace; the Australian Mutual Provident Society [AMP] Building; the Temperance and General Insurance Company [T&G] Building; and the Savings Bank of South Australia, all on King William Street) reaching a height of more than six storeys. Given this, the built environment of Adelaide presented the ideal location for Type I shelters in its suburbs and CBD.

6.3.2 Factors affecting Type I construction

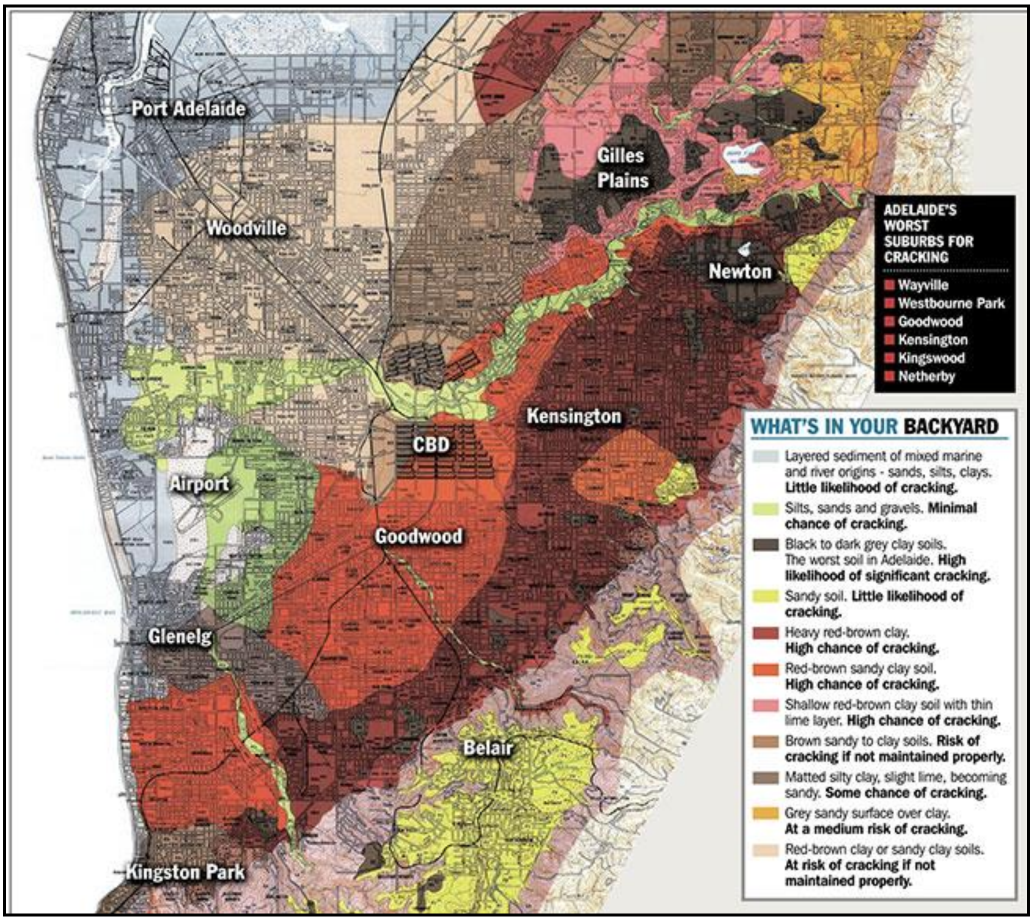
A number of factors affected trench and dug-out construction and placement in SA. These included: differing designs and recommendations that were available in handbooks and popular print media, as well as from local authorities and delegated ARP officials; previous wartime experience; the availability of manpower and construction material (for instance, suitable panelling for shoring up trench walls in un-stable ground); and environmental factors.

Designs for trenches were readily available to the public in official government publications, such as the ARP handbooks (see, for example, Home Office, Air Raid Precautions Department [1938], War Office [1941(1939 Provisional)] and State Emergency Council for Civil Defence, Victoria [1941: 31-32]), in locally produced pamphlets (see, for example, Bartlett [n.d.: 12-13] and The Blind Self-Aid Society [n.d.: 8]), and in popular literature, such as, *Australian Home Beautiful* (see, for example, Mellor 1942: 12-14 and Fuchs 1942: 10-11). They were also published in the daily press over a number of editions as serialised ARP guides (see, for instance, the contents of GRG 9/20). Throughout the late 1930s and early 1940s, ARP wardens, as well as members of the Red Cross Society and the St. John Ambulance Association, gave public lectures about ARP which included advice on constructing trench shelters (see Red Cross Society and St. John Ambulance Association n.d.: 24).

By late 1941 and early 1942, Adelaide's work force had been greatly depleted, since a large proportion of its able-bodied men were either abroad on war service or stationed away from home in military training camps around Australia. For instance, South Australians could be found fighting in the Middle East and in the islands to the north of Australia, but they were also sent to other Australian States (Felstead MW1-08: 6). For many families, this absent labour force meant that women, children, adolescents and the elderly had to swing the trenching tools in their own defence, an almost impossible task for these sections of the community given the environmental conditions they had to contend with at that precise moment in Adelaide (Holt MW4-07: 2-3).

The two major environmental factors affecting trench construction in Adelaide in the summer of 1941/42 were its soil type and the weather. Away from the narrow band of coastal white sand, more than 50% of the total area of the Adelaide Plain has soil categorised as RB Earths. The thick red clay found just under the surface is known locally as ‘Bay of Biscay’, and was named by Adelaide’s early settlers in memory of their horror passage out to Australia through the rough, shallow seas of the French west coast, an indication of their adverse feelings for it. The elasticity of Adelaide’s RB Earths presents numerous engineering problems for structures whose footings move with the seasonal expansion and contraction of this clay foundation. So extreme are the properties of the Adelaide Plains soils that in the mid-1950s the Department of Mines saw a need to characterise soil profiles of Adelaide and its suburbs, and correlate these with engineering properties of the soils in a baseline study for the local construction industry (see Aitchinson et al. 1954). Map 6-1 depicts the spread of soil types across Adelaide—the darker colours are also the hardest areas to dig trenches in.

This undertaking is unique to SA. Unfortunately, for a desperate and panicking Adelaide population of trench diggers, these unique soil properties presented problems and challenges of a different sort. In the summer months, the local red clay shrinks and bakes so hard that picks and other trenching tools (as well as gardening implements) tend to bounce off, and in winter the clay swells into a heavy, sticky plastic paste which is impossible to remove from boots and digging utensils. Archaeologists have also discovered that the Adelaide clay is so elastic that after a few winter seasons, it is often impossible to locate a former cut when attempting to re-open an old trench (Justin McCarthy 2008, pers. comm. 8 February, Managing Director, Austral Archaeology).



Map 6-1: Profile of Adelaide soils
(Stokes 2013)

Table 6-1 depicts the total monthly rainfall recorded at the West Terrace Weather Station in Adelaide from the beginning of October 1941 to the end of May 1942 (Australian Bureau of Meteorology 2009).

Table 6-1: Monthly rainfall in Adelaide, October 1941 – May 1942, recorded at Weather Station #023000 on West Terrace, 5000

Date	1941	Oct	Nov	Dec	1942	Jan	Feb	Mar	April	May
Monthly Rainfall	(mm)	36.4	25.4	14.6	(mm)	41.0	5.4	7.9	47.2	124.8
Mean Monthly Rainfall	(mm)	44.5	30.7	26.3	(mm)	20.0	20.7	24.0	44.3	68.2

Clearly, from these statistics, October through December 1941 had been very dry months with below average rainfall, and Adelaide had received only 55.5% of its mean rainfall in December. This dry spell coincided precisely with the initial panic and flurry of trench digging in Adelaide which followed the Japanese attack on Pearl Harbour on 7 December, the sinking of the *Prince of Wales* and *Repulse* off Malaya on 10 December, and the rapid Japanese advance south towards Australia[19]. Conversely, January 1942 recorded 205% of the mean rainfall for that month, with most rain falling on two days: 20 and 25 January (23.9 mm and 16.3 mm respectively). The January deluge dutifully filled whatever emergency trenches had been started or completed. Wet weather led to never-ending concerns about trench walls slumping, accidental drowning, eroding sanitation and ensuing mosquito epidemics (see Chapman 1942f & Town Clerk, Corporation of Adelaide 1942e). By April 1942, and the onset of a period of above average rainfall with 27.2 mm falling on 28 April and 45 mm on 3 May (in fact, rain fell on 22 of the 31 days in May), the folly and shortcomings of various open trench designs employed in Adelaide (and other Australian cities) became painfully obvious, even without battle proofing:

> …[t]he great number of half completed, wrongly laid-out, water-filled and partly collapsed open trenches that were to be seen in all the suburbs of the metropolitan area after the last rain are mute evidence of the mistakes committed…resulting in a waste of material, labour and money (Fuchs 1942: 10).

The meteorological data confirms accounts in the archives and oral histories which mention the difficulty of digging trenches at this time because the earth was so dry and hard and the disappointments which followed the unexpected heavy rains (see, for example, Holt MW4-07: 3).

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[19] So rapid was this advance that on 15 February 1942 (nine weeks after Pearl Harbour), 6,000 Japanese troops landed on Timor. Timor is over 3,000 miles from Tokyo and only 400 miles from Darwin. With its two airports, Timor represented a strategic location from which to launch an aerial attack against the Australian mainland (Shute1953: xviii & xxiii).

6.3.3 Type I(a): Open trenches

Prior to the codification of shelter design, the recommendations regarding trench construction (both open and covered) were little more than instructions on how to dig, and seemed to focus largely on how deep and wide to make a prospective trench. These were dimensions ultimately ignored by the Code which placed greater importance on increasing the lateral and overhead protection of shelters rather than on providing more guidelines on how and what to dig. For the main, these early guides were conceptualised and issued as emergency measures, and were intended to aid people who could protect themselves to some extent. It is quite possible that local municipalities and employers also utilised these types of pamphlets in the initial phases of shelter building and prior to the regulation of shelter construction. Table 6-2 summarises the published recommendations for shelter dimensions, and provides an arithmetical mean of the stated widths and depths.

Guides recommending open shelters as an option were no longer produced after January 1942. This may be because of the introduction of local shelter codes by February of that year, or because of the widespread experiences of flooding. Whereas these guides provided a range of ideas on the dimensions for structures, the air raid shelter codes provided absolute minimum requirements for their construction. The letter of the codes meant that structures could incorporate greater dimensions than those stated, but not less. In fact, so novel and stringent were the engineering aspects of the South Australian Code that it prompted John Chapman, Acting Adelaide City Engineer, to write that “the *Building Act* 1923 - 1940 did not apply to any air raid shelter constructed” (Chapman 1942b).

Table 6-2: Comparative guidelines for open trenches (April 1941 - January 1942).

Author/Date	Depth	Width	Lateral	Floor
Sate Emergency Council for Civil Defence 04/1941 (Vic) *suitable for clay, shale or firm soil	4-5 ft	4 ½ ft at top 3 ½ ft at base 3ft trench length/ person. Should not be straight for more than 15-20 ft	Suitable posts, sheeted with boarding or corrugated galvanised iron	Duckboards
Bartlett n.d. (SA) (approx 1941) Example 1	4 ft & build up sides another 1 ft 6 in. with earth 20 ft from house	>2 ft 2ft of length/ person	In sandy soil – frame of 4 in. x 2 in. wood, 4 ft intervals, corrugated iron	
Bartlett n.d. (SA) (approx 1941) Example 2	4 ft & 1 ft 6 in. earth parapet 20 ft from single story house	3 ft Can be covered in bad weather with galvanised iron Zigzag arms (15 ft long) at right angles	Board sides if soil unstable	Duckboards & sump
War Office 1941(Provisional 1939) (UK)	6 ft 6 in. from base to top of parapet Entrances facing exits of dwellings	<3 ft at bottom Zigzag or traversed arms 10 yds long	Batter of 5/1 with revetment supported by 6 ft 6 in. A-frame strutted at top for every 2 ft of trench	Entrance carried below floor level to form a sump and boards used for flooring
Australian Home Beautiful 1942a (derived from State Emergency Council suggestions) *suitable for clay, shale or firm soil	4-5 ft	4 ½ ft at top 3 ½ ft at base	4 in. x 2 in. posts at 18 in. intervals Asbestos cement sheets, corrugated iron or other	Duckboards
Red Cross Society and St John Ambulance Society n.d. (SA)	At least 6 ft Distance from house = ½ height of walls.	2 ½ ft (dug in zigzag)	Strutted in sandy soil	Duckboards with sump
Arithmetical Mean	5.6 ft of lateral cover	3.3 ft at top 2.9 ft at bottom		

In reality, the structures proposed in the earlier guides were little more than amenities when compared with the lifesaving installations mandated in the Code. Open trenches were not even recognised by the Code. In fact, its only definition of a trench shelter was an “air raid shelter in the form of a covered trench or tunnel” (*South Australian Government Gazette* 1942: 358).

Open trench guidelines probably owed their origins to an official English ARP pamphlet on garden trenches (Home Office Air Raid Precautions Department 1938) which advocated similar dimensions to many of those published later in Australia (see Table 6-2). Peculiarly, and if this particular pamphlet is, in fact, the genesis of open trench construction in Australia, it makes no reference to open trenches and provides advice and designs for covered trench construction only. The summary of open trench ‘specifications’, shown in Table 6-2, indicates that the recommended depths for trenches varied between 4 and 6 ft (with a mean maximum depth of 5.6 ft) and widths ranging from not less than 2 ft, to as much as 4.5 ft (with mean values ranging from 2.9 ft at the bottom of the trench to 3.3 ft at the top). It is interesting to compare these figures with those recommended later in the war by Conrad Hamann (1943), Deputy Chief Engineer for the British Ministry of Home Security, who toured Adelaide’s civil defence infrastructure in February 1943. He stated that the “ideal trench depth was 3’6” to 4’ and crouching is the correct position”. He further advised that wider trenches were better than narrow ones because of potential earth-slip. In early 1943, the Department of Home Security, Canberra, in consultation with Hamann, wrote to the Commissioner of Civil Defence in Adelaide outlining the preferred dimensions for two types of slit trench. The first was for “active persons such as for men in factories”, and the second “for the floating population which would include women and children and old and crippled persons". The suggested dimensions for these two types of trench were:

> Type 1 – Depth 3 feet. Width of top 3 feet. Width of bottom 1 foot 6 inches.
>
> Type 2 – Depth 4 feet. Width of top 3 feet 9 inches to 4 feet 6 inches, (depending on holding power of soil). Width of bottom 1 foot 9 inches.
>
> (Department for Home Security 1943:2)

It is clear from the substance of Hamann's remarks, and the basic argument in the letter from the Department of Home Security, that a slit trench was something only to be used in absolute emergencies and not for prolonged occupation. These communications also show that, despite the introduction of a code for design, shelters not endorsed by the Code were still tolerated and valued as some form of protection in the public domain.

The guides also recommended that open trenches were to be dug 20 ft from a single storey house, or at a distance at least half the height of the walls, to ensure that no debris fell into it if the house was bombed. If the trench was dug in unstable or sandy soil, the walls were to be braced and reinforced with a wooden frame and sheets of corrugated iron, asbestos cement or boarding. Most designs included a wooden floor, and some included a sump for drainage, a design feature which seems to have been either largely ignored in the early trenches, or inadequate as a means of diverting the amount of water actually coming into the trenches immediately after they were completed. Some guides recommended 2 to 3 ft of linear trench space for each occupant, therefore, a family of four would need to dig a trench 8 to 12 ft long for their sustained comfort. Historical plans show that Adelaide and Glenelg Councils allowed 2 linear feet per trench occupant (see, for example, the trench plans for Light Square in CEF[1942]032). By way of favourable comparison, the English standard quoted by Tecton Architects (1939: 33) of 3.5 ft² equated to a rectangle of 1 ft 9 in. x 2 ft per person.

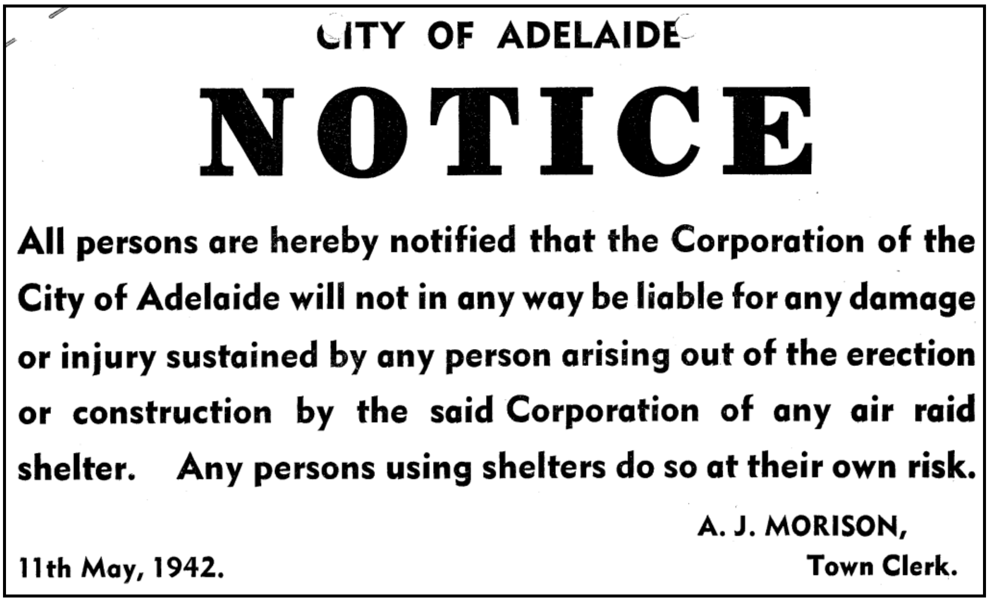
An obvious example of how divergent the general guides were when placed against the codes (both Australian and English standards) can be seen in the method of calculating how much space each person required for the comfortable occupancy of shelters. Where the guides provided a linear recommendation for personal comfort, the codes calculated personal space very differently, and specified a square measure for (covered) trenches and a volume measure for bunker-type shelters. For example, Section 8 (1) of the South Australian Code stated that in specified shelters (including trenches) housing 12 persons or less and open at both ends "there must be for each person accommodated a floor area of not less than 6 square feet"[20]. At 8 (2) ii, for shelters other than those at 8 (1) and not permanently sealed or mechanically ventilated, there must be for each person accommodated not less than "(i.) 7 square feet of floor area. (ii.) 56 cubic feet capacity. (iii.) 30 square feet of surface area of all walls, floor and ceiling or roof…" (Pettifer 1941: 4-5; *South Australian Government Gazette* 1942a: 362). The codes were more concerned with interior temperatures due to accumulating body heat in confined spaces than they were with replenishing fouled air (see Pettifer 1941: 18 and War Office 1941[Provisional 1939]:21), hence the recommendations made, varied according to the type of material the shelters were constructed from and the number of exits built into each.

[20] In England, this area was calculated at 3.75 ft² per person for a trench shelter of identical dimensions to that described in the SA Code (Office of the Lord Privy Seal 1939: 5).

6.3.3.1 Pitfalls of Type I(a) shelters

Generally, Adelaide's open trenches fell far short of what was needed to adequately protect the community, and were at risk of slumping during attack (or heavy rainfall). Not only were the trenches seen as being grossly inadequate, but they also exhibited certain dissolute qualities. They were unsanitary, often filling with water (becoming breeding grounds for mosquitoes) and litter, as well as regularly being used as public conveniences. The Curator of Parks and Gardens (1942) reported that the trenches in Victoria Square were being used for "…drinking parties, crayfish suppers etc…during the afternoon when hotels are closed"; and the Director of Education (1942) complained that the trenches were visited overnight "…by undesirable folk with the result that empty bottles are the least disgusting of the articles that are left".

The trenches also proved a hazard to passers-by, with numerous pedestrians and animals accidentally falling in (Adelaide City Council 1944a). Ron Praite (Praite MW1-07: 3) recalled a fellow falling into a trench in the South Parklands during a blackout and breaking his leg: "…he lay there in the middle of the night, lay there until morning 'til he could attract some attention". Council records contain many similar incidents, for example, in May 1944, a horse slipped into a trench in Hurtle Square (Adelaide City Council 1944a), and in November 1942 an injuries claim was filed by a Mr. F. Harris who had fallen into a trench in Victoria Square (Adelaide City Council 1942b).


CITY OF ADELAIDE

NOTICE

All persons are hereby notified that the Corporation of the City of Adelaide will not in any way be liable for any damage or injury sustained by any person arising out of the erection or construction by the said Corporation of any air raid shelter. Any persons using shelters do so at their own risk.

A. J. MORISON,

11th May, 1942. Town Clerk.

Figure 6-1: City of Adelaide disclaimer
(CEF[1942]027a)

The communal open trenches dug in public domains around Adelaide between late 1941 and early 1942 were little more than a knee-jerk reaction to the perceived threat of attack, and in their most rudimentary, un-roofed form, provided little real protection against attack by aircraft. “[S]helter of this type can only be regarded as emergency protection” and “should not be used as a shelter for the Civilian population except as an emergency measure” (Department of Home Security 1943: 2). They had been designed for occasional use over short periods of time (weather permitting), were inadequate for overnight occupancy and in Britain they had been abandoned immediately after the outbreak of war (Fuchs 1942: 10).

The reality is that an open trench (Type I[a]) offered the lowest type of protection of all purpose built shelters: “The only thing one could say in its favour is that it offers better protection than no shelter at all – assuming that weather conditions do not in any case forbid its being used” (Fuchs 1942: 10). Fuchs’ observation was supported to some extent by a graph (Figure 6-2) prepared from data based on English experience (see Pettifer 1941: 9) and reproduced in a number of ARP publications (including State Emergency Council for Civil Defence, Vic. 1941: 30; Bartlett, J. n.d.: 6; Pettifer 1941: 28) depicting a wartime risk assessment of different forms of cover. It seems that the risk associated with using an open trench during an air raid would be only a little less than lying behind low cover or in a doorway.

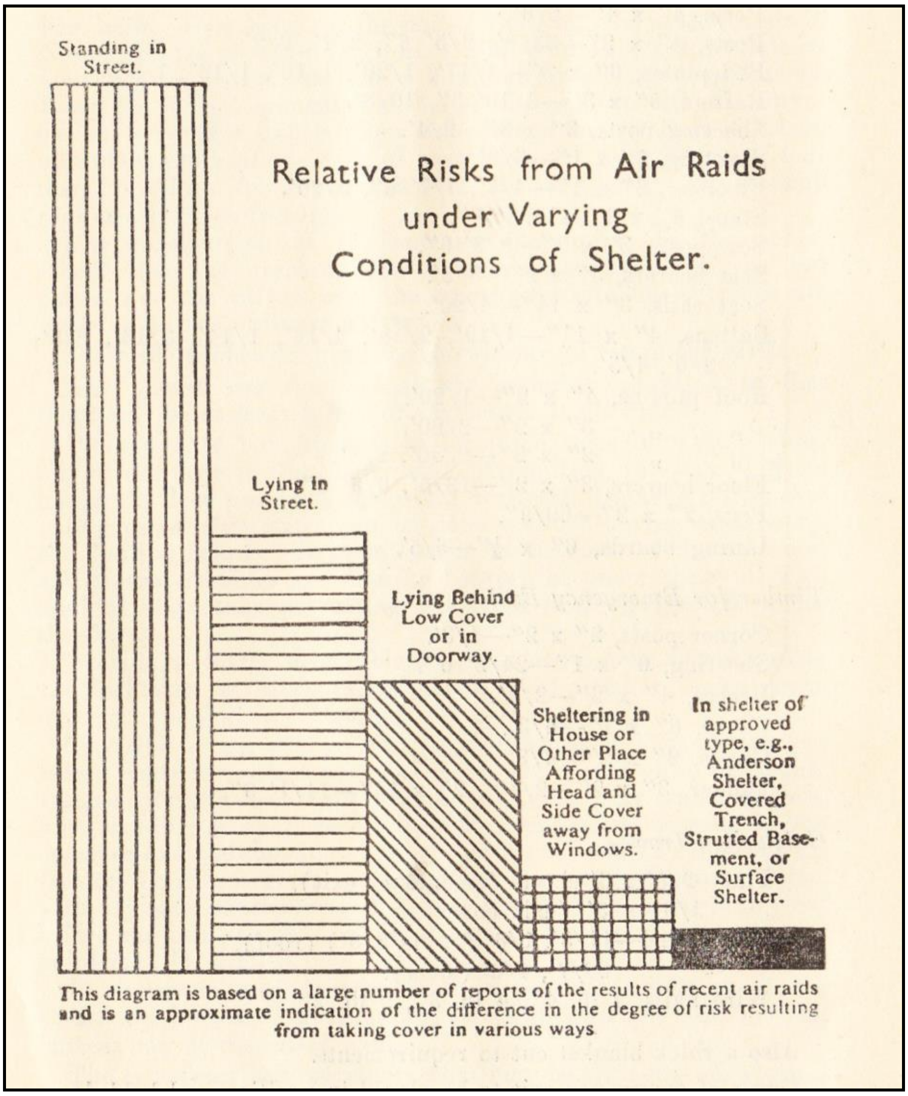


Figure 6-2: Relative risks from air raids under various shelter conditions
(State Emergency Council for Civil Defence, Vic. 1941: 30)

Tecton Architects (1939: 45 - italics in original) had criticised trenches on the basis that:

> …trenches in any form will remain unsuitable for use in densely built-up urban areas, and this not only because of the lack of open space, but first and foremost because, owing to the impracticability of giving them very strong roof protection…they are therefore *not the best shelters for areas where many bombs may be dropped*.

Despite their shortcomings, and the introduction of the Code, open trenches remained permanent, defensive features of the Adelaide cityscape until the end of the war. It made sense, at that time, to keep and maintain those open shelters already constructed in public spaces, while also supplementing them with other types, thereby increasing emergency protection per head of population, rather than re-engineering them and providing protection for fewer people in the long run. The costs involved in maintaining and cleaning the existing shelters were apportioned 50% to the Commonwealth, 25% to the State and 25% to the relevant council (Adelaide City Council 1943).

6.3.4 Type I(b): Covered trenches

All stakeholders appreciated the fact that covering trenches not only provided overhead protection against attack, but also kept the weather out and improved the overall structural integrity of the shelter. Part II (5) of the Code borrows heavily from Office of the Lord Privy Seal (1939: 1 & 9), although without referencing it. This part of the Code addresses trench shelters and states that "[e]xcept where excavated in hard rock trench shelters must be lined…[and] shall have overhead protection consisting of not less than 18 in. thickness of ballast, broken stone, earth or sand properly confined". Further, acceptable wall linings for trenches included "4½in. of reinforced concrete of monolithic framed construction,…[a]pproved pre-cast reinforced concrete arch designs,…[or] 9in.

thickness of reinforced brickwork" (*South Australian Government Gazette* 1942a: 361). Remedies on the drawing board in SA considered the specifications stated in the Code and included lining the walls with 5 in. of reinforced concrete, providing open trenches with 18 in. thick covers and installing drains in trench floors [see Figure 6-3]). Various Hodgson Bros products, including pre-cast concrete walls (with approximate panel dimensions of 2.5 in. x 4 ft x 3 ft 6 in.), 2.5 in. concrete floors and patent cement dome roofs, were also considered for re-working existing trenches (see CEDKT1942/1121A 1942a).

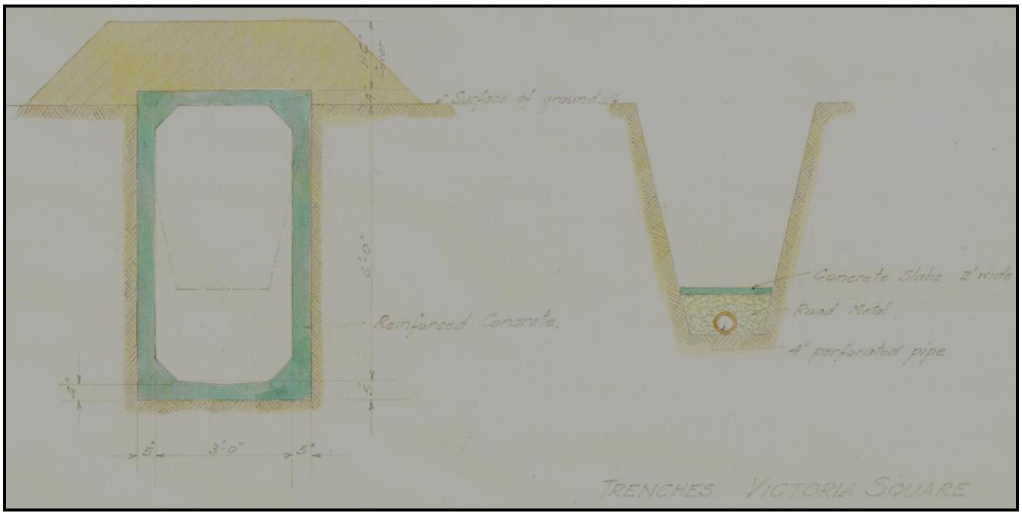


Figure 6-3: Proposed modifications to open trench shelters (CEF[1942]021).

Adelaide City Council costed three different schemes to comply with the Code (CEDKT1942 1121Ag):

- Scheme A: lining and covering the existing trenches with reinforced concrete of monolithic framed construction in accordance with the letter of the Code for Air Raid Shelters—cost ₤35,000.
- Scheme B: constructing pipe shelters using 54" and 60" diameter pipes to be placed on the line of existing trenches sufficient for 5,430 people (the number of people the existing CBD public square trenches could protect)—cost ₤17,500.
- Scheme C: draining and paving the bottom of existing trenches using concrete paving slabs, but providing no extra lateral or overhead protection—cost ₤3,000.

In each of the schemes, the additional infrastructure (concrete panels, pipes etc) could be re-used after the war in public works. The costs and logistics of initiating the modifications to each existing trench shelter outlined in Scheme A proved prohibitive, whilst the reality of Scheme C was that no extra protection was gained for the potential investment. Ultimately, Scheme B, with reduced sized pipes, was chosen as the emergency protection alternative (See section 6.6).

The decision not to proceed with trench modifications may have been a blessing had Adelaide ever been attacked. In the UK, the Government had issued a standard design for pre-cast concrete trench lining, however, these proved inherently unstable and highly vulnerable to explosions, largely because the panels were not securely fixed to each other (in other words, they were not of monolithic construction). Baker (1978: 15) observed that "some of the most widespread and serious damage occurred in trenches which were lined with the standard pre-cast concrete units", because the linings shifted with the lateral pressure of earth movement following an explosion. Baker (1978: 16) recounted an incident in October 1940 when a small 50 kg high explosive bomb dropped 10 ft away from a 30 ft long, 50 person trench in Southwark, London, lined with pre-cast concrete. The shelter was demolished by this near miss and 24 people were killed. The concrete roof had lifted in the blast, caving the wall panels and bringing the roof down to crush the occupants. There is no record of the number of occupants at the time of the blast, but the mortality rate may well have been 100%. Baker also noted that large trenches were shockingly vulnerable to a direct hit because of the funnelling effect they had on the blast. Again, in October 1940, a 250 kg high explosive bomb made a direct hit on a 3,000 person underground, concrete panel-lined trench shelter in Kennington Park, London.

An area of almost 10,000 ft² was devastated, killing 46 occupants. By mid-December 1940, *Home Security Circular* No. 290/1940 had been made available to local authorities in the UK which stated that the current practice of lining trenches with previously endorsed pre-cast concrete panels should be discontinued (in Baker 1978: 32-33). In London, all earth trenches strengthened with pre-cast concrete panels had to be re-engineered and reinforced or public protection re-considered.

Table 6-3 summarises data from a number of publications providing guidelines on covered trench design between September 1938 and July 1942. Generally, the advised depth and width of a covered trench was greater than that of an open trench. The increase in the mean range of maximum depth was approximately 1 ft (5.6 ft up to 6.4 ft) and the increase in maximum width approximately 6 in. (3.3 ft up to 3.88 ft). Most guides outlining designs for covered trenches recommended at least 24 in. of earth piled onto corrugated iron sheeting as a covering, or 5 in. to 8 in. of concrete.

Table 6-3: Comparative general guidelines for covered trenches (September 1938 – July 1942)

Author	Depth	Width	Lateral	Floor	Overhead
Home Office, Air Raid Precautions Dept 09/1938 (UK)	**6 ft (4 ft 6 in. in emergency) Blanket for gas curtain over entrance**	**4 ½ ft at top 3 ½ ft at base Space of 1 ft 6 in. /person = min 2 ft 6 in. /person**	**Lined with corrugated iron sheets behind wooden frame (or wooden planking etc) (3 in. x 2 in. posts at 36 in. intervals)**		**Corrugated iron (or planking)on 5 in. x 2 in. wooden joists & covered with earth**
War Office 1941(Provisional 1939) (UK)	**>6 ft Entrance sited with building exits and covered**	**<3 ft at bottom**	**Batter of 5/1 with revetment supported by 6 ft 6 in. A-frame**	**Entrance carried below floor level to form a sump and**	**Corrugated iron laid on struts covered with earth between 9**

	for gas protection Steps or ramps		strutted at top for every 2 ft of trench	boards used for flooring	in. & 12 in. depth
Sate Emergency Council for Civil Defence 04/1941 (Vic)	3 ½ ft built up to a height of 6 ½ ft with sand bags and boxes of dirt				Wooden beams with corrugated iron
Blind Self-Aid Society (n.d.) (SA & Vic) (approx. 1938/39)	8 ft 2 ramps entrance/exit 150 cubic ft/ person/2 hrs	<4 ft at top >2 ft 6 in. at base 10 ft from house with 20 ft high walls	Box frame supports & galvanised iron or boards		36 in. earth over box frame supports & galvanised iron or boards
Browne 07/1941 (NSW)	6 ft		Lined or strutted	Dry covering eg duckboards	5 in. concrete or 24 in. earth
Bartlett n.d. (SA) (approx 1941)	6 ft	3 ft			Timber frames & corrugated iron & 24 in. earth
Australian Home Beautiful 1942a (derived from State Emergency Council suggestions)	3 ½ ft built up to a height of 6 ½ ft with sand bags and boxes of dirt	4ft at top 3 ½ ft at base Entrance at right angles (6 ft 3 in. deep & 3 ft 6 in. wide)	Lined with wooden frame & corrugated iron sheets	Sump	Galvanised iron on wooden joists – 24 in. earth
Australian Home Beautiful 1942a (derived from State Emergency Council suggestions)	6 ½ ft Ramp entrance right angles to trench & air lock		4 in. x 2 in. posts at 18 in. intervals Asbestos cement sheets, corrugated iron or other	Sump & flooring	Galvanised iron on wooden joists – 24 in. earth or concrete
Fuchs 07/1942			Lined with 8 in. reinforced concrete	8 in. reinforced concrete	8 in. reinforced concrete
Arithmetical Mean	6.4 ft	3.9 ft at top 3.1 ft at base			9 in. -26.4 in. earth or 6.5 in. concrete

Table 6-4 summarises specifications provided in various codes available in Australia from 1939. Only the *South Australian Government Gazette* (1942a) specifically addressed covered trenches, but the standards given in the Office of the Lord Privy Seal (1939) and Pettifer (1941) could be applied to all types of shelter, including covered trenches. Refinements to the codes were made as the war continued and more bomb damage data became available. When placed next to the previous tables on trench construction, the summary below demonstrates the differences in advice between the various do-it-yourself publications and the codes. The codes were designed for professional use, whilst the other publications allowed those with no engineering or building experience to protect themselves to some extent.

Testimonials recorded during the course of this research have shown that trench design on the home front during the late 1930s and early 1940s was also informed by experience gained in combat on the Western Front between 1914 and 1918, particularly in terms of structural elements such as bracing, drainage and overhead protection. Returned servicemen from WWI, many of whom were husbands, fathers and grandfathers by WWII, used their wartime experience and memories to construct considerable defensive structures for the family home. The manifestation of these previous wartime experiences was best reflected in the construction of the Type II shelters: Dug-outs.

Table 6-4: Comparative guidelines from the various Codes for covered trenches (1939 - 1942)

Author	Lateral	Floor	Overhead
Office of the Lord Privy Seal (1939)	**Standards for all shelter types: 1½ in. mild steel. 12 in. reinforced concrete. 13½ in. solid brick or masonry. 2 ft 6 in. of earth, ballast or sandbags, broken stone.**		**Standards for all shelter types: ¼ in. mild steel. 6 in. concrete. 4 in. structural concrete. Brick or masonry arches at least 8½ in. deep. 1 ft 6 in. of ballast, broken stone, sandbags or earth.**
Pettifer (1941)	**Standards for all shelter types: 1 ½ in. mild steel or iron plate. 12 in. reinforced concrete. 13 ½ in. reinforced brickwork. >13 in. of existing brickwork. 2 ft of ballast or broken stone. 2 ft 6 in. of earth or sand. - All wall and roof panels to be securely bolted together and braced.**	**Drain**	**Standards for all shelter types: ¼ in. mild steel or iron plate. 5 in. reinforced structural concrete. 3 in. slab – ribbed type construction. 9 in. existing arched brickwork. 1 ft 6 in. of ballast, broken stone or earth.**
***South Australian Government Gazette* (1942a)**	**Except where excavated in hard rock, shelters must be lined. 4½ in. reinforced concrete of monolithic framed construction. Pre-cast reinforced concrete arch designs. 9 in. reinforced brickwork. Built-up steel corrugated sheet. 1 in. hardwood timber, or corrugated sheets supported by framed, braced & secured timbers.**	**4½ in. reinforced concrete. Drain**	**9 in. arched brick roof. 4½ in. reinforced concrete roof. 18 in. of ballast, broken stone, sand or earth.**

6.4 Type II: Dug-outs

6.4.1 Background

Dug-outs were excavations that closely resembled underground rooms, a high percentage of which were constructed by ex-servicemen (the ‘diggers’ of WWI who had experienced life underground during a bombardment). These structures were an extension of the covered trench idea, and follow trenches in this typology because of the similarities in construction technique and the level of protection provided. Dug-outs were larger in plan and had more substantial overhead protection than trench shelters. Some dug-outs were also fitted with a heavy solid door (a feature lacking in Australian Type I and Type III shelters).

Dug-outs could be furnished with wooden benches, tables and shelving for storing emergency supplies with many simply cut into their earthen walls, and some had breather pipes for ventilation. Their roofs commonly consisted of logs hewn from tree trunks rather than the sawn wooden bearers of covered trenches, over which was placed several layers of sandbags and earth. Dug-outs were intended for extended bombardment and long-term sub-surface occupation.

Designs for dug-outs were not covered in any of the official handbooks, nor did they feature in those guides released by benevolent societies. Dug-outs are mentioned in a publication issued by the War Office (1941[1939 Provisional]: 21), but these structures were very different to the Type II shelters used in Australia and refer to complexes of galleries dug into hillsides. *Australian Home Beautiful* (see Mellor 1942: 12-14) published instructions and sketches (see Figures 6-4 and 6-5) for constructing a dug-out of approximately 15 ft x 4.5 ft in plan, with a maximum internal height of approximately 6 ft 3 in., which seems typical of the Type. Its description details the level of ingenuity, sophistication and refinement of this type of defensive structure. The Mellor design included two exits at right angles to the main chamber, three sumps (properly cemented) and a duckboard floor which sloped into the main sump area. The two larger sumps were covered with wooden boxes that formed the bottom step of each exit, and the bailing sump was covered by a “single light board that can be easily lifted by a woman”. Benches 19 in. high were cut out of the walls during the excavation process, on top of which were placed wooden boards for seats. There was also a large storage area cut into a wall of the shelter. The walls were lined with floorboards to "prevent any slipping". The roof was constructed of wooden bearers overlaid with overlapping galvanised iron sheets and 9 in. of earth. A table top (it was considered that the legs would be a "serious obstacle" in an emergency) could be placed across the seats in any position required. This dug-out lacked the characteristic heavy doors of the type, but Mellor suggested heavy curtains instead. The author recommended furnishing the dug-out with straw-filled cushions, dark blankets and rugs, to be kept in the storage area, as well as:

> …a lantern…a spirit stove and spirits, water and a kettle, some tinned foods, including powdered milk, a tin of biscuits and wafer bread would be good, and even a tin of butter **and** a tin-opener. Tea, sugar, cocoa should also be included, a portable gramophone, and a few games.
> Mellor 1942: 14 – bold font in original text

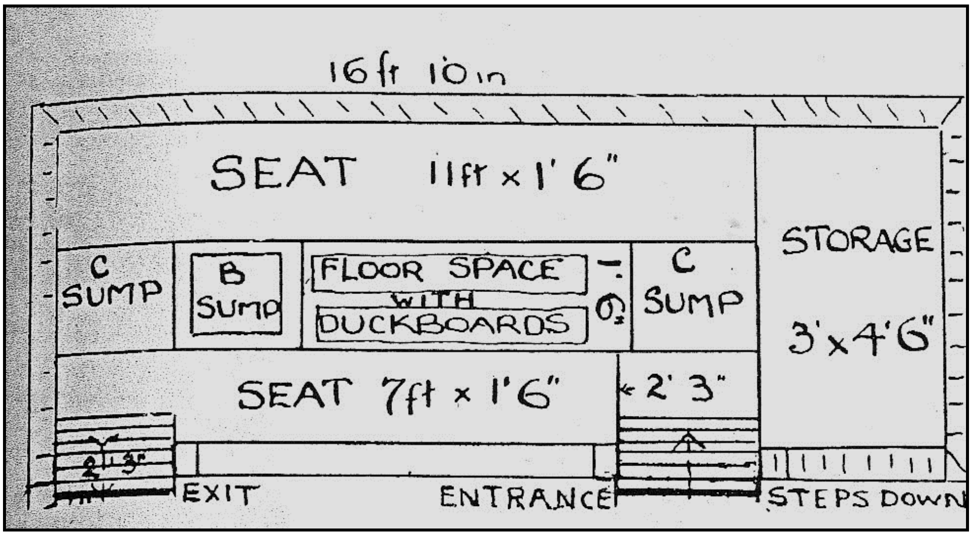


Figure 6-4: Plan of Mellor dug-out
(Mellor 1942: 13)

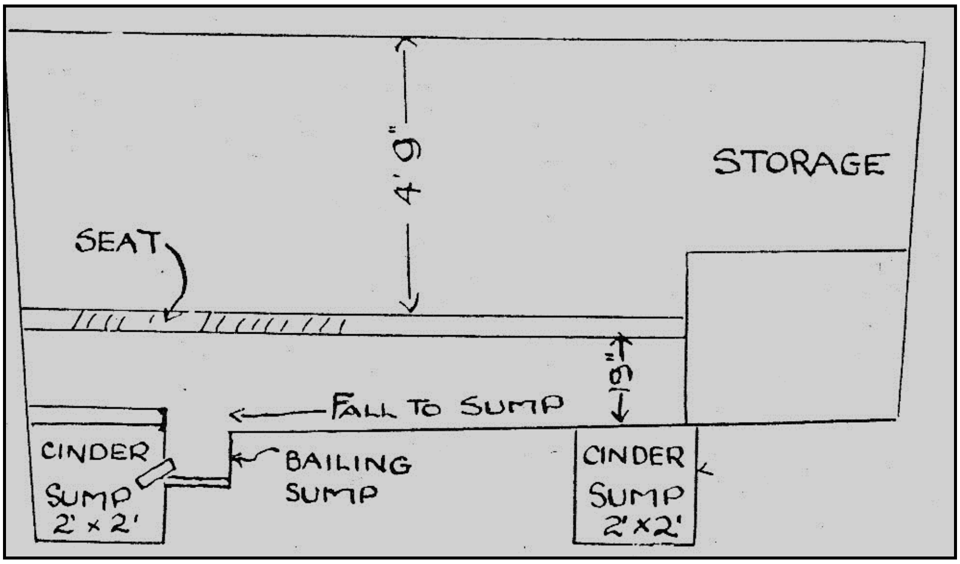


Figure 6-5: Elevation of Mellor dug-out
(Mellor 1942: 13)

6.5 Type III: Sectional shelters

6.5.1 Background

Sectional shelters, such as the Anderson shelter which most commonly consisted of six sections of heavy arched and corrugated steel sheet bolted at the top, two flat end sections and some framework, were thought of essentially as trench shelters in the UK (Baker 1978: 4 & 42). In this study, however, they are considered a separate type because of their pre-manufactured form and portability. Such structures were able to provide both overhead and lateral protection that was superior to lined trenches because of their continuous and ductile design (Baker 1978: 42). The tensile nature of the structure also allowed it to spring back to its original shape after being distorted during a bombing incident. In fact:

> … [they] were strong enough to bear the weight of any debris falling on them from the type of house [domestic suburban dwelling] for which they were intended…[and] their fabric could withstand without damage a 500lb. high explosive bomb falling at least fifty feet away.
>
> O’Brien 1955: 196

Developed in the UK shortly before the outbreak of WWII, they were intended to be partially buried, with the excavated earth thrown back over the top for added protection from bomb splinters. Cheap to produce and easy to manufacture, they came flat packed and could be bolted together with the aid of a basic instruction sheet (see section 7.4.2). O’Brien (1955: 197) described the Anderson shelter as the core of the UK Government’s domestic shelter program, with a production output at the outbreak of war of 50,000 per week. By September 1939, nearly 1,500,000 units (approximately two-thirds of the eventual total distribution) had been delivered free to poorer households (with an annual income of less than £250) in high risk areas. These 1.5 million shelters were estimated, rather optimistically, to be able to shelter 6,000,000 people, and through the early 1940s the threshold for receiving a free Anderson shelter was “increased by £50 for each child of school age in excess of two” (Meisel 1994: 307). The Anderson shelter was incredibly resilient to bomb blasts and “[t]he occupants often survived the nearest of “near misses”, that is to say when the shelter was on the lip of the crater formed by the bomb explosion” (Baker 1978: 16). O’Brien (1955: 368) commented that:

> …the ‘Anderson’ proved even more effective than the authorities had promised…Those under attack who possessed this type of protection experienced, nevertheless, solid grounds for comfort.

As a demonstration of its strength in Australia, “[s]eventy-five tons of pig iron were placed on its roof” (*Cairns Post*, 20 August 1940: 4) with no ill-effects. The Anderson shelter, seen in the yard of an obliterated London home in Figure 6-6, demonstrates its robust integrity.

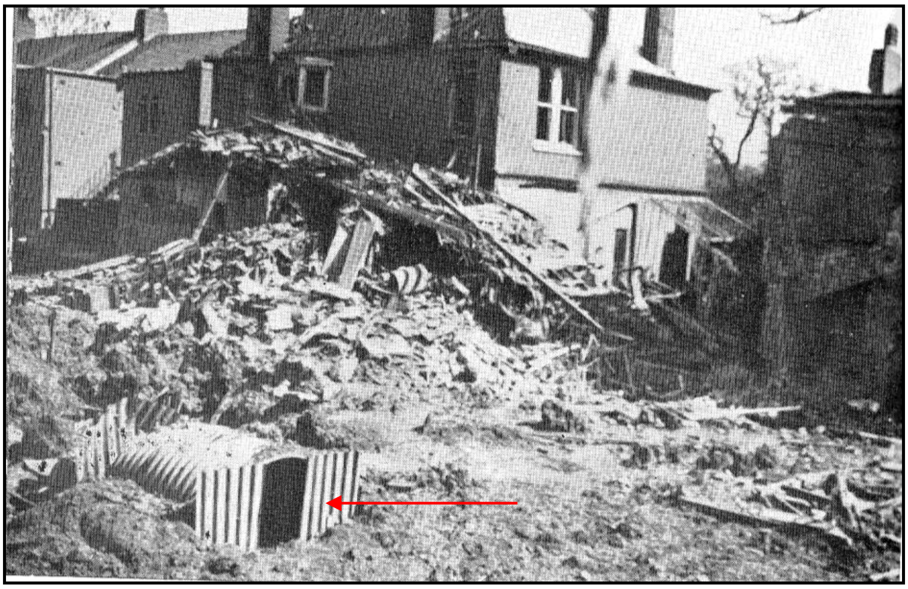


Figure 6-6: Anderson Shelter (arrowed): Chingford, East London 19-20 April 1941 (Warburton 1946: n.p.)

John Strachey, Privy Council, (1941: 37-38) told of an Anderson incident recounted to him by a bomb victim:

> …we went down to the shelter to find the Missus and my little boy Sam…When we got there the Anderson wasn’t to be seen under the earth and bricks. But we soon found it, and tapped on the steel. As soon as they ‘eard us, my little boy Sam…calls out, ‘Come on, Dad, be quick and take this earth off.’…and not a penny the worse they were.

Anderson shelters were also produced in Australia. The Australian War Memorial, Canberra, has identified John Lysaght Pty Ltd and Lysaght’s

Newcastle Works Pty Ltd as the sole manufacturer and exporter[21] of shelters for the local market, and to have shipped 40,000 tons of Australian manufactured shelters to the UK (Anstey 2009: 8).

In the UK, those households not entitled to receive a free Anderson could purchase the shelter for a subsidised £5 after the free distribution was completed (Meisel 1994: 307), but in Australia this type of home defence seems to have been un-subsidised. Previous to this research, most of what is known of the 'Anderson' in Australia came from two surviving examples in Australian public collections. The six-sectioned Anderson shelter in the collection of the Australian War Memorial (accession number REL20934) was purchased in Sydney for £15/11/6 in June 1942, according to the diary of the original owner who had shared the purchase cost with his brother (Chris Goddard 2010, pers. comm. 20 July, Assistant Curator, Military Heraldry and Technology, Australian War Memorial). In comparison, the Anderson in the Western Australian Museum collection (registration number 2009.97.1-3) was priced at around £16/10/0 plus installation in 1942/43 (Anstey 2009: 12). Staff at the Western Australian Museum were unable to discover any local WA manufacturers of Anderson shelters, so the greater WA cost may have reflected freight costs from the eastern States, or price rises between the times of the two purchases. In Melbourne, however, and according to advertisements placed in the local press, the cost was a few shillings over £12 (*The Argus* 1941: 8-9). Regardless of the variance in price across Australia, the purchase price of an Anderson shelter in Australia would seem to have put it well outside of the reach of many households when compared to the minimum weekly wage for the war years (Table 6-5). The

[21] John Lysaght, originally established in Bristol, UK in 1857, began producing corrugated iron in Australia in 1921 (Warr 2000: 3) and seemed a logical choice for an off-shore producer in wartime.

basic Australian annual wage fell well below the English means test standard for a free shelter. In SA, the cost of an Anderson would have been the equivalent of three or four weeks wages for a male earning a basic wage, or approximately six to eight weeks for a female. Along with its rust-prone fabric, its high cost may have been a factor in the type's rarity in an Australian context.

Table 6-5: Basic weekly wage rates declared by various States during WWII (abridged from Carver 1944: 478)

Australian State	Males £ s. d.	Females £ s. d.	Date Instituted
New South Wales	**4 19 0**	**2 13 6**	**1 November 1943**
Victoria	**4 17 0**	**2 12 6**	**1 February 1944**
Queensland	**4 17 0**	**2 14 6**	**2 August 1943**
South Australia	**4 14 0**	**2 6 2**	**15 October 1942**
Western Australia	**5 1 1**	**2 4 7**	**1 August 1943**
Tasmania	**4 14 0**	**2 11 0**	**1 February 1944**

One of the original design criterion for the Anderson shelter, as detailed by the Research and Experiments Department, Home Office (cited in Baker 1978: 46), had been that its dimensions were to be no less than 6 ft x 4 ft 6 in. x 6 ft because:

> Anything smaller would have no market value above its value as scrap, whereas a structure of the minimum size which we recommend would have a definite value for other useful purposes.

During the war, Anderson shelters were used opportunistically as rabbit hutches (Strachey 1941: 37), and post-war variously as wood sheds (Figure 6-7), children's play houses (Anstey 2009: 4) or storage spaces. Because of their engineered portability, they were often moved to different locations around the yard or, in some cases, moved from house to house as the owners changed residence (Anstey 2009: 8-9).

Figure 6-7: Anderson re-used as a wood shed
(Anstey 2009: 1)

Sectional shelters were also modified and used in various ways to increase their level of protection. For example, some were completely buried, whilst others were used as the formwork for creating a concrete shelter. A simple above ground shelter, illustrated by the CCA (see Figure 6-8), and which had been promoted by the French Ministry of Interior, consisted of "bolting together curved galvanised iron corrugated sheets to form a sectional tunnel, similar to the Nissen Hut [or the Anderson shelter]….This is encased in reinforced concrete" (CCA n.d.c: 15). The only dimensions provided were for the interior space; however, these could be extrapolated by using them as a scale to determine other measurements, such as the thickness of the surrounding concrete casing. It is unclear whether the shelter was open-ended similar to a pipe shelter (see section 6.6), as information about how the entrance should be constructed or finished was not provided.

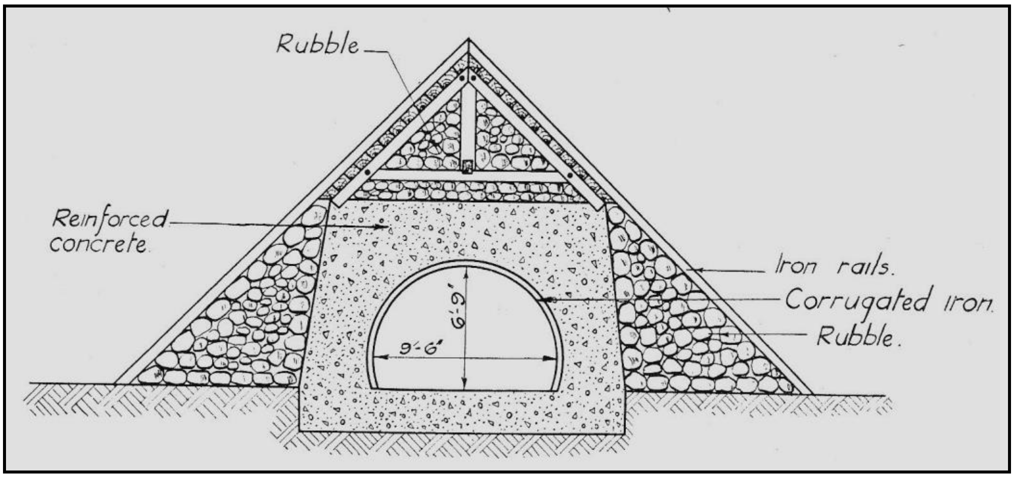


Figure 6-8: Corrugated iron shell encased with concrete and rubble
(CCA n.d.c: 14)

6.6 Type IV: Pipe shelters

> …a thousand feet of pipes is worth 10 miles of earth trenches not dug and to the ones already filled with water (Hedley Forth, Municipality of Burnside, 1942).

An easier and more effective solution to modifying existing trench shelters was to use reinforced concrete (RC) pipes. These were readily available and commonly used by municipalities and government utilities for sewerage and drainage works, but as early as February 1942, mayoral staff at Adelaide Town Hall had begun to make enquiries (both locally and internationally) regarding the suitability of using such pipes as emergency shelters.

6.6.1 Background

On 26 February 1942—one assumes it was no coincidence that it was the same day as the codification of shelter design in SA—the Lord Mayor's Office in Adelaide cabled Charles McCann, Agent General for South Australia in London, with the following message:

> SUGGEST USING FORTYEIGHT INCH FORTYTWO INCH THIRTYSIX INCH REINFORCED CONCRETE PIPES TWO AND ONE HALF INCHES THICK AS EMERGENCY AIR RAID SHELTERS STOP PLEASE ADVISE IF USED IN ENGLAND AND ARE THEY SATISFACTORY STOP CAN THEY BE USED AT SURFACE LEVEL STOP IF ON SURFACE HOW SHOULD ENDS AND JOINTS BE PROTECTED STOP ANY OTHER INFORMATION WILL BE ACCEPTABLE.
>
> Barry 1942, cablegram

The sizes quoted referred to the internal diameter of the pipes. McCann (1942a: 1) replied that he consulted the Home Office's technical expert(s) and discovered that reinforced concrete pipes had been used successfully in the UK, but that the sizes under consideration for SA were too small for occupation over an extended period of time. McCann (1942b: 1) later qualified this by pointing out that if an adult were to use the largest of the pipes proposed by the Lord Mayor's Office (48 in.), they would need to sit in a very crouched position. Further, in the smallest of the proposed Adelaide pipe sizes (36 in.) an adult would have to assume the prone position. The Home Office had intimated to McCann that even though these smaller pipes would offer shelter, the psychological effect of enduring an air raid in such a small enclosure, even for brief periods of time, would have a detrimental effect on morale. Since fortifying the morale of a wartime population was a key component of ARP, pipes of 60 in. and 72 in. diameter had been preferred in the UK.

McCann also reported that the recommended installation method for pipes was to half bury them and then cover their tops with no less than 15 in. of earth or sand. Burying the structures not only provided extra protection, but also stability, for a bomb blast could lift or dislodge surface pipes. Pipes could, however, be used at surface level provided they were suitably covered as per those placed sub-surface. This covering was needed because it was thought that the thickness of the pipes provided no protection against bomb splinters: "actually, the pipe is only the support for the earth covering, which is the guard against splinters" (McCann 1942b: 2). Other recommendations for pipe shelters included protecting the open ends with 14 in. thick baffle walls of reinforced concrete or bricks, to be placed as close to the entrance as possible. These baffle walls were to extend to the top of the shelter and for 2 ft on either side of the mouth of the pipe, in order to protect the entrance against a blast.

McCann provides us with an interesting dichotomy on the nature of the war in Europe and the South Pacific. The English model of using larger pipes as shelters seems to have been based on prolonged bombing activity that caused people to shelter for a long period of time, such as the London *Blitz*. Protection in the UK was also more commonly and urgently sought against "splinters from the large number of shells fired from anti-aircraft guns [and] small incendiary bombs scattered from aircraft flying at great heights" (CCA n.d. a: 1). In Australia where the bombing experience had been less intense and more sporadic, and where anti-aircraft fire from large calibre weapons was almost non-existent, there was obviously less need to provide long term 'accommodation' during an attack. In fact, as Stanley (2008: 140) observed, bombing in Australia had been largely confined to places without a substantial population. This point was not lost on Chapman (1942a: n.p.), the Acting City Engineer and Surveyor of the Municipality of Adelaide who, after reading McCann's comments, recommended putting pipes in place as soon as possible, and also that:

> …it is anticipated that air raids in Adelaide would be of much shorter duration than those experienced in England, and under these conditions smaller diameter pipes such as the 42” and 48” diameter R.C. Pipe can, in my opinion, be utilised to advantage. The pipes should prove efficient protection against machine gun fire, which, from recent reports, appears to be one of the most outstanding dangers experienced during raids by Japanese planes.

The fact that the real threat posed by Japanese aircraft to Australia (or at least to SA) was seen to come not from the bombs they carried, but from their machine gun rounds (see footnote 23 for further explanation about the capabilities of Japanese aircraft used against Australia) may have also influenced Chapman’s suggestion of placing the pipes at ground level or, alternatively, bedding them to a depth of only 12 in., despite intelligence regarding the English practice of embedding pipes to a greater depth to avoid being dislodged during an attack. Chapman also advocated protecting the entrances with sandbag walling, as well as sandbagging the pipes to a height of 2 ft and, if time permitted, extending this to cover the top as well.

Chapman’s concern about machine gun fire is further underlined by his request to the Manager of the Hume Pipe Company, manufacturers and suppliers of reinforced concrete pipes (RC Pipes) in Australia and abroad[22], to have a pipe “subjected to machine gun fire to test the effect of direct hits at right angles to the surface” (Chapman 1942a: n.p.). A pipe’s curvature not only has the potential to deflect shot, but also makes it more difficult to breach. The thickness of a pipe (or any surface) increases if it is hit at an angle other than 90° (armour plating is tilted on armoured fighting vehicles for this reason).

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[22] In the 1920s, Hume (an Adelaide company), had developed and patented a way of using centrifugal force to spin concrete into a wire cage, producing reinforced concrete pipes.

The machine gun tests were carried out at Fort Largs on RC Pipes of 48 in. and 60 in. diameter. It seems strange that 60 in. pipes were tested when Chapman recommended using only the smaller sizes, but the tests may have been conducted for a comparative study between the structural integrity of smaller and larger pipes. The following results were returned to the Town Hall, Adelaide, by 14 March 1942:

> (1) The bare pipes were definitely proof against 303 machine gun fire and 303 high velocity armour piercing bullets.
>
> (2) .55 full charge anti-tank gun fire was deflected from the surface of the pipe after penetrating to a depth of 1" when directed at the pipe at an angle of 50 [degrees].
>
> (3) A .55 anti-tank bullet when directed normal to the surface of the pipe from a range of 150 yards, penetrated 20" of sand, but did not reach the surface of the pipe.
>
> (4) If covered with 15" of sand, it could be reliably assumed that the pipe shelter would be proof against .55 anti tank munition, with the bullets directed at right angles to the surface of the pipe.
>
> SPF 233Q:01 1942

Lieutenant-Colonel G. Shaw, the Commissioner for Civil Defence in Adelaide (*Hume Pipe News* 1942: 3), further reported that direct hits on pipes of 3 in. thickness with ordinary and armour piercing ammunition, fired at 130 yds, did not penetrate more than 1 in. No mention was made in either correspondence of the differences in the durability of the two pipe sizes.

Further enquiries with the Hume Pipe Company were made in May 1942. Through correspondence with their office in Singapore, it was revealed that Hume had supplied "as fast as they could make them" a large number of 60 in. and 72 in. pipes for shelters erected in the municipality of Kuala Lumpur and at the adjacent naval base.

> In most cases the pipes were sunk down at about 2'6 to 3' with steps going down, a covered entrance at both ends, keeping the entrances as narrow as possible. [It was claimed that] for the type of bomb which they were dropping in Singapore, that a bomb landing within 15' of a shelter left the people inside perfectly safe (Kube 1942).

Once again, there is mention of the larger 60 in. and 72 in. pipes being sunk to considerable depth. Kube's letter was passed on to the Lord Mayor of Adelaide on 9 June 1942, although he directed that no action be taken by the Acting City Engineer regarding this new information (Town Clerk, Adelaide 1942c). This may well have been due to general consensus that the larger pipes were more than what was required for SA conditions, but it may have also been a result of the huge investment already made in trenches and smaller gauge pipes. The Corporation of the City of Adelaide had previously invested heavily in trenches for its main squares and parks, and by the time this new information had filtered through in June, hundreds of feet of smaller gauge pipe had already been purchased (SPF 233Q:01 1942).

But there was also a further financial benefit for the City of Adelaide (CEF[1942]027) in choosing the smaller diameter pipes:

> …[these pipes] will have a definite value after the War for the construction of underground drainage systems, whereas if 72" dia. pipes are insisted upon, they will have very limited use in post-war Municipality and Council drainage schemes.

Hume had developed a method of spinning concrete onto a wire form to produce their pipes, but they were not the only manufacturers of concrete pipes for air raid shelters in Adelaide. Concreters (SA) Ltd of Coglin Street, Brompton, produced, marketed and sold a product called 'The Pneumatic Core Air Raid Shelter' (see Figure 7-22). The Pneumatic Core system incorporated pipes which were 25 ft in length (three times longer than the standard Hume pipes used around Adelaide in public areas), 48 in. wide and had walls which were 4.5 in. thick. A functional design feature of the Pneumatic Core which would have been of benefit during a bombing raid was its flat base; this would have provided stability and made it harder to dislodge than the round-base surface shelters of the Hume type which were reported as being prone to roll if lifted by a blast (McCann 1942b).

The original concept for concrete shelters of cylindrical form for the Adelaide CBD c1939 also had a flat base (see Figure 6-15). For this point alone (its flat base), the Pneumatic Core would have been a better choice of pipe shelter for protecting workers of factories and municipal infrastructure. Given the small bomb payloads that Japanese aircraft could carry, these industrial facilities would have presented a more strategic and economical bombing target than a park or schoolyard, which, from a tactical platform probably deserved little more than machine gunning[23]. Other marketable features of Pneumatic Core shelters were that they could be built to any length without broken joints, and to any thickness and reinforcement to suit the engineer's specifications (the standards of protection laid down by the Code were no more than approved minimum figures [*South Australian Government Gazette* 1942a: 359]). Long lengths of pipe did not have to be laid in a straight line, but could be "at suitable angles to minimise

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[23] None of the seven types of Japanese aircraft used to attack the Australian mainland during World War II could carry bomb loads of more than 1000kg. The *Kawanishi* H6K4 flying boat had the greatest payload of 1000kg; the three types of land-based bombers used, the *Kawasaki* ki-48, the *Mitsubishi* G3M2 and G4M1, all had payloads of 800kg; and the smaller planes which were launched off aircraft carriers against Australia, the *Nakajima* B5N2 torpedo bomber (800kg), the *Aichi* D3A1 dive bomber (370kg) and the early *Mitsubishi* A6M series fighters (120kg). The average bomb carrying capacity of Japan's main bombers at this time seemed to be well below that of any other major warring nation. For example, only one German bomber of the same era (the *Junkers* Ju.86E-1) could deliver less than 1000kg of bombs (see Bellhouse 1943; Weaver 1943; and Angelucci 1983). See also Woolven (2002: 184) for an analysis of bomb weights dropped by the *Luftwaffe* on London on one night (10/11 May 1940), eighteen months before Pearl Harbour.

the effect of a straight-through blast". Further, the shelters were built *in situ*, eliminating "cumbersome cartage and tackle for installation, especially when wanted partly or entirely below ground level" (Concreters [S.A.] Ltd. n.d.). Sandbagging was optional and, in the manufacturer's opinion, unnecessary.

Pre-fabricated pipes were also used as shelters in other States. By late May 1942, a third option for cylindrical protection was being advertised in Adelaide (see *News*, 27 May 1942: 6). These were corrugated steel pipes of 5 ft and 6 ft diameter, employed by industry in NSW as air raid shelters with similar protective qualities and tolerances to the concrete pipes already in use in SA. However, no records have been located indicating if any were purchased or installed in Adelaide. Also in use in NSW was a more flimsy pipe type which could effortlessly be manipulated by a man at each end (Figures 6-9 and 6-10). Unlike Adelaide's concrete pipes, Sydney's pipes were made of waterproof plywood which the makers claimed could withstand 200 lb of pressure per square foot when securely embedded in the ground (*Sydney Morning Herald*, 31 December 1941: 9).

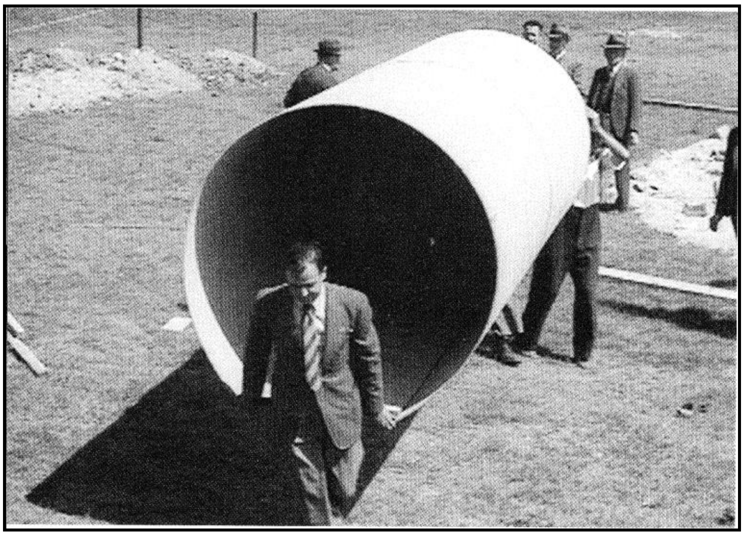

Figure 6-9: Plywood pipe shelter, Bellevue Hill, NSW, December 1941
(*Sydney Morning Herald*, 31 December 1941: 9)

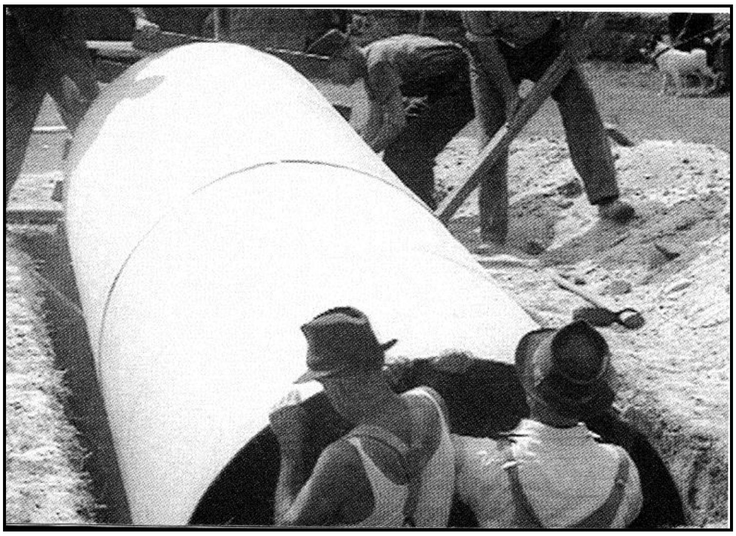

Figure 6-10: Installing a plywood pipe shelter in suburban Sydney, December 1941
(In Fallows 2005: 132)

RC Pipes were used interstate by industry to provide shelter from aerial attack. A variation of the normal method of installation is demonstrated at the Defence Explosive Factory in Maribyrnong, Victoria:

> A range of Air Raid Protection (ARP) shelters were constructed on the site, including concrete bunker style shelters and shelters for individuals. The latter consist of a concrete pipe sunk vertically into the ground and covered with a concrete slab (Australian Heritage Database 2008).

In the UK, manufacturers of "shelters of tubular construction" (i.e. RC Pipes) not only targeted industry, but also the general public with their own designs and innovations. Below are two examples of advertisements for comfortable subterranean pipe living, sponsored by the CCA, London. The CCA touted tube shelters as being inexpensive alternatives to standard reinforced concrete shelters. For example, a pipe shelter of 90 in. diameter and able to accommodate 50 persons (complete with end and entrance details) cost as little as £100, or £2 per head (false economy for a family of four lacking such economies of scale). The shelters portrayed in the CCA brochure seem quite sophisticated and modern, and are more reminiscent of Cold War era images. This may also indicate a more relaxed approach to protection before hostilities began and the ensuing exposure to *Blitz* conditions. Even though the CCA pamphlets and technical information also appeared in SA, such sophistication doesn't seem to have been embraced by local pipe manufacturers. Although RC Pipes have been recorded at several factories in Adelaide, to date, none have been recorded at private residences.

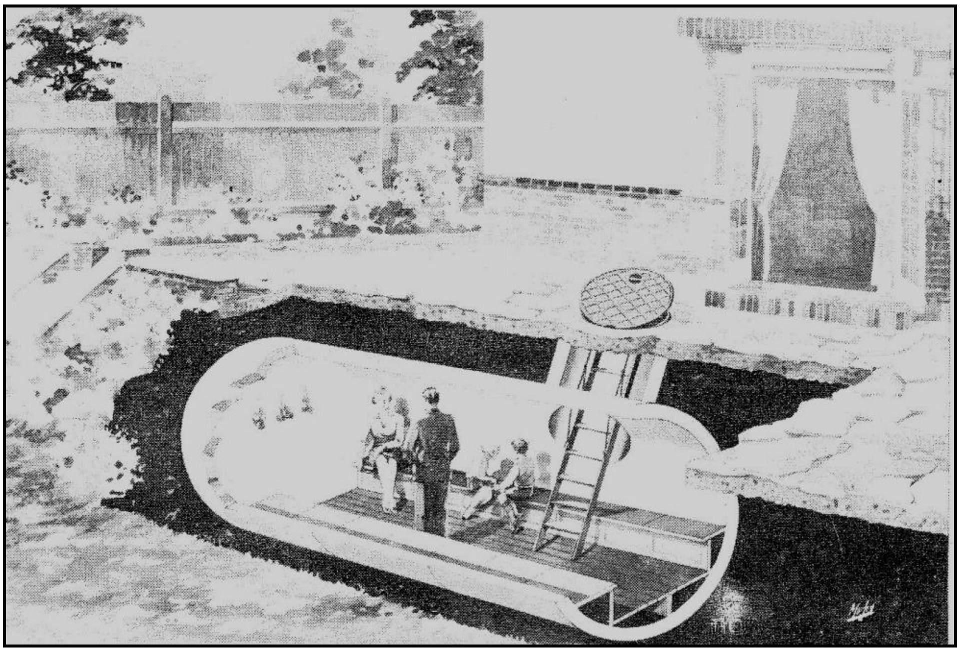

Figure 6-11: Pipe shelter suitable for a typical suburban house
(CCA n.d.a: 3)

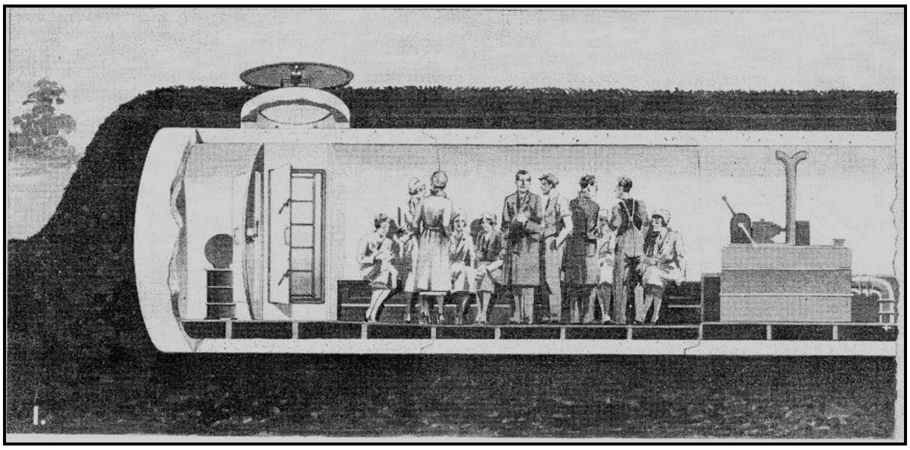

Figure 6-12: Protection for the factory worker
(CCA n.d.a: 2)

6.7 Type V: Bunkers

Bunkers are solidly built defensive structures designed specifically to absorb bomb blast. In this study, the term bunker refers to those structures made solely of reinforced concrete, brick, stone or steel, or a combination of these elements. It is important to note that even though concrete is a major component in the structural composition of many Type V shelters, they often included other ‘hard’ building materials in their construction as well. Bunkers appeared in both the public and domestic realms during WWII, and were also employed extensively by the manufacturing industry for the protection of workers in Adelaide. Bunkers could be situated completely sub-surface, partially sub-surface, or above ground. Unlike the portable reinforced concrete pipes (Type IV shelters) described above (see section 6.6) which were opportunistically used as air raid shelters, this type of structure was purposely engineered for that purpose, and its form more closely resembled a traditional standing structure rather than the tubular form of pipes or concrete covered sectional shelters. Bunkers could be constructed on site, or pre-fabricated off site and then assembled and installed at a pre-determined location. Their direct ancestral lineage can be traced back to the German development of similar defensive structures for the protection of troops in the front lines of WWI (see Figure 6-14).

In the Australian context, domestic ownership of this type of shelter was normally beyond the reach of most people. This was not only because of the cost and amount of building material required, but also because to build one (despite Home Office 1939e: 1 re-assurances that “the work was normal in character and no special precautions are called for”) required some engineering or building expertise, as well as the ability and connections to be able to source the necessary, but war restricted, materials. Consequently, these types of shelter were relatively expensive (both in monetary terms and in terms of bartered goods and services), especially when compared with alternatives such as trenches or dug-outs.

Figure 6-13: Advertisements for shelters
(*Australian Home Beautiful* 1942b: 38 and 1942c: 39)

More likely than not, those people who owned one outside of the construction industry either would have had it designed for their particular needs by an architect or engineer and then installed by a builder or, alternatively, may have ordered a shelter from a specialist concreting business offering customers a number of standard catalogue designs as well as installation (see Figure 6-13). A few people with no prior knowledge of, or skill in, the building industry also tried their hand at erecting one.

In the UK, the huge cost of these types of shelters had led to discrimination between rich and poor. A collective of professionals and industry specialists publishing under the pen-name, A Group of Australian Scientists (1940: 15), noted that:

> Only the wealthy could afford the various kinds of private shelters suggested in official handbooks. And the poor not only lived in industrial areas most often exposed to attack but did not, for the most part, have space in which garden-trenches or dug-outs could be constructed.

Despite ongoing research into structural defence between the Wars, a protracted and under-funded, research paradigm into the bomb-repellent properties of concrete (as well as other building materials) and consequent shelter designs in the UK after WWI meant that the entry of Type V shelters into general ARP infrastructure for WWII was very much last minute. Pre-war Australia, lacking a dedicated research program into civilian structural defence, was in a position to benefit from English research. By the time of the Japanese advance south in December 1941, a great deal of technical information had already filtered through from the UK.

6.7.1 Background

Building technologies kept pace with advancing armaments technologies in the early twentieth century, developing around a need to neutralise the destructive force of explosives. With the wartime scarcity of bricks, timber and other traditional building materials, and the urgent need to protect troops at the front from bombardment and civilians at home from air raids, a search for alternative construction materials and methods began. Home front bunker design in the Commonwealth during WWII was informed, to some extent, by German use of reinforced concrete, steel and masonry in small scale defensive structures and military bunkers on the battlefront of WWI. Germany was so far ahead in the innovative use of concrete and other resilient building materials in defensive military application that reports from the Front concerning their widespread use in the battlefield were treated with scepticism:

> The wonderful advances that have been made in field engineering work generally are apparent from the scanty news that filters through the censors, although the reports of solid concrete trenches for infantry, and reinforced concrete gun mountings must be read with caution (Gurney 1914: 245).

A set of sketches of a German reinforced concrete bunker, captured by Gordon Keesing, a member of the Australian Institute of Architects who was fighting in France, were published in the January 1918 edition of the Australian journal, *Architecture* (Figure 6-14). It was remarkable that Keesing came across the detailed sketches, for such information was generally considered secret and closely guarded by the military. The Keesing sketch clearly showed a concrete slab with steel rod reinforcing under the habitable section and walls of the shelter, a massive concrete roof (approximately 1.3 m thick) also reinforced with steel rods, and 1.3 m thick brick walls, with steel rods extending up from the footing of the shelter through the front wall and into the roof of the structure. Bricks were also keyed into the concrete superstructure. Evidently, there seemed little need to reinforce the rear and side sections of wall with steel rod, except for that portion which appeared to be above ground level. The shelter also had a ventilation pipe, and on a portion of the roof there was a parapet constructed of sandbags or logs with the rest of the structure covered by earth.

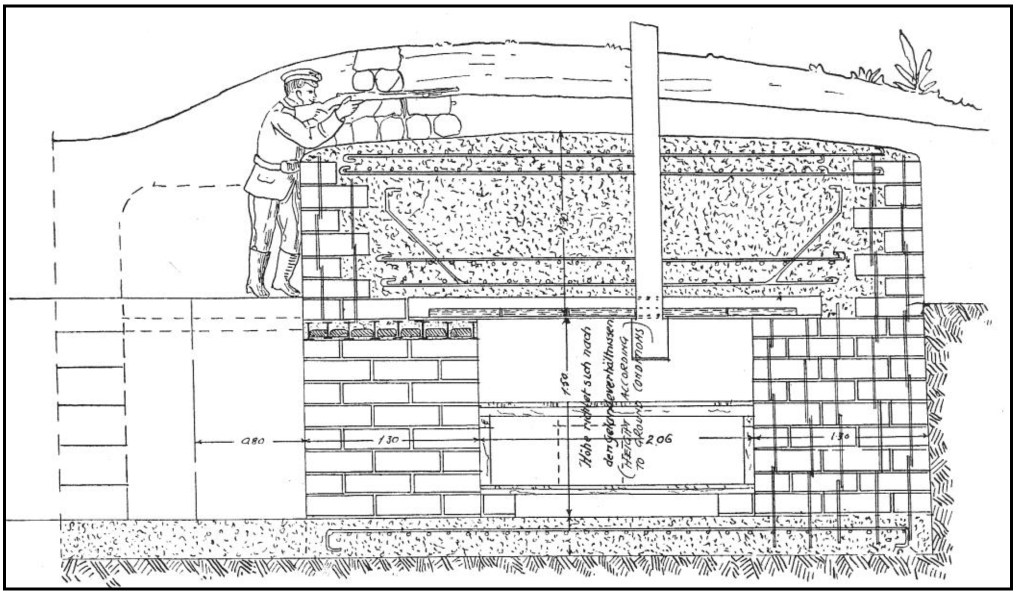

Figure 6-14: Section of a German WWI concrete bunker
(*Architecture* 1918: 15)

In the UK, a great deal of research had been scheduled between the wars by the various bureaucratic departments aligned with civil defence to determine the ways that concrete and other building materials could best be used to afford such “reasonable security against air attack”. Tecton Architects (1939: 18-21) identified these effects as being impact, penetration, shock, blast, splinters and falling debris. The scope of this research went beyond the protection of civilians. The ARP Committee’s First Report, in 1925, claimed the “measures of protection [should include] not only the problem of shelters but the wider subject of the protection of public buildings and those of national importance” (cited in O’Brien 1955: 22). The ARP Committee further identified the need for technical data which was best obtained through direct experiment on the destructive power of bombs of 500 lb or greater. Once obtained, this essential data had to be worked into plans for the provision of public shelters and the protection of national buildings. Yet, fifteen years after the ARP Committee's initial recommendations, the CCA noted that hardly any progress had been made in the collection or dissemination of this type of data:

> … [t]he study of the effects of bombs on solids must be based on theoretical considerations which have been evolved during the last century for bullets and artillery ammunition. Empirical formulae can give practical information only if the factors on which they are based have been checked by tests carried out with aerial bombs and protective material as used today. The results of only a very few tests have been published so that for the present the old formulae adapted to modern conditions must be regarded as of limited value. (CCA n.d.c: 25).

Baker (1978: 2) highlighted the existence of serious mismatches in goals and funding between the various government departments and committees involved in shelter research (among them the War Office, the Office of Works and the ARP Committee). By 1929, it was obvious to the Office of Works that the quantity of material required (including bricks, mortar, concrete and steel) to build and provide adequate shelters for the general population—figures compounded by the continually escalating projections of civilian casualties in future air raids and the actual number of shelters required—made it financially prohibitive for any such works to proceed. Further, it proved to be an unrealistic and expensive exercise to experiment with building test structures, only to destroy them with high explosives in order to obtain the relevant data needed for technical assessment. Much information on air raid shelters had been previously published in Germany, Italy and France (see, for example, CCA n.d.c, an English publication which was almost entirely based on continental research), but it is uncertain to what extent these were consulted by the Home Office.

David Anderson (1939: 244), chairman of the Design Panel, Engineering Precautions (Air Raids) Committee, claimed in a lecture given to the Institution of Civil Engineers that:

> The Committee took steps to compare their recommendations with the regulations adopted in other countries, and found them to be in general agreement.

A cheaper alternative for the Home Office was to send observers abroad to actual theatres of conflict, whilst at the same time focusing on and investing in other areas of ARP at home. For example, during the Spanish Civil War (1936-39) and the early phase of the Second Sino-Japanese War (1937-45) the Intelligence Branch of the ARP Department, London, dispatched an inter-connected group of architects, scientists and structural engineers to Barcelona and Shanghai to report on the effects of terror bombing. British Members of Parliament, Oliver Simmonds and Duncan Sandys, who had set up the Parliamentary ARP Committee, also visited Spain in early 1938 to view the effects of terror bombing firsthand (Woolven 2002: 77). It is possible that these intelligence reports may have been used in drafting SA's own code because copies of these reports marked "SECRET: TO BE LOCKED UP", and dated between 3 January 1938 and 25 March 1939, were sent to SA by the Home Office, London. They are currently held by State Records of South Australia (see the contents of GRG: 9/21).

In the lead up to WWII, ARP anti-gas measures and associated anti-gas infrastructure became the main focus of investment and research in the UK. This direction left important and obvious gaps in the available advice on public shelter standards and construction when the bombs finally started falling. O'Brien (1955: 283) noted that:

> …[u]se of the air weapon against China, Abyssinia and Republican Spain had been too limited in scope to furnish much useful data. But Spanish experience had reinforced the most important conjecture – suggested by the bombing of London in the First World War – that high explosive attack on this scale, apart from any use of gas, would cause an extremely large number of casualties.

Information on air raid research and ARP measures also flowed out of the UK and not only to Australia. Haldane (1938: 117) observed that in Spain the Catalonian Ministry of Propaganda and the Council of Military Medicine had issued a pamphlet in 1937 before the great air raids on Spanish towns, instructing its readers on how to gas-proof rooms and fight fires with sand and water. Haldane (1938: 118) found that many paragraphs were taken straight from the British ARP Handbooks, but doubted if they had saved a single life, for "[t]he people of Barcelona were killed by high explosives" and not gas. He further lamented at the lack of local ARP structural defence and asked: "[w]hat protection have the people of London against this peril?"

Despite the continual setbacks caused by financial difficulties and changes of policy, Baker (1978: 5) revealed that by the time the war began:

> … three full-scale bombing trials had been made, on a brick basement, an underground reinforced structure, and a brick surface building, as well as a blast and splinter trial. The Anderson shelter was also tested.

The sparse bomb damage data seems to have been hastily analysed and worked into the relevant ARP pamphlets and handbooks shortly before the war began. This is borne out in the preface to Handbook 5A published in August 1939 (remembering that Germany invaded Poland on 1 September and England declared war two days later) which stated that the members of the panel tasked by the Home Office Air Raid Precautions Department with designing bomb proof shelters “agreed that, in the very short time available, an attempt must be made to establish a standard of protection” (Home Office 1939c: VI). The above statement could more appropriately have been worded: “in the very short time left”, for despite twenty years of grace between wars, and the realisation of what may eventually be coming in terms of air-borne weapons and their delivery systems, it was only four weeks before the war started that an officially sanctioned recommendation on standards of protecting the public against bombs was finally made available. It was not until bombs began landing on British soil that real assessments of bomb damage on various concrete structures could be made by the Research and Experiments Branch of the Ministry of Home Security. The first such investigation was in May 1940, eight months into the war (see Baker 1978: 13-21 for examples of the types of ‘incidents’ investigated). Sir Clement Hindley (cited in Anderson 1939: 244), President-Elect of the Institution of Civil Engineers, stated that:

> …when one looked back on the somewhat difficult history of air-raid shelters, he thought it would be agreed that a great sense of relief should be felt that the work of designing shelters was at last in the hands of competent people….

The following section details some of the designs and major innovations which were developed once Type V shelter research began in earnest. Although the research and recommendations associated with public, domestic and industrial sectors are presented here as separate sections, the shelters detailed in each are not considered sub-types of Type V shelters in this study. Neither are those shelters which are recommended for placement sub-surface or above ground—these and reinforced concrete pipe shelters, whether partly buried or wholly above ground, are all considered Type IV shelters. Further, trench shelters have obvious structural differences represented by covered and open sub-types, but the main structural difference of bunkers placed below or above ground is less obvious, represented by a thickening of that portion of the walls situated below ground in some cases. For these reasons, it was considered unwarranted to sub-classify bunker type shelters.

6.7.1.1 Factors affecting Type V shelter construction: Public spaces

From 1935/36, the Home Office, "recognised guardian of the public safety" (O'Brien 1955: 60), began releasing large numbers of official publications (handbooks, memoranda, pamphlets and circulars) dealing with all aspects of ARP for domestic and organisational consumption. The authorised ARP handbooks, of which 12 were projected but 13 actually released, dealt with subjects as diverse as *Personal Protection against Gas* (Home Office 1939a) and *Air Raid Precautions for Animals* (Home Office 1939d). However, ARP Handbook No. 5, *Structural Precautions against Bombs and Gas* (Home Office 1939b), was one of the last to be made available and was still in preparation in mid-1939. This was possibly a direct consequence of the minimal and confused research into bomb resisting shelters conducted up to the beginning of hostilities. Finally released in June 1939 under the re-worked title of *Structural Defence*, ARP Handbook No. 5 was already available in Australia by August of that year and was referenced by John Fargher, member of the staff of the Chief Engineer for Railways, SA, in a paper given to the Australian Institution of Engineers on the 18th of that month. This was followed almost immediately by ARP Handbook No. 5A, *Bomb Resisting Shelters* (Home Office 1939c).

The introduction to Handbook No. 5A states that it may be regarded as supplementary to No. 5. This gives an indication of the urgency and importance of structural defence for the general public when there was an air war imminent.

No other ARP handbook has a supplementary volume, although others were often revised and reprinted during the war years, with four handbooks already up to their second or third editions by May 1939. The booklet contained technical data regarding the results of aerial bombing which had been included in the original publication (Handbook No. 5), but had since been passed to a design panel "for the purpose of framing specific recommendations as to the design of bomb-resisting structures" (Home Office 1939c: IV). It offered advice and designs which were not written to specific standards of protection. Thirty provisional shelter designs were assessed for their structural merits and costs during its preparation, with a "typical selection" of these included in the publication (Anderson 1939: 242-243). Four standards of protection had been identified by the Home Office[24], but only Types III and IV were dealt with. The shelter specifications in Handbook 5A were illustrated by designs of three two-storey structures which could provide an overhead protection of "adequately reinforced" concrete between 5 ft and 7 ft 6 in. thick, against 500 lb bombs travelling at maximum velocity. These standards could "meet the combined effect of direct impact, disruptive force of explosion and spalling effect on the inner surface [of the shelters]" (Anderson 1939: 243); they could also accommodate between 200 and 1,200 persons.

The shelter designs in Handbook 5A were represented as partially buried structures. Anderson (1939: 243) reported that these designs were for reinforced shelters which were intended to be "placed generally half above and half below

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[24] Type I: resistance to blast, splinters, debris loads and small incendiary bombs. Type II: resistance to direct hits of medium-weight incendiary bombs and high explosives of 50lb weight. Type III: protection against medium-case, high-explosive bombs of 500lb weight, as well as light case bombs of greater weight, striking at maximum velocity. Type IV: similar to Type III, but designed to give protection against heavy-case bombs (Home Office 1939c: 1).

ground”, but Handbook 5A states clearly that the enclosed designs were only intended to “illustrate the principles of construction recommended, and for this reason the shelters are shown partly above and partly below ground level” (Home Office 1939c: VI). This is an interesting point, for it may provide one explanation as to why Adelaide’s public bunkers were, likewise, only partially buried.

Handbook 5A was available in SA by at least the middle of 1940 (the copy in the State Library of SA has an accession date of 24 July 1940)—eighteen months before Japan attacked Pearl Harbour. The demonstrated principles of construction referred to in the handbook relate to the recommendations regarding lateral protection. These decreed that shelters built below ground needed thicker walls than those built above because of the “tamping effect of the soil when a bomb explodes near the surface of the wall below ground” (Home Office 1939c: 2). Simply put the force of an explosion is less if it occurs above ground or on the surface of a structure than if it occurs below ground, or if it penetrates a solid surface. An indication of the huge disparity between the forces released by an above vs. below ground event can be seen in the standards set in Handbook 5A, which recommended reinforced walls 3 ft 3 in. thick above ground and 6 ft 6 in. thick below, for medium-case, high explosive bombs and heavy-case bombs (Home Office 1939c: 1).

Tecton Architects, harsh critics of the British Government’s civil defence preparedness and shelter policy, were commissioned by the London Borough of Finsbury to conduct a risk assessment of their civil defence requirements and prepare a strategy to minimise the risk to their constituents. Relying on overseas bomb damage data, Tecton provided plans and estimates of costs for complex and grandiose, subterranean, multi-storey public shelters able to withstand direct hits from 1000 lb bombs and gas attack. The various structures recommended for Finsbury were capable of accommodating 7,600 to 12,600 persons each, and together could protect the total estimated daytime population of the Borough (131,970 persons) at 6 ft^2 per head (Tecton Architects 1939: 111). These shelters, distributed through 15 locations, were wholly bespoke for Finsbury, with their designs taking into account the available open space, geology of the district and population levels throughout the Borough. Because of their massive proportions, re-use in peace-time had been a consideration in the design of the shelters; they were intended to be converted into revenue-raising garages housing a total of 1,740 cars to off-set their construction cost. The shelters, all intended to be built below ground, were cylindrical and contained a continuous spiral ramp, latrines, air conditioning and other amenities. The largest would have cost £10/10 per occupant to construct. These shelters had a 13 ft thick concrete roof 200 ft wide, the top of which was to be placed at ground level and built upon if needed. The Home Office rejected the Tecton/Finsbury scheme, possibly because of Tecton's previous outspoken dissent, favouring instead a policy against deep shelters. The Home Office argued in defence of its decision that heavy protection may foster a shelter mentality, interrupt processes of essential production and unduly divert national effort (Meisel 1994: 313).

Tecton's plans and theoretical work, based on mathematical assumptions and calculations of the spread of falling bombs and the risks associated with various types of shelter structure, were also available to technicians in Australia. Their model demonstrated the potential for protecting the whole community with strategically placed, massive concrete structures at a cheaper cost than scattering smaller shelters throughout the community. Eventually, a limited number (eight) were constructed in the UK under Herbert Morrison's direction in the London Region (Woolven 2002: 215-216), but ultimately none of the Australian projects materialised.

The South Australian Air Raid Shelter Committee's defence scheme (c1939) called for concrete shelters to be placed within the Adelaide CBD, whilst trenches were to be placed in its parklands. Some of their earliest designs for concrete shelters were of long semi-cylindrical structures with traversed entrances which could accommodate 50 individuals each. These shelters were planned as standard units to be furnished with seats and further protected with sandbags, and were designed to be placed in the city's lanes in such a way as to not obstruct traffic. According to the plans, the doorways were open with a curtain acting as a protective membrane against gas, but were also protected by a screen of sandbags. John Fargher's[25] shelter diagram, with its 10 in. walls and continuous, seamless roof line, seems extraordinary for its time, and superior to structures brought into service in the UK in the ensuing years. The early Adelaide designs may have been influenced by the CCA (n.d.a) pamphlet which was available in Adelaide by June 1938, and which showcased a number of tubular shelters. Fargher (1940: 132) explained:

> The aim has been to provide public shelters which will be proof against blast, splinters and debris, and which can be made gas proof. The great cost of providing complete protection against direct hits does not appear to be warranted in South Australia where it is unlikely that anything more than sporadic raiding will be experienced.

[25] Fargher was a member of the staff of the Chief Engineer for Railways, South Australia.

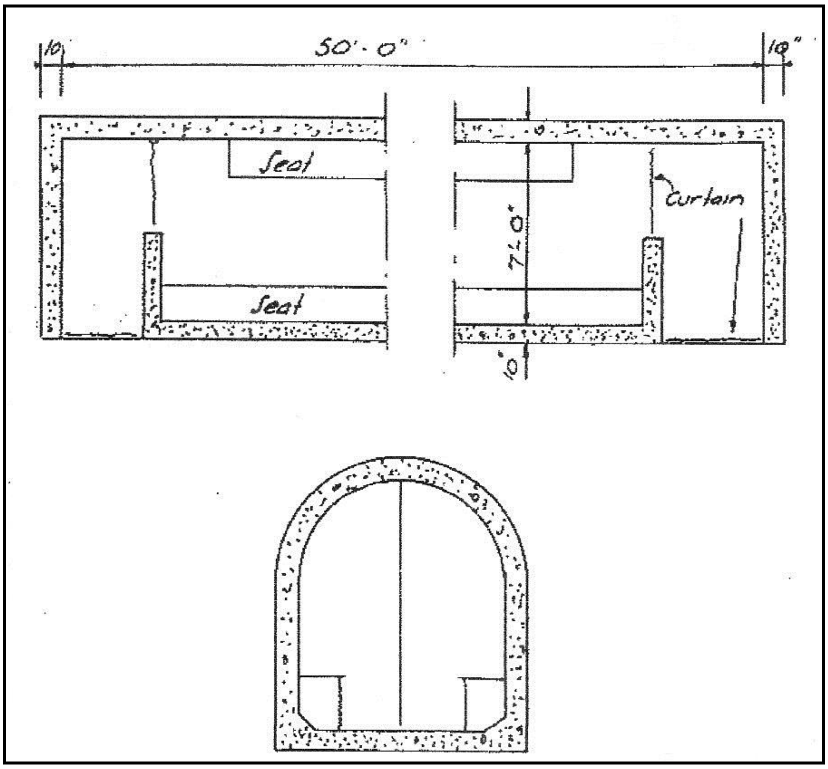


Figure 6-15: Concrete shelter for 50 persons intended for use in Adelaide streets c1939 (Fargher 1940: 132)

At this time, one of the theories developing around ways of countering direct hits by bombs and minimizing the tamping effect of soil was to have a separate layer of reinforced concrete (known as a detonating slab) above a shelter, with a void for absorbing the compression from the blast between this and the shelter proper. The detonating slab would cause the bomb to explode before it reached the surface of the actual shelter (unless it was an armour piercing bomb, or one with a time-delayed fuse), and the void between the slab and the shelter wall would fill with the earth and debris dislodged by the explosion rather than forcing the blast against the protective structure and possibly rupturing or shifting it. This was a more expensive shelter to construct as it entailed a deeper excavation (the deeper a shelter, the safer the occupants) and more concrete. It was, effectively, a "shelter within a shelter" (Baker 1978: 9). CCA also provided illustrations of this concept (see Figure 6-16), but once again with no annotated dimensions. For instance, there is no indication of the recommended thickness for the detonating slab, the shelter roof or the space between the two. Fargher (1940:131) also advocated the use of detonating slabs, arguing that they had the added benefit of protecting against concussion. His method was to fill the void between the detonating slab and shelter casing with a cushion of sand or gravel to absorb the shock of the blast. Fargher (1940: 131) provided a table, derived from a Swiss source, which outlined the required thicknesses of shelter roofs of differing construction for protection against direct hits by three different weighted bombs (1, 2, and 6 cwt.), as well as two fully annotated diagrams of shelters with detonating slabs.

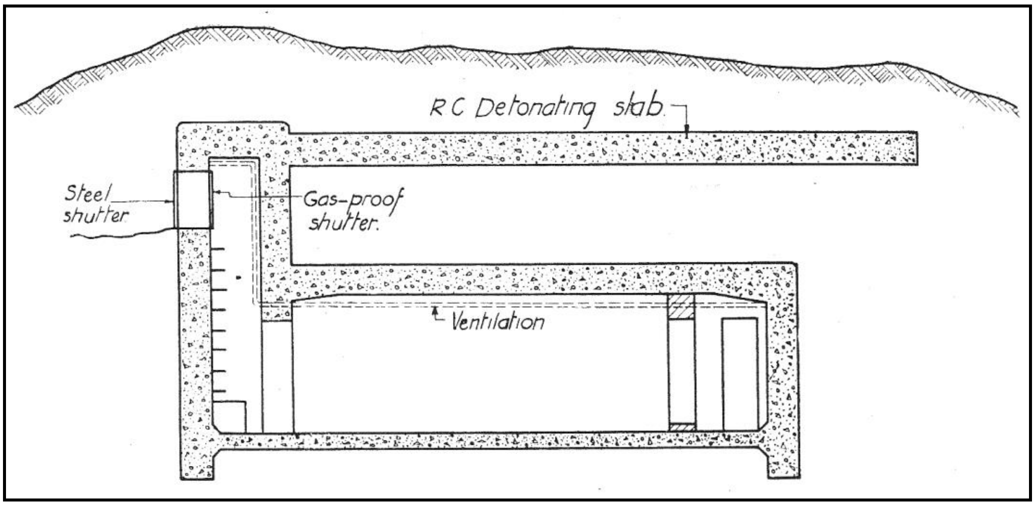


Figure 6-16: Section view of bomb proof shelter with detonating slab above (CCA n.d.c: 16)

An extension of the detonating slab theory can be seen in shelters with an overhanging, reinforced concrete roof (see sketches in CCA n.d.c: 27). One of the greatest dangers faced by structures from aerial attack was that bombs dropped from a moving aircraft seldom fell with a vertical trajectory, but typically came down at an angle other than 90˚, with the potential of hitting the sides of targets as well as their roofs. Fargher (1940:125) explained that "…the arrival of a bomb from an aircraft flying at 200 m.p.h. varies from about 38 deg. from a height of 2,000 ft. to about 17 deg. from a height of 10,000 ft." The trajectory of aerial bombs depended on variables such as speed and height of release, distance from target, the weight of the explosive device, air resistance and the prevailing atmospheric conditions (for example, wind direction and intensity). High altitude bombing in 1943 meant that "[a]t 20,000 feet the bombs left the aircraft two miles short of the target and dropped for forty-five seconds before they hit" (Brickhill 1953: 146; see also War Office 1941 [1939 Provisional]: 24). The resulting angle of travel served to increase the surface area of the target by exposing its walls, as well as its roof, at the point of impact. Consequently, if the structure survived the detonation and explosion, the lateral blast could shift the structure, or parts of it, sideways, increasing the chance of collapse.

The plan view of a Type V shelter illustrated below (Figure 6-17) demonstrates some classic design features in the development of this class of structure (see also the Griff shelter in section 7.6.2.3 for a similar structure built in Adelaide). Of great importance was the traversed entrance. A traversed entrance significantly increased the protection for occupants in several ways. Firstly, it prevented the blast of an aerial bomb (or other ordnance) venting straight into the shelter, which could happen if the external entrance was located in line with the shelter door. As can be seen from the sketch below, blast travelling down the steps would be neutralised by the facing wall (known as a blast or baffle wall). Secondly, it provided an area which could be easily sealed off and converted into a gas lock, preventing poisonous gas from entering the main refuge of the structure.

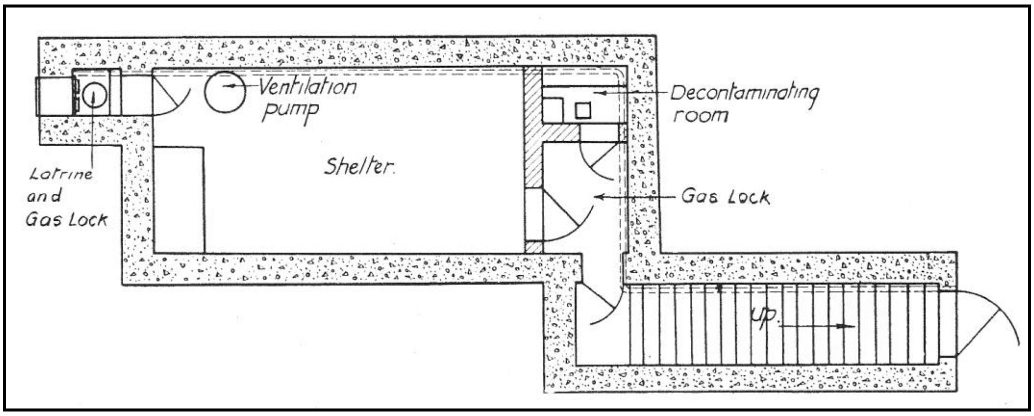


Figure 6-17: Plan view of bomb proof shelter showing traversed entrance (CCA n.d.c: 16)

6.7.1.2 Factors affecting Type V shelter construction: Domestic spaces

In May 1939, before the appearance of Handbook No. 5, the Home Office published a pamphlet entitled *Directions for the Erection of Domestic Surface Shelters* (Home Office 1939e). This publication was available in Australia by at least March 1941[26]. It provided specifications and several sketches of a small surface shelter made of brick or concrete. These were suitable for the backyard, or near working class tenements and flats that, due to the absence of lawn areas and gardens for many occupants, were found to be inappropriate for the installation of Andersons. Nowhere, however, did the pamphlet state the standard of protection provided by the shelter. The thickness of the reinforced roof and walls was almost identical to those mandated in the Code (see *South Australian Government Gazette* 1942: 359) two-and-a-half years later in 1942, which were minimum figures required to give protection against:

> (a) Blast and splinters from a 500lb. high explosive bomb exploding not nearer than 50ft. from the shelter.
> (b) A direct hit of a 1 kilo incendiary bomb.
> (c) Gas

[26] State Library of South Australia accession date for this publication is 19 March 1941.

The guidelines in the Code seem to apply to both surface and sub-surface shelters, with the only provisos that surface shelters be constructed on footings and be of ‘monolithic construction’ (*South Australian Government Gazette* 1942: 360). In view of this, it would seem that the recommendations in the ARP pamphlet could also protect the occupants against contingencies (a) and (b) in the SA guidelines. In fact, these are the same requirements/standards that the Anderson shelter was designed around (see O’Brien 1955: 196). No mention of protection against poisonous gas is made in the ARP pamphlet, perhaps because most English citizens had already been issued with a gas mask some eight months previously (at the time of the Munich Crisis). Some designs could be easily gas-proofed, to some extent, by hanging a curtain of heavy fabric across the entrance, and in the case of the traversed entry type described above, by hanging fabric across both doorways, thus creating a rudimentary gas lock.

The basic shelter design in the pamphlet is illustrated in various configurations and could be constructed as a shelter for a single household, or as a shared structure straddling the boundary of multiple properties, each with self-contained familial spaces. This simple and basic shelter was designed with an internal floor space also based on that of the Anderson shelter (approximately 6 ft 6 in. x 4 ft 6 in.) and could accommodate up to six people. A curious feature of this shelter was that it had an open doorway because the design called for the structure to be built within 6 ft to 15 ft of either the owner’s house or a solid wall. The assumption was that the house or adjacent wall would protect the entrance from blast. In those cases where the distance from the house was greater than that prescribed, a screening wall of brick, concrete block or earth was to be built across the front of the structure creating, in effect, a traversed entry as blast protection. These designs also included an emergency exit in the rear wall of each cell of the structure (arrowed in red below), and at a point furthest from the entrance and in line with a screening wall (Figure 6-18). These entrances were for double shelters constructed on a boundary fence and shared with a neighbour. The plan to the left is for a shelter with an un-obscured entrance which was designed to be situated within 15 ft of a house wall (hence the open doorway) whilst the plan to the right includes a traversed entry for shelters placed outside the protective shadow of a residence or other solid structure.

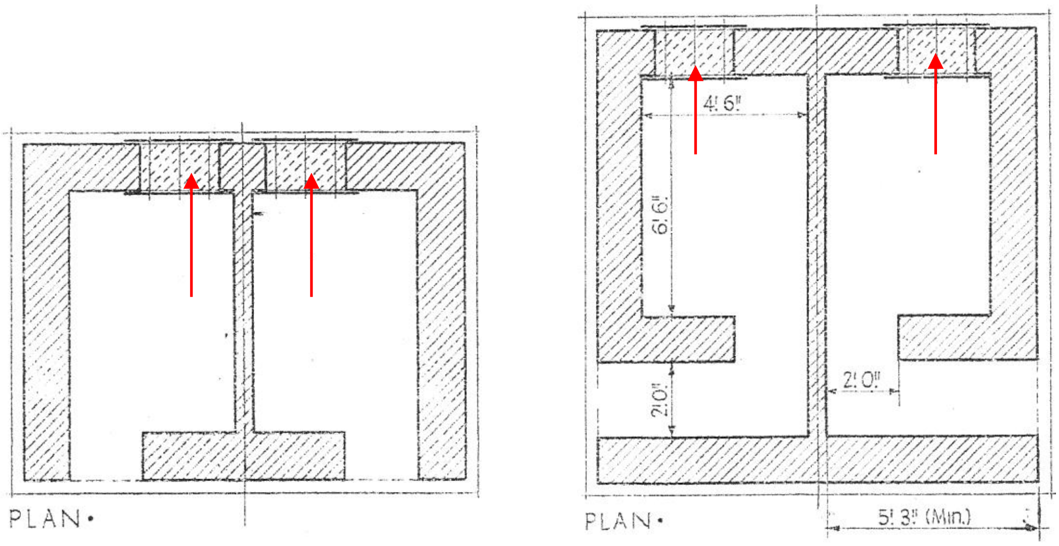


Figure 6-18: Plan views of double shelters demonstrating alternative entrances. Emergency exits arrowed
(Home Office 1939e: 9)

These structures included a concrete roof 5 in. thick, reinforced with steel rod or steel mesh which did not over-hang the structure, but instead finished flush with the external wall. External walls were to be of 13.5 in. thick brickwork (the thickness of three bricks) or 15 in. thick pre-cast concrete. Pre-cast concrete panels may have been recommended over site-formed concrete walls for a number of reasons, including to effect a faster construction, to allow the concrete to cure properly before the shelter was used (normally twenty-eight days for maximum strength [*South Australian Government Gazette* 1942: 358]), or because of a predicted lack of skilled labour for building. Likewise, the South Australian Code stipulated 13.5 in. brickwork, but only 12 in. of reinforced concrete for the walls, which in fact mirrored the minimum dimensions in the English code for factory shelters (see Office of the Lord Privy Seal 1939: 1). It could be that the pre-cast concrete walls in the English domestic model were without adequate reinforcement, or that by the time the South Australian Code was drafted more precise bomb damage data had become available, allowing for narrower gauge walls. The internal walls in double and quadruple shelters, detailed by the Home Office (1939e), were of 4.5 in. thick brickwork (the width of a standard brick) or of 4 in. thick concrete. A concrete floor was recommended for shelters erected in locations that had no pre-existing paving of concrete, brick or flagstone, and for those not built on an existing roadway.

The same shelter design was re-used in Australia with some modifications by the Victorian State Emergency Council for Civil Defence, who referred to it as a 'pill box' shelter. The dimensions mirrored those of the English version, but included improvements such as:

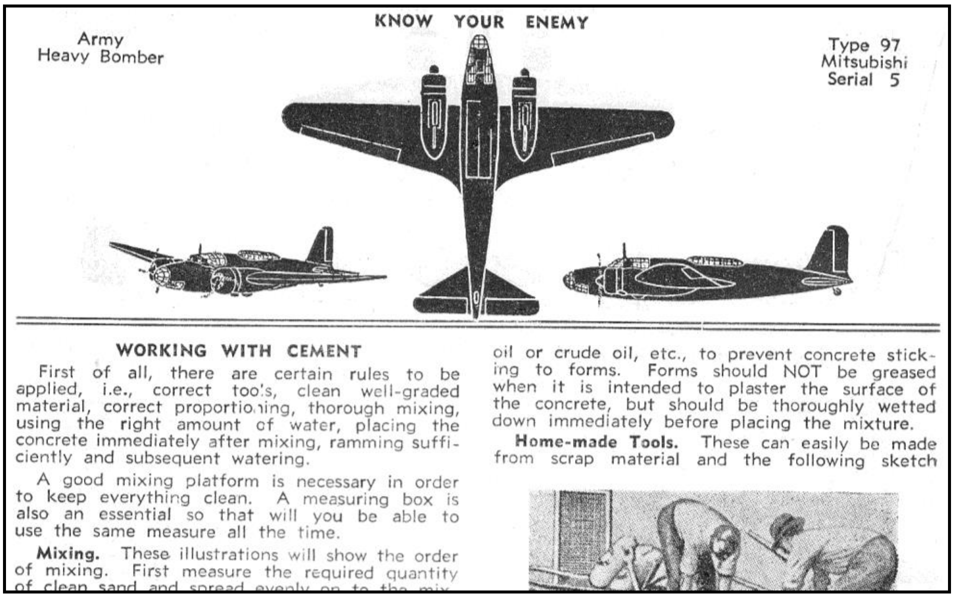
> …reinforced walls, a bituminous damp course…placed near ground level and [a roof that] projects outside the walls a minimum distance of 3 inches (State Emergency Council for Civil Defence, Victoria 1941: 26).

These improvements may have been influenced by weaknesses discovered during the previous two years of air raids and environmental degradation in the UK. An overhanging (or oversized) roof would have certainly protected the sides of the structure to some degree, but may have also stopped the roof from falling into the shelter if dislodged by a blast. The Australian design retained the emergency exit, and was based on the English traversed entrance option, meaning that it did not need to be placed within 15 ft of a solid wall. The open front version of the shelter was not offered as an option in the Australian publication.

The CCA (n.d.d) also proposed a number of designs for “superseding ‘Anderson’ steel shelters”. These were pitched at those people with an annual income in excess of £250 (the cut off point for receiving a free Anderson), and were shelters that could be erected by a local builder in a few days. The outlay would not exceed £20 in most districts (this estimate seems to include the builder’s fee since a separate estimate for material alone of £11 - £12 is also provided) (CCA n.d.d: 2). In Australia, however, this cost was almost five times the weekly minimum wage for a male.

In this instance, the CCA recommended obtaining a copy of ARP Memorandum No.14 for clear instruction on such construction. Unfortunately, this Memorandum was not sighted during this research. However, it is possibly a version of the Home Office (1939e) pamphlet detailed above, for according to descriptions in CCA (n.d.d), the shelters seem to be identical in both publications. CCA explained that one of the simplest and quickest forms of construction for the amateur to undertake was to utilise hollow concrete blocks, each the size of 12 normal bricks. These were to be laid like brick-work using cement or lime mortar, and the cavities filled with earth, sand or gravel. The CCA structure had an arched concrete roof (it could also be pitched) that differed from the Home Office (1939e) design, which had a flat roof. The arched roof was composed of bearers of pre-fabricated concrete planks thickened with ordinary concrete shovelled over the top, and giving a total minimum thickness of 6 in. The CCA shelters also had open doorways. It was recommended to place the shelter 15 ft from the house with the entrance facing it, or to build a baffle wall 2 ft from the shelter entrance, to the height and width of the structure. The CCA plan was fully annotated and even provided an itemised list of all materials required (for instance: 216 x double cavity blocks [18 in. x 9 in. x 9 in.] and 100 bricks, amongst other items).

Some Australian civil defence booklets also published guidelines on subjects such as “working with concrete” and “bricklaying for the amateur” (see, for instance, Bartlett n.d.: 52-55). These were intended to help improvise one’s own home repairs (or one’s ‘own defence’ as the publication’s title suggested). Each page had the silhouette of a different enemy bomber (German, Japanese or Italian) as its header (Figure 6-19) so that people could learn to precisely identify who was bombing their house. These instructions could have been very useful to those attempting to build a shelter themselves, including, as they did, formulae for mixing different strength concretes for different types of structure and tolerances.


KNOW YOUR ENEMY

Army Heavy Bomber

Type 97 Mitsubishi Serial 5

WORKING WITH CEMENT

First of all, there are certain rules to be applied, i.e., correct tools, clean well-graded material, correct proportioning, thorough mixing, using the right amount of water, placing the concrete immediately after mixing, ramming sufficiently and subsequent watering.

A good mixing platform is necessary in order to keep everything clean. A measuring box is also an essential so that will you be able to use the same measure all the time.

Mixing. These illustrations will show the order of mixing. First measure the required quantity of clean sand and spread evenly on to the mix-

oil or crude oil, etc., to prevent concrete sticking to forms. Forms should NOT be greased when it is intended to plaster the surface of the concrete, but should be thoroughly wetted down immediately before placing the mixture.

Home-made Tools. These can easily be made from scrap material and the following sketch

Figure 6-19: Know your enemy and improvise your own repairs
(Bartlett n.d.: 52)

The mortar used in construction became a crucial part of shelter building. South Australian guidelines stipulated that cement mortar could not be weaker than one part of cement to four parts of sand (*South Australian Government Gazette* 1942: 358), whilst the ARP pamphlet (Home Office 1939e: 2) suggested one part Portland cement, one-tenth part lime putty or hydrated lime and three parts approved sand by volume. In an effort to lessen the demands on cement after the outbreak of war, the British Government instructed that lime "in the ration of two parts to one of cement… [be] used in the mortar of all surface shelters" (O'Brien 1955: 369), with further 'ambiguous' instructions issued in April 1940 for domestic shelters leading to lime and sand only being used for the mortar mix. The result was that shelters constructed with ungauged lime mortar fared poorly during bombing raids, and those that survived needed to be strengthened, demolished or re-built, as was the case for 5,000 surface shelters in the London Region and 4,000 in the Bristol Region. In March 1941, all public and communal shelters constructed in the UK with a mortar of only lime and sand were dutifully closed, with many being demolished as unsafe so that the fabric could be re-used in civil defence elsewhere. Smaller individual shelters escaped this decree because they proved stronger and more stable than larger shelters of the same construction (O'Brien 1955: 522).

The strength of Adelaide's shelters was never put to the test, although Colonel Light Gardens was inadvertently 'bombed' in August 1944 by a B-24 Liberator piloted by First Lieutenant Woodward. It took off from an army camp on the south side of Daws Road (now Daws Road High School) bound for the 529th Squadron in Northern Australia with supplies and rested troops. However, the aircraft's bomb doors accidentally opened during an 'evasive' manoeuvre and the bomber spread its cargo of burgundy, Coca Cola, eggs, oranges, cordial and other groceries across Goodwood Road and Mortlock Park in Colonel Light Gardens (Ragless 1995: 12; Sieber 2009: 2).

6.7.1.3 Factors affecting Type V shelter construction: Factories and businesses

ARP Handbook No 6, *Air Raid Precautions in Factories and Business Premises* (Home Office 1937), was published in Australia in 1939. That same year, and also published in Australia, the Office of the Lord Privy Seal issued a draft of the Provisional Code for minimum standards of overhead and lateral protection to persons working in factories. Plant and machinery were not considered for protection in the Code, but special consideration was given "to the provision of shelters near the scene of their duties for special classes of personnel, such as :- (a) key men whose duty it is to remain at their posts [and] (b) A.R.P. Personnel" (Office of the Lord Privy Seal 1939: 7).

The CCA's ARP technical information, similar to that in official government publications, was that fragments from a 500 lb bomb could not penetrate 12 in. of reinforced concrete from a distance of 50 ft, but suggested that complete protection could be attained if a structure with 12 in. walls was covered with at least 2 to 3 ft of earth. To protect against blast in open areas, the CCA recommended a "masked" entrance (probably meaning a traversed entrance or one with a baffle wall across it) and streamlining that portion of a shelter above ground with sloping earth banks. CCA were clearly not interested in providing shelter within factories, for their suggestions only related to external structures placed far enough away from buildings to protect them from potential structural collapse. The technical data supplied by the CCA is quite thin and often seems anecdotal, but they recommended consulting engineers experienced in ARP work, and offered to supply the contact details for contractors and concrete products merchants to help construct shelters specific to each situation.

6.8 Type VI: Structurally modified rooms

A sixth type of structural defence employed in Adelaide was simply to reinforce, or modify, an existing room in a dwelling or a commercial premise to provide a safe refuge. Not surprisingly, and largely because of the portability of their components, Type VI shelters have proven the most difficult to quantify in this research. Structurally modified rooms appear in the official literature, and were visible in public spaces but they are largely absent from oral histories. It is uncertain whether the population of Adelaide refused to embrace the concept, or whether the modifications were not remarkable enough to have made an impression on the survivors when asked of their recollections of air raid shelters. One further reason for this absence could relate to the availability of a version of the Morrison table shelter in Adelaide. People may have purchased a Morrison with the thought of using it to create a safe room in their homes rather than structurally modifying a room. This thesis, however, would be incomplete without mentioning structurally modified household and commercial refuges, and the part they played in ARP. Domestic and commercial modified rooms are not considered sub-types of Type VI shelters, but are dealt with separately in this section for ease of description.

6.8.1 Background

In the UK, an early structural ARP initiative was to provide free steel props to people in high bomb risk areas who had no space for a trench (or Anderson shelter) in their garden. These props were to brace the ceilings of basements and secure them against air raids (Baker 1978: 4). As the *Blitz* wore on, the true value of the distribution of props was realised and their demand escalated. It was discovered, as the war progressed, that more and more people chose to stay indoors during a raid rather than go to their outdoor shelters, especially as the winter approached. This decision was driven by a number of factors, including the fact that the trenches were not weather proof, the unbearable and de-moralising noise associated with air raids (sirens, anti-aircraft fire, explosions from bombs—all muffled indoors to a degree), and the reality that most trench-type shelters had no beds which meant that many workers were not able to get any sleep during all-night raids (Baker 1978: 43-44). Because of this, an increasing number of steel props were handed out, until in early 1941 the development and distribution of the portable Table (Morrison) Indoor Shelter gave people a secure place to sleep without the need to make structural modifications to their properties. A locally produced version of the Morrison shelter was available in Adelaide from March 1942 (*News*, 27 May 1942: 6).

6.8.1.1 Factors affecting Type VI shelter construction: Domestic dwellings

In Australia before the war in Europe, advice was already available on how to choose and strengthen the best room in the house for shelter during an attack of high explosives or gas. The following advice, published by the Blind Self-Aid Society of Australia (n.d.: 6-7) in approximately 1938/39, is typical of the era:

> …[s]helter under metal ceilings in preference to lath and plaster as concussion may dislodge heavy pieces of plaster. Select a room with as little glass, such as windows, etc., in it….select a room with the strongest outside walls near the rear of the premises….stick sheets of cellophane over all windows, as this will lessen the danger from flying shattered materials.
>
> Outside the refuge room sandbags should be placed. These must be at least two feet six inches thick at the top and may be filled with sand or earth, but not with coal dust or other flammable materials.

Bartlett Publishers (n.d.) gave similar advice approximately two years later, warning that "…there are few home-made air raid shelters of any sort that will survive a direct hit… [But] certain precautions are well worth taking." It is possible that the advice in their booklet was informed by incidents in the UK. Bartlett (n.d.: 8) suggested selecting a room in the house with:

> …as many walls as possible around it…the middle room—the walls of the other rooms will give it added protection…select a room with the smallest area of glass, as few doors, windows and ventilators as possible…use the one farthest from the street…avoid a room that has a lot of ornamental work on the ceiling.

Bartlett (n.d.: 14-15) also provided advice on how to use furniture (such as heavy tables, lounge chairs, mattresses and piles of books) as added protection, and illustrated how to make a table shelter out of wooden members, half-inch bird wire, and a piece of steel or solid wooden planks. It also recommended consulting the local warden when planning structural overhead protection, as well as letting them know where one's family intended sheltering.

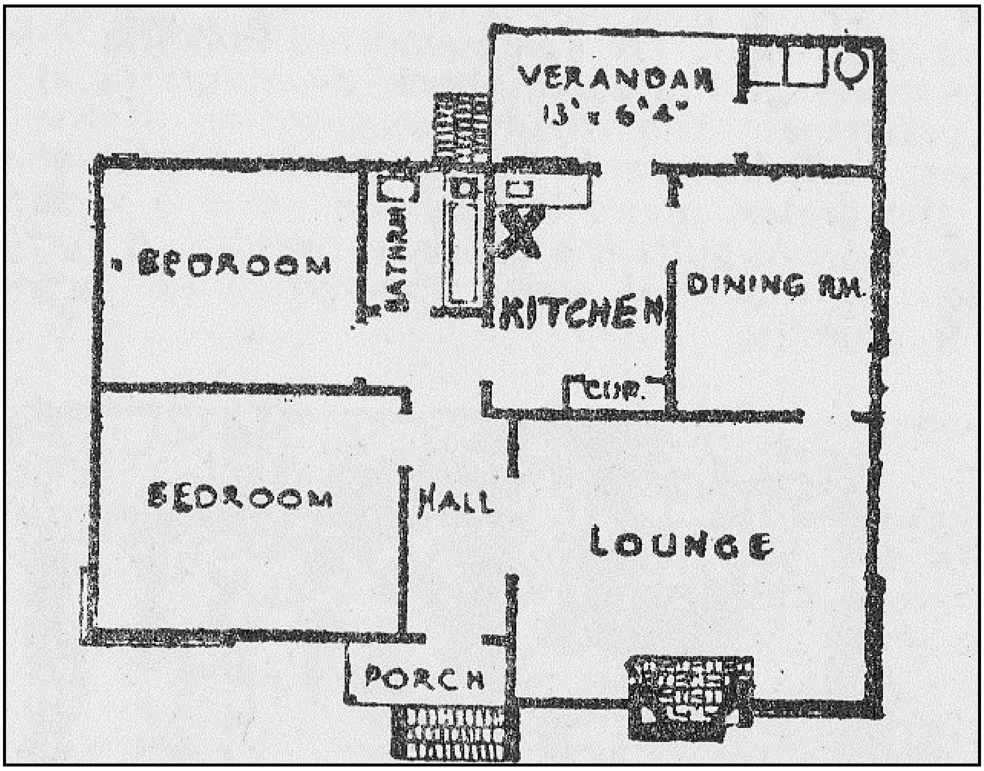


Figure 6-20: The safest room in this house marked with an 'X'
(Bartlett n.d.: 8)

The State Emergency Council for Civil Defence, Victoria (1941: 20-22), suggested choosing a room that was easy to enter and leave, and recommended that: "[w]indows and doorways should be blocked up at least to a height of six feet, or barricaded either internally or externally, ceilings must be supported in case of collapse of the roof or upper storey". Because of an absence of windows, converting an internal passage made an ideal refuge, although a cellar or basement was the best location for a refuge room:

> …providing it can be made gas resisting, there is no likelihood of its becoming flooded, the entrances are not likely to be covered with fallen debris, and the ceiling is strong enough to bear the weight of debris.

This particular publication contained technical information that was absent from both the Blind Self-Aid of Australia (n.d.) and Bartlett (n.d.), and seemed to be derived from English codes. It provided standards for lateral protection dependent on the type of reinforcing material used for walls; for instance, thicknesses of 12 in. of reinforced concrete or 13.5 in. of brick, amongst others (the same standards found in Office of the Lord Privy Seal [1939]). There are no guidelines for strengthening ceilings, only a recommendation that this should be carried out under the supervision of a qualified person. There are also guidelines for the maximum number of occupants who could be comfortably accommodated in such a room based on a formula of 25 ft^2 per person; for example, a 10 ft x 10 ft room would have an optimum capacity of four people.

A Group of Australian Scientists (1940: 12) was critical of this policy and wrote:

> …[i]n the event of an air raid each was to return home whenever possible, retire quietly to the refuge-room and "pass the time reading, writing, sewing, playing cards or quiet games, listening to the wireless or gramophone". No serious observer of the effects of intensive bombing in Spain or China denied that such refuge-rooms would be other than death-traps. But the sense of domestic security aroused…was the main objective of A.R.P.: to "ensure the country against panic".

They also emphasised that "…basements and cellars had finally been prohibited as shelters in many Spanish towns because of the disastrous effects of collapsing buildings [burying occupants under tons of wreckage]" (A Group of Australian Scientists 1940: 17). However, advice and recommendations about fortifying the home perfectly suited the Government's policy of dispersal. It also meant that most expenses incurred in equipping a refuge room fell on the individual and further reduced the need for local government to supply additional public shelters.

6.8.1.2 Factors affecting Type VI shelter construction: Factories and businesses

The Provisional Code—*Air Raid Shelters for Persons Working in Factories and Commercial Buildings* (Office of the Lord Privy Seal 1939) covered external shelters such as trenches and tunnels in factory grounds, as well as internal shelters such as converted basements and inner rooms. It drew attention to the added dangers in the factory environment when planning the placement of shelters, and listed six hazardous areas, including proximity to water tanks, large chimneys and under heavy machinery. The draft gave examples of how to fortify areas within four different types of building: a mill; a multi-storey warehouse; an office block with basement; and a shop on a corner site with basement. It also recommended that structural ARP work be carried out by qualified engineers or architects.

The Provisional Code did not specify the level of protection, and may have been published before the scientific assessment done for Handbook 5A was available. The lateral (brickwork 13½ in. thick or reinforced concrete 12 in. thick) and overhead (concrete 6 in. thick or structural concrete 4 in. thick) dimensions recommended seem little different to those stipulated for English domestic or communal shelters (see Home Office 1939e), nor do they differ greatly from the South Australian Code of 1942 (see *South Australian Government Gazette* 1942). The main differences between shelter protections in factories compared to those in the suburbs lay not in the shelter itself, but in how the parts of the building around the shelter were braced, and the load bearing capacity of the various floors above the shelter.

6.9 Characterisation and archaeology

The characterisation of the six air raid shelter types in Adelaide during WWII (see Table 6-6) enables these structures to be readily identified in the field. Although each type has many variations influenced by local environmental conditions and the builder's unique personal situation, the main structural features within each type are largely uniform. The exception to this is the Type I shelter (trenches) which can have obvious major structural differences (i.e. they can be covered or uncovered) and, consequently are allocated to different sub-types in this study.

Table 6-6: South Australian shelter Types and their characteristics

SHELTER TYPE	CHARACTERISTICS
Type I: Trench Shelters	**Emergency protection. Two sub-groups—open and covered. Long, narrow earthworks of varying length with a maximum depth of approximately six feet. Single or multiple arms which can be straight, zigzag or any other configuration. Sides can be shored up with panelling.**
Type II: Dug-outs	**Long term habitation. Substantial, room size earthworks. Commonly constructed by WWI veterans. Thick overhead protection. Rudimentary furniture often cut out of earthen walls, stocked with emergency supplies.**
Type III: Sectional Shelters	**Long term habitation. Pre-fabricated, portable and self contained. Constructed of arched, thick gauge, galvanised iron sheets bolted together. Partially or completely sub-surface.**
Type IV: Reinforced Concrete Pipes	**Emergency protection. Typically 33 in., 36 in., 42 in. or 48 in. diameter. Smaller pipes for children, larger for adults. Some left *in situ* in playgrounds after the war. Surface or partially sub-surface. Benches often fitted.**
Type V: Bunkers	**Long term habitation. Purpose-designed air raid protection—could be of brick, stone, concrete or steel. Surface, sub-surface or partially sub-surface. Often had bunks, built in shelves, breather pipes, solid doors, emergency provisions.**
Type VI: Structurally Modified Rooms	**Long term habitation. In domestic, commercial or public properties. Ceilings and walls braced with steel or wood, often sandbagged and with thickened walls, stocked with emergency provisions. Can be a basement/cellar or above ground room. Sometimes included a Morrison table shelter.**

The following chapter details the investigation of the archaeological remains of each type of shelter, and provides an analysis of their dimensions and attributes.

Chapter Seven

Archaeological Results:

The Pity of War Distilled

…I mean the truth untold,
The pity of war, the pity war distilled.

Wilfred Owen 1918

7.1 The truth told: Gimme shelter

Based on archival and oral history evidence, this research recorded the location of a total of 547 air raid shelters across the greater Adelaide region (including 140 domestic shelters and 407 public shelters), and a further 39 in country regions of SA. The majority of air raid shelters no longer survive, but eleven extant shelters were archaeologically recorded. Eight of these were domestic structures and a further three were public shelters. The physically recorded shelters include one Type III and ten Type V structures. Geophysical surveys were conducted at two additional locations in an attempt to locate the footprints of purported shelters. Even though the numbers of some described shelters are small (for instance the analysis of certain dimensions of some shelter types is based on data from only one recorded example) these recorded sites do give some impression of the Type and what life in Adelaide was like during the war years for some of its inhabitants.

7.2 Type I: Trenches

This study recorded 303 Type I shelters in metropolitan Adelaide, and a further 35 in country SA (see Table 7-1). These figures are minimum counts only. Surviving municipal records seldom detailed the exact number or location of shelters, but often only referred to the combined total length of trenches in a park, or the total number of trenches dug in a suburb (see, for instance, 7.2.2.1). Consequently, where a park was mentioned as having a certain linear measurement of trenches, but no indication of how many trenches made up that figure, only one trench was counted for the purposes of this study. Similarly, where oral testimonies were imprecise, such as in the case of Claire Woods (2009, pers. comm. 19 November, Professor, University of South Australia) who recollected that her school, the Presbyterian Girls College (now Seymour

College) in Glen Osmond, had “several trenches dug behind the grade seven block”, only a notation of ‘>1’ was entered into the data base and ‘2’ added to the count as a minimum figure. However, such aggregate data is still able to provide information on the responses to the fear of attack and the spread of shelter types across Adelaide.

Fortunately, data relating to domestic shelters provided a more exact count of the number of shelters built because most homes had only one. However, where more than one shelter was dug in a domestic yard, as in the case of the Entwhistles who were forced to dig a second when the first filled with water, or where neighbours shared a common shelter on their fence line (for instance, the residents of Alice Street, Lauder Avenue and Scott Street in Sefton Park, see section 7.2.3.1 below), these were recorded separately. This data contributes to an understanding of the extent to which private individuals protected themselves, and the level of fear manifest in suburbia.

Table 7-1: Number of Type I shelters in Adelaide and country SA (shown in red). Numbers followed by ‘p’ are proposed shelters that may not have been built

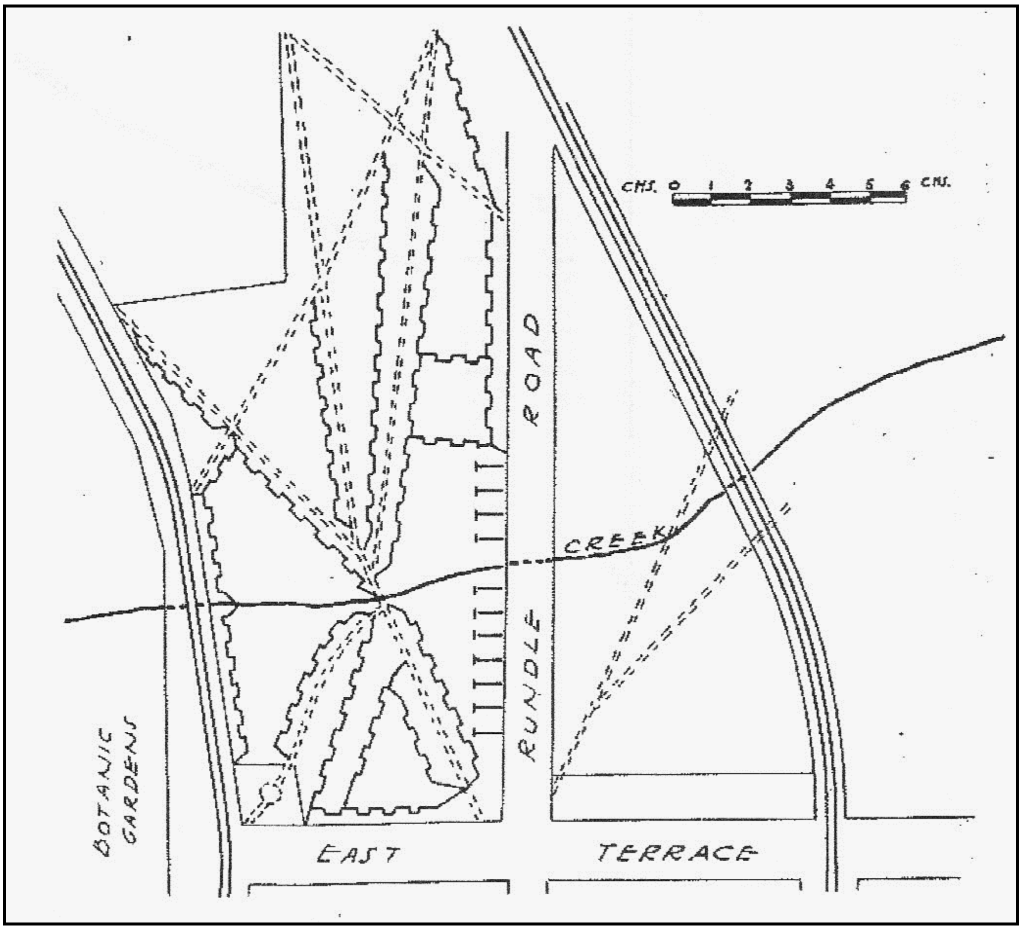
	Type I(a) Open	Type I(b) Covered	Unknown Sub-Type	Total
Public Spaces	**130 + 4**	**2 + 1**	**58 + 1p + 5**	**191 + 10**
Schools	**36 + 6**	**2 + 7**	**20 + 1p + 9**	**59 + 22**
Businesses	**6**	**1+ 1p**	**9**	**17**
Domestic Abodes	**13**	**8 + 3**	**15**	**36 + 3**
Total	**185 + 10**	**14 + 11**	**104 +14**	**303 +35**

Table 7-1 contains all Type I shelters recorded in Adelaide and country SA, including 118 of unknown sub-type which were referred to only minimally in oral histories and archival documents. Playground shelters were included in the public spaces data because they serviced a floating population as well as school children. Three shelters were proposed to be built and could not be verified as having been constructed, but are included here because even their conceptualisation remains relevant to the goals of this research. These figures demonstrate that it was largely only Type I(a) shelters which were installed by the municipalities of Adelaide, and that Type I(b) shelters, as far as could be determined, were infrequently utilised in public spaces. In all probability, those shelters uncharacterised in open public spaces and schools were also Type I(a) slit trenches. Some corporations and businesses supplied, or intended to supply, covered trenches for their employees. Even so, Type I(b) shelters featured more prominently in the domestic spaces than in public and commercial areas of Adelaide. Towns in country SA appear to have taken a different approach to shelter construction than Adelaide, with approximately equal numbers of covered and uncovered trenches recorded. Each of these categories of trench will be expanded upon below, according to whether they were constructed in public space by corporate bodies, such as local councils, or as private shelters.

7.2.1 Trenching the public spaces of Adelaide

7.2.1.1 Type 1(a): Open trenches

By August 1939, the Adelaide Air Raid Precautions Organisation, under the direction of Lieutenant Colonel Veale, had prepared various schemes for the protection of the civilian population of the City of Adelaide against potential air attack. The schemes included a system of trenches which: "…would be dug in the parklands [since] the bulk of the people, who could not reach their homes in the suburbs, would be expected to take shelter in the trenches" (Fargher 1940: 132). Map 7-1 is a depiction of the planned trench layout for a section of the East Parklands, drawn as a part of Veale's defence schemes. No written information on the linear dimensions of this projected trench system, or of the number of people it could theoretically shelter, was provided by Fargher. However, the scale provided on the plan indicates that the combined length of the trenches was in excess of 46 chains (1,402.1 m). The historical slope of the land (much altered in the twenty-first century) is indicated in Fargher's map and descends south to Rundle Road. This gradient would have diverted water away from a section of the trench layout and onto Rundle Road in the winter months. The trenches were also to be dug alongside existing pathways for easier access.



Map 7-1: Proposed trench system for the East Parklands, Adelaide
(Fargher 1940: 132)

Sumerling (2011:157) makes the unsubstantiated claim that this network of trenches, like those adjacent to the Cheer-Up Hut[27] between the central railway

[27] The Cheer-Up Hut provided meals, recreation and social opportunities for convalescing service personnel or those on leave.

station and Elder Park, was for troops only, and totalled 7,500 linear feet with accommodation for 2,500 men.

The civil defence planners of Adelaide had learnt much from the mistakes made in England in the lead up to war. After the Munich Crisis, large areas of London had been trenched without much consideration of the adjacent daytime population, or of the amount of time required to reach the shelters from surrounding areas. The last UK census had been carried out seventeen years previously in 1921, and only recorded the number of people who lived in the area, not the floating population. By 1939, some already congested areas regularly swelled to three times their normal population level during work hours, leaving the local trench systems unable to cope with the number of people (Tecton Architects 1939: 4-5). In their seminal ARP study of a London suburb, Tecton Architects (1939: 33) concluded that:

> …[t]he first consideration in applying a trench system to any particular area must, of course, be the possibility or otherwise of housing the population of that area in trenches dug on open spaces available.

The design of Adelaide, and especially its CBD with its many parks and open spaces situated near permanently populated areas and large floating populations of workers and shoppers, lent itself to such a program of trench construction. All open spaces (parks, squares, main thoroughfares and vacant lots) were assessed for their proximity to both static and floating populations, and allocated ARP infrastructure according to estimated maximum civilian numbers in their immediate vicinities. For instance, Wellington Square, in North Adelaide, was deemed to have no floating population (TCDKT1942/1539:01). Consequently, it was proposed to install shelters there to accommodate only 120 people, presumably those who occupied or visited the dwellings and businesses surrounding the Square, with no need to make allowances for additional flow through traffic on specific days (Chapman 1942d). Conversely, Victoria Square, and its proximity to the Adelaide Central Market, was known to have a huge floating population on market day (Chapman 1942e), hence 22 trenches totalling approximately 2060 linear feet and able to shelter 1030 people were planned (CEF[1942]030).

Figure 7-1: Trenching Victoria Square, Adelaide c1942
(c/o Ray Hirst, NEWS LTD)

Where vacant land was privately owned and calculated to be strategic in providing local civilian shelter, the owners were contacted by mail with a standard letter enquiring whether they would permit the Corporation of Adelaide:

> (1) For a merely nominal consideration of 5/- to install air raid shelters on the land mentioned above for the duration of the war for the use of the public;
>
> (2) To remove such shelters at the end of the war
>
> Town Clerk, Corporation of Adelaide 1942d

At an ARP Conference held in Adelaide on 29 May 1940, it was reported that preparations were in hand for the construction of public trench shelters capable of protecting 25,000 people in the CBD and Port Adelaide (a Group of Australian Scientists 1940: 26). This equated to 50,000 linear feet of earthworks estimated at 2 ft per person. Trenches providing protection for a total of approximately 1200 people were dug in six separate locations along South Terrace (see CEF[1942]028).

Figure 7-2: Depth of trenches in Victoria Square, Adelaide c1942
(c/o Ray Hirst, NEWS LTD)

By 9 June 1942, the five city squares in the Adelaide CBD (Victoria Square, Whitmore Square, Hurtle Square, Hindmarsh Square and Light Square) contained 10,860 linear feet of open trenches which could accommodate 5,430 people (Chapman 1942c). This is particularly interesting given that Type I(a) trenches had been virtually outlawed in the public spaces of SA with the introduction of the Code. It demonstrates the perceived need for emergency protection in the months after Japan's push south and indicates that the Code may have only applied to new or recently proposed building projects.

Hindmarsh Square alone had ten trenches aligned east-west, with five placed in its south/east corner and another five on its western side (CEDKT1942/1121A 1942c). Originally, 12 trenches on the same alignment had been planned (six on each section) totalling 1,230 linear feet and capable of protecting 665 people (CEF[1942]029). The alignment of trenches in Hindmarsh Square is, at first, perplexing because their axes lie directly in line with the main approaches from the Gulf of St Vincent and Adelaide's western beaches, as do those of Light Square (see the drawings in CEF[1942]032). One would assume, because of Adelaide's grid-like town plan, that carrier-based enemy aircraft of the day needed only to head east along the main arterial roads (such as Henley Beach Road) leading from the beaches to the city centre, in order to be able to strafe along the east-west aligned open trenches (see also Griggs' observation at section 7.2.2.1). However, the position of the trenches in Hindmarsh Square indicates that an attack may have been expected from the south, where the open, deeper waters off Kangaroo Island would have been better able to accommodate a carrier fleet than a shallow body of water bounded on three sides by land, such as the Gulf of St Vincent.

An unsubstantiated oral history (Jan Leaver 2008, pers. comm. 15 August, daughter of shelter builder) recounts a Tokyo Rose[28] broadcast which claimed that a Japanese aircraft carrier would be stationed off Kangaroo Island on a

[28] Japanese propaganda broadcaster.

specific Wednesday; its planes would fly down South Road into Adelaide and bomb Parliament, police headquarters and the military barracks. The broadcaster's accurate knowledge of street and building names shocked residents of Adelaide and Kangaroo Island at the time[29]. One Type V shelter was recorded at Kingscote on Kangaroo Island, the construction of which may have been influenced by this broadcast scenario. The reality for all terrestrial participants in modern conflict is that the skills of some wartime aviators, especially the ability of dive bomber pilots to 'drop a bomb in a jug' (see, for example, the auto-biography of WWII *Stuka* pilot, Hans Ulrich Rudel[30] [1953: 231]), would make a mockery of such precautions as open trenches. WWII pilots had the skill to kill civilians in trenches if they desired to do so, however, the positive psychological effect of having trenches in place, whatever their orientation far outweighed their life saving potential.

Northwest of the city centre adjacent to a major industrial precinct of Adelaide involved in war production (see Map 8-1 for more information), the Corporation of the Town of Hindmarsh dug trenches equalling approximately 14,000 linear feet which were estimated to be able to accommodate 7,000 people. Most of these were equipped with duck-boards for use in wet weather (Parsons 1974: 257). The huge number of trenches constructed in the Town of Hindmarsh gives an indication of the size of the population living in and around industrial areas, its

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[29] Up until the outbreak of WWII, a large number of Australia's maps and street directories were printed in Japan—it is little wonder Japanese forces had a good knowledge of Australia's public infrastructure.

[30] The *Stuka* (Junkers Ju.87) was a German tactical bomber. It was deployed equally successfully as a dive bomber against large static objectives such as ships or buildings, and in an anti-tank role against smaller and more mobile targets (Angelucci 1983:297-298). Rudel is personally credited with sinking the Russian battleship *Marat* and destroying over 500 tanks whilst piloting a *Stuka*. The Japanese Imperial forces had aircraft with similar theoretical and practical capabilities to the *Stuka* at their disposal during the Second World War.

status as a target area, and the importance attributed to the workers involved in war production. It also underlines an awareness of the risks to civilians living near industry from accidental or intentional aerial attack. Such behaviour around industrial areas is universal, and its patterning may still be detectable in the landscape of other warring nations (such as Britain and Germany) whose manufacturing precincts were likewise threatened during WWII.

While, immediately south of the city and parklands, in Unley, Bentzen (1942: 30) reported that:

> Trenches were … constructed on the Tramway Car routes, and near business centres and playgrounds, where the floating population might, at any time, be congregated, and so situated that the public could reach them in 5 minutes.
>
> 45 trench shelters, 4 feet wide at the top, 2 feet wide at the bottom, and 4 feet deep were constructed to accommodate in all 1200 persons.
>
> The total cost amounted to approximately £620.

The hot, dry summer of 1941/42 in Adelaide coincided with the Japanese advance south towards Australia and the annual migration to its beaches of the local inhabitants. The possible collision of this aspiring Japanese Diaspora with a burgeoning seasonal beach population prompted seaside municipalities to modify their landscapes in an attempt to cushion the possible impact. An example of the extent of this reaction comes from Glenelg, a popular seaside suburb of Adelaide whose population swells on weekends and public holidays, especially in the warmer months. Here, 20 sets of public trenches of various configurations totalling 1,552 linear feet, and able to shelter approximately 770 people, were dug on thirteen of its reserves and vacant lots in early 1942 (Glenelg Air Raid Shelter Interpretive Centre).

Designed and dug at least six weeks after the Code was gazetted, the Glenelg trenches were wholly bespoke, being individually tailored to each plot of available ground (for example, some were 'Y' shaped, some 'T' shaped, others 'U' shaped and some zigzag), yet most were of a similar depth (4 ft or less) and width (2 to 3 ft). None fell within the parameters of the Code. In retrospect, they seem to fit more closely with Hamann's and the Department of Home Security's 1943 idea of an emergency trench than the earlier published designs (see Table 7-2), and highlight the desperate measures taken to put something in place relatively quickly. One of the plans, dated April 1942 (Figure 7-3), is of a six arm zigzag trench positioned west of the Pier Hotel along the jetty approach.

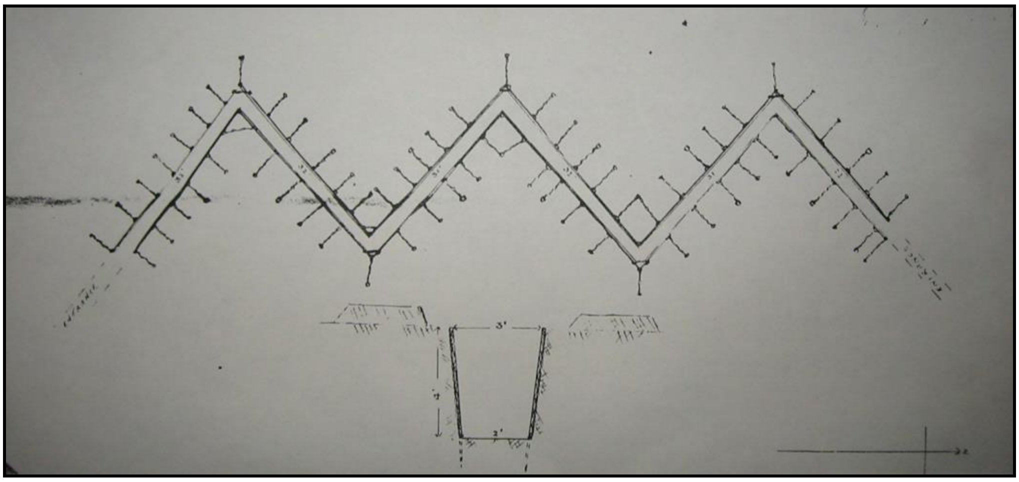

Figure 7-3: Plan and elevation for a zigzag trench, Glenelg foreshore, April 1942
(Glenelg Air Raid Shelter Interpretive Centre)

An aerial photograph taken three-and-a-half years after the war clearly depicts the location of the same six arm zigzag trench on the foreshore (see Figure 7-4). The image also shows that the trench system, capable of sheltering approximately 96 people, was positioned directly in front of the hotel.

The trenches dug in sand had their sides packed with seaweed and held in place by a system of wire netting and jarrah[31] stakes and rails. The length of the trench arms varied greatly, ranging between 12 ft and 45 ft depending on the available space. At least two Australian ARP guides (see State Emergency Council for Civil Defence 1941 and Bartlett n.d.) made recommendations for the ideal length of trench arms (15 ft to 30 ft). Early English ARP regulations called for 50 ft lengths with connecting trenches placed at right angles at alternate ends (Tecton Architects 1939: 31), but by 1941 the War Office (1941[1939 Provisional]:22) had revised this to no more than 30 ft between traverses and zigzags. The general consensus, however, was that a shorter straight run was safer.

By March 1943, definite ideas were held on this aspect of trench design. The Department of Home Security, Canberra (1943: 2), wrote to the Commissioner of Civil Defence, Adelaide, stating that:

> … the length [of a trench] should be limited to 30 feet and in no slit trench system should the length, without changing direction be more than 30 feet and the angle of change should be within the limit of 80°and 120°.

Private schools in the Glenelg region, such as Sacred Heart College and Woodlands Glenelg Church of England Girls Grammar School, took precautions of their own. Sacred Heart used an empty dam as a shelter (John Entwhistle 2009, pers. comm. 29 October, son of shelter builder), and Woodlands dug slit trenches on the lawn between the hockey field and the hits board (see Figure 7-5).

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[31] *Eucalyptus marginate*—extremely hard wood, indigenous to southwest Western Australia and often used in public infrastructure (for example: railway sleepers, wharfs and docks) throughout Australia.

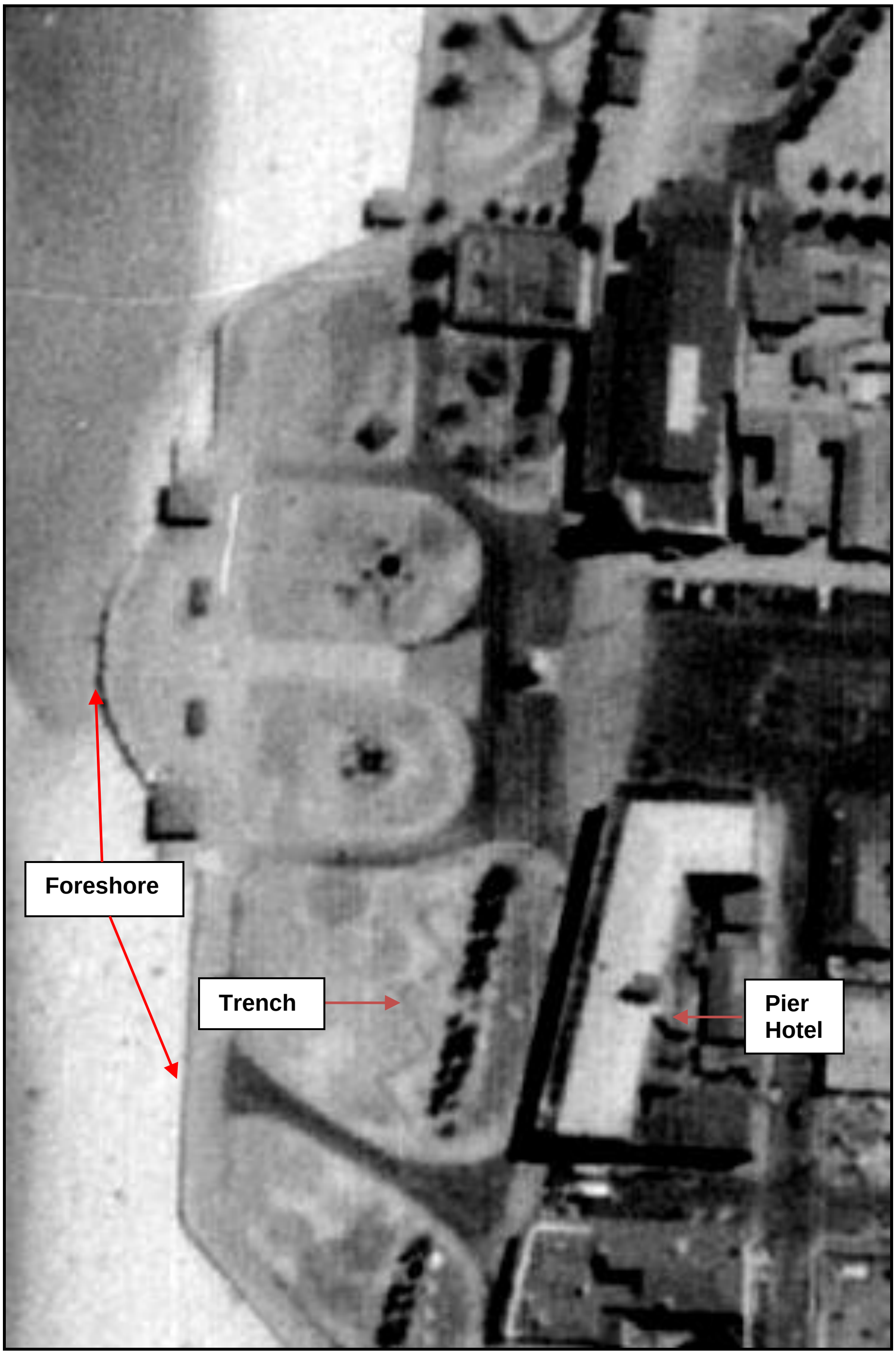


Figure 7-4: Footprint of zigzag trench on lawns west of Pier Hotel, Glenelg foreshore, 10 January 1949 (MAPLAND 1949a)

Table 7-2: Type 1(a) shelters in Glenelg (Glenelg Air Raid Shelter Interpretive Centre)

Location	Design	Length of Arms	Depth of Trench	Width of Trench
West of Pier Hotel	Zigzag of 6 connecting arms with entrances at each end	6 x 32 ft Total of 192 ft (96 persons)	4 ft - in sand	2 ft at bottom 3 ft at top
East of Pier Hotel	Zigzag of 4 connecting arms	1 x 27 ft; 1 x 26 ft; 2 x 24 ft Total of 101 ft (50 persons)	4 ft – solid ground	2 ft at bottom 3 ft at top
Colley Reserve, adjacent to Town Hall	Zigzag of 4 connecting arms	4 x 36 ft Total of 144 ft (72 persons)	4 ft - in sand	3 ft at bottom 4 ft at top
Colley Reserve, adjacent to Town Hall	Zigzag of 4 connecting arms	4 x 36 ft Total of 144 ft (72 persons)	4 ft - in sand	3 ft at bottom 4 ft at top
Jetty Rd next to Savings Bank	'Y' shaped	2 x 42 ft; 1 x 45 ft Total of 129ft (64 persons)		2 ft at bottom 2.5 ft at top
Vacant block, Cowper St, corner of Jetty Rd	straight	1 x 19 ft (9 persons)	4 ft – firm ground	2 ft at bottom 3 ft at top
Vacant block, Cowper St, corner of Jetty Rd	straight	1 x 20 ft (10 persons)	4 ft – firm ground	2 ft at bottom 3 ft at top
Vacant block, Cowper Street, corner of Jetty Rd	'V' shaped	1 x 21 ft; 1 x 29 ft Total of 50 ft (25 persons)	4 ft – firm ground	2 ft at bottom 3 ft at top
St Leonards Bus Terminal, McFarlane St	'V' shaped	1 x 29 ft; 1 x 34 ft Total of 63 ft (31 persons)	4 ft – firm ground	2 ft at bottom 3 ft at top
Anzac Highway, St Leonards adjacent Pasquin St – former train yards	Zigzag of 4 arms	2 x 36 ft; 2 x 33 ft Total of 138 ft (69 persons)		
Brighton Rd tram stop	Zigzag of 3 arms	1 x 20 ft; 2 x 22 ft Total of 64 ft (32 persons)	4 ft	2 ft at bottom 3 ft at top
Vacant block next to Hotel Broadway	'V' shaped	1 x 30 ft; 1 x 35 ft Total of 65ft (32 persons)	4 ft	2 ft at bottom 2.5 ft at top
Vacant block Cnr Pier and Moseley Streets	Zigzag of 4 arms	3 x 30 ft; 1 x 17 ft Total of 107 ft (53 persons)	4 ft	2 ft at bottom 3 ft at top
Augusta St adjacent Church of England	'T' shaped	1 x 31 ft; central entrance ramp (15 persons)	4 ft	3 ft at bottom 3 ft at top
Augusta St adjacent Church of England	'V' shaped	1 x 24 ft; 1 x 28 ft Total of 52ft (26 persons)	3 ft	3 ft at bottom 3 ft at top
Wigley Reserve, Glenelg end of Anzac Highway	'V' shaped	2 x 19 ft Total of 38 ft (19 persons)		

Wigley Reserve, Glenelg end of Anzac Highway	**'V' shaped**	**1 x 16 ft; 1 x 23 ft Total of 39 ft (19 persons)**		
Wigley Reserve, Glenelg end of Anzac Highway	**'V' shaped**	**1 x 22 ft; 1 x 29 ft Total of 51 ft (25 persons)**		
Wigley Reserve, Glenelg end of Anzac Highway	**'V' shaped**	**1 x 22 ft; 1 x 25 ft Total of 47 ft (23 persons)**		
Corporation Depot Yard, St Leonards	**'U' shaped**	**1 x 21 ft; 1 x 12 ft; 1 x 2 5ft Total of 58 ft (29 persons)**	**4 ft**	**2 ft at bottom 2.5 ft at top**

Figure 7-5: Footprint of a zigzag trench system (arrowed) on the playing fields of Woodlands, Glenelg, 10 January 1949
(MAPLAND 1949a)

Local councils also dug or assisted others to dig trenches at schools, playgrounds, churches, benevolent institutions and civilian relief depots, as well as at their own works depots. For instance, the North Adelaide Baptist Church in Tynte Street had trenches in the backyard of the manse, and the Archer Street Methodist Church, North Adelaide, which was also a civilian relief depot, had a shelter that could accommodate 30 people at the rear of its lecture room. Council workers must have done a reasonable job with installing shelters, since the Reverend Martin Comey (1942), of Archbishop House, praised the Mayor on the suitability and attractiveness of the shelters at the Franklin Street and Russel Street schools.

7.2.1.2 Type I(b): Covered trenches

No Type I(b) trenches in public parks have been revealed in this research and only two dug on vacant lots were recorded. One reason for so few covered trenches being installed is that the trenches dug in parks and vacant lots were an immediate emergency response directed purely at providing as much emergency protection in the shortest possible time, without consideration of diverting resources to construct more sophisticated, covered structures.

Initially, open trenches were favoured by schools for the protection of children and teachers. In many cases, these were later supplemented, or replaced, with concrete pipes. Research found that only Grange Public School had a Type I(b) shelter. This was reported as being camouflaged and well covered with earth, timber and sandbags (*Mail*, 20 June 1942: 5). Some boarding schools also provided overhead protection in the form of Type V shelters (for instance, Church of England Walkerville Boy’s Home, Walkerville and the Orphanage, Goodwood).

These are covered separately below (section 7.6.1.5). The opposite seems true for country centres where more schools turned to Type I(b) trenches.

7.2.2 Trenching the corporate spaces of Adelaide

7.2.2.1 Type I(a): Open trenches

Larger businesses and the owners of every building in the metropolitan area with 30 or more people were responsible for providing adequate shelter. Of particular concern were the employees of industries involved in war work, such as munitions factories, steel mills, engineering firms and private contractors. Of these, there was a high concentration in the north-western suburbs of Adelaide. Architect Harold Griggs was appointed to the Ministry of Munitions as ARP investigator (Ministry of Munitions 1942) to ensure the Code was being adhered to, and to advise factory owners such as Pope Products Ltd, Kelvinator, Perry Engineering and Colton's (Lillywhite 1942; *News*, 9 March 1942:1). He supplied architects' reports to various businesses, including one to Holden's automobile manufacturers at Beverley which, in his opinion, had installed unsatisfactory trenches:

> …it was noted that many trenches were being dug which were very long and very wide. It is submitted that these trenches would form admirable targets for machine gunners in raiders. The Japanese seem very fond of this kind of warfare and open trenches should therefore be discouraged or covered trenches substituted (Griggs 1942).

Griggs also designed a trench system for a factory annexe which seems to be for Type I(a) trenches, even though he recommended avoiding them (see Figure 7-6). His sketch is undated, but is archived with other Griggs ARP ephemera dating from 1942 in the Louis Laybourne Smith School of Architecture and Design Museum. It is uncertain whether the sketch post-dates the introduction of

Code in 1942, but if it does, it certainly does not conform to it. More likely than not, the sketch represents a design for an emergency shelter of the type still 'tolerated' despite the existence of the Code. In his notes to this sketch, Griggs (S167/867/1) stated that "this type of trench can have any number of bays and … trench systems should be kept 50 feet apart from each other". In 1939, English ARP regulations required trenches to be spaced 25 ft apart (Tecton Architects 1939: 31-32), and by 1941 30 ft (War Office 1941[Provisional 1939]:23), although this may be a reflection of higher population densities requiring more trenches in a given area, or less open space in English towns compared to Australia. Tecton Architects (1939: 40) argued that:

> …if bombs are being dropped at random over a given area, the idea that people within that area would be safer if they were evenly spread out than if they were concentrated in large groups is fallacious…every bomb dropped is likely to kill somebody.

Tecton Architects (1939: 41) further highlighted that the same mathematical principle applied to the grouping of trenches, and that there was no reason not to reduce the separating space to 15 ft or even 10 ft, but placing them too close together would compromise the solidity of the separating ground and could lead to collapse during a raid. The bays cut into the longer walls of the Griggs trench system were a device employed to afford trench occupants extra protection from aircraft strafing along the passages, and were a direct response and remedy to his criticism of the Holden trenches.

Ultimately, businesses of all sizes and types took some kind of precautions against air raids. Examples of this come from the Adelaide CBD, where W. Jacobs Ltd, dairy produce merchants of 367/9 King William Street, Adelaide, had shelters at the rear of their premises, as did J.A. Lawton and Sons Ltd (Adelaide City Council 1942a).

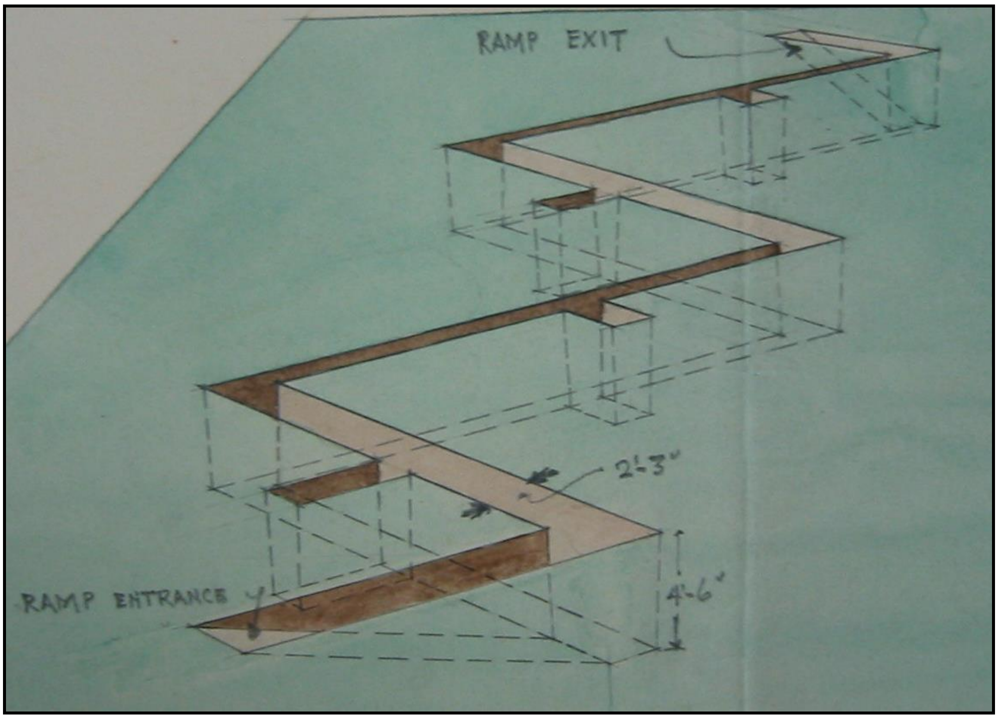


Figure 7-6: Griggs' undated perspective sketch of a Type I(a) shelter (S167/867/1)

7.2.2.2 Type I(b): Covered trenches

Correspondence relating to a proposed work place Type I(b) shelter for the Dobbie Dico Meter Co. Ltd, of 11 Sultram Place, Adelaide, is lodged in the Adelaide City Archive, but no further documentation regarding its approval or construction was located. Consequently, it cannot be ascertained whether or not this structure was actually installed. The meter company had sought approval from the Adelaide City Council to place a trench 16 ft long, 6 ft wide and 5 ft deep, with brick sides and ends, on a vacant allotment adjacent to the factory. It was to be located 6 ft from an 11 ft house wall and roofed with timber and earth, or sandbags (CEDKT1942/1121A 1942b). The information provided with the building application demonstrates that careful thought and some knowledge of available advice had been employed in its design. For instance, its distance from an adjacent wall was approximately half the height of that wall as specified for a Type I(a) in the Red Cross Society and St. John Ambulance Society (n.d.) publication. If this was considered a safe distance for an open trench, it must have been more so for a covered one.

Only one example of a workplace-installed Type I(b) trench was uncovered by this research. This was at the Adelaide City Corporation depot in Halifax Street in early 1942 (CEDKT1942/1121A).

7.2.3 Trenching the private spaces of Adelaide

As in the UK, government in Australia favoured a policy of dispersal during air raids. During WWII, civil defence theory proposed that people could protect themselves much better at home than they could out in the public domain. Further, with the civilian population dispersed in low-rise suburbs, there would have been little incentive for the Japanese to use demolition bombs; by extension, a slit trench would prove an easily constructed and ideal domestic shelter (Department of Home Security 1943: 1).

In contrast to more formal, code-approved corporate shelters, every trench excavated in the backyards of Adelaide's suburbs was a unique structure. Each was the product of many individual factors specific to that site, or to the excavators. But it was not only in the suburbs that civilians took matters into their own hands. In the city centre, despite the presence of many public shelters, people still looked after themselves. For example, a group of inner-city residents opportunistically dug trenches on a vacant block of land in Vaughan Place (off

Tavistock Lane) adjacent to the East End Market, causing the City Council to look for additional labour to backfill them in late 1944 once the threat was deemed to have passed (CEDKT1942/1121Af). The following case studies and analyses, drawn from oral history interviews and personal communications with civilians who had firsthand experiences with air raid shelter trenches, give an indication of the diversity, ingenuity and social traits attached to the construction and memory of these trenches.

7.2.3.1 Type I(a): Open trenches

Thirteen Adelaide homes were recorded as having Type I(a) trenches[32]. One house in Everard Park had an open trench lined with galvanised iron sheets, but oddly, iron was not used to provide overhead protection (grandson of builder 2013, pers. comm. 21 November). Twelve of these houses were in the suburb of Sefton Park, and shared a long, open trench dug along their rear boundaries in Alice Street, Lauder Avenue and Scott Street (see Figure 7-7). Entry to the trench was situated approximately 15 to 20 m (49.21 to 65.62 ft) from each back door and was eventually backfilled with household refuse after the war (Jill Tumes 2012, pers. comm. 24 March, resident of Lauder St, Sefton Park). These houses were constructed between the late 1920s and 1930s in what was then a new suburb. Fences may not have been erected between many properties in these streets by the time the war commenced, allowing for shared trenches to be installed.

Figure 7-7 shows the location of the Sefton Park trench (heavy red line) and what may be a section of the original trench (arrowed) which was uncovered when 21

[32] Fifteen additional Type I shelters could not be properly characterised because of a lack of information relating to their construction.

Lauder Street was re-developed in early 2010. The Sefton Park trench would have required many hands and great cooperation to construct, and is a striking example of the community spirit present in Adelaide at the time.

Figure 7-7: Shared trench in Sefton Park depicted by heavy red line, section of original trench arrowed
(Google Maps, accessed 15 September 2012)

A further example of this community spirit comes from Eric Neilson who lived in the Adelaide beachside suburb of Brighton, adjacent to Glenelg. Neilson's neighbours in Hartley Street were an elderly couple, Tom and Mary Holmes. Eric dug a trench of indeterminable type for them in their yard (see Figure 7-8). It is not known whether he also dug one for himself or intended to share the Holmes'. Figure 7-8 highlights the differing conditions shelter builders faced. It clearly shows how dry the earth was at the time that Eric dug the trench, but also indicates that he was digging through the sandy soil found near the coast rather than the red clay so ubiquitous to other parts of Adelaide (see Map 6-1).

Figure 7-8: Eric Neilson excavating a trench in Brighton, December 1941
(photo: R.E. Ragless [nee Holmes])

7.2.3.2 Type I(b): Covered trenches

Eight Type I(b) trenches were recorded in Adelaide, and a further three in country SA at Peterborough. Laurie Shields (2008, pers. comm. 5 December, Port Adelaide Historical Society) dug a trench for his grandparents in Duke Street (now Ozone Street), Alberton, as a teenager. The trench was V-shaped, with one of the arms forming an entrance 5 or 6 ft long leading into the main shelter. The shelter proper was shorter than the entrance, being approximately only 4 or 5 ft in length and 3 or 4 ft wide. Laurie covered the trench with cross-timbers, corrugated iron and dirt. He remembers that in the beginning it was very easy to dig because there was sand to a depth of about 2 ft (Alberton lies adjacent to the Port of Adelaide and its tidal river which had deposited sand in this area of

Adelaide since at least the beginning of the Holocene era)[33]. However, it became increasingly difficult to dig the deeper he went, because beneath the sand was a layer of red Bay of Biscay clay, followed by white marl. After the war, the trench was slowly filled with household refuse and covered over with earth. Laurie's trench was smaller than, but very similar to, a design published by the State Emergency Council for Civil Defence in Victoria (see Figure 7-9), and was in fact influenced by what he had read of the trenches of WWI and not by what was published in ARP handbooks.

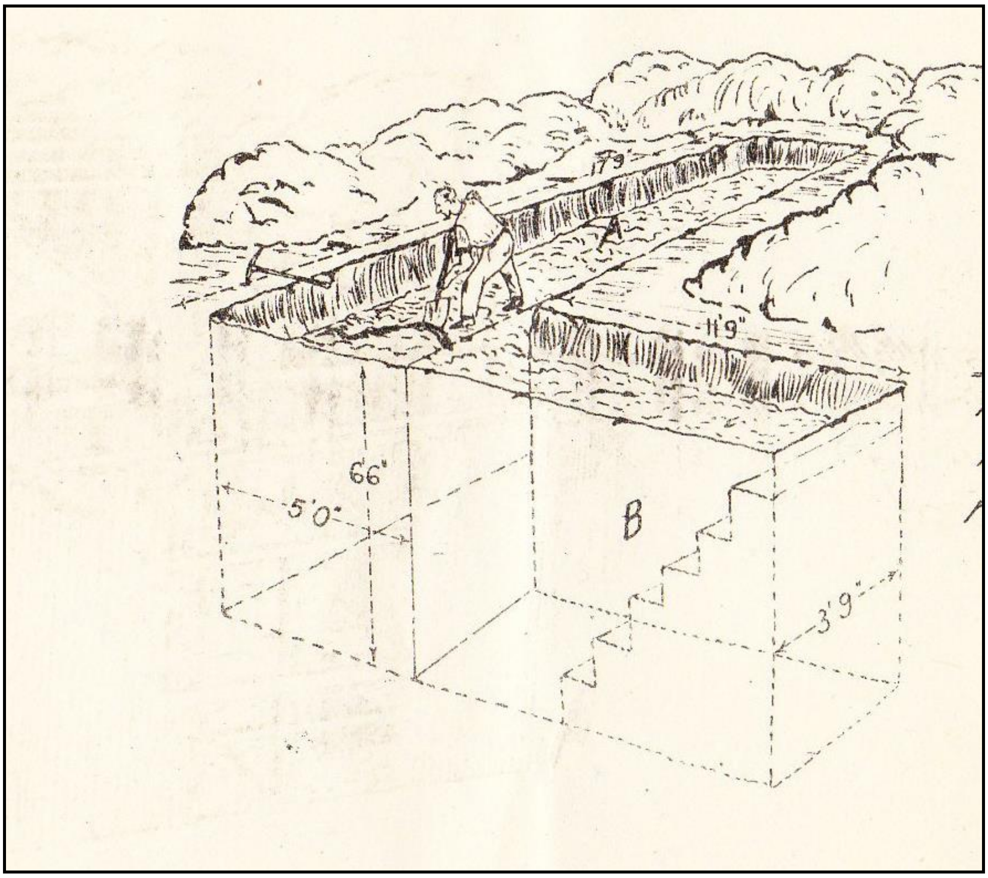


Figure 7-9: Type I shelter construction
(State Emergency Council for Civil Defence in Victoria 1941: sketch 8)

[33] Laurie describes exactly the geological stratigraphy in this region of Adelaide being "fill overlying the sandy marine sediments of the St Kilda or Glanville Formations" (Grounds 2013: 3).

Malcolm Haskard (2010, pers. comm. 16 June, son of shelter builder) recalled that his father, George, an academic, was one resident who used a published design to construct a covered trench for his family in Te Anau Avenue, Prospect. From time to time as a boy, George Haskard helped his father, a builder, on various construction jobs and became skilled in this trade. For his shelter, George chose the middle design on page 12 of Bartlett (n.d.) (see Figure 7-10). The shelter was positioned amongst several fruit and ornamental trees in the southwest corner of the backyard, 15 m (49.21 ft) from the house, 3 m (9.84 ft) in from two boundary fences and north facing. It was dug into clay, under which was found limestone that required a pick to excavate. Malcolm remembered sandbags being stacked around the curved entrance steps and the corrugated sheets for roof supports, as recommended in the publication. The shelter had no door and there was no roof over the stairwell. At that time, the family had a pet Kookaburra (Jacky), so “there was even a perch for him in the shelter which was part of the wooden seat” (Malcolm Haskard 2010, pers. comm. 16 June, son of shelter builder). ARP for family pets had also been considered by the Home Office, as evidenced by the release of Handbook #12: *Air Raid Precautions for Animals* in 1939.

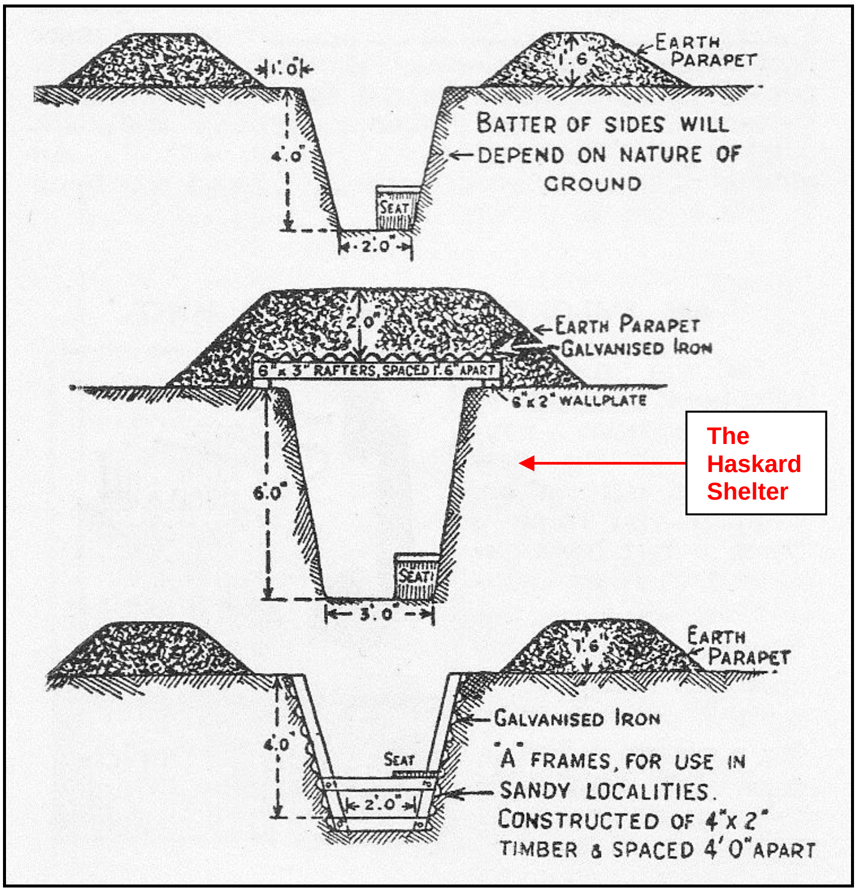


Figure 7-10: Type I trenches in Bartlett (n.d.: 12) and George Haskard's choice

7.2.4 Archaeological analysis of Type I domestic shelters

7.2.4.1 Dimensions

No Type I shelters were excavated or physically recorded during this study, but dimensions were sometimes recalled by those who had interacted with them during the war. Of these, depth was the most common memory, followed by width and length. This is logical, since when standing in a trench or underground room, height (or depth below ground level) and width (the narrowest/closest horizontal distance to where one is standing) is what contributes to feelings of claustrophobia and safety. The length (or furthest wall) of a subterranean structure seems to affect a person's discomfort very little, and consequently is rarely remembered.

The depth of five (13.9%) recorded shelters, all Type I(b) structures, could be established through testimonial evidence. Eighty percent (n=4) of these were dug to between 3 and 4 ft, whilst 20% (n=1), were at least 6 ft. Whereas the various 'do-it-yourself' guides advocated a mean depth of 6.4 ft (see Table 6-3), only one recorded trench, the Haskard's, was at least 6 ft deep as detailed in Bartlett (n.d.: 12).

The shallowness of the other four trenches resembled closely the dimensions of the emergency public trenches dug across Adelaide. Public trenches may have given domestic trench diggers an idea of depth, but unlike the public trenches, all domestic shelters of known depth also had roofs. Environmental constraints, such as soil type, were further reasons for shallow excavations. Three people (8.6% of the sample) remembered the difficulty of digging because of the soil type. Distinct soil horizons were certainly a memory for Shields (sand/clay/marl) and Haskard (clay/limestone). For Coral Jones (see section 8.3.2), the obvious hardship was that no men or teenage boys were available to help, a fact that limited the depth of her trench (Coral Jones 2009, pers. comm. 31 December, child shelter builder). Coral lived with her aunt and three female cousins during the war and helped them dig a "pit" in their backyard as a shelter.

The width of only three (8.3%) trenches is known. All of these are Type I(b) shelters. Of these, two (66.7%) were between 2 and 3 ft wide, whilst one (33.3%) was between 3 and 4 ft wide. An analysis of the ARP literature provided a mean width for Type I(b) shelters of 3.1 ft at the bottom and 3.9 ft at the top (see Table

6-3). The widest recorded trench followed the unofficial ARP guidelines for a covered trench and allowed enough space for the installation of a wooden bench. The two narrower trenches would have provided standing (or crouching) room only, and may have also had their dimensions restricted by the same environmental factors that restricted their depth.

The length of only one trench, a Type I(b) shelter, is known: Laurie Shields' trench dug for his grandparents in Alberton, which was approximately 4 or 5 ft long. This would have allowed between 2 to 2.5 ft per occupant and compares favourably with SA public trenches (engineered to provide 2 linear feet per person). The Shields shelter also had a 5 to 6 ft entry ramp off-set to the main trench. Although the angle of the ramp and the depth of the trench were unknown, it was possible to estimate depth from the length of the ramp. A gradient of 40° or less would have allowed comfortable access for an elderly couple. A ramp angled at 40° and measuring 6 ft in length would mean that the trench was approximately 3.5 ft deep. As this angle lessens, the depth of the trench would also decrease unless there was an extra step down into the shelter at the doorway.

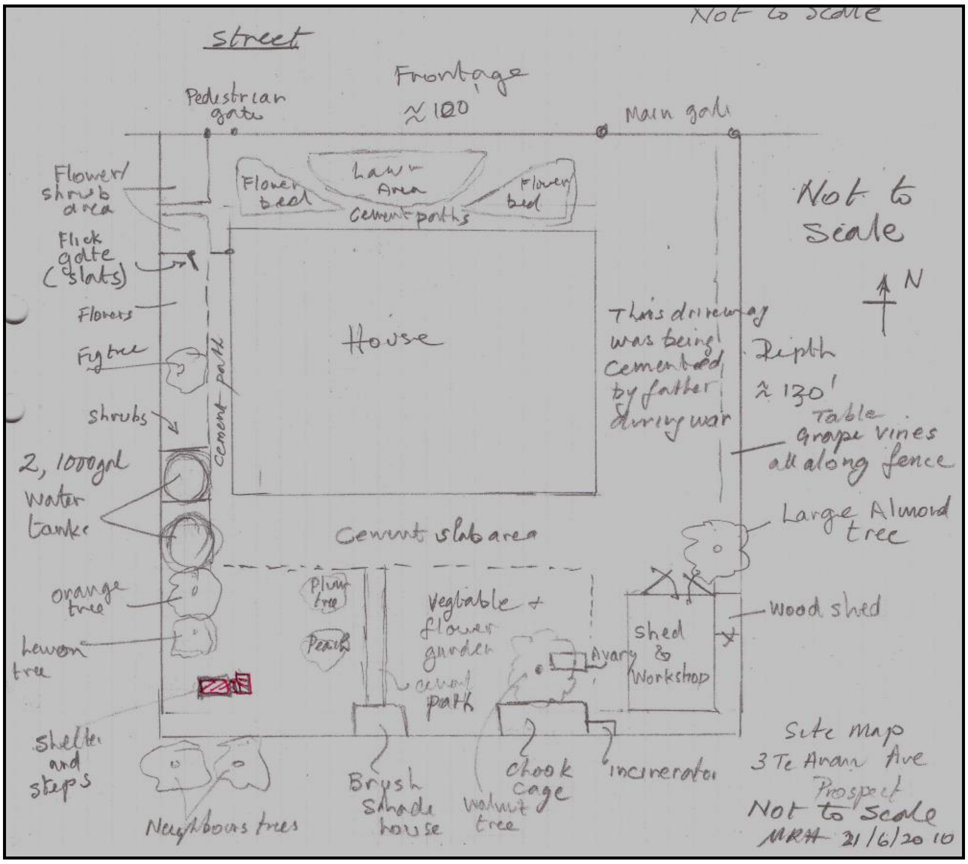
7.2.4.2 Roof

The ingenuity and opportunism displayed by Coral Jones and her cousins in using an old stretcher base and springs to cover their trench (Coral Jones 2009, pers. comm. 31 December, child shelter builder) was a common trait among shelter builders. Other examples come from Florence Street, Goodwood, where Ray Wallace constructed a Type I(b) shelter using two wooden garage doors for its roof over which he mounded earth (Ken Wallace 2010, pers. comm. 24 September, son of shelter builder), and from Peterborough (a railway town), where thick jarrah railway sleepers were used as overhead protection on three compact trench shelters. In Adelaide, the favoured method in roofing Type I(b) shelters was to mound earth over corrugated iron sheets supported by wooden bearers (used for 62.5% [n=5] of this sub-type type).

7.2.4.3 Alignment

The alignment of domestic trenches was dictated by the axes of the house and block rather than the direction of a potential in-coming attack. In all but one of the recorded cases where the axes were known, the entrance, whether in line with the trench or off-set, faced the rear of the house. The Eden Hills trench built at the front of the property, but well back from the street, had access which faced the front of the house. ARP literature had recommended placing shelters behind a house and as far away from the street as possible, with entrances facing the building's exits (see, for example, War Office 1941[Provisional 1939]: 22). Type I shelters were the shelter type placed, on average, furthest from a house, with 44.1% positioned between 15 m and 20 m (49.2 ft and 65.6 ft) from a dwelling's exit.

Map 7-2 depicts the relationship between the Haskard house and their trench, located as far away from the street as possible and approximately 15 m (49.2 ft) from the backdoor of the house. It also clearly shows how the shelter steps faced the back of the house.



Map 7-2: Sketch map by Malcolm Haskard, 21 June 2010, depicting location of family trench (highlighted area in original)

7.2.4.4 Furnishings

Despite the recommendations in some ARP literature, Type I shelters were rarely furnished. They were designed for emergency use only and hence required no amenities such as seats, tables or shelving. Most, by virtue of their design, were also too narrow to allow for the installation of even basic comforts. Only one recorded Type I(b) trench (2.7% of the sample) included any furnishings. This was the Haskard shelter built using an ARP pamphlet design, which had a seat for its occupants and a perch for the family's pet bird.

7.3 Type II: Dug-outs

Some companies and home-owners, especially veterans of WWI, undertook considerably larger excavations at their premises and in their backyards, constructing dug-outs instead of trenches. Dug-outs were, in effect, underground rooms with thick overhead protection, complex entrances, ventilation systems and room for basic furniture. Dug-outs were also commonly provisioned with food, water and medical supplies.

7.3.1 Public dug-outs

Only one public Type II was located during this research. This was constructed in the yard of the Commercial Case Company's premises on Payneham Road, St Peters. Large enough to seat 60 men with standing room for another 30, it was 6 ft deep and 24 ft long. The structure took eight days to build, was lined with red gum boards and had duckboards similar to the trenches of WWI. The shelter was covered with 50 tons of pine logs and 15 tons of earth, having a further 50 tons of logs strategically stacked around it as blast walls (*News* 27 February 1942: 3).

The Commercial Case Company was a timber merchant dealing in stringy bark (*Eucalyptus* sp.), red gum (*Eucalyptus camaldulensis*) and pine (Sands and McDougall 1941: 897) and appeared to have opportunistically used their surplus stock to great effect in providing structural protection for their staff and clients.

Figure 7-11: Commercial Case Company's Type II shelter
(*News*, 27 February 1942: 3)

7.3.2 Domestic dug-outs

This research located fifteen domestic Type IIs. Four of these were incorporated into one structure and dug on the boundary of adjoining South Australian Housing Trust properties between Brunswick and Goodman Streets, Kilburn, serving as protection for the residents of all four houses (Talmage 2010, pers. comm. 4 November, Prospect Local History Group). Positioning a shelter between homes had been demonstrated in various ARP publications, including Home Office (1939e) and State Emergency Council for Civil Defence, Victoria (1941), and may have influenced the Kilburn concept.

Evan Holt (Holt MW4-07: 2), who was a child in the early 1940s and grew up in Kingswood Park (now part of Mitcham), remembered his family's air raid shelter as little more than a "shell scrape" compared to others in his street. Evan's father had fought in WWI and "was no longer young, nor fit and strong", but managed to dig a shelter in their yard through earth "as hard as bricks" using only a pick, shovel, crow bar and wheel barrow. Mitcham lies in that part of Adelaide with RB Earths (see Map 6-1 and section 6.3.2). The shelter had a roof of 4 in. x 6 in. kauri beams (according to Evan, the only sort of hard wood available to the public at the time), with the excavated earth piled back on top to a depth of approximately 3 ft and a tree planted over it. There was a set of cement steps leading into it. However, shortly after completion it rained, filling the shelter to a depth of 300 mm to 400 mm. Evan remembered going down the steps after the rain stopped and seeing the blue painted kerosene tins containing provisions floating in the shelter.

Doug Freeman, with the help of his neighbour, placed a dugout in his back yard in Haig Street, Galway Estate. Between wars, he was a member of the Volunteer Defence Force in Adelaide. When WWII began, he enlisted in the armed forces, building the shelter before he left. His daughter, Margaret Cornwall (2008, pers. comm. 27 November, Mitcham Historical Centre), believed that the shelter gave her father some peace of mind when he left his family behind. The shelter was a very early one in Adelaide, and Margaret thinks it was built in late 1939 or early 1940. However, when comparing the ages of Margaret and her sister Pamela in available images (consisting of several black and white photos taken in August 1944 and a home movie of the shelter's construction – all included in Appendix 6 of the accompanying CD in the Freeman Type II folder), it seems more likely to have been dug much later in 1940 or early 1941. This would still pre-date Pearl Harbour and the main shelter digging phase in Adelaide by approximately twelve months, and gives an insight into the prudence of those with defence force training.

The Freeman shelter had a heavy, angled wooden door, a ventilation pipe at one end, and a bed or bench to the right of the entrance. When viewing the footage of the shelter's construction, at least three layers of sandbags (or thick logs) forming the roof are visible through the open door of the shelter which was further covered by excavated earth (see Figure 7-12). Heavy timbers were employed in its construction, as evidenced by the re-worked tree trunk protruding from the shelter next to the entrance (see Figure 7-12 and Figure 7-13).

Figure 7-12: Still taken from home movie of Doug Freeman's shelter c1941
(with kind permission of Margaret Cornwall & Pamela Pearce, 2008).

Only a few streets away from the Freeman's, in Lisburne Avenue, Mitcham, the Williams also constructed a dug-out in their backyard. Wanda (2013, pers. comm. 28 March, daughter of shelter builder) recalled her father, a WWI veteran of the Kings Own Liverpool Regiment[34] who, re-enlisted to fight in WWII, dug the shelter when he was home on leave. The Williams' dug-out had earthen seats

[34] See also the Entwhistle's Type I(b) shelter in Torrensville, constructed by John's father who had been a miner in the Tunnelling Company of the Kings Own Liverpool Regiment during WWI.

and was large enough to shelter the four family members while her father was away. The dug-out survived for a number of years after the war as Wanda's play house, but slumped one night after a downpour.

Figure 7-13: Doug and Margaret Freeman with dug-out (visible at right), August 1944
(with kind permission of Margaret Cornwall 2008)

Jan Leaver (nee Laffer) recalled her father, also a WWI veteran, placing a "fairly deep" dug-out strategically between two sheds "for added protection" on their vineyard block, *Laffer's Triangle*, at the corner of South and Sturt Roads, Sturt (now Bedford Park). Positioning a shelter in the protective shadow of other structures was recommended by Bartlett (n.d.: 13). The interior dimensions of the Laffer shelter were approximately 10 ft x 8 ft, with a ceiling height of about 6 ft 2 in. The walls were lined with wood panelling (probably old floorboards) and the roof made from corrugated iron and dirt supported by heavy timbers. The dug-out also had a heavy door and an entrance with a ramp and steep stairs built on a sharp curve, a design feature Jan's father had told her would protect them better from flying shrapnel. Furniture consisted of two permanently made-up stretcher beds and shelves for provisions along one of the short walls. Jan was never allowed to play in the shelter, either before or after hostilities, and her father backfilled the dug-out shortly after the war because it reminded him too much of the horrors of WWI (Leaver MW2-08: 3).

It was not only ex-servicemen who constructed trenches and dug-outs, but also enlisted servicemen who were stationed or billeted around town. Jan Leaver (Leaver MW2-08: 1) recalled a group of American soldiers coming to their property and digging a system of trenches on the high ground among their grape vines. These trenches formed part of a defensive line and faced the beaches of Brighton and Seacliff, the direction from which a Japanese landing was expected (see Map 9-1). It was thought the Japanese would move inland from here along the Sturt River and Gorge, approaching the Adelaide CBD from the rear. The fact that the military had dug trenches on the Laffer property may have been another reason that Jan's father constructed a dug-out for the family, especially if he thought their property could become a battle ground.

Margaret McDonald (2010, pers. comm. 9 June, Archivist, Seymour College) who, as a child, lived in a large residence in Bedford Street, Kensington Park, recalled two or three groups of soldiers being billeted at their house during the war. These soldiers constructed a large dug-out in the family's front yard, telling her father that they "had to look after the missus and kids". The dug-out was aligned east-west and had earthen steps and bunks which were ledges cut into the earth on each side of the longer walls. Post-war, the dug-out was slowly backfilled with household refuse.

One of the most elaborate dug-outs was constructed in Wilson Street, Little Adelaide (now Prospect), by two teenage boys Oswald Crick and Kenneth Ingram aged 15 and 16 respectively. The boys worked after school and on weekends for three weeks to build a shelter 9 ft deep that could house ten people. It was covered with 9 in. logs and several feet of earth, and then camouflaged with wire netting, grass and branches. The shelter was accessorised with a ventilator shaft and a system of mirrors that brought natural light into its recesses, electric light run off car batteries, lockers for provisions and first aid gear and carpet floor covering. There was a long entrance ramp alongside which was sunk a tank containing additional spare clothing and provisions (*News*, 27 February 1942: 3).

7.3.3 Archaeological analysis of Type II domestic shelters

Data relating to 14 dug-outs was retrieved from oral sources and one from the Adelaide press. No archaeological remains were physically investigated.

7.3.3.1 Dimensions

Data on dimensions for three recorded shelters were recalled through oral histories and a further one from the Adelaide press (Table 7-3).

Table 7-3: Type II shelter recorded dimensions

	4 ft	5 ft	6 ft	7 ft	8 ft	9 ft	10 ft	Unknown
Depth		1	1			1		12
Length			2				1	12
Width	2				1			12
Entrance Length								15

Average depth for Type II shelters (6.7 ft [n=3]) exceeded that for Type I shelters (4.4 ft [n=5]) by approximately 2.3 ft. This is one indication of the extra work that was required to build them, and of the added lateral protection they provided.

Type II shelters were built for long term occupation during sustained bombardment. In order to make such shelters more comfortable for extended periods, the Code, although not enforceable in these backyard do-it-yourself structures, had recommended a minimum internal height of 6 ft in covered trench shelters and in others, not less than 7 ft (*South Australian Government Gazette* 1942: 362). Type II shelters ranged from 5 ft for the shallowest to 9 ft for the deepest. The depth of the smaller was limited by the health and fitness of its digger and the nature of the soil, which in the summer of 1941/1942, was "like bricks" (Holt MW4-07: 2). The deeper of these two shelters was dug by two teenage boys approximately 40 houses due east of the Haskard Type I(b) and next door to the long open trench at the Prospect Woodwork School (see section 8.3.3). They also would have discovered limestone under the upper horizon of clay as did their neighbours, yet still managed to dig to a depth of 9 ft.

Two Type II shelters had identical internal dimensions of 6 ft x 4 ft. This appears to be a common size for underground rooms with similar dimensions recorded in Type III and some Type V shelters (see sections 6.5.1 and 7.6.4.1).

The width of the three recorded Type II shelters ranged from 4 ft to 8 ft. The average width of this Type (5 ft 4 in. [n=3]) exceeded that of Type I shelters (3 ft 6 in. [n=3]) by 1 ft 10 in., whilst the average length of recorded Type II shelters (7 ft 4 in. [n=3]) was almost double that of the Type Is (4 ft [n=1]). Type II lengths ranged from 6 ft to 10 ft, whereas the longest recorded domestic Type I shelter was only 4 to 5 ft long.

The dimensions give an indication of the spaciousness of these subterranean rooms when compared to Type I shelters. No data was recorded relating to the length of the entry ramps or stairs, but, given the depth of Type II shelters, ramp entrances would have been considerably longer than Type I ramps to enable comfortable access. The Ingram shelter was described as having a very long ramp. Some Type II shelter entrances were fortified, for instance, the Holt dug-out boasted steps of concrete (Holt MW4-07: 2).

7.3.3.2 Floor space and volume

Of great concern to the regulatory authorities involved in the construction of fully enclosed shelters were the floor space and the volume of space available for each occupant. As opposed to the 2 linear feet per person in public Type I shelters, the Code at Section 8 required 6 ft^2 of floor space per person in a shelter accommodating not more than 12 people, or 7 ft^2 of floor space and 56 ft^3 per person in larger shelters (*South Australian Government Gazette* 1942: 362). Although un-enforceable in the domestic sector, the Code provides a gauge for comparing what people actually did with what was recommended by the authorities. Two recorded Type II shelters (the Williams' and the Jones') with dimensions of 6 ft x 4 ft had a corresponding floor space of 24 ft^2. For the four remaining occupants of the Williams household, this equated to 6 ft^2 per occupant—exactly what the Code stipulated. The larger Laffer shelter had dimensions of 10 ft x 8 ft x 6 ft 2 in. (Leaver MW2-08: 2), giving it a floor space of 80 ft^2 and a volume of approximately 493.6 ft^3. For a family of four, this equates to 20 ft^2, or 123.4 ft^3, per occupant. The size of the Laffer family is, however, unknown, but their shelter may have also been constructed for the protection of any employees on the property. Although the width and length of the Ingram shelter is not known, it is described as having room for ten people which would extend to a floor space of 60 ft^2.

The Freeman and Ingram shelters had ventilation systems to circulate air and aid in transferring accumulated body heat out of the confined space.

7.3.3.3 Roof

Six of the shelters (40% of the total sample) had no data relating to their roof construction. However, a significant increase in overhead protection was evident in the available data for Type II shelters. Nine shelters displayed the same opportunism and ingenuity in their construction as demonstrated by the Type I(b) shelters. One of these, Freeman's, had an extremely solid roof consisting of many layers of sandbags and logs overlain with earth. A second, Laffer's, used tree logs overlain with galvanised iron and covered with earth, but lacked the sandbags. A third shelter, Jones', incorporated an arched section of galvanised iron rain-water tank for its roof, over which was mounded earth. This particular shelter may have been influenced by the installation method employed for the expensive Type III sectional shelters which displayed similar arched steel characteristics and were intended to be partially buried. The arch would have increased headroom in the shelter and possibly even provided stronger overhead protection, although if not securely anchored to the rest of the shelter it could easily have been dislodged by lateral blasts. The Code stipulated all shelters to be of monolithic construction, simply meaning that each structural component must securely fasten to the next, to guard against just such an occurrence.

As with Type I(b) shelters, five Type II shelter builders preferred a combination of sawn wooden beams, corrugated iron and heaped earth for roof construction (see Table 7-4). Although similar to Type I(b) construction, the roofing materials in Type II shelters were of greater dimensions. For example, the sawn wood used in the Holt shelter (Holt MW4-07: 2) consisted of oversized hardwood bearers with dimensions of 6 in. x 4 in., compared to the standard 4 in. x 2 in. bearers. The Holt shelter also had 36 in. of earth mounded over the top when 18 in. of earth was the recommended thickness for overhead protection. Ingram's had a roof of 9 in. thick logs and several feet of earth.

Table 7-4: Type II shelter roof construction

Roof	Wood/ Galvanised Iron/ Earth	Half Rainwater Tank/ Earth	Logs/ Galvanised Iron/Earth	Logs/ Earth	Logs/ Sand Bags/ Earth	Unknown
Total	5	1	1	1	1	6

7.3.3.4 Access

Whereas Type I shelters favoured a ramped entrance, Type II shelters were more likely to have steps (see Table 7-5). This was a result of their extra depth and created a shorter entrance corridor than a ramp (see also Type V shelters). Three shelters (50% of those with recorded access) were equipped with steps. Two shelters were recorded with ramp access, and another had a combination of ramp and steps. Nine shelters (60% of the total sample) could not be characterised.

Table 7-5: Recorded entrances of Type II shelters

Entrance	Stairs	Ramp	Ramp/Stairs	Unknown
Total	3	2	1	9

Given that dug-outs were designed to offer greater protection, it was anticipated that Type II shelters would have a secure door. However, only 13.3% (n=2) of the total sample of Type II shelters are known to have had doors; both examples were described as being made of heavy wood. The Freeman dug-out (see Figure 7-12) had roof access through a self-closing heavy wooden door that was angled back on the shelter. The position and angle of this door may have acted to deflect a bomb blast back over its roof, a concept mooted in ARP literature when detailing the sloping of shelter roofs. The Laffer dug-out had a heavy wooden door at the bottom of a ramp, and steep stairs which were built on a sharp curve and designed to deflect shrapnel (Leaver MW2-08: 2).

7.3.3.5 Alignment

The alignment of seven shelters (46.7% of the total sample) could be determined. All were aligned north/south and six of these (85.7%) were in line with the family home, although the entrance to the Freeman shelter, which was in the roof of the structure, did not face the dwelling's back door. No shelters were aligned east/west. Twelve of the 13 (92.3%) inner suburban shelters were placed in the backyard of their respective residences, whilst one (7.7%) was dug in the front yard because the house was situated well back on the block. The remaining two shelters from outer suburbs (Sturt [now Bedford Park] and Mitchell Park) were dug on agricultural blocks, and their alignment and proximity to the respective property's dwellings is unrecorded. However, the Laffer dug-out was strategically positioned between two large existing sheds which, to some extent, would have hidden and protected the family and workers as they made their way to the shelter during an attack. For the main, Type II shelters, like the Type I, were placed some distance from the house.

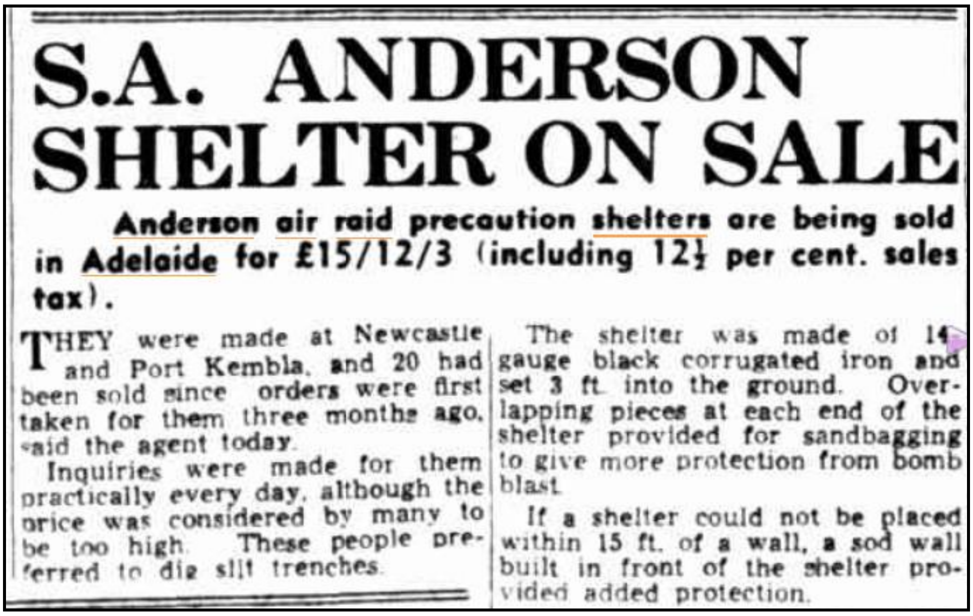
7.3.3.6 Furnishings

Type II shelters were equipped with rudimentary furnishings to make their occupants' anticipated subterranean sojourn more comfortable. Seven (46.7%) of the 15 recorded shelters contained furnishings. Most shelters (71.4%, or n=5) contained wooden seats, shelving or beds—in the Jones' shelter the seating consisted of nothing more than two planks supported by bricks (Harold Jones

2010, pers. comm. 31 December, son of shelter builder). Two had benches/bunks that were carved out of their earthen walls. No other types of furnishings (e.g. tables) were recalled in oral testimony, but lockers for emergency provisions were reported placed in a Type II by the Adelaide press (*News*, 27 February 1942: 3).

7.4 Type III: Sectional shelters

John Lysaght manufactured Anderson shelters in Australia at factories in Newcastle and Port Kembla, NSW. Priced at £15/12/3 in Adelaide, they were well beyond the reach of most people who instead "preferred to dig slit trenches" (*News*, 12 June 1942:5). Despite the prohibitive cost, at least 21 were sold to Adelaide residents.



S.A. ANDERSON SHELTER ON SALE

Anderson air raid precaution shelters are being sold in Adelaide for £15/12/3 (including 12½ per cent. sales tax).

THEY were made at Newcastle and Port Kembla, and 20 had been sold since orders were first taken for them three months ago, said the agent today.

Inquiries were made for them practically every day, although the price was considered by many to be too high. These people preferred to dig slit trenches.

The shelter was made of 14 gauge black corrugated iron and set 3 ft. into the ground. Overlapping pieces at each end of the shelter provided for sandbagging to give more protection from bomb blast.

If a shelter could not be placed within 15 ft. of a wall, a sod wall built in front of the shelter provided added protection.

Figure 7-14: Andersons for sale in Adelaide
(*News*, 12 June 1942: 5)

Available for general purchase in Adelaide within four months of the attack on Pearl Harbour, only 20 had been sold during the most fearful period to 12 June 1942. Additionally, the Bruce family, well known Adelaide auctioneers, had obtained and installed one as early as June 1941, claiming it to be "the first Anderson made here" (*Mail*, 7 June 1941: 2).

Figure 7-15: The Bruce family in their Anderson
(*Mail*, 7 June 1941: 2)

Apart from Fred Bruce, two other people (who bought three between them) have been identified. It is not known when these three other shelters were purchased, but they may well be part of the 20 that were sold between March and June 1942. As such, they are not counted as additional shelters to the 20 known from sales records and Bruce's earlier Type III. Further, because two were joined to form one shelter, a minimum count of only 20 Type IIIs is recorded here. One of these was erected in Black Forest by Frederick James Uren, who cited his profession as 'Tractor Expert' (LTO CT1670/ Folio 2). Little more is known of Uren other than he was skilled at carpentry and fitted his Type III with wooden benches. He, with the help of two billeted soldiers, also completely buried his shelter (grandson of shelter builder 2011, pers. comm. 29 September). The other two were purchased by Fred Trowse, company director, who joined them to make one large shelter at his property in Hazelwood Park.

7.4.1 Archaeological analysis of Type III domestic shelters

Only one surviving Type III shelter (the Trowse Anderson shelter) was found in Adelaide and was recorded in January 2010. This is one of only three known to survive in Australia, two of which are no longer *in situ*, but located in public collections (see section 6.5.1).

7.4.2 Construction

The Trowse 'Anderson' is constructed of 12 curved sections and four straight end sections (two sections bolted together at each end of the shelter) of corrugated sheet rather than the normal configuration of six curved and two straight (see Figure 7-16). Given this, it is highly likely that the Trowse shelter is actually two Andersons which have been joined to make one large shelter, with the two surplus end pieces bolted to the normal single end pieces for thickening and extra protection. Alternatively, the Trowse shelter may have been a larger, 'deluxe' version since Anstey (2009: 12) hints at the availability of different sized shelters in WA. Either way, this form of construction is unrecorded in the literature.

In reality, the simple design of the Anderson would allow a limitless number of curved panels to be bolted together to create a closed space of any desired length. The Hazelwood Park example is constructed of sheets of heavy 14 gauge galvanised iron, each 72 cm (28.35 in.) wide. These are bolted at the top with 36 nuts of 25 mm (1 in.) diameter in a repeating pattern of 2:4:2:4, and spaced at alternating intervals of 255 mm and 125 mm (10.04 in. and 4.92 in.), for example, 2 bolts at 255 mm, 4 bolts at 125 mm, 2 bolts at 255 mm and 4 bolts at 125 mm and so on.

The shelter has a concrete floor which includes a large three tier sump measuring 49.4 cm x 52.8 cm (19.45 in. x 20.79 in.) wide at the bottom of the stairwell that can be covered with three floorboards when not in use. The concrete floor is unusual because earthen floors were the norm for Andersons. No fastening framework for the corrugated sheets is visible, implying that the shelter was assembled first and then concrete poured into it to a depth which concealed the frame. This feature also makes it difficult to gain an absolute value for the actual height of the shelter before it was installed because the base of the original structure (the framework which is ordinarily exposed) is obscured by an indeterminable depth of concrete.

This ‘Anderson’ also appears to be completely covered in concrete, a method of installation which shifts the shelter from being one of English trench-like classification to one of monolithic construction. This was the highest grade of protection and a type recommended by the Code—ultimately transforming it into a Type V shelter.

The Trowse shelter also boasts several structural modifications to its original design. These include a 155 mm (6.10 in.) internal diameter, ventilation pipe in the middle of the roof which extends to 1.6 m (5.25 ft) above current ground level—Andersons were not designed with additional ventilation systems given that they ordinarily had an open and above ground window. That portion of the pipe above ground has chicken wire wrapped around it which is then fortified with concrete, creating a pillar 32 cm (12.60 in.) square. This shelter also has two exits instead of one. The structure seems to have been reversed during its installation, with a new doorway of 0.54 m x 1.67 m (1.77 ft x 5.48 ft) cut into the original rear wall panels. There is a 30 mm (1.18 in.) high lip of galvanised corrugated iron across the floor of the entrance. This is the remaining portion of the end panel from which the doorway was cut, and would serve to keep rainwater out of the main refuge during a deluge. The doorway leads out to the traversed entrance of the concrete stairwell at the front of the shelter, whilst the original window-sized entrance of 60 cm x 80 cm (1.97 ft x 2.63 ft) is now in the rear wall and worked as an escape hatch.

This escape hatch is 80 cm (2.63 ft) above the shelter floor, and while there is presently no step access to the opening, there may originally have been a crate or something similar to stand on beneath the ledge to assist evacuation. The alcove of the escape hatch is constructed of rough formed concrete (as opposed to the rendered walls of the main entrance), and the boards used to form this—the imprints of which are clearly visible—were 24 cm (9.45 in.) wide. Four layers of board were used over which lay a course of bricks 8 cm (3.15 in.) wide followed by another 24 cm (9.45 in.) of concrete. The alcove is 84 cm (2.76 ft) deep and has a height of 1.28 m (4.20 ft). The following sections provide greater detail of the various physical attributes of the shelter.

7.4.2.1 Dimensions

The Trowse shelter further deviates from the norm by being installed completely underground (instead of only partially, as per the original specification). Headroom in the centre of the main refuge is 1.822 m (5.98 ft) and the absolute internal height, measured from the concrete floor to the trough in the corrugations, is 1.845 m (6.05 ft).

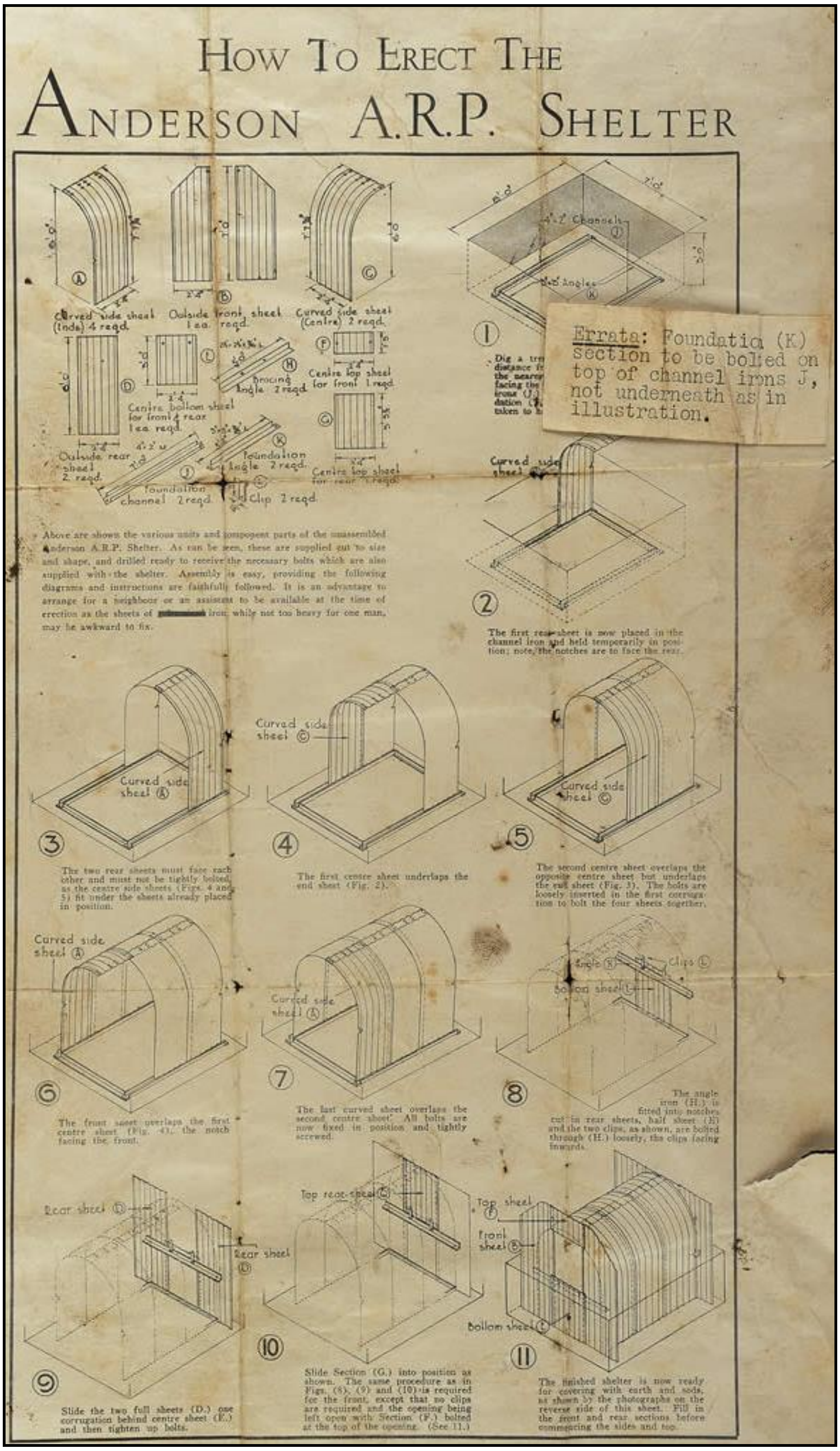


Figure 7-16: Instructions for assembly of Anderson shelters
(Australian War Memorial RC02049)

Headroom at the base of the traversed entry is 2.041 m (6.70 ft) and above this is a concrete slab 11.5 cm (4.53 in.) thick, and over that another 36 cm (14.17 in.) of earth, concrete and slate. The floor of the shelter is 2.516 m (8.26 ft) below the current ground level.

Given that the individual metal components of the Anderson were all machine made, it was expected that the width of the Hazelwood Park example would mirror a standard Anderson (4 ft 6 in. at the base). In fact, the shelter is 1.403 m (4 ft 6 in.) wide.

Figure 7-17: Inside the Hazelwood Park Type III shelter facing the rear escape hatch (Wimmer 2010)

The length of the main refuge is approximately 3.884 m (12 ft 7 in.) or twice that of the standard Anderson (6 ft). This supports the theory that it is two Anderson kits joined together. The total length of the shelter when including the stairwell and escape hatch alcove is 5.627 m (18.46 ft). This gives an indication of the enormity of the excavation required to house the recorded structure. This measurement does not include the thickness of the concrete walls or the larger cut required during construction. The Trowse bungalow is a very broad house and takes up the whole of its street frontage, restricting access down the sides of the house. Construction of the shelter, in this instance, would have been effected via the service lane at the rear of the property. Lack of access to the backyard may have been a factor limiting similar constructions in other dwellings (see also the Willis Type V shelter in section 7.6.2.4).

7.4.2.2 Floor space

As a recognised and approved shelter design, the Anderson's floor space would have conformed to government standards if installed to the manufacturer's specifications. However, because installation of the Trowse example deviated from the norm, the formula for calculating occupant comfort may have been that used for Type V shelters (bunkers) and not Type I(b) shelters (covered trenches) or Type III shelters (sectional shelters). By joining two smaller shelters, floor space and enclosed volume would have been increased to recommended standards. The floor space of the main refuge of the Trowse shelter is 5.45 m^2 (56.61 ft^2), large enough to accommodate eight persons given that the Code recommended 7 ft^2 per person in all shelters other than covered trenches.

7.4.2.3 Roof

The whole of the Trowse shelter is encased in at least 11.43 cm (4.5 in.) of concrete. This is the measureable depth of concrete above the entrance, but it may not be representative of the total thickness above the main refuge. The concrete is further covered with 36.83 cm (14.5 in.) of earth. Being completely covered with concrete may have contributed to the shelter's good state of preservation when compared with the two other existing Australian Andersons. The arithmetical mean of the various ARP guides detailing overhead protection (see Table 6-3) was calculated at 6.5 in. of concrete and another 26.4 in. of earth, whilst the Code stipulated 4.5 in. of concrete and 18 in. of earth (see Table 6-4). From these figures, it would appear that the Trowse shelter was constructed with consideration of the dimensions provided by the Code, and although there is less earth over the structure than recommended, it is possible that 3.5 in. of earth may have been removed since the war for re-levelling the backyard (the dwelling has a 1980s extension which comes to within several metres of the shelter). These dimensions would also indicate that the shelter was constructed and installed by an entity to which the Act applied, for example, a person or business aligned with the construction industry.

Encasing a sectional galvanised iron 'tunnel' in concrete is an idea developed for an above ground shelter which was mooted by the French in the late 1930s, and detailed by the Cement and Concrete Association (CCA n.d.c: 14) before the war (see section 6.5.1 and Figure 6-8). This has been taken a step further with the Trowse shelter by placing it completely underground. Uren's Type III was also completely buried and covered with earth.

7.4.2.4 Entry configuration and access

The Trowse shelter has a traversed main entry and is roughly 'L' shaped (see Figure 7-18). The entrance to the shelter originally resembled an outhouse and was most likely constructed of brick with a galvanised iron roof that rested on wooden bearers (similar structures have been recorded in association with three

Adelaide Type V shelters—Pierce, Willis and Jackson [see Figure 7-41 and Figure 7-50]). Ten steps originally led from the garden entrance down to a landing west of the refuge doorway, although now only six survive. The steps had an average width of 277 mm (10.91 in.) and height of 167 mm (6.58 in.). It is unknown what type of doors hung at each of these entrances (see Appendix 6 in the accompanying CD for more images and information on this shelter in the Trowse Type III folder).

7.4.2.5 Alignment

The shelter follows the east/west axes of the house and has a bearing of 276˚W/96˚E. The traversed entrance is at right angles to the shelter and house, and in line with the original back door of the bungalow which is approximately 11 m (36.09 ft) away. This is far enough from the one-storey dwelling to prevent demolition rubble blocking the shelter exits during an air raid.

7.4.2.6 Furnishings

When originally installed, the shelter had two double swing bunks on bespoke cradles each side of the shelter (long since removed, but some of the wall fixtures are still in place). The bunks are an interesting addition to the Adelaide Anderson, and don’t feature in the Australian War Memorial or Western Australian Museum examples. The lack of them in the UK was one of the Anderson’s major criticisms during the all night air raids, and the reason why many owners decided to sleep indoors rather than stay in the shelters.

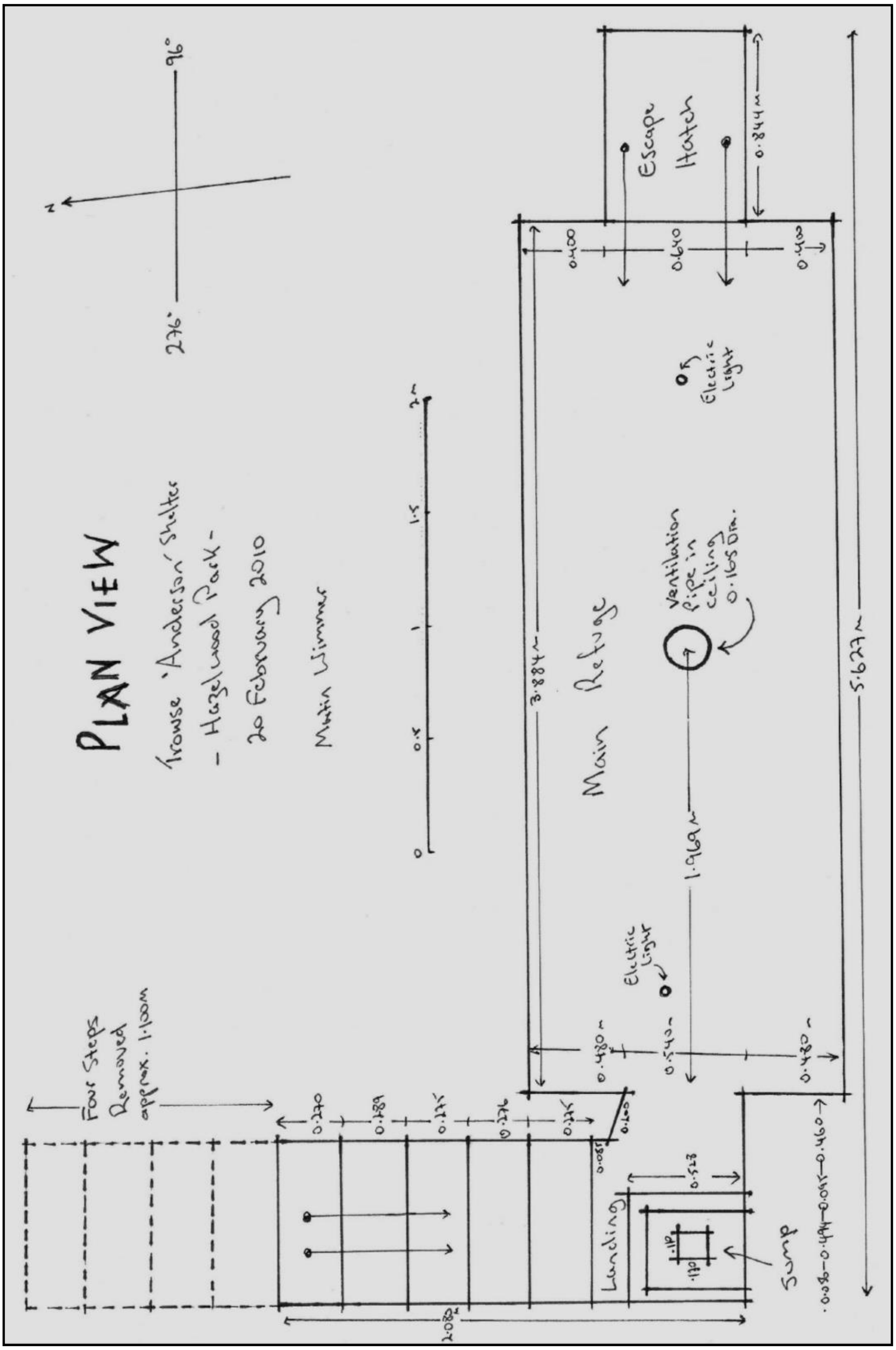


Figure 7-18: Plan view of Trowse Type III shelter

Woolven (2002: 173) commented:

> By October 1940 it was realised in the UK that sleep deprivation, due to bombing and inadequate sleeping arrangements in domestic shelters, was greatly affecting the work force and morale of the community as a whole. At this time, Herbert Morrison, Minister for Home Security, undertook to provide more steel for constructing larger 'Andersons' and extending the original ones to take bunks.

The Trowse shelter also had a kerosene refrigerator and stores of food (Robert Elliott 2010, pers. comm. 30 January, current shelter owner). The presence of a kerosene burning appliance may also be one of the reasons for a ventilation system being required in the shelter. Kerosene refrigerators further required a concrete floor for safe use. The shelter is also fitted with electric lights that may post-date the war, even though they, and the associated conduit, appear to be from the WWII era. Both the Uren and Bruce Type IIIs had wooden benches, and Bruce also had an emergency shovel.

7.5 Type IV: Reinforced concrete pipes

Type IV shelters were the second most common type of shelter installed in the public areas and schools of Adelaide. No evidence was found to indicate that reinforced concrete pipes were purchased by individuals to use as air raid shelters in domestic situations. Pipes were largely purchased by local councils for their own use, or supplied to institutions, such as churches and schools. Pipes were also obtained by larger businesses as protection for their workers.

It is difficult to quantify how many individual pipe shelters were erected throughout greater Adelaide because each pipe was, in effect, a shelter in its own right, but they could also be joined in various configurations. In these instances, historical documents indicate that pipe shelters were located alongside streets and carriageways or placed in schools and playgrounds, but give no indication of how many pipes were installed. It is also difficult to gauge numbers from available photographs (see Figure 7-19 and Figure 7-20). An indication of the extraordinary number of pipes used in defence comes from the Adelaide City Council which alone had ordered 1,100 by March 1942, with North Terrace having many clusters along its length. Because of the difficulties with quantification, it was decided only to record the locations of shelters created by nesting pipes together, and stand alone pipes, rather than the total number of pipes used as shelters[35]. The following table (Table 7-6) depicts known locations with pipes, either installed or proposed for installation (n=76). Here, as with Type I shelters, playground shelters are included in the public count rather than the school count. Barmera, 226 km northeast of Adelaide and well out of the study area, also had at least one Type IV shelter at its primary school, and is included here for completeness of the record and to demonstrate the extent to which reinforced concrete pipes were used in SA for protection against air raids.

Table 7-6: Number of Type IV locations (country pipes in red)

Public Areas	Schools	Businesses	Total
54	17+2	5	76+2

Initial orders for pipes by the Corporation of the City of Adelaide had been placed with the Hume Pipe Co. (Aust) Ltd in early March 1942. In a memo dated 9 March 1942, it was reported that 200 ft of 42 in. piping and 300 ft of 48 in. piping had been purchased from Hume and was to be placed along North Terrace (SPF 233Q:01 1942). Eight hundred feet of 36 in. pipe had also been ordered, with a further 7,430 ft in consideration. The following image (Figure 7-19) shows the

[35] For instance, Highgate Primary School had two rows of three pipes nested together, but these are counted as one shelter only rather than as two or six for individual rows or single pipes.

placement of pipes on North Terrace. There appears to be at least three distinct shelters with each composed of three pipes in this image. The pipes have been positioned well back from the concrete curb and hidden under a thick canopy of overhanging branches, making them virtually invisible from the air, and distancing them from the potential blast of bombs dropping on the hardened road surface.

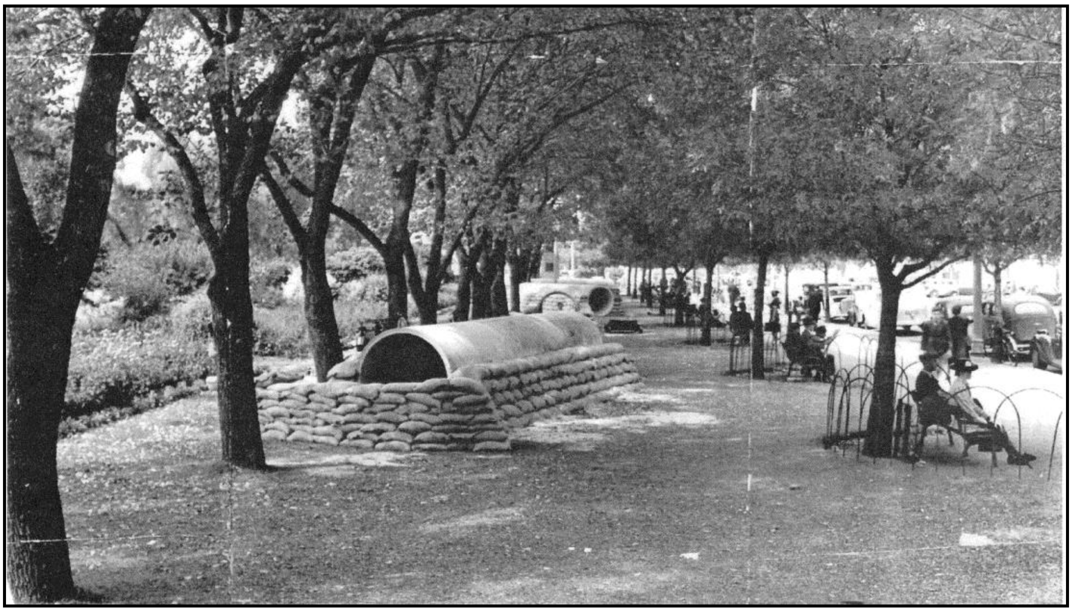


Figure 7-19: Reinforced concrete pipes, North Terrace
(image c/o Ray Hirst, NEWS Ltd, Adelaide)

As an 'accessory' to the pipes, it was also decided to purchase between 2,000 and 3,000 old bitumen drums for a penny each (Aerial War & Civil Defence Committee 1942). These drums were to be filled with sand and placed around the pipes as baffle walls, replacing sandbags which were continually rupturing and proving expensive to maintain (see Figure 7-20).

Approval was quickly granted to place up to six of the 36 in. x 8 ft pipes in each of the children's playgrounds within the city boundary, except those that already had trenches (Town Clerk, Adelaide 1942a). Shelters in each playground were to accommodate 120 children, and all children's playgrounds within a quarter mile of a State school were to be included in, or be supplementary to, the dispersal plans for those State schools (Town Clerk, Adelaide 1942b). An example of such a scheme comes from the West Terrace Playground where it was intended to place larger pipes than at Princess Elizabeth Playground in South Terrace, because it was closer to the Sturt Street School and subsequently included in its dispersal plan. The larger pipes were intended for teacher use (CEDKT 1942/1121A 1942d).

Figure 7-20: Fully accessorised: 48 in. x 8 ft pipes installed on North Terrace with sand filled bitumen drums being used in lieu of sandbags
(*Hume Pipe News* 1942: 5)

Unley, a municipality immediately south of the city, had pipe shelters constructed at the Glen Osmond, Parkside, Highgate, Unley (see Figure 7-21) and Black Forest public schools grounds, and also at the Grove Free Kindergarten, using 36 in. and 33 in. pipes which had been procured from the Rugby Street Drain[36].

[36] The extension of the existing underground drain from Frederick Street along Rugby Street to Wattle Street in 36 in., 33 in., 27 in. and 24 in. diameter pipe and along Wattle Street to Cambridge Terrace in 18 in. diameter pipe at an estimated cost of £2,450 was authorized, but the work was set aside for more urgent Civil Defence requirements. (Bentzen 1942: 30)

The Unley mayoral report of 1942 states that:

> The pipe shelters for children were constructed by setting the pipes half-way in the ground and covering them with the excavated earth. The pipes being laid in nests of six in two rows, each of three pipes set side by side, the ends being 2'6" apart and covered over with plate or timber, forming a covered entrance at the centre of the shelter from either side, and with earth banks for protection from blast.
>
> At the extreme ends of the nests of pipes open trenches 15" wide were made for emergency exit or lavatory use. (Bentzen 1942: 31).

Pipes were also used to protect the workers of municipal depots and factories. The *News* (9 March 1942: 1) reported that "[h]uge concrete pipes are being installed as additional shelter for workers at British Tube Mills, Kilburn, where open trenches have already been dug". Concreters (SA) Ltd's flat base Pneumatic Core pipes were purchased by Kensington and Norwood Corporation (see Figure 7-22), as well as Reid Brothers, timber and iron merchants of Port Adelaide. The Kensington and Norwood Corporation pipe shelter was later supplemented with a Type V Sub-Control Station (see Figure 7-24).

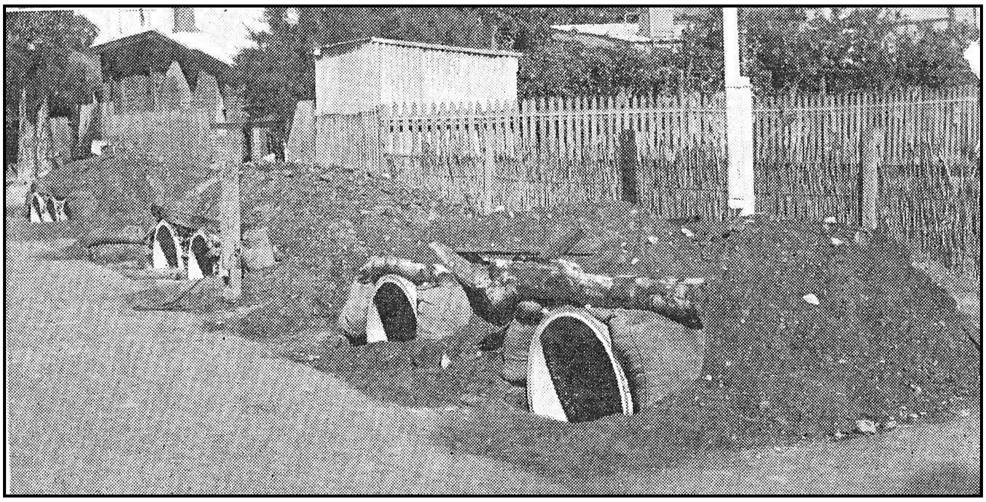


Figure 7-21: 36 in. x 8 ft pipes at Unley School awaiting installation of blast walls (*Hume Pipe News* 1942: 4)

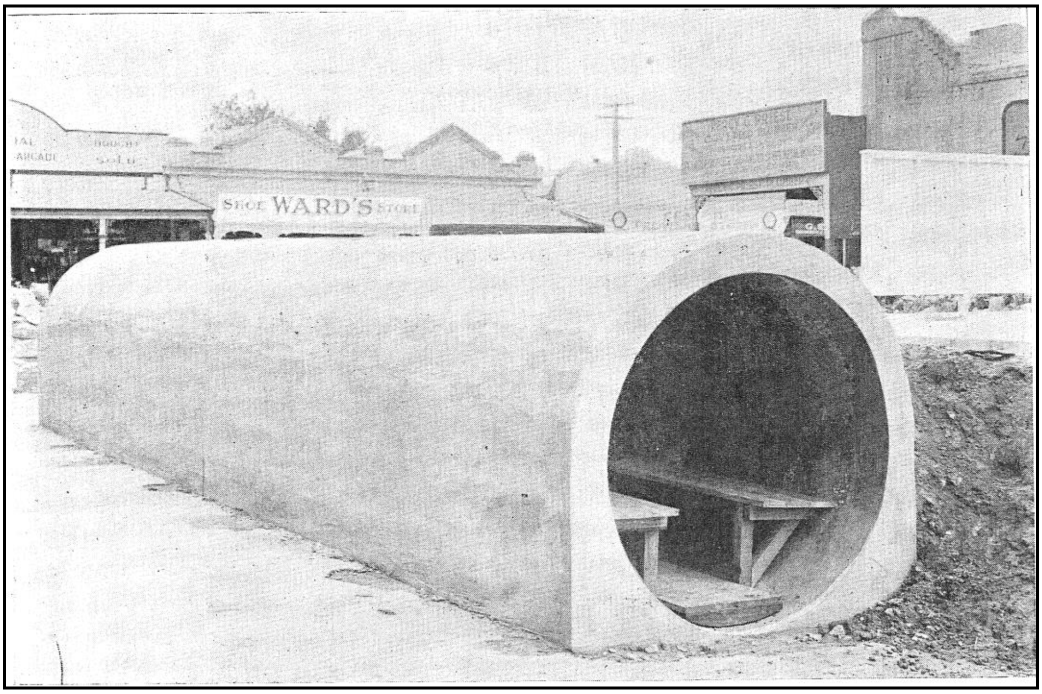


Figure 7-22: A Pneumatic Core Concrete Shelter installed above ground at Norwood (Concreters [S.A.] Ltd. n.d.)

7.5.1 Archaeological analysis of Type IV shelters

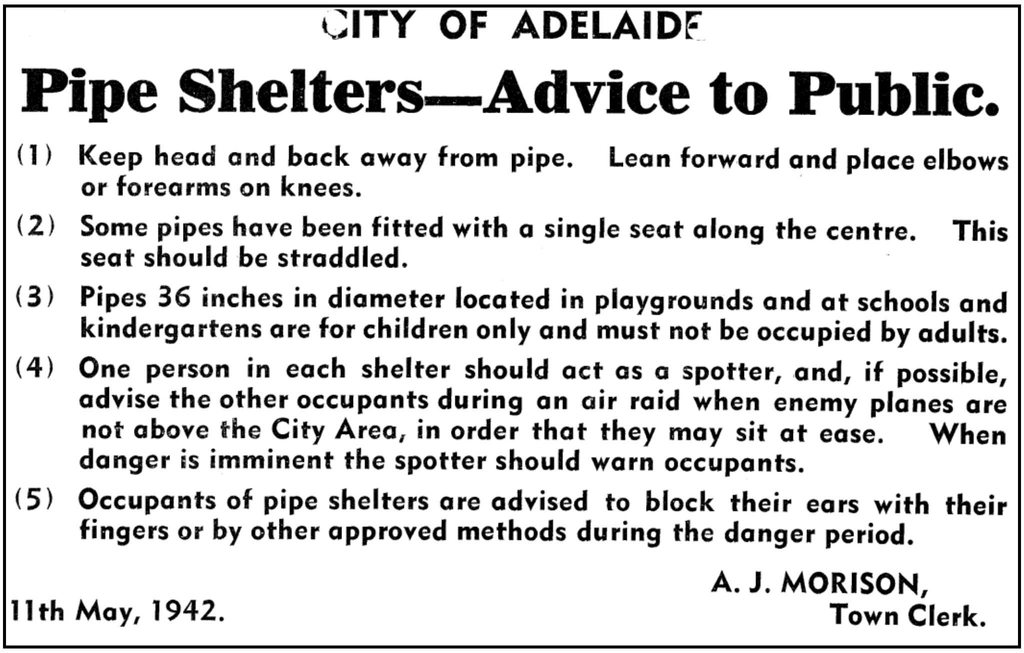
Most pipes were recalled and used in public works once the threat had passed. Consequently, analysis is based wholly on the archival record. It was found that no pipe shelters were completely buried. Some, for instance, those placed in schoolyards, were partially buried then covered with plate, logs, sandbags and earth (see Figure 7-21). In areas where utilities such as gas and water mains were close to the surface, the shelters were placed wholly above ground and provided with baffle walls of sandbags or sand filled 44 gallon drums to waist height (see Figure 7-19 and Figure 7-20).

7.5.1.1 Dimensions

The preferred diameter for pipes was 48 in., but in schools and playgrounds a mix of 48 in. for adults and 36 in. for children was employed. There also appears to have been an opportunistic use of smaller size pipes, especially by Unley Council. Larger pipes were employed by manufacturers, such as automobile builder Richard's Industries at Keswick, where 8 x 54 in. was installed for the employees (CEDKT 1942/1121A). Hume's pipes were preferred over other maker's pipes, and came in 8 ft lengths with a flange at one end enabling seamless coupling. Contemporary photographs indicate that three pipes were often joined to make one roadside shelter, whereas in schoolyards and playgrounds pipes were placed side by side.

7.5.1.2 Furnishings

Pipes were commonly fitted with one or two benches. Hamann (1943) recommended having seating on one side only. Where one bench was placed in a pipe, straddling it was the recommended way of sitting (see Figure 7-23).



CITY OF ADELAIDE

Pipe Shelters—Advice to Public.

(1) Keep head and back away from pipe. Lean forward and place elbows or forearms on knees.

(2) Some pipes have been fitted with a single seat along the centre. This seat should be straddled.

(3) Pipes 36 inches in diameter located in playgrounds and at schools and kindergartens are for children only and must not be occupied by adults.

(4) One person in each shelter should act as a spotter, and, if possible, advise the other occupants during an air raid when enemy planes are not above the City Area, in order that they may sit at ease. When danger is imminent the spotter should warn occupants.

(5) Occupants of pipe shelters are advised to block their ears with their fingers or by other approved methods during the danger period.

A. J. MORISON,
Town Clerk.

11th May, 1942.

Figure 7-23: City of Adelaide pipe shelter user's guide
(CEF[1942]027b)

7.6 Type V: Bunkers

A total of 57 bunkers (comprising 28 public and 29 domestic) were recorded in Adelaide during this research. A further two shelters were located in country centres, comprising one public on Kangaroo Island and one domestic in Peterborough. Ten (three public and seven domestic) were archaeologically recorded, whilst the remains of a further domestic Type V was excavated in the late 1980s by a group of volunteers associated with a local history group. Of the total 28 shelters recorded in the public domain, few were intended to protect the general public during an attack. For the main, this type was more commonly used as fortified communications headquarters, or to provide cover for factory workers or patrons of various businesses. This section discusses and compares the attributes of Type V shelters under the headings of the specific agencies that led to their construction.

7.6.1 Public Type V shelters

7.6.1.1 ARP Sub-Control Station Type V shelters

Seven Type V shelters (25% of the total public sample) served as fortified communications centres for the ARP network and were known as Sub-Control Stations. These bunkers were staffed with dispatch riders and telephonists who communicated with air raid wardens in their immediate area, and also with the Main Control Centre in the city. They were built in easily identifiable locations, for example, adjacent to Adelaide's premier football grounds and arterial roads where hundreds of passers-by glimpsed them each day.

All seven original bunkers were designed by the Engineering and Water Supply Department. Plans were submitted by 2 January 1942 (eight weeks ahead of the introduction of the Code) and referenced paragraph 59, clause 44 in Publication 22/1939 of the Institute of Structural Engineers (Commissioner of Civil Defence 1942) which provided structural guidelines for walls and roofs. All shelters were of massive proportions, with the roof alone weighing an estimated 70 tonnes (Goldsmith 2009: 5).

Sub-Control Stations were semi-buried, but retained large portions of their superstructure above ground. They also had two traversed exits, with the Glenelg and Prospect examples having concrete steps, and the Thebarton shelter wooden steps, fastened to concrete ramps (see also the smaller Unley Oxford Terrace shelter in section 7.6.1.2 below and the Willis domestic Type V shelter in section 7.6.2.4, for other examples of this innovation).

Figure 7-24: Construction of Norwood Sub-Control Station
(SA Water photo archive)

The entrances could easily be converted to a gas lock, a later requirement of the Code (*South Australian Government Gazette* 1942: 362) and annotated in the plan at Figure 7-25. Each of the recorded shelters had an overhanging roof 310 mm (12.2 in.) thick positioned approximately 640 mm (2.1 ft) above ground level (this height varied marginally from shelter to shelter and corner to corner of individual shelters), protecting a total of 12 deep set windows. External walls were 320 mm (12.6 in.) wide. Twelve inches of lateral protection was a minimum requirement in the Code for public shelters of this type, but only a 5 in. thick roof. These codified dimensions would provide protection against blast and splinters from a 500 lb bomb exploding 50 ft away (*South Australian Government Gazette* 1942: 359). The Code stipulated that blast walls were to be placed across all shelter openings (*South Australian Government Gazette* 1942: 360) and the plans for each ARP Sub-Station showed them drawn in, again ahead of the Code.

The largest room in each Sub-Control Station has dimensions of 6.091 m x 5.25 m x 2.892 m (19.98 ft x 17.22 ft x 9.49 ft) at Glenelg, and 6.068 m x 5.062 m x 2.898 m (19.91 ft x 16.61 ft x 9.51 ft) at Thebarton. These slight size differences demonstrate that even though the shelters are based on one design, there are minor structural differences between them, possibly because they were hand-built.

The Glenelg, Thebarton and Prospect Sub-Control Stations had much thicker roofs than what was eventually required by the Code, and were obviously built to be better than the standard, possibly to withstand a larger blast or a direct hit in order to ensure emergency services were not interrupted. An overhanging 'veranda' of 310 mm (12.2 in.) had the potential to intercept and detonate bombs coming in at an angle before they could reach the walls, and also prevented the roof falling in if dislodged by a lateral blast (see Figure 7-28 and the Griff Type V shelter for an example of this principle in domestic application at section 7.6.2.3). Originally, the windows were dressed with thick jarrah shutters. The Code called for timber shutters not less than 2 in. thick to increase lateral protection at these points (*South Australian Government Gazette* 1942: 360).

In plan, the Thebarton structure is 16.2 m x 9.2 m (53.15 ft x 30.18 ft) measured from the edges of its overhanging roof; in section, it has a maximum above ground height of 3.07 m (10.07 ft) to the top of its northern entrance. The size and scale of this structure can be gauged by viewing Figure 7-27 and comparing it with the adjacent automobiles to see how large a target it presents, justifying a thicker roof. An amenities block built over a portion of the exterior of the Glenelg shelter prevented it from being comprehensively recorded. The Thebarton shelter still has traces of the original wartime telegraphic wiring, conduits and switches fastened to its ceiling.

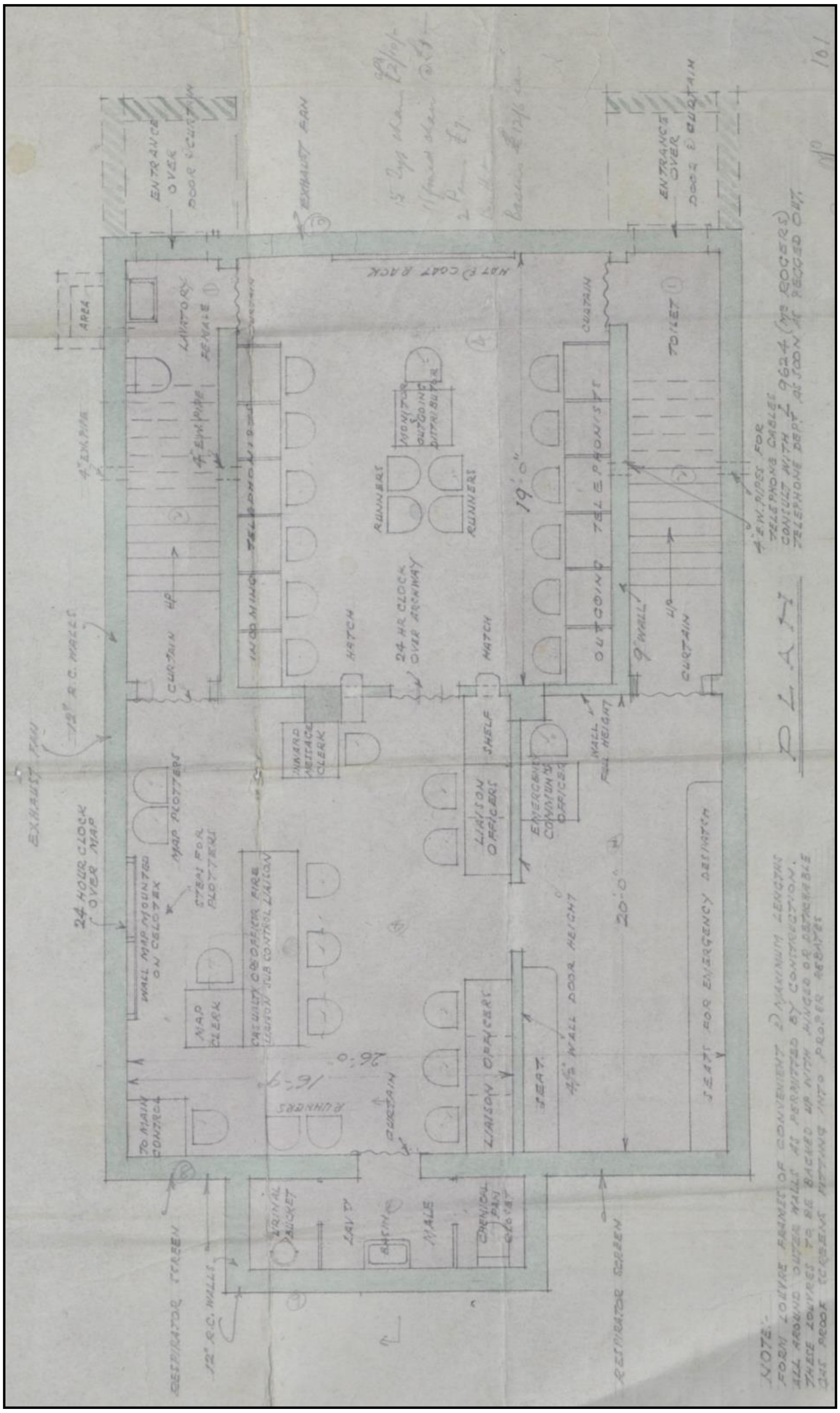


Figure 7-25: January 1942 plan of proposed Type V Sub-Control Stations (GRG 53/21/00000 Unit Id 705, 3115/41)

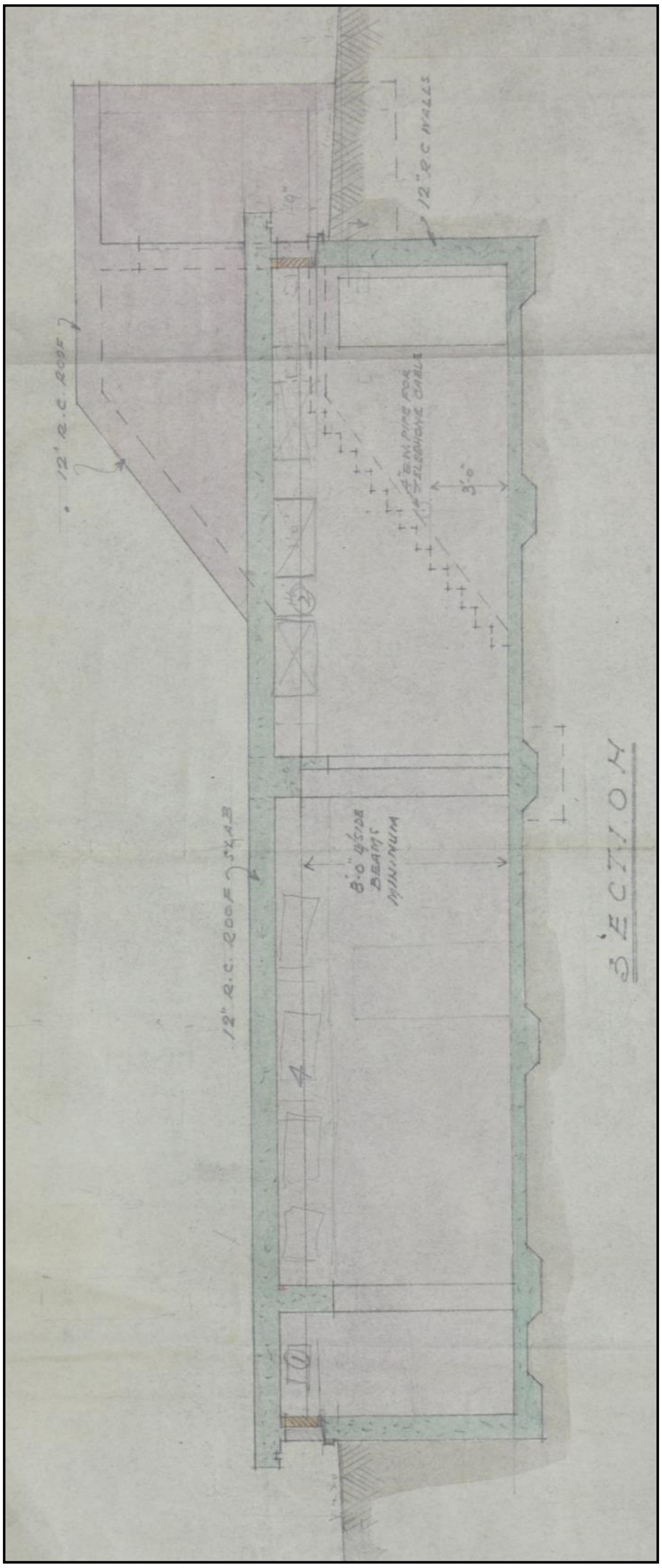


Figure 7-26: Section drawing of ARP Sub-Control Station showing portions above and below ground
(GRG 53/21/00000 Unit Id 705, 3115/41)

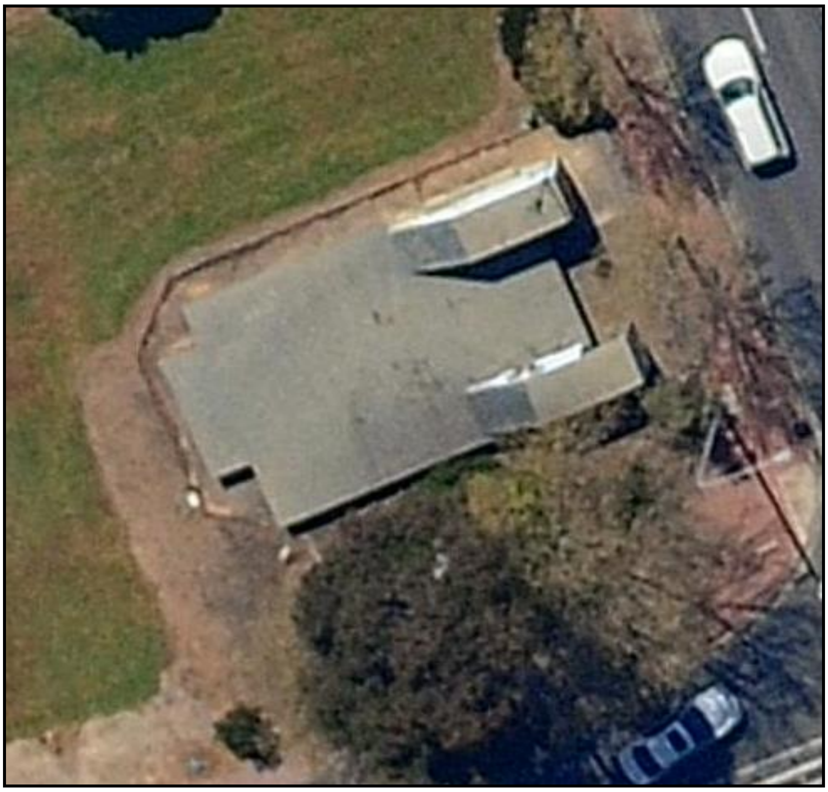


Figure 7-27: Aerial view of Thebarton ARP Sub-Control Station 2010
(URL image www.nearmap.com)

Figure 7-28: Rear of Thebarton Sub-Control Station showing roof overhang
(Wimmer 2006)

The 1942 Unley mayoral summary (Bentzen 1942: 30) describes the dimensions of the Sub-Control Station in Arthur Street, Unley:

> The building is 58 feet long by 28 feet wide by 12 feet high, 12" reinforced concrete walls, roof and floor consisting of three rooms with two entrance stairways. The floor being 7 feet below ground level, walls for protection against blast have been constructed all round the building.

The immensity of design and poverty of detail that characterises such structures can also be seen in a photograph of Unley's Sub-Control Station c1965 showing two women alongside its northern exit (see Figure 7-29).

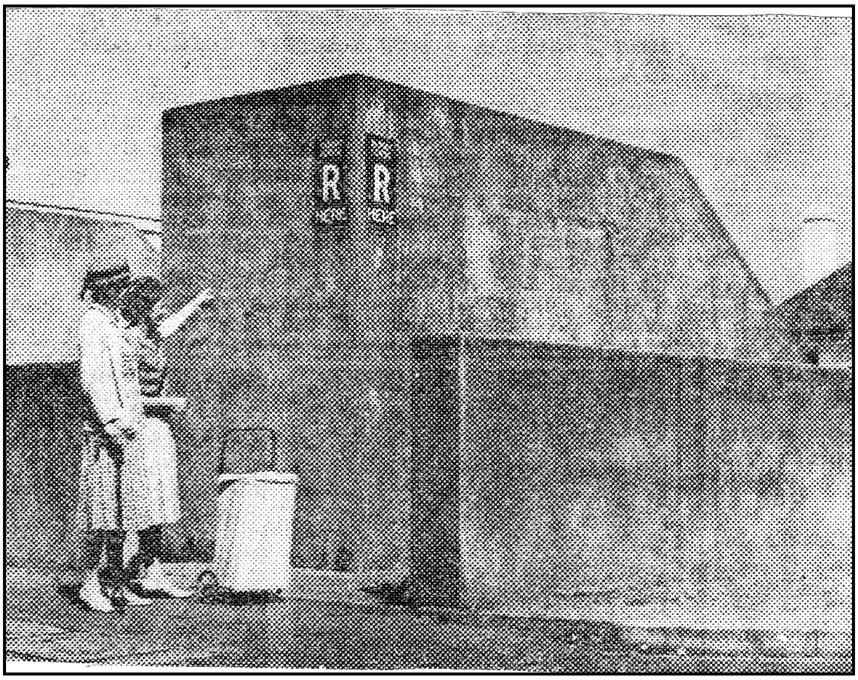


Figure 7-29: Unley ARP Sub-Control Station c1965
(with permission of David Vincent)

One oral history (Praite MW1-07: 5) had the Unley ARP Sub-Control Station facing north on Arthur Street, but its original plan and an aerial photograph from 1949 showed that it was actually facing east on Ann Street (see Figure 7-30).

Designed with approximately 60% of the mass of the shelter underground, it is uncertain how much of it now survives after demolition in the mid-1960s.

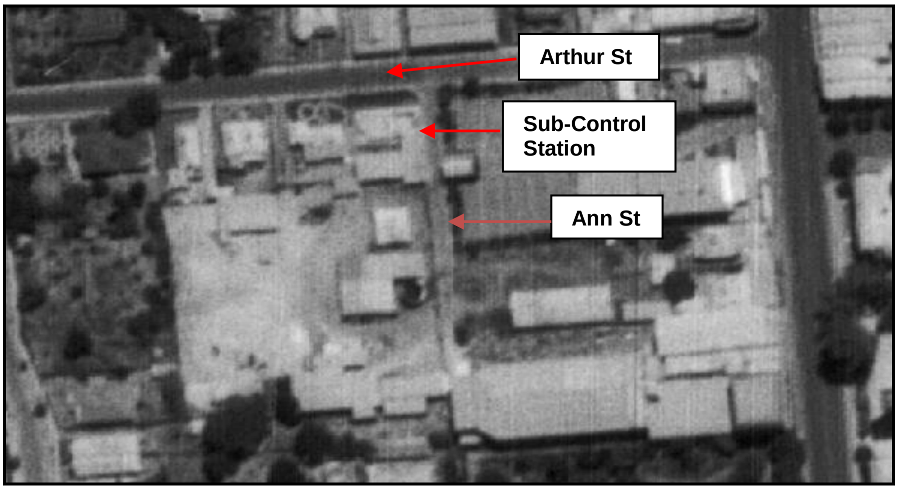


Figure 7-30: Aerial view of Unley ARP Sub-Control Station, 1949 (MAPLAND 1949b).

Historical records showed that all ARP Sub-Control Stations were to have a blast wall around the entire structure. Only Prospect's walls survive, although they do not conform to those depicted in the plans. This shelter faces north and still has protective walls along its northern and western sides. These are of rendered red brick, 380 mm (15 in.) wide, 1.345 m (4.41 ft) high and placed 1.213 m (3.98 ft) from the leading edge of the shelter exits and 1.4 m (4.59 ft) from the western wall. Whereas the whole of the front is protected by a blast wall (plans show that only the section of shelter between the doorways was originally intended to have the wall), today the western side of the shelter has a blast wall only extending as far as the sloped entry on the western side of the structure. In effect, this protects only the side of the stairwell, but a section may have been removed post-war. More images and information on the three surviving ARP Sub-Stations can be found in Appendix 6 on the accompanying CD in the Glenelg, Prospect and Thebarton Sub Control Station folders.

Figure 7-31: Prospect ARP Sub-Control Station showing blast wall across both exits (Wimmer 2007)

7.6.1.2 Council Chamber Type V shelters

A further two Type V shelters (7.1% of the total public sample) were of similar design to the Sub-Control Stations, but of much smaller dimensions. One is situated alongside the present day Unley Town Hall, in Oxford Terrace, Unley, and another (now demolished) was near the Prospect Council chambers (Ruciak 2010, pers. comm. 24 September, child during WWII). The Unley shelter was the Red Cross civilian relief volunteers, the Warden's Executive, and the Emergency Communications official's headquarters (Keenan 2001: 8) and given its similar size and placement, it is likely the Prospect shelter had the same purpose. The structure in Oxford Terrace cost ₤1200 to build (Bentzen 1942: 30). Unley had seven Civilian Relief Depots (Bentzen 1942: 31) across its jurisdiction by June 1942, and the smaller Unley Type V shelter may have been the coordinating centre for these. Civilian Relief Depots were public Type I and/or Type IV shelters typically installed in church grounds (see, for example, Civilian Relief

Depots at the Methodist Church, Archer Street [SPF233Q:01] and the North Adelaide Baptist Church, Tynte Street [CEDKT 1942/1121A]—both in North Adelaide).

Figure 7-32: Oxford Terrace Type V shelter c1970s
(Unley Museum photographic archive #89:117)

The Oxford Terrace shelter has two exits and originally contained three main rooms (the internal walls are now removed, but their partial 'shadows' remain on the floor). The external walls are 330 mm (13 in.) thick, and the roof 300 mm (11.8 in.) thick. The roof overhangs the structure by 230 mm (9.1 in.). Unlike the roof of the larger ARP shelters, it is bowed across the front, possibly to aid egress given the smaller scale of the structure. The external dimensions are largely obscured by modern additions, but in plan it is approximately 11.9 m x 7.7 m (39.04 ft x 25.26 ft) to the edges of the overhang. In section, the highest point of the original shelter structure is 2.53 m (8.3 ft) to the top of the eastern entrance. The stairs, like those at the Thebarton ARP Sub-Control Station, are made of wood fastened to a concrete ramp. The size of the individual rooms is now hard to ascertain because only portions of the original internal wall footprint are visible and largely obscured by plant and machinery, but the height of the ceiling is 2.899 m (9.51 ft) (identical within a few millimetres to the larger Glenelg and

Thebarton shelters). Only four of the original windows and two of the roof air vents are still visible. For additional images and information on this shelter see the Unley Oxford Tce Type V folder in Appendix 6 of the accompanying CD.

7.6.1.3 Public venue Type V shelters

Five (17.9%) of the recorded public Type V shelters were built for the use of patrons of venues such as football grounds, shopping arcades and hotels, or for hospital patients. From at least mid-1940, Adelaide's public venues employed local architects, including Harold Griggs (ARP Inspector for the Ministry of Munitions) and Russell and Yelland, to help fortify their premises against bombs and gas. In January 1942, and in accordance with the *Emergency Powers Act*, the Ramsgate Hotel at Henley Beach had a shelter designed by H. T. Griggs (see Figure 7-33) which cost the proprietor, Mrs P. Lonsdale, £161/11/5. The shelter had a floor space of 168 ft^2, enough room to accommodate 24 people under the Code. The shelter also had traversed entries, air vents and seating, and was protected with sandbags and an earthen mound.

The Unley Soldiers Memorial Gardens had a shelter with two similar sloping exits to the ARP Sub-Stations, and is thought to have been constructed for the patrons of the adjacent Unley shopping arcade and theatre complex at the corner of Unley Road and Arthur Street. No trace of this shelter exists above ground in the present, but it was recollected in two testimonials (Leon Ruciak 2010, pers. comm. 24 September, child during WWII and Tony Simm 2008, pers. comm. 3 March, independent researcher).

Civil Defence works at Norwood Oval included two Type V shelters built into the mound on the northern edge of the oval opposite the grandstand. These had vaulted galvanised 'mini orb' iron roofs covered with concrete, as well as concrete entrances which followed the curvature of the oval boundary (see Figure 7-34 and Appendix 6 of the accompanying CD for more images in the Norwood Oval Type V folder).

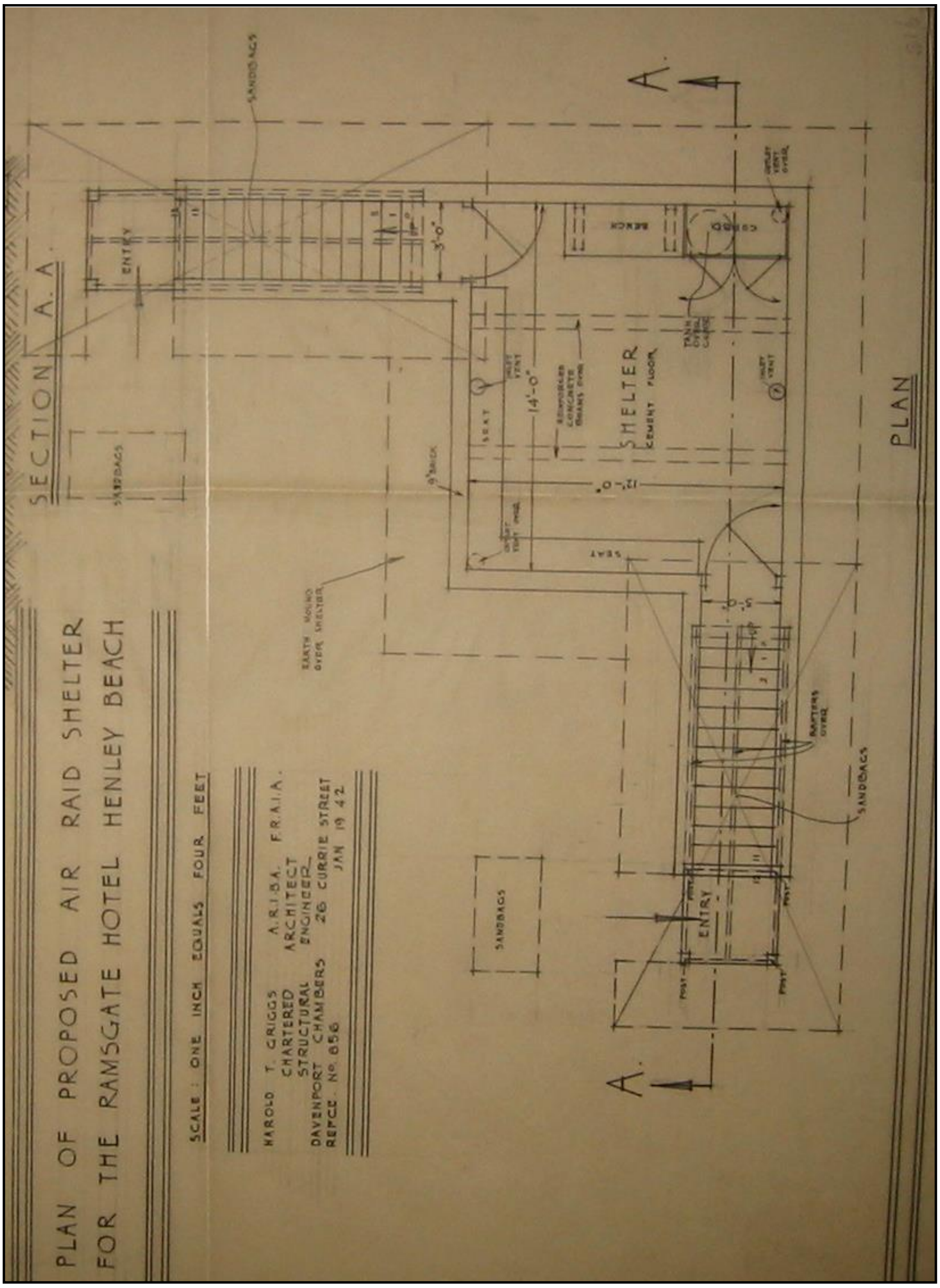


Figure 7-33: Griggs shelter plan for Ramsgate Hotel, January 1942 (S167/856/1)

Figure 7-34: Norwood Oval entrances to former air raid shelters
(Wimmer 2010)

Public Type V shelters were also constructed in country SA. In mid-2012, one was uncovered during construction work on the Esplanade at Kingscote, Kangaroo Island (see Figure 7-35). This shelter, built on a vacant block, was thought to have been for the staff and patients of the hospital next door (Black 2012). The very deep water off Kangaroo Island led to a fear during WWII that Japanese aircraft carriers would position themselves off the island to attack the island's vulnerable residents on an opportunistic fly-over while assailing Adelaide. The type and strength of the shelter on Kangaroo Island gives an indication of the fear present in that community, and the extent to which islanders went to protect themselves against such an eventuality.

Figure 7-35: Remains of Type V shelter on Kangaroo Island
(Black 2012)

7.6.1.4 Industrial Type V shelters

Ten industrial sites with Type V shelters (35.7% of the total sample) were located during this research. The scale of some demonstrates how seriously the threat from attack was considered. For instance, Pope Products Ltd in Beverley had a concrete bunker under a factory floor which Malcolm Ahrens (2010, pers. comm. 25 December, employee of Pope) described as having two main rooms, several smaller rooms and two exits (see also the Willis's Type V shelter in section 7.6.2.4 below, built opposite the Pope factory for the civilian response to the same threat). The Islington Railway Works in Kilburn used 7 ft long steel boiler sections with a diameter of 6 ft 8 in. as shelters. These were placed on their ends, then topped with steel domed lids and hinged doors that needed regular maintenance because they continually rusted. Merv Haese (2010, pers. comm.

24 November), a former employee, remembered them being completely surrounded with sandbags and able to house eight workers each.

Major concrete shelters could be found throughout the industrial quarter of Adelaide, stretching from Woodville to Port Adelaide. This area had been designated 'Target Area One' because of its concentration of factories and wharfs. For instance, some shelters were situated at the entrance to the Finsbury Munition Works and at the Hendon State Small Arms Ammunition complex. The Finsbury shelters, located each side of Audley Avenue, Woodville North, were demolished in the early 1990s and are now covered by new factories and a mosque (Laurie Shields 2008, pers. comm. 24 July, Port Adelaide Historical Society and shelter builder). These shelters were similar in appearance to the ARP Sub-Control Stations. Those at Hendon were located opposite the ammunition complex car park, and by the 1960s were shoulder deep with water (Lesley Attema 2010, pers. comm. 5 November, Prospect Local History Group). All are now demolished.

7.6.1.5 School Type V shelters

Three schools, St Aloysius College, the Church of England Walkerville Boys School and the Goodwood Orphanage, had 14.3% of the total Type V public shelters. St Aloysius had at least two shelters stocked with "First Aid apparatus, stimulants and food" (*Mail*, 5 December 1942: 5). Oral testimony taken from a former student in 2006 placed a concrete shelter with wooden seating under the Walkerville Boys School oval. However, archival evidence suggests that the shelter was under the school proper, with an entrance under the home and three exits, one which may have opened onto the oval (*The Advertiser*, 17 April 1942: 5). A geophysical survey of the oval in 2006 found no trace of the shelter (see

Appendix 6 of the accompanying CD for images of this survey in the Geophysics folder). The Goodwood Orphanage had a concrete shelter adjacent to its laundry with an east facing stair exit facing away from the classrooms and accommodation blocks. The bells of the Orphanage would ring to signal an air raid drill, and the children would make their way to the bunker (Rosemary Willis 2010, pers. comm. 30 September, former boarder at Goodwood Orphanage).

7.6.2 Type V shelters in domestic application

Thirty shelters of this type (including one in country Peterborough) were recorded; seven were archaeologically investigated. Domestic Type V shelters could be built by a home owner with basic ‘handyman’ skills, purchased from a supplier who also installed them, or constructed by a person whose business was aligned to the engineering/construction industry, either from architectural plans or after consultation with the home owner. Often people with a background in the construction industry would build one for themselves.

7.6.2.1 Handyman-built Type V shelters

Four shelters (19.1% of those whose builder’s occupations are known [n=21]) were constructed by men with no background in the construction industry. These included a storekeeper, a baker, a cycle builder and a Peterborough chicken farmer. William Sharpe, the cycle builder, had fought in WWI and may have drawn on his military experience to erect some form of structural defence for himself.

Two-hundred-and-sixty kilometres north of Adelaide, George Chapman hand-built a Type V shelter in Hurlstone Street, Peterborough (see Figure 7-36).

Figure 7-36: Chapman Type V shelter, Peterborough
(John Mannion 2007)

His son, Norm, recalled that he began by digging a pit 3 to 3.5 ft deep in solid rock, building up the sides and ends with brick and placing half a 1,000 gallon galvanised iron rainwater tank (cut length-ways) over the top of it. Apart from the doorway, the entire structure was “patched over” with 7.62 cm (3 in.) of concrete composed of cement, local river sand and river pebbles in a five to one mix (Chapman MW1-10: 2). The Code, stipulating that cement mortar could not be weaker than one part of cement to four parts of sand (*South Australian Government Gazette* 1942: 358), did not apply to Chapman as a self-builder. The front of the shelter was also sheathed in 6.4 mm (0.25 in.) flat iron, and Norm recalled how he helped his father fashion a vent in it with a cold chisel and hammer (see Figure 7-37).

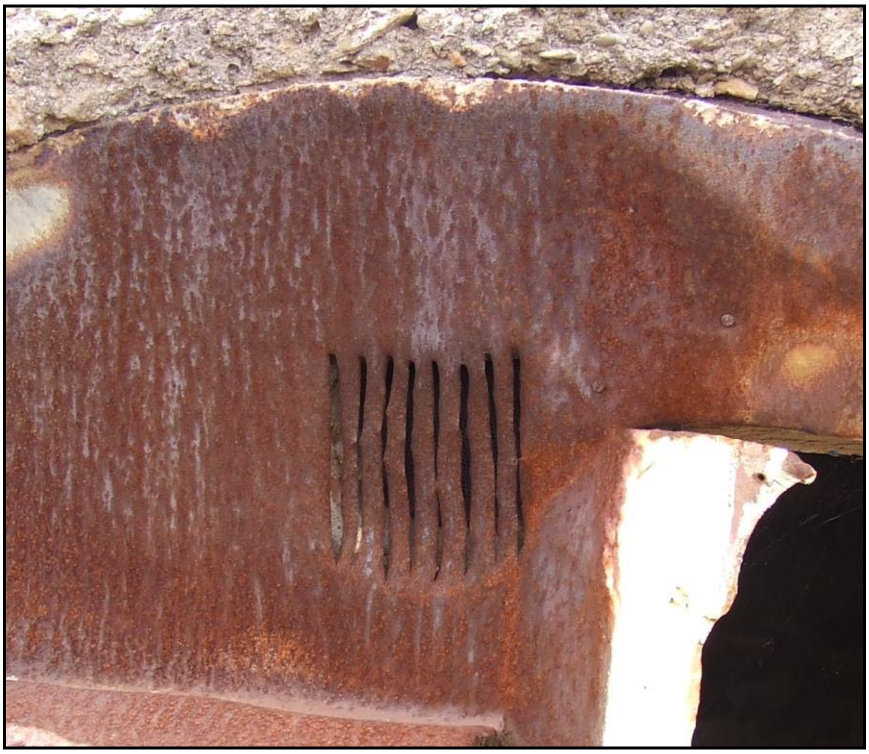


Figure 7-37: Detail of air vent, Chapman Type V shelter
(Wimmer 2010)

The shelter, originally rendered inside and out, had a traversed entry with a heavy wooden door, a concrete floor and a 10.16 cm (4 in.) diameter, right angled breather pipe at the rear which was supported on the roof with a brick.

George, a chicken farmer, realised shortly after its completion that the shelter maintained a steady temperature in Peterborough's harsh climate. Consequently, he installed a kerosene incubator (the shelter had no power or electric light) under the breather pipe at the rear of the structure and stored sacks of chicken feed along the northern wall. The approximate floor space 2.73 m^3 (29.42 ft ^{2}) and volume 4.72 m^3 (166.78 ft^3) of the structure, according to the Code, was a large enough space to comfortably accommodate three to four adults (*South Australian Government Gazette* 1942: 362) or an incalculable number of chickens. The Chapman family consisted of two adults and two children during the war years.

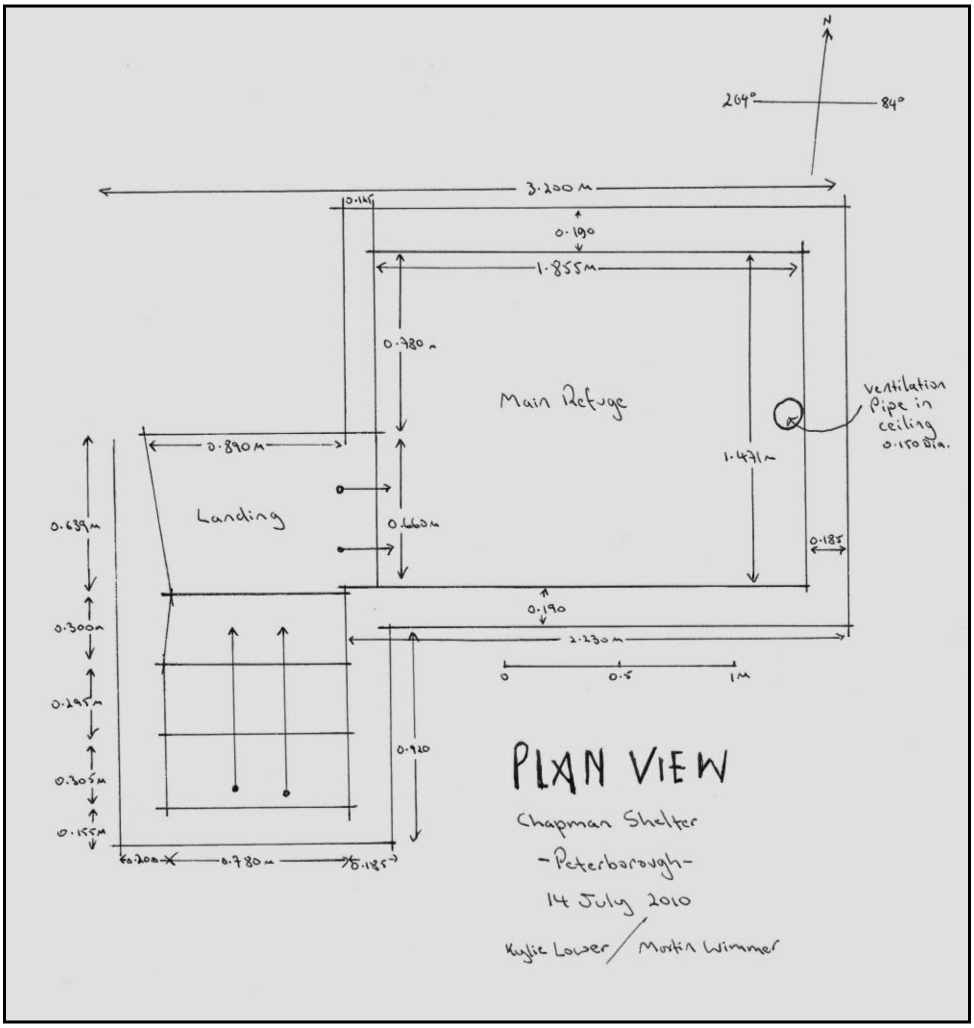


Figure 7-38: Plan of Chapman Type V shelter

Today, the shelter is unused and slowly deteriorating. The door and breather pipe have been removed, opening internal sections of the fortified room to the elements, leaf litter and household refuse. The un-clad rainwater tank ceiling is badly rusted. Most of the external render has fallen off, exposing the river pebbles and the concrete which is slowly degrading. In winter, the whole of the external shell is covered in a green slime which may be contributing to its demise. The current owner has no intention of demolishing the shelter, or of re-using it for another purpose. Additional images and information about this shelter can be found in Appendix 6 of the accompanying CD in the Chapman folder.

Arthur Cashmore, baker and owner of the successful *Maltina Bread Crumbs* label, built a Type V shelter in his backyard at Lockleys. This structure had a convex reinforced roof and was fitted-out with bunk beds. Arthur's grandson, Philip Jones (2010, pers. comm. 15 October, curator, SA Museum), recalled his grandfather being a keen inventor. Lockleys is a wealthy and leafy suburb west of the CBD presenting little of strategic military value, but it does lie between a possible beach landing and the city centre. Due to his retail success, and the fact that he manufactured hard to obtain foodstuffs in times of coupon-regulated commerce, Arthur had the means to procure (either by purchasing or trading goods) the necessary construction material to build a reinforced shelter for the protection of his family. Despite his wealth, he chose not to employ a builder, but instead erected the structure himself.

7.6.2.2 Industry know-how built Type V shelters

Seven shelters (33.3% of those with identified builders) were constructed by people with some affiliation to the building industry. Two of these were archaeologically recorded. Type V shelters built by those with a background in the construction industry, or who had access to construction material, often exhibited quite robust features, such as thicker walls, and indicate the owners' penchant for taking full advantage of the materials they had at hand.

One example is the shelter built by Philip Sydney (Syd) Jackson of Rosetta Street, West Croydon, who owned a truck and carted sand and gravel for a living. He also owned a variety of over-sized shovels and a motorised soil elevator which he would use to load his truck. Syd built a large Type V shelter in his backyard, digging the pit himself with a size ‘6’ shovel which his daughter recalled “weighed as much empty, as a small one weighed full” (Spry 2012, pers. com. 27 May, daughter of shelter builder). As the hole deepened he would lift the soil out using the motorised elevator. Syd’s neighbours included the Freburgs and the Hallets, two Adelaide brick makers of some renown, who may have helped obtain additional construction materials, such as bricks.

The Jackson shelter was off-set to the house and placed near the rear northern boundary fence, with the entrance facing the back door of the dwelling. The concrete steps of the shelter are higher than they are wide, creating a very steep decent of 2.96 m (9.71 ft) over a horizontal distance of only 2.087 m (6.85 ft). Egress is aided with the inclusion of a handrail. There is a small round hole of approximately 5.08 cm (2 in.) diameter under the bottom step which possibly functioned as a storm water drain. The structure originally had electric light with the switch next to the main power board inside the house; this meant that the light needed to be turned on before leaving the house whilst running for the shelter. A unique feature of this Type V was a dim emergency light placed behind dimpled glass (now missing) at the bottom of the stairwell at a height of 1.22 m (4 ft) (see Figure 7-39). This may have been required because of the hazardous descent.

The shelter has a traversed entry, with the stairwell descending to a small hallway which could be converted to a gas lock. An outward opening wooden door led into the main refuge. The landing had wooden shelving which contained emergency supplies, including powdered milk and candles. The main refuge has a floor space of 5.91 m^2 (63.63 ft^2) and a capacity of 13.50 m^3 (477.19 ft^3), which is almost twice the recommended area for the five members of the Jackson family. This room is serviced by four breather pipes, one in each wall (opposing top and bottom). There is a fifth breather pipe in the landing/hallway.

Figure 7-39: Emergency light, Jackson Type V shelter
(Wimmer 2012)

The above ground portion of this shelter (the entrance) is fortified and seems typical for a completely buried Type V (see Figure 7-40 and Figure 7-50). This external structure has a maximum height of 1.485 m (4.87 ft) and width of 1.185 m (3.89 ft) with the doorway only 1.27 m (4.17 ft) high, meaning adults must stoop to enter. The walls are of cement rendered brick approximately 24.5 cm (9.65 in.) thick. The roof, which is reinforced with steel bands, curves into the ground at a distance of 1.755 m (5.76 ft) from the architrave and is 21.5 cm (8.47 in.) thick. A heavy steel door protects the entry.

The Jacksons lived next door to the West Croydon and Kilkenny Returned Services League who eventually bought and demolished their house in order to build a car park. The club retained the shelter, and now use it to store their documents.

More images and information about this shelter can be found in the Jackson Type V folder in Appendix 6 of the accompanying CD.

Figure 7-40: Jackson Type V shelter exit
(Wimmer 2012)

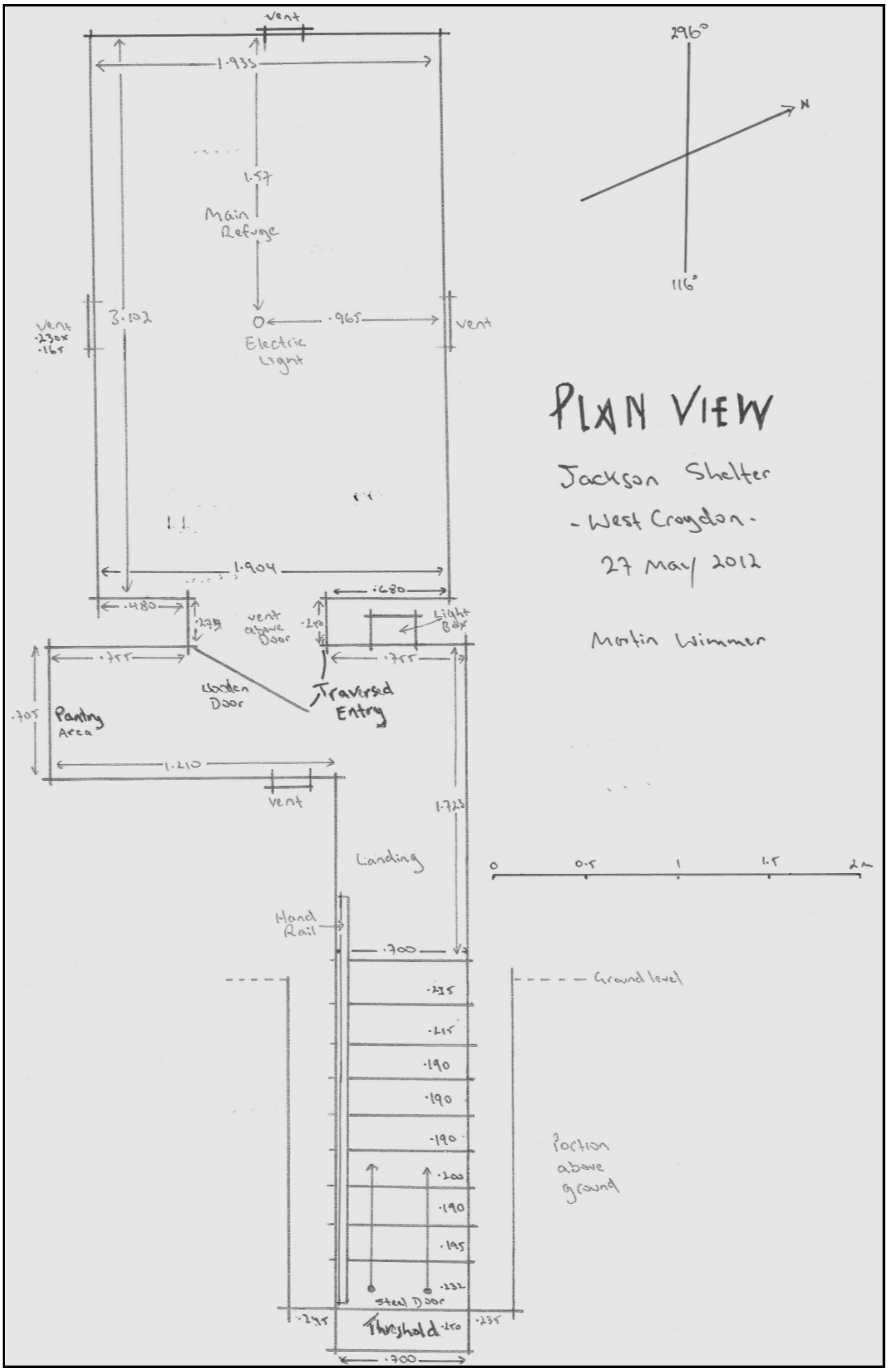


Figure 7-41: Plan of Jackson Type V shelter

William Bertram Lamberton, a building contractor living in Farrell Street, Glenelg South, owned a large, 1928 Gentleman's Bungalow only 200 m (656.16 ft) from the coast (CT1639/Folio153). He built a tiny Type V shelter (see Figure 7:42) 19.5 m (74.26 ft) north of his back door with an entrance that faced east away from the coast and the possible direction of attack. An eastward facing entrance meant that Lamberton would have needed to run around the side of the shelter to gain access to it if attacked, for it was positioned at right angles to the house.

The shelter is semi-buried with a vaulted roof, and is similar to Chapman's Type V in appearance (see section 7.6.2.1 above). It may have originally been mounded over with the excavated earth, but there is now no evidence of this. The vault is the only part that is above ground, and is unusual in that it has been formed up on a wooden mould with boards 95 mm (3.74 in) wide. All other shelters recorded with vaulted ceilings were formed up on curved iron sheets, or on half rain water tanks. The shelter is of coarse concrete construction with a matrix consisting of a high quartz stone content. The exterior was originally rendered, but little of this finish survives. There is a traversed earth ramp entrance protected by a reinforced brick and concrete wall which, when entering the shelter, gives the impression of being in a trench. The corners of the ramp walls are of rounded glazed bricks. This is an ergonomic feature aiding rapid and safe entry. An 8 mm (0.32 in.) copper pipe in the front and rear domed section possibly served as a breather pipe.

Although the shelter appears too small for the large size house it services, it has an internal floor space of 2.29 m^2 (25.48 ft^2) and an approximate volume of 4.05 m^3 (147.79 ft^3) which is large enough for a family of three or four. It is unknown how many were living at this address during the war years. The main refuge has an earth floor and a ceiling, and walls 17 cm (6.69 in.) thick.

Figure 7-42: The Lamberton Type V shelter
(Wimmer 2013)

There may not have been a door originally, for there are no signs of how one was attached. An iron bar is embedded in the wall to the right of the doorway; its function is unknown, but it may have been a fixture for a lantern. The location of the shelter and its indirect approach may have necessitated the use of a dim light or beacon for night-time use. It is unlikely that the iron bar was a door hinge, as this would have meant that the door opened backward into the ramp, impeding access to the refuge; logically, a door would have been fixed to the left of the entry and opened against the landing alcove wall or internally. Running along the southern side of the shelter at a distance of 17 cm (6.69 in.) is a low bluestone wall which may have been intended to provide a buffer against blast.

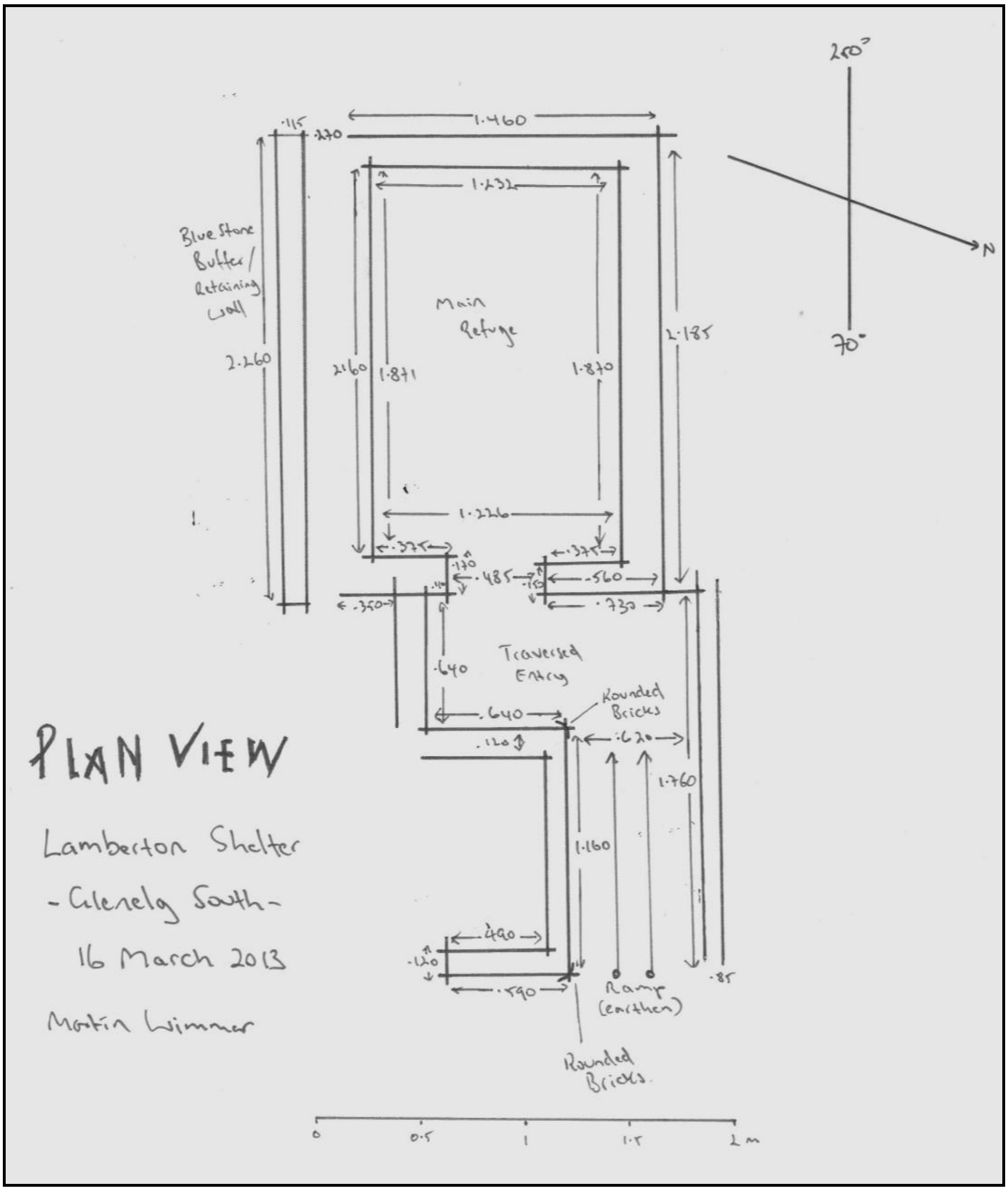


Figure 7-43: Plan of Lamberton Type V shelter

The current owners intend to retain the shelter and use it to cultivate mushrooms. Both the Chapman and Lamberton shelters resemble an Anderson Type III shelter in size and form, and may well have been modelled on one.

More images and information about this shelter can be found in the Lamberton Type V folder in Appendix 6 of the accompanying CD.

Other examples of Type V constructions of this agency in Adelaide come from the suburbs of Parkside and Woodville. The Mosaic and Terrazzo Granolithic Speciality Flooring Company at the corner of Liston Street and Park Terrace (now Greenhill Road), Parkside, were concrete layers. Their large property consisted of a family residence at the front of the block with their factory to the rear. The owners constructed a substantial and deep concrete shelter straddling their rear boundary fence. The shelter boasted walls 18 in. thick, but lacked a baffle wall across the entrance. It seems that comfort was not a consideration for the occupants, for it was fitted out with nothing more than a wooden bench. The shelter could protect not only the owner's family and their factory workers, but also their neighbours (Praite MW1-07: 4).

A further example comes from the Morrell household in Park Street, Woodville. The Morrells owned an engineering and scrap metal business—C.H. Morrell Pty Ltd—and Robert Morrell (Morrell MW2-07: 4), born in 1937, recalled that his father built an air raid shelter out of scrap metal sequestered from the family's work place which he thinks may have consisted of rolled boiler plate welded onto a steel frame. Without exception, the whole of C.H. Morrell's staff were exempt from war service because the business was defined as belonging to a reserved industry and important for the war effort. It is possible that Robert's father may have enlisted his employees' collective skills to help construct the family shelter. The Morrell home was situated only a few streets from General Motors Holden, a company that was producing much of the mechanised transport, arms, munitions and military supplies needed by the Australian Army (Marsden 1977: 214). This proximity to obvious tactical bombing targets may have prompted Robert's father to construct a more robust shelter in the family home. The fortified domestic structure was under the bungalow's enclosed back veranda (see Figure 7-44) with access gained through a wooden door from the sleep-out. It was completely covered with a pyramid of sandbags.

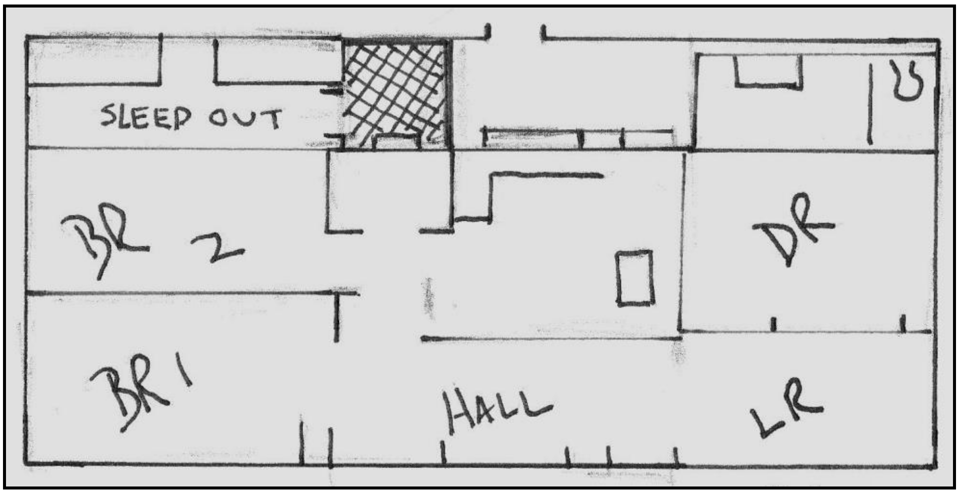


Figure 7-44: Morrell bungalow, Woodville, location of air raid shelter as hatched area (drawn by Bob Morrell 21 August 2007)

The shelter had an approximate floor space of 144 ft² and an internal height of 5 ft. The entrance was tiny and adults needed to crawl in. It was fitted-out with mattresses, blankets and pillows, and provisioned with dripping, tinned food (such as sardines, herrings and tomato soup), bottles of fresh water (replenished fortnightly), first aid kits, torches and tin hats (which also came via the family scrap business). The shelter was dismantled approximately twelve months after the end of the war at Mrs Morrell's insistence, with the scrap metal going back into the family business (Morrell MW2-07: 3).

7.6.2.3 Catalogue-purchased Type V shelters

In SA after 26 February 1942, businesses and trades persons supplying shelters and designs for shelters were entities to whom the Code for shelter construction applied. Only one shelter (4.8%) appears to have been purchased from a catalogue, pre-fabricated off site and then moved to the property, installed and finished. This shelter was archaeologically recorded.

Leigh Grange is a magnificent mansion with an Art Deco portico on Avenue Street, Millswood. It was purchased by Sophie Griff, a married woman from Broken Hill, in January 1937 (CT1133/Folio95). No mention is made of Mrs Griff's husband in the certificate of title and he may have remained in Broken Hill when she moved to Adelaide. The yard was subdivided in the 1970s and a new house built. Twenty-three metres (75.46 ft) from the rear door of the mansion, and now situated over the fence and in the backyard of the newer house, is the entrance to the Griff Type V shelter (see Figure 7-45). It is highly likely that this shelter is an example of a gendered response to the threat of air attack. If Sophie Griff was alone in Adelaide at the outbreak of the war, it may have been her decision to install a shelter, her decision as to who to contract to build it and possibly even her decision as to where in the yard it should go. Given the grandness of the original home, it would seem that money was no obstacle for Mrs Griff in purchasing a concrete shelter and having it installed. This shelter, from its design and finish, looks like it may be a standard catalogue product rather than a bespoke structure.

This semi-buried structure displays some classic air raid shelter design features, including a traversed entry, overhanging roof and thicker below than above ground walls (see section 6.7.1.1, above, for a similar design published by the CCA). Inside the main refuge there is a concrete ledge 8 cm (3.15 in.) wide along the two longest walls of the room and reaching to a height of 1.092 m (3.58 ft) from the shelter floor. This may have been used opportunistically to place candles or tinned supplies on, but it is actually a device which thickens the walls below ground. Outside the shelter, the walls are also 7 cm (2.76 in.) thicker below ground than above. When this extra width is added to the inside ledge width, it increases the overall wall thickness on the shelter sides by 15 cm (5.9

in.) from its above ground width of 25 cm (9.84 in.) to 40 cm (15.75 in.) below ground.

Although it is unclear if the Code related to surface or sub-surface shelters, it specified a minimum lateral protection of 12 in. (*South Australian Government Gazette* 1942: 359), meaning that the portion of the Griff shelter above ground fell below the standard. It could not be ascertained whether the ledge also ran along the inside of the rear wall because it was obscured, but the outside of the rear wall has the extra 7 cm (2.76 in.) below ground, giving the lower rear section a thickness of at least 32 cm (12.6 in.). The front wall had no thickening because of the buffer provided by the entry corridor. In effect, the outer wall of the corridor would act as a detonating slab, and the void of the corridor would absorb the blast/compression to some extent. The main refuge of the shelter has a floor area of 4.28 m^2 (46.06 ft^2) and a volume of 9.28 m^3 (327.45 ft^3). It is large enough for six or seven people (*South Australian Government Gazette* 1942: 362) suggesting that there may have been a number of Griff children. Three breather pipes feed into the main room. One is a galvanised iron pipe extending to 1.76 m (5.77 ft) above the middle of the structure, and two are ‘U’ shaped earthenware sewer pipes facing downward in the back wall. Thick bilateral wooden doors (each made of two wooden doors fastened together and sheathed in sheet metal) hung internally on barn door hinges protect the entrance to the refuge. These can be locked from the inside with a heavy iron bolt.

Figure 7-45: External wall thickening evident below range pole in Griff Type V shelter (Wimmer 2008)

The stairwell and entry are of rendered brickwork. It seems that the concrete box, which is the main refuge, was installed first and the protected stairwell added after; it is not as strongly constructed as the shelter proper. The stairwell landing and corridor leading to the entrance of the shelter could have easily been turned into a gas lock of 3.39 m^3 (119.79 ft^3) capacity with the aid of a heavy curtain. A 15 to 16 cm (5.91 to 6.30 in.) thick reinforced concrete lid, unevenly formed, was the last part of the structure to be put in place and covers the refuge and entry corridor, leaving only the five stairs uncovered. This is greater than the minimum of 5 in. of overhead protection specified by the Code (*South Australian Government Gazette* 1942: 358-9). A section of the roof is also damaged, and steel reinforcing rods of 13 mm to 14 mm (0.5 in.) diameter placed north/south and 23 mm (1 in.) diameter placed east/west can be seen in the exposed area. The roof overhangs the structure by 9 cm (3.5 in.) and was, given the height of the wall above ground (0.970 m [3.18 ft]), probably intended to stop the roof being pushed into the shelter by a near miss rather than to arrest in-coming bombs. Simply, the higher the walls above ground, the wider the overhang needed to be in order to stop bombs landing next to the base of the structure.

However, a 3 in. roof overhang was recommended by the State Emergency Council for Civil Defence, Victoria handbook (1941: 26) which was also available in SA.

The structure is long and narrow, and apart from the concrete ledge there are no other internal features which could be considered furniture, nor is there room for additional furniture. Despite its solid construction, it is not a practical space for long term occupation and was quite possibly only intended as an emergency shelter. Its narrow, almost trench like proportions may explain the presence of three breather pipes that not only bring fresh air in, but also dissipate body heat.

The house to which the shelter is now attached is a rental property. The current tenants have made an offer to buy the property and, if successful, will demolish the shelter and re-develop the block. Today, the shelter is disposed as a storage room for old furniture, bags of assorted household items and old clothing. More images and information about this shelter can be found in the Griff Type V folder in Appendix 6 of the accompanying CD.

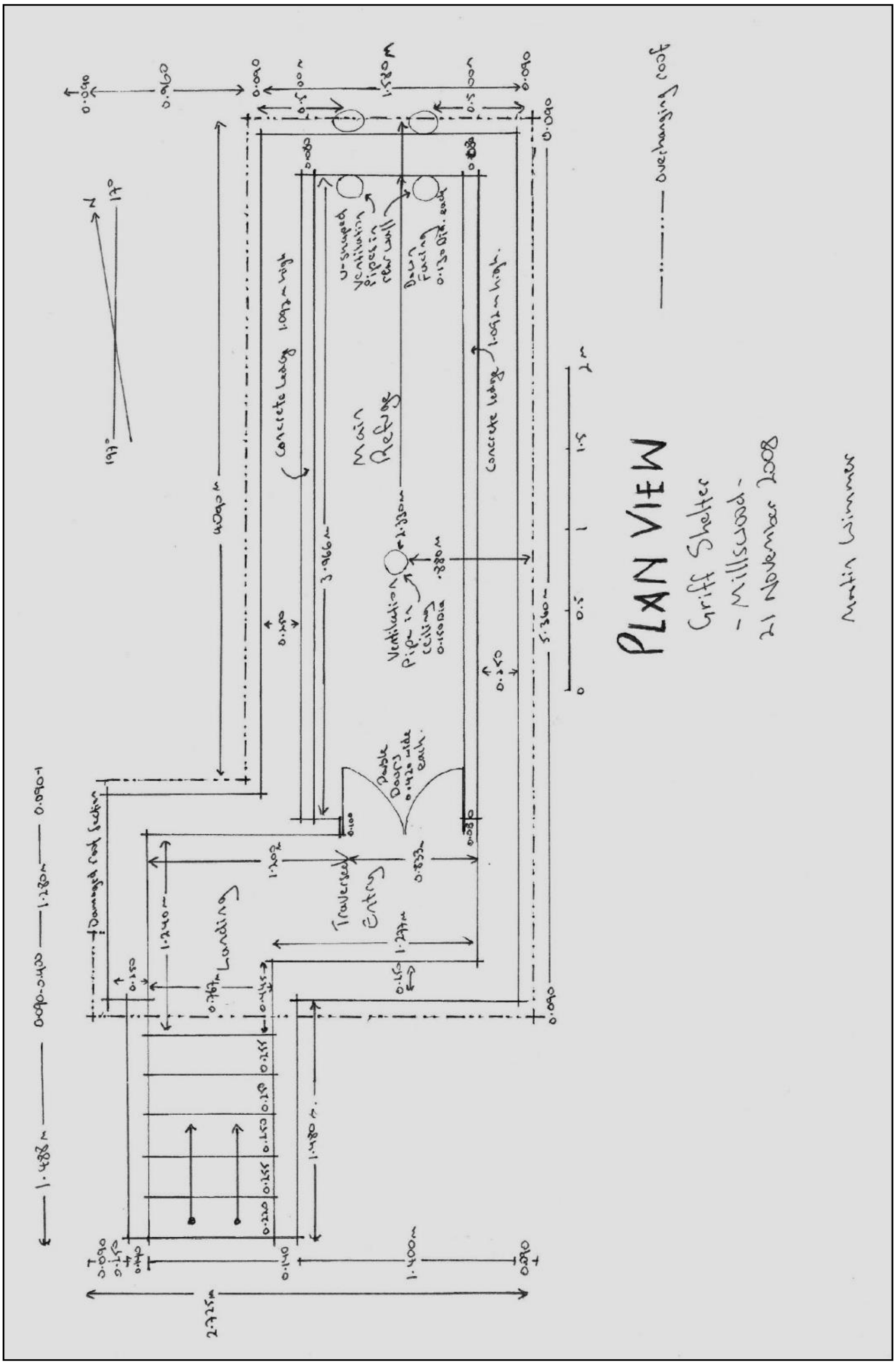


Figure 7-46: Plan of Griff Type V shelter

7.6.2.4 Type V shelters of unknown construction agency

Eighteen Type Vs could not be conclusively attributed to a construction source. Three of these shelters were archaeologically recorded. None appeared to be catalogue-purchased shelters, but it is unknown if they were self-built or constructed by professional builders. It is assumed that these shelters were professionally built by entities other than the home owners, for they display an increasing sophistication compared to the Chapman shelter, are well constructed and finished, and belonged to people such as a farmer, greengrocer and business manager who, ordinarily, may not have had the expertise to design and install such structures for themselves.

Hilvue is a Tudor-style home in Kennaway Street, Tusmore, purchased by Edward James Pierce, a farmer, in July 1938 (CT1494/Folio84). The Pierces constructed a complex concrete shelter 4 m (13.12 ft) from their back door and possibly before the Code was introduced. It has two exits, in-built shelving, a concrete bench, two breather pipes and a storm water sump.

This shelter is almost completely underground, with only 20 cm (7.87 in.) evident above. This includes an 8 cm (3.15 in) thick concrete roof slab. Sometime after construction, a concrete dome reinforced with steel rod and steel mesh was placed over the top of the shelter. At 8 cm (3.15 in.) thick, the original roof was approximately 5.08 cm (2 in.) short of the minimum required by the Code (*South Australian Government Gazette* 1942: 359). It is not known whether the shelter was constructed prior to the introduction of the Code and later modified to comply with the new legislation, or whether it had been originally designed with the dome. The current owners purchased the property in the late 1980s and remembered during a backyard renovation that the dome had not adhered to the shelter roof, but came away easily once demolition began. This indicates that it may have been an after-thought rather than having been part of an original monolithic design[37].

Figure 7-47: Pierce Type V shelter showing concrete bench and built in shelves (Wimmer 2009)

The main entrance facing the home and resembling an outhouse was built of brick with a galvanised iron roof on wooden bearers, and would have had six

[37] One other property, "an old house in Glynde", was recorded as having a similar roof (two 5 ft concrete domes) over its shelter (Philip 2010, pers. comm. 23 September).

steps leading into the shelter. This was also demolished during the 1980s, and the wooden door re-hung across the second entrance whilst the main entrance was bricked in. The second entrance had been backfilled some time before the current owners purchased the property and was only re-discovered during the backyard renovation. Its re-discovery was the reason the shelter (ear-marked, in the first instance, for demolition by the current owners) was retained. This second entrance also had six steps originally, but the top two are now backfilled because of a re-alignment of the driveway with only their shadows evident in the stairwell wall.

There is a concrete bench 0.445 m (1.46 ft) wide and 0.416 m (1.37 ft) high running the length of the internal western wall which could seat five people, or sleep two. Above this are a set of steel pins similar to those in the Trowse Anderson shelter which supported fold-down bunks. If pins in the Pierce shelter were also for bunks, sleeping capacity would increase to four. The room has an area of 5.46 m^2 (58.72 ft^2) and approximate volume of 9.87 m^3 (348.77 ft^3), enough capacity to comfortably accommodate six to eight adults (*South Australian Government Gazette* 1942: 362). Immediately above the bench in the north-western and south-western corners of the shelter are earthenware breather pipes of the type used in domestic sewerage works. This appears to have been a common method of ventilating Type V shelters and was also used by Griff and Willis. The placement of these ventilation devices directly above where people would be sitting or lying seems ideal.

In the eastern and northern walls are two wood-lined shelf alcoves, each of different dimensions.

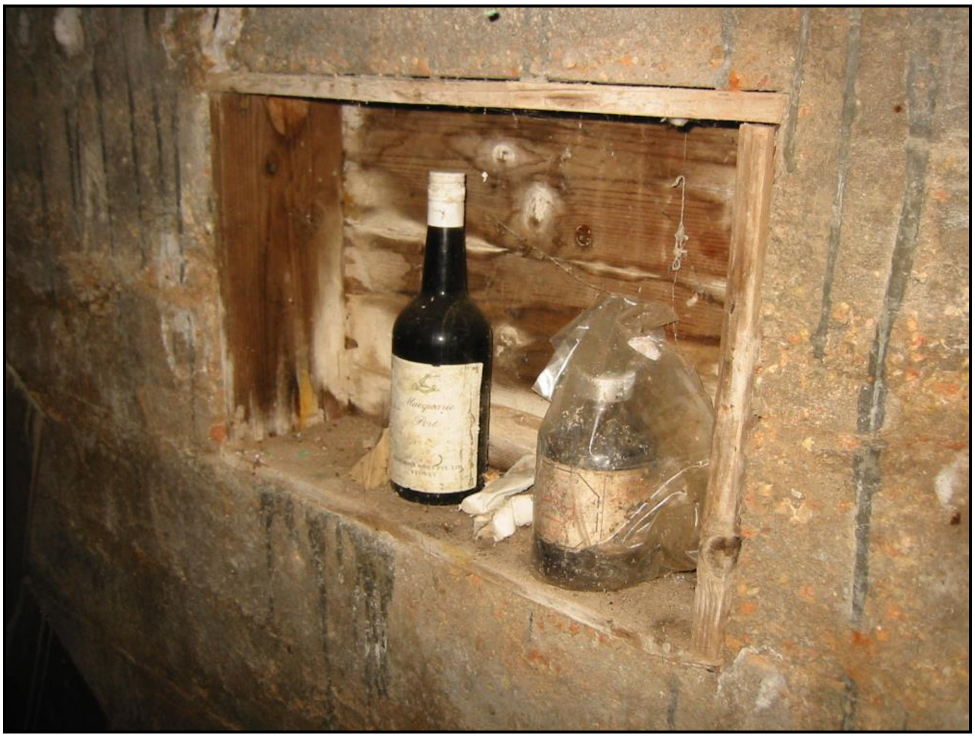


Figure 7-48: Detail of shelf in eastern wall, Pierce Type V shelter
(Wimmer 2009)

The depth of these shelves provides an indication of the minimum width of the shelter walls at those places. It was not possible to get an absolute width because each shelf has a concrete backing, which indicates the wall extends behind them. The northern wall is at least 23 cm (9.06 in.) thick, and the eastern at least 14 cm (5.51 in.) thick. It was possible, however, to get an absolute width for the southern wall. Whereas the Code stipulated a minimum lateral protection of 12 in. of reinforced concrete (*South Australian Government Gazette* 1942: 359), the southern wall is only 12.5 cm (4.9 in.) thick. This is 17.78 cm (7 in.) below the standard, and possibly a reason the second exit was backfilled and covered by the lens of the concrete dome, if this occurred because of the introduction of the Code. It is possible that the Pierces may have sacrificed an exit in order to increase their overhead protection. The Code states that the regulated dimensions are for premises, structures and excavations (*South Australian Government Gazette* 1942: 358).

The walls are un-rendered and of rough-formed concrete. The planks used in forming up the structure were of four different sizes and varied in width from 16 cm to 24 cm (6.3 in. to 9.45 in.). The floor is concrete, but appears not to be very solid or thick, for it sounds hollow when tapped and clearly not the 4.5 in. of reinforced concrete required by the Code (*South Australian Government Gazette* 1942: 362). There is a sump just inside the current doorway covered with a metal grate and there is a narrow 1.18 m (3.97 ft) long channel leading to it from further inside the shelter. This drain has been formed by simply dragging a stick through the concrete before it set.

The shelter is currently disposed as a wine cellar and, like the Trowse sectional shelter, has a paved entertainment area above it. See Appendix 6 of the accompanying CD for more images and information on this shelter in the Pierce Type V folder.

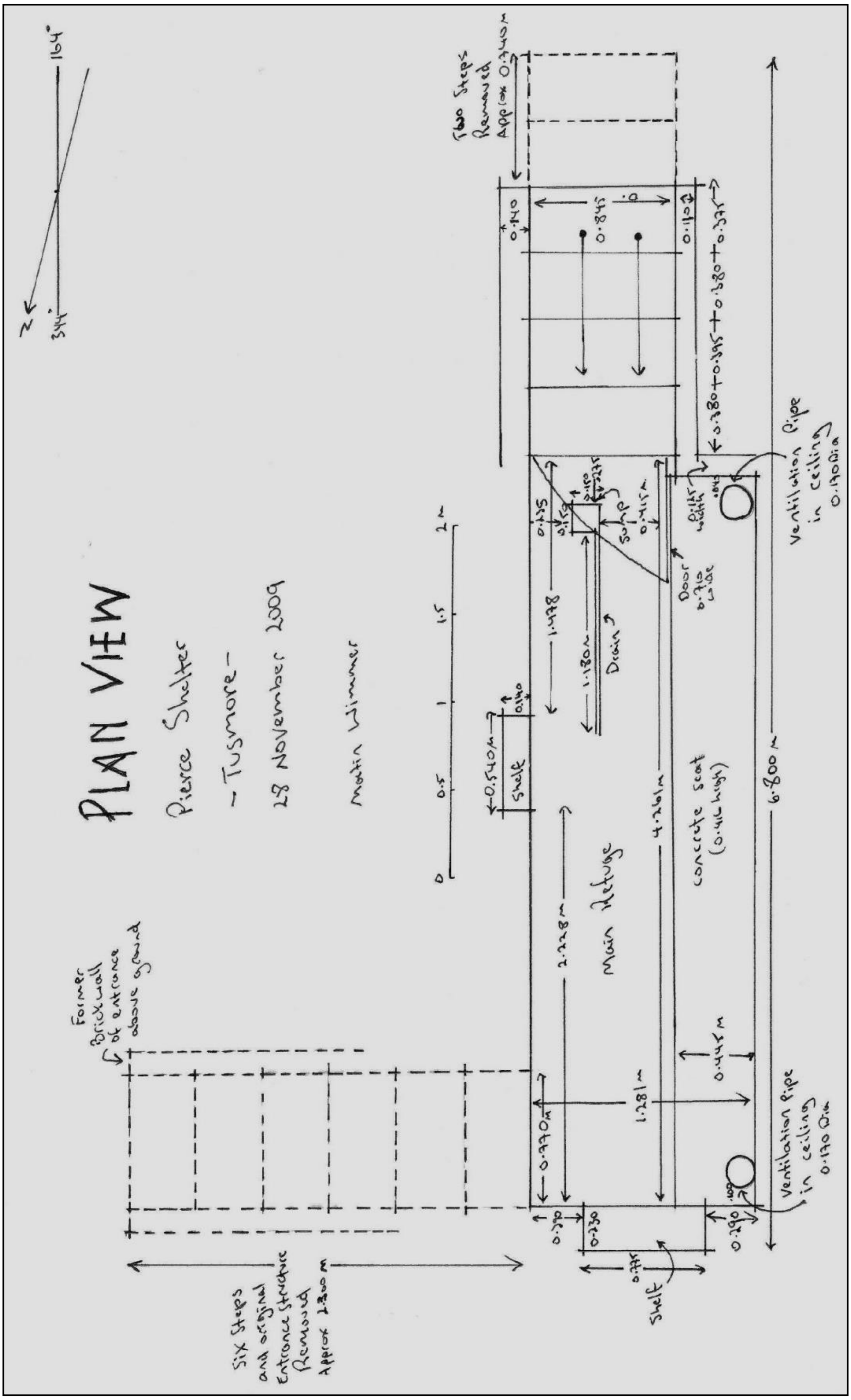


Figure 7-49: Plan of Pierce Type V shelter

In May 1936, Walter and Kathleen Willis, greengrocers of Brompton, purchased a symmetrical cottage in William Street, Beverley (CT910/Folio139).

The floor of the bunker they built in the backyard of their property is 3.36 m (11.02 ft) below ground level and is the deepest, largest and most sophisticated domestic shelter recorded in this study. It features two exits, built-in shelves, a hidden compartment, built-in bunk alcoves, a ventilation pipe, electric light and a built-in fireplace. Approximately one-third of the shelter is below the house, adding to the structural protection value of the shelter and its accessibility, but also subjecting it to the possibility of being smothered by demolition debris, or being flooded if the water mains ruptured during an attack since there is no sump in the shelter floor. One exit is positioned under a trap door in the kitchen and the second in the backyard. The garden exit, which doesn't face the house, is 3.3 m (10.83 ft) from the back door. It is similar to that of the Jackson shelter and those now demolished at the former Trowse and Pierce properties. From the front, the above ground entrance resembles an outhouse, but in profile is a long, sloping structure that disappears into the ground (see Figure 7:50). Whereas the other demolished exits were constructed of brick (as is the extant Jackson exit) and easily dismantled, the Willis example is made of solid concrete, 35 cm (13.78 in.) thick and able to withstand the blows of a mechanical excavator (Louise Holt 2010, pers. comm. 19 May, Technical Officer, Department of Archaeology, Flinders University). Twelve concrete steps lead from the outside exit down to a landing, and traverse another four steps into the shelter proper. The traversed kitchen exit formerly consisted of wooden steps fastened to a sloping concrete ramp similar to those of the Thebarton ARP Sub-Control Station and the Unley Oxford Terrace shelter (see sections 7.6.1.1 and 7.6.1.2 above). Only the ramp now remains. This exit is 90 cm (2.95 ft) wide at the top making it easier to enter from the kitchen, but narrows to 62 cm (2.03 ft) at the bottom, which is also the width of the garden exit. It is considered that the narrowing at the bottom of this exit is probably caused by the thickness of the walls (40.5 cm [15.95 in.]) at the eastern end of the shelter as the ramp reaches down to the level of the room and moves around it.

Figure 7-50: Garden exit and steps, Willis Type V shelter
(Martin Wimmer and Louise Holt 2010)

The refuge room has two deep, wood-lined shelves on its southern wall, one with a secret compartment behind a sliding wood panel. There is a single electric light in the middle of the ceiling and a two-way light switch inside each exit (now disconnected). The northern and southern walls also have shallow recesses of 4.5 cm (1.77 in.) wide that appear to have been for fold-down bunks. Similar bolts to those in the Trowse and Pierce shelters are still *in situ* in the recesses (see Figure 7-51). If they are bunk spaces, then two people could have slept along the northern wall, and one along the southern wall. There would also be space for a stretcher bed on the ground under each of these, and a fourth under the wooden shelves, if these areas were not already allocated to other furniture.

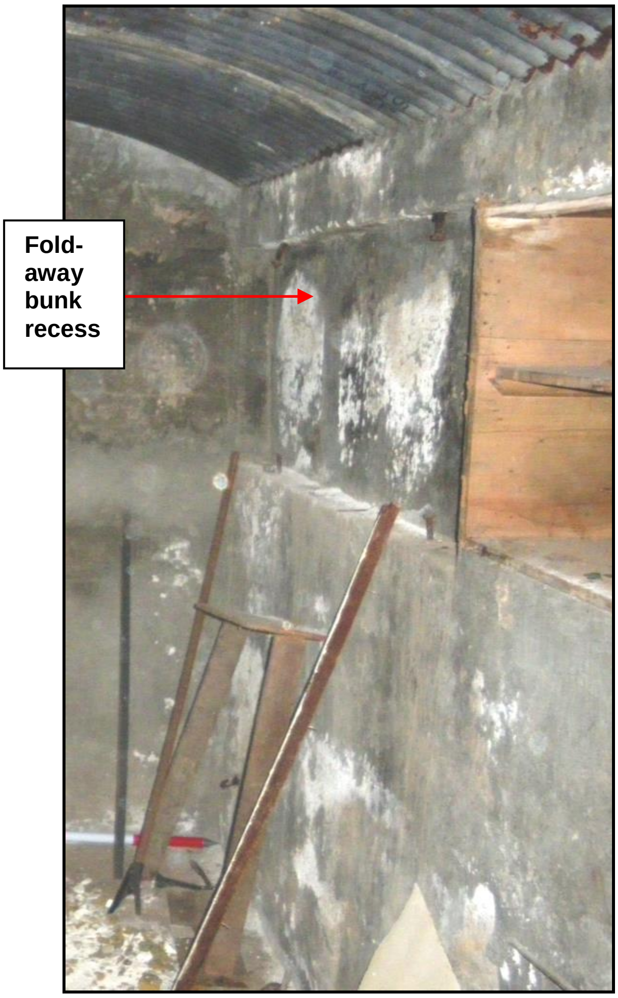


Figure 7-51: Detail of southern wall, Willis Type V shelter
(Louise Holt 2010)

The main refuge of the shelter has an area of 6.23 m^2 (67.07 ft^2) and an approximate volume of 12.97 m^3 (457.43 ft^3) and is large enough to accommodate eight to ten adults according to the Code (*South Australian Government Gazette* 1942: 362). Given the size of the interior, it seems odd that only one earthenware ventilation pipe was installed in the middle of the room (there is a second smaller earthenware pipe if the fireplace flue is included). The fireplace also seems out of place in an air raid shelter; to date no other example has been recorded in extant shelters or revealed in the related literature. The fireplace had, however, an ingenious use. Once the fire was lit, it would act to draw fresh air down the pipe in the centre of the shelter whilst smoke and hot air was forced out of the flue, creating convection currents. This would ensure air was continually replenished and circulated in the shelter and heat transferred out. In principle, this would function much like a mechanical ventilation device, but would not have relied on generated power. The fireplace may have also provided an emergency light source if power was cut. Being so far underground, and with both exits traversed, meant that very little natural light would have entered the refuge; this could be one reason electric light was installed. For additional images and information on this shelter see the Willis Type V folder in Appendix 6 of the accompanying CD.

Figure 7-52: Fire place in Willis Type V shelter
(Wimmer 2010)

It is difficult to gauge the width of the walls and roof, however, the shelf with the hidden compartment is 61.5 cm (2.02 ft) deep and has concrete at the back of it, indicating that the walls may be at least that thick on its southern side. This is twice that mandated by the Code, and fits the British research available in Australia which states that sub-surface walls needed to be double the width of surface walls—assuming that the Code was referring to surface structures. The walls are un-rendered and bear the imprint of the boards used to form the structure. By subtracting the internal height of the refuge 2.08 m (6.82 ft) from the depth of the shelter floor 3.36 m (11.02 ft), it can be determined that 1.28 m (50.39 in.) of tin, concrete and earth separate the shelter from the surface, a margin which provides an extraordinary protective barrier above the middle of the Willis shelter. The Code stipulated a minimum of only 5 in. of reinforced concrete or 18 in. of earth for overhead protection (*South Australian Government Gazette* 1942: 359). The physical dimensions of the shelter certainly seem to post-date the introduction of the Code. Although it is very dry inside, the walls and concrete floor are covered with a white crystalline powder which may be salts leaching out of the concrete and the product of rising damp.

The ceiling is vaulted and formed on curved sheets of corrugated iron. An indication of the dry conditions of the shelter can be seen in the extraordinary preservation of these branded iron sheets. Their diagnostic script reading "GLOBE/ AUSTRALIA/ ROOFING TERNES/ UNSUITABLE/ FOR/ DRINKING WATER" (see Figure 7-53) indicates that they are of a type now rare in Australia, but at least three still survive in the Willis shelter. *Globe* was a John Lysaght brand registered in Australia between 1887 and 1927 (Lewis n.d.). Lysaght also manufactured Anderson shelters during WWII. Roofing ternes were a product of the war years (WWI and WWII) when zinc was unavailable for civil purposes in

Australia and lead was substituted in the galvanising process (Lysaght 1957: sheet 1811). These '*Globe*' marked sheets appear to be of a WWI vintage given that *Globe* was not registered post-1927.

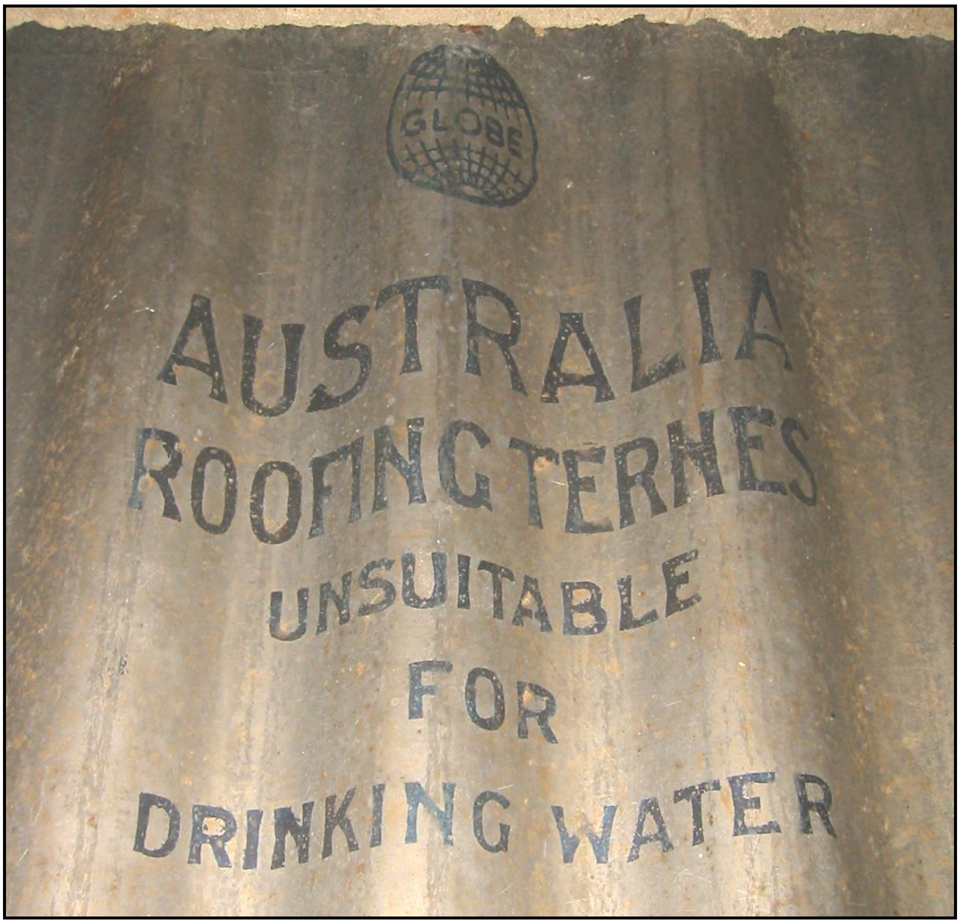


Figure 7-53: Globe roofing terne, Willis Type V shelter
(Wimmer 2010)

The Willis's shelter would have been an incredibly complicated and expensive structure to build. The excavation alone would have been beyond the means of most people living in Adelaide at the time. The property has two street frontages and, like the Trowse Type III shelter, rear access would have aided excavation and construction by allowing egress to heavy machinery. Being greengrocers and having access to fresh fruit and vegetables in times of restrictions may have given the Willis's the means to barter produce for building materials or labour.

Today, the residence is owned by the South Australian Highways Department and used as a rental property. Unsuccessful attempts were made to demolish the garden exit during recent renovations, and it is now sealed with corrugated iron sheeting bolted to the architrave. The kitchen exit has also been sealed.

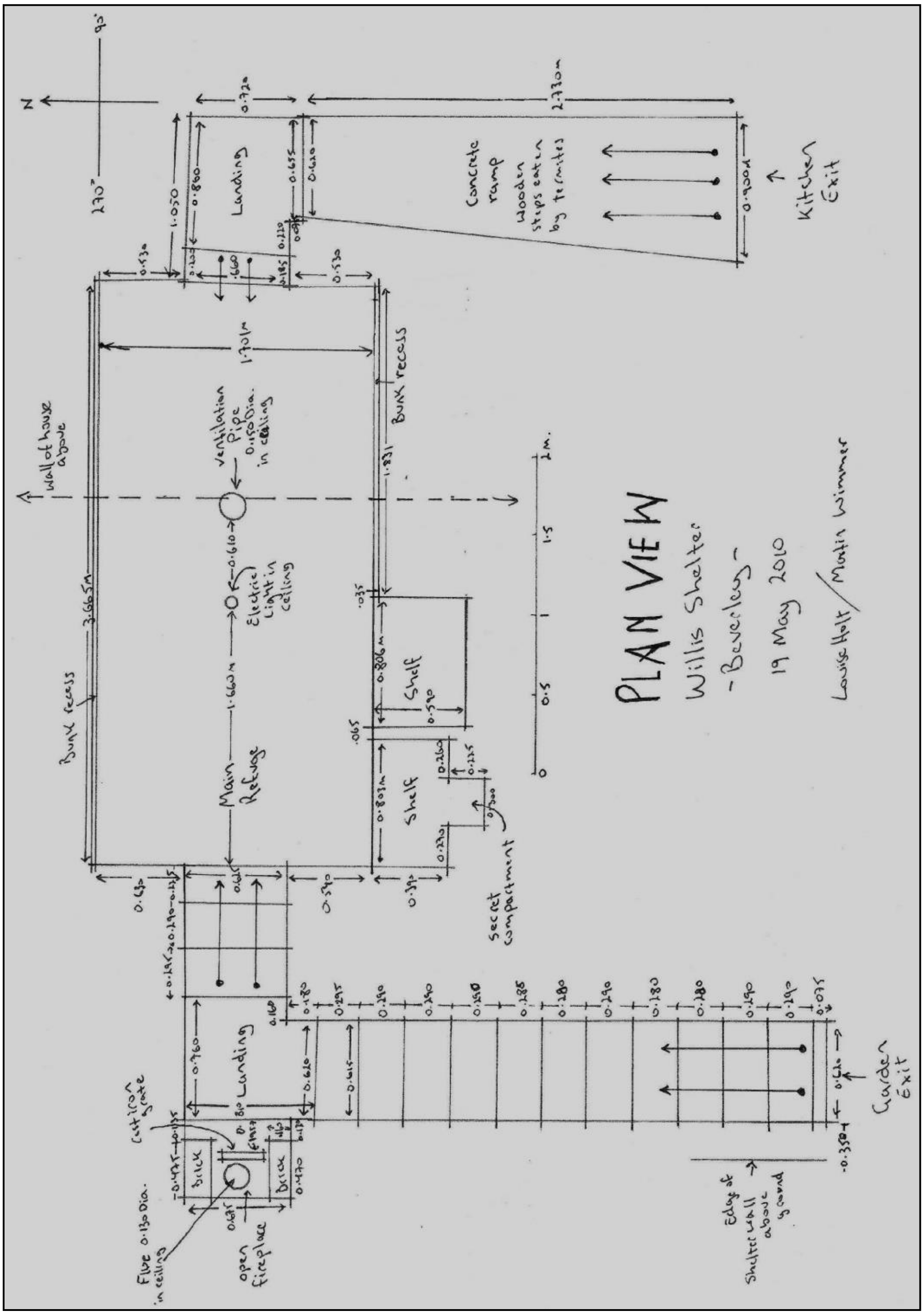


Figure 7-54: Plan of Willis Type V shelter

Another Type V domestic shelter was constructed on the grounds of business manager Lesley Morrison Harley's palatial split-level house (see Figure 7-55) immediately east of the city centre on Dequetteville Terrace, Kent Town, one of Adelaide's blue ribbon addresses (CT636/Folio167). The shelter, positioned at the rear of the premises, abuts a retaining wall 38 cm (14.96 in.) wide and put in place after the basement level of the house was excavated—this formed the southern wall of the shelter. The shelter is 1.10 m (3.61 ft) from the back wall of the house and appears to be constructed of brick, dressed stone and concrete.

Figure 7-55: Rear of Harley home. Fenced Type V shelter location arrowed (Wimmer 2013)

This Type V is unusual in the context of others recorded during this research in that it has a vaulted roof constructed of two courses of bricks with a thickness of 27.5 cm (10.83 in.) (see Figure 7-57), yet it complied with the Code which required arching brickwork for overhead protection. The structure had a floor area of 4.95 m² (53.27 ft²) and a volume of approximately 8.91 m³ (314.83 ft³), large enough for six to eight adults to shelter in comfort.

The house, owned by the Country Women's Association since 1951, was undergoing renovations in 2012 during which time the shelter was largely demolished. The remains have been stabilised with rendering and landscaped to create a sunken garden (see Figure 10-3). These renovations have covered over the arched doorway which faced the house, and which was originally 3.6 m (11.81 ft) from its basement level exit and 7.2 m (23.62 ft) from its ground floor exit. Very few diagnostic features remain of this Type V, but it appears to have been the least complex of all of those archaeologically recorded. It lacks a traversed entry, however, its location only 1 m from the rear wall of the house would ensure it was largely protected from blast (this type of positioning was recommended by the Home Office in 1939), but not from being smothered by rubble. The off-set doorway would also provide some protection against blast, with occupants being able to shelter behind the thick retaining wall alongside the exit (arrowed in Figure 7-56). The former arched doorway is an unusual feature for a shelter, but aesthetically matches the vaulted ceiling. This feature also indicates that the structure may have originally been a cellar that was later converted to a shelter (so really a Type VI rather than Type V). However, as testimonials refer to it only as a shelter, it is consequently recorded here as a Type V. More images and information about this shelter can be found in the Harley Type V folder in Appendix 6 of the accompanying CD.

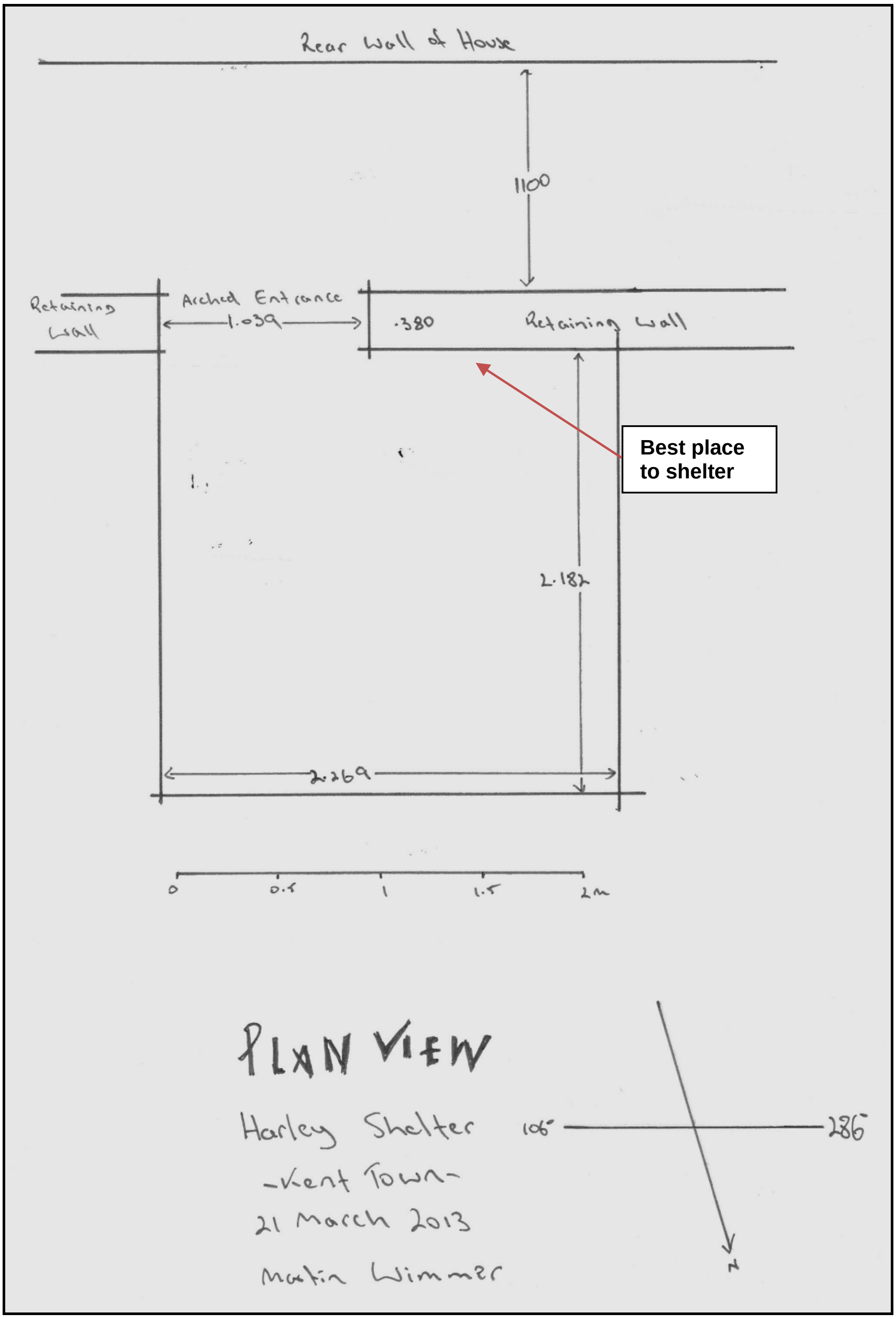


Figure 7-56: Plan of Harley Type V shelter

Figure 7-57: Detail of roof vault showing two courses of bricks, Harley Type V shelter (Wimmer 2013)

7.6.3 The archaeological potential of Type V structures

Due to the robust nature of Type V shelters and the expense involved in completely demolishing them, there is a high probability that sub-surface remains will survive demolition. The Fleming shelter demonstrates this principle.

The Fleming sisters were school teachers who lived together in a house on South Road, Edwardstown. Their home lay under the presumed flight path of aircraft attacking Adelaide from carriers stationed south off Kangaroo Island. In July 1988, staff and volunteers from the Mitcham Heritage Centre conducted an amateur archaeological investigation of the ruins of an historic house (formerly the Fleming's) which had been demolished to ground level in 1976 and then backfilled with demolition rubble (Maggie Ragless 2007, pers. comm. 7

September, Mitcham Historical Society). During the investigation, a portion of what is thought to have been the property's air raid shelter was discovered outside the original footings of the house and adjacent to the cellar which was under the house proper. The concrete walled shelter seems to have been of a type that was partially buried, and an oral history recalled that it had a wooden beam and earth-mound roof (Brian 1989: 98).

The stratigraphy of the contents indicated that the shelter may have been re-used as a storeroom after the war. Various documents and photographs were recovered from the bottom layer of deposits in the shelter. The shelter walls were formed on wide concrete footings (possibly supporting a wooden floor) and bore the imprint of the rough-cut wooden boards used in their construction. Access into the shelter had been through a doorway 81 cm (31.89 in.) wide, leading from the cellar. The known dimensions of the shelter are 2.7 m x 3 m (8.86 ft x 9.84 ft) giving it an area of 8.10 m^2 (87.18 ft^2). The structure's dimensions would allow up to 13 people to shelter comfortably in it. The concrete floor was 1.4 m (4.59 ft) below ground level (Brian 1989: 98).

Figure 7-58: Remains of the Fleming shelter
(Mitcham Heritage Centre 1988)

7.6.4 Archaeological analysis of domestic Type V shelters

Seven domestic Type V shelters were archaeologically recorded. Also included in the analysis is data gathered during the excavation of the Fleming shelter in 1988. Information derived from oral histories relating to a further nineteen Type V shelters is used only in so far as determining the material used in building the shelters, whether they were completely buried or not, their distance from the house, the number of entrances and their orientation. In order to obtain a more accurate account of the dimensions of what was actually built, recollections about the size of shelters are not considered in this analysis.

7.6.4.1 Dimensions

Whereas Type I, II, III and IV shelters were restricted in size by virtue of the sort of structures they were, Type V proved to be the most diverse in design and dimensions because of the materials they were constructed of and the way they could be formed. Their diversity challenged pre-existing notions of wealth and construction industry expertise because their size and design did not always match their owner's occupations and wealth. For instance, the smallest was constructed by a builder (Lamberton) who ordinarily may have been expected to erect a large and over-engineered structure for himself, whilst the most complex was constructed by a greengrocer (Willis) who may have been seen not to have the resources or skills necessary to undertake a large scale excavation and construction project (see section 8.2.4.1 for an analysis of shelter dimensions as markers of fear).

Table 7-7: Dimensions of main refuge in recorded Type V shelters

Owner	Length of Main Refuge	Width of Main Refuge	Height of Main Refuge	Depth to Refuge Floor
Lamberton	**1.870 m (6.14 ft)**	**1.226 m (4.15 ft)**	**1.768 m (5.80 ft)**	**1.500 m (4.92 ft)**
Chapman*	**1.855 m (6.09 ft)**	**1.471 m (4.83 ft)**	**1.729 m (5.67 ft)**	**0.846 m (2.78 ft)**
Griff	**3.966 m (13.01 ft)**	**1.080 m (3.54 ft)**	**2.167 m (7.11 ft)**	**1.147 m (3.76 ft)**
Harley	**2.269 m (7.44 ft)**	**2.182 m (7.16 ft)**	**≈1.800 m (≈5.91 ft)**	**2.200 m (7.21 ft)**
Pierce	**4.261 m (13.98 ft)**	**1.281 m (4.20 ft)**	**1.809 m (5.94 ft)**	**1.545 m (5.07 ft)**
Jackson	**3.102 m (10.18 ft)**	**1.904 m (6.25 ft)**	**2.285 m (7.50 ft)**	**2.960 m (9.71 ft)**
Willis	**3.665 m (12.02 ft)**	**1.701 m (5.58 ft)**	**2.080 m (6.82 ft)**	**3.360 m (11.02 ft)**
Fleming**	**3.000 m (9.84 ft)**	**2.700 m (8.86 ft)**	**NA**	**1.400 m (4.95 ft)**

*Country SA shelter **Recorded by an avocational group

Table 7-7 depicts the dimensions of the main refuge in each archaeologically recorded shelter. It does not consider the dimensions of stairwells and landings within these structures. Not all structures had enclosed stairwells or landings, but all had a main refuge, so this was used as a point of comparison. The height of shelters with curved roofs (Lamberton, Chapman, Harley and Willis) is calculated on the highest point of the ceiling. Type Vs could be as narrow as 1.08 m (Griff) or as wide as 2.7 m (Fleming). They could also be as long as 4.26 m (Pierce) or as short as 1.86 m (Chapman). They were the deepest of all shelter types recorded, with the floor of the Willis shelter 3.36 m below ground level, but they could also be built completely above ground like the Morrell's.

7.6.4.2 Floor space and volume

It was found that the dimensions of most Type Vs referenced articles of the Code. The Code specified how much space (7 ft^2 of floor area or 56 ft^3 capacity) each person required in shelters which were adequately ventilated and intended to be used by less than 12 people.

Table 7-8: Area and volume of main refuge in recorded Type V shelters

Owner	Area	Persons/ ft^2	Volume	Persons/ ft^3
Lamberton	**2.293 m^2 (25.48 ft^2)**	**3.6**	**4.053 m^3 (147.79 ft^3)**	**2.6**
Chapman*	**2.729 m^2 (29.42 ft^2)**	**4.2**	**4.718 m^3 (166.78 ft^3)**	**3.0**
Griff	**4.283 m^2 (46.06 ft^2)**	**6.6**	**9.282 m^3 (327.45 ft^3)**	**5.9**
Harley	**4.951 m^2 (53.27 ft^2)**	**7.6**	**≈8.912 m^3 (≈314.83 ft^3)**	**≈5.6**
Pierce	**5.458 m^2 (58.72 ft^2)**	**8.4**	**9.874 m^3 (348.77 ft^3)**	**6.2**
Jackson	**5.906 m^2 (63.63 ft^2)**	**9.1**	**13.496 m^3 (477.19 ft^3)**	**8.5**
Willis	**6.234 m^2 (67.07 ft^2)**	**9.6**	**12.967 m^3 (457.43 ft^3)**	**8.2**
Fleming**	**8.100 m^2 (87.18 ft^2)**	**12.5**	**- -**	**-**

*Country SA shelter **Recorded by an avocational group

Table 7-8 depicts the calculated area and volume of each archaeologically recorded shelter and the number of persons each could accommodate under the

Code. The volume of shelters with curved roofs (Lamberton, Chapman, Harley and Willis) is calculated on the highest point of the ceiling and does not consider the diminishing volume of the arch.

7.6.4.3 Roof

Six (75%) of eight archaeologically recorded Type V shelters had concrete roofs. Only Harley's had brick and Fleming's was reputed to be of galvanised iron and earth. Four of the eight (50%) had vaulted ceilings and three of these were made of concrete. Two of the vaulted concrete roofs were formed on curved iron sheets and one on a wooden mould. All other concrete roofs were flat and formed on a wooden mould.

From oral histories, another five bunker roofs can be characterised. Two were flat and three arched. The flat roofs included one of steel (Morrell's rolled boiler plate) and one of iron sheets covered with earth. The domed roofs included one formed on a half rainwater tank covered with earth, one of concrete and another of unknown construction.

7.6.4.4 Access

Five (63%) of eight archaeologically recorded Type V shelters had stair access, one had a ramp and two could be entered from an occupation level of the dwelling which was also a feature of Type VI shelters. Two of these eight had dual exits, and the remainder had only one.

Oral histories indicate a further four bunkers had steps; and one could be accessed from within the house at ground level. Six also had only one exit and another had two. Steps were more prominent in Type Vs than other shelters because of this type's depth. Steps allowed steeper and quicker access over a shorter distance. The fact that they could also be entered from an occupation level of the house (generally ground or basement level) indicates that many were built adjacent to or against a home.

7.6.4.5 Alignment

The size of the yard did not affect the orientation of this type. All were built in houses with large yards, with 50% of shelters following the lay of the house and the other 50% at right angles to it. No type Vs were recorded in front yards. Six (75%) of archaeologically recorded shelters had entrances that faced the house, two (25%) faced away. Those with two entrances had one which faced the house and another which did not. Type V, like the Type VI, could be built directly under the home, but some, like Griff's, were placed up to 23 m (75.46 ft) from the back door. Oral histories record that they were sometimes built under, and accessed from inside, sheds, such as Williamson's in Prospect.

7.6.4.6 Furnishings

Type V shelters were well furnished, suggesting that they were intended to be lived in or frequented often. This observation is substantiated by the many people who remembered bedding and/or bunks and the archaeological evidence surviving in the physically recorded shelters, such as bolts and alcoves for fold-away bunks (see, for example, Willis and Pierce above in section 7.6.2.4). Furniture such as shelves, benches and bunk alcoves was often built-in, but could also include portable units of the same. The fact that some Type Vs had built-in furniture indicates they were designed from the outset for the worst possible scenario. Two shelters (Jackson [section 7.6.2.2 above] and Willis [section 7.6.2.4 above]) also had electric light. In both instances, the light switches were in the main house, but Willis, with two exits, had a switch at both ends. It is also possible that the people who built this type of structure were factoring in potential secondary uses for them after the war.

7.7 Type VI: Structurally modified rooms

Seventy-five Type VI shelters comprising 35 public and 40 domestic shelters were identified during this research. None were archaeologically recorded. The domestic fraction includes 35 Morrison type table shelters which were purchased by Adelaide residents in the six months to June 1942 (*News* 12 June 1942: 5). It is argued that the Morrisons were used to fortify existing rooms in domestic homes, hence their inclusion in this section. The Adelaide Morrison table shelters were hand-made locally costing £20 each and weighing 3 cwt when assembled (*News*, 27 May 1942: 6). Their huge expense (largely due to the fact that they were not mass produced) made them unpopular, and their sales fell away sharply six months after the attack on Pearl Harbour when the initial fear of bombardment lessened and cheaper alternatives were sought.

Structurally modifying a room could be a simple and economical option for structural defence, and was practised at home, in the work place and in public spaces. Often the process involved nothing more than converting a room by outfitting it with emergency supplies and bedding, or bracing a cellar or basement with wood or steel beams. ARP guides recommended getting advice from a structural engineer or builder before proceeding with any structural modifications. Such measures could easily be reversed once hostilities ceased, leaving no trace of the former structural precautions. Consequently, these are the rarest type of shelter and have left few archaeological footprints.

7.7.1 Public conversions

Every public building in Adelaide was obliged by the Act to have protection for its staff and patrons against air raids. The simplest and cheapest way to comply was to reinforce a basement. As early as August 1941, coloured plans showing the location and layout of 32 basements which could be used as shelters in Adelaide's city buildings were being prepared (*Mail*, 2 August 1941: 2). There is a high likelihood that the five city basement shelters and two ARP communications shelters, described below, formed part of the original 32 surveyed. Consequently, these seven are not counted as additional shelters even though this possibility has not been substantiated.

Conrad Hamann (1942: 1-2), British Ministry of Home Security, on his visit to Adelaide in February 1942, toured a number of key public buildings and advised on their individual structural defence. These included Myer Emporium, a department store in Rundle Street which was advised to fortify a portion of its basement with a frame structure. The basement, however, was not large enough to potentially shelter everyone in the store at any one time, so Hamann also suggested supplementing the basement refuge with surface shelters along North Terrace. Pipe shelters were placed along the northern side of North Terrace (see Figures 7-19 and 7-20), but no record exists of them being placed on the southern side alongside the Myer building. The Adelaide Town Hall housed the Corporation of Adelaide offices and had already strengthened its basement with wooden bracing by the time of Hamann's visit, which he concluded was a very good modification. He also approved the basement modification of the Eagle Chambers, Pirie Street. Unfortunately, two buildings in Grenfell St—the Brookman Building and Goode, Durrant and Murray—were deemed to be too expensive to modify, and he suggested instead that it would be much cheaper to install external surface shelters. Again, no record exists to substantiate whether these surface shelters were installed.

In Hamann's (1942: 2) opinion, the types of buildings that were generally available in the Adelaide CBD were not entirely satisfactory for modification against air attack. The most suitable premises were large framed buildings, such as that of the new Savings Bank of South Australia and the Bank of New South Wales. He further suggested that all potential in-door shelters needed at least three concrete floors and a roof above, to allow a bomb to penetrate and detonate before it reached the refuge.

7.7.1.1 ARP emergency services network Type VI shelters

Within twelve months of Hamann's suggestions, the ARP emergency services network had been established. The service's central Type VI headquarters was set up in the converted basement of the AMP building (see Figure 7-59) with an inner-city Type VI Sub-Control Centre operating from the converted basement of the Savings Bank of South Australia (see Figure 7-60). These connected to the seven Type V Sub-Control Centres in outlying suburbs (see section 7.6.1.1 above). The plans for both Type VI shelters were drawn in December 1941, approximately one week after the attack on Pearl Harbour and just prior to Hamann's visit.

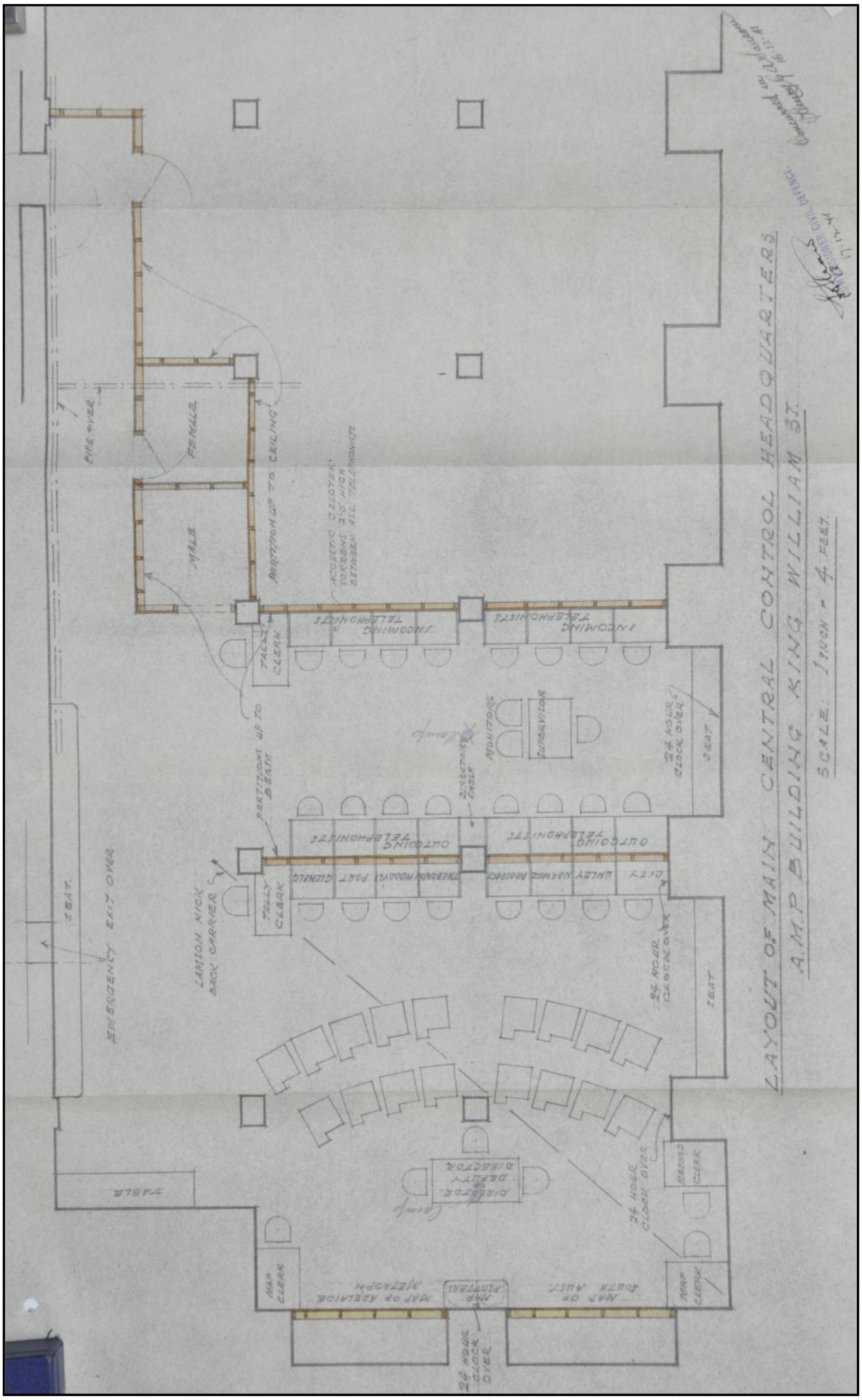


Figure 7-59: December 1941 Plan of ARP Central Control Headquarters in Adelaide CBD (GRG 53/21/00000 Unit Id 705, 3115/41)

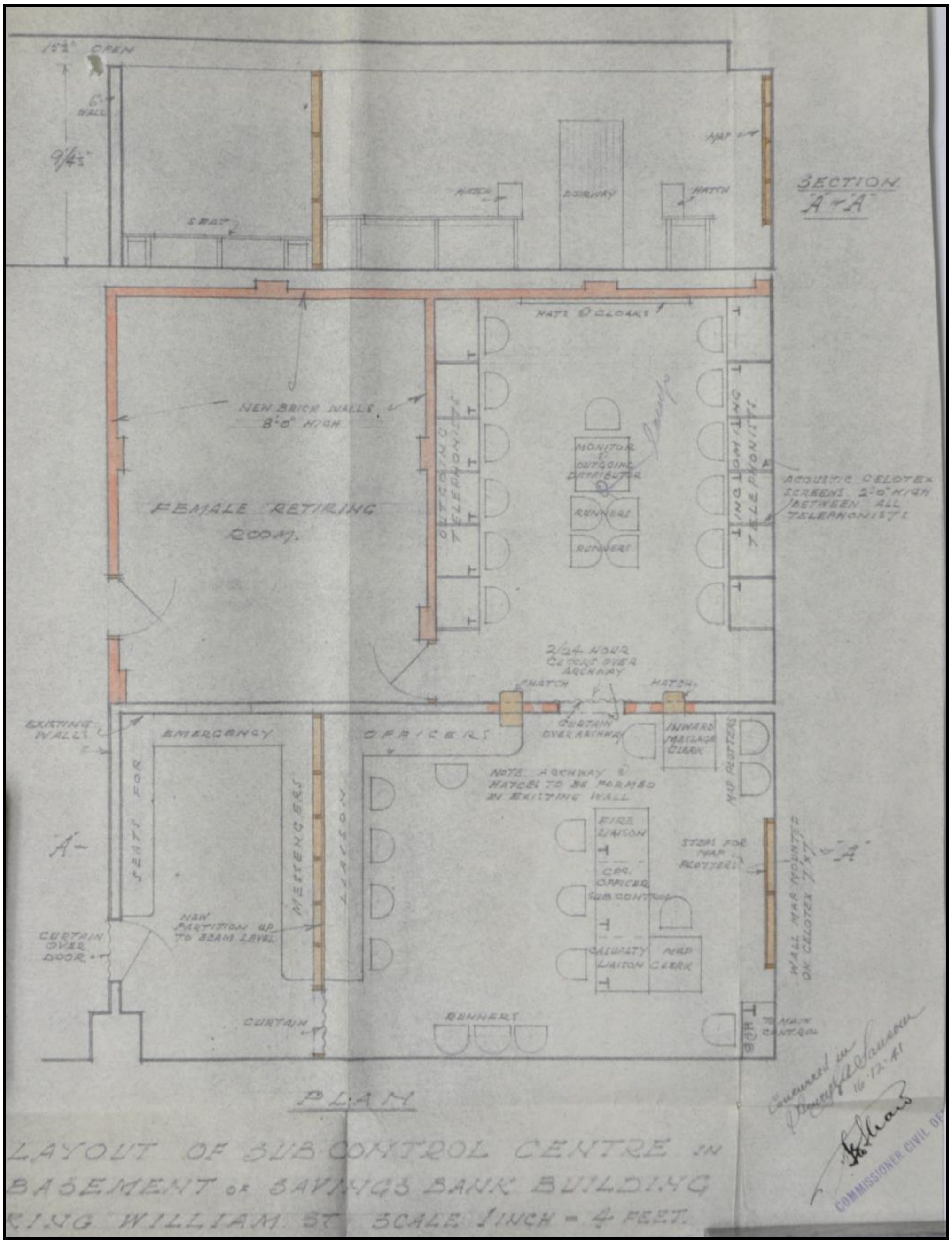


Figure 7-60: December 1941 Plan of ARP Sub-Control Centre in Adelaide CBD (GRG 53/21/00000 Unit Id 705, 3115/41)

7.7.1.2 Public venues

Both the Adelaide and Norwood Ovals had Type VI shelters for their patrons and staff. The Sir Edwin Smith Stand at Adelaide Oval had been planned for conversion into a first aid post with the help of architects Russell and Yelland in June 1940 (S98/7/1 – sheet 2), eighteen months before the Japanese advance toward Australia. Others wasted no time once the Act and Code were gazetted. The custodians of Norwood Oval also asked Russell and Yelland to supply drawings in March 1942, with the brief of converting the grandstand into a first aid post for Casualty Services (see Figure 7-61). This involved creating numerous air locks, sandbagging entrances and windows, erecting new walls, and dismantling or strengthening portions of old walls.

7.7.1.3 Work Places

Only one Type VI was recorded as being constructed for workers. Near the wharfs in Port Adelaide, the basement of a warehouse was fortified for the protection of 300 dockside workers (*Mail*, 28 March 1942: 5).

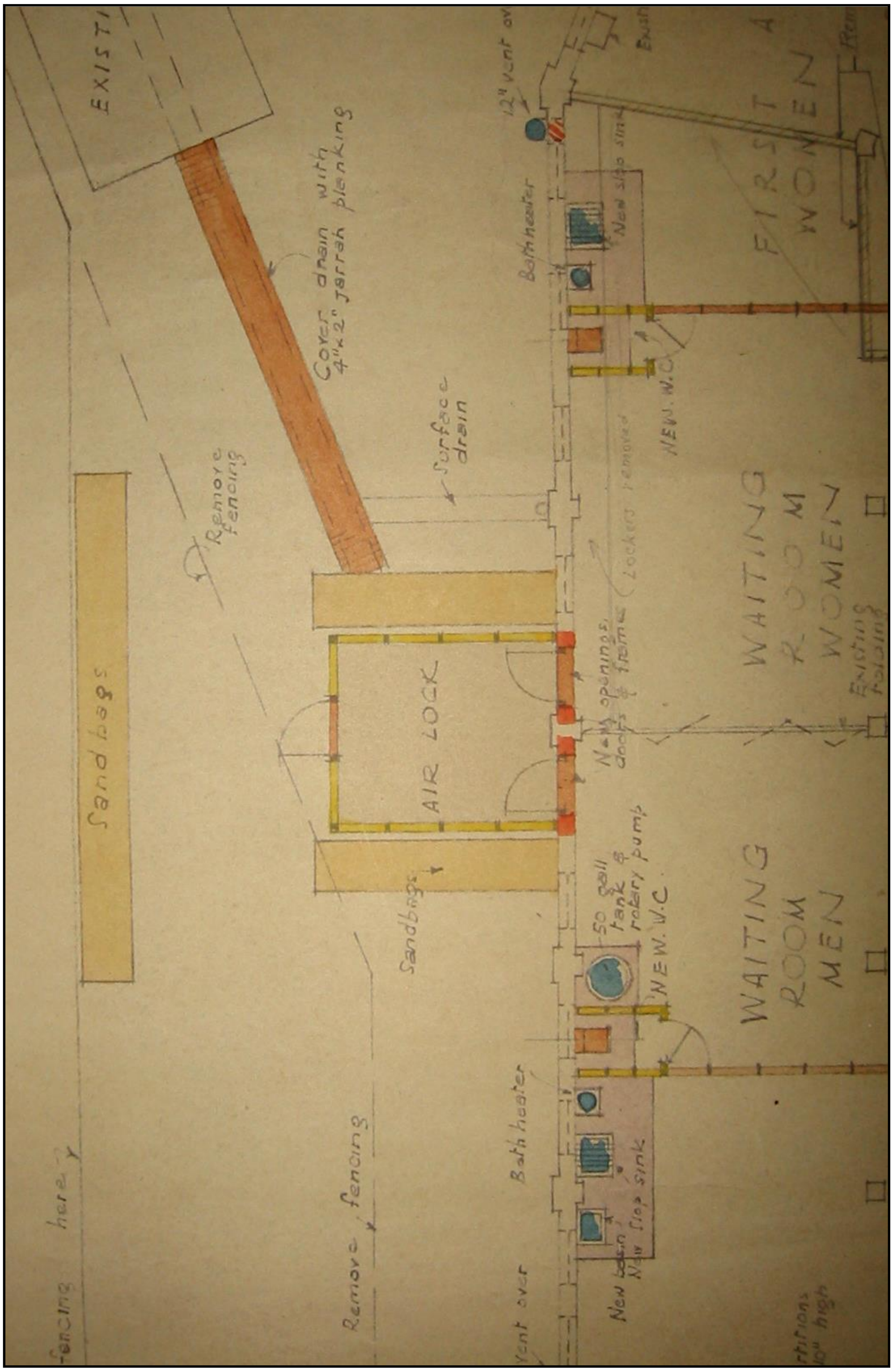


Figure 7-61: Norwood Oval grandstand showing proposed modifications, March 1942 (S98/6/1)

7.7.2 Domestic conversions

Home owners had the option of fortifying their own premises, or employing the services of an architect or engineer to advise them. Architects and engineers were obligated to adhere to the Code when supplying shelter designs, as is evidenced by the before and after versions of a plan for a domestic Type VI shelter in Marryatville. In February 1942, the Scarfe family, original partners in the Harris Scarfe Ltd store, received two designs for an indoor air raid shelter from local architects Russell and Yelland for their property *Eden Park*. One design, labelled "Proposed Raid Shelter", is dated February 1942 (see S98/192/1).

This design seems to be for a shelter constructed of nothing more than 1.5 in. planking, a 'solid' door, a 'sheathe' door, and wooden bearers and studs. Its flimsy appearance suggests that it may have been designed to be installed inside *Eden Park* by modifying an existing room, using the house walls as the primary form of protection. The wooden panels were designed to arrest any debris from entering the refuge. Dated February 1942, the shelter was most probably designed before the Code came into force. A second set of plans labelled "Proposed Indoor Air Raid Shelter", although undated, would indicate that the previous "Proposed Raid Shelter" was re-designed after the Code was gazetted, for it seems to be a more strongly fortified structure (see S98/192/2a).

From this second set of sketches, it is obvious that the shelter abuts two interior walls and is sandbagged on three sides to a height of 6 ft which is the full height of the shelter. There is a 6 ft high baffle wall of sandbags in front of the entrance to create a traversed entry, and the ceiling width has been increased to 2 in. It is not known whether this shelter was constructed, but its design adds to our understanding of the range of options considered and types of material available for home defence.

A short distance from the Scarfe mansion lived the Lees. John Lee (2010, pers. comm. 21 October, stepson of shelter builder), born in 1945, had very clear post-war childhood memories of the reinforced cellar at his house in Augusta Street, Magill. John recollected that in the cellar:

> …were big wooden chests with vegemite and condensed milk that lasted into the 1950s… [there was also] a WWI 303 rifle to shoot Japs if they came. The ceiling was reinforced with railway lines of steel.

The Lee cellar had two exits, one into the house and one into the yard. His impression in the immediate post-war years was that "everyone had a cellar to go to if bombs were going to drop." His recollections also indicate that the defensive response was not only passive, but that some people protected themselves with firearms as well.

A further example of fortifying an existing room comes from the suburb of St Peters where a home had its hallway walls thickened and its ceiling reinforced. So solid and well finished was this structural modification that it was still in place in June 2010 (Dale 2010, pers. comm. 15 June, participant in radio talk back program).

7.7.3 Archaeological analysis of Type VI domestic shelters

Forty domestic Type VI shelters were recorded during this study, with all data being obtained through testimonial and archival sources; none were archaeologically recorded. Aside from the sales records of the 35 Morrison shelters, two sets of plans (the Scarfe's) and only vague recollections of another three shelters have come to light. Very little data is available for analysis as a consequence.

7.7.5 Construction

7.7.5.1 Location of modified rooms

The data shows that 40% of modified rooms not using Morrison shelters were cellars. However, cellars were not always supported as being ideal in the ARP literature as they were difficult to secure against gas (which tends to stay low to the ground and spills into crevices), falling debris (most Adelaide homes of the time would have had soft pine floorboards forming the roof of the cellar), and water (from burst mains)—see State Emergency Council for Civil defence, Victoria (1941: 20-21) and A Group of Australian Scientists (1940: 17). The Lee shelter, with its steel reinforced ceiling and two exits, may have overcome some of these criticisms. One of Scarfe's internal room designs, the exterior of which is shown lined with sandbags, fits with advice given by the Blind Self-Aid Society of SA (n.d.: 6-7). The Scarfe's modified shelter design also included a sandbag baffle wall to create a traversed entry which would have provided the 18 in. earth walls called for in the Code.

The best refuge, however, was the strengthened hallway in St Peters. Most ARP publications agreed that middle rooms with the least amount of glass, a sturdy ceiling and multiple exits protected by walls of outer rooms, were the best choice—see Bartlett (n.d.: 8), State Emergency Council for Civil defence, Victoria (1941: 20-21) and Blind Self-Aid Society of SA (n.d.: 6-7).

It is unknown how any of the 35 Morrisons were used, or where in the homes they were placed, but they were designed to protect their users from falling debris. Consequently, they could effectively be placed in a cellar or an above ground room to good effect.

7.8 The sum of all fears

The results of the analysis show how people reacted to the expected threat, the range of precautions that were taken, and the extent to which they went to protect themselves. It also tells us of the resources (publications, construction materials and professional advice) available to help home defence. The analysis paints a picture of wartime Adelaide, and the landscape created, as a result of the fear of attack by the aircraft of a hostile nation.

Some of the data sets are incomplete, due the fading memory of those people who interacted with these structures at the time they were built and the small number of surviving structures that could be archaeologically recorded. One complication is that, in the present day, surviving air raid shelters are not usually recognised as such, and their original function and meaning has shifted through at least three generations of re-use, making them difficult to locate. The following chapter will discuss these results in light of the wartime landscape of Adelaide, and the various social and demographic characteristics of shelter builders.

Chapter Eight

Discussion:

Life in Adelaide, South Australia

7 December 1941 – August 1943

I read the news today oh boy
Four thousand holes in Blackburn, Lancashire
And though the holes were rather small
They had to count them all
Now they know how many holes it takes....

The Beatles (A Day in the Life, 1967)

8.1 Five Hundred Holes in Adelaide, South Australia

The military use of aircraft against civilian targets in overseas theatres of war led to a loss of confidence amongst Australian citizens in the ability of the Federal government and armed forces to protect them at home from an industrialised international aggressor. This loss of confidence was exacerbated by the knowledge that Darwin's residents were to be evacuated to more southerly and safer reaches of Australia at that time (see War Cabinet Minute 1578). One local response to this was the development of a unique range of civil defence strategies which permeated all levels of Australian society during WWII. The Japanese attack against the United States of America at Pearl Harbour on 7 December 1941, and Imperial Japan's subsequent push into South-East Asia, led to an intensification of war preparedness in Australia.

A total of 547 shelters were recorded across the six distinct types of structural defence which had been identified and characterised in Adelaide. An additional 39 were recorded in country areas[38]. These types were classified by form, differing levels of sophistication and the quality of protection provided by each. The frequency of all shelter types recorded is represented in Table 8-1.

Table 8-1: Total number of each type of shelter recorded (country SA in red)

	Type I	Type II	Type III	Type IV	Type V	Type VI	Total
Domestic Spaces	**36 + 3**	**15**	**20**	**-**	**29 + 1**	**40**	**140+ 4**
Public Spaces	**267 + 32**	**1**	**-**	**76 + 2**	**28 + 1**	**35**	**407+ 35**
Total	**303 + 35**	**16**	**20**	**76 + 2**	**57 + 2**	**75**	**547+ 39**

[38] See Shelter Database spreadsheet in Appendix 4 of the accompanying CD.

The results of this study not only allow us to make a determination on the size and rarity of the resource, but also provide new data on a wide spectrum of wartime social contingencies. These include people's relationship to the wartime militarised landscape of urban Adelaide, gendered responses to the threat of aerial attack, the effect of previous war experience and military training on domestic shelter construction, the spread of wealth across Adelaide, and the type of construction materials that were available to people of various means in times of severe shortages and restrictions.

8.2 Spatial analysis of domestic shelters against the wartime landscape

Table 8-2 shows the distribution of domestic shelter types across the civil defence divisions of Adelaide. This demonstrates that every Sub-Control Area was represented with shelters. Included in the table for comparison is the country SA data. Fifty-three (37.8%) of the recorded domestic shelters have no location data. Consequently, these cannot be placed in specific Sub-Control Areas. Of these, seventeen are Type III (Anderson) and 35 are Type VI (Morrison) shelters whose existence was revealed in sales figures of those Types. Type IV shelters do not feature in the following analysis as none were recorded in domestic use.

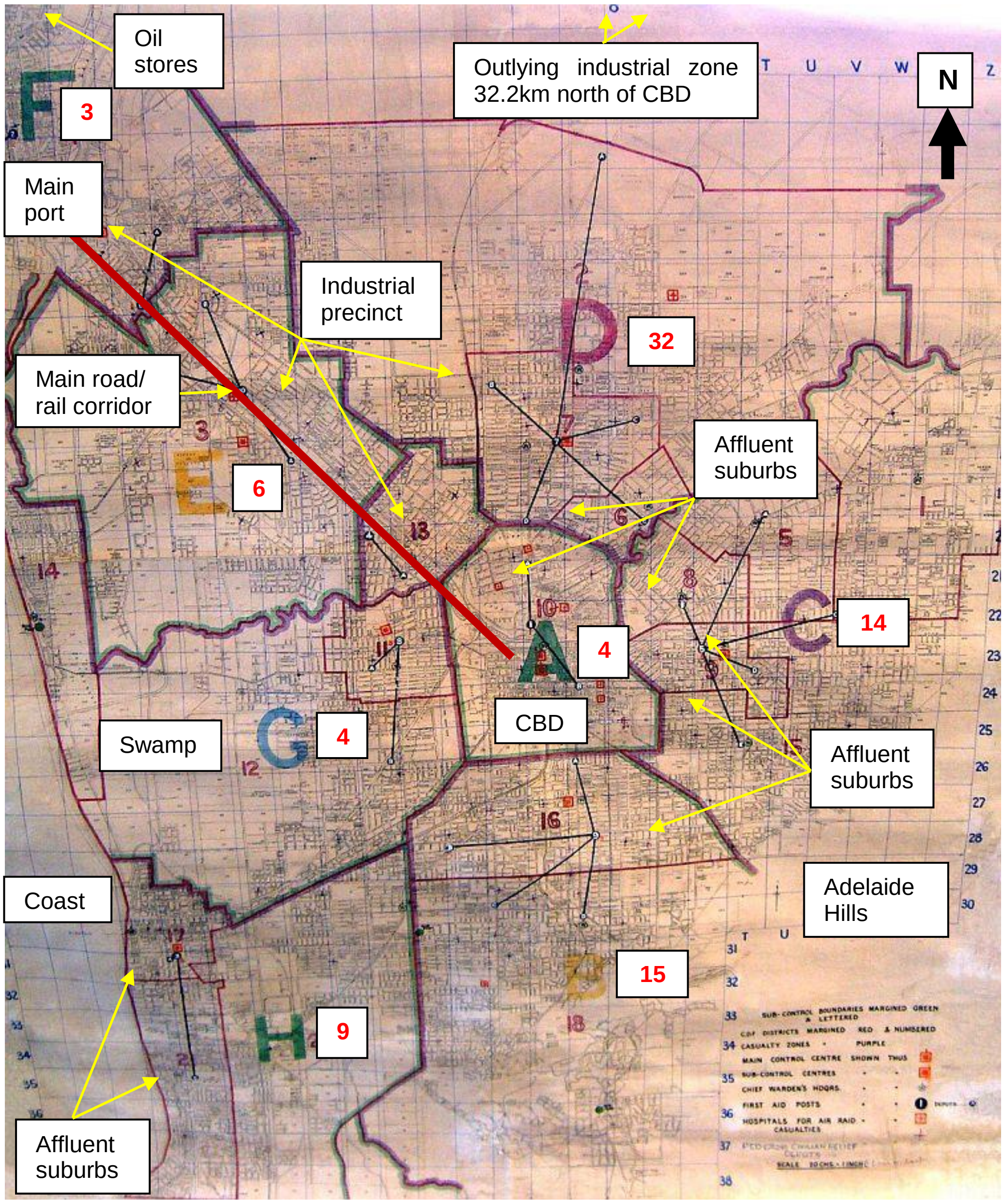
Table 8-2: Frequency of domestic shelter types in Adelaide's Sub-Control Areas

	Type 1	Type II	Type III	Type IV	Type V	Type VI	Total	% of Adelaide Total
Area A	**3**	**-**	**1**	**-**	**-**	**-**	**4**	**2.9**
Area B	**7**	**4**	**1**	**-**	**3**	**-**	**15**	**10.7**
Area C	**1**	**2**	**1**	**-**	**6**	**4**	**14**	**10.0**
Area D	**18**	**6**	**-**	**-**	**7**	**1**	**32**	**22.9**
Area E	**1**	**-**	**-**	**-**	**5**	**-**	**6**	**4.3**
Area F	**1**	**-**	**-**	**-**	**2**	**-**	**3**	**2.1**
Area G	**2**	**1**	**-**	**-**	**1**	**-**	**4**	**2.9**
Area H	**2**	**2**	**-**	**-**	**5**	**-**	**9**	**6.4**
Unknown Location	**1**	**-**	**17**	**-**	**-**	**35**	**53**	**37.8**
Adelaide Total	**36**	**15**	**20**	**-**	**29**	**40**	**140**	**100.0**
% of Adelaide Total	**25.7**	**10.7**	**14.3**	**-**	**20.7**	**28.6**	**100.0**	
Country SA	**3**	**-**	**-**	**-**	**1**	**-**	**4**	**-**
SA Total	**39**	**15**	**20**	**-**	**30**	**40**	**144**	**-**

Map 8-1 shows the spatial relationship of various social and landscape elements of Adelaide during the war years. At the start of WWII, Adelaide's population was approximately one-quarter of what it is in the early twenty-first century, and it occupied a proportionately reduced area on the Adelaide Plain. When viewed from the air in the early 1940s, the layout would have resembled a horseshoe with its apex east of the CBD at Norwood and Burnside (Sub-Control Area C). One end of this horseshoe stretched through Unley (Area B) down to Marion, Brighton and Glenelg (Area H), and the other through Prospect (Area D) and Woodville (Area E) terminating at Port Adelaide (Area F). Large tracts of land west of the CBD were market gardens, swamp and waste land (Area G). South beyond the corporation of Marion and north beyond Prospect lay farmland, and east of Burnside lay the Adelaide Hills. Newer suburbs, such as Hazelwood Park (in Area C) and Sefton Park (in Area D) which were opened up in the late 1920s, had many vacant blocks of land and few fences constructed between neighbours.

Indicated on Map 8-1 with yellow arrows are the main geographical features (hills, coastline and swamp), the location of Port Adelaide (Adelaide's main port), the main industrial precinct[39] and the direction to Adelaide's satellite industrial area (32.2 km north of the CBD) both involved in war and munitions production, as well as the more affluent areas of Adelaide and their spatial relationship to the CBD. The main transport hub (Port Road and its adjacent rail network) linking the manufacturing area with the port and the central railway station in the CBD is depicted on the map as a bold red line. Also depicted is the number of air raid shelters that were recorded in each Sub-Control Area (indicated as a red number to the right of each Sub-Control Area letter).

[39] This area was identified as Target Area 1 during WWII because of its heavy industry and associated transport hubs (Laurie Shields 2008, pers. comm. 5 December, Port Adelaide Historical Society).

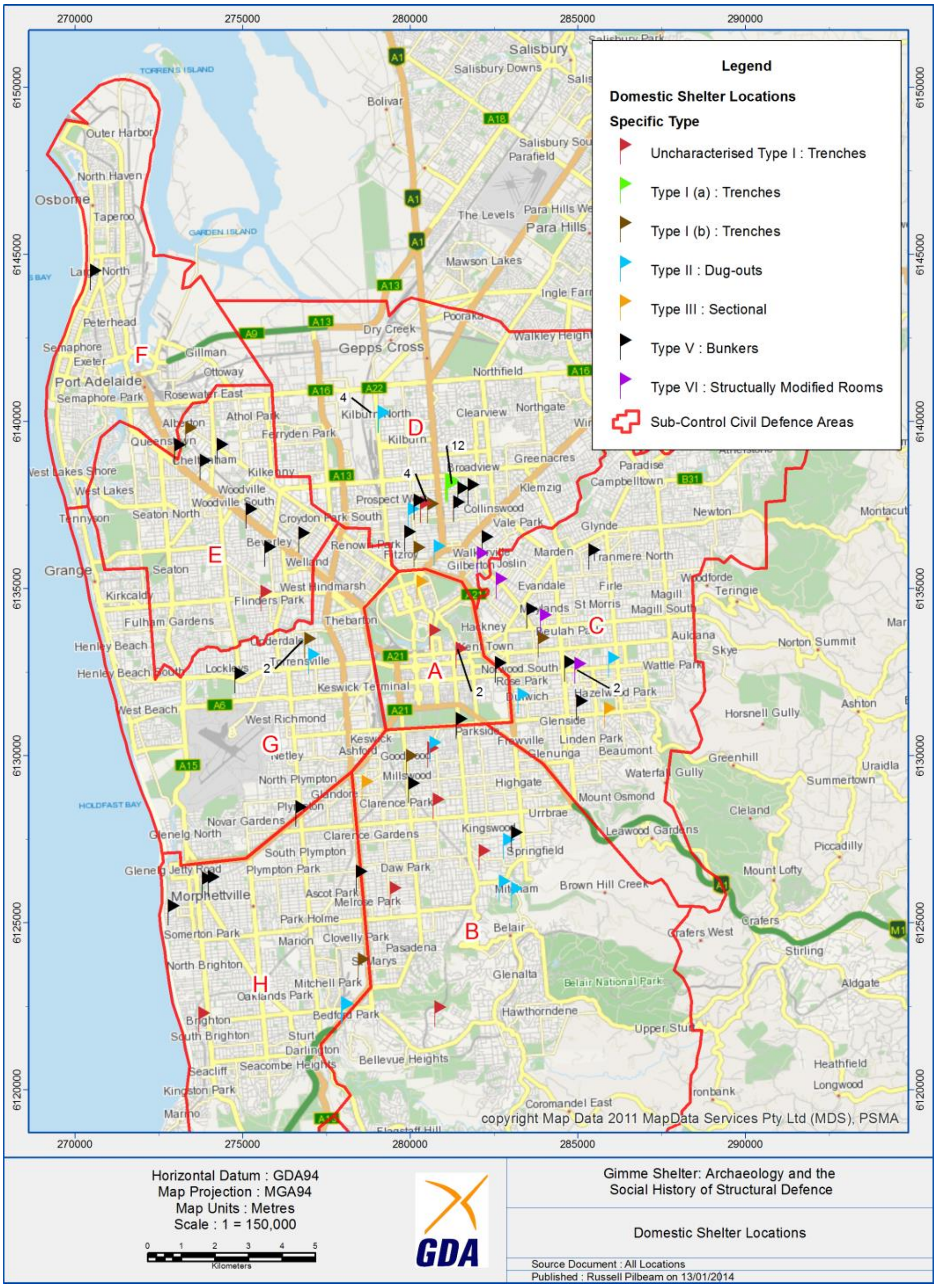


Map 8-1: Wartime map of Adelaide showing the spatial relationship of its various elements including the ARP Sub-Control Areas and the number of domestic shelters recorded in each (http://mapco.net/adelwar/adelwar.htm)

The square mile of the CBD housed parliament, police headquarters, a military barracks, the central railway station, the central bus station, the main hospital and major telecommunications networks. Adelaide's wartime manufacturing industries included in Area E: Pope Products Ltd producing munitions and aircraft components, State Small Arms Ammunition factories in Woodville and Hendon, a

Commonwealth munitions and pyrotechnics factory in Cheltenham (S348/1), and automobile manufacturer General Motors Holden in Woodville; in area D: a fuse and cartridge case factory in Finsbury (*Sunday Mail*, 29 January 1972: 79; Marsden 1977: 210-214), gas storage cylinders, ammunition and aircraft parts in Kilburn (Lamshed n.d.: 108), the Islington Railway Workshops, and British Tube Mills (*Sunday Mail*, 29 January 1972: 79); in Area F: Geo. Bolton manufacturing aerial torpedo percussion caps and machine gun trigger spring tensioners in Semaphore (Whitaker 2012: 44), and the huge oil/petroleum storage facilities at Peterhead (*Sunday Mail*, 22 January 1972: 34). Operating in the northern satellite suburbs were a Commonwealth explosives and munitions filling factory at Salisbury (S348/1) and explosives depots at Smithfield and Penfield (*Sunday Mail*, 29 January 1972: 79; Lewis 1980: 207).

Map series 8-2 to 8-7 overlay the wartime Sub-Control Areas and those WWII domestic shelters whose street number and address is known (n=83) onto a modern day map of Adelaide, using ArcGIS applications for greater location accuracy. Unfortunately, given the greatly changed cadastral alignments, altered topography, amalgamated council boundaries of Adelaide since WWII and poor quality existing maps from the war, an exact fit of wartime boundaries could not be achieved. The outcome is that some shelters, especially those on divisional borders and which were originally in one Sub-Control Area now appear on the maps to be in an adjacent Area. Regardless, the maps still provide a visual representation of the spatial distribution and patterning of the shelters across Adelaide.



Map 8-2: Spread of domestic shelter types across Adelaide.

8.2.1 Type I spatial distribution

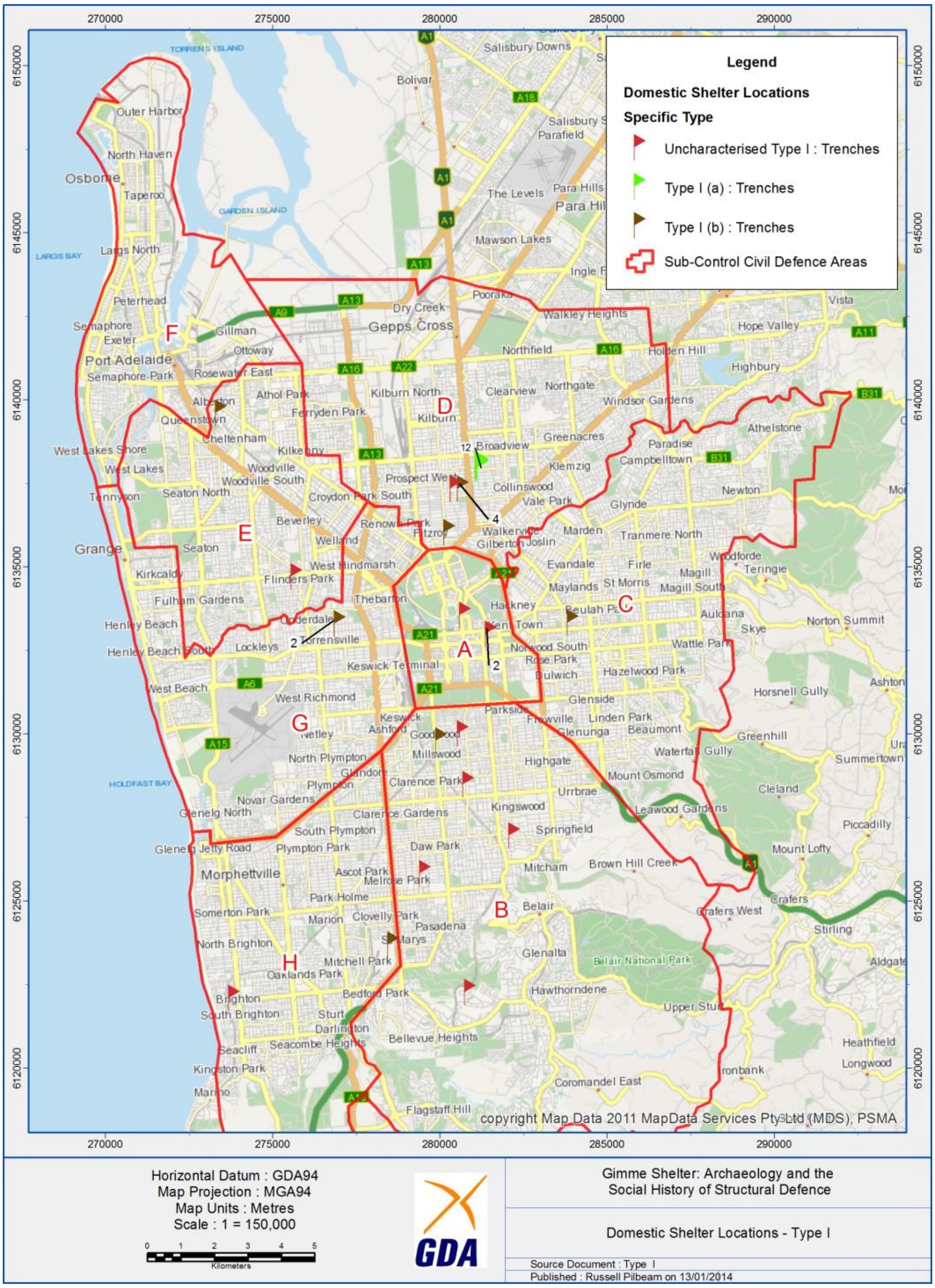
Table 8-3 demonstrates that Type I(a) trenches were only recorded in Areas B and D; Type I(b) trenches were recorded in all areas except Areas A and E; and Type I shelters that could not be further characterised as either Type I(a) or Type I(b) were recorded in all areas except Areas C and F. Of the six domestic shelter types, the data suggests that Type I was the only type constructed in all Sub-Control Areas of Adelaide.

Table 8-3: Distribution of Type I shelters across Adelaide Sub-Control Areas

	Type I(a)	Type 1(b)	Uncharacterised Type I	Total
Area A			3	3
Area B	1	1	5	7
Area C		1		1
Area D	12	2	4	18
Area E			1	1
Area F		1		1
Area G		1	1	2
Area H		1	1	2
Unknown Location		1		1
Country SA		3		3
Total	13	8 + 3	15	36 + 3

The spread of this Type across Adelaide can be interpreted in the following manner. Only three (8.3%) Type Is were recorded in Sub-Control Area A; one of these was on the bank of the River Torrens (Jolly's) and two others on vacant land off Tavistock Lane. The lack of domestic Type I shelters in the most densely populated area of Adelaide may be explained variously by the availability of many public shelters in the CBD and the small size of the Sub-Control Area. There was a notable lack of space in which to dig private shelters in the CBD: most dwellings were workers' cottages and high density dwellings with tiny gardens and no space or access to effect large excavations and build protective structures. Many of these cottages were built right up to the front fence or almost directly on the footpath, leaving no room at the front of the dwelling for a shelter either.

These observations do not, however, explain the absence of Type I shelters away from the CBD in North Adelaide (also covered by Area A). Here, larger homes and gardens would have proven ideal ground for their construction, and there was less public protection available (for example, the shelters in Wellington Square could accommodate only 120 people and the Civilian Relief Centres operating at various churches only 20 to 30 people each). The residents of Areas E and F (with only one Type I recorded in each area) seemed to have relied on sturdier types and public infrastructure for their protection in response to their proximity to the industrial targets and their associated transport hubs (see Table 8-2 and section 8.2.4). Area D, with its heavy industry and reputed to be the best prepared area in Adelaide, did in fact have the highest number of Type I shelters (50% of the sample [n=18]). Area B, the largest of Adelaide's civil defence divisions, had seven of this type (representing 19.4% of the sample).



Map 8-3: Type I shelter distribution across Adelaide

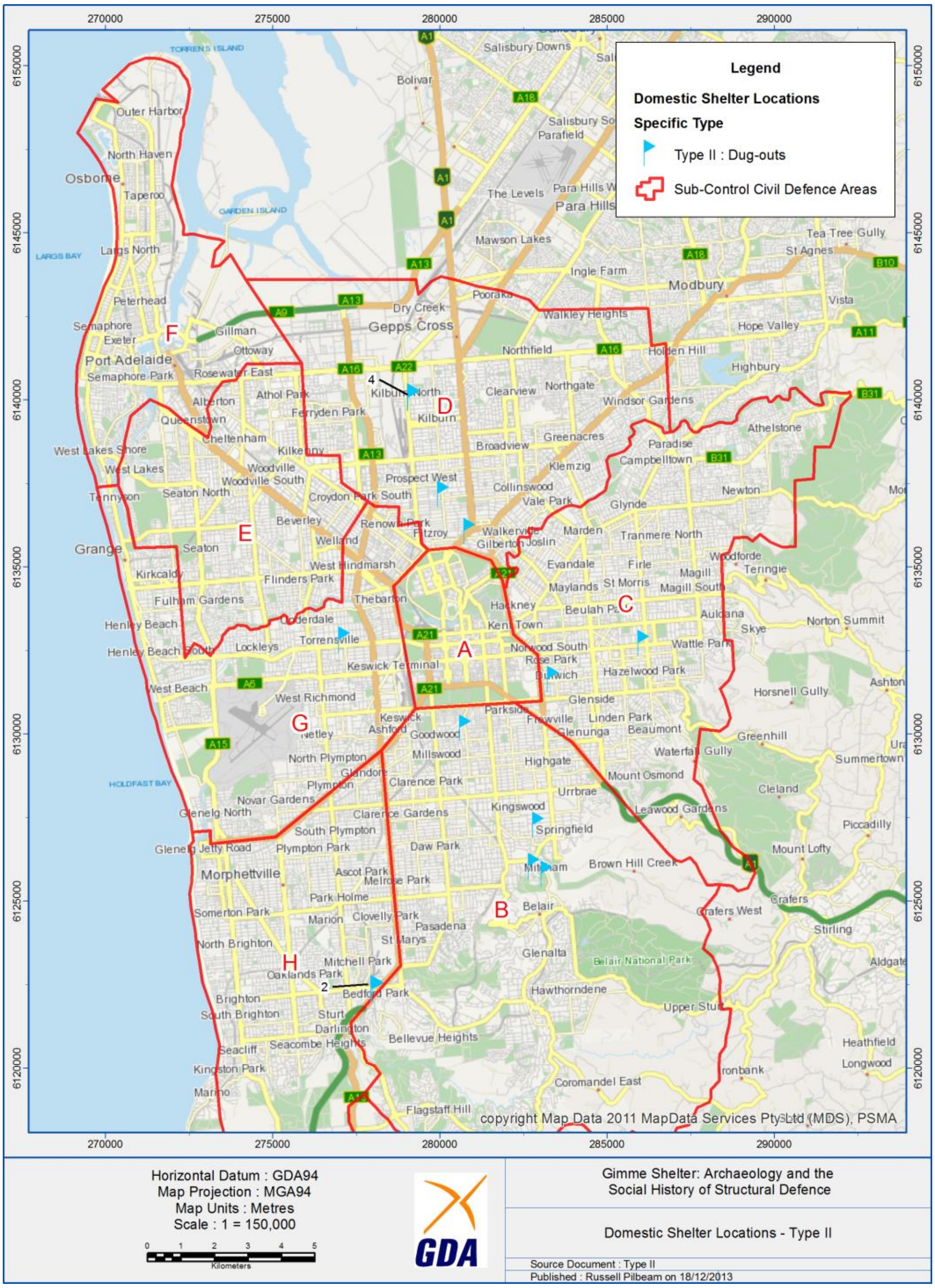
8.2.2 Type II spatial distribution

By grouping Type II shelters according to wartime Sub-Control Areas, Table 8-4 demonstrates the frequency of this type across suburban Adelaide. The table shows that no Type II shelters were recorded in Sub-Control Areas A, E and F. This seems odd in that these were the high risk target areas of the CBD and munitions manufacturing suburbs where bombardment was expected, and that Type II had a proven pedigree in heavy bombardment during WWI. All of these areas, however, were well serviced by public trenches, and the local population may have thought these adequate, or favoured the sturdier Type V instead (see section 8.2.4). Again, the tiny residential allotments in the CBD may have also been a factor restricting the construction of larger private shelters by their occupants.

Table 8-4: Distribution of Type II shelters across Adelaide Sub-Control Areas

Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Total
-	4	2	6	-	-	1	2	15

Sub-Control Area D had the highest number of Type II shelters (40% [n=6] of the sample). This result, however, is skewed because four of the six shelters form part of the same structure on the boundary of four properties in Kilburn adjacent to the heavy industry of the Islington Railway Workshops. Sub-Control Area B had 26.7% (n=4) of recorded dug-outs, Sub-Control Areas C and H each had two (13.3% each), and Sub-Control Area G had one (6.7%).



Map 8-4: Type II shelter distribution across Adelaide

8.2.3 Type III spatial distribution

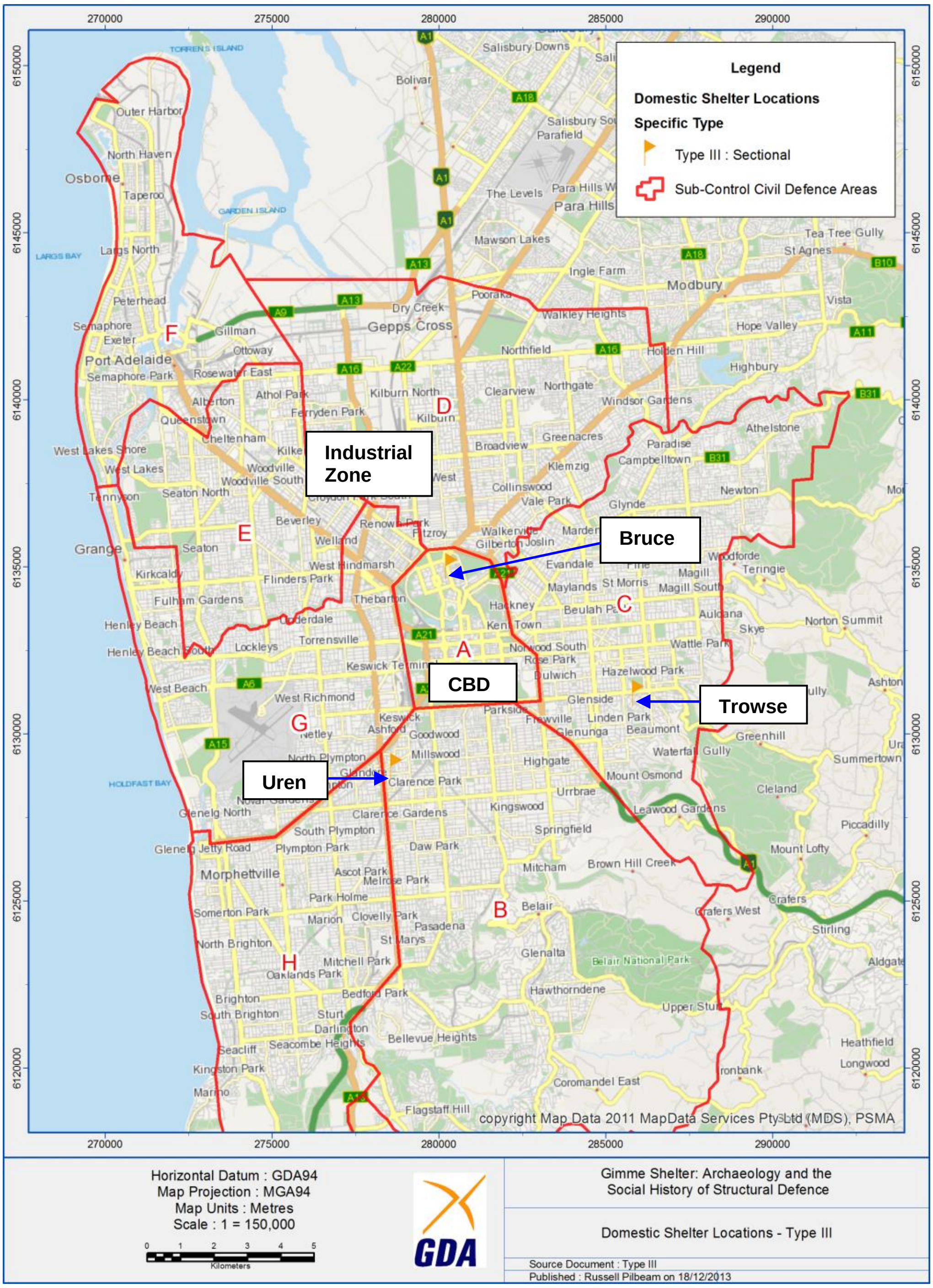
Type III shelters were recorded in only Sub-Control Areas A, B and C (Table 8-5 and Map 8-5). Of the Type IIIs that could be attributed to specific people, Trowse lived in the municipality of Burnside, one of Adelaide's blue ribbon residential areas. Burnside was situated well away from the industrial area of the north-western suburbs and fell under the civil defence jurisdiction of Sub-Control Area C. Given the cost of Anderson shelters in Adelaide, Trowse, and also Bruce's residence in North Adelaide (the northern portion of Sub-Control Area A), are in precisely the locations that one would expect to find Type III shelters. Uren's in Black Forest (Area B) does not entirely fit this wealth-hedged profile. It is constructed well away from the main target areas of Adelaide and, as such, presents a very different method of use to that of the UK Anderson shelters (however, see section 9.4.2.1). Bruce's shelter positioned between the high risk CBD and manufacturing precinct, seems a better choice of structural protection than the trenches of the CBD and is similar to the UK placement of Andersons.

Table 8-5: Distribution of Type III shelters across Adelaide Sub-Control Areas

Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Unknown Location	Total
1	1	1*	-	-	-	-	-	17	20

*single structure comprising two Andersons

At least 17 more of the Type III sold in Adelaide had no known address. However, because of their cost and the known locations of others in Adelaide, there is a high probability that most found their way into the Sub-Control Areas that covered the more affluent suburbs. These include the south-eastern, north-eastern, and eastern suburbs (Areas B and C and the south-eastern portion of Area D), North Adelaide (the northern portion of Area A), and the coastal suburbs of Glenelg and Brighton (Area H)—see Map 8-1.



Map 8-5: Type III shelter distribution across Adelaide

8.2.4 Type V spatial distribution

Domestic Type V shelters were found throughout metropolitan Adelaide, with only the CBD unrepresented—in fact, not even the ARP communications shelters in the CBD were Type V structures. Sub-Control Area D was under the jurisdiction of Mayor and Chief ARP Warden Charlie Williamson, and was purported to be the best prepared in Adelaide (see section 8.2.6 for more information on Mayor Williamson). It certainly had the highest proportion of Type V shelters for a single area—24.1% of the total Adelaide sample, the frequency of which may reflect the mix of heavy war industry and wealth that could be found there. Area C, with 20.7%, and Areas E and H, each with 17.2%, were predicted to have a high number of Type Vs. These included the high risk war industry Area E, and the more affluent parts of Adelaide, Areas C and H. Surprisingly, Area F, with its rail and sea hubs, had only two shelters (6.9%).

Table 8-6: Distribution of Type V shelters across Adelaide Sub-Control Areas

Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Country SA	Total
-	3	6	7	5	2	1	5	1	29+ 1

Both Areas E and F were in the low income belt of Adelaide. The Type Vs in these areas were largely built by owners with some affiliation to the construction or food industries. The true wealth of these individual builders is unknown; however, given their occupations and modest homes, it was unlikely to have been monetary wealth which enabled these structures to be erected, but other physical means and/or know how. Type Vs in these industrial areas are, for the main, clustered along Port Road and the rail line linking the manufacturing zone to Port Adelaide and the CBD. This suggests there may have been a heightened sense of fear associated with living adjacent to these major transport hubs (see Map 8-6).

The back door of the Willis's cottage was only 35.8 metres (117.5 ft) from Pope Products Ltd factory. Pope Products Ltd became involved in war production only a few years after Willis moved in, and, from then on, was an obvious target for enemy aircraft (see Figure 8-1 and section 7.6.1.4 for Pope's response to the bombing threat). Given the inaccuracy of bomb sights in the early 1940s and the cottage's proximity to the factory, the Willis's home would have fallen within the kill radius of both high and low altitude bombing runs, and may have suffered catastrophic collateral damage. Little wonder the Willis's installed the deepest, most heavily fortified and most sophisticated domestic shelter recorded in this study.

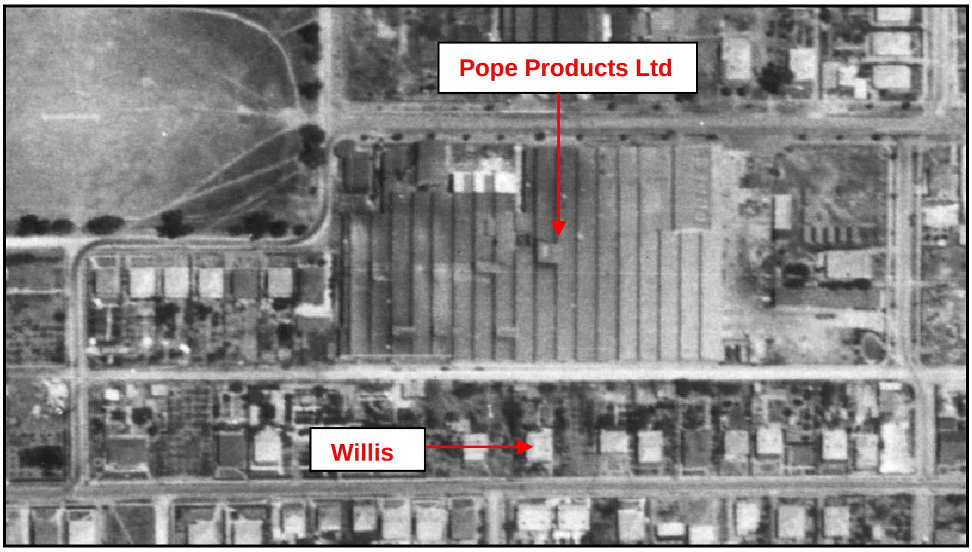
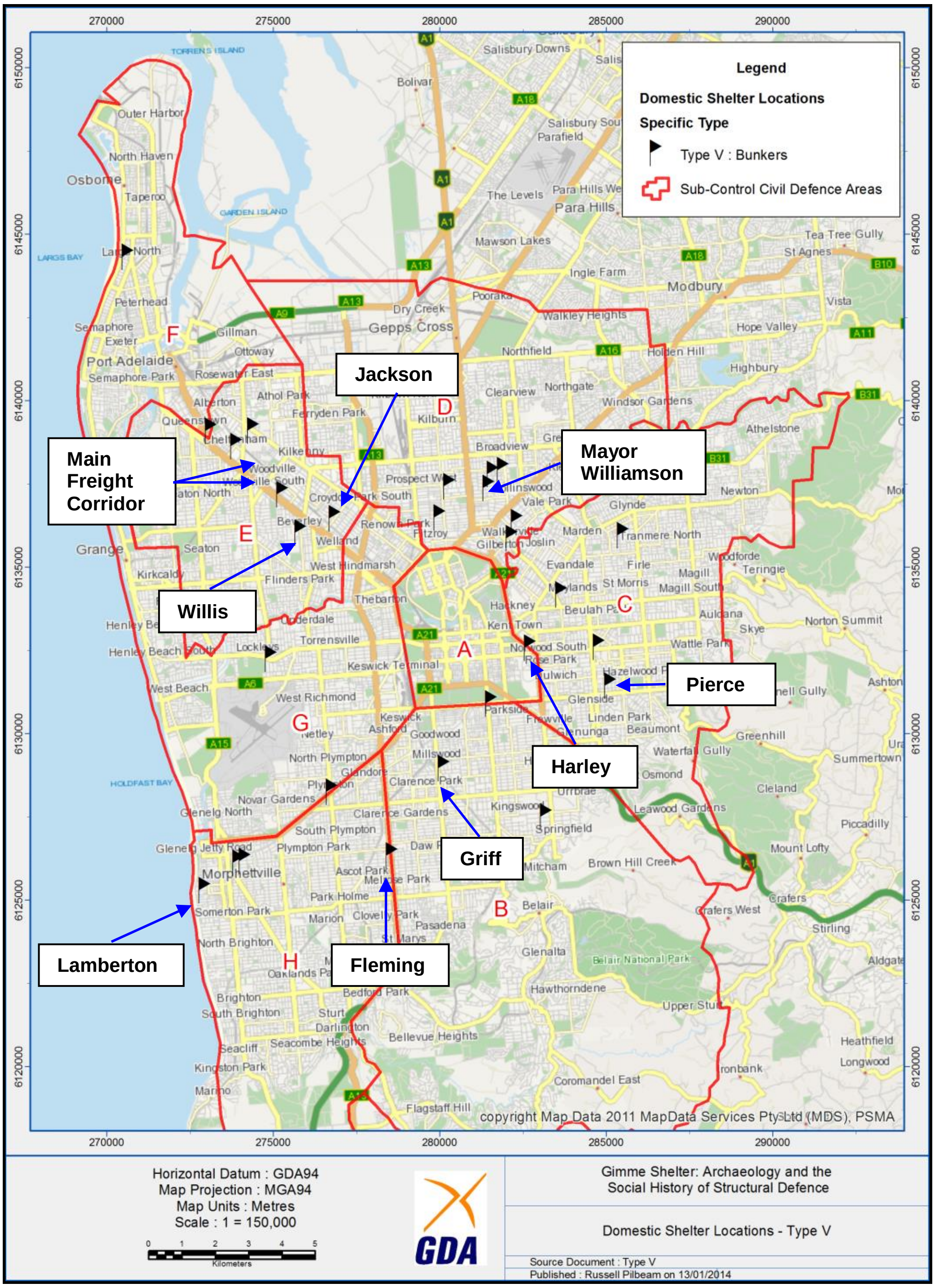


Figure 8-1: Proximity of Willis's residence to Pope Products Ltd
(MAPLAND 1949c)

Area G had one Type V only (3.5%); however this Sub-Control Area comprised largely swamp land and market gardens.



Map 8-6: Type V shelter distribution across Adelaide

8.2.4.1 Type V shelter dimensions as markers of fear

The following tables (Table 8-7 and Table 8-8) correlate the averaged dimensions of the main refuge room in archaeologically recorded Type V shelters with Sub-Control Areas. Two shelters were archaeologically recorded in Areas C, E and H, and only one each in Area B and country SA. Dimensions of other shelters were recorded via oral testimony during this research, but none have been used in this analysis. These came from people who were only children at the time and who may have exaggerated their shelter's dimensions. Two shelters were narrower at the bottom than the top because of in-built architectural features, such as a concrete bench (Pierce) and additional wall thickening below ground level (Griff).

Some pattering is evident in the dimensions of the recorded shelters when cross-referenced with Sub-Control Areas. The two shelters recorded in each of Areas C and H displayed substantial differences in their dimensions. Area E, however, had two shelters with similar widths (see Table 7-7 for individual dimensions). If fear is considered a factor in determining the width of a protective structure, then the consistency of wider shelter sizes in Area E may add weight to this determination given that it was 'Target Area 1' (see footnote 39). It follows then that narrow shelters may indicate a lesser fear. The wider individual shelters recorded in Areas C and H may only point to a heightened localised fear and a heightened localised wealth at a particular address, given the mix of wide and narrow shelters in each of these Sub-Control Areas.

Length is less definitive in recognising social contingencies. Even though the longest individual shelters were in the better neighbourhoods of Sub-Control Areas B (Griff) and C (Pierce), Area E averaged an overall greater length than

Area C. Mrs Griff's mansion in Area B certainly points to her having had a very comfortable existence. The Pierces in Area C had a modest Tudor-style home, but being farmers (or ex-farmers) may have provided them with some surplus to invest in better protection for themselves. The dimensions of Willis's and Jackson's shelters, on the other hand, most likely reflect the predicted targeting of war production in their area, and the realisation that they may have been forced underground for extended periods.

Table 8-7: Sub-Control Area and average length and width of Domestic Type V shelters

Sub-Control Area	Average length	Average width
B	**3.966 m (13.01 ft)**	**1.080 m (3.54 ft)**
C	**3.265 m (10.71 ft)**	**1.732 m (5.68 ft)**
E	**3.384 m (11.1 ft)**	**1.803 m (5.92 ft)**
H	**2.435 m (7.99 ft)**	**1.963 m (6.51 ft)**
Country SA	**1.855 m (6.09 ft)**	**1.471 m (4.83 ft)**

The data suggests that shelter width may be a better barometer for gauging the level of fear in a neighbourhood than shelter length, with narrower shelters indicating lower levels of fear. Table 8-8 reflects the observation more clearly when comparing the average area and volume of shelters from different defence zones.

Two shelters (one each in Areas C and H) had their roofs removed some time prior to recording. An estimate of the original height could still be deduced from the remains of the Harley shelter in Area C (the averaged volume of this Area is prefixed with '≈' in the table), but this was not possible for the shelter in Area H

(Fleming's). Consequently, even though the average floor space in Area H is calculated on two shelter dimensions, volume is calculated on only one.

Table 8-8: Sub-Control Area and average floor space and volume of Domestic Type V shelters

Sub-Control Area	Average Floor Area	Average Volume
B	**4.283 m² (46.06 ft²)**	**9.282 m³ (327.45 ft³)**
C	**5.205 m² (56 ft²)**	**≈9.393 m³ (≈331.8 ft³)**
E	**6.07 m² (65.35 ft²)**	**13.232 m³ (467.31 ft³)**
H	**5.107 m² (56.33)**	**4.053 m³ (147.79 ft³)**
Country SA	**2.73 m² (29.42 ft²)**	**4.718 m³ (166.78 ft³)**

In this analysis, the data shows that, on average, those living in Area E (the industrial precinct of Adelaide during WWII) had shelters with larger floor space and volume than those living in other Sub-Control Areas. It is unlikely that wealth was a factor in the size of these Area E structures. One was self-built by a sand and gravel carting contractor, and the other belonged to a greengrocer. Both were built in yards of modest homes, one a bungalow and the other a symmetrical cottage. Larger shelter sizes could also be an indication of bigger families. For instance, it is known that the Jacksons had three children, but their shelter was large enough to support up to nine adults (see Table 7-8). What is a more likely scenario, however, is that fear was the main catalyst governing shelter size in Area E, with the owners installing a large protective space in which they could shelter (and live) comfortably for an extended period of time.

Large individual shelters were constructed in other areas (such as Areas C and H). This may point to a heightened fear in those areas. The Fleming sisters lived on South Road in Area H which was considered to be one of the main aircraft approaches from the deeper waters off Kangaroo Island into the heart of Adelaide. This may have increased their anxiety, forcing them to build a larger shelter for longer term occupancy. Their shelter, able to accommodate 12 or 13 people under the Code, seems an extraordinary size for only two occupants, given the context of the smaller Jackson shelter built for five or the Chapman's for four, but it is possible the sisters (both teachers) may have held classes in their home and needed a larger size shelter for their pupils. Harley, on the other hand, lived on the city ring in Area C, which verged on Area A (the city centre). Despite the green belt buffer of the Adelaide parklands between the city and his residence, he may have taken into consideration the risk of bombs over-flying their city targets and the subsequent collateral damage to adjacent suburban blocks. However, Harley's mansion indicates that he was a very wealthy man and this, rather than fear, may be the real factor influencing the size of his protective structure given his distance from the industrial hub of Adelaide.

8.2.4.2 Faith in Type V shelters

Most Type V shelters were positioned close to the house and had one exit. Only two were recorded with two exits (Willis and Pierce). The figures show that, for the main, the owners of these structures considered them safe enough to allow such close placement to the home (unlike trenches and dug-outs) and that they took the threat of attack seriously. Areas B and H had Type V shelters which were furthest from their homes: Griff at 23 m (75.46 ft) and Lamberton at 19.5 m (63.98 ft) respectively[40]. However, Area H also had a shelter abutting a house wall belonging to the Fleming sisters, who lived under an assumed enemy flight path.

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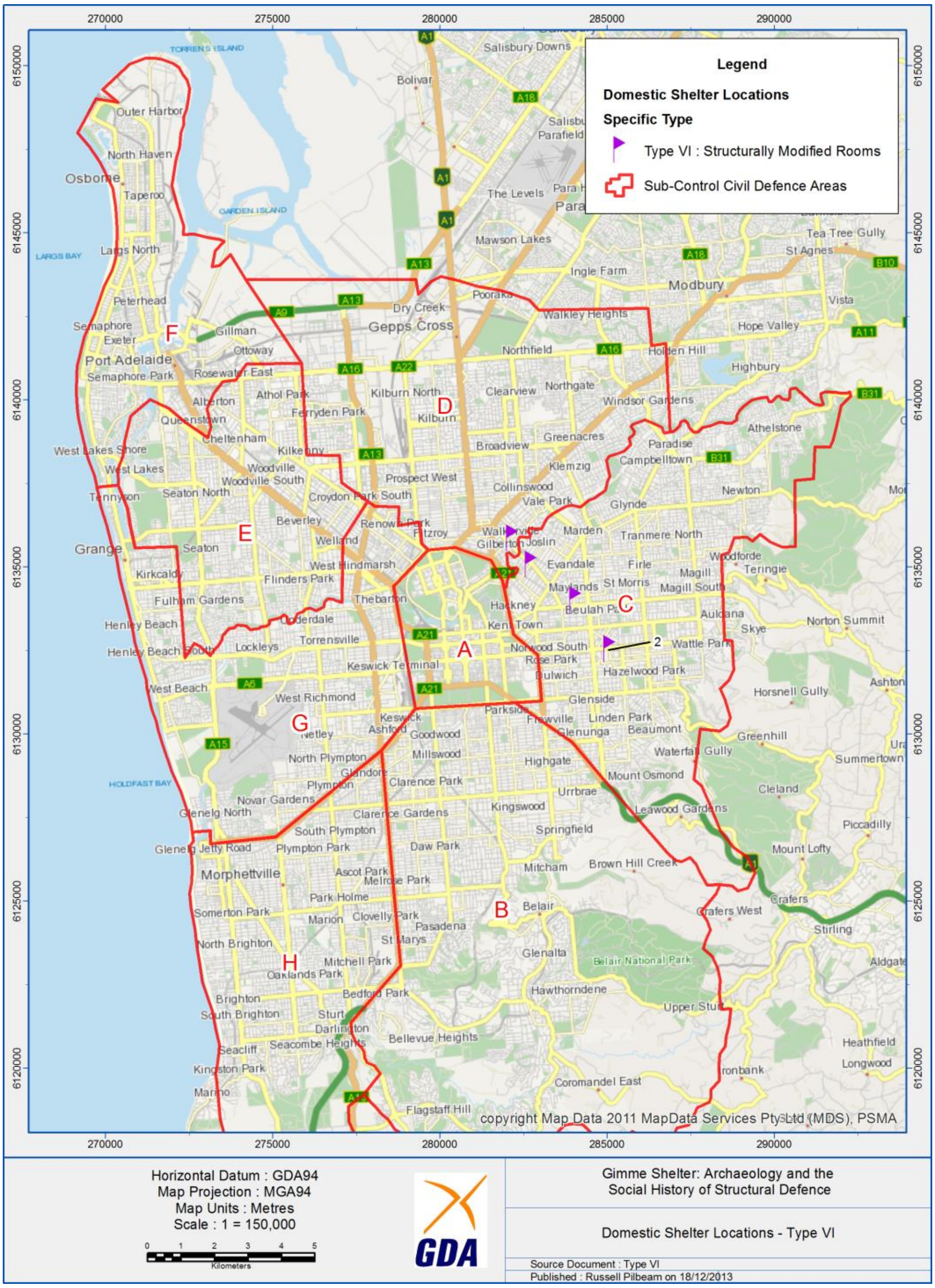
[40] This placement of Type V shelters is more in line with that in country SA where Chapman's was 20.7 m (67.91 ft) from the back door.

8.2.5 Type VI spatial distribution

Type VI structures appeared to be built in the more affluent areas of Adelaide (see Map 8-7). The majority (80%) were in Sub-Control Area C and 20% were in the more affluent south-eastern portion of Area D. The people living in these areas could well afford the services of an architect or engineer who was able to provide a cheaper alternative of certified structural defence compared to constructing Type V shelters. They could also afford the £20 Morrison table shelters to help fortify a room. Thirty-five of the Type had no known address; these are the Morrison shelters which would have been used to bolster protection in an existing room, and information about them is recorded as sales data only. Not one Morrison was located during the archaeological survey, nor were any recalled in testimonials.

Table 8-9: Distribution of Type VI shelters across Adelaide Sub-Control Areas

Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Unknown Location	Total
-	-	4	1	-	-	-	-	35	40



Map 8-7: Type VI shelter distribution across Adelaide

8.2.6 Summary

When viewing the clusters of shelters in Maps 8-2 to Maps 8-7 several trends become apparent. Area D was the most heavily fortified of all Sub-Control Areas with more Type I, Type II and Type V shelters constructed there than other areas. This was despite it having the smallest population of the eight sub-divisions (see Table 8-13). It was, however, an area of moderate wealth and adjacent to heavy industry.

Areas B and C were the two most heavily populated areas of Adelaide. Both had approximately 60% more inhabitants than Area D, and were also the next most heavily fortified after Area D. Each had approximately equal numbers of shelters. However, the frequency of shelter types in each area was weighted differently. Area B had more Type Is and IIs whilst Area C had more Type Vs and VIs. No Type VI shelters were recorded in Area B.

Sub-Control Area A (the CBD and North Adelaide) had few domestic shelters overall, with only four recorded. The absence of domestic shelters in this area may be due to the large numbers of public shelters available, or the fact that the three shelters that were dug in the CBD were dug on public spaces—none were constructed in the builder's yards. It was found in other parts of suburban Adelaide that some domestic properties with large concrete bunkers requiring major earthworks in the construction phase had an alternative access to their backyards (via rear laneways), which made it possible for the grandiose works to proceed (see Trowse section 7.4.2, and Willis section 7.6.2.4). This was something cottages lacked. Shelters were not only placed in backyards. In some cases where the front yard was larger than the back, shelters were dug there instead (see McDonald in section 7.3.2 and the Eden Hills Type I in section

7.2.4.3). However, in the industrial and CBD precincts, many cottages were built right up to the front fence or almost directly on the footpath, leaving no room at the front of the dwelling for a shelter either. The lower income of Area A may have also precluded its residents from installing adequate structural defence, and further forced them to rely on public infrastructure. North Adelaide, however, is an anomaly to these observations because very wealthy people with large homes and gardens lived in this suburb, and the location of the one shelter that was recorded there (an expensive Type III) is exactly where it should be. The implications for wealth as a catalyst for shelter building will be explored further in section 8.5.

Area G also had only four shelters recorded; this was the largely undeveloped swampy region west of the CBD which had fewer dwellings than other areas. The high risk manufacturing zones of Adelaide (Sub-Control Areas E and F) had relatively few shelters - only nine between them; this may have been because the locals relied on the extensive municipal and industrial civil defence infrastructure placed in these areas for their protection. Even so, 77.8% of domestic shelters in these areas were Type Vs, indicating that those who built shelters were very fearful of an attack and had the means to construct expensive and complicated bunkers.

Area H had nine shelters; a high proportion of these (55.6%) were Type V. The large amounts of public infrastructure put in place by this city corporation, especially along the coastal strip in the suburb of Glenelg (1,552 linear feet of open trenches), may have diminished the need for residents to construct their own shelters in this Area. Despite this, 60 % of the Type Vs in Area H were built in the suburb of Glenelg.

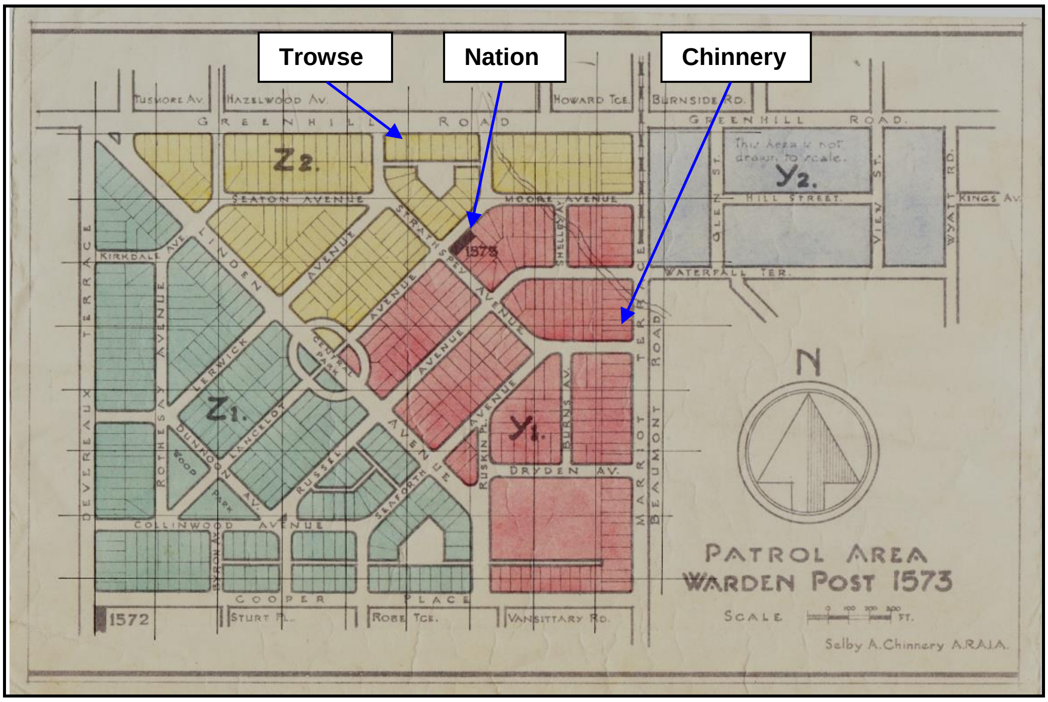
To some extent, variations within the local landscape can be attributed to the actions of known individuals. Area D, for example, contained the heaviest concentration of domestic shelters whose spatial location is known, with 36.8% (Map 8-1). This was more than twice the number of any other area. Area D was purported to be the best prepared civil defence area in Adelaide (Lampshed n.d.: 87). The domestic shelter data tends to support that claim. This state of preparedness may well be the result of one man's tireless activities in promoting ARP in Prospect. Charlie Williamson, Mayor of Prospect, was also the Civil Defence Chief Warden for Prospect and the Zone Staff Officer for Prospect, Walkerville and Enfield. Williamson was pro-active in organising his area for defence, teaching ARP techniques and training air raid wardens in an air raid shelter in his backyard. He also wrote and published an ARP handbook (see Williamson 1942) which was bespoke to the Prospect area and fashioned on those produced by His Majesty's Stationary Office, London.

In a way, and because this civil defence landscape of Prospect can be tied to an historical figure, it can be distilled from the greater Adelaide civil defence landscape of WWII. It is similar to Sir William Jervois's vision and plan of the colonial era coastal defence landscape of Adelaide (c1880s) and has some historical merit and heritage significance because of this. Like Jervois who was reacting to the 'Russian Scare' (see Wimmer 2008), Williamson's vision of localised civil defence was also tied to an historical event—the Japanese threat of invasion during WWII. The surviving ARP landscape in Prospect is representative of the early twentieth century fear of aerial attack, and the subsequent social activity of constructing air raid shelters which, in this instance, was conceived and crystallised under Williamson's tutelage. The spatial integrity of this landscape's components ensures that these associations with Williamson survive *in situ*.

Another example is the Trowse Type III shelter. Drawn by local architect A.J.S. (Selby) Chinnery who was employed in War Service (Essential Services), Map 8-8 depicts Air Raid Warden Nation's patrol area in Hazelwood Park, SA, which covered the Trowse household. Generally, Warden's Posts, in this example #1573 (the adjoining sector #1572 can also be seen), were established on a basis of 1,000 persons per sector. The South Australian Civil Defence Department (1941: 4) stipulated that when designating such areas:

> Due consideration must, however, be given to the extent of the area to be patrolled by the warden to ensure the practicability of adequate supervision.
>
> The post will be any room or building in a convenient position in the sector, preferably one from which the street or streets can be easily seen. It may be the house of one of the wardens… and should have a telephone installed.

The plan demonstrates the macro element of ARP infrastructure, and shows how the Trowse shelter fits into the local ARP network, including its spatial relationship to the local Air Raid Warden Post at the Nation's residence. Hazelwood Park was a newly opened residential area at the beginning of WWII with many vacant blocks and few fences dividing properties (Claire Woods 2009, pers. comm. 19 November, Professor, University of South Australia). The map visually depicts the close proximity of the Trowse, Nation (ARP warden for this area) and Chinnery households - three families who, in all probability, knew each other (and could probably see each other from their homes) and who contributed to the local landscape of fear in their own way.



Map 8-8: Chinnery's plan of ARP Patrol Area #1573
(author's collection)

In these three households alone were found a shelter builder, an essential war service architect[41], an air raid warden, and a volunteer in the Fighting Forces Comforts Fund (FFCF)[42]. The local air raid warden's wife, Mrs F. Nation, was a member of the Erindale FFCF, Unit No. G4 (FFCF in South Australia Inc. n.d.). It is uncertain whether Chinnery was awarded the contract to draw a plan of the area because of his position in the War Service Department, or because of his residency in the area.

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[41] Chinnery was Supervising Architect of the Commonwealth Munitions and Pyrotechnic facilities at Salisbury and Cheltenham and Architect in Charge Northern Area, Darwin and Adelaide River (S348/1).

[42] A wartime organisation, run mainly by women, which distributed comforts (parcels etc) to the armed forces, and from February 1942 to men on active service in civil defence organisations.

8.3 Gender and the shelter builders

8.3.1 Men: Type I

Of the 36 Type I domestic shelters recorded in Adelaide, it is known that 12 (75% of those with identifiable builders [n=16]) were built by men (see Table 8-10). This was despite there being a purported shortage of able-bodied men in Adelaide. However, this observation could also indicate that it was largely only those households with males still living at home or that had helpful male neighbours that were fortified with a trench. It is also possible that some trench shelters were constructed prior to men going off to war, as was the case with the Freeman and Williams Type IIs. The construction of three trenches (18.8%) was influenced by military experience. One was a Type 1(b) in Area F and two in Area G (one being a Type I(b) and a second an uncharacterised Type I).

Given the deficit of males in Adelaide in the lead up to WWII and the drain of fit males because of war service, there seems to have been enough present in Adelaide to have been able to enlist them in shelter construction. For instance, there were many male troops stationed in, and passing through, Adelaide who volunteered their services to dig shelters (see Leaver and McDonald at section 7.3.2, Uren section 7.4 and Figure 8-2), while those in reserved occupations were exempt from fighting but not from digging. In early March 1942, the Lord Mayor of Adelaide, Lieutenant Colonel A. S. Hawker, made a public appeal to those men in reserved occupations and working a forty-four hour week to volunteer to dig trenches for those “families whose menfolk were either in the fighting forces or on shift work at munitions factories” (*Advertiser*, 3 March 1942: 3). Male householders also helped construct shelters for their neighbours (see Neilson at section 7.2.3.1).

Figure 8-2: Members of the 2/1st Light Anti-Aircraft Regiment
digging trenches at St George's Anglican Church, Magill
(with permission of Sue Teagle)

8.3.2 Women: Type I

Adelaide, with 17,490 more females than males in the lead up to WWII (see Table 8-13), had its workforce further depleted of able-bodied men because of the war, meaning that women needed to step into many new roles in order to keep the wartime economy and munitions production moving ahead. Women consequently enlisted in the defence and auxiliary defence forces and could be found patrolling the streets as air raid wardens. They also had to make decisions about defending their families at home. Decisions included whether or not to install an air raid shelter, where in the yard to place it and how to organise the labour to dig it.

Often complete households of women were left to fend for themselves. Despite this, only one example of women digging a trench for their own protection in

Adelaide was recorded during this research. This represents 6.2% of the Adelaide sample of 16 and comes from the experiences of Coral Jones (2009, pers. comm. 31 December, shelter builder). During the war, Coral lived with her aunt and three older cousins in Harris Street, Norwood, and helped them dig a 'pit' for use as an air raid shelter in the backyard. Coral was approximately 8 years old at the time and her cousins (all girls) were aged 13, 15 and 16 respectively. The shelter, dug alongside the neighbour's fence, had a side entrance with "a few steps leading down into it" and was deep enough for Coral to be able to stand up - approximately 3.5 ft to 4 ft. Coral's uncle had passed away, and the rudimentary shelter she helped her aunt and cousins dig was the very best that her aunt could do with the means (labour and financial) available to her. At this time, the basic wage for women was approximately 50% of the male wage (see Table 6-5 for a breakdown of the minimum wages paid across Australia in WWII). The Norwood 'pit' was originally left uncovered, but sometime after being dug, the base and springs of an old stretcher bed were dragged over the top of it and covered with earth for extra protection.

8.3.2.1 Debunking bunker myths: Women as shelter builders

Table 8-10 details the division of labour among the Type I shelter builders of Adelaide. The heading '% of known labour' refers solely to the portion of shelters whose builders could be identified as male, female or child (up to 18 years) through testimonial evidence. The heading '% of total sample' refers to the fraction of the total Adelaide Type I shelters each category represents. The country SA shelters are not included in this analysis.

Table 8-10: Division of labour in Adelaide shelter sample

Labourer	men	women	children	unknown
Number	12	1	3	20
% of known labour	75.0	6.2	18.8	-
% of total sample	33.3	2.8	8.3	55.6

One myth associated with air raid shelters is that women played a large part in building them because the men were away fighting. This research found that some women (6.2% of identifiable Type I shelter builders) did construct Type I shelters by themselves and that they most likely did initiate construction projects involving Type V shelters (see, for instance, Griff at section 7.6.2.3). They also contributed to digging Type I shelters as part of family units (which included their husband and children - Merv Haese 2010, pers. comm. 24 November, son of a shelter builder), but they are largely absent from the labour data. The data further shows that, despite an absence of local fit and able bodied men in the community, the greater portion of Type I domestic shelters (75%) and almost 100% of all other types were still constructed by men. Women alone took little part in digging Type I shelters and no part in constructing the more robust types by themselves. However, children, and especially older children up to the age of 18 of both sexes, did take up the mantle (and shovel) and constructed 18.8% of Type I shelters by themselves, filling a large portion of the labour hole.

8.3.3 Children: Type I

Children, expert fort builders, often took it upon themselves to dig a trench of sorts in play or volunteered their services in constructing the same. For example, in Kingston Avenue, Mitcham Park (now Daw Park), Valerie, Ken and Peggy O'Neill, aged 17, 13 and 11 respectively, dug a trench in their backyard for their family next to their shed (Mitcham Local History Collection). Only a few streets away, a group of local boys, in a letter to the District Clerk of Mitcham dated 15 January 1942, wrote:

> Dear Sir,
>
> We the Boys of Edwards St would like your permission to dig a [sic] air raid trench in the Playgrounds situated in our street, which is Edward Street, we boys would like to do our bit, and would you please tell us how you would like us to build it (Mitcham Local History Collection 1942).

The letter was signed James, Jack and Ross Mahoney aged 15, 13 and 9 years respectively and Colin Well and Dennis Moyle both aged 12 years.

Three examples of children digging, or proposing to dig, trenches without the help of adults, were uncovered by this research. This equates to 18.8% (approximately one fifth) of identified diggers. The size of this statistic could be directly attributable to the absent male labour force and the fact that many of the children involved in digging these trenches were in their late teens. In all probability, these older children would have been quite fit and more than capable of undertaking some extended manual labour. For instance, Laurie Shields was 17 when he dug a trench for his grandparents in Alberton (see section 7.2.3.2), Valerie O'Neill of Mitcham Park was also 17, and James Mahoney of the 'Edward Street dig crew' was 15 years of age.

The following image, taken in Adelaide during the war by an *Advertiser* newspaper photographer, is now in the collection of the Australian War Memorial. It depicts children mimicking what they must have seen adults doing all over town. This shelter appears to be acquiring a sturdier roof (consisting of logs and sand bags) than some of the recorded Type I shelters that were constructed by adults.

Figure 8-3: Children constructing a Type I(b) shelter in an Adelaide backyard
(Australian War Memorial n.d.: 4)

Boys often helped their fathers dig a family trench (Merv Haese 2010, pers. comm. 24 November, son of a shelter builder). They were also engaged to construct school trenches. For instance, boys aged between 9 and 12 years dug a trench 45 ft long and 6 ft deep at the Prospect Woodwork School (*News*, 27 February 1942: 3).

8.3.4 Unattributable labour: Type I

Twenty Type 1 shelters (55.6% of the total Adelaide sample) had builders who could not be identified due to scant surviving records or fading memories. This is despite knowing the personal details (gender and occupation) of most home owners. For example, two of the shelter properties had been purchased by women before the war—Agnes Renfrew who was a widow (see CT1409/Folio177), and Pearl Whittle who listed her occupation as home duties

(CT1485/Folio186). Both women may have had partners by the time the war began. Their properties were part of the group of homes sharing the long open trench in Sefton Park, and backed onto neighbouring blocks whose owners included labourers and railway workers. Male neighbours may have dug the trench without their help if not absent on war service, however, there is no evidence to verify this. Hence, whether or not these female home owners dug their own shelters cannot be concluded.

8.4 Military training: Type II construction

The Australian census nearest to the beginning of WWII was held on 30 June 1933 (no census were conducted during the war years). Even though this was eight-and-a-half years before the attack on Pearl Harbour, results from the census may help interpret the archaeological data gathered during this research. For instance, determining the spread of wealth and WWI veterans across Adelaide may help us understand the frequency or absence of particular shelter types in those areas.

The table below (Table 8-11) details the concentration of WWI service men and women living in the Sub-Control Areas of Adelaide[43] on census night 1933, and depicts what percentage of that particular population they represent. Most women had served as nurses. Population densities of returned defence force personnel are in line with the population sizes of each area, with the areas of largest population also having more ex-service men and women. As a proportion of their respective populations, however, Area H had the highest with 4.6% of the constituents being ex-defence force personnel (an approximate ratio of 1:22 WWI veterans to civilians) and Area C and F had the lowest with 3.4%

[43] Includes naval personnel.

(approximately 1:29 veterans to civilians). Overall, however, WWI veterans seemed evenly spread throughout metropolitan Adelaide, which suggests that there is no statistical significance (or advantage) between areas as far as military service and shelter types is concerned. In other words, numbers of the types of shelter that ex-service men favoured should be evenly spread throughout all Sub-Control Areas proportional to their population size.

Table 8-11: Number of individuals with WWI war service living in Sub-Control Areas on 30 June 1933 (abridged from Wilson 1936: 365-367)

	Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H
Male	**1217**	**2357**	**2048**	**1006**	**1154**	**1025**	**1862**	**853**
Female	**18**	**47**	**34**	**11**	**4**	**2**	**9**	**12**
Total	**1235**	**2404**	**2082**	**1017**	**1158**	**1027**	**1871**	**865**
% of Area Population	**3.9**	**3.8**	**3.4**	**4.1**	**4.2**	**3.4**	**3.9**	**4.6**

Type II shelters were, to a larger extent, influenced by combat experience or training. This is demonstrated in Table 8-12 which shows that the majority of this type was constructed by men with some military know-how. There was a high ratio of WWI veterans to non-combatants in some areas that had dug-outs (especially Areas D and H which had, between them, 53.3% of all Type IIs). Many of the men who dug these types of shelter had experienced firsthand the destructive power of explosives and the low, creeping characteristics of poisonous gas, and knew what life was like underground, and so took these experiences into consideration when designing their subterranean structures.

Ten of the 15 dug-outs (66.7%) had identifiable builders. Of those with unidentified builders, four were built in Housing Trust homes which had transient residents and of whom little information is known. A fifth which survived into the 1970s is only known from a post-war resident. The design of six (60%) of these ten shelters with identifiable builders can be directly attributed to war experience or combat preparedness. Of these six, 83.3% (n=5) had fought in WWI and 16.7% (n=1) were WWII troops who were trained and skilled in digging earthen defences. Two (33.3%) of these six men with military experience had enlisted in both world wars.

Table 8-12: Division of labour in Type II construction

Labourer	Male Civilian	Children	Ex-WWI Soldiers	WWII Soldiers	Unknown
Number	3	1	5	1	5
% of known labour	30.0	10.0	50.0	10.0	
% of known Type II	20.0	6.7	33.3	6.7	33.3

Conversely, three dug-outs (30%) were constructed by men with no exposure to the military and one (10%) was dug by two boys aged 15 and 16 years. It is possible that some dug-outs were enlarged Type I(b) shelters whose designs were available in various ARP pamphlets, but at least two of these recorded examples seem to be unique structures and unlike expanded versions of documented trenches. Neither of these two structures appears to be as sturdily built as those constructed with military expertise. One used local stone as a wall lining (Richard Brownrigg 2010, pers. comm. 22 February, grandson of shelter builder) and the other, a half section of galvanised iron rainwater tank as its roof (Harold Jones 2010, pers. comm. 31 December, son of shelter builder). Both had earth mounded over the top of them. No ARP guides suggested these innovations, but half a rainwater tank was commonly used in forming-up the concrete roof of Type V shelters (see section 7.6). On the other hand, a dug-out constructed by two schoolboys (see section 7.3.2) was the deepest and most elaborate recorded, but the inspiration for their design is unknown.

In Adelaide, these structures were built largely by males with battlefront experience and military training, and from the outset were intended to be life saving and resistant to siege conditions. They were wholly underground room-sized earthen structures with thick overhead protection (consisting of many layers of sandbags, logs and earth), rudimentary furniture and emergency provisions. The furniture and emergency supplies placed in these structures indicates that they were intended to be used very differently to Type I shelters. They were deeper than Type I shelters by an average of 14 in. (see section 7.3.3.1). No women are known to have constructed or aided in the construction of Type II shelters, a fact which may relate to the scale of construction required and weight of the robust materials utilised, or to few, if any, Australian women having firsthand battle experience or combat training in the early twentieth century (most WWI female veterans had been nurses).

Type II frequency in particular areas may also indicate the presence of billeted WWII soldiers. Dwellings housing billeted soldiers were most likely large by necessity, and may have had a yard big enough in which to have a shelter. It is likely that the soldiers who built these Type II shelters in the leafier suburbs had witnessed the non-discriminatory nature of modern warfare and realised that bombardment could not possibly be contained to the high risk areas alone.

8.5 Wealth and the distribution of shelters

Eighty-eight of the 140 recorded domestic shelters (62.9%) were of a Type requiring substantial outlay of capital to acquire and erect. This figure comprises 20 Type III, 29 Type V and at least 39 of the 40 Type VI shelters. These astounding figures raise an interesting question in that while both rich and poor could dig a trench, one would assume that fewer people could afford to purchase and construct these expensive Types or engage the services of an architect or engineer to design one for them. How can these large numbers of expensive shelters then be explained?

Table 8-13 details the income of males and females across the eight Sub-Control Areas on census night in 1933. It includes the combined male and female total of each category. Of note, and possibly as a direct result of the casualties inflicted on Australian forces during WWI, there were 17,490 more females living in the study area than males at that time. Area B had the largest population (n=62,738) and Area D the smallest (n=24,573). Areas B and C had the largest number of big earners (>£259 per annum). However, as a proportion of the earning population in their respective Sub-Control Areas, 13.9% in Area H were in the top bracket of earners, 13.4% in Area B, 13.3% in Area D, 13% in Area C, 7.8% in Area E, 7.7% in Area A, 7.2% in Area G, and 6.5% in Area F. The mid-western and north-western suburbs of Adelaide (Areas E, F and G) were the low income belt, and large tracts of land were vacant because of its swampy nature. Area A also fell into the low income bracket, an indication of the cheap housing available in the CBD, but not reflective of the wealth in North Adelaide, which was also in Area A.

Table 8-13: Income of males and females across Adelaide Sub-Control Areas on 30 June 1933 (abridged from Wilson 1936: 421-426)

	Non-earners[44]	<£52	£52-£103	£104-£155	£156-£207	£208-£259	>£259	Not Stated
Area A*	5961 8598 14559	3240 3701 6941	1627 2208 3835	1147 905 2052	1024 349 1373	603 156 759	939 311 1250	275 343 618
Area B*	10342 21618 31960	4370 5795 10165	2937 3127 6064	2308 1577 3885	2707 694 3401	2022 283 2305	3588 403 3991	430 537 967
Area C*	11049 21073 32122	4209 5760 9969	2814 2920 5734	2258 1398 3656	2542 635 3177	1728 281 2009	3204 463 3667	395 496 891
Area D*	4072 8360 12702	1575 2320 3895	1126 1149 2275	900 552 1452	1134 249 1383	902 92 994	1318 214 1532	131 209 340
Area E*	5457 10634 16091	2186 1827 4013	1438 810 2248	1247 326 1573	1381 107 1488	827 33 860	826 31 857	123 99 222
Area F*	6074 11086 17160	2838 2296 5134	1867 927 2794	1072 376 1448	1216 112 1328	701 49 750	745 51 796	226 214 440
Area G*	9151 17560 26711	3973 3792 7765	2564 1907 4471	2153 743 2896	2415 204 2619	1551 70 1621	1400 105 1505	304 289 593
Area H*	3945 4072 8917	1454 1820 3274	1005 896 1901	867 469 1336	807 208 1015	595 81 676	1164 159 1323	130 161 291

*number of males 1st row, number of females 2nd row, total 3rd row

8.5.1 Wealth and Type III shelters

Despite their high Australian wartime cost, which at almost four times the basic weekly wage placed it beyond the economic means of many, at least 21 Anderson shelters were purchased in Adelaide during the war. Two of these were joined to make one shelter, hence the minimum count of only 20.

The Anderson shelter was an option of structural defence seemingly unavailable to the average worker. Instead, it was only people of greater means and some surplus income who could afford these pre-fabricated structures. Among them were Mr. T. Fred Bruce, an auctioneer and the patriarch of an old established Adelaide family, noted in *The Australian Dictionary of Biography*, and Mr F.W.

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44 Includes dependents.

Trowse, a Managing Director of Harris Scarfe Ltd department store and a member of its board from 1931-1938. Trowse had joined the Harris Scarfe Company in 1916, eventually becoming Manager of the Engineer's Supplies and Tool Departments (Penley 1991: 17). This work place experience may have given him some technical grounding in the properties of steel and sheet metal, as well as many contacts in the steel industry. Such knowledge and experience may have also tempered his faith in sectional steel shelters as an air raid precaution even though he was compelled to completely bury and cover it with concrete indicating the heightened level of fear he felt.

The purchase price of two standard shelters of this type in Adelaide in 1942/1943 (not including installation, which in the Trowse case would have been considerable) was £31/4/12. This is another indication of Trowse's wealth, given that the basic weekly wage for a South Australian male at this time was £4/14 (see Table 6-5). As a senior staff member of Harris Scarfe Ltd, Trowse may have been entitled to a staff discount if he purchased his shelter from, or through, his employer. Anderson shelters were sold through department stores in Sydney (Anstey 2009: 8), and may well have been stocked by Harris Scarfe Ltd in Adelaide who had been suppliers of hardware and building materials in the mid-twentieth century. It is obvious from Harris Scarfe trade catalogues archived at the State Library of South Australia (BRG 16/6; see specifically, Harris, Scarfe, Limited n.d. & Harris, Scarfe, Limited 1965) that, historically, they did carry Lysaght products. By the 1930s, Harris Scarfe Ltd owned their own large steel yards and a factory which manufactured guttering, down pipes and rainwater tanks. Theoretically, given that the factory manufactured curved iron sheets for its tanks, it could have been re-tooled with little effort to produce Andersons (or a similar product). Often sheets of iron were stamped with a brand name, but those of the Trowse shelter are too rusted to identify their origin (see Figure 7-17).

With such a small sample recorded, it cannot be concluded that all Adelaide sectional shelters were installed in a similar fashion to the Trowse and Uren examples (i.e. completely buried). However, sectional shelters are exemplar in demonstrating the value of contemporary archaeology in contributing to an understanding of society during WWII. As a litmus test for wealth during WWII, the Anderson shelter, used for defence in both hemispheres, seems truly bi-polar. They are identical items which do not mean the same thing in different parts of the world. In the UK, they can be interpreted as representing the lower classes because they were made available for free, or at greatly subsidised rates, to those with limited income in specific geographic areas (for instance, those living adjacent to commercial or industrial areas within range of hostile German aircraft—see sections 2.3 and 6.5.1). But in Australia, and especially in Adelaide where less than 5% of the population earned more than £250 per annum, they were not subsidised, were much more expensive and seem to have been an option available only to the middle or upper classes. Hence, the presence or absence of Andersons in some areas of Adelaide may help to define specific demographics, such as those areas of higher or lower income as well as the level of fear present in those areas.

The geographical distribution of sectional shelters in Adelaide does not seem to correspond to the areas of greatest threat, such as in the industrial working class suburbs where they had the potential to shelter munitions workers as they did in the UK. Rather, in Adelaide they are found in leafy and affluent suburbs such as Hazelwood Park and North Adelaide or middle class Black Forest suggesting that the fear of attack was still very real in those areas but those living there had the means to upgrade their protection.

The research conducted by the Home Office leading to the design of sectional shelters is well documented, as is the shelter's method of assembly and installation (see instruction sheet at Figure 7-16). They were made by machines to specific dimensions and tolerances, which left little room for variation between one shelter and the next. What is crucial to this narrative however, are the reasons why they were procured by certain individuals in the first instance, and how they were then used around the home. The fact that two sectional shelters designed to be partially buried were instead completely buried (and one of these enlarged and reinforced with concrete, in effect turning it into a Type V) speaks to us not only of the income of each of these families, but also of the heightened level of fear and foreboding they experienced. It further informs us that the purchasers had little faith in the recommended method of installation and chose instead to increase the level of protection each shelter provided. Without archaeological research and interpretation of the existing fabric of Type III shelters in Adelaide, such modifications may never have been known.

8.5.2 Wealth and Type V shelters

The number of domestic Type V structures recorded across Adelaide is astounding, and their existence seems counter-intuitive given the huge cost associated with their construction and the fact that less than 5% of Adelaide's population earned above £250 per annum. Type V shelters were not restricted to the wealthier areas but were instead distributed across Adelaide, with the exception of the cramped CBD.

One of the myths about Type V shelters is that only people of great economic means could afford them. This research, however, shows that even though there was a correlation between obvious wealth (occupation and size and type of dwelling) and the building of some Type V shelters, more commonly, the people who built them were aligned with either the construction or food related industries. Those in the construction industry had access to building materials and technologies which could be employed in producing shelters for their families. Primary producers, food manufacturers and food retailers, on the other hand, were in a position, during times of rationing and coupon driven economic systems, to capitalise on their restricted commodities and procure some form of structural defence or the material to construct it by either bartering or selling their produce for peace of mind.

Thirty-three percent of Type V owners were aligned with the construction industry, whilst another 29% had links to the food industry. Archaeological analysis found that the deepest, most heavily fortified, innovative and probably the most expensive domestic example recorded belonged to Willis, a green-grocer. Analysis also showed that those individuals with ties to the construction industry tended to over-engineer the structural properties of their shelters with thicker walls and roofs, thereby greatly increasing their own protection.

8.5.2.1 Peculiarities of local Type V shelters

The results of international research into shelter design were published in numerous handbooks and pamphlets that were available in Australia. These were put to good use after December 1941 and the coming of the war to the South Pacific. Also available were drafts of provisional British codes of shelter construction (see, for example, Office of the Lord Privy Seal 1939). These British publications were closely followed by the development of local Australian shelter codes (see Pettifer 1941), including SA's own unique code for regulating air raid shelter construction (see *South Australian Government Gazette* 1942: 358-366). This codification re-cast the concept of shelter design from an advisory notion to a mandatory requirement, and can be used by archaeology as both a tool for dating and for classifying shelters by comparing their dimensions against the standard. This section details peculiarities of the SA experience.

Of the seven Type V shelters that were archaeologically recorded, six had overhead protection greater than what was specified by the Code and may well have been built with reference to it. The Chapman shelter "patched over" with un-reinforced concrete is the only exception, but it was self-built and did not need to comply. Further, Chapman seems to have designed it more with a view toward repelling bullets than bombs. An uncle at the time told young Norm that "[a] gun, a three-o[45], could pick at that all day and it wouldn't go through it" (Chapman MW1-10: 2).

The table below (Table 8-15) details the thickness and composition of each archaeologically recorded shelter roof and compares it with the SA Government's recommended minimum dimensions in the materials column. The Pierce shelter, although having a reinforced concrete roof which was 3.81 cm (1.5 in.) less than the recommended thickness, was bolstered with a reinforced concrete dome. The Code also recommended 18 in. of earth "properly confined" when used as overhead protection—some shelters had earth in addition to their hardened shells. In Jackson's case, there was a vegetable plot above the shelter adding several inches of earth to his protection, while Willis had an indeterminable soil

[45] Colloquialism used in Australia for a .303 calibre firearm.

depth above his very deep Type V. Overhead protection for Willis consisted of a combined 1.28 m (50.39 in.) of tin, reinforced concrete and earth. It is also possible that Griff, Lamberton and Harley mounded earth around and over their shelters, but no evidence of this exists in the present.

Analysis shows that Adelaide's shelter builders were more concerned with their overhead protection than their lateral. Of these seven shelters, only three had aspects of lateral protection greater than what was specified by the Code (see Table 8-16). What is not indicated in the text of the Code is whether the specifications are for surface or sub-surface shelters, but most likely they were for either situation. None of the shelters recorded were surface shelters; all were either completely or partially buried and, as far as is known, only the Chapman shelter definitely did not have earth mounded over the exposed areas during the war. Again, Chapman did not need to comply with the Code.

Table 8-14: Overhead protection of archaeologically recorded domestic Type V shelters vs. the Code

The Code	Brickwork Arching 9 in.	Un-reinforced Concrete not recommended	Reinforced Concrete 5 in.	Reinforced Concrete/Earth 5 in./18 in.	Tin/Reinforced Concrete/Earth 5 in./18 in.
Chapman*		19 cm (7.5 in.)			
Griff			15 - 16 cm (5.9 - 6.3 in.)		
Pierce			8 cm** (3.5 in.)		
Willis					1.28 m (50.4 in.)
Jackson				67.5 cm (26.6 in.)	
Lamberton			17 cm (6.7in.)		
Harley	27.5 cm (10.8 in.)				

*Country SA (Peterborough); **originally also capped with reinforced concrete dome

The Griff shelter, which seemed to follow British structural defence theory by having thicker walls below ground than above (although not twice as thick as per

English recommendations), exceeded the Code below ground by almost 10.16 cm (4 in.), but fell short with its above ground section by over 5.08 cm (2 in.). Pierce may have complied with the Code, but as an absolute wall width could not be determined to prove this, the depth of a built-in shelf was used as a point of reference to determine a minimum thickness. This method was also used with the Willis Type V, but here the minimum wall thickness was found to be twice that of the standard.

The exterior wall width of the Jackson shelter could not be determined, but interior walls were only 2.54 cm (1 in.) under the standard. Considering that other archaeologically recorded Type Vs where both internal and external walls could be measured all had thinner interior walls, it is likely that Jackson did conform, although as a self-builder he did not need to. Lamberton, another self-builder, had walls a little more than half the thickness stipulated. At least one wall of Harley's Type V (the concrete retaining wall) was above the standard, but this was opportunistic use of an existing structural element of the dwelling and not purpose built for a civil defence role. Harley's other walls appeared to be built of double brick given the form of the roof, but this could not be verified. If so, they would have been one brick width short of the endorsed method of construction which required a minimum thickness of three bricks.

Table 8-15: Archaeologically recorded lateral dimensions of domestic Type V shelters vs. the Code

The Code	Brickwork in Cement Mortar (13.5 in.)	Reinforced Concrete (12 in.)
Chapman*	19.0 cm (7.5 in.)	
Griff		25.0 cm (9.8 in.) - above 40.0 cm (15.8 in.) - below
Pierce		23.0 cm (9.1 in.) minimum width of thickest wall
Willis		61.5 cm (24.2 in.) minimum width of thickest wall
Jackson		27.5 cm (10.8 in.) internal wall
Lamberton		17.0 cm (6.7 in.)
Harley	≈ 27.5 cm (10.8 in.) side walls	38.0 cm (15 in.) rear wall

*Country SA (Peterborough)

Oral testimonies also relate how the Morrell steel Type V and the Terrazzo Granolithic Speciality Flooring Company's concrete Type V had protection far greater than that recommended. Granolithic's shelter is included in the domestic data because it was built to protect the family of the business owners, as well as their neighbours and staff (the business was at the back of the family house block). Morrell's shelter was covered with a pyramid of sandbags whilst the flooring company's had 18 in. thick walls.

Many of the recorded shelters appeared to be designed based on research in the UK and/or displayed some knowledge of the dimensions outlined in the South Australian Code. However, the Griff shelter was the only one to have all the classic shelter design elements of an over-hanging roof, traversed entry and an area which could serve as a gas lock, thicker walls below ground than above and ventilation. At first glance, it would seem the Griff shelter was built after the introduction of the Code, but its roof and that portion of its walls above ground were below the recommended tolerances, meaning that if it was a purchased shelter it probably pre-dated the Code. Most Adelaide Type Vs (73.7%) were completely buried and 100% of archaeologically recorded Adelaide shelters had overhead protection which was equal to, or greater than, that specified by the Code. Approximately one-fifth of Adelaide shelters (21%) were semi-buried and only one (5.3%) was completely above ground. The Peterborough Type V (Chapman's) was neither completely buried nor Code compliant, but it was built from scrap by the owner and was not governed by the strictures of the law. Those Adelaide shelters that were not completely buried and had structural elements falling short of the standard requirements had their protection supplemented by adding a reinforced concrete dome to the roof, piling up sand bags above it or mounding the excavated earth around it.

Only the Griff shelter, with 50% of its superstructure above ground, had an over-hanging roof and walls thicker below ground than above. Most shelters with enclosed traversed entries could be gas locked. The most common architectural feature was ventilation, with the Jackson Type V out-fitted with five breather pipes. Williamson (not archaeologically recorded) and Griff both had three breather pipes each (see Figure 8-4). Williamson gave lectures to his subordinate air raid wardens in his shelter and would have had a heat and foul air issue. Griff's standardised catalogue shelter with its small dimensions may have necessitated more pipes for the possible crowding of occupants in its confined space. The Willis shelter had an ingenious convection system which continuously replenished the air when the fireplace was operational.

Figure 8-4: Three breather pipes (arrowed) above the Williamson shelter, Prospect (Prospect Local History Group 2009)

Experience in Europe had shown that "bomb shelters were no defence...unless one took up permanent residence in them" (O'Donnell 1979: 199-200). This European experience is referenced by Adelaide's bunkers which were built to endure siege conditions and for long term habitation. They were well provisioned with emergency supplies and out-fitted with shelving and beds. Most shelving alcoves were part of the concrete form-work of the bunker, indicating that provisions were always intended to be placed in them. Some Type Vs also had in-built bunk alcoves and concrete ledges which could be used to sleep on, again an indication of planned defensive hibernation.

8.5.3 Wealth and Type VI shelters

Of the 40 recorded Type VI shelters, 87.5% were Morrison Table Shelters (n=35). At £20 each, they were priced at approximately five times the minimum weekly male wage or ten times the minimum female wage in SA. At least three Type VIs were room conversions drafted by architects with a fourth, the St Peters fortified hallway, probably also professionally modified. Only one Type VI (2.5%) of the total may have been constructed by the owner without him having to pay for professional structural advice or the services of a builder. This was the Lee's cellar which had its ceiling strengthened with lengths of railway track.

The cluster of known Type VI locations is 2 km from the eastern edge of the CBD (see Map 8-7) and falls within the affluent belt of suburbs in Sub-Control Areas C and D. Both these Sub-Control Areas had a high percentage of their population in the top tier of earners compared to other civil defence districts (13.9% of Area D earned above £250 per annum and Area C, 13%). Despite not knowing where any of the Morrison shelters were installed after they were purchased, their high cost suggests they would mirror the spatial distribution of the Anderson shelters and likely went to Areas B, C and the south-eastern corner of Area D, North Adelaide (the northern portion of Area A) and the coastal strip of Area H.

8.6 A condensed timeframe

The fact that most people in Adelaide who installed some type of structural defence opted for a type with overhead protection (89.3% of domestic shelters that could be properly characterised had a roof) and over-engineered their structural protection (in many cases, the thickness of the overhead protection was above what was recommended by the Code), suggests there was a real fear in the community following the attack on Pearl Harbour. Attitudes to invasion among Adelaide's residents had been informed by unfolding events in Europe and the final coming of war in September 1939. Shelters had begun to appear in the SA landscape at least as early as September 1940, with Port Augusta, 307 km to Adelaide's north, claiming to have the first (*Advertiser*, 13 September 1940: 17). Some Adelaide residents like Doug Freeman (Type II built in late 1940 or early 1941) and Fred Bruce (Type III built in June 1941) 'jumped the gun' and organised their structural defence early. But generally, Adelaide's population only acted in self-defence and with heightened fear after the attack on Pearl Harbour. This is proven by the extraordinary number of very expensive Anderson (20 at £15/12/3 each) and Morrison (35 at £20 each) shelters sold in the three months to June 1942, and the archaeological recording of extant domestic Type V shelters which suggest they were built after the introduction of the Code in February 1942.

8.7 Particular views of the world in time and place

Air raid shelters were constructed by real people. They were built in a specific time and place, and collided with twentieth century ideas of imperialism, nationalism and militarism. Each shelter is unique and tells a story of how ordinary Australian's interpreted world events and the choices they made in order to protect themselves against a possible catastrophe. These structures represented the very best each family or individual could do in order to protect themselves, and each represents a huge personal investment in research, materials and labour. They have associations with historic figures, world events, national policy, innovative design and architecture, changing technology, the human condition and personal means. They are storehouses of social data from a very precise point in Australian social history (7 December 1941 to August 1943) and, as such, can provide new information about Adelaide from a time when interest in national and global events over-shadowed the local. The archaeological interpretation of domestic air raid shelters allows us to focus on the individual lives of those who were overtaken by, and forced to adapt to, dynamic world events.

Chapter Nine

The Psychology of Fabric

> The primary aim of ARP…was not the protection of individuals and property from destruction, but the maintenance of the morale of the people.

Jones *et al.* 2004: 466

9.1 A measure of success in defence

The early chapters of this thesis outlined the changing defensive posture of Australia, with particular reference to SA in the lead up to WWII. These chapters also demonstrated how ARP, theorised in Europe since WWI, did not feature in Australia's defensive schemes until the late 1930s. Despite this, an extraordinary civilian response followed Japan's entry into the war, as is evidenced by the number and types of defensive structures erected in Adelaide. In fact, so many and so varied were the shelters recorded in Adelaide that, through the agency of this research, it has now become a type area for civilian structural defence in Australia during WWII. Air raid shelters are representative of the early twentieth century theory and practice of civil defence, and demonstrate the lengths that people went to in order to protect themselves against aerial bombardment. The air raid shelters that were built to protect their occupants from conventional airborne weapons were era-specific, and lost their primary design function when the first non-conventional weapon was dropped on Hiroshima in August 1945. Those in Adelaide were ultimately never used for the purpose for which they were built, and began to fall into disrepair two years prior to Japan's capitulation, once the threat of attack had diminished.

9.2 The psychological health of the community

The hundreds of holes dug in one of Australia's southern-most capital cities against an expected attack during WWII are a barometer of the psychological health of the community. This same remote community had felt secure in its isolation, and well protected by its attending armed forces, since its proclamation as a colony in December 1836. But in December 1941, confidence in both shortened considerably. Today, it is largely only those people who were children during the war who survive from that time. Because of their young age during the war, their testimonials contain no recollection of a sense of foreboding or fear. Conversely, the material remains of ARP suggest otherwise for their parents. Although they left no written records of what, how and why they took the measures they did, the archaeological analysis of the type and structural strength of the shelters they built suggests a loss of confidence in the government and a genuine fear of being attacked. The building of air raid shelters marks the precise point, a turning point in Australian social history and psyche, at which civilians became self-aware of their vulnerability and also self-reliant in home defence. The closest historical parallel to this had been the frontier settlers of the nineteenth century who found themselves in situations with “no legal or government presence, such as police, in newly settled areas…and [who therefore had to make] arrangements regarding their own safety” (Grguric 2008: 35). The technological innovation of powered flight, however, forced a change in the traditional defence posture of SA (and the rest of the world) by making targets of the civilian population, even though they were well to the rear of the battlefront.

9.3 Predicted mayhem

Psychological warfare has always been used to gain the upper hand in battle; in the twentieth century, aircraft were employed for this purpose. From the instant the first military airships appeared over suburbia in WWI, governments and military tacticians predicted that they would one day be used to deliver an aerial knockout blow by inciting mass panic (Bourke 2005: 224). It was theorised by Wells and other observers of WWI that aerial bombardment would traumatise the masses, who would then vent their anger on their incumbent government, turning them out of office and forcing a capitulation to the enemy. Bombers were, from the beginning, seen as being unassailable and unstoppable. Overseas, contingency plans were drawn up between the wars, and continually modified as aeronautical technology advanced, in order to cater for the predicted casualties and to fortify public infrastructure and morale.

The psychological impact of war on civilians is pivotal to this research and is investigated at three distinct levels in order to help understand the physical remains and the cultural landscape created by fear in Adelaide during WWII. These are:

- How psychological studies which helped determine what scared people the most about aerial bombardment aided in the design and placement of civil defence infrastructure.
- How the expected directions of attack or invasion might have influenced people in particular ways.
- How the communal act of working together affected people positively.

9.4 The psychology of fabric

Air raid shelters are symbols of fear. They were designed and built because there was a real fear in the community that the bombers were coming. Yet, the reason they were 'shaped' the way they were goes "beyond functionality: they are the product of socially constructed choices between valid functional alternatives" (Graves-Brown 1995: 90). One of those choices was influenced by psychological research into the fear of aerial bombardment. The psychological research cited here was conducted at the precise moment that civilian defence against an attack by aircraft and conventional air-borne weapons was being theorised, and air raid shelters were being built. It provides an age-specific, clinically and scientifically measured snapshot of the mentality of a population and generation of shelter builders who were expecting a catastrophe, and as interpreted by trained psychologists and clinicians of the time. Conversely, the shelters now provide a snapshot of the material manifestation of these cognitions, the fabric and landscape setting of which, in turn, and with the help of those contemporary psychological studies, can be interpreted by trained historical archaeologists. This is demonstrated by re-visiting the following model (Figure 9-1). Here, psychological research and archaeological interpretation link directly to social context which, in turn, creates and provides an understanding of the material remains.

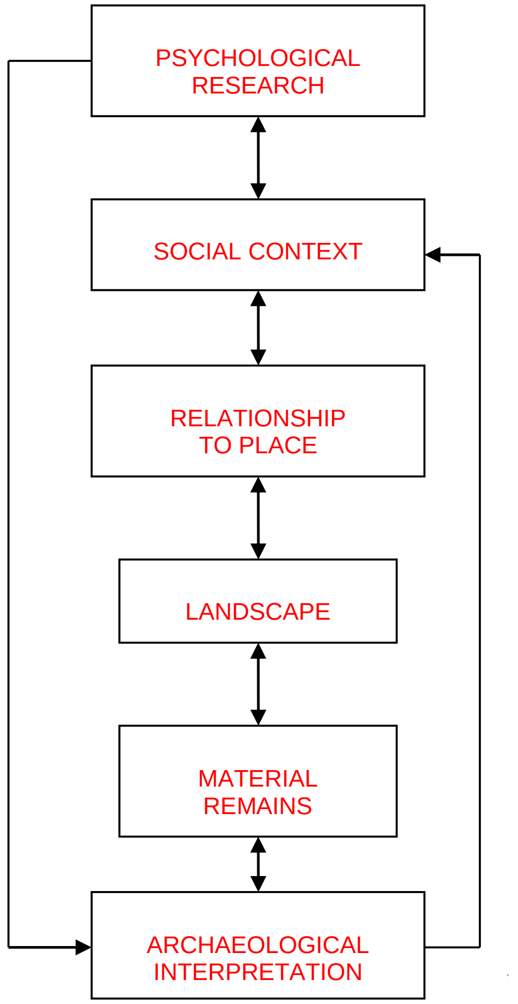

Figure 9-1: Psychology as an agency in creating and understanding material remains

The 'psychology of fabric' is a term coined by this study. It references the fear, and research into fear, which fed into the design, construction and placement of air raid shelters, endowing the existing fabric of structural defence with psychological and social markers that are unique attributes of this material culture type. This principle has direct relevance to Adelaide where the fear associated with an anticipated attack or invasion, rather than the need to protect oneself against falling bombs, created its landscape of fear.

9.4.1 The cognitive reverse-engineering of fabric

Orser (2004: 19, italics in original) stated that "historical archaeology is unique in that it is *by nature* multidisciplinary", that it uses "documents and texts of all kinds to support and supplement archaeological information" and that historical archaeologists "must be able to relate these sources to their archaeological evidence". Through a type of cognitive reverse-engineering, contemporary psychological studies provide researchers (such as archaeologists) with information that can help to understand why shelters were built in the first place, why they were placed at specific points and what influenced the choice of fabric (i.e. why they were built and how they were built). This is possible because clinical and ethnographic studies of war-related fear contain:

> …information about the psychological impact of wartime catastrophes [and have been] a fundamental requirement for developing effective civil defense policies, for planning over-all military strategy, and for appraising the political, social, and moral consequences of … warfare (Janis 1951: 1).

Robin Woolven (2002: 159) discovered that:

> …[o]nce regular nightly bombing raids were experienced [in London], people sought safe shelter and the extent to which they found it depended upon both the level of local provision and the culture and psychology of those seeking shelter.

The need for civilian shelters is borne out by Janis (1951: 99), who pointed to contemporary morale interviews conducted by the USSBS which gave some indication of the incidence of subjective fear among a cross section of Germans who had experienced bombing during air raids. These showed that:

> 38 per cent…experienced severe upset, intense fear, or nervous collapse; an additional 31 per cent, temporary or less severe fright or upset. Only 22 per cent claimed to have experienced little or no fear.

Alongside psychological anomalies, psychosomatic disorders were also recorded after air raids and included (among other things) an increased incidence of peptic ulcers, menstrual difficulties and various abnormal coronary symptoms (Janis 1951: 89-92). These psychological descriptors are now outdated, but their purpose here is to demonstrate the causal link between contemporary psychological research and the creation of a unique cultural landscape. Janis (1951:147-149 and 1971:68-70) also summarized a number of wartime studies completed between 1942 and 1945 which demonstrated a link between air raid victims and a marked decline in their performance at work, along with an increase in absenteeism (see also USSBS 1976a [1946a]: 4).

It was clinical evidence of this nature which demonstrated the effect of aerial bombardment, not only on war industry production through the destruction of plant and machinery, but also on work force morale through diminishing people's capacity for work. The research bore testimony to the fact that those who had access to shelters displayed fewer adverse psychological and psychosomatic symptoms than those who did not. Numerous German psychiatrists indicated that "hysterical manifestations in front of bunkers or air raid shelters were rare in general" (Janis 1951: 86). Given that these studies were either largely conducted or commissioned by government departments, such as the Ministry of Information, it makes sense that they may have directly affected policy and guidelines around public shelter construction and placement, although this tie-in could not be verified by archival research during this study. Janis (1951: 153) noted that:

> Mental breakdown, panic, and mass demoralization – the triple psychological threat that dominated so much thinking in official quarters – rarely materialized during World War II.

One reason for this could be that the strategies developed through psychological research and employed to keep the 'triple threat' in check (for instance, shelter design and placement, public access to technical data and a policy of dispersal which encouraged people to fend for themselves) may have done their job.

Many generations of psychological theory, research and practice have passed since these wartime studies were conducted. As with most scientific disciplines, there is a continual evolution of the ways in which data is interpreted and, *ipso facto*, re-interpreted. Clinical studies of anxiety-related conditions caused by the anticipation and experience of aerial bombardment during the Second World War provided data for further research during the Cold War with regard to predicting how the public might react during an A-bomb attack (see Janis 1951). In a more modern context, since 11 September 2001, and with the on-set of the War on Terror, this early twentieth century data is, once again, being scrutinised to provide new predictive models for understanding how the fear of terrorist attack may affect the contemporary public of the twenty-first century (see Jones *et al*. 2004 and 2006).

Archaeologists can now interpret the psychology behind the surviving fabric (the psychology of fabric) and make determinations about how civilians reacted. Providing the public with technical information on how to affect their own defence, whilst at the same time demonstrating that what was put in place for them was adequate, may have gone some way to calming public skittishness and leading to a belief that the government cared for them. Placing protective structures in very obvious and visible locations, and accessorising them with men in uniform and badges of rank where hundreds, if not thousands, passed and viewed them every day, may have had the same effect. But it may also have had the opposite effect. The vast number of structures erected, the constant air raid drills and the publicity surrounding ARP may have led people to wonder what exactly was coming their way, and to question what they were not being told. This in turn may have made them work harder at their own defence.

So good was the strategic placement of the Sub-Control Stations and municipal Type V shelters at highly visible locations that, to this day, people still believe they were public shelters built to accommodate and protect civilians. General knowledge about these types of urban concrete structures in Adelaide has been informed by documentaries and depictions of how similar structures in England and Germany were used in WWII. To date, no documentaries depict their true and very different role in Adelaide during WWII. This research clearly shows that only Type I and Type IV shelters were erected for the general public to use. The municipal Type Vs were nothing more than fortified command posts vital to the ARP communications network in directing emergency services to bombing incidents, or coordinating a network of civilian relief centres and air raid wardens. Further, their archaeologically recorded dimensions demonstrates that the floor plans would limit the number of people who could be comfortably accommodated within, making them inefficient choices for protecting the masses. Type V shelters that did allow public access were built by factories for their workers, some schools and by public houses and stadiums for their patrons.

9.4.2 Fear and the anticipated direction of attack on Adelaide

Of importance to this study is the fear that grew from the perceived direction of attack. Arrowed in red on Map 9-1 are some of the expected points of attack as derived from residents' recollections of that fear. As most oral histories and personal communications came from people who were children during the war years, the placement of these arrows depended on what they remembered their parents talking about, and the defensive military infrastructure they had seen around Adelaide. Analysis shows that in some cases these fears linked directly to the number, type, size and strength of domestic air raid shelters constructed. This section does not consider the many protective military installations that had been placed throughout Adelaide, such as the fixed and mobile gun positions or the location of search light battalions and anti-aircraft guns. None of these types of defences were recalled by those interviewed.

9.4.2.1 Attack vs. invasion

The fear in Adelaide grew out of a perceived two-prong assault, this being an aerial attack followed by an invasion. Both threats appear in the recollections of those eyewitnesses that participated in this research and hinge on the assumption that key infrastructure would be bombed in the first instance, and that this would then be followed by landings of troops at various points along the western beaches. The alternative possibility of an invasion coming from the north along road and rail routes if Darwin fell was not recorded in any testimonials[46].

Recollections included:

- Every house on the Esplanade at Largs Bay (#1 on map) being ordered to install a shelter as protection against bombardment. Largs Bay is situated on Lefevre Peninsula which housed the main oil storage facilities of Adelaide.
- Barbed wire entanglements and fortified observation posts (covered trenches) in the sand dunes along Henley Beach, West Beach and Kirkaldy Beach (#2 on map). These are the closest beaches to the CBD.
- The threat of the enemy landing at Brighton and Seacliff (#3 on map), southwest of Adelaide, then making their way inland by road and moving through Sturt Gorge and the Adelaide foothills to attack Adelaide from the rear. The Military had dug in at the corner of South Road and Sturt Road (where the red lines intersect) on the Laffer's property (see section 7.3.2), and machine gun nests were placed in Sturt Gorge along this presumed route.
- A Tokyo Rose broadcast which suggested that an aircraft carrier would be stationed off Kangaroo Island, with aircraft flying along South Road (#4 on map) and into the CBD to destroy key infrastructure.

Understanding the threat of invasion or the threat of particular directions of attack in some cases helps to explain the type, placement and peculiarities of shelters better than wealth, war experience or proximity to industry. For instance, when viewing the clusters of shelters in Map 8-1 and Map 8-2, two Sub-Control Divisions with large numbers of recorded shelters (Areas C and D) appear to be those furthest from the expected direction of attack, largely those areas to the east and northeast of the CBD and away from the coast. The shelters there can be variously explained by wealth, proximity to heavy industry or limited public

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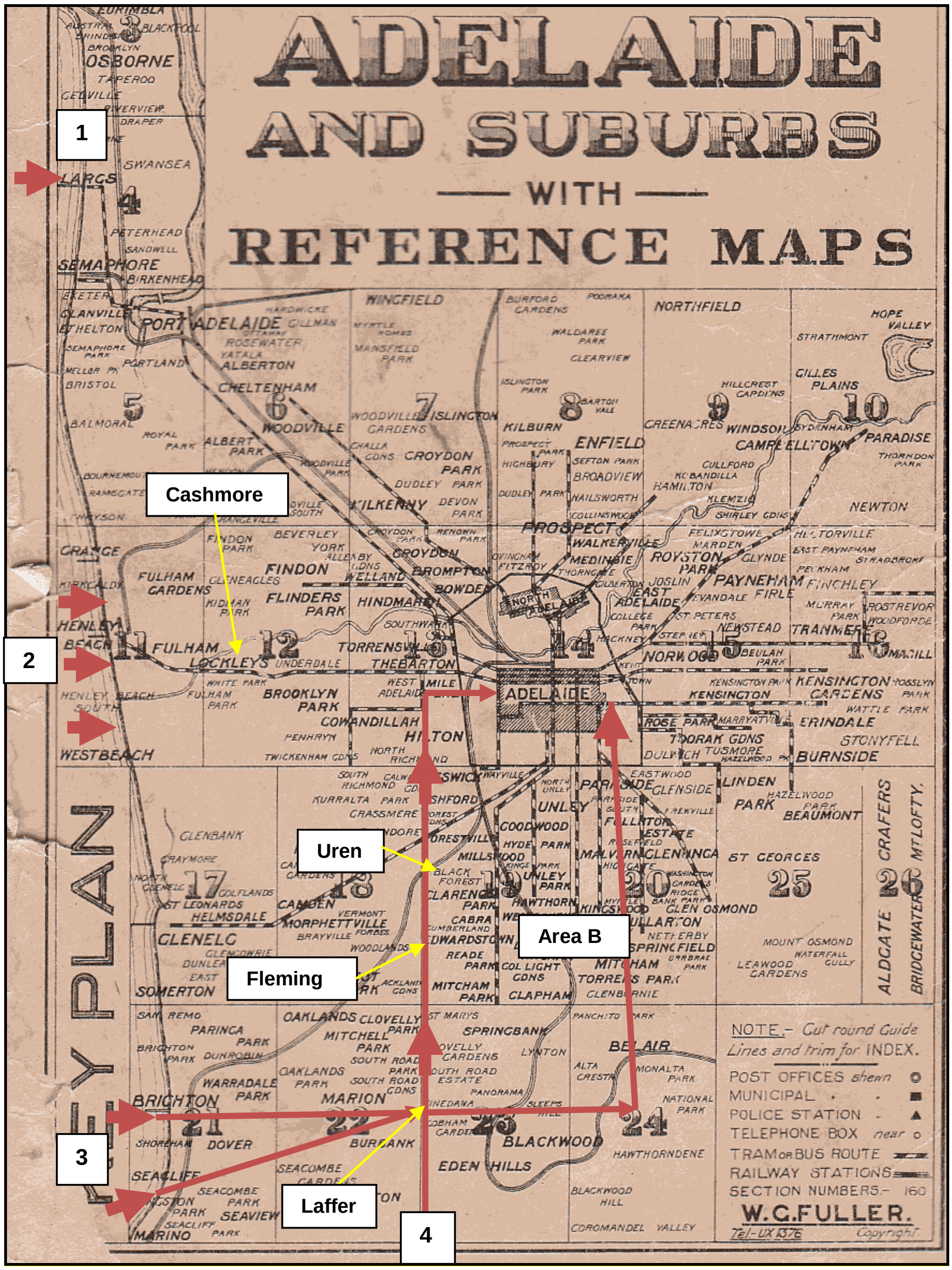
[46] Authorities deemed the risk of an overland attack from the north to be low, partly because there was no rail link between Darwin and Alice Springs (a distance of 1,497 km). For most parts of Australia, invasion was expected to come from the coast adjacent to the major centres. Adelaide, however, could be approached from the north from landings around Pt Augusta which had a good road and rail network connecting it to the State capital. On 30 July 1942 a general policy of 'scorched earth' was issued where all roads and infrastructure would be destroyed ahead of a Japanese advance, denying the enemy an easy approach from the interior.

shelter availability. In contrast, Area B, with more shelters than Area C, had a large public shelter program and was not situated near the industrial sector.



Map 9-1: Adelaide in WWII showing civilian's anticipated directions of attack (Fuller 1940: front cover)

The large shelter numbers in Area B could relate to it lying on the suspected indirect route to the CBD for invading forces (see Map 9-1). Certainly, Laffer's Type II is known to have been constructed with this scenario in mind, a fear that was reinforced in the family by American troops digging coast-facing slit trenches in their vineyard adjacent to their home. The Fleming sister's large Type V lies under the suspected flight path of enemy aircraft approaching from the south along South Road and this may explain why Uren chose an expensive Type III for protection, as he also lived under this aircraft corridor. Arthur Cashmore's Type V in Lockleys (Area G) was constructed on the edge of the largely uninhabited swamp and market garden region, well away from the industrial precinct, but it also lay between a possible Japanese landing at Henley Beach or West Beach and the CBD.

The many shelters constructed in Area B indicate a heightened fear of attack. However, the mix of Types constructed there suggests that the level of fear of living under predicted enemy flight paths or adjacent to suspected routes of enemy troop movements, may not be as great as living in an industrial zone. This can be seen when comparing the Types built in Area B with those in industrialised Area E (see Table 9-1).

Table 9-1: Comparison of shelter Types, direction of attack vs. industrial zone

	% Type I	% Type II	% Type III	% Type V
Area B	**46.7**	**26.7**	**6.7**	**20.0**
Area E	**16.7**	**-**	**-**	**83.3**

From this analysis, it can be seen that Area E had a much larger proportion of concrete bunkers (Type V) than Area B. It may well be that, given the small bomb loads that Japanese planes could carry, there was an understanding among Adelaide's residents that high explosive bombs would be used only against factories and key infrastructure. Suburban areas where opportunistic machine gunning on the way to, or back from, major targets was more plausible, and requiring, therefore, a lesser grade of protection, may explain the larger number of Type I and Type II structures found in Area B.

9.5 Fear: The adhesive of community spirit

Rather than fracture the Adelaide community, the fear of aerial bombardment tended to draw people together. This research has found that the war created a real sense of community and promoted the notion that 'we are all in this together'. Neighbours often helped each other to construct shelters or to share them once complete[47], and fathers joined together to dig trenches on school ovals. This behaviour indicates solidarity and camaraderie in Adelaide during the war years. Where governments had originally predicted mass panic among civilians with the threat of terror bombing, the opposite seems to have occurred in Adelaide, with it strengthening the stoicism and resolve of ordinary Australians who took defensive matters into their own hands. Wartime psychological studies had also shown that people were much more able to face fear and/or death if they faced it with others rather than alone (see section 3.2), an observation which may also be relevant to a neighbour's altruism or the need to ask another for assistance. The social activity of building shelters can further be interpreted as a healthy community distraction in times of greatest threat, which suggests an interesting paradox given they originated in fear. Air raid shelters built in a far flung and un-bombed city, then, not only indicate the level of fear evident in that community, but also the resolve of that community to stand fast.

[47] See, for example, the experience of Eric Neilson at section 7.3.2.1, the long open trench shared by at least 12 homes in Sefton Park at section 7.2.4.1 and the Freeman's Type II shelter in Netherby at section 7.3.

The crucial point, however, is not whether the Japanese ever intended to attack Adelaide from the air, but rather that the local population thought they would, and then prepared for that eventuality. This research has found that Adelaide's civilian population was well prepared for the anticipated aerial attack and that individual responses to the predicted eventuality were tempered by each shelter builder's unique circumstances, whether intuitive or otherwise dictated by social and economic constraints. Despite never being put to the test, the success of the population's efforts can be measured, instead, by the positive psychological effect the structures had on the community, rather than the structural qualities of their choices.

In contrast to what had been predicted by the authorities, the population did not panic. Instead the opposite occurred: shelters fostered positive social interaction and provided a distraction from fearful world events. Within an eighteen month period of shelter building from early December 1941, defence in Australia had taken on a new direction and meaning. Average Australians made individual choices about their own protection independent of their government's military capability, and independent of defence agreements with Australia's allies.

Chapter Ten

Conclusions:

A Vernacular Life

To study a particular bunker in close detail is of course a legitimate archaeological exercise, just as the close investigation of a prehistoric burial mound or medieval castle would be. But...for recent conflict especially, a regional scale of enquiry is required to make real sense of the event and the traces and legacies that remain.

Schofield 2009a: 123

10.1 Primary use surpassed

Few of Adelaide's WWII air raid shelters survive in the twenty-first century. The Japanese advance had faltered by June 1942[48], after which time Imperial Japanese forces attempted to consolidate their position in the islands to the north of Australia. Shelter construction in SA peaked between December 1941 and March 1942 when the Japanese advance was most aggressive. Sales records suggest that shelter purchases in SA began to decrease from March 1942 (see *News*, 27 May 1942: 6 and *News*, 12 June 1942: 5). Council records (cited in this chapter) indicate that public shelters were maintained and improved well into 1943, but from approximately August 1943 interest in their upkeep waned and there was some debate about their future.

On 30 June 1944, Francis Forde (1944), Acting Prime Minister of Australia, gave his consent for the demolition of trench shelters in all areas south of 20 degrees latitude (roughly a line stretching from Port Hedland, WA to Townsville, QLD) subject to the further approval of local authorities.

In essence, from 9:45 a.m. local time (8:15 a.m. Japanese time) 6 August 1945, with the very public appearance of uranium-235 in armed conflict, all six types of shelter used in Adelaide for civil defence in WWII were no longer viable options for defence in future wars.

[48] This was one outcome of the Battle of the Coral Sea and the Battle of Midway where the Imperial Japanese Navy lost a large number of its key assets and its momentum.

10.2 Shelter transit: A heritage reality

Those Adelaide shelters that did not decay naturally and were not demolished with the cessation of hostilities generally acquired some secondary use dependent on the Type of shelter they were, but these were few. The best preserved and longest lived of all shelter Types is the Type V. Most Types, however, because of their unreinforced construction, disappeared from the landscape. The following sections track the fates of each shelter Type.

10.2.1 The fate of Type I shelters

As early as July 1944, the filling in of trenches dug on city squares was mooted at an Adelaide City Council meeting (Adelaide City Council 1944b), and by August of that year the Town Clerk attempted to gain assurances from the Premier "that the Government and the Corporation shall each meet half the cost of the work" (Corporation of Adelaide 1944:1).

Institutions that had been supplied with air raid shelters were full of praise for the city councils once the threat had passed. The following example comes from the West End Baptist Mission (1944) in Wright Street:

> We are very grateful to the City Council for the provision and maintenance of the air-raid shelters. It has given us all a great sense of security in our responsibility to the children in our charge, and we are exceedingly grateful to the Divine Providence which now permits the removal of the shelters without them having been used as a protection against air raids.

It was to be another two years before all visible signs of the trenches at ground level were finally obliterated. On 14 September 1946, B. Bone (SPF233Q:1c), Director of the Department for Parks and Gardens, wrote to the Adelaide Town Clerk suggesting that:

> Following the heavy rains of the past few months the time is considered opportune to complete the sinking of soil filled back into air-raid trenches in City Squares.
>
> This would best be accomplished by means of a heavy roller…run over the trench mounds to complete the sinking and enable the work of levelling and regrassing to be carried out more expeditiously.

The Town Clerk (1946) replied that a 10 ton steamroller was available for rolling the air raid shelter trenches, but there were concerns for the adjacent lawns and that tests needed to be carried out before the work could proceed.

Unlike other more robust shelters which were constructed of concrete and brick, trenches offered very little opportunity for re-use post-hostilities. Few domestic Type I shelters survived for any length of time into the post-war period, and most were backfilled within eighteen months of the war ending. Some backyard trench shelters were used by children as cubbyhouses for a few years until they caved in, and others were used as rubbish pits for household refuse. A common practice in Adelaide since first settlement and up to the time of regular rubbish collection by the local councils was to dig pits at the bottom of the garden for this purpose and trenches became a logical extension of this practice. Today, outside of documentation, trenches survive mainly as human testimony to civilian wartime experiences and psyche, or as shadows and 'footprints' in aerial photographs or geophysical surveys.

10.2.2 The fate of Type II shelters

Most Type II shelters were backfilled shortly after the war in the late 1940s. Of those whose fate is known, two (22.2%) were re-used. Richard Brownrigg (2010, pers. comm. 22 February) recalled his grandfather landscaping his dug-out after the war and turning it into a garden feature. He had constructed a dry-stone walled dug-out (of Adelaide Hills bluestone) in the backyard of his Tudor-style house on King William Rd, Wayville, then removed the roof of wooden beams, galvanised iron and earth sometime after the war, and turned the 'pit' into a sunken garden. The house, now a doctor's surgery, currently has a bitumen car park covering the whole of the backyard, leaving no sign of the Brownrigg garden feature. The Williams' shelter was used by their children as a cubbyhouse until it slumped. Five shelters (55.6%) were backfilled with household refuse—four of these comprised the Kilburn multiple shelter complex. Two shelters (22.2%) were backfilled with earth immediately following hostilities because they reminded the owners too much of the horrors of WWI (see, for example, Leaver MW2-08: 3).

10.2.3 The fate of Type III shelters

Type III shelters are scarce in the Australian landscape. Their huge cost was a factor that limited their spread across suburban Adelaide in the first instance, and their rust prone fabric meant that few examples have survived intact, despite at least 21 having been purchased. During the war years, lead was substituted for zinc in the galvanising process of sheet iron, because zinc was needed in other areas of war production. This, coupled with the recommended method of partially burying Andersons in earth which would have been damp for a large part of the year, may have assisted their deterioration. Anderson shelters were deliberately designed to have some post-war re-use, and consequently were endowed with a value beyond scrap. Their ability to be easily disassembled and reassembled, as well as their portability, meant that they could be re-used in various situations, such as children's cubbyhouses, wood sheds and wine cellars. Further, individual components may have been re-used for various repairs or projects around the home, slowly whittling away the fabric of the original structure.

Today, the Trowse shelter, despite its modifications, is largely in original condition and re-used as a wine cellar, with only the traversed entry functional and the escape hatch sealed. The stairwell no longer extends to its original length, possibly because it was too close to a late 1980s rear-house extension. Instead, a ladder is used to access the first of the surviving original steps located approximately 1.2 m (3.94 ft) below current ground level, with the modified entrance pit now covered by a wooden trapdoor. Entry into the shelter proper is gained via a modern pad-locked tubular steel door. Sometime after the war, the original entry structure was demolished to ground level and both exits backfilled. The shelter entrances were re-located with a probe and excavated by the current owner, who was told of the shelter's existence by a relative of Trowse in 1983. Ground directly above the shelter has been re-levelled, paved with slate and covered with a pergola, to create an outdoor entertainment area that has direct access, via the trap door, to the wine supply below (an identical re-use can be seen with the Pierce shelter in Tusmore detailed in section 7.6.2.4).

10.2.4 The fate of Type IV shelters

Removal of all RC pipes in the city centre had been mooted at a council meeting as early as July 1944 (Adelaide City Council 1944b) and recommended by the Special Defence Committee (1944) to be effected "as opportunity offers". In order to expedite the removal process, and using the Deputy Prime Minister's qualification for affecting this, J. Chapman (1944), Acting City Engineer and Surveyor, wrote to the Adelaide Town Clerk on 17 August advising that:

> All of the concrete pipes which have been used in the construction of Air Raid Shelters by the Corporation are required for outstanding underground drainage works.

For the main, the various organisations and institutions which had pipe shelters in place, such as schools and churches, were keen to be rid of them. In the long queue of disgruntled entities petitioning to have them taken away were officials at Government House who wished the shelter near the main gates removed before the new Governor arrived to take up residence (see Adelaide Town Clerk 1944). Father Redden, St Francis Xavier Cathedral, also requested their removal from alongside the cathedral ahead of the large crowd expected for Cardinal Gilroy's[49] first visit to Adelaide on 11 May 1946 (see Adelaide City Engineer 1946 and *The Mail*, 11 May 1946: 1). This request indicates that some Type IVs were still *in situ* as late as mid 1946.

Concurrently, another queue was forming. The pipes had become so popular with school children that as early as October 1943 a number of schools and kindergartens began to request that they be left one pipe once they were no longer required for the protection of children. The Home School rang the Town Clerks Office (1944) asking that:

> …the air-raid trench in their grounds be left for the time being as the vegetables they planted on the mounds were now appearing, and they would like them left if possible.

---

[49] Sir Norman Gilroy was Australia's first Roman Catholic Cardinal.

Mrs E. Tipping (1943), Hon. Secretary, Lucy Morice Kindergarten, in a letter to the Adelaide Town Clerk, passed on the school committee's wishes:

> …now the need for shelters seems to have passed, we wonder if it would be possible to remove one of them [pipes] which cramps the children's playground. We would appreciate it if you could allow us to keep one pipe as play equipment.

This request was granted by J. Chapman (1943), Acting City Engineer:

> …provided they accept liability as regards damage to the pipe, or accidents which may result from the use of the pipe as play equipment.

Pipes used as play equipment feature as fond memories for many of the post-war generation who can recall having them at their schools as children. For example, Julie Collins (2010, pers. comm. 7 June, Collection Manager of the Architecture Museum, UNISA), remembers five pipes—two stacked on top of three—at Flinders Park Primary School. Oral testimony also places pipes at Kilkenny Primary School, Croydon Park Primary School, Strathmont Junior and Primary School and Sturt Primary School, in the 1960s and 1970s. It is uncertain whether any of these school pipes were war remainders or procured post-war, due to their obvious popularity among that generation of school children. Regardless, playground landscapes of the post-war years owe much to wartime air raid precautions and innovation. Unfortunately, none of these five schools retained their pipes into the twenty-first century, and they were consequently not able to be physically recorded for this study. Some pipes, however, can still be located in Adelaide schools, playgrounds and national parks. Several of these were recorded (see Table 10-1).

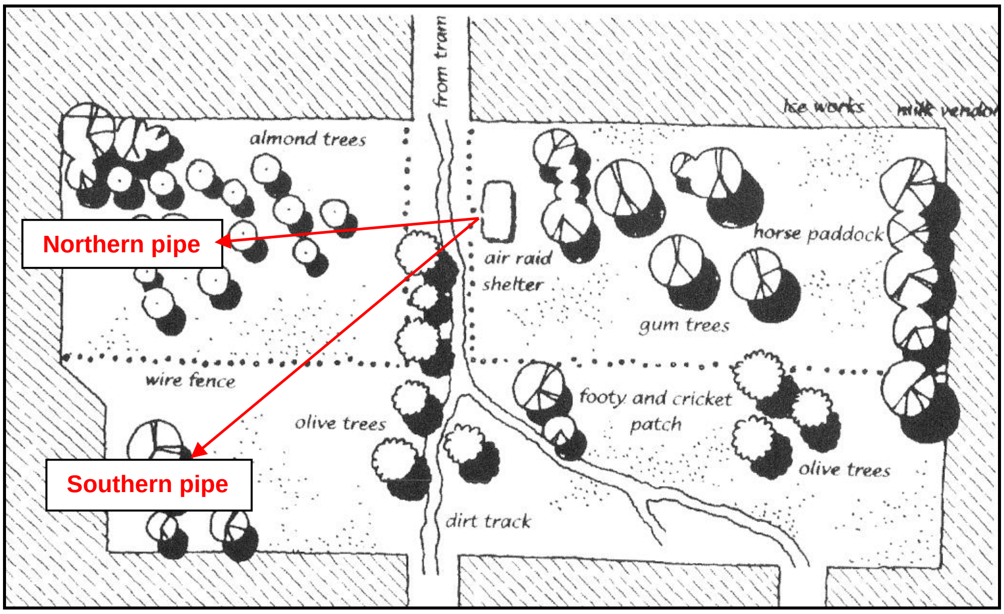
Table 10-1: Dimensions of extant schoolyard and playground pipes

Location	Length	Internal Width	External Width	Thickness of Wall	Flanged End
Mitcham Primary Northern Pipe	249.0 cm (98 in.)	122.0 cm (48 in.)	136.0 cm (53.5 in.)	14.0 cm (5.5 in.)	Yes
Mitcham Primary Southern Pipe	NA	NA	NA	NA	NA
Marshmallow Park Playground Red Pipe	242.5 cm (95.5 in.)	137.0 cm (54 in.)	152.0 cm (60 in.)	15.0 cm (6 in.)	No
Marshmallow Park Playground Yellow Pipe	242.0 cm (95 in.)	136.5 cm (54 in.)	152.0 cm (60 in.)	15.5 cm (6 in.)	No
Glover Playground Purple Pipe	240.0 cm (94.5 in.)	105.0 cm (41.5 in.)	118.0 cm (46.5 in.)	13.0 cm (5 in.)	No
Glover Playground Yellow Pipe	240.0 cm (94.5 in.)	106.0 cm (41.7 in.)	119.0 cm (46.9 in.)	13.0 cm (5.2 in.)	No
Glover Playground Red Pipe	240.0 cm (94.5 in.)	91.0 cm (35.8 in.)	102.6 cm (40.4 in.)	11.6 cm (4.6 in.)	No
Glover Playground Orange Pipe	240.0 cm (94.5 in.)	91.0 cm (35.8 in.)	102.0 cm (40.2 in.)	11.0 cm (4.4 in.)	No
Glover Playground Blue Pipe	242.5 cm (95.5 in.)	76.0 cm (29.9 in.)	86.8 cm (34.2 in.)	10.8 cm (4.3 in.)	No
Glover Playground Green Pipe	240.5 cm (94.5 in.)	76.0 cm (29.9 in.)	86.8 cm (34.1 in.)	10.8 cm (4.2 in.)	No

Figure 10-1: Excavated playground pipe, Mitcham Primary School September 2009 (Wimmer 2009)

Mitcham Primary School, situated on the grounds of a former wartime adventure playground which did have an air raid shelter, has one pipe near its Grade 6/7 block. It also had a second pipe, re-discovered during a re-development program in September 2009, under a playground mound on which was seated an old metal slippery dip (see Figure 10-1).

Both pipes were placed several hundred metres from the original shelter location (see Map 10-1), but may have been moved to their most recent positions after the war. The area where the shelter had been positioned is now a staff car park. No documentary evidence was found to indicate that these pipes were originally part of the shelter, but the measured pipe has an internal diameter of 121.92 cm (48 in.) and is 2.44 m (8 ft) long (see Table 10-1)—dimensions which fit those of the larger Hume pipes employed during the war for use by adults in playgrounds. It was not possible to record the excavated pipe beyond photography as it was located within a fenced construction site and removed shortly after discovery.



Map 10-1: War and post-war location of pipes at Mitcham Primary School.
With permission of Mitcham School 150 History Committee (Cornwall 1997: 128).

Some public playgrounds in Adelaide, such as Glover Playground (see Figure 10-2) and Marshmallow Park, in the South Park lands, also retain pipes as part of their play equipment. Glover Playground has six pipes, all 2.44 m (8 ft) long. This fits the prescribed pipe allocation for wartime CBD playgrounds, yet the pipes are of three different widths, not two as detailed in historical documents (see Table 10-1). These consist of two 76.2 cm (30 in.), two 91.44 cm (36 in.) and two 106.68 cm (42 in.). It is known that the Adelaide City Council purchased 36 in., 42 in. and 48 in. pipes early in the war (SPF 233Q:01 1942), and that Unley Council also used various width pipes for civil defence (Bentzen 1942: 30-31). If the Glover Playground pipes are artefacts of the war years, their varied widths may be an indication of the shortages of the prescribed sizes, as well as further evidence of the desperate measures taken to provide some form of protection by using 30 in. pipes for children and adults in the public spaces of Adelaide.

Figure 10-2: Glover Playground, South Terrace, Adelaide
(Wimmer 2007)

As well as concrete pipes, Glover Playground has two mounds within its boundary which are similar in shape to the mounds observed at Mitcham Primary and Soutar Park, Goodwood. Both Glover Playground mounds were surveyed with an automatic level. The smallest, with a maximum height of 0.64 m (2.1 ft), appears as a landscape feature in the playground. The largest, with a maximum height of 1.395 m (4.65 ft), has been used as the foundation for play equipment. These mounds may well be different size pipes buried to different depths. Time constraints meant that sub-surface imaging could not be conducted at the site to verify whether the mounds are constructed over concrete pipes or other ARP man-made structures. More images of these pipes can be found in the Glover Playground pipes folder in Appendix 6 of the accompanying CD.

Marshmallow Park playground, also in the South Park Lands, has two pipes—137.16 cm (54 in.) wide and 2.44 m (8 ft) long—which are currently disposed as play equipment. Although larger diameter pipes were used in civil defence overseas during WWII (see McCann 1942a: 1), no reference to this size pipe has been found in any of the historical documents relating to public defence in Adelaide. Some were, however, used in industrial settings, for example, by automobile manufacturer Richard's Industries at Keswick where eight were installed for the employees (CEDKT 1942/1121A). A 60 in. pipe had also been tested against various weapons, along with a 48 in. pipe, at Fort Glanville in March 1942 (see SPF 233Q:01 1942). The large diameter of the Marshmallow Park pipes suggests that it may not relate to Adelaide's public spaces ARP infrastructure. Images of these pipes can be found in the Marshmallow Park pipes folder in Appendix 6 of the accompanying CD.

The Adelaide City Council also had many enquiries from all over South Australia (including Cleve on Eyre Peninsula [Gaskill 1946], Berri in the Riverland [Berri Co-operative Packing Union Ltd 1946] and Orroroo in the Mid North [Hennessy 1946]) as to the availability of pipes for purchase. Typical of these enquiries was that of Mr. C.H. Joyce (1945) of Kersbrook in the Adelaide Hills:

> I am writing to see if you are selling those big cement pipes what the air shelters are made of. I am digging a well and they would be just the things, instead of using timber. If you are selling them I would like to (sic) if the price is not to hot. Please reply at your earliest.

As far as can be ascertained from the archival record, no pipes were sold on to the public but some may have been sold to the South Australian Housing Trust who installed concrete pipes as rain-water tanks on several of their rental properties in the late1940s and early 1950s (see Figure 10-3).

Concrete pipes re-used as rain-water tanks, were observed in five Housing Trust backyards in suburban Kilburn. Only one of these was recorded. This pipe is 48 inches wide and has a length of 6 feet. Its width is that favoured for ARP but its length is two feet short of the standard. It is also flanged at one end which allows it to be easily joined to another. Now installed vertically on a footing of bricks three courses high, the bottom of the tank is sealed with concrete and the top has a removable concrete cover (4 cm/1.58 in. thick) which is cast in two parts so that half can be easily slid aside for cistern maintenance. These Kilburn Housing Trust homes were constructed in 1950/51. The tenant of one house has resided there since 1957 and was told that his rain-water tank was a former air raid shelter shortly after taking procession of the property (Max Beale 2010, pers. comm. 7 October). It could not be determined categorically whether these pipes are ex-air raid shelters. Their installation as rain-water tanks in the early post-war period lends support to the theory that they may well have seen active civil defence service in the years previous and were surplus to public drainage work needs yet remained in public service. More images of these rainwater tanks can be found in the Kilburn Type IV rainwater tanks folder in Appendix 6 of the accompanying CD.

Figure 10-3: A concrete pipe rainwater tank, Kilburn, SA
(Wimmer 2012)

10.2.5 The fate of Type V shelters

The solid construction of Type V shelters has ensured a large number have survived intact into the twenty first-century to be re-used however the custodians see fit. It has also ensured that the partial remains of demolished shelters survive in the archaeological record. Hardened and reinforced structures are not only expensive to build, but also expensive to knock down. Because of this, many are only demolished to ground level and built over as was the Fleming's and the Unley Sub-Control Station.

A question often asked of this project concerns the re-use of air raid shelters, and, in particular, Type V structures. The extant shelters that have been located and archaeologically recorded herein have largely come to light because the current owners recognise them as shelters, despite their many and varied re-uses. Without a doubt, the original use of the majority that survive is no longer recognised; they are, therefore, likely to go undetected by researchers because of their new guises. The surviving structures are not only heritage assets, but they are also capital assets to modern day property owners who use them to fill an incalculable number of utilitarian needs. Aside from some obvious non-architectural conversions of these 'spare' rooms to mushroom cultivation chambers (Lamberton), wine cellars (Pierce) and storage rooms (Griff and Jackson), and some less obvious, to chicken hatcheries (Chapman), a number of shelters are also physically modified beyond recognition to fulfil a new function.

Lawrence William Sharpe, a cycle builder of Sefton Park, built a shed over his Type V, and then removed the shelter's top and converted it into an automobile service pit. The Country Women's Association purchased Harley's mansion in 1951 (LTO CT636/ Folio 167) and, like Brownrigg's Type II, converted it into a sunken garden during renovations in 2012 (see Figure 10-4).

Figure 10-4: The Harley Type V sunken garden
(Wimmer 2013)

Due to their solid construction and massive size, most Sub-Control Station Type V shelters became council assets after the war and were commonly re-used as club rooms for various organisations. Robert Morrell (MW2-07: 10) remembered that as a child he raced his friends up the slippery slopes of the Woodville Sub-Control Station, and that one side was more slippery than the other. The Woodville Football Club held various club functions in this shelter during the 1950s (the shelter was adjacent to Woodville Oval), and Robert recalls attending pastry nights there as a member of the club's Colts.

The Prospect shelter was used variously by the St John Ambulance Brigade and North Adelaide Football Club. In addition, in September 1965 it was considered as a potential club room by the South Australian Police Model Car Club. This was the era of the SCALEXTRIC® craze in the UK and Australia. The SA Police

Model Car Club wanted to renovate the premises by removing an internal wall to install a slot car track (see Figure 10-5). The model car club estimated that it would cost in the vicinity of £125 to make the shelter habitable and a further £120 to purchase the track and electronic equipment. The flooding in the shelter seems to have been a perpetual problem; Riddle (1965: 1) observed:

> Regarding the water seepage problem it was decided we have not the facilities or knowledge to effect a satisfactory and permanent repair. Temporary patching we are afraid would not solve this problem.

The model car club had made enquiries with three clubs and organisations using air raid shelters in other council areas, and discovered that two did not pay rent and that upkeep and maintenance were the only payment required. The third paid a nominal rent of only £1 per annum. The Prospect Local History Group currently has plans underway to turn the shelter into a museum and interpretive centre.

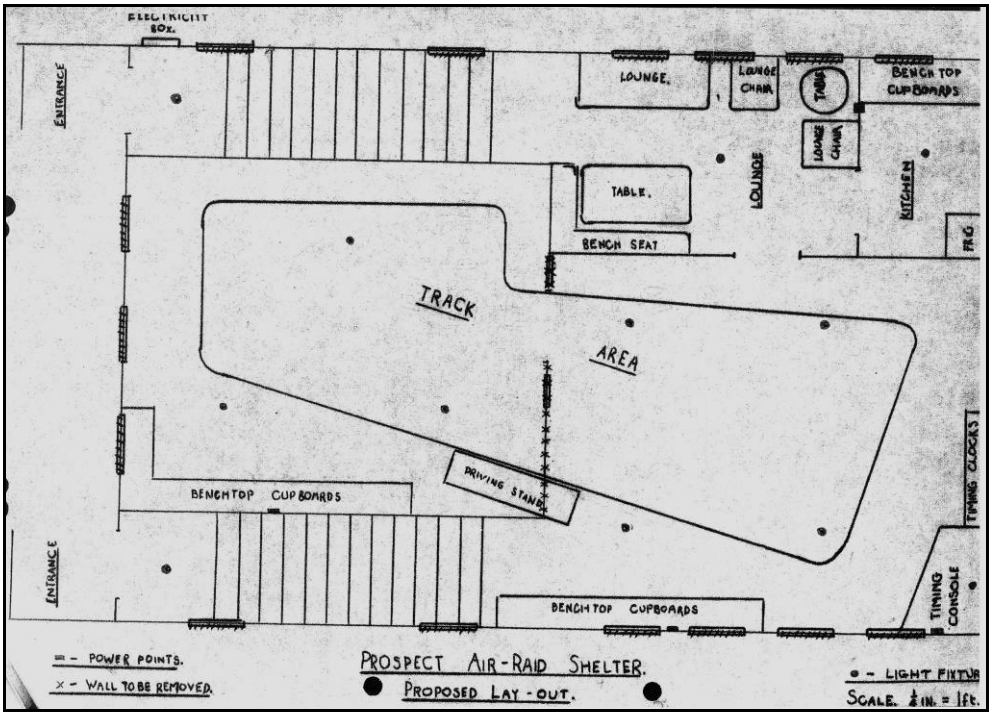


Figure 10-5: Proposed re-use of Prospect ARP Sub-Control Station as model car club (Riddle1965:2)

In the immediate post-war era, the Thebarton Sub-Control Station was used as a St John Ambulance cadet training facility, and since 1969 has housed the Australian Society of Magicians. It is now externally painted with murals depicting various magicians of note performing magic tricks (see Figure 10-6). In 2008, the shelter was estimated to have a replacement value of $178,960 (City of West Torrens 2008: 33). It is currently threatened by plans to widen South Road, one of the main arterial roads of Adelaide.

Figure 10-6: Murals on entrances of Thebarton Sub-Control Station
(Wimmer 2010)

The Glenelg Sub-Control Station was used variously as a Boy Scout Hall and St John Ambulance training facility. It was also used to store Glenelg Football Club’s stationary and the cheer squad banners until gutted by fire in 1994. It has since been refurbished, and is currently an interpretive centre that details, through the use of objects and archival material, the social history of Glenelg during WWII, with a focus on civil defence. It is painted in dove grey, the original colour of its exterior woodwork and louvers (Controller of Construction 1942), and has signage contemporary with the war stating that it is an air raid shelter.

Prior to demolition, the Unley Sub-Control Station was used as a store for war-era emergency services equipment, and as the last local headquarters for civil defence in post-war Unley. Ron Praite (MW1-07: 8) recalled cleaning out the shelter before it was demolished and finding that:

> ...[it] had a lot of stock in it. It had old steel helmets, a lot of old first-aid gear but that was twenty years after the finish of the war. The Solyptol[50] liquid that was in it had deteriorated, the bandages had all virtually rotted…And there were old torches that were very mass produced, crudely made things… nap-sacks, pumps, stirrup pumps.

The Oxford Terrace shelter was used to store council documents. However, it was prone to flooding and much of its contents were lost to water damage (Praite MW1-07: 7). Today, the shelter has been extensively modified and houses the air-conditioning plant for the new Council Civic Centre (see Figure 10-7).

Figure 10-7: Plant room, Oxford Terrace Type V shelter
(Wimmer 2010)

[50] Solyptol is a eucalyptus oil based antiseptic manufactured in Australia by F.H. Faulding and Co. Ltd

10.2.6 The fate of Type VI shelters

For the main, measures such as sandbagging, covering windows or adding in supporting beams to convert existing rooms into Type VI shelters could easily be reversed once hostilities ceased, leaving no trace of the former structural precautions. Morrison Table Shelters could also be dismantled and removed. These are the rarest type of domestic shelter to record archaeologically, despite more of them being recorded through archival research than any other type. They are elusive, and difficult to describe and interpret as a result. In some cases where structural modifications were not intrusive (such as the Lee's use of steel railway lines to reinforce the cellar ceiling), they were left in place without changing the original use of the modified room.

10.3 A heritage of real people and of Adelaide wartime society

Orser (2004: 300) writes that "[t]he past is ... cultural and social, political and economic, technological and environmental". All of these things have been explored herein through the interpretation of a specific type of material culture which emerged at a precise point in time and had a very short primary use life. Air raid shelters are important because they are anchored by their contexts to the past despite their current dispositions and uses. This allows us to study cultural processes in their past. The surviving structures and information about those that have been demolished have the potential to inform us about the people who built them and about their society just as they informed the society who constructed them in the first instance. These people form a collective that, from time to time, took personal photographs or kept diaries detailing facets of their daily lives, but of whom little is generally known outside of a few mementos and keepsakes. The landscape, born out of fear and created by them in the early 1940s, reflects those private and unrecorded aspects of their lives. This is an archaeology of real and identifiable people (such as Trowse and Willis) whom we can get to know by studying and interpreting what they built and left behind.

The shelters are more than just protective structures. Their diversity, spatial distribution, and the fact that not everybody had one, allow us not only to order them in historical and particularist ways, but to also ask sociological questions about them. A growing awareness of personal vulnerability fostered a causal relationship between technology and economic and social processes, leading to, and in all probability directing, those independent decisions being made by individuals about their own protection. The material product of this causality was dependent on each individual's perspective (often informed by earlier and unfolding events in Europe) and how war ultimately affected that individual. That perspective can still be read through archaeological enquiry. Such enquiries need not only focus the on fear reflected by these structures but could consider other complementary reasons for their existence. For example, archaeological enquiry may also detect status rivalries between groups of neighbours or within members of the same family, especially where those shelter builders live close to one another.

10.3.1 Why shelters matter

Air raid shelters owe their existence to global warfare, yet despite their obvious relationship to war, this research has shown that the archaeology of these unprecedented and previously unimagined South Australian urban structures is also an archaeology of the commonplace and the ordinary. Air raid shelters tell us how ordinary everyday individuals co-opted everyday materials to help cope with extraordinary world events. These early twentieth century structures, now seated in a modern landscape, are still legible and remind us of war, individual reactions to war and how society accommodated militarism. The shelters were left to us by our forebears and are consequently our heritage. Schofield (2009: 3) observes that:

> ...as heritage these ordinary places have become in some ways extraordinary, in the meanings and values they can encapsulate and convey to society. These are typically modern and supposedly familiar places that present particular and difficult choices and challenges, for heritage practitioners and the academe.

These structures matter. They are endowed with evidential and communal value. They have sociological dimensions which tie them to place and they are markers that symbolise a shift in defensive posture from a dependence on governments and armed forces to independent civilian thought and action.

10.4 A regional study with national application

This study is the first in-depth, regional investigation of individual material responses to the threat of aerial bombardment during WWII in Australia. The outcome of this research allows us to gain an understanding of the independent nature of local communities. They also allow us to make Australia-wide hypotheses about attitudinal perspectives towards conflict during the war years which can be used as a theoretical platform from which to view the national condition.

This research focussed on the reaction to the Japanese threat that was manifest on one of the southern-most reaches of mainland Australia, spanning an eighteen month period from 7 December 1941 to August 1943. Due to Adelaide's geographical distance from the locus of conflict in Asia and the Pacific, it is a region which was least likely to be attacked from the air, given the technological and logistical limitations facing the Imperial Japanese forces during

WWII. Therefore, the data collected in Adelaide could be interpreted as providing an indication of the lowest level of the fear spectrum in Australia, a level which presumably increased around coastal Australia in the direction of the on-coming assault to both the northeast and northwest of Adelaide. This observation is supported by the order to evacuate Darwin's residents to the south. If the frequency of air raid shelters in Adelaide is a barometer for the level of fear in that community, then one would expect the rate of construction and the structural strength of air raid shelters to increase significantly in cities and towns in northern Australia where the fear of attack would be amplified. As such, this study lends itself to comparative studies of other Australian regions and capital cities in order to test this prediction. And if not a fear based hypotheses, future research could also consider hypotheses based on complementary reasons for the distribution of types of shelter such as status rivalry, the desire to being seen to be doing 'one's bit' or childhood adventure (where children were involved in shelter construction).

The potential for extracting comparative data in replicated studies across Australia is immense. Not only could such studies be used to gauge the level of fear around Australia, but they could also compare the social contingencies identified in Adelaide and attributable to each shelter type. Local context can completely invert the significance and meanings of artefacts. The Anderson Shelter demonstrated this inversion between Australian and UK contexts (see section 8.5.1). Local studies could also be important in identifying inversions between other Australian communities or regions. Such studies are essential therefore, and could be used to identify attributes in material culture which cannot be known simply by assuming something means the same thing everywhere (for instance, it can't be assumed that the shelters represent fear everywhere they were built). This, in its turn, would contribute new knowledge to the international sphere by demonstrating the independence of local communities, and lead to further comparisons of self-reliance in defence.

A premise of this study has been that air raid shelters reflect aspects of their contemporary society which are absent in other forms of material culture. Given this assumption, and the fact that prior to this research there had been no comprehensive archaeological study of shelters anywhere in Australia, the possibility for gaining new information about ‘us’, and identifying patterns and trends in Australian wartime society from this un-tapped resource, represents an opportunity too good to miss. This is especially so, because it is still possible to enhance this data with the testimony of those who interacted with the structures when they first appeared in the landscape. There is also some urgency in effecting further studies in the near future, given the advanced age of eyewitnesses.

Like shipwrecks and other catastrophic events, the shelters—spawn of potential catastrophe—allow us look back on a very precise point in time. The information they can provide comes from a compressed period during a significant world event, and may allow us to precisely define, and accurately log, sociological fluctuations and trends. This type of research moves histories away from the traditional time spans of decades and centuries (and indeed millennia, as in the case of Australian Indigenous archaeology) where whole events are summarised in retrospective analysis, to a more surgical inspection of an event’s individual sociological components.

10.5 Application in heritage assessment

This research has potential application as a gauge against which the heritage significance of air raid shelters can be assessed. The significance of the resource has already been demonstrated. Prior to this research, there was little or no prior understanding of these structures. The implication was that their heritage value could only be assessed via general and sweeping statements regarding their relationship to WWII, and the community's responses to fear during that conflict. Now, with the development of a structural typology that can link to rarity of type and wider social attributes, each shelter can also be assessed on specific archaeological and social grounds.

This research has drawn on the English experience of assessing the heritage value of contemporary military structures (see section 4.3). Australia lags behind the UK and other nations in accepting the archaeology of contemporary events as valid avenues of research and discourse in attributing heritage significance to modern material culture. This thesis demonstrates the potential of the archaeology of the recent past and the archaeology of short and precise time periods in Australia. Through this research, the heritage value of the Australian WWII air raid shelters can now be recognised, and a degree of academic discourse generated about the resource.

10.6 Think again...

This thesis began by asking the reader to think of local structures which embody facets of global politics, architectural theory, catastrophe theory, psychological warfare, defence theory and personal economic hardship. At the completion of this study, the reader is again asked to think of a seventy year-old cultural landscape emerging from the fog of seven decades of global and local social change. To think again of fearful wartime structures which reflect every aspect of a society dogged by a predicted catastrophe, and that only now surrender their social nuance because of this research. Air raid shelters are exemplars in demonstrating how such a complex interplay of topics is manifest to various degrees in all material culture. Once this concept is grasped, the potential for gaining a greater understanding of our past (regardless of how recent that past may be) is greatly enhanced.

There are many ways of looking at, and judging, the past. By considering and interpreting the complex interplay of social characteristics reflected by air raid shelters at a regional level, this thesis demonstrates a new way of looking at a vernacular past, a way of looking which can ultimately inform us of the social processes which have formed the vernacular present.

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Appendices

Appendix 1 – Ethics Approval Letter

FLINDERS UNIVERSITY
ADELAIDE • AUSTRALIA

Social and Behavioural Research Ethics Committee
Office of Research

GPO Box 2100
Adelaide 5001 Australia

Telephone: (+61 8) 8201 5962
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SBRE 3897

20 July 2007

Mr Martin Wimmer
Department of Archaeology

Dear Mr Wimmer

Project 3897 **Archaeology of Defence: The Sum of All Fears**

Further to my letter dated 22 June 2007, I am pleased to inform you that approval of the above project has been confirmed following receipt of the additional information you submitted on 10 July 2007. Approval is valid for the period of time requested or three years, whichever is the least, and is given on the basis of information provided in the application, its attachments and the information subsequently provided.

In accordance with the undertaking you provided in the application, please inform the Social and Behavioural Research Ethics Committee, giving reasons, if the research project is discontinued before the expected date of completion and report anything which might warrant review of ethical approval of the protocol. Such matters include:

- serious or unexpected adverse effects on participants;
- proposed changes in the protocol; and
- unforeseen events that might affect continued ethical acceptability of the project.

I draw to your attention the requirement of the *National Statement on Ethical Conduct in Human Research* that you submit an annual progress and/or final report to SBREC. If a report is not received beforehand, a reminder notice will be issued in twelve months' time. A copy of the report pro forma is available from the SBREC website
http://www.flinders.edu.au/research/Office/ethics/socialbehavioural.html.

Yours sincerely

For

Sandy Huxtable
Secretary
Social and Behavioural Research Ethics Committee

cc: Dr Heather Burke, Department of Archaeology
A/Prof Mark Staniforth, Department of Archaeology
Dr Alice Gorman, Department of Archaeology

Location: Sturt Road, Bedford Park, South Australia.

Appendix 2 – Information Sheet for Oral History Participants

The Sum of all Fears: Archaeology of Australian World War II Civil Defence

DEPARTMENT OF ARCHAEOLOGY - FLINDERS UNIVERSITY

INFORMATION SHEET FOR ORAL HISTORY PARTICIPANTS

Thank you for consenting to participate in an oral history interview.
Please take a few minutes to read through the following information about the research and the interview process.

The Research
The purpose of this research is to record people's memories of the World War II air raid shelters that were erected in and around Adelaide. This will be done in order to relocate lost shelters and to gain some knowledge with respect to how people interacted with the shelters. Some of the things that it is hoped the interviews will inform the research on include information on how they were built, how they were used before and after the war, if people felt safe in them or by having them around, if they were easily accessible and so on.

Results
Information extracted from the interviews will be used to guide and support post-graduate research on the civil defences of Australia during World War II in the Department of Archaeology at Flinders University. The data may be used in other research publications arising from the project, such as journal articles, books, posters or pamphlets. No material from your interview will be used without your permission and you will be given the opportunity to review the use of any material from your interview prior to publication.

The Oral History Interview Process

- Martin Wimmer, a student from Flinders University, will have made contact with you initially to seek your participation in an oral history interview. If you have agreed to proceed, you will then be asked to read and sign a **Consent Form for Interview**. The interview will then take place.
- A **List of key questions and general issues** has been prepared for use during your oral history interview. This is a guideline only, and you are free to make any suggestions about information to be included or excluded from the interview.
- It is your right to request that the interview be stopped at any time.
- The interview will then take place. Martin Wimmer will take notes of your responses to the key questions and issues discussed. Your responses during the interview will also be recorded with a digital recorder. This will not take any longer than one hour.
- After your interview you will be sent a typed draft copy (**transcript**) of the interview. Please read through the transcript and make any corrections or comments for editing and review. You are free to exclude any material at any time.

Thank you once again for your participation. I look forward to hearing about your memories of the air raid shelters and to sharing the results of the project with you.

Martin Wimmer

Contact Details
Department of Archaeology
Flinders University
GPO Box 2100, Adelaide SA 5001
Email: martin.wimmer@flinders.edu.au

Appendix 3 – Consent Form for Interview

The Sum of all fears: Archaeology of Australian World War II Civil Defence

DEPARTMENT OF ARCHAEOLOGY - FLINDERS UNIVERSITY

CONSENT FORM FOR INTERVIEW

I ....

Being over the age of 18 years hereby consent to participate as requested in the interview for the research project on World War II air raid shelters of Adelaide.

1. I have read the information provided.
2. Details of procedures and any risks have been explained to my satisfaction.
3. I agree to my information and participation being recorded by note taking and/or on a digital recorder.
4. While the information gained in this study will be published as explained, I understand that I have the right to remain anonymous and to have my individual information remain confidential.
   - ☐ **YES**, I wish to remain anonymous and to keep my individual information confidential.
   - ☐ **NO**, I wish to be identified by name as a contributor to this study, and am happy to have my individual information kept on file by the co-ordinator of this project (Dr Heather Burke).
5. I agree to the notes/digital recording being made available to other researchers who are not members of this research team:
   - ☐ And am happy for my name to be attached.
   - ☐ Only on condition that my identity is not revealed.
   - ☐ **NO,** I do not wish to have my notes/ digital recordings made available to other researchers.
6. I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.
7. I understand that:
   - I may not directly benefit from taking part in this research.
   - I am free to withdraw from the project at any time and am free to decline to answer particular questions.
   - I may ask that the recording/observation be stopped at any time, and that I may withdraw at any time from the session or the research without disadvantage.
8. I have had the opportunity to discuss taking part in this research with a family member or friend.

Participant's signature ....Date.....................

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to their participation.

Researcher's signature...Date.....................

NB: Two signed copies of this form should be obtained. One copy will be retained by the researcher for authorisation of Items 9 and 10 below, as appropriate.

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9. I, the participant whose signature appears below, have read a transcript of my participation, have edited it to my satisfaction, and agree to its use by the researcher as explained.

Participant's signature...Date.....................

10. I, the participant whose signature appears below, have read the researcher's report and agree to the publication of my information as reported.

Participant's signature...Date.....................

Appendix 4 – Shelter Database

Refer to: **http://andspub.flinders.edu.au/rdr/wimmer_hist_struct_def_adl/#**.

Appendix 5 – Oral History Transcripts

Refer to:
http://andspub.flinders.edu.au/rdr/wimmer_hist_struct_def_adl/#.

Appendix 6 – Additional Shelter Data

Refer to:
http://andspub.flinders.edu.au/rdr/wimmer_hist_struct_def_adl/#

Appendix 7 – Additional Sources

Refer to: http://andspub.flinders.edu.au/rdr/wimmer_hist_struct_def_adl/#