Former Fannie Bay Gaol

Improving thermal comfort

February 2017

A report for

NT Department of Tourism and Culture

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Contents

Introduction

This Report was commissioned by the Heritage Branch of the NT Department of Tourism & Culture in February 2017. Its purpose is to investigate ways in which thermal comfort could potentially be improved for visitors to Fannie Bay Gaol heritage site and within the individual buildings in the gaol complex.

In broad terms this means to:

- Identify those buildings on the site that could potentially be air conditioned and discuss in conceptual and schematic terms, with appropriate illustrations, how this might occur. Provide schematic details indicating the location of outdoor air conditioning units and the proposed reticulation of pipework and cabling; and
- Where buildings cannot or should not be air conditioned, for practical or conservation reasons, discuss alternative strategies that could potentially be adopted that may contribute to improving visitor comfort within the individual buildings.

Study area
The Fannie Bay Gaol and site is owned by the Northern Territory Government and managed by the Museum and Art Gallery of the Northern Territory. Fannie Bay Gaol is located on Lot 5219 Town of Darwin (82 East Point Road) in the suburb of Fannie Bay.

Heritage status
Fannie Bay Gaol was listed on the Northern Territory Heritage Register on the 8th February 1995 (Asset Identifier: File H93/0005). It is also on the National Trust of Australia (NT Branch) Register of Significant Places (entered 25 March 1985), and on the Australian Heritage database, Department of the Environment and Energy (Entered 1 November 1983).

Methodology
The methodology and assessment criteria are defined in the first section of this Report. Reference was made to the Conservation Management Plan (2016) and the methodology is in accordance with the principles and definitions set out in *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*.

Authorship
This report was prepared by Dr David Bridgman. The author would like to acknowledge the input of Simon Watkins a consulting mechanical engineer from Irwin Consult, who provided advice and information on the refrigerated air conditioning systems discussed in this report.

Executive summary

Visitor comfort

The Fannie Bay Gaol site has the potential to become an important visitor experience where the story of the oldest extant gaol in the Northern Territory can be told. Alongside this story of incarceration is the broader history of policing in the Northern Territory and, by extension, the Judiciary. The Northern Territory Archives and the National Archives of Australia have an extensive collection of documents relating to the gaol when it was operational, including very early records from police inspector Paul Foelsche dating from the late nineteenth century.

However, it is the Gaol itself and the various buildings on the site that are fascinating. One disadvantage though, is that even during the cooler dry season months the site can become very warm and sometimes unpleasant for a number of reasons. This means that people often tend to spend the minimum amount of time on the site, quickly returning to the comfort of their vehicles. How then to improve visitor comfort without compromising the heritage values of the site and the individual buildings on the site?

The first consideration was the gaol site itself and there are various issues with the site including the lack of shade and seating and a perimeter wall that blocks cooling breezes across the site. The second consideration was the sixteen individual buildings on the gaol site. While one approach would be to provide refrigerated air-conditioning to the buildings, there are many buildings that cannot be air conditioned because of their open design. While modifications could be made to enclose some of these buildings, in most cases these changes would compromise the heritage value of the building which is not a desirable outcome. These individual buildings have been placed into two distinct groups: those buildings that should not or cannot reasonably be air conditioned and those buildings that could potentially be air-conditioned.

Heritage considerations

Suggestions and recommendations provided in this report have been shaped to conform to the requirements of the Conservation Management Plan with particular reference to the Statement of Significance, the schedule of levels of significance, policy section 3.0 and to conservation policies 1.5; 4.2; 8.8 and 8.9. These Policies and the Statement of Significance are reproduced later in this report for reference.

Key considerations were:

- To conserve original and early fabric;
- To reduce the visual impact of any mechanical system on the site;
- To retain the open nature of buildings on the site;
- To conceal, wherever possible, any new introduced material.

Cooling strategies

This report recommends a combination of passive and active cooling strategies to modify internal conditions within the various buildings to contribute to improving thermal comfort. Passive strategies make use of the natural energy in the environment such as the microclimate and the built form and fabric of a building to modify internal conditions and include the benefit of shade, insulation and air movement. Active strategies use manufactured energy, such as ceiling fans, exhausts and air conditioning, to modify internal conditions. Several other options were investigated including roof and ridge vents, roof mounted rotary vents and the introduction of fins to deflect prevailing breezes into building interiors. These are often highly visible elements that were never part of the original gaol and as a result, the use of such visible options is not generally recommended.

The following passive cooling strategies have been recommended:

- Increase air movement across the site by providing strategically located openings in the perimeter wall to take advantage of prevailing winds;
- Increase air movement within buildings by reinstating ventilation openings, by providing low-profile ventilated ridges or by opening the existing windows of some buildings;
- Reduce glare by retaining landscape, particularly grass and low vegetation, around all of the buildings;
- Reduce radiant and convection heat to interiors by providing reflective foil insulation to the roof of some buildings;

In addition to the above, the following active cooling strategies have been recommend:

- Provide new ceiling fans or additional ceiling fans in some buildings to provide a cooling effect, create air movement on still days and circulate conditioned air in buildings should air conditioning be installed;
- Consider refrigerated air conditioning to four buildings:
  - Part of the Stores building
  - Infirmary
  - Women's section
  - Cell block A&B.
- Provide exhaust fans to the toilets in the Stores building and to exhaust the ceiling space over the kitchen and the dining area in the Kitchen and mess building.
- Whole of building exhausting was investigated but considered largely ineffective given the small temperature difference between day and night in the tropics, especially during the wet season when cooling was most needed.

Other strategies to potentially improve visitor comfort that were considered include:

- Provide shaded seating in strategic locations around the site;
- Provide chilled water bubblers around the site, notably at the Stores building (existing) and the Muster shelter (new);
- Provide a new purpose designed Visitor's centre on the site.

Air conditioning

Where air conditioning is recommended for a building, the location of the outdoor units was carefully considered to reduce the impact of mechanical plant on the site and the potential impact of mechanical plant on heritage values. Drawings provide at the end of this section indicate the suggested location of the outdoor air conditioning units and can be summarised as follows:

Site 04 - Stores:	Located within the eastern end of the Stores building.
Site 08 - Infirmary	Preferably located within the eastern end of the Stores building or, alternatively, located against the eastern perimeter wall.
Site 14 - Women's section	Located in the yard to the south of the building.
Site 16 - Cell block A&B	Located in the yard to the north of the building.

The following general recommendations are made:

1. Any air-conditioning system should be designed and documented by a mechanical engineer in conjunction with a heritage conservation architect and their services should continue through to the construction phase of the project;
2. An air-conditioning system should be designed for maintenance access and for future replacement without damaging significant materials.
3. Select air-conditioning system types, components, and placement to minimize alteration to significant spaces.
4. Locate and install the air conditioning system so that the work is reversible.
5. Select temperature and humidity conditions that will not accelerate deterioration of building materials. The internal temperature within a building should be set no lower than 25-26°C.

Recommendations

The following specific recommendations have been made for the site and for each of the buildings at Fannie Bay Gaol:

The Site

1. Large trees around the perimeter of the gaol wall (externally) should be retained to provide a shaded and landscaped area through which breezes pass before crossing the gaol site.

2. Grass areas against the buildings and in the open areas inside the gaol should be retained to reduce glare.

3. Windows of non-air conditioned buildings should be opened during the day to promote cross ventilation within the building and to provide breezes paths across the site.

4. Ventilation openings to Site 05 – Remand Section should be reconstructed.

5. Consider replacing part of the western perimeter wall with more permeable material such as security fencing to promote air movement across the site from the prevailing north-westerly and westerly breezes.

6. Consider providing a new Visitors centre on the site incorporating a large shaded verandah, information centre / reception, interpretative centre, café and public toilets.

Site 01 – Visitor's building

1. If sufficient evidence can be located in support of the documented reconstruction works, then reconstruct the Visitor's building. Increasing the openings in the external walls will increase air movement and contribute to cooling. The two visitor functions of the building could then be interpreted and the building opened to visitor access.

2. The roof should be insulated using a fibre-free reflective insulation.

3. Existing fans could be replaced with larger fans.

Site 02 – Guard House

There are no recommendations for this site.

Site 03 – Reception

1. If the building's current use remains, insulation and a vapour barrier should be installed to the roof. The existing window mounted room air conditioning system should be retained.

2. When the building's current use as an attendant station ceases the air conditioning system should be removed from the building, louvre windows reconstructed and the roof insulated using a fibre-free reflective insulation.

Site 04 - Stores

1. The gallery space at the western end of the building and the small office in the eastern end of the building could be air conditioned using exposed ceiling mounted cassette units located between truss members. The scheduled modifications should be undertaken including provision of insulation and a vapour barrier.

2. The open store, workshop and toilets should not be air conditioned.

3. In any air conditioned space, a ceiling following the rake of the roof should be installed. The roof cladding will need to be removed over air conditioned areas and a vapour barrier and suitable thermal insulation installed. External walls should be lined and insulation and a vapour barrier installed.

   Alternatively, insulated pre-finished steel panels nominally 80mm thick could be used to form walls and the ceiling lining. These panels have the advantage of being well insulated (R4.15) and of providing a vapour seal when correctly installed so the roof cladding would not need to be removed.

4. Install exposed, ducted, exhaust fans in the male and female toilets to promote air movement if they are to be retained as public toilets.

5. Upgrade the existing chilled water bubbler and additional provide seating in the breezeway for visitor use.

Site 05 – Remand section

1. Remove the later internal office partitions and associated accretions (wall lining, windows, air-conditioning, sink)

2. Reconstruct the ventilation openings to the top and bottom of the external walls.

3. Provide three new ceiling fans resulting in a fan in each bay of the building. Fans should match existing and be mounted at the same height.

4. Consider installing a low-profile ridge vent to the roof.

Site 06 – Medium security cell block D

1. Provide four additional ceiling fans resulting in a fan in each bay of the building. Fans should match existing and be mounted at the same height. The cabling and hanging brackets for additional fans appear to be in place.

2. Consider opening the windows in the Infirmary during gaol opening hours to improve air movement across the site and to this building.

3. Consider installing a low-profile ridge vent to the roof.

Site 07 – Medium security cell block C

1. Reposition the existing fans to the tie member so they finish at nominally 2700mm above the floor matching the fans in the Remand section and Cell block D.

2. Provide two new ceiling fans resulting in a fan in each bay of the building. Fans should match existing and be mounted at nominally 2700mm above the floor.

3. Do not air condition the small guard's house located at the northern end of Cell block C.

4. Consider installing a low-profile ridge vent to the roof.

Site 08 – Infirmary

1. The Infirmary could be air conditioned using a commercial split system comprising an outdoor condenser unit and a single indoor ceiling mounted cassette unit located centrally in the ceiling space. The scheduled modifications should be undertaken including provision of insulation and a vapour barrier to the roof.

2. Install four ceiling fans in the building. Fans should ideally be good quality commercial fans such as the 2100mm diameter Haiku fan set at nominally 3600mm above the floor.

Site 10 – Guard house

There are no recommendations for this site.

Site 11 – Ablutions block

There are no recommendations for this site.

Site 12 – Separate confinement block

There are no recommendations for this site.

Site 13 – Covered muster shelter

1. Install four grade 316 stainless steel ceiling fans in the shelter suspended from the ridge by a stainless steel dropper and located at nominally 2600mm above the floor.

2. Consider providing a chilled water bubbler at the site for use by visitors.

3. Consider providing seating under the shelter for use by visitors.

Site 14 – Women's section

1. The Women's section could be air conditioned using a commercial ceiling mounted cassette unit to the annexe and high wall air conditioning units to each of the cells. The outdoor condenser unit could be located within the screened enclosure between the Women's section and Cell block A&B. The scheduled modifications should be undertaken including provision of insulation and a vapour barrier to studwork walls and to the roof.

   However, given the difficulty in reticulating refrigerant pipework, the lack of ceiling space over the cells requiring the use of intrusive wall-mounted air conditioning units, and the need to remove both roof and wall cladding to install insulation and a vapour barrier, consideration should be given to leaving the building as designed and not installing air conditioning.

2. Replace the existing ceiling fans with new fans and ensure they are operational. Fans should ideally be good quality commercial fans such as the Haiku or the Aeroton fan.

Site 15 – Children's Section

1. Openings in the perimeter wall on the western side would increase air movement across the site from prevailing west and north-west breezes.

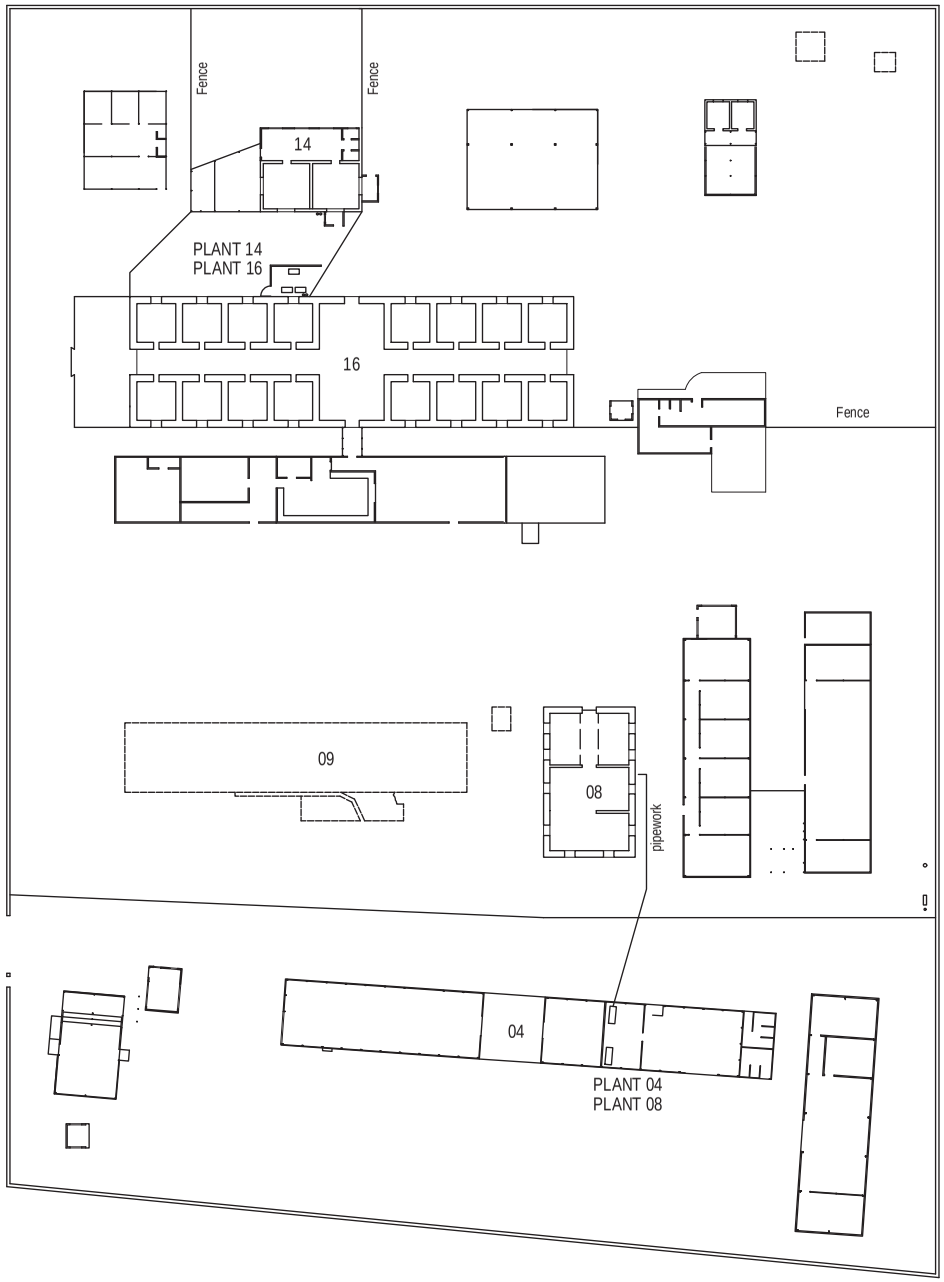
Site 16 – Cell block A&B

1. Cell block A&B could be air conditioned using commercial ducted split systems comprising outdoor condenser units and indoor air handling units located in the ceiling space. The scheduled modifications should be undertaken including provision of insulation and a vapour barrier to the roof and sealing of openings in the external walls.

2. Provide a large low speed, high volume fan in the central area to promote air circulation in this area.

Site 17 – Kitchen and mess

1. Consider installing a low speed ducted exhaust fan to remove hot air from the ceiling space over the kitchen and the mess area. The fan could exhaust through a discrete grille located in the eastern facing gable end.



OPTION 1 - Provide a dedicated air conditioning system for each building with the external unit located adjacent to, or near, the building and suitably screened from view. The refrigerant pipework and cabling would need to be reticulated underground to the building and the internal fan unit.

Plant 04 - Stores (143 m2) - 35 m pipe run.
Locate the external unit within the Stores building in the open store area.

Plant 08 - Infirmary (92 m2) - 30 m pipe run.
Locate the external unit within the Stores building in the open store area.

Plant 14 - Women's section (64 m2) - 30 m pipe run.
Locate the external unit within the screened garden area between Cell block A&B and the Women's section.

Plant 16 - Cell block A&B (357 m2) - 20 m pipe run.
Locate the external unit within the screened garden area between Cell block A&B and the Women's section.

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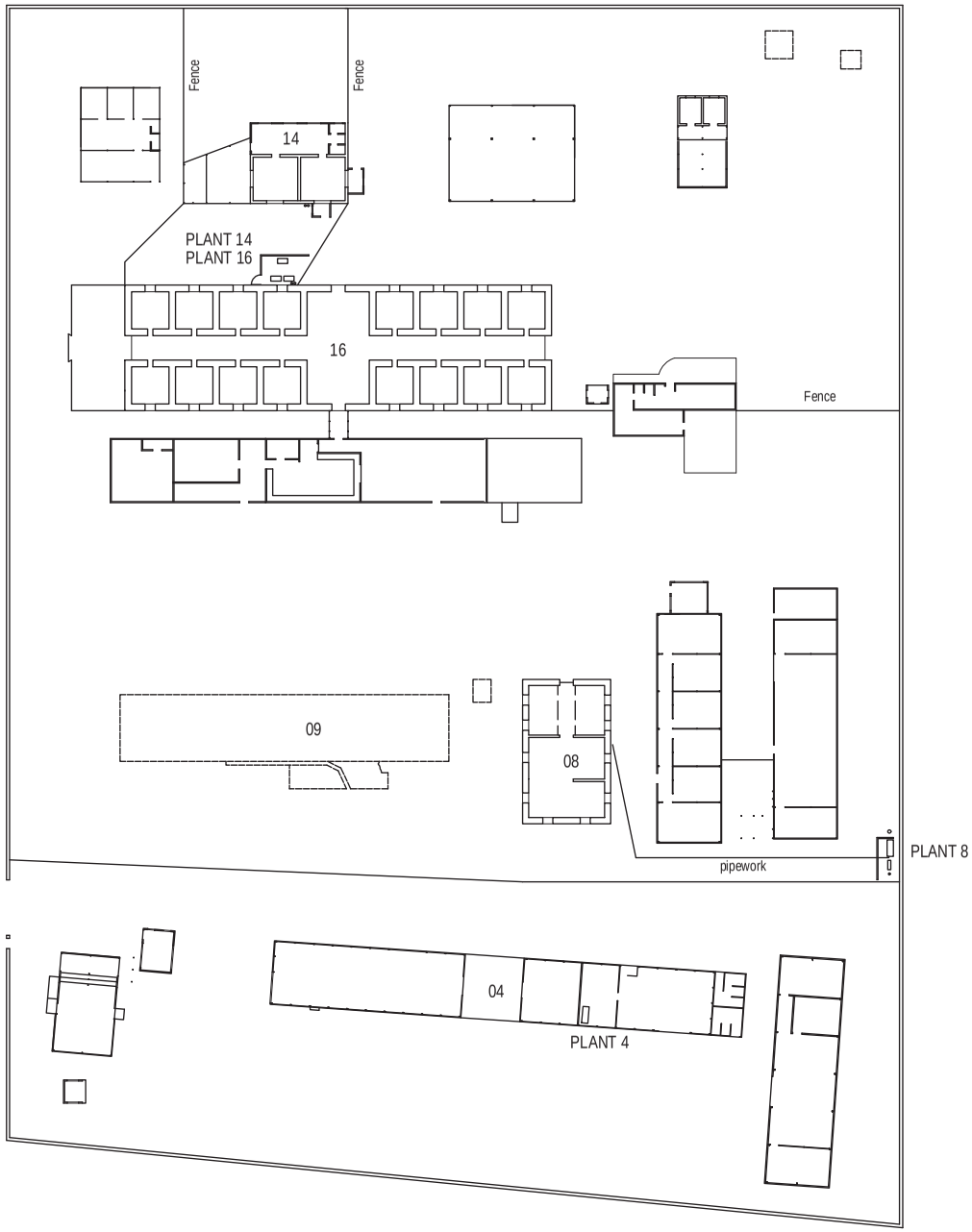
SITE PLAN - OPTION 1



OPTION 2 - Provide a dedicated air conditioning system for each building with the external unit located adjacent to, or near, the building and suitably screened from view. The refrigerant pipework and cabling would need to be reticulated underground to the building and the internal fan unit.

Plant 04 - Stores (143 m2) - 35 m pipe run.
Locate external unit within the stores building in the open store area.

Plant 08 - Infirmary (92 m2) - 50 m pipe run.
Locate external unit adjacent to the main electrical switchboard for the site, power pole and pedestal lighting near the eastern perimeter wall.

Plant 14 - Women's section (64 m2) - 30 m pipe run.
The external unit for Cell Block A&B located in the garden area to the south of the Women's section.

Plant 16 - Cell block A&B (357 m2) - 20 m pipe run.
Locate external unit within the fenced garden area between Cell block A&B and the Women's section.

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SITE PLAN - OPTION 2

Methodology

Fannie Bay Gaol, ca 1930.

Northern Territory Archives Service, Edward George Richardson, NTRS 1406, Photographs of Darwin landmarks during the Second World War, ca1940-ca1944, Item 2.

General site constraints

General

The recommendations in this report have been guided by several important criteria:

1. Most importantly was the need to safeguard and not compromise the heritage significance of the gaol. Reference was made to the Conservation Management Plan (2016) and to relevant Policies within the Plan to guide decisions.

2. The onsite examination process was guided by the methodology provided in the Burra Charter (2013).

3. In assessing visitor thermal comfort levels, local climate data for the hot-humid tropics was consulted and a summary of this data is provided below indicating the environmental framework within which passive and active cooling systems were considered. Passive cooling is understood here to be any cooling method that requires no energy input either by the owner or by a mechanical device. Active cooling involves the input of energy into the building.

4. The gaol was first considered within a framework of best practice criteria for passive cooling design in the hot-humid tropics before considering good practice for the design and installation of active cooling, and in particular, air conditioning systems in heritage buildings.

Heritage considerations

Suggestions and recommendations provided in this report have been shaped to conform to the requirements of the Conservation Management Plan with particular reference to the Statement of Significance. An extract from the statement of significance is reproduced below.

The Fannie Bay Gaol is Significant because:

- *The relative intactness of the precinct and the survival of details of use embodied in the fabric enables Fannie Bay Gaol to retain a powerful penal atmosphere and sense of place, and to demonstrate routines and living conditions that were in place during its last phase of operations prior to closure in 1979.*

- *The successive layers expressed in the fabric of the buildings demonstrate the considerable adaption of prison design to accommodate Territory conditions and resources. The various buildings were constructed between 1883 and 1978, starting with the masonry Cell Block A & B (1883) and the*

Infirmary (1887) and finishing with more recent steel-framed and corrugated iron-clad buildings. The Gaol is a good example of a medium sized gaol precinct in Australia in which local adaptation is evident.

- *Fannie Bay Gaol is a rare intact example of a medium security prison complex;*
- *The Cell Block A & B (1883) is the only nineteenth century flanking cell block in the Northern Territory.*
- *The Infirmary (1887) is a fine surviving example of the work of the architect John George Knight.*
- *The gaol contains an intact gallows mechanism, modelled on the Newgate Gallows in England, erected and used for the first and last time in 1952.*
- *The gaol is an important archaeological and social resource and has associations with many people and events connected with the history of the Northern Territory.*

Conservation policies 1.5; 4.2; 8.8 and 8.9 were particularly relevant to this Report and these policies are reproduced below for reference:

Policy 1.5 *Original and early fabric shall generally be conserved intact. Where original or early fabric is proposed to be removed for whatever reason, an archival record of the fabric shall be made (recorded, measure and photographed). Wherever possible the fabric as a whole or a representative sample of the fabric shall be stored, preferably on site, for future reconstruction works. Refer to Policies 3.2 to 3.6.*

Policy 4.2 *The open nature of many of the later buildings shall be conserved. This demonstrates a response to the tropical climate and contrasts with the earlier more enclosed masonry buildings. These later buildings also provided many inmates with a more socially appropriate and physically comfortable environment.*

Policy 8.8 *Air conditioning of existing buildings shall only be permitted where the original fabric is conserved and the detailing of the external walls of the building will not be altered. For example:*

- *Closing off the weld-mesh ventilation openings at the top and base of metal walls shall not be permitted.*
- *Closing off openings, grille doors and grille side panels, or other openings shall not be permitted*
- *The addition of insulation against the metal wall and ceiling cladding shall not be permitted where it will be visible from the inside of the buildings.*

Policy 8.9 *Where buildings or individual rooms are air-conditioned, modern split or ducted systems shall be used. Mechanical units shall be concealed either in designated plant rooms or by some other means and all refrigerant and condensate pipework shall be hidden from general view.*

Characteristics of a hot-humid climate

Darwin's climate is characterised by relatively high temperatures throughout the year, with seasonal change distinguished more by changes in humidity and rainfall than temperature. There is little change between day and night temperatures, meaning there is little cooling effect on building fabric. The wet season (Oct-Apr) is hot, with average maximum temperature and humidity levels exceeding human thermal comfort levels, the dry season (May-Sept) is cooler with average mean temperatures usually within the range of human thermal comfort. Prevailing winds are from the west and north-west during the wet season and from the east and south-east during the dry season often with an afternoon sea breeze from the westerly quarter.

Comfort is defined as the complete physical and mental well-being of a person while thermal comfort is a subset of the broad definition of comfort and relates to human and environmental factors.[1] Human thermal comfort is difficult to measure because it is highly subjective and research has shown that physiological responses, such as acclimatisation, can have an effect on people's perception of climatic conditions and hence of thermal comfort.[2] The main environmental factors affecting thermal comfort are: air temperature; solar radiation; air movement and humidity. Personal factors affecting thermal comfort are: activity levels and clothing.

A summary of climate data for Darwin is provided in the following table: [3]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature													
Mean maximum temperature (°C)	31.8	31.4	31.9	32.7	32.0	30.7	30.6	31.4	32.6	33.3	33.3	32.6	32.0
Mean minimum temperature (°C)	24.8	24.7	24.6	24.0	22.1	19.9	19.3	20.3	23.0	24.9	25.3	25.3	23.2
Rainfall													
Mean rainfall (mm)	424	371	315	100	21	1.8	1.1	4.8	15.8	70	142	254	1722
Humidity													
Mean relative humidity 9am (%)	81	83	82	74	65	60	60	64	68	69	72	76	81
Mean relative humidity 3pm (%)	70	72	67	52	43	38	37	40	47	52	58	65	70

High humidity during the wet season not only results in uncomfortable conditions, it can have a detrimental effect on the building fabric as a result of condensation that occurs when surface temperature is at, or below, dew point temperature. Darwin can experience outdoor dew point temperatures as high as 28°C during the wet season. This is above indoor temperatures in air conditioned spaces and poses a risk of condensation near leaks in the building envelope. In warm, humid climates there is a vapour pressure difference between inside and out. Moisture will move towards the inside if some form of preventative vapour barrier is not installed.[4] Maintaining conditioned air at a higher temperature significantly reduces but does not eliminate the risk of condensation.

[1] Hyde, R. Climate responsive Design, London E+FN Spon, 2000pp66-67.
[2] Hyde, R.. ibid.
[3] Climate data from the Bureau of Meteorology.
[4] Hyde, R. op. cit, p82.

Assessment criteria

Passive cooling systems are relatively straightforward for the hot-humid tropics with the goal in broad terms being to maximise shade and air movement, and to minimise solar gain. The site and individual buildings were examined and assessed under these three criteria. In practical terms, where air conditioning was not considered appropriate, the following strategies were considered:

1. Providing shade by retaining grass, landscaping and shade trees outside the perimeter wall.

2. Reducing glare and heat radiation by retaining grassed areas close to the buildings and in the open areas inside the gaol yards.

3. Maximising exposure to cooling breezes onto the site by providing strategic openings of an appropriate type in the perimeter wall and to the interior of buildings by opening windows and louvres.

4. Adopting insulation solutions that minimise heat gain during the day and maximise heat loss at night such as fibre-free reflective insulation. Bulk insulation is not suitable as it will slow the dissipation rate of heat from within a building.

5. Examining strategies to exhaust heat from building interiors.

Where active cooling systems were considered to be an appropriate strategy to cooling a building the following additional strategies were considered:

1. Creating air movement during still periods through the use of fans.

2. Designing cooling systems that are compatible with the building's architecture. For example, adopting hidden systems with unobtrusive grilles for formal or more significant spaces and exposed systems for secondary spaces.

3. Locating external air conditioning units at ground level where they are not visible from public areas, where they can be more easily screened and where they are easily accessible for maintenance. One important requirement was that outdoor air conditioning units were not to be located on, or in front of, the front façade of a building, nor on the roof of any building.

4. Locating external air conditioning units where their installation, and the reticulation of cabling and/or pipework connecting the internal and external units, does not damage significant elements of the building and pipework run across an exposed external wall is concealed in an appropriate manner.

5. Locating condensate pipework and soakage pits to ensure they are concealed from view while suitably disposing condensate on the site.

Other strategies to improve visitor comfort have been considered in the discussion on each building and including the provision of shaded seating around the site and within buildings and the location and availability of chilled water bubblers for visitor's use.

Cooling systems – an overview

Passive cooling strategies

Passive cooling takes advantage of the climate to maintain a comfortable temperature range within a building. In a passive designed building the ambient temperature and relative humidity are established by the prevailing environmental conditions. The surrounding surface temperatures, radiation from the sun and sky, and air movement, however, are variable and changes to these criteria can contribute greatly to thermal comfort.

While criteria such as siting, orientation, the form and fabric of the building envelope and the arrangement of interior spaces can contribute greatly to cooling a building, at Fannie Bay Gaol these are existing conditions. The criteria discussed below are those that could potentially be altered to the benefit of visitors.

Shading

The efficiency of an existing building envelope can be increased in a number of ways to minimise heat gain including shading windows, walls and roof from direct solar radiation, using light coloured roof cladding to reflect heat and by using landscaping to shade the surrounding ground. However, the opportunity to modify existing buildings at Fannie Bay Gaol is limited and the site and buildings will generally need to be accepted as they are.

Insulation

Insulation, particularly to the roof, reduces conducted and radiated heat gains. Windows are often left open to take advantage of natural cooling and walls are shaded by roof overhangs, the roof, however, is often fully exposed to the sun. Reflective foil insulation or the newer fibre-free reflective insulation is preferable to bulk insulation if the building is not air conditioned as it maximises night-time heat loss through conduction and convection.

Air movement

Air movement can reduce the build-up of hot air within a building and contributes to bodily comfort by changing the rate of convective heat transfer between skin and air and the rate of bodily cooling through evaporation of skin moisture.

While passive cooling strategies at Fannie Bay Gaol are limited by the need to safeguard heritage values, strategies that could be introduced include (i) reducing heat gain through insulating the roof of buildings; (ii) reducing radiation from the surrounding ground by maintaining grass and vegetation around buildings; and (iii) maximising air movement by opening the site and buildings to the prevailing breezes..

Active cooling strategies

Active cooling takes advantage of a range of mechanical systems to contribute towards comfortable temperature conditions within a building. The most common systems are the use of roof ventilators, ceiling, wall, pedestal or desktop mounted fans and, of course, mechanical air conditioning. In practical terms a combination of passive and active systems will provide optimum indoor conditions for comfort. Shade and appropriate insulation can increase the efficiency of active systems and reduce their operational costs.

Ventilation of roof space

A well ventilated roof space can contribute to cooling a building by providing a buffer zone between internal and external spaces thereby reducing heat transfer into the spaces below the roof. This form of ventilation is more efficient where there is a ceiling below the roof and where the ceiling can be insulated. However, exhausting hot air from the interior of a building without a ceiling can also contribute to cooling the interior space.

Ventilation can take the form of passive systems such as ridge vents, openings, grilles or vents in the eaves and gables and wind driven rotary vents, or active systems such as ducted exhaust with electric fans or rotary vents with electric fans. The installation of any exhaust system would need to conform to the following policies from the Conservation Management Plan:

Policy 2.5 *Additions and/or extensions to existing buildings within the perimeter wall shall not be permitted unless it is to reconstruct some known element or building associated with the gaol.*

Policy 6.1 *The original external form and detail of the various buildings shall be conserved.*

While discrete low-profile ridge vents, and small grilles in the gables would meet the intent of the Conservation Management Plan, it would be inappropriate, for example, to introduce more visible elements, such as roof mounted rotary ventilators, that would alter the form of the buildings at Fannie Bay Gaol.

Some form of passive or active roof exhaust system could be beneficial to the Remand Section, Cell Block D, Cell Block C and the Kitchen and Mess building. If the Stores, Infirmary and Cell Block A&B are not to be air conditioned, then some form of roof exhaust could also be beneficial installed in these buildings.

Advantages: Low cost; effective in contributing to the cooling of interiors. Low profile ridge vents could be installed; gable end vents in conjunction with low volume fans could be used.

Disadvantages: Many systems, such as rotary ventilators, are intrusive and should not be used;

Whole of building exhaust systems

Where natural ventilation through openings proves insufficient to exhaust heat from the building's interior, exhaust fans, which typically induce 30 to 60 air changes per hour, could be used to increase ventilation. The whole of building exhaust fan operates by pulling air in through openings such as doors and windows and exhausts it through the roof or eaves. The exhaust fan should be centrally located so that it draws in air from all parts of the building.

Whole of building exhausts are primarily used for cooling the building fabric, often by enhancing night ventilation, but do not create sufficient air speed to cool occupants. The fan is turned on when the outdoor temperatures drop in the early evening. In the morning, the fan is turned off before the outdoor temperatures begin to rise above the interior temperature. They are most efficient when there is a high diurnal range. While potentially effective in Darwin during the cooler dry season months, during the wet season months when cooling is most needed, the temperature difference between day and night is around 6C with the mean temperature rarely falling below 25C. For this reason, whole of building exhausts would have very limited effectiveness during this period and are not recommended.

The only building that could potentially benefit from whole of building exhausting is Cell Block A&B where cooler outside air could be drawn through the cells and corridors and exhausted through the eaves at the central area of the building. The high thermal mass of the internal building fabric may contribute to some extent to cooling the interiors but the temperature difference is likely to be very small and may not even be noticeable. One further disadvantage of this system is that during the wet season the fans would be drawing warm, very humid, air into the building which is not desirable. If considered for this building, further investigation would be necessary to determine such a systems effectiveness and value.

If the building were to be air conditioned then a whole of building exhaust system would prove ineffective and may even be counter-productive because the outside air would, at most times, be warmer than the internal building fabric.

Advantages:	Low capital, installation and operating cost; effective in contributing to the cooling of interiors where there is a relatively large diurnal range. Some merit in installing an exhaust system to operate during the dry season.
Disadvantages:	Whole of building exhaust fans are of limited effectiveness when there is a low diurnal range as experienced in the tropics;

Fans

Ceiling fans, and to a lesser extent wall, pedestal and desktop fans can be effective for cooling on a room-by-room basis and can provide inexpensive air movement within a room on calm days when ventilation from prevailing breezes is inadequate. Fans cannot lower the air temperature but provide cooling due to the movement of air across the skin and the evaporation of moisture. They are most effective for people located directly under the fan. Figure 02 adjacent shows the typical distribution of air velocity under a ceiling fan.[1]

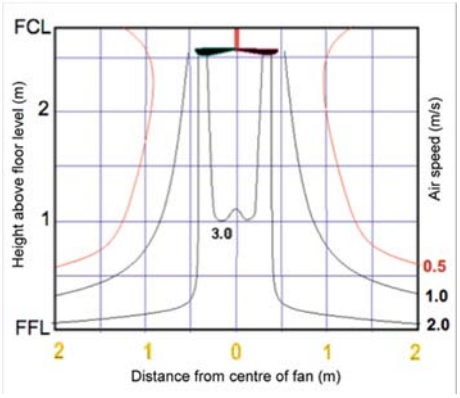


Fig.02 – Air velocity under a ceiling fan. Reproduced from Ballinger 1992.

Fans can also be used to supplement air conditioning systems and can provide a cooling effect while evenly distributing conditioned air throughout a space. This can result in more comfortable conditions at a higher air conditioning temperature setting. This has considerable advantages in heritage buildings where the temperature of conditioned air should not be set too low.

There are several different types of fans to suit various installations and room sizes.

- Wall mounted, pedestal and desktop fans include large industrial or smaller domestic models with a protective cover over the blades;
- Domestic ceiling fans available in a range of materials and sizes from 900mm diameter up to 1300mm diameter.
- High volume, low speed fans were initially developed for larger open areas such as industrial, assembly or sporting venues but are now used in a range of situations and although potentially visually intrusive, they are nonetheless, quiet, attractive and very effective. They are available in sizes from 2400 to 7300mm diameter.
- High quality domestic or commercial fans such as the Haiku fan in sizes up to 2100mm diameter and the Aeratron fan available in sizes up to 1500mm diameter with two or three blades.

Advantages:	Low operating cost; indispensable for air movement in the tropics; can assist air conditioning systems to circulate air;
Disadvantages:	Industrial fans can be noisy; large fans can be visually intrusive; fans do not reduce the ambient temperature but can provide body cooling;
Considerations:	Control over speed variability, minimum and maximum speeds, noise level, power requirements and minimum floor to ceiling heights.

[1] Source: http://www.yourhome.gov.au accessed 13.02.2017.

Mechanical air conditioning

In broad terms, mechanical air coolers remove heat from the hot internal environment dissipating it to the outside thus cooling the internal air and removing humidity. It is important to understand the differences between air conditioning systems and how they function. There are a number of ways of providing air conditioning to a space from single domestic split type air conditioners through to large scale ducted air handling systems and central chiller units.

The following discussion summarises the main points of the air conditioning systems considered for Fannie Bay Gaol.

Domestic Room air-conditioners

A room air-conditioner is a compact small package unit comprising compressor and fan unit installed in a window or external wall of a building. The air conditioning units are visually intrusive and can have an adverse impact on the fabric of an historic building as windows must be removed and infill panels inserted above or around the unit. In some cases a large hole must be cut into the wall to accommodate the units. They are not commonly used today, being replaced with split systems although they are often found in older, domestic scale, buildings. There are three units at Fannie Bay Gaol (one currently in use).

Advantages: Low capital cost; relatively easy to install and replace;

Disadvantages: Visibly intrusive both inside and outside; condensate pipework often highly visible; can result in damage to historic fabric when installed in widows or walls, noisy.

Domestic Split systems

A split system air-conditioner consists of two main elements connected by pipework: an outdoor condenser unit and one or more indoor air outlets that recycle the air within a room to the required temperature. Internal units can be wall mounted, in-ceiling cassette, floor or ceiling console units. For optimum efficiency the external condenser unit should be located close to the internal unit but can generally be located a reasonable distance from the internal fan unit if desired.

Larger, commercial systems operating on the same principles are also available and allow the outdoor condenser unit to be located a significant distance from the indoor fan unit. These are commonly referred to as VRV type systems. Most mainstream manufacturers now offer mini-type VRV systems of capacities down to as low as 10kW while retaining the ability for longer pipe runs.

Advantages: Economical to operate; outdoor condenser unit can be located some distance away from the indoor unit;

Disadvantages: Traditional split units have limited capacity can result in several outdoor condenser units to serve a larger building, or larger floor-mounted condenser units will be required; domestic style heads (wall mounted) usually recirculate only and don't include fresh air, although larger ducted units can be configured with a fresh air component.

Commercial ducted systems
A ducted air conditioner consisting of either:

(1) A single package unit comprising compressor, condenser and fan unit located on the roof, within a plant room or on the ground adjacent to a building with metal ductwork from the unit reticulated throughout the building to air outlets located in the various rooms;

Advantages: A single unit; economical to install;

Disadvantages: Ductwork from the units can be visibly intrusive; noise; outdoor unit can be visually intrusive; outdoor units need to be located close to the building;

(2) Large scale split system with a central air conditioning unit reticulating refrigerant via pipework to fan coil units located within the ceiling space or in a dedicated plant room in the building. The air from the fan coil unit is ducted via flexible or rigid metal ductwork (or a combination of the two) to air outlets located in the various rooms throughout the building. This type of unit can be a small domestic-sized installation with an outdoor condenser unit not unlike the split-system discussed above, or a large commercial installation using significantly larger mechanical equipment.

Advantages: No visible ductwork; outdoor condenser unit can be located away from the building;

Disadvantages: Noise; outdoor condenser unit can be visually intrusive; refrigerant pipework can be intrusive and difficult to conceal;

(3) A large scale system with a central chiller unit reticulating chilled water via pipework to air handling units located within the ceiling space or in a dedicated plant room in the building. The cooled air is ducted via flexible or rigid metal ductwork (or a combination of the two) to air outlets located in the various rooms throughout the building. This system is ideal for large commercial and office installations providing flexibility in installation.

Advantages: No visible ductwork; outdoor chilled water unit can be located away from the building;

Disadvantages: The air conditioning unit tends to be large; high capital cost; high installation cost to reticulate the chilled water pipework; over 300 metres of chilled water pipework would be required at Fannie Bay Gaol depending on the location of the chiller unit; cannot successfully integrate smaller head units such as ceiling cassettes or wall fan units; complex system; high fan noise; outdoor chiller unit can be visually intrusive; vertical discharge units require clear vertical area resulting in vents or openings in the plant room roof;

In considering the above air conditioning systems:

- The room air conditioner is not the preferred system and should only be considered when replacing like for like and providing there is no requirement to enlarge openings in any building for a new unit.

- The ducted single package unit would be inappropriate because of the use of exposed external ductwork and the difficulty in introducing that ductwork into the existing buildings.

- The central chilled water system would not be cost effective and is unduly complex for installation in the buildings at Fannie Bay Gaol.

- The commercial split system (including mini type VRV systems) and the split package system are the preferred air conditioning systems for the buildings at Fannie Bay Gaol. This system comprises an outdoor condenser unit and an indoor air handling unit ducting air to internal rooms or an internal fan unit such as an in ceiling cassette or high wall mounted fan unit.

Energy saving initiatives

Various energy saving initiatives should be part of any new air conditioning system, although the prime functional objectives and heritage value of this application would tend to take a greater precedence, especially considering the nature of intended use at Fannie Bay Gaol.

1. Energy recovery systems, although at the gaol it is proposed that outdoor air minimisation be a preferred option.
2. High efficiency inverter driven compressors including optimum refrigerants.
3. Variable speed fans

Other systems

The following systems have not been considered as they are largely unsuited to the tropics or are emerging technology which is not considered suitable in this situation:

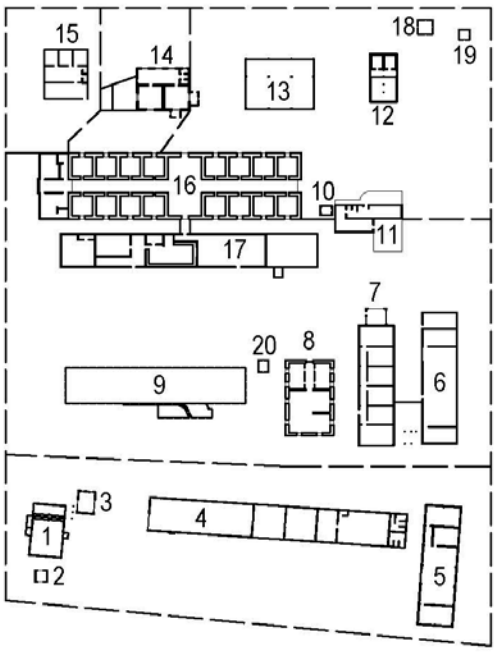
- Evaporative cooling systems
- Geothermal systems using the earth as a heat sink for cooling
- Radiant chilled beams
- Solar air conditioning

Discussion

The entrance to HM Gaol, East Point Road after cyclone Tracy, ca 1975.

NT Library PH0244-0020, Rob Wesley-Smith Collection.

Fannie Bay Gaol site considerations



2016

1 VISITOR'S BUILDING
2 GUARD HOUSE No.3 YARD
3 RECEPTION
4 STORES BUILDING
5 REMAND CELL BLOCK E
6 MEDIUM SECURITY CELL BLOCK D
7 MEDIUM SECURITY CELL BLOCK C
8 INFIRMARY
9 FORMER LAUNDRY
10 GUARD HOUSE
11 ABLUTIONS BLOCK
12 SOLITARY CONFINEMENT BLOCK
13 COVERED MUSTER AREA
14 WOMEN'S SECTION
15 CHILDREN'S SECTION
16 MAXIMUM SECURITY CELL BLOCKS A & B
17 KITCHEN AND MESS BUILDING
18 FORMER REMAND YARD TOILET BLOCK
19 FORMER GUARD HOUSE
20 FORMER TOILET BLOCK

Fig.03 Current site plan (2016) showing existing buildings and slabs.

Description

The gaol yard is defined by a low 2700mm high solid wall and bounded by East Point Road to the west, Ross Smith Avenue to the north and Allen Street to the east. To the south of the site are residential properties. A wide road reserve defines both the west and north sides of the site providing an open landscape setting for the gaol. Whilst road alignments have changed since the gaol was first constructed the open setting has been consistent throughout its history and is a significant part of the setting for the gaol today.

Fig.04 - Western facing perimeter wall showing the vehicle entrance gates and pedestrian entrance gate. The wall dates from ca 1976.

The current site is largely as it was when the gaol closed in 1979. Some buildings have been removed from the site and some structures, such as the Guard house to the north-east corner and a locked gate complex have since been demolished. Internal steel post fences with mesh infill and barbed wire tops have been retained maintaining the three distinct yards within the gaol walls. The Women's section and Children's section are also separately fenced within No.1 yard.

The site contains a number of separate elements that include:

- Pathways, pavement, open stormwater drains and concrete pads throughout the site;
- Remnant posts cut off near ground level for two watchtowers;
- Concrete slabs in the southern end of the site near the Stores building (Site 4) for buildings that have since been removed;
- A concrete floor slab in the north-east corner for a Guard house constructed post-1974;
- A concrete floor slab in the north-east corner for the remand yard toilet block;
- Circular concrete piers for demountable buildings;
- A diesel fuel tank raised on a stand;
- Electrical switchboard and floodlights;
- Planter pots introduced post-1979;
- Seating (both part of the gaol and later additions).

Fig.05 - Eastern perimeter wall looking south from inside the gaol.

Significance

The site and setting is of Exceptional significance as a gaol complex.

The perimeter wall is of Considerable significance in providing a sense of enclosure and security and it delineates the extent of the gaol itself.

The open area immediately outside the gaol is also of significance in providing a setting for the gaol.

Discussion

New Visitor's Centre building

Consideration should be given to constructing a new visitor's centre on the site located over the existing concrete slab at Site 09 – Laundry. The new building could include:

- Large shaded verandah;
- Information centre / reception;
- Interpretative centre;
- Café;
- Public toilets;
- Service areas (including plant room).

Existing functions located in Site 03-Reception could transfer to the new building and the Reception building could be reconstructed and interpreted as part of the gaol complex. The new building would be fully accessible, and provide a cool, shaded platform with ample seating for visitors to rest and to observe the site. A small café serving light refreshments could be provided with seating on the verandah.

Fig.06. View towards the site from the road showing landscaped areas.

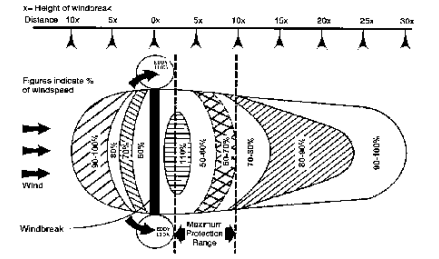
Shading of the site

Shading of the buildings helps reduce solar gain and while from a heritage perspective it would be inappropriate to plant additional trees on the site or to provide other fixed or permanent forms of shading, the existing trees around the site located outside the perimeter wall, contribute to cooling some of the buildings located near the perimeter wall. Grass and low vegetation around the buildings also contributes significantly to reducing solar radiation in the form of glare.

Air movement

Whilst there is little opportunity to improve shading of buildings at the gaol, there is scope to significantly improve ventilation within some buildings and to improve air movement across the site.

Air movement is significantly reduced by barriers or wind breaks. In the case of Fannie Bay Gaol these barriers are the 2700mm high solid perimeter wall and the various buildings on the site, effectively blocking some breeze paths across the site. Studies show that breezes are significantly reduced for a distance up to 25 times the height of an obstruction with maximum wind reduction occurring in a range of 5-8 times the height of the obstruction. Some disruption of breeze also occurs in front of the obstruction as illustrated in the diagrams adjacent.[1]



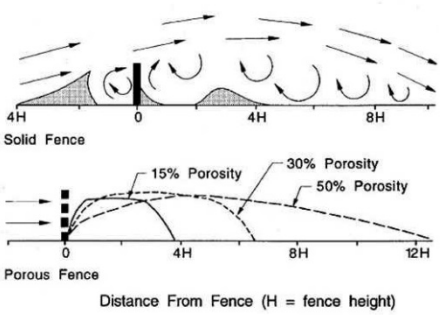


Fig.07. Breeze path diagrams against a barrier such as the gaol perimeter wall.

[1] Diagrams from http://aggie-horticulture.tamu.edu/southerngarden/coastplants.html Accessed 30.01.2017.

At the gaol, greatest benefit would be obtained by visitors from breezes during the hot wet season and the warm afternoons of the dry season. With dominant winds coming from the north-west during the wet season and as an afternoon sea breeze in the dry season, a substantial portion of the site is screened either by the perimeter wall or by the individual buildings on the site. The site plan reproduced here (Fig. 08) illustrate that a small area in front of the Infirmary and to the east of the Ablutions Block would be open to the north-west prevailing breeze (coloured grey) although there would be some disruption in front of adjacent buildings and the eastern perimeter wall.

The situation improves somewhat when the prevailing wind veers to the west in the wet season as there are long corridors through the site (Fig. 09). However, buildings with their long axis oriented in the east-west direction such as Cell block A&B, the Women's section and the Stores would benefit little from a prevailing westerly breeze. The Infirmary running across the site acts to screen Cell block C and Cell block D with all three buildings currently benefitting little from a westerly breeze.

To improve air movement, the windows in the Infirmary could be opened during the day to create a more permeable barrier and thus increasing air movement in this sector of the site with particular benefit to the Infirmary and to Cell block C and Cell block D. The most significant barrier to air movement across the site, however, is the perimeter wall. If a section of the solid wall were to be replaced with more permeable material, such as security fencing, this would promote air movement across the centre of the site and to key buildings such as the Children's section that are currently within the wind shadow of the perimeter wall. Consideration should be given to opening part of the western wall as illustrated in the diagram overleaf.

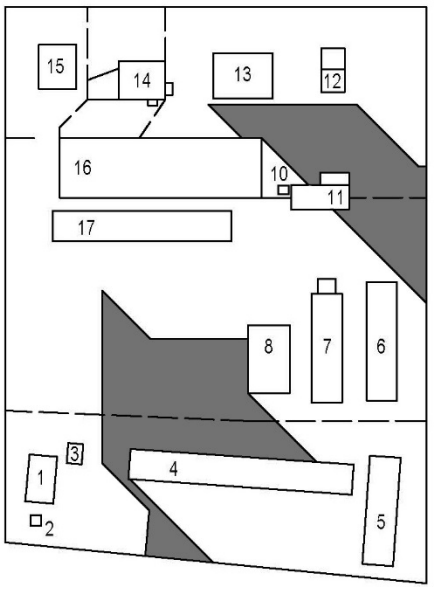


Fig.08 - Site plan showing areas open to breezes from the north-west (coloured grey).
1 Visitor's building
2. Guard house
3. Reception
4. Stores building
5. Remand section
6. Cell block D
7. Cell block C
8. Infirmary
10. Guard house
11. Ablutions block
12. Separate confinement block
13. Covered muster shelter
14. Women's section
15. Children's section
16. Cell block A&B
17. Kitchen and mess

Recommendations

1. Large trees around the perimeter of the gaol wall (externally) should be retained to provide a shaded and landscaped area through which breezes pass before crossing the gaol site.

2. Grass areas against the buildings and in the open areas inside the gaol should be retained to reduce glare.

3. Windows of non-air conditioned buildings should be opened during the day to promote cross ventilation within the building and to provide breezes paths across the site.

4. Ventilation openings to Site 05 – Remand Section should be reconstructed.

5. Consider replacing part of the western perimeter wall with more permeable material such as security fencing to promote air movement across the site from the prevailing north-westerly and westerly breezes.

6. Consider providing a new Visitors centre on the site incorporating a large shaded verandah, information centre / reception, interpretative centre, café and public toilets.

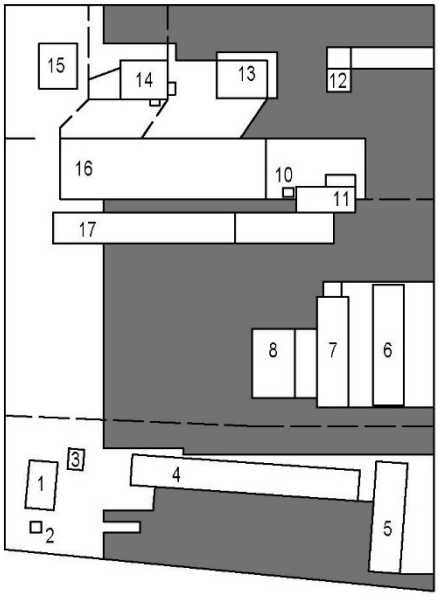
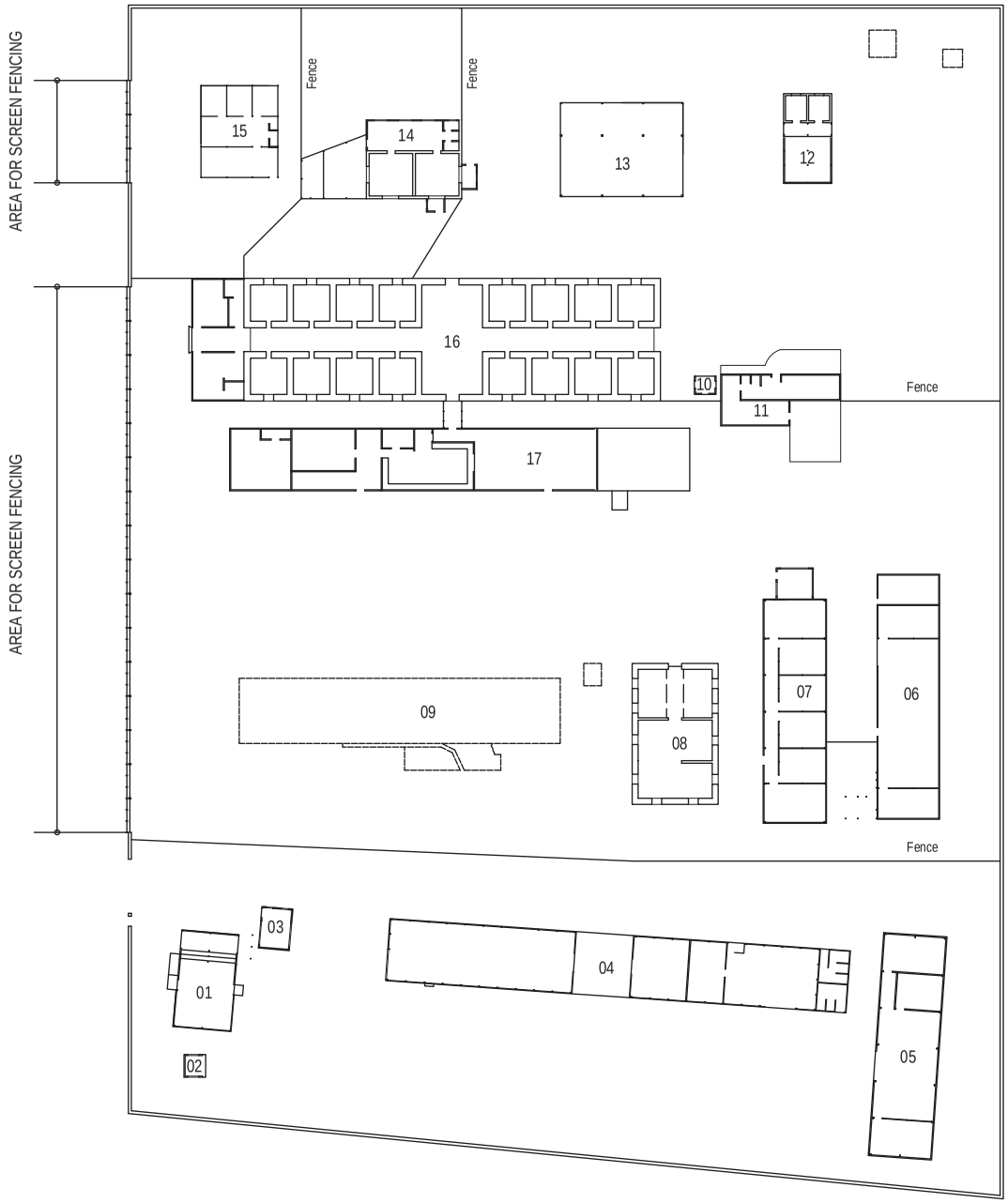


Fig.09 - Site plan showing areas open to breezes from the west (coloured grey).



During the prevailing north-west sea breezes a significant part of the site is in the wind shadow of the perimeter wall. When the wind veers to the west the situation improves to an extent, however, the perimeter wall still blocks the westerly breezes.

Providing some screen fencing to the western perimeter wall will open the site to prevailing breezes and contribute to cooling both the site and the buildings on the site.

The three images indicate a suitable fencing type that provides a pathway for breezes but maintains security.

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FEBRUARY 2017

SITE PLAN - SCREEN FENCE

Individual buildings – group 1

Each of the individual buildings within the Fannie Bay Gaol site have been reviewed and placed into two groups as follows:

- Those buildings that should not or cannot reasonably be air-conditioned,
- Those buildings that could potentially be air-conditioned.

This section examines the first group of buildings investigating the following criteria:

- To identify the buildings and discuss why they cannot be air-conditioned and/or why they should not be modified to allow them to be air-conditioned;
- To examine alternative ways to cool the building and to improve visitor comfort where relevant;
- To identify what will need to be done to the building to accommodate alternative ways of cooling and what impact this will have on heritage values;
- To provide recommendations for each of the buildings.

Site 01 – VISITOR'S BUILDING – ca 1968/69 and extended 1978

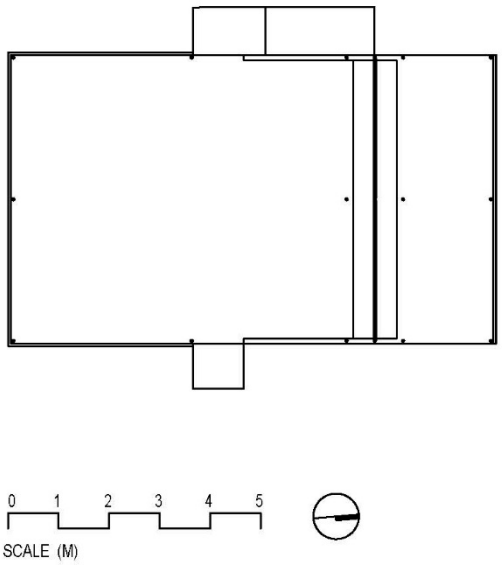


Fig.10 Floor plan of the Visitor's Building.

Description

This was originally a simple shelter consisting of a roof with chain mesh dividing walls and erected around 1968-9 using a bicycle shelter salvaged from Parap School. The building was later extended to the rear (ca 1978) and enclosed to form a contact visiting area. Conservation work to redefine the two functions of the building as a 'partitioned' and a 'contact' visiting area was documented in 1982 but the work was not carried out.[1] The building is an uninsulated tubular steel framed structure with timber wall and roof framing, corrugated iron cladding to the roof and fibre-cement sheet wall cladding. The present interior is a single open room with exposed wall framing. There is a wide plywood bench for the full width of the northern end divided by a weld-mesh screen partition.

At present the enclosed portion of the building is not open to visitors but used as a store room for the gaol. The non-contact visitor area is used as an entrance walk-through to enter the gaol and includes some interpretative panels and general information brochures.

Significance

The building is of Moderate significance illustrating the architectural development of the gaol complex. John Kerr (1981) notes that the structure demonstrates two steps in the visiting routine of the gaol: (i) separation by barrier and (ii) physical contact area.[2]

[1] Refer Architectural drawing B82-2828 and B94-1304.

[2] Kerr, J, 'Fannie Bay Gaol Precinct Conservation Management Plan', Darwin, National Trust of Australia (NT), September 1981.

Cooling strategy

This building should not be air conditioned.

In its present form this building is not capable of being air conditioned as the northern wall consists of an open weld-mesh screen. Whilst the screen could be enclosed, this would obscure its function as a non-contact visitor area and detract from the overall significance of the building. Should the building be reconstructed to form an open partitioned visitor area and an enclosed contact visitor area, the smaller enclosed room forming the contact visitor area would also be unable to be air conditioned as most walls are shown on the drawings as open chain-wire mesh.

Enclosing the openings to air condition the interior would detract from the heritage significance of this building.

Fig.11 - East façade of the Visitor's building.

Passive cooling

Insulation

There is no insulation to the walls or roof. The addition of insulation to the roof in the form of a fibre-free reflective insulation would reduce radiant heat and convection should the building be opened to visitors. Insulation should not be added to the walls.

Air movement

The building is in the wind shadow of the perimeter wall although some air movement is experienced when the entrance gate is opened. There are currently two small ceiling fans in the building mounted at 2350mm above the floor. If the building were to be open to the public these fans should be replaced with larger fans.

Reconstructing the building would potentially improve air movement within the interior as the drawings indicate a large expanse of chain-wire mesh to three walls of the enclosed contact visitor area. The wall openings would also help to exhaust hot air from within the building. However, the building's proximity to the perimeter wall would reduce air movement due to a shadowing effect from the wall unless corresponding openings were made in the perimeter wall.

Required modifications

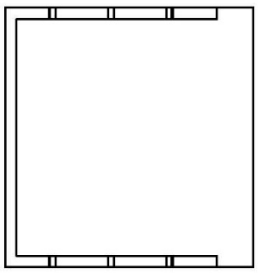
- Install reflective foil insulation under the roof cladding. This will require the removal and then replacement of the roof cladding. Given the small size of this building this would be feasible.
- Reconstructing the building, if considered appropriate, would require significant work, however, it would have the benefit of clearly interpreting the two visitor functions of the building and of the gaol.

Recommendations

1. If sufficient evidence can be located in support of the documented reconstruction works, then reconstruct the Visitor's building. Increasing the openings in the external walls will increase air movement and contribute to cooling. The two visitor functions of the building could then be interpreted and the building opened to visitor access.
2. The roof should be insulated using a fibre-free reflective insulation.
3. Existing fans could be replaced with larger fans.

Fig.12 - Non-contact visitor's area – currently the access walkway from the main gate.

SITE 02 – GUARD HOUSE No.3 YARD - 1975



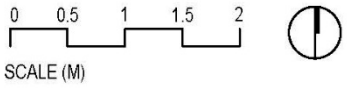


Fig.13 Floor plan of the Guard house.

Fig.14 - South façade of the Guard house.

Description

Three small Guard houses were constructed at the gaol following cyclone Tracy in 1974 when the watchtowers constructed along the perimeter wall were destroyed. This Guard house was reported to have been lying on its side in 1981 and was reconstructed in ca 1982 including the construction of a new concrete floor slab.[1] This is an open timber stud framed structure on a concrete slab. The wall framing is clad on the external face with painted fibre-cement sheet. The roof is a skillion clad with corrugated galvanised iron screw-fixed to timber battens. The structure is open on the eastern side and provided with louvre windows on the north and south sides.

Significance

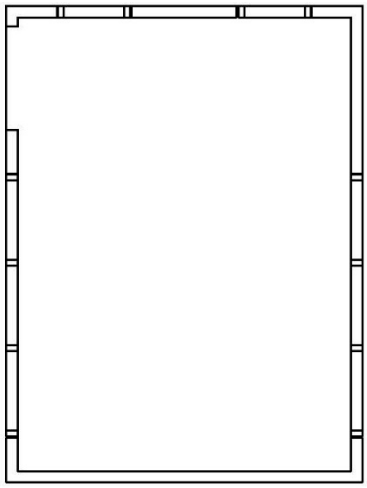
The building is of Moderate significance. It was a temporary structure developed and constructed to provide shelter for prison guards following the loss of the watchtowers in cyclone Tracy

Recommendations

There are no recommendations for this site.

[1] Refer Kerr, 1981, op.cit.; reconstruction work is detailed on Architectural drawing B82-2827 dated September 1982 and B82-2829 dated, incorrectly, September 1981.

Site 03 – RECEPTION (FORMER GUARD'S OFFICE) - 1969



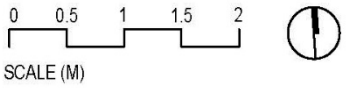


Fig.15 *Floor plan of the Reception Building.*
Floor area of building: 11.5 m2

Description

This building was originally constructed in 1969 as a Guard's office for the supervision of No.2 and no.3 yards. It was extended in 1970 and later converted to a 'reception room. By 1976 it was noted as the 'gate office' on a site plan. This is a timber framed structure on a concrete floor slab. The wall framing is clad on the external face with painted corrugated galvanised iron cladding. The roof is a skillion clad with corrugated galvanised iron. There are timber-framed windows in each of the walls but most have been blocked except for the windows in the western wall. Aluminium sun louvres provide shade to these windows from the afternoon sun. The interior is a single open room with a raking ceiling following the roof pitch. There is a sink bench located on the southern wall and a wide bench on the western wall that forms a counter for the attendant's station function of the building.

Heritage Significance

The building is of Moderate significance illustrating the ongoing evolution of the gaol complex.

Cooling strategy

The building should not be air conditioned.

The building is currently air conditioned and forms the office of the attendant on the site. The air conditioner is a small room air conditioner installed in a window on the eastern façade. The current air conditioning system is relatively new and appears effective although it would not be particularly efficient as the building is uninsulated, the door is not well sealed and the front window is often open to allow the attendant to speak to visitors.

The long-term goal should be to relocate the attendant's function and reconstruct this building.

Fig.16 - North and west façade of the Reception building.

Passive cooling

Insulation

The building roof is insulated with reflective foil that appears to have been installed some time ago. There does not appear to be a vapour barrier installed and it is unlikely there is a vapour barrier or insulation in the walls.

Air movement

There is little ventilation to the interiors as most of the windows have been infilled or changed to fixed glass with the exception of the western window which slides open. The original windows were louvres and if these were reconstructed they would allow some ventilation to the interiors. There is no fan in the building and the ceiling is too low to safely accommodate a fan.

Required modifications

- Installing new insulation and a vapour barrier to the roof would require the removal and then replacement of the roof cladding. Given the small size of this building this would be feasible.

Recommendations

1. If the building's current use remains, insulation and a vapour barrier should be installed to the roof. The existing window mounted room air conditioning system should be retained.

2. When the building's current use as an attendant station ceases the air conditioning system should be removed from this building, louvre windows reconstructed and the roof insulated using a fibre-free reflective insulation.

Fig.17 - North façade of the Reception building.

Site 05 – REMAND SECTION (CELL BLOCK E) – 1970-71

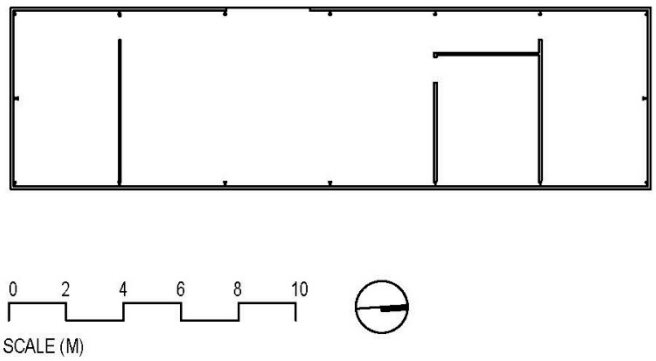


Fig.18 Floor plan of the Remand Section.

Description

This building was completed in early 1971. The cell partitioning, with the exception of the southern cell, was removed post-1979 and two timber-framed offices were constructed at the northern end in 1985-86. Additional windows were added to the external wall and flashings added top and bottom of the external wall closing the ventilation openings in these walls.

The building is a prefabricated steel structure comprising steel columns and light steel trusses made from welded angles similar to details adopted in Sydney Williams huts. Weld-mesh lining encloses walls and roof/ceiling for security with galvanised iron cladding fixed over the weld-mesh to angle roof purlins and wall girts. The floor is a concrete slab poured in small panels. Wall cladding stops short of the floor and the roof for part the building providing weld-mesh screened openings that allow cross-ventilation.

Heritage Significance

The building is of Considerable significance. It is a medium security cell block used for prisoners on remand and illustrates the architectural development of the gaol.

Cooling strategy

This building should not be air conditioned.

This building is a single-skin uninsulated metal clad structure with permanent ventilation openings to the top and bottom of the wall, some of which have been covered with metal trim. The entrance door is a large open weld-mesh panel. There is no ceiling in the building. As it currently stands, the building cannot be air-conditioned. Two offices were constructed in the building in 1985-86 and these offices were air conditioned with room air conditioners of which one air conditioner remains but does not appear to be operational. Internal walls were lined and possibly insulated. The Conservation Management Plan recommends these offices and associated accretions are removed.

Fig.19 - West façade of the Remand section (Cell block E). Note large weld-mesh doorway.

Closing off the ventilation openings, screening the entrance door and providing insulation to the walls would detract from the heritage significance of this building.

Passive cooling

Insulation

The roof cladding has recently been replaced and new reflective foil insulation has been installed under the roof sheeting. There is no insulation to the walls and insulation should not be provided to the walls.

Air movement

All internal solid partitions should be removed to reconstruct the original, open plan, building to promote air movement. All ventilation openings to the top and bottom of the external walls should be reconstructed to provide a breeze path through the building. There are three ceiling fans in the building positioned at 2700 from the floor. Additional ceiling fans would assist in air movement within the building.

Required modifications

Reconstruct this building to its 1979 form and details.

Recommendations

1. Remove the later internal office partitions and associated accretions (wall lining, windows, air-conditioning, sink)
2. Reconstruct the ventilation openings to the top and bottom of the external walls.
3. Provide three new ceiling fans resulting in a fan in each bay of the building. Fans should match existing and be mounted at the same height.
4. Consider installing a low-profile ridge vent to the roof.

Fig.20 - Interior looking north. The CMP recommends removal of the later internal partitioning, removal of later louvre windows and reconstruction of the ventilation openings at the base and top of the external walls.

Site 06 – MEDIUM SECURITY CELL BLOCK D - 1968

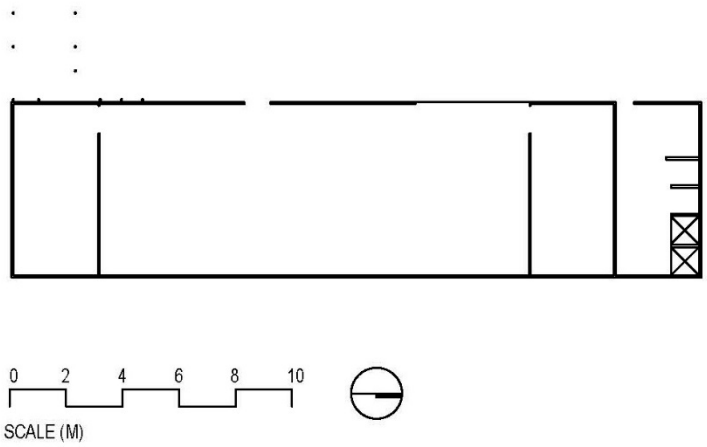


Fig.21 Floor plan of Cell Block D.

Description

This cell block consists of a Sydney Williams hut that was dismantled and removed from the Lands Branch in Cavenagh Street and re-erected at the gaol. The building is noted as being complete by December 1968.[1] A toilet block was constructed at the end of the cell block in 1969.[2] Internal cell partitions comprised weld-mesh screens to allow air movement through the interiors.

This building is a pre-fabricated steel framed Sydney Williams hut. Weld-mesh lining encloses walls and roof for security with single-skin galvanised iron cladding fixed over the weld-mesh to angle roof purlins and wall girts. The roof cladding and trims are recent. Wall cladding stops short of the floor and the roof providing weld-mesh screened openings that allowed air movement through the building. A large mesh opening is provided in the western wall. Although originally constructed with cells, this partitioning has been removed with the exception of the two end cells. The toilet block, an addition to the northern end of the building, comprises showers, toilets and basins and is relatively intact.

Heritage Significance

The building is of Considerable significance. It is a medium security cell block and illustrates the architectural development of the gaol.

[1] NAA F1 1967/234, cited in Troppo, Fannie Bay Gaol Infirmary: Structural risk assessment, February 1998, for Museum and Art Gallery of the Northern Territory.
[2] NAA F1 1969/172, cited in Troppo, 1998, op.cit.

Cooling strategy

This building should not be air conditioned.

This building is a single-skin uninsulated metal clad structure with permanent ventilation openings to the top and bottom of the wall. There is no ceiling in the building. As it currently stands, the building cannot be air conditioned.

Closing off the ventilation openings, screening the entrance door and providing insulation to the walls to air condition the interior would detract from the heritage significance of the building.

Fig.22 - South and East façade of Cell block D. Cell block C is to the left and the perimeter wall is to the right.

Passive cooling

Insulation

The roof cladding has recently been replaced and new reflective foil insulation has been installed under the roof sheeting. There is no insulation to the walls and insulation should not be installed to the walls.

Air movement

The building is in the wind shadow of the Infirmary and Cell block C effectively restricting westerly and north-westerly breezes. All ventilation openings to the top and bottom of the external walls should be retained to provide a breeze path through the building. The large opening in the western wall should also be retained. There are three ceiling fans in the building positioned at 2700 from the floor. Additional ceiling fans would assist in air movement within the building.

Required modifications

There are no modifications required for this building.

Recommendations

1. Provide four additional ceiling fans resulting in a fan in each bay of the building. Fans should match existing and be mounted at the same height. The cabling and hanging brackets for additional fans appear to be in place.
2. Consider opening the windows in the Infirmary during gaol opening hours to improve air movement across the site.
3. Consider installing a low-profile ridge vent to the roof.

Fig.23 - Interior looking south. Note the weldmesh internal partition forming a cell.

Site 07 - MEDIUM SECURITY CELL BLOCK C - 1967

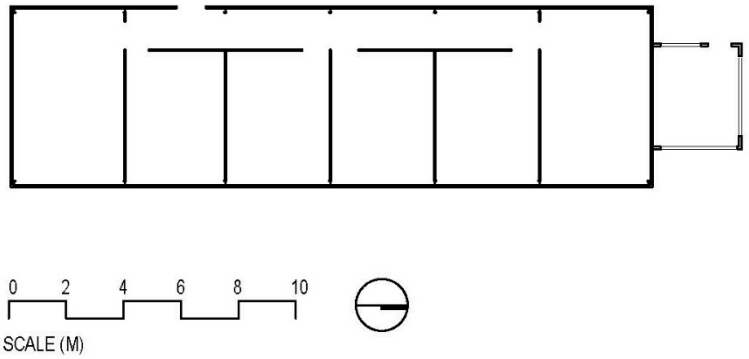


Fig.24 Floor plan of Cell Block C.

Description

This building was constructed to the same detail, including the partitioning into dormitory cells, as used for the Remand Building (Cell Block E). The building is noted as being complete by August 1967.[1] A senior Guard's office was constructed at the end of the building and completed in January 1971.[2] It is the most intact of the three steel frame cell blocks as the internal cell partitions remain in place.

The building is a prefabricated steel structure comprising steel columns and light steel trusses made from welded angles similar to details adopted in Sydney Williams huts. Weld-mesh lining encloses walls and roof/ceiling for security with galvanised iron cladding fixed over the weld-mesh to angle roof purlins and wall girts. The floor is a concrete slab poured in small panels. Wall cladding stops short of the floor and the roof providing weld-mesh screened openings that allowed air movement through the building. Internal partitioning of tubular steel with weld-mesh lining forming cells is intact, as are the doors and bolts. A single office of timber-frame walls clad with fibre-cement sheet and timber frame roof clad with corrugated galvanised iron is constructed at the north end of the building.

Heritage Significance

The building is of Considerable significance. It is a medium security cell block illustrating the architectural development of the gaol. This is the most intact of the steel frame cell blocks.

[1] NAA F1 1967/234, cited in Troppo, 1998, op.cit.
[2] NAA F1 1969/172, cited in Troppo, 1998, op.cit.

Cooling strategy

This building should not be air-conditioned.

This building is a single-skin uninsulated metal clad structure with permanent ventilation openings to the top and bottom of the wall. There is no ceiling in the building. As it currently stands, the building cannot be air-conditioned. Closing off the ventilation openings and providing insulation to the walls would detract from the heritage significance of this building.

Fig.25 - North and east façade of Cell block C. The annexe for the senior guard is on the north end of the cell block.

A small Guard's office is located on the northern end of the building. This office has louvres on three sides and a raking ceiling following the roof pitch. There is an old ceiling fan in the office, however, the room does not appear to have been air conditioned. If the office were to be air conditioned, a split system should be used with the outdoor air conditioning unit located immediately outside the eastern wall and appropriately screened.

Passive cooling

Insulation

The roof cladding has recently been replaced and new reflective foil insulation has been installed under the roof sheeting. There is no insulation to the walls and insulation should not be installed to the walls. There is no vapour barrier. If the guard house were to be air conditioned a vapour barrier and insulation should ideally be installed to the roof and walls. This would require removal of the roof cladding and the external wall cladding.

Air movement

The building is largely in the wind shadow of the Infirmary, except for part of the northern end, effectively restricting westerly and north-westerly breezes through the building. All ventilation openings to the top and bottom of the external walls should be retained to provide a breeze path through the building. There are four ceiling fans in the building fixed at the apex of the roof at 3500mm from the floor. They are close to the underside of the roof which is not ideal as the fans will tend to push warm air down from the roof area to the level of the visitors below. The fans should be repositioned to the tie beam running the length of the cell block as they have been in the adjacent Cell block D to finish nominally 2700mm above the floor.

Required modifications

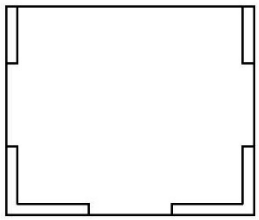
There are no modifications required for this building.

Recommendations

1. Reposition the existing fans to the tie member so they finish at nominally 2700mm above the floor matching the fans in the Remand section and Cell block D
2. Provide two new ceiling fans resulting in a fan in each bay of the building. Fans should match existing and be mounted at nominally 2700mm above the floor.
3. Do not air condition the small guard's house located at the northern end of Cell block C.
4. Consider installing a low-profile ridge vent to the roof.

Fig.26 - The interior looking along the corridor. Cell partitioning is lined with weld-mesh.

Site 10 – GUARD HOUSE No.1 YARD - 1975



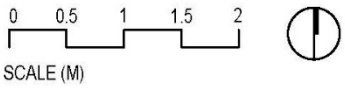


Fig.27 Floor plan of the Guard house.

Fig.28 - View of the Guard house. The Ablutions block is immediately adjacent.

Description

There were 3 small Guard houses constructed at the gaol, one each located in No.1, No.2 and No.3 yards. The Guard house in No.1 yard is no longer extant except for the concrete slab. These were temporary structures put in by the Gaol administration following cyclone Tracy in 1974 when the Watchtowers were destroyed.

This is an open hardwood timber stud framed structure sitting beside a concrete floor slab immediately adjacent to the ablutions block (Site 11). The wall framing is clad on the external face with painted fibre-cement sheeting. The roof is a skillion clad with corrugated galvanised iron screw-fixed to timber battens.

Conservation work to the Guard house was documented in 1982 and it is likely that this structure was largely if not completely reconstructed at this time.

Significance

The building is of Low significance. It was a temporary structure developed and constructed to provide shelter for prison guards following the loss of the watchtowers in cyclone Tracy.

Recommendations

There are no recommendations for this site.

Site 11 - ABLUTIONS BLOCK - 1954

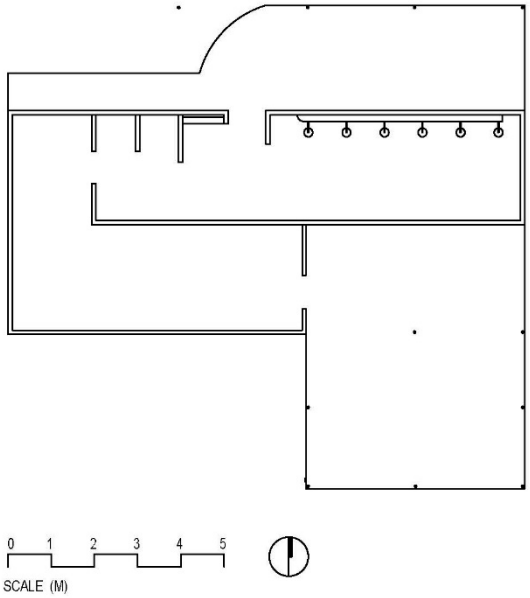


Fig.29 Floor plan of the Ablutions Block.

Description

The Ablutions Block was completed during the 1953-1955 period. When first constructed the building included toilets, showers and laundry facilities. The building was altered in 1964 when additional showers and basins were added.[1]

This is a timber-frame structure on a concrete floor slab with walls and roof clad with corrugated galvanised iron. The roof cladding and flashings have recently been replaced. Verandahs on the north and south sides once housed the laundries comprising copper boilers and troughs. A system of drainage channels and spoon drains direct water away from the building. The interior walls are lined up to sill height and then unlined above the window openings. Fixtures comprise toilets, urinal, hand basins, showers and a concrete foot bath.

Heritage Significance

The building is of Considerable significance. It is the main ablution facility for the gaol and it is largely intact.

[1] NAA F1 1963/2694 cited in Troppo 1998

Cooling strategy

The building cannot be air-conditioned.

The building is an uninsulated timber framed structure with large openings above sill height to all walls and to the central dividing wall which continues to the ridge as open studwork to support the roof framing. The external wall height is 2600 rising to 3150 at the ridge. As it currently stands, the building cannot be air-conditioned.

Infilling openings in the walls and enclosing the building would detract from the heritage significance of the building.

Fig.30 - South facade of the Ablutions block.

Passive cooling

Insulation

The roof cladding has recently been replaced, however, reflective foil insulation was not installed under the roof sheeting when this occurred. While radiant heat from the uninsulated roof cladding will transfer to the interior, the open nature of the building will encourage dissipation of this heat.

Air movement

There are sufficient openings in the external walls to promote air movement through the building, however, the building is partially in the wind shadow of the Kitchen and mess building and of Cell block A&B. . There are no ceiling fans in the building. The addition of fans would help with air movement during the warmer periods of the year, however, the central wall framing limits the available space for fans. While ceiling fans could potentially be installed either side of the central wall framing, they would tend to clutter the space and possibly feel too low. The verandah roof is too low to install fans.

Required modifications

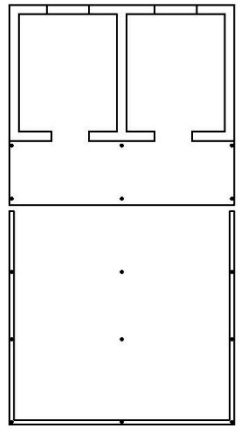
There are no modifications required for this building.

Recommendations

There are no recommendations for this building.

Fig.31 – Open interior of the Ablutions block. Note the open external walls and cladding to sill height only.

Site 12 – SEPARATE CONFINEMENT BLOCK - 1955



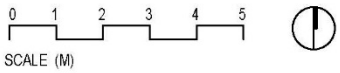


Fig.32 Floor plan of the Separate Confinement Block.

Description

Drawings for a Separate confinement block comprising two cells, one padded the other a solitary cell, were prepared in May 1955 with the building completed soon after. The exercise yard in front of the two cells was completed in September 1965 using prison labour.[1]

The building comprises two rendered masonry cells with a lightweight steel roof frame and corrugated galvanised iron roof cladding. A concrete slab forms a secure ceiling to the cells. The exercise yard is fabricated from tubular steel frame and weld-mesh cladding. The area in front of the cell doors is concrete, the remainder is grass. Doors are located on the southern side and there are small windows on the north and south sides. Support framing for pedestal fans remain outside the windows on the south side, as do the original light fittings. The interiors of the cells are rendered. The western cell was once padded and some of the fixing points are still evident.

Heritage Significance

The building is of Considerable significance. It is part of the development of the gaol complex and the only solitary cell block provided in the gaol.

[1] NAA F1 1963/2694 cited in Troppo, 1998, op.cit.

Cooling strategy
The building should not be air conditioned.

The building is a small masonry cell block. While the building could potentially be air conditioned with modification to the existing windows to seal the building, from an interpretative perspective, it is preferable to leave the cell block as it was originally constructed to demonstrate the difficult conditions that prisoners in separate confinement would have experienced, particularly during the wet season months.

Fig.33 - West facade of the Separate Confinement block and exercise yard.

Passive cooling
Insulation
The roof cladding has recently been replaced, however, reflective foil insulation was not installed under the roof sheeting when this occurred as there would have been no advantage in doing so. The metal roof is in effect a fly-roof sitting over a concrete slab that forms the ceiling of the two cells. This fly roof is open at the gable ends to exhaust hot air and is an effective cooling strategy providing shade to the concrete ceiling and preventing radiant heat transfer into the cells below.

Air movement
The orientation of the building and position of openings effectively restricts any airflow within the cells. There are small barred windows in the north and south wall at high level that provide little if any cooling effect although they would possibly contribute to exhausting hot air from the interior.

An attempt to promote air movement in the form of a single pedestal fan located on a bracket outside the southern window of each cell was part of the original design and appears to have been constructed. It is doubtful the fan would have been effective. From an interpretative perspective, however, this fan could be reconstructed.

The open weld-mesh screened exercise yard benefits from sea breezes. Opening the first (western) cell door to 90 degrees creates a fin that directs some breeze into the cell.

Required modifications
There are no modifications required for this building.

Recommendations
There are no recommendations for this site.

Fig.34 – cell doors from the exercise yard. Pedestal fans, directed into the cells, were fixed to the brackets seen in front of the two high level windows.

Site 13 - COVERED MUSTER SHELTER - 1970

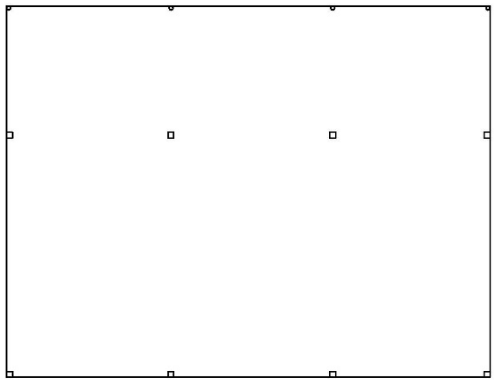


Fig.35 Floor plan of the Muster Shelter.

Description

The Muster shelter was completed in August 1970.[1] It is an open steel frame shelter that appears to have been fabricated from salvaged materials. The steel roof trusses appear to have come from Sydney Williams huts. Steel angles used for verandah rafters could also have been salvaged from Sydney Williams huts. The roof cladding, gable end cladding and screen to the north side have recently been replaced. Timber bench seating is provided along the east and west sides. There are numbered squares painted on the concrete floor slab and numbered pavers located to the south of the site (5 rows of 25 pavers in each row). Kerbing to the west encloses a garden area and an adjacent depression indicates the location of an underground water tank that is no longer used.

Heritage Significance

The building is of Moderate significance. It is evidence of the daily muster, an important part of the routine at the gaol.

[1] NAA F1 1969/172, cited in Troppo, 1998, op.cit.

Cooling strategy
The building cannot be air-conditioned.

The building is a shelter open on all four sides. The underside of the roof trusses are at 2400mm and the ridge is at 4000mm above the floor.

Fig.36 - West facade of the Muster shelter. Note rows of numbered tiles in the yard. Similar numbered squares are painted on the floor slab of the shelter.

Passive cooling
Insulation
The roof cladding has recently been replaced, however, reflective foil insulation was not installed under the roof sheeting when this occurred. While radiant heat from the uninsulated roof cladding will transfer to the interior, the open nature of the building will encourage dissipation of this heat.

Air movement
The building is open and could potentially benefit from sea breezes, although it is in the wind shadow of the perimeter fence and partially in the wind shadow of the Women's section. There are currently no ceiling fans in the shelter. The addition of fans would help with air movement during the warmer periods of the year. There is currently no power to the building.

From an interpretative perspective, it may be preferable to leave the shelter as it was originally constructed to demonstrate the difficult conditions that prisoners must have experienced, particularly during the wet season months, at the daily muster. However, the shelter also provides the opportunity to create a shaded seating area for visitors to the gaol and ceiling fans would improve comfort for anyone seated under the shelter.

Required modifications
Provide power and water to the Muster shelter.

Recommendations
1. Install four, grade 316 stainless steel ceiling fans in the shelter suspended from the ridge by a stainless steel dropper and located at nominally 2600mm above the floor.
2. Consider providing a chilled water bubbler at the site for use by visitors.
3. Consider providing seating under the shelter for use by visitors.

Fig.37 - Interior looking north-east.

Site 15 – CHILDREN'S SECTION - 1963

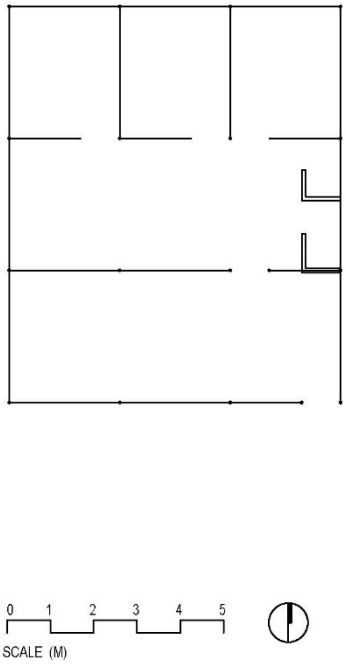


Fig.38 Floor plan of the Children's Section.

Description

Drawings were prepared for a contagious disease isolation cell in January of 1963 consisting of three cells, an amenities area with ablution facilities and an enclosed exercise yard.[1] The cell block was used to house juvenile offenders and for a short period after cyclone Tracy in 1974 it was used to accommodate refugee Vietnamese boat people.

The structure is tubular steel frame in a concrete floor slab clad with weld-mesh for security and corrugated galvanised iron. Timber purlins are used to form a skillion roof clad with corrugated galvanised iron. The roof cladding and trims are recent. The wall sheeting is fixed with hook bolts and is clear of the floor and roof creating ventilation openings top and bottom.

Heritage Significance

The building is of Considerable significance. It is evocative of its use as a cell block in the tropics.

[1] NAA F1 1962/627 and NAA F1 1950/769, cited in Troppo, 1998, op.cit.

Cooling strategy
The building cannot be air conditioned.

The building is a single-skin uninsulated metal clad structure with weld-mesh screened openings in the main north/south walls including the internal walls. Dividing walls between cells are lined with single skin corrugated iron fixed clear of the floor and roof.

Enclosing these openings to air condition the interior would detract from the heritage significance of this building.

Fig.39 - South facade of the Children's section. The perimeter wall can be seen in the distance.

Passive cooling
Shade
The building is afforded some shade by a large beauty-leaf tree growing outside the fence on the northern side.

Insulation
The roof cladding has recently been replaced, however, reflective foil insulation was not installed under the roof sheeting when this occurred. While radiant heat from the uninsulated roof cladding will transfer to the interior, the open nature of the building will encourage dissipation of this heat. There is no insulation to the walls and insulation should not be installed to the walls.

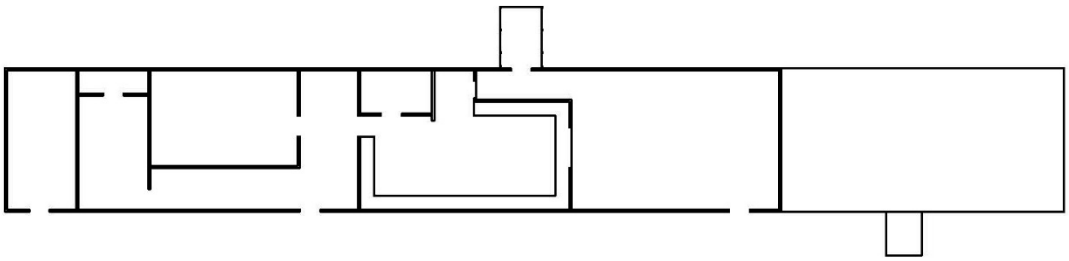
Air movement
The building is within the wind shadow of the perimeter wall on both the north and western sides. There are openings at the base of the walls on all sides, the western gable end is open and the back (northern) wall is open at the top. The southern wall and internal wall dividing the amenities area from the enclosed exercise yard are open above sill height. There are two ceiling fans in the amenities area and one fan in each of the three cells positioned at 2340mm from the floor.

Required modifications
There are no modifications required for this building.

Recommendations
1. Openings in the perimeter wall on the western side would increase air movement across the site from prevailing west and north-west breezes.

Fig.40 - Interior looking west. External walls to the north and south are weld-mesh above sill height. End walls are single skin with open gables.

Site 17 – KITCHEN AND MESS - 1954



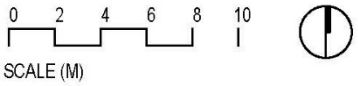


Fig.41 *Floor plan of the Kitchen and Mess.*

Floor area of dining: 80 m2
kitchen: 50 m2

Description

This building was erected in 1954 using a 70ft Sydney Williams hut dismantled and moved from Larrakeyah. The building contains a large mess or dining room, a flyscreened kitchen that has benches but no equipment, and various secured storage areas to the west.

Weld-mesh lining encloses walls and roof/ceiling for security with galvanised iron cladding fixed over the weld-mesh to angle roof purlins and wall girts. The roof cladding and trims are recent. Wall cladding stops short of the floor and the roof for part the building providing weld-mesh screened openings that allowed airflow through the building. There is a concrete slab to the west that once housed part of the original building damaged in cyclone Tracy and subsequently demolished.

Heritage Significance

The building is of Considerable significance. It illustrates the architectural development of the gaol complex and is the first of the Sydney Williams huts to be constructed at the gaol.

Cooling strategy

The building should not be air-conditioned.

While the kitchen and mess areas could potentially be air conditioned they would require significant modification to the original structure to close off openings in the top and bottom of the north and south facing window walls. Other spaces within the building are largely open or have large weld-mesh openings in some walls.

Enclosing openings to air condition the interiors would detract from the heritage significance of this building.

Fig.42 - South and west facade of the Kitchen and mess.

Passive cooling

Insulation

The roof cladding has recently been replaced and new reflective foil insulation has been installed under the roof sheeting. There is a fibro ceiling in the kitchen and mess area at 3150 above the floor providing a ceiling space that contributes to cooling the two rooms under the ceiling. One of the gable ends (western) is lined with weld-mesh effectively ventilating the ceiling space. The other spaces have no ceilings.

Air movement

The orientation of the building, with the long axis east-west, and the proximity of the perimeter wall and Cell block A&B to the north, means that the building does not benefit greatly from the prevailing north-west or westerly breezes. There are openings top and bottom of most of the north and south facing walls and the storage area has a large weld-mesh screen to the southern wall and the internal partitions are full height weld-mesh. There are three ceiling fans in the mess area and two in the kitchen positioned 2800 from the floor. There are also ceiling fans in the storage areas of the building.

Required modifications

There are no modifications required for this building.

Recommendations

1. Consider installing a low speed ducted exhaust fan to remove hot air from the ceiling space over the kitchen and the mess area. The fan could exhaust through a discrete grille located in the eastern facing gable end.

Fig.43 - Interior of the mess (dining room) looking towards the kitchen. Note openings to the top and bottom of the external window walls.

Individual buildings – group 2

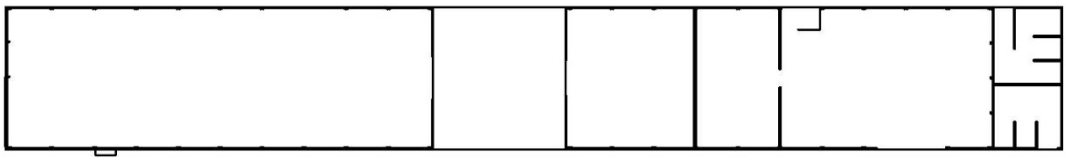
Each of the individual buildings within the Fannie Bay Gaol site have been reviewed and placed into two groups as follows:

- Group 1 - Those buildings that should not or cannot reasonably be air-conditioned,
- Group 2 - Those buildings that could potentially be air conditioned.

This section examines the second group of buildings investigating the following criteria:

- To identify the buildings that can potentially be air conditioned;
- To discuss what will need to be done to the building to allow it to be air conditioned and what impact this will have on heritage values;
- To examine the various mechanical system options;
- To recommend a location for the outdoor air conditioning unit, or central air-conditioning plant, and indoor fan units and pipework and discuss how the various plant items might be concealed.
- Provide schematic drawings indicating the location of air conditioning plant and methods of concealment;
- Provide recommendations for each of the buildings in this group.

Site 04 – STORES BUILDING - 1966



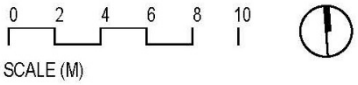


Fig.44 Floor plan of the Stores Building.

1.	Gallery space	110 m2
2.	Open breezeway	33 m2
3.	Office	33 m2
4.	Store	21.5 m2
5.	Workshop	55 m2
6.	Toilets	18 m2

Description

The Stores Building was erected as two separate dormitory buildings around 1966. A toilet extension was added to the eastern end in 1968. The western end was modified in 1971 to create a chief guard's office, private property and general store, and an adult education classroom while the eastern end was converted into a store and spray painting workshop.[1] The linking roof between the two original dormitory blocks was constructed at this time creating a central breezeway.[2] The building is of prefabricated steel construction. Weld-mesh lining encloses walls and roof/ceiling with galvanised iron cladding fixed over the mesh to pipe roof purlins and wall girts. The roof cladding and trims are recent. Wall cladding stops short of the floor and the roof for much of the building providing mesh screened openings allowing air movement through the building.

Conservation works were undertaken in 1994 and internal partitioning in the western end was removed to form an open gallery space. A concrete slab and steel frame awning roof were added to the southern side of the building in ca 1983-4 to house a railway engine that has since been removed. Today, the western end of the building is a single open room devoid of partitioning. The eastern end of the building is divided into an enclosed office with tiled floor that was air conditioned in the 1980s, a small store, workshop, and an ablution facility that contains male and female toilets.

Heritage Significance

The building is of Moderate significance. The building illustrates the architectural development of the gaol complex, however, while the exterior is largely original, the interior has been significantly altered since the gaol closed in 1979 with much of the internal partitioning removed and modifications made to create an office in the eastern wing.

[1] NAA F1 1969/172 and NAA F1 1969/356, cited in Troppo, 1998, op.cit.
[2] Troppo 1998, op.cit.

Cooling strategy

Part of the building could potentially be air conditioned.

The interior of the Stores building has been significantly altered post 1979 when the gaol closed. Internal partitions have been removed from the western end of the building which is now an open gallery space. Remnants from the former store, workshop, and the ablutions in the eastern end of the building are all that remain from its use while a gaol. It would be feasible, although not without some difficulty, to enclose and then air condition the gallery space at the western end of the building, and the office in the eastern side of the building could also be air conditioned.

Fig.45 - North and west façade of the Stores building.

Air-conditioning system

General

Two spaces could potentially be air conditioned: the Gallery space (110 m2) and the Office (33 m2). One constraint in air conditioning the building is the low height of the roof structure. The bottom of the roof trusses are at 2550mm above the underside of the floor, rising to the ridge at 3150mm. Trusses are clad both sides resulting in a series of baffles along the length of the building. This effectively precludes running ductwork in the space.

Gallery

It is proposed to supply sufficient cooling to provide thermal comfort conditions for visitors who are generally appropriately dressed for the conditions. This would be in the order of 25-26°C. This will also assist in minimising the risk of condensation occurring within the building. The recommended air conditioning system is three commercial ceiling cassette type air conditioning units located between the roof trusses with the bottom of the cassette level with, or slightly higher than, the underside of the roof truss.

Fig.46 - Southern façade of the Stores building. The large opening is a door into the workshop

Office

It is proposed to supply sufficient cooling to provide 24°C to the office. The recommended air conditioning system is a single commercial ceiling cassette type air conditioning unit located between the roof trusses with the bottom of the cassette level with, or slightly higher than, the underside of the roof truss.

Location of outdoor condenser unit

(i) The preferred option is for the condenser units to be located within the Stores area in the eastern wing of this building effectively screening the units from view.

Refrigerant pipework would run either in the ceiling space or in a duct at the apex of the ceiling. Penetrations would be required in the cladding to the roof trusses to allow the pipework to run the length of the Gallery.

If ventilation is required to this building the provisions of AS1668:2 would require sufficient ventilation to accommodate approximately 73 persons in the Gallery. This is unlikely to occur. The option is to:

(i) For the Gallery, pursue a concession for a maximum occupancy of 20 - 30 persons at any one time, with outdoor air delivered by way of the cassette air conditioning units.

Fig.47 - Interior of the gallery space looking east. Walls are open top and bottom for ventilation. Ceiling fans are installed between truss members.

(ii) For the Office, ventilation for a maximum occupancy of 3 persons would be delivered by way of the cassette air conditioning units.

Insulation

The roof cladding has recently been replaced and new reflective foil insulation has been installed under the roof sheeting. There is no insulation to the walls. If part of the building were to be air conditioned insulation would need to be installed to the roof and to the walls.

Vapour barrier

There is currently no vapour barrier installed in the building. If the air conditioning were to be set at a temperature in the order of 25-26°C condensation would be minimised. Under these conditions, the installation of a vapour barrier could be delayed. It is, however, good building practice to install a vapour barrier over the roof and to the walls should air conditioning be installed.

Installing a vapour barrier in the wall is possible when wall framing is installed, although it would not be achieved without difficulty. However, installing a vapour barrier in the roof is more difficult and it can only be successfully undertaken if the roof cladding is removed. Trying to retro-fit a vapour barrier under the roof cladding is problematic and unlikely to meet with complete success, particularly as the vapour barrier needs to be installed on the warm side of any bulk insulation. Roof cladding could be progressively removed, a few sheets at a time, the vapour barrier and insulation correctly installed, and the cladding refixed.

Air movement

Currently the building has openings at the top and bottom of the external walls to allow air movement. The workshop area has a large weld-mesh door providing ventilation. The office is fully enclosed and was once air conditioned. There is a row of ceiling fans located between the trusses in the gallery space and ceiling fans in every second bay in the workshop and open store. If part of the building is to be air conditioned, all openings in the air conditioned areas will need to be sealed. The ceiling fans, however, should be retained in all spaces, including the air conditioned spaces where they will assist in circulating cooler air.

Currently there is little ventilation in the two toilets at the end of the building. These are used as public toilets. If they are to remain as public toilets, exhaust fans should be provided to increase air movement within the toilets.

Required modifications

If part of the building is to be air conditioned the following modification will be required:

- Construct framing and install internal wall and ceiling lining to enclose the gallery space at the western end of the building.

- Install insulation and a vapour barrier to the walls and the roof.

While sealing the walls and ceiling could be achieved using conventional construction systems such as studwork, battens and linings, great care would need to be taken at the wall and ceiling/roof junction to ensure a satisfactory result, particularly with respect to the installation of insulation and vapour barriers. In this instance it may be more appropriate to consider the use of insulated pre-finished panels fixed inside the existing wall and roof framing which, when erected, form a complete vapour seal.

Fig.48 - Interior of the store area in the eastern side of the building. This area has weld mesh openings in the external walls and is well ventilated. Air conditioning outdoor units could be located within this space effectively concealing them from view.

Fig.49 - Interior of the workshop in the eastern side of the building.

Recommendations

1. The gallery space at the western end of the building and the small office in the eastern end of the building could be air conditioned using exposed ceiling mounted cassette units located between truss members. The scheduled modifications should be undertaken including provision of insulation and a vapour barrier.

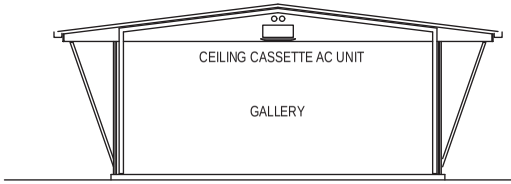
2. The open store, workshop and toilets should not be air conditioned.

3. In any air conditioned space, a ceiling following the rake of the roof should be installed. The roof cladding will need to be removed over air conditioned areas and a vapour barrier and suitable thermal insulation installed. External walls should be lined and insulation and a vapour barrier installed.

   Alternatively, insulated pre-finished steel panels nominally 80mm thick could be used to form walls and the ceiling lining. These panels have the advantage of being well insulated (R4.15) and of providing a vapour seal when correctly installed so the roof cladding would not need to be removed.

4. Install exposed, ducted, exhaust fans in the male and female toilets to promote air movement if they are to be retained as public toilets.

5. Upgrade the existing chilled water bubbler and additional provide seating in the breezeway for visitor use.



SECTION - 1 SITE 04 - STORES

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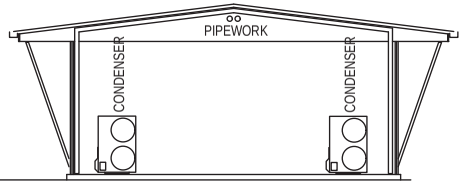

SECTION - 2 SITE 04 - STORES

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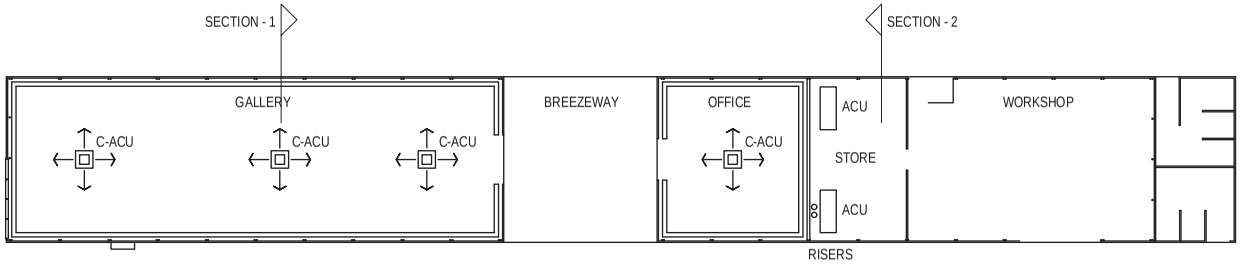

FLOOR PLAN SITE 04 - STORES

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AIR CONDITIONING

The recommended air conditioning system for the Gallery is 3 commercial ceiling cassette type air conditioning units installed between roof trusses with a nominal capacity of 8kW each. Note that additional, smaller, units may be selected for aesthetic reasons.

The recommended air conditioning system for the Office is a single commercial ceiling cassette type air conditioning unit with a nominal capacity of 3.5kW.

The outdoor condenser units would be located in the store in the eastern end of the building.

Refrigerant pipework would run under the ceiling along the length of the building as required. Penetrations would be required in the lining to the roof trusses.

This option assumes a concession is pursued for a maximum occupancy of 20 persons in the Gallery at any time time with outdoor air delivered by way of the cassette air conditioning units. Ventilation to the Office will be provided by way of the cassette air conditionin unit for an occupancy of 3 persons

ACU - Outdoor air conditioner unit
C-ACU - Ceiling cassette AC unit

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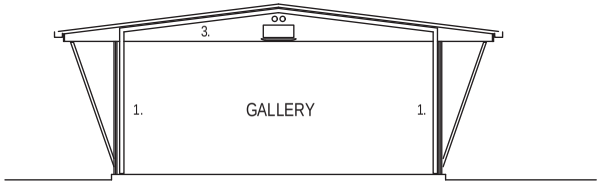
SITE 04 - STORES



FLOOR PLAN SITE 04 - STORES

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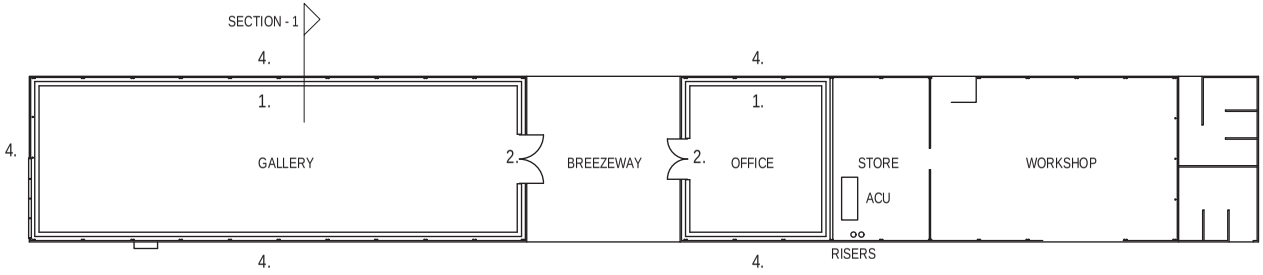

FLOOR PLAN SITE 04 - STORES

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PROPOSED MODIFICATION

The following changes are recommended to the Stores to enable the building to be air conditioned:

1. Provide new insulated wall panels installed inside the existing structure. Retain the existing wall framing and cladding and the existing weld-mesh security screening.
2. Remove existing and provide new solid core doors.
3. Provide new insulated ceiling panels installed inside the existing structure. Retain the existing ceiling framing and the existing weld-mesh security screening
4. Retain external wall cladding.

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SITE 04 - STORES

Site 08 - INFIRMARY - 1887

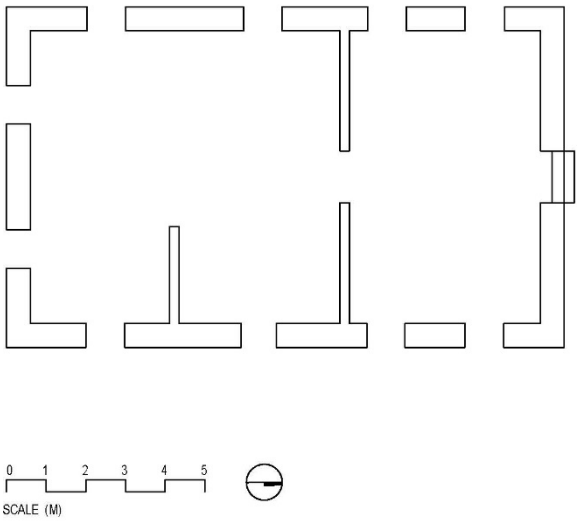


Fig.50 Floor plan of the Infirmary.

1. Cells 35 m2
2. Gallows area 57 m2

Description

The Infirmary was constructed during 1887 and initially located outside the gaol's southern wall. A padded cell was constructed in the Infirmary in 1919 and removed in 1930 along with the existing suspended timber floor and a new concrete floor was laid throughout.[1] In 1952 gallows were constructed inside the Infirmary. The building lost its roof during cyclone Tracy in 1974 and the roof was reconstructed in 1999 using steel trusses and a horizontal bracing truss at the top of the walls. All windows are later, and the front door appears to have been reconstructed. A second set of double doors at the front entrance (opening inwards) have been removed.

The building is constructed of local porcellanite stone rubble finished in tuck-pointing. The exterior walls are virtually original with the exception of a band of render at the base of the walls on three sides. The interior is divided into two sections by a part-height internal wall. Two tubular pipe and weld-mesh cages have been constructed inside the entrance at the northern end of the building. A gallows, constructed in 1952, is located in the second section protected by a timber balustrade and weld-mesh screen.

Heritage Significance

The building is of Exceptional significance. The Infirmary, along with Cell block A&B, are the oldest structures in the gaol complex and amongst the earliest buildings in Darwin.

[1] South Australian Parliamentary Papers 1931, cited in Troppo, 1998, op.cit.

Cooling strategy

The building could potentially be air conditioned.

The Infirmary consists of a single space divided into two smaller rooms by a part-height masonry partition. There is a plasterboard ceiling at 4200mm above the floor. Consideration needs to be given to the benefit of air conditioning against the benefit of using more passive means of cooling the building. The Infirmary is one of the buildings on site best located to take full advantage of the prevailing westerly breezes during the hotter periods of the year. If the windows in the building were opened and ceiling fans installed this would contribute to cooling the interior of the Infirmary with the added benefit of creating a breeze path through the building to benefit the two cell blocks immediately behind.

Fig.51 - West façade of the Infirmary.

Air-conditioning system

General

The interior, comprising an area of 92 m2 could potentially be air conditioned and there is sufficient space within the ceiling to accommodate air conditioning plant.

It is proposed to supply sufficient cooling to provide thermal comfort conditions for visitors who are generally appropriately dressed for the conditions. This would be in the order of 25-26°C. This will also assist in minimising the risk of condensation occurring within the building. The recommended air conditioning system is a commercial split system consisting of an outdoor condenser unit and a single indoor ceiling mounted cassette unit located centrally within the ceiling.

There are two options for the outdoor condenser units:

(i) The preferred option is for the condenser unit to be installed within the nearby Stores building (Site 04).

(ii) If this is not considered suitable, then the condenser unit could be located against the eastern perimeter wall adjacent to the main electrical switchboard and suitably screened.

Fig.52 – Refrigerant pipework could be concealed in ducts matching downpipes.

Refrigerant pipework and cabling would run underground in conduits from the outdoor condenser unit to the base of the Infirmary wall on the eastern side. Pipework and cabling would then be concealed within galvanised ductwork risers, which match the existing downpipes, and run up to the eaves where the refrigerant pipework and cabling can enter the roof space

If ventilation is required to this building the provisions of AS1668:2 would require sufficient ventilation to accommodate approximately 60 persons. This is unlikely to occur. The option is to:

(i) Pursue a concession for a maximum occupancy of 10-20 persons at any one time with outdoor air delivered by way of the ceiling cassette unit.

Fig.53 – External wall showing possible location for air conditioning refrigerant pipework running up to the roof space

Insulation

Although not visible, there is likely to be reflective foil insulation below the roof cladding. There is no insulation to the masonry walls and insulation should not be installed. If the building were to be air conditioned insulation would need to be installed to the roof and preferably over the ceiling.

Fig.54 - Interior of the building with the gallows on the right.

Vapour barrier

While there is likely to be reflective foil insulation installed below the roof cladding this is unlikely to be sealed to form a vapour barrier. If the air conditioning were to be set at a temperature in the order of 25-26°C condensation would be minimised. Under these conditions, the installation of a vapour barrier could be delayed. However, given that the existing ceiling is plasterboard, it would be good building practice to install a vapour barrier over the roof and sealed to the top of the masonry walls should air conditioning be installed.

Installing a vapour barrier can only be successfully undertaken if the roof cladding is removed. Trying to retro-fit a vapour barrier under the roof cladding is problematic and unlikely to meet with complete success, particularly as the vapour barrier needs to be installed on the warm side of any bulk insulation. Roof cladding could be progressively removed, a few sheets at a time, the vapour barrier and insulation correctly installed, and the roof cladding then refixed in place.

The opportunity could then be taken to replace the roofing screws and rubber washers.

Air movement

The building has ten large double-hung windows in the external walls. There are no ceiling fans in the building. Ceiling fans should be installed as they will assist in cooling and, if the building is air conditioned, will assist in circulating cooler air allowing the temperature at which the air conditioning system is set, to be raised while maintaining comfort levels.

Required modifications

If the building is to be air conditioned the following modification will be required:

- Install new inward-opening front doors in the existing timber door frame. Doors should be framed and panelled timber doors with a large toughened glass panel.
- Install bulk insulation to the roof and lay insulation over the ceiling.
- Install a vapour barrier to the roof.
- Provide vertical risers, to match the existing downpipes, on the eastern facing wall.
- Provide underground conduit and suitable access to reticulate refrigerant pipework and electrical cabling between the indoor unit and the outdoor condenser unit.
- Construct a screen to conceal the outdoor condenser unit if it is to be located against the eastern perimeter wall.
- Provide soakage pits for condensate disposal. Condensate pipework should be concealed within the existing downpipes.

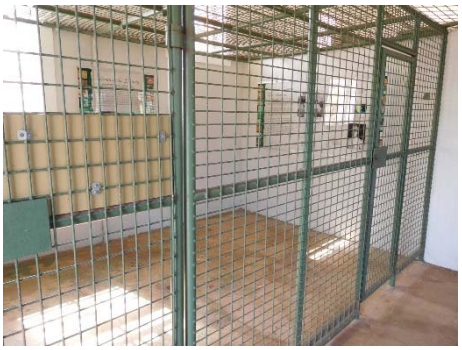
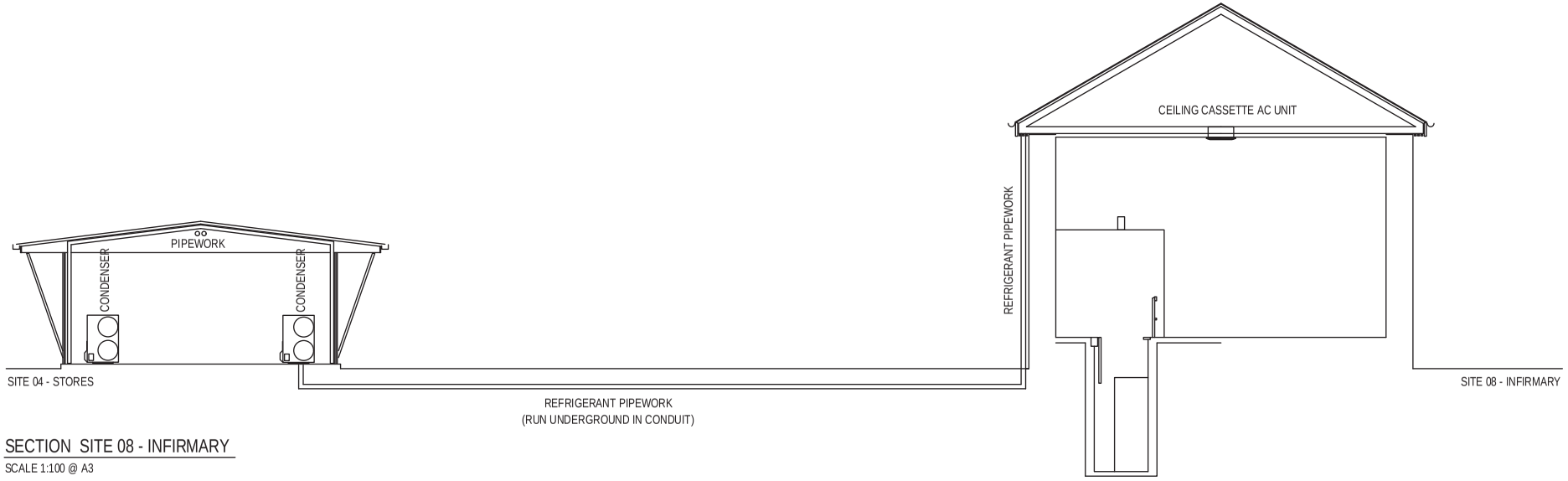


Fig.55 – Cell area with open weld-mesh cells.

Recommendations

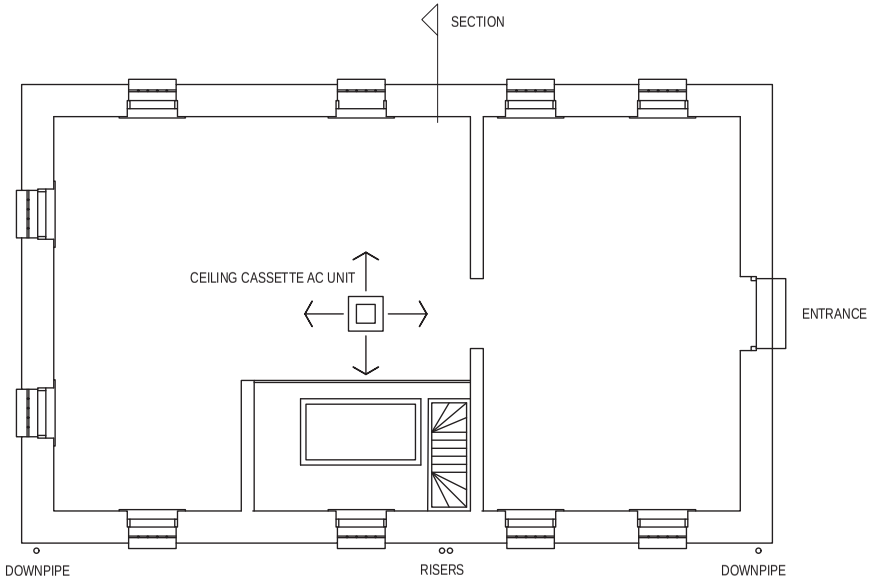
1. The Infirmary could be air conditioned using a commercial split system comprising an outdoor condenser unit and a single indoor ceiling mounted cassette unit located centrally in the ceiling space. The scheduled modifications should be undertaken including provision of insulation and a vapour barrier to the roof.
2. Install four ceiling fans in the building. Fans should ideally be good quality commercial fans such as the 2100mm diameter Haiku fan set at nominally 3600mm above the floor.



SECTION SITE 08 - INFIRMARY

SCALE 1:100 @ A3

NOTE: SECTION INDICATIVE ONLY



FLOOR PLAN SITE 08 - INFIRMARY

SCALE 1:100 @ A3

AIR CONDITIONING - OPTION 1

The recommended air conditioning system is a single commercial in-ceiling cassette type air conditioning unit with nominal capacity of 14kW.

The outdoor condenser unit could be located in Site 04 - Stores building as indicated here or, alternatively, it could be located against the eastern perimeter wall, near the main site switchboard and be suitably screened as indicated in Option 2.

Refrigerant pipework would run through the ceiling and drop down the eastern side of the Infirmary in two galvanised risers matching the existing downpipes. Pipework would then run underground in conduits from the base of the Infirmary wall to the condenser unit.

This option assumes a concession is pursued for a maximum occupancy of 10 persons at any one time with outdoor air delivered by way of the cassette air conditioning unit.

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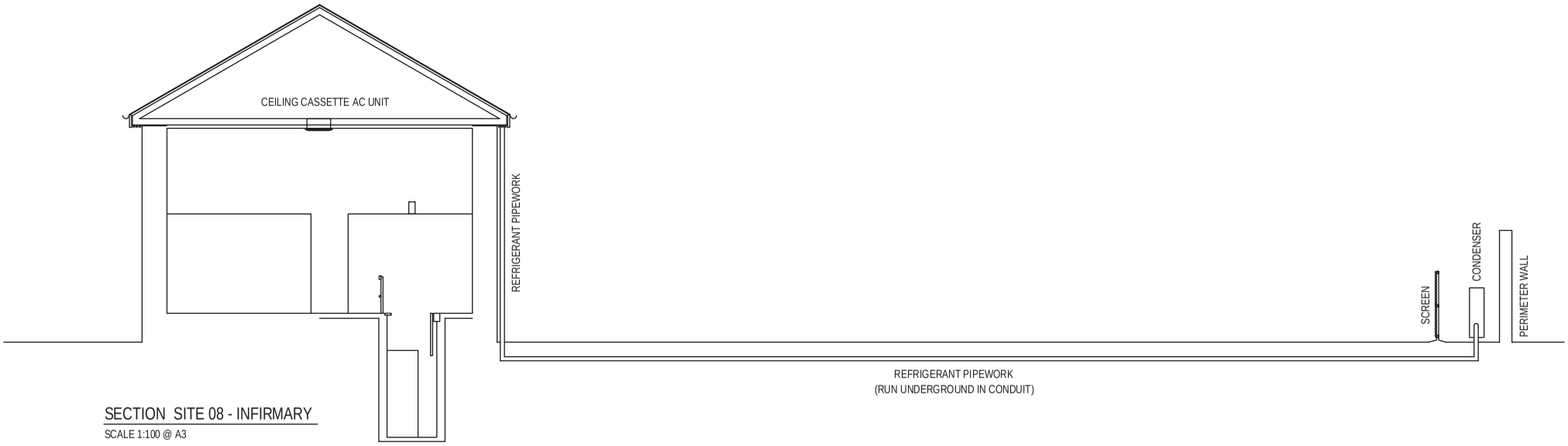
SITE 08 - INFIRMARY



SECTION SITE 08 - INFIRMARY

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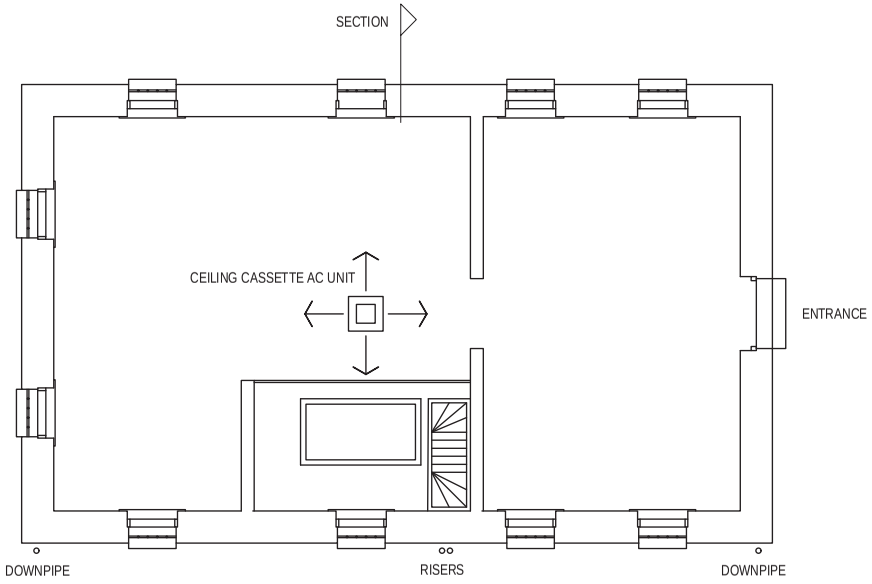

FLOOR PLAN SITE 08 - INFIRMARY

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AIR CONDITIONING - OPTION 2

The recommended air conditioning system is a single commercial in-ceiling cassette type air conditioning unit with a nominal capacity of 14kW.

The outdoor condenser unit could be located in Site 04 - Stores building as indicated in Option 1 or, alternatively, it could be located against the eastern perimeter wall, near the main site switchboard and be suitably screened as indicated here.

Refrigerant pipework would run through the ceiling and drop down the eastern side of the Infirmary in two galvanised risers matching the existing downpipes. Pipework would then run underground in conduits from the base of the Infirmary wall to the condenser unit.

This option assumes a concession is pursued for a maximum occupancy of 10 persons at any one time with outdoor air delivered by way of the cassette air conditioning unit.

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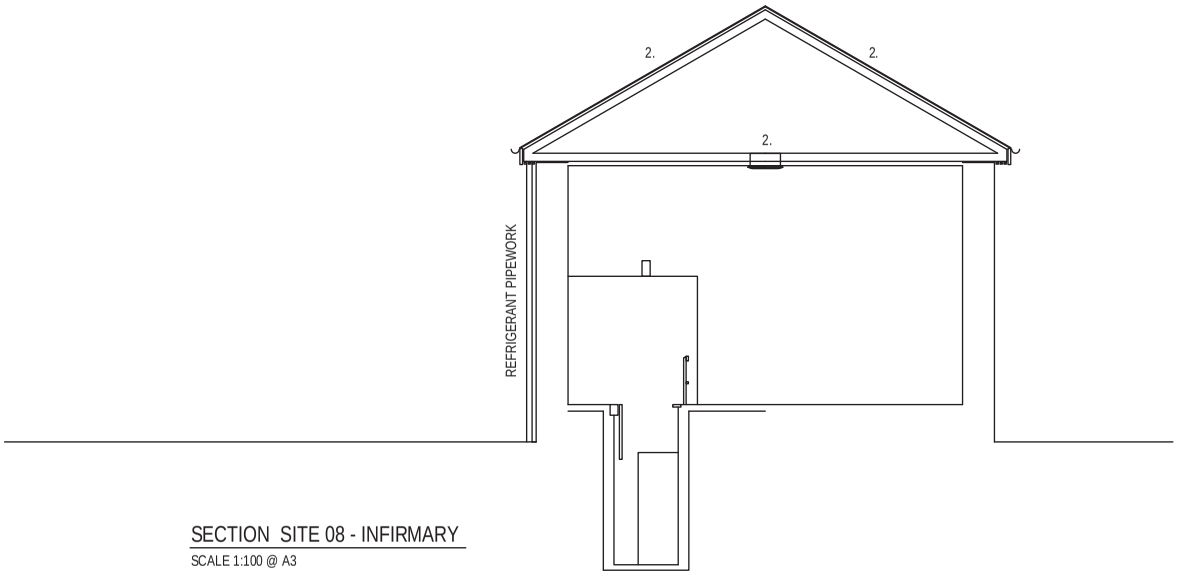
SITE 08 - INFIRMARY



SECTION SITE 08 - INFIRMARY

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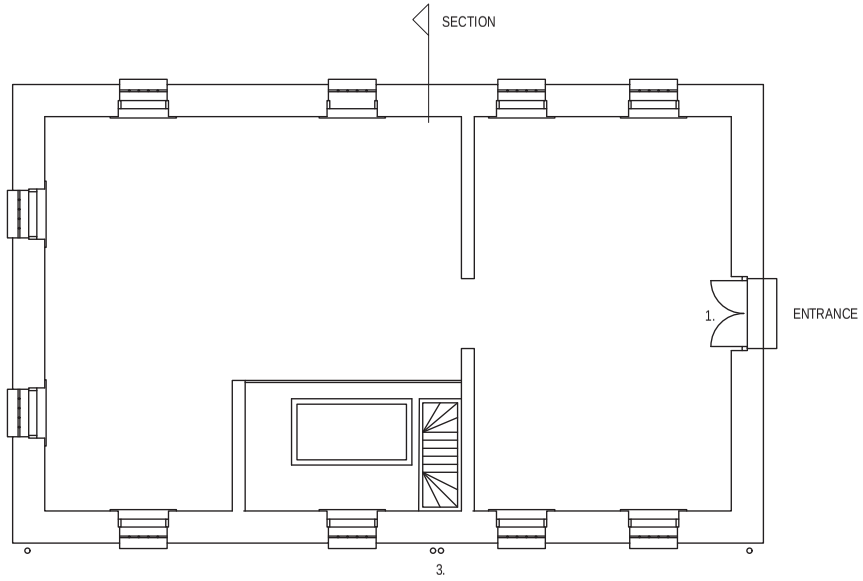

FLOOR PLAN SITE 08 - INFIRMARY

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PROPOSED MODIFICATIONS

The following changes are recommended to the Infirmary to enable the building to be air conditioned:

1. Install new inward opening front doors to the existing timber door frame.
2. Install insulation and a vapour barrier to the roof.
3. Provide vertical risers to conceal cabling and refrigerant pipework.

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SITE 08 - INFIRMARY

Site 14 – WOMEN'S SECTION - 1928

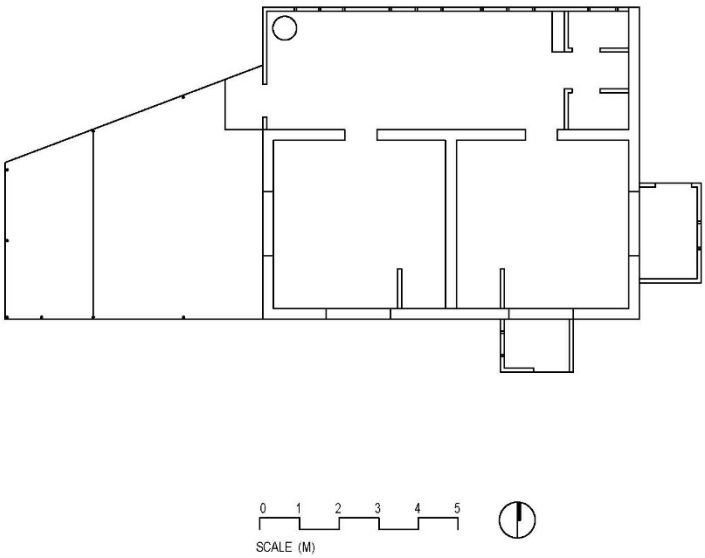


Fig.56 Floor plan of the Women's Section.

1.	Annexe	22.5 m2
2.	Toilets	4.5 m2
3.	Cell 1	18.5 m2
4.	Cell 2	18.5 m2
5.	Exercise yard	

Description

The construction of separate facilities for women, comprising two cells and an exercise yard, was completed on in 1928.[1] One of the cells (cell 2) was converted to a kitchen in the post WWII era and converted back to a cell in ca 1954. The Women's section was enlarged with the construction of an annexe on the northern side of the cells housing amenities, laundry and ablution facilities in ca 1954 and the weld-mesh exercise yard was constructed in 1956.[2] Substantial renovations were undertaken in 1968,[3] and toilets were installed in the exercise yard in 1969. The roof was damaged in cyclone Tracy in 1974 and part of the yard wall destroyed. The cells were further upgraded in 1976[4] and the timber-frame annexe appears to have been reconstructed in 1993.[5]

Heritage Significance

The building is of Considerable significance. The building is a purpose built cell for women prisoners dating from 1928 and illustrating subsequent adaptations. James Kerr notes that this '…structure and associated artefacts provides an evocative demonstration of its former use.'

[1] SAPP 1928, cited in Troppo 1998, op.cit.
[2] NAA 1955/434 Pt1 cited in Troppo, 1998, op.cit.
[3] NAA F1 1967/1547, cited in Troppo, 1998, op.cit.
[4] Kerr 1981, op.cit.
[5] Refer Architectural drawing B93-3137

Cooling strategy

The building could potentially be air conditioned.

The annexe forms a single space comprising laundry, toilets, shower and a common area. The cells are separate, however, the cell doors are formed from steel flat bars in a grated pattern and do not seal. The ceiling in the annexe is located at 2900mm above the floor and the ceiling in the cells is located at 3700mm above the floor.

The whole of the building should be air conditioned rather than the three spaces independently as it would require sealing doors and vent openings in the cell internal walls, which is not desirable.

Fig.57 - North facade of the Women's section. The exercise yard enclosure is to the right. The roof to the left is the Muster shelter (Site 13).

Air-conditioning system

General

The building could potentially be air conditioned, however, one impediment is the lack of ceiling space. There is negligible ceiling space above the two cells and very little ceiling space above the annexe except for a small section close to the cell wall formed between the raking roof and the flat ceiling. There is insufficient space for ductwork or for an air handling unit in this space. There is also insufficient space to install ceiling mounted cassettes in the cells.

It is proposed to supply sufficient cooling to provide thermal comfort conditions for visitors who are generally appropriately dressed for the conditions. This would be in the order of 25-26°C. This will also assist in minimising the risk of condensation occurring within the building. The recommended air conditioning system is a single commercial ceiling cassette type air conditioning unit to the annexe and high wall split type units to each of the cells. Reticulation of pipework and cabling is impeded by the lack of roof space and it may be necessary to remove the roof cladding to allow pipework to be more easily run to the indoor units.

Fig.58 - Southern façade showing mesh exercise yard.

Location of outdoor condenser unit

(i) The preferred option is for the outdoor condenser unit to be located within a screened enclosure immediately outside the northern wall of Cell block A&B in the space between the Cell block and the Women's section.

(ii) The condenser unit for Cell block A&B could be located in the same screened enclosure to centralise air conditioning plant.

Refrigerant pipework and cabling would run underground in conduits from the outdoor condenser unit to the base of the Women's section wall on the southern side and run up to the roof concealed in a suitable duct where the pipework and cabling should be able to enter the roof space. Due to refrigerant pipework constraints, the system would most likely be light commercial mini VRV systems that have the ability for longer pipe runs.

If ventilation is required to this building the provisions of AS1668:2 would require sufficient ventilation to accommodate approximately 40 persons. This is unlikely to occur. The option is to:

(i) Pursue a concession for a maximum occupancy of 10-15 persons at any one time, with outdoor air delivered by way of the cassette air conditioning unit in the annexe.

Insulation

There does not appear to be reflective foil insulation installed under the roof cladding and there is no bulk insulation to the roof or to the walls. If the building were to be air conditioned insulation would need to be installed to the roof and to the timber framed studwork walls.

Fig.59 - Interior of the Annexe looking towards the toilets.

Vapour barrier

There is currently no vapour barrier installed in the building. If the building were to be air conditioned, then a vapour barrier will be required to the timber frame walls of the annexe and to the roof.

It is not possible to install a vapour barrier to this building without removing external wall cladding and roof cladding. Roof cladding could be progressively removed, a few sheets at a time, the vapour barrier and insulation correctly installed, and the cladding refixed.

Air movement

The building is located within the wind shadow of the perimeter wall and partially within the wind shadow of the Children's section to the west. The orientation of the building also restricts air movement through the building although there are barred window on the eastern and western façade of the cells. There are also louvred windows in the northern wall of the annexe. If the building is to be air conditioned, all openings will need to be sealed.

Fig.60 - Interior of the Annexe looking towards the open grid cell door. Ventilation opening is located low in the wall.

There is one ceiling fans in each of the cells at 3100mm above the floor and two ceiling fans in the annexe at 2500mm above the floor. The fans are dated and none of the fans appear to be operational. Ceiling fans should be retained in all spaces, including the air conditioned spaces where they will assist in circulating cooler air.

Required modifications

If the building is to be air conditioned the following modification will be required:

- Remove the roof cladding run the refrigerant pipework and install insulation and a vapour barrier to the roof.
- Remove the external wall cladding to the timber-frame annexe and install insulation and a vapour barrier to the wall.
- Provide conduit and suitable access to reticulate refrigerant pipework and electrical cabling between the air handling unit and the outdoor air conditioner unit.
- Construct a screen to conceal the outdoor air conditioner unit.
- Seal windows and vents in the external walls of the cells using frameless glass panels.

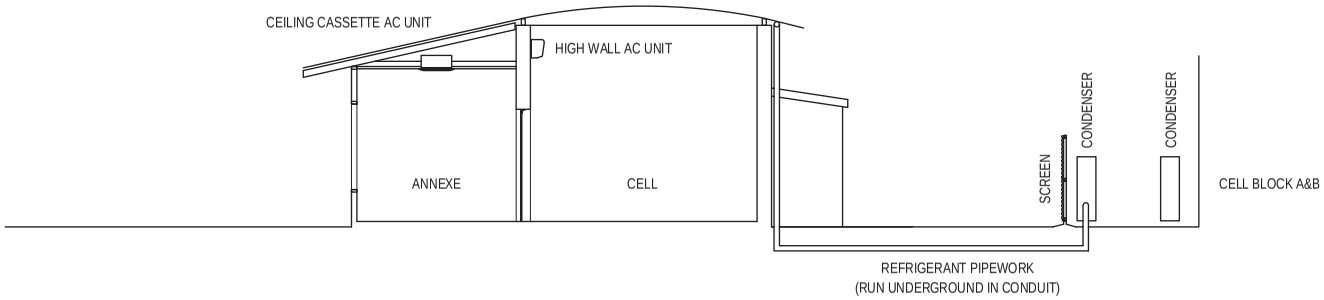
Fig.61 - Interior of the cell looking at high level barred windows located in the end walls (east and west facing).

Recommendations

1. The Women's section could be air conditioned using a commercial ceiling mounted cassette unit to the annexe and high wall air conditioning units to each of the cells. The outdoor condenser unit could be located within the screened enclosure between the Women's section and Cell block A&B. The scheduled modifications should be undertaken including provision of insulation and a vapour barrier to studwork walls and to the roof.

   However, given the difficulty in reticulating refrigerant pipework, the lack of ceiling space over the cells requiring the use of intrusive wall-mounted air conditioning units, and the need to remove both roof and wall cladding to install insulation and a vapour barrier, consideration should be given to leaving the building as designed and not installing air conditioning.

2. Replace the existing ceiling fans with new fans and ensure they are operational. Fans should ideally be good quality commercial fans such as the Haiku or the Aeroton fan.



SECTION SITE 14 - WOMEN'S SECTION

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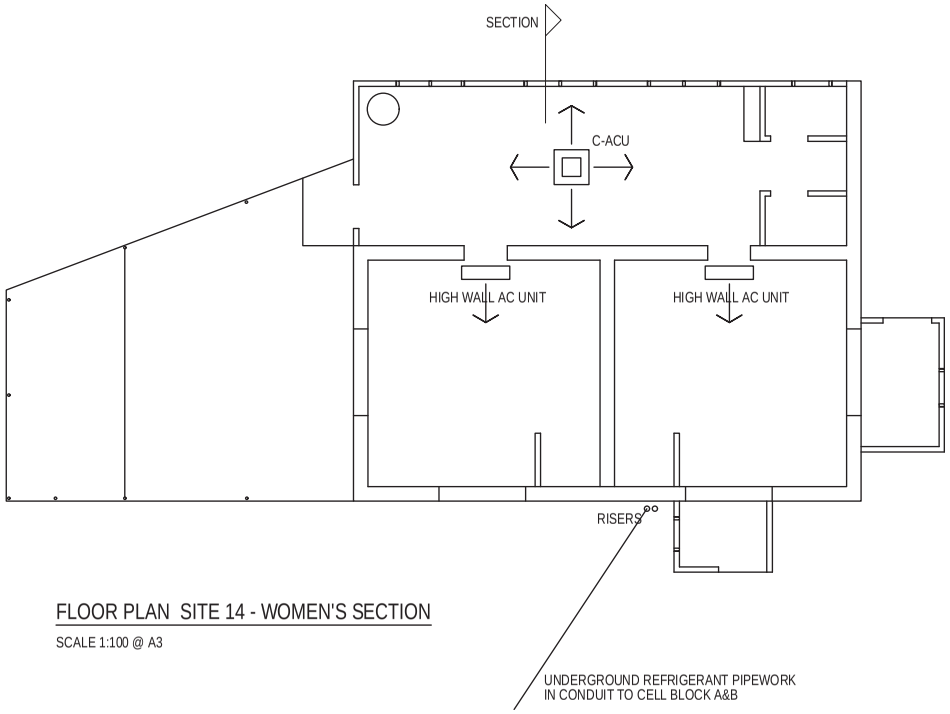

FLOOR PLAN SITE 14 - WOMEN'S SECTION

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AIR CONDITIONING

The recommended air conditioning system is a single commercial ceiling cassette type air conditioning unit with a nominal capacity of 5kW to the annexe and high wall split type units with a nominal capacity of 3.5kW to each of the cells. Due to the refrigerant pipework constraints, this unit is likely to be a light commercial mini VRV system that has the ability for longer pipe runs.

A single outdoor condenser unit would be located in a screened enclosure on the northern side of Cell block A&B within the yard between Cell block A&B and the Women's section.

Refrigerant pipework would run underground in conduits from the condenser unit near the Cell block A&B and rise up the southern wall of the Women's section to the roof.

This option assumes a concession is pursued for a maximum occupancy of 10 persons at any one time with outdoor air delivered by way of the cassette unit in the annexe.

C-ACU - CEILING CASSETTE AC UNIT

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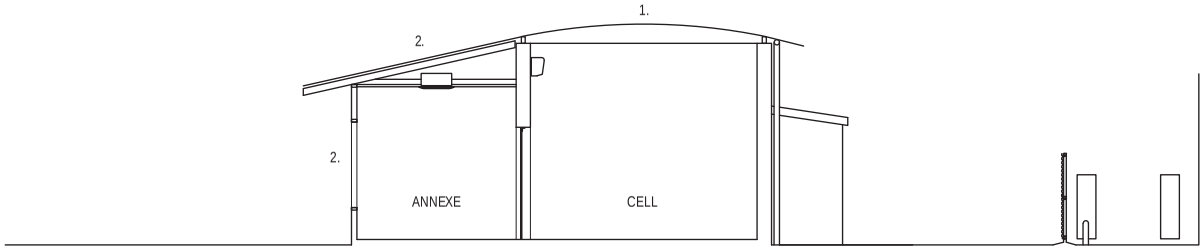
SITE 14 - WOMEN'S SECTION



SECTION SITE 14 - WOMEN'S SECTION

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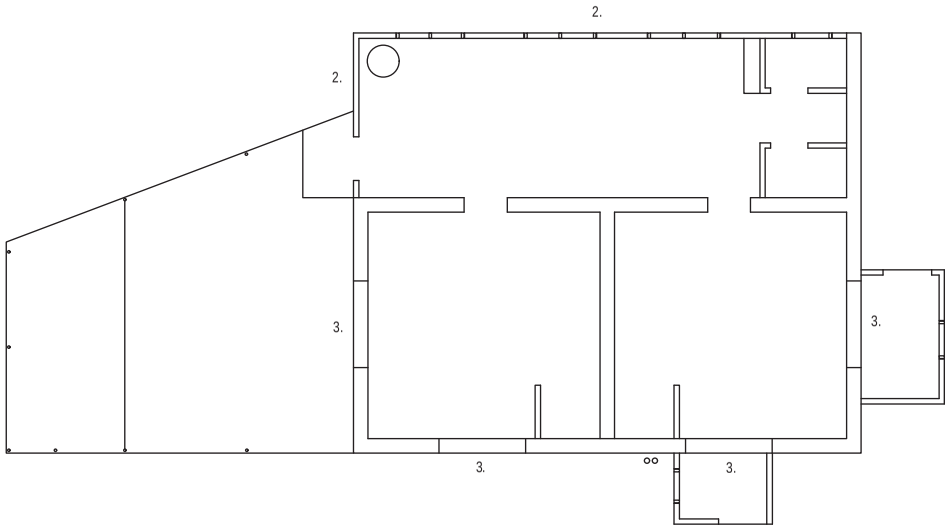

FLOOR PLAN SITE 14 - WOMEN'S SECTION

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PROPOSED MODIFICATIONS

The following changes are recommended to the Women's section to enable the building to be air conditioned:

1. remove roof cladding to enable the refrigerant pipework to be run to the indoor units.
2. Install insulation and a vapour barrier to the walls and to the roof.
3. Seal windows in the external walls of the cells using frameless glass panels.

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SITE 14 - WOMEN'S SECTION

Site 16 – MAXIMUM SECURITY CELL BLOCK A & B - 1883

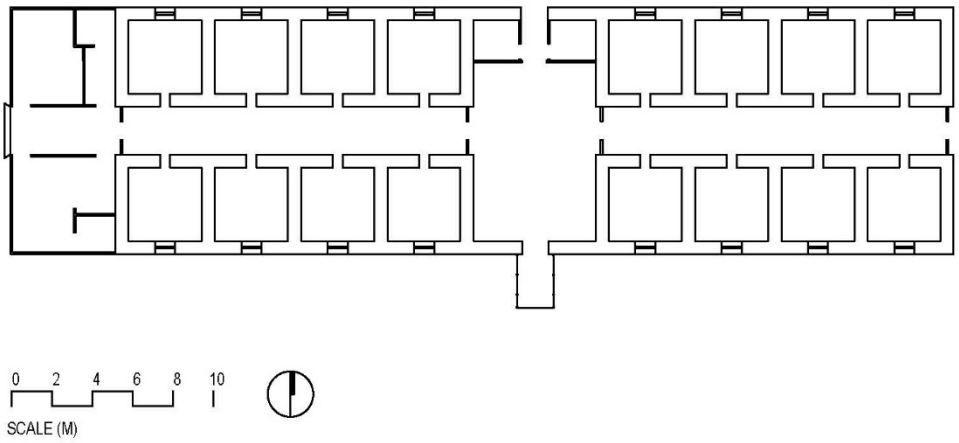


Fig.62 Floor plan of Cell Block A&B.

1. Cells 13.2 m2 each (105.6 m2 each side)
2. Corridors 40 m2 each
3. Central area 66 m2
4. Toilet and store
5. Concrete slab of former offices

Description

This building, divided into Cell block A (western end) & Cell block B (eastern end), is part of the original gaol and was constructed in 1883.[1] In the 1930s stucco rendering was applied to the exterior of the cell block.[2] An annex on the western end was constructed in the 1950s, badly damaged in cyclone Tracy and subsequently demolished. The building lost its roof in cyclone Tracy and the former timber truss hip roof was replaced with a metal frame gable roof of a lower pitch. A toilet and store were added to the north side of the central area in 1977.

The masonry walls are coursed porcellanite rubble covered with a cement render. The interior is virtually intact and little changed since 1883. Toilets and hand basins have been introduced into each of the cells and many of the securing eye bolts for shackling prisoners to the walls have been removed. Ironwork forming doors and windows is largely original or early. Ceilings with corrugated metal lining were installed after cyclone Tracy. In some cells, cages have been constructed to cover the ceiling fans.

Heritage Significance

The building is of Exceptional significance. This is the earliest building in the gaol and a rare example of a nineteenth century cell block. James Kerr (1981) notes it is an 'unusual survival of a masonry flanking cell system.'[3]

[1] Troppo 1998, op.cit.

[2] Forrest, P, 'Fannie Bay Gaol After 1979', interim report on some future use alternatives for the former Gaol site, prepared by the National Trust of Australia (NT) for Department of Community Development of the Northern Territory Government, 14 December 1979, p.15.

[3] Kerr, 1981, op.cit.

Cooling strategy

The building could potentially be air conditioned.

Cell block A&B consists of 16 cells either side of a central corridor. There is a central area in the building dividing Cell block A from Cell block B. There is a metal ceiling in the cells and corridor located at 3650mm above the floor. There is no ceiling in the central area, the ridge is some 5200mm above the floor. There is a nominally 1400mm ceiling space at the centre of the building with a nominally 10 degree roof pitch.

The building is constructed of random rubble masonry. Any air conditioning system will lower humidity levels within the building with the potential to cause long term problems. Air conditioning should not be set at too low a temperature and humidity levels should be closely monitored.

There are, however, other issues to consider if Cell Block A&B is to be air conditioned as an interpretative centre:

- Cell doors are very narrow making access difficult for the elderly, the more corpulent and almost impossible for people with even mild disabilities.
- There is potential for limited access for people with disabilities, however, access could not be achieved to the whole of the building without significant alterations to the historic fabric resulting in compromise to the heritage significance of the building.
- Air conditioning could leave visitors with a false impression of conditions experienced by prisoners. During the wet season, the cells would have been hot with little air movement and this is an important part of the interpretation of the gaol.

Fig.63 - North facade of Cell block B. The pavers for the muster yard can be seen in the foreground.

Fig.64 - East façade showing large barred door and screen to the central corridor.

Air-conditioning system

General

The building could potentially be air conditioned and there is sufficient space within the ceiling to accommodate the air handling plant.

It is proposed to supply sufficient cooling to provide thermal comfort conditions for visitors who are generally appropriately dressed for the conditions. This would be in the order of 25-26°C. This will also assist in minimising the risk of condensation occurring within the building. The recommended air conditioning system is two commercial ducted split-type air conditioning units, one serving each serving one wing of the cell block comprising 180 m2 each. The air handling units would be located within the ceiling space above the central corridors with rigid metal supply air ducts running along the length of the corridor. Flexible ducts would supply air into each of the cells and to the central area. Return air could be located in the centre of each corridor via a ceiling plenum.

Location of outdoor condenser units:

(i) The preferred option is for the two outdoor condenser units to be located within a screened enclosure immediately outside the northern wall of the Cell block in the space between Cell block A&B and the Women's section.

(ii) The condenser unit for the Women's section could be located in the same screened enclosure to centralise air conditioning plant.

Refrigerant pipework and cabling would run from the outdoor condenser unit to the base of the Cell block wall on the northern side and run up to the eaves where the pipework and cabling should be able to enter the roof space.

Fig.65 – North façade, western end, showing potential location for the outdoor unit in the yard between Cell block A and the Women's section.

Depending on refrigerant pipework constraints, the system would be either conventional 1 on 1 split-systems or light commercial VRV systems that have the ability for longer pipe runs.

If ventilation is required to this building the provisions of AS1668:2 would require sufficient ventilation to accommodate approximately 200 persons. This is unlikely to occur. The option is to:

(i) Pursue a concession for a maximum occupancy of 20 -40 persons at any one time, with outdoor air delivered by way of the ducted air conditioning units.

Fig.66 – The corridor looking west. .

Insulation

There is reflective foil insulation installed below the roof cladding. There is no insulation to the masonry walls and insulation should not be installed. If the building were to be air conditioned insulation would need to be installed to the roof and preferably over the ceiling. External and internal walls are random rubble masonry with a total nominal thickness of 650mm. These walls provide some insulation and protection to the interiors from solar gain.

Vapour barrier

Reflective foil insulation was installed below the roof cladding, however, this has not been sealed to form a vapour barrier. If the air conditioning were to be set at a temperature in the order of 25-26°C condensation would be minimised. Under these conditions, the installation of a vapour barrier could be delayed. It is, however, good building practice to install a vapour barrier over the roof and sealed to the top of the masonry walls should air conditioning be installed.

Fig.67 – Cell doors and large permanent ventilation opening above the door in the corridor wall

Installing a vapour barrier in the roof can only successfully be undertaken if the roof cladding is removed. Trying to retro-fit a vapour barrier under the roof cladding is problematic and unlikely to meet with complete success, particularly as the vapour barrier needs to be installed on the warm side of any bulk insulation. Roof cladding could be progressively removed, a few sheets at a time, the vapour barrier and insulation correctly installed, and the cladding refixed.

The opportunity could then be taken to replace the roof cladding and trims, roofing screws and rubber washers.

Air movement

The corridors are fitted with secure, but open barred doors and panels at each end and there are small high level barred windows in each of the cells. Currently there is a large sunscreen blocking the western end of the corridors so little breeze is drawn through these corridors. Ceiling fans are located in each of the cells and create adequate air movement within the small cells.

A large, low speed fan, could be installed in the common area to promote air movement in the centre of the building.

Fig.68 – Central area looking towards the passage to the Kitchen and Mess. A new door and frame is required and the highlight sealed.

Required modifications

If the building is to be air conditioned the following modification will be required:

- Install new frameless glazed doors and glazed panels to the ends of the corridors. The doors should be installed well inside the existing barred doors and panels and all existing barred doors and panels retained.

- Install new frameless glazed doors to the two doorways in the central area of the cell block (north and south facing walls) and glazed panels to the window in the south facing wall. Reconstruct the timber door frame in the south facing wall based on the remnant head section remaining in situ.

- Provide frameless glass panels to high level windows in the external walls of each of the cells. The existing windows have a heavy timber frame and a glass panel could be installed over the frame. Retain the barred openings in the corridor side of the cells for air circulation. These openings are nominally 1000 x 800mm.

- Install a ceiling in the common area to conceal any mechanical plant. The ceiling could be an open grid ceiling if desired and should ideally NOT match the ceilings installed elsewhere in the building.

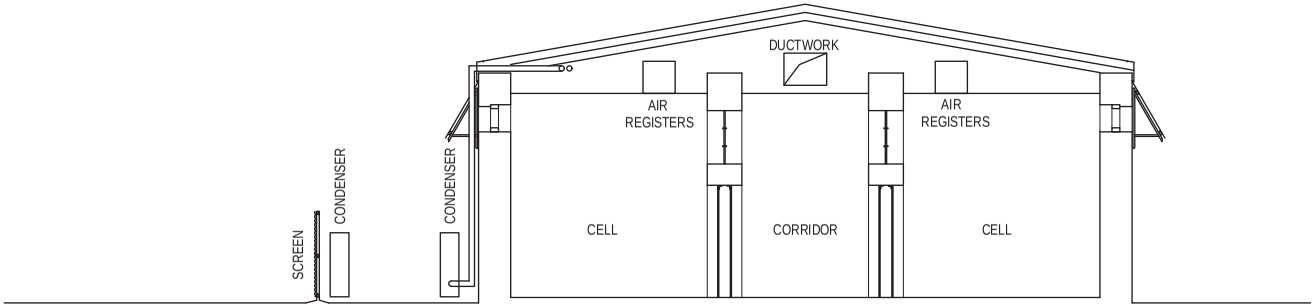
- Install insulation and a vapour barrier to the roof and insulation over the ceiling. The roof cladding is nearing the end of its economic life and will need to be replaced in the near future. The installation of air conditioning could be the impetus to replace the roof cladding.

- Construct a screened enclosure to conceal the outdoor condenser units. The screen should be constructed from corrugated metal cladding fixed to steel posts. A concrete plinth will be required to support the air conditioning unit.

Recommendations

1. Cell block A&B could be air conditioned using commercial ducted split systems comprising outdoor condenser units and indoor air handling units located in the ceiling space. The scheduled modifications should be undertaken including provision of insulation and a vapour barrier to the roof and sealing of openings in the external walls.

2. Provide a large low speed, high volume fan in the central area to promote air circulation in this area.



SECTION SITE 16 - CELL BLOCK A & B

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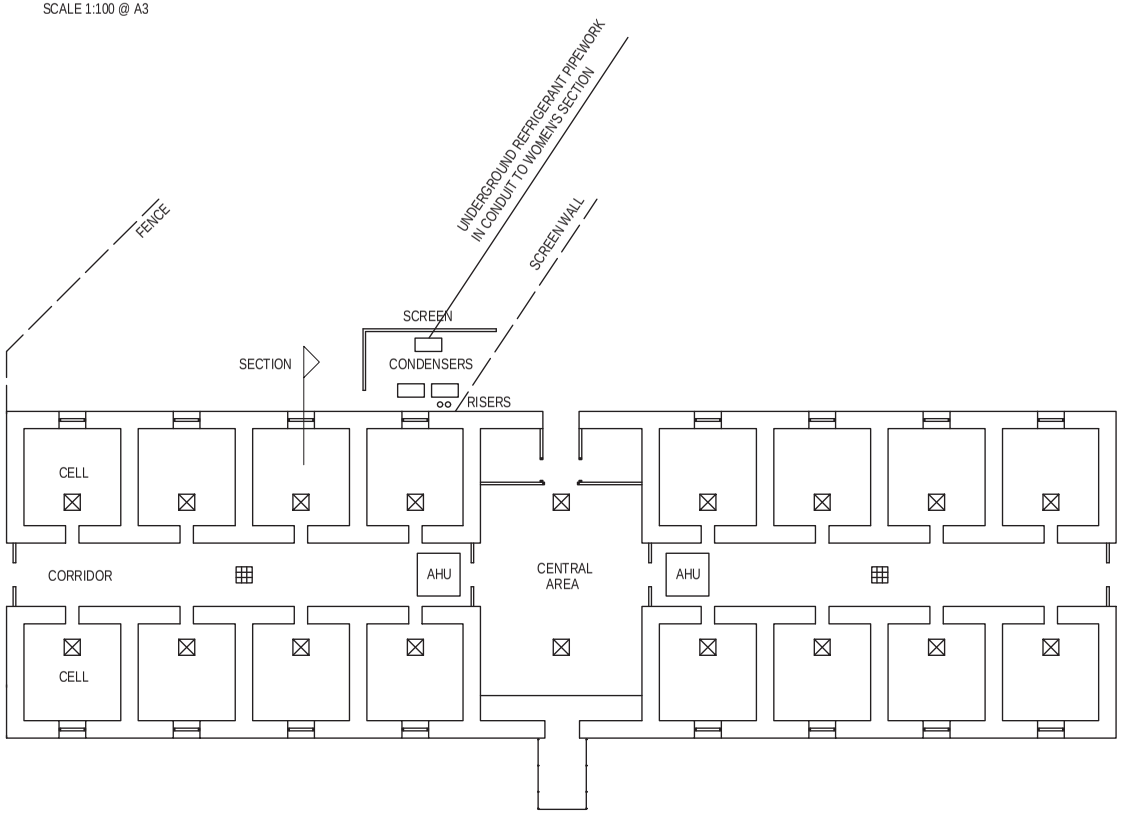

FLOOR PLAN SITE 16 - CELL BLOCK A & B

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AIR CONDITIONING

The recommended air conditioning system is two commercial ducted split type air conditioning units of nominal capacity of 14kW each. Depending on refrigerant pipework runs, the system would be either conventional 1 on 1 splits or light commercial VRV units that have the ability for longer pipe runs.

The outdoor condenser units would be located in a screened enclosure on the northern side of the building within the yard between Cell block A&B and the Women's section .

Refrigerant pipework would rise against the northern wall of Cell block A&B in galvanised ducts to the ceiling space.

Two air handling units would be installed in the roof space over the central corridors. Cool air would be reticulated through air registers located in the ceiling of each cell and connected to the air handling plant by flexible ductwork.

This option assumes a concession is pursued for a maximum occupancy of 20 persons at any one time with outdoor air delivered by way of the ducted air conditioning units.

ACU - Outdoor condenser unit
AHU - Indoor air handling unit
⊠ Supply air register
▦ Return air register

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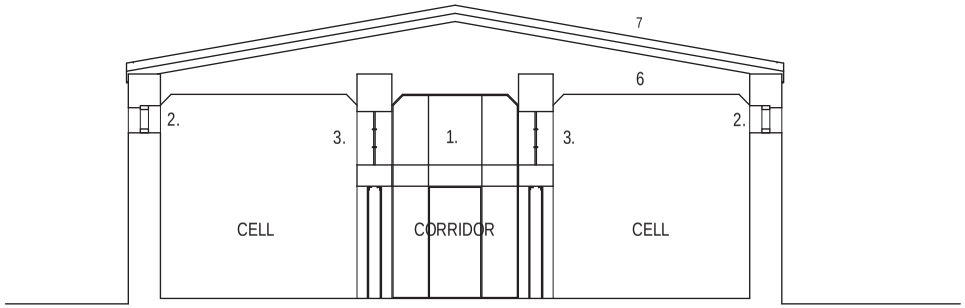
SITE 16 - CELL BLOCK A&B



FLOOR PLAN SITE 16 - CELL BLOCK A & B

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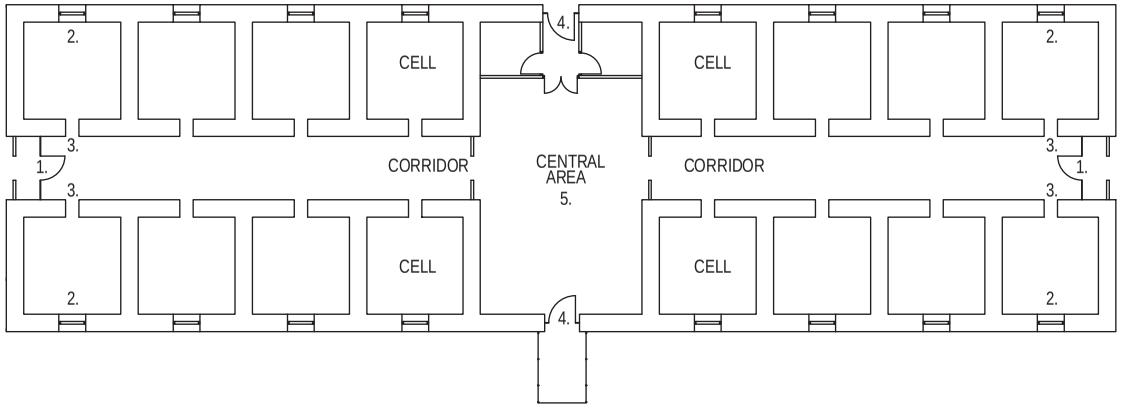
SECTION



FLOOR PLAN SITE 16 - CELL BLOCK A & B

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PROPOSED MODIFICATION

The following changes are recommended to Cell Block A&B to enable it to be economically air conditioned:

1. Provide new frameless glass doors and panels to close off openings at the end of the corridor. Panels will need to be supported against wind loads with suitable framing. Existing barred doors and panels are to remain.
2. Provide glazed panel in a glazing frame to close off high level windows in each cell.
3. Retain cell openings in the corridor wall for return air circulation.
4. Provide new frameless glass doors and panels to close off openings in external wall. Provide glazed panels in a glazing frame to close off highlights.
5. Provide new ceiling to enclose ceiling space over the common area and to conceal air conditioning plant. The ceiling need not be profiled metal sheet as used elsewhere.
6. Provide insulation to the roof and laid over the ceilings.
7. Provide a vapour barrier to the roof.

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SITE 16 - CELL BLOCK A&B

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