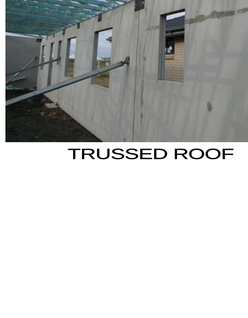
TRUSSED ROOF

PRECAST WALL ON
PRECAST PAD FOOTING

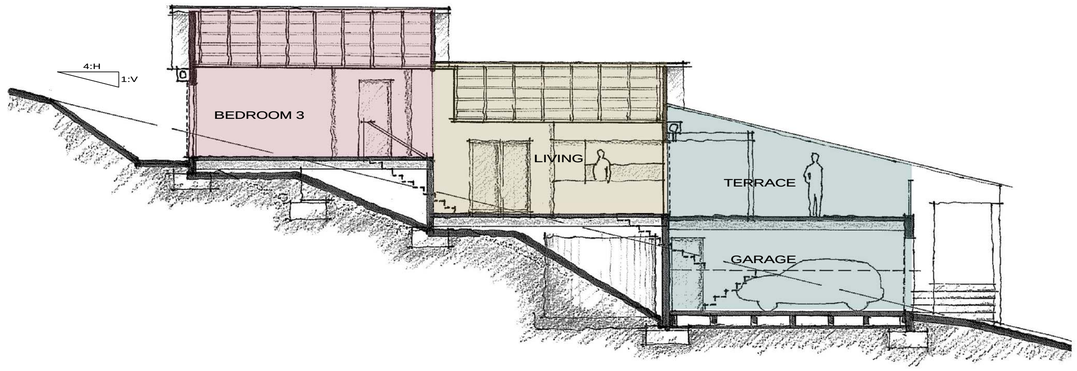


INDEPENDENT FRAMED
INTERNAL WALLS, NON
LOAD BEARING

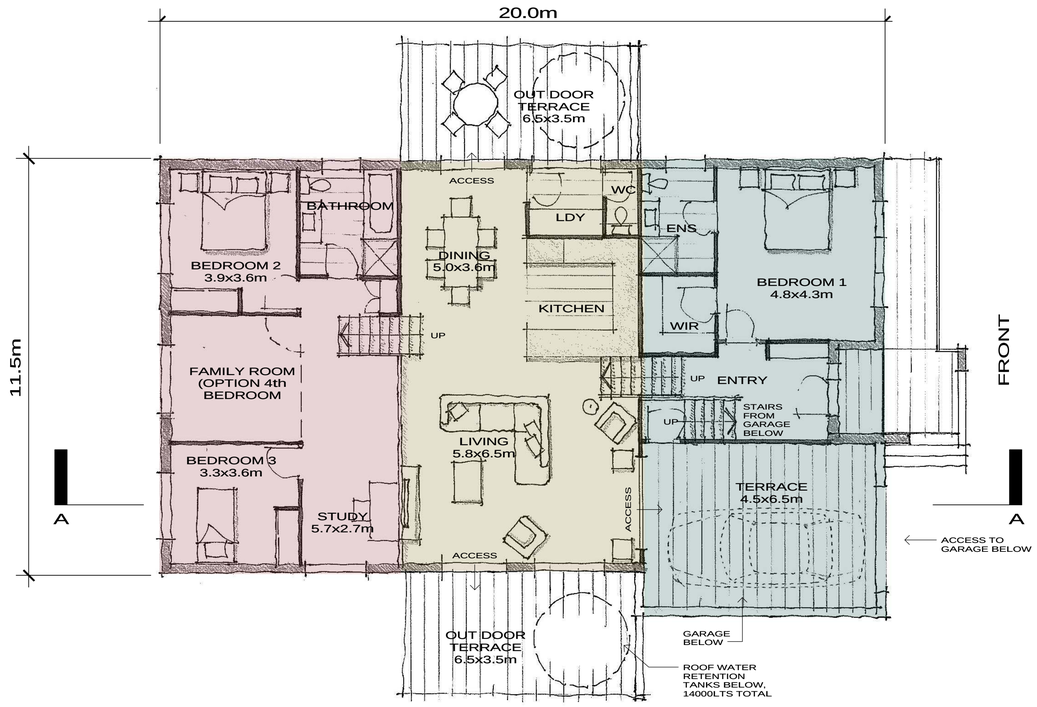
INSITU FLOOR
SLAB SUPPORTS
PRECAST WALL

extreme natural hazards			
a.	A sustained 20 minute hailstorm with hail upto 8 cm in size at velocities of 125 kmh.	✓	yes
b.	Water inundation above the floor sill height of the property.	✓	yes
c.	Exposure to external fire risks where radiant heat will exceed 40kw/m².	✓	yes
d.	Exposure to extreme rainfall in excess of 50 ARI for 1hr.	✓	yes
e.	Gusting exposure to winds in excess of 279 kmh.	✓	yes
f.	Earthquake Exceeds the requirements of AS1170.4 Earthquake actions in Australia	✓	yes

3D MODEL UPSLOPE VERSION
CONSTRUCTION DETAILS

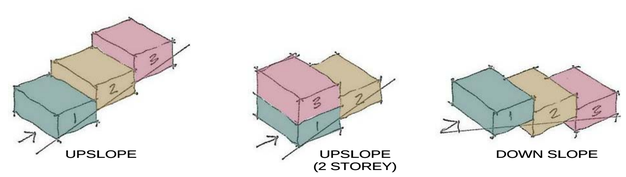


SECTION A-A



PLAN

3 BEDROOM RESIDENCE - 190sqm (EXCLUDE GARAGE)



MODULAR DESIGN ALTERNATIVES

THE DURABLE HOUSE

APRIL 2011

GHD + BURKE ENGINEERING SERVICES PTY.LTD.

Plot Date: 14/04/2011 12:16:31 PM File Path: G:\22\0905813\CADD\BIM\Model\110411Durable House2.rvt

Durable House

April 2011

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1 Construction Sequence

2 NaTHERS Report

3 Engineering Details

4 Construction Cost Documentation

5 Additional Shots of the Architectural Model

1. Introduction

This proposal responds to the design brief by integrating design flexibility with a patented precast concrete construction system and conventional domestic construction technology. The proposed building exceeds all of the stated durability design criteria, provides cost effective and quality design. The design also incorporates a range of sustainable design principals to achieve higher levels of energy conservation than that provided by a conventional dwelling.

1.1 Executive Summary

The building is conceived as a combination of three modules of equal plan size. The modules can be arranged to provide for up- slope or down-slope design. Access to the building can be provided from the street located above or below the entry level depending on site gradient. External walls to living spaces are orientated to three of the four compass points. Providing good solar egress to living spaces.

The building structural system incorporates a system of precast concrete foundations and precast external walls, in combination with proprietary suspended precast concrete floor slab and non load-bearing framed internal walls and a timber trussed roof. This combination of precast and conventional domestic construction technologies provides for cost effective construction which is not restricted in its geographical location. The only restriction to construction being crane access to site.

The proposed structural system is not a prototype. It is currently being used to construct dwellings in the following locations:

- The Hunter Region of New South Wales.
- 29 dwellings in Invercargill New Zealand. These buildings were required to meet the New Zealand earthquake code.

The benefits of the proposed design are:

- Exceeds all durable design engineering criteria (refer Section 3).
- Inherent design flexibility without impact on construction cost.
- Quick construction: 15 weeks from commencement to completion.
- Cost effective construction estimated: to be $1,300.00 per square metre inclusive of GST (refer Appendix 4).
- Incorporates sustainable design principals (refer Section 6).

2. Extant Compliance with the Existing BCA

The design is based upon a patented precast concrete construction system currently being used to construct dwellings in NSW. These developments have followed standard approval processes including the ability to demonstrate compliance with the Building Code of Australia (BCA) and other legislative requirements (BASIX etc).

In particular, the design in is accordance with the BCA Vol.2, Housing Provisions and meets the Performance Requirements akin to those of masonry veneer type construction with some key benefits as described in the report.

BCA compliance is obtained by employing a combination of 'Deemed-to-Satisfy Provisions' and Alternative Solutions with engineering certification carried out by Burke Engineering Services P/L.

3. Demonstrated ability to move beyond the BCA and be durable to extreme weather hazards, based upon available research on hazard resistant building materials, hazard avoidance design techniques and inbuilt protection measures

3.1 A sustained 20 minute hailstorm with hail up to 8cm in size at velocities of 125km/hr

- The design uses a heavy duty colorbond steel roof with a base metal thickness of 0.60mm to provide the impact resistance against hail up to 8cm in diameter travelling at 125km/hr.
- Additional fasteners will be installed along cladding side lap joints at max. 600mm c/c to offer greater resistance to impact.
- While the aim is to prevent hail stones penetrating through the roof sheeting, some denting or creasing of the sheeting should be expected.

3.2 Water inundation above floor sill height of the property

- The design uses durable materials that are resistant to the effects of flooding.
- Water inundation above floor sill height will not affect the structural integrity of the building.
- Replacement of floor coverings and cleaning of the internal wall cladding would be expected after such an event.
- The building design and construction method is capable of withstanding considerable flood water flow velocities without structural damage.

3.3 Exposure to external fire risks where radiant heat will exceed 40kw/m^2

- The building complies with Australian Standard AS 3959-2009 *Construction of buildings in bushfire-prone areas* for Bushfire Attack Level 'BAL–FZ' where the building is exposed to flames from the fire front in addition to ember attack and a heat flux exposure exceeding 40kw/m^2.
- Non-combustible materials are used for the external shell of the building with all window openings protected by Bushfire shutters complying AS 3959-2009 & AS 1530.8.2-2007. External door systems have an FRL of at least –30/– or are protected by Bushfire shutters as appropriate.
- The external precast concrete walls panels achieve an FRL of 120/120/120 which is far greater than the 30 minutes required by the standard.

- The roofing system incorporates a layer of 13mm CSR GYPROCK FYRCHEK directly under the external metal cladding. This system achieves an FRL of 30/30/30 according to *The Gyprock® Fire Design Manual* and complies with the BAL–FZ roofing requirements of AS 3959-2009.

3.4 Exposure to extreme rainfall in excess of 50ARI for one hour

- Protection against the immediate ingress of water falling on the building envelope is achieved by setting the finished floor levels inside the building at least 150mm above the adjacent finished ground level; or 75mm above adjoining paved areas that slope away from the building.
- Landscaping is to direct surface flows away from the building envelope and sub-soil drains are used to divert water away from footings, basements and retaining walls.
- Extended roof eaves up to 1.0m wide offer additional protection against driving rain entering through vertical planes.
- Box gutters have been excluded from the design to ensure all rainwater overflow paths are kept outside the building envelope.

3.5 Gusting exposure to winds in excess of 279km/h

- The building is designed to withstand a design gust wind speed of 310km/hr which corresponds to a cyclonic wind classification of C4, the most severe in accordance with AS 4055-2006 *Wind loads for housing*.
- Wind speeds exceeding this value could be catered for with reference to AS 1170.2-2002 *Wind actions* however this is outside the scope of the submission.
- The roof structure is tied down to the solid precast concrete wall panels via an innovative system of steel connection plates and cast-in fixings.
- Windows are protected from the impact of airborne debris by operating the Bushfire shutters identified in Section 3.3.
- The precast concrete external walls and heavy duty roof sheeting also offer excellent resistance to impact from airborne debris.
- Roof and wall claddings are to be installed in accordance with the Lysaght Cyclonic Area Design Manual.
- Additional fasteners will be installed along cladding side lap joints at max. 600mm c/c to offer greater resistance to impact from airborne debris.

3.6 Ability to withstand other extreme events

- The building is designed to withstand seismic events.
- The design meets the requirements of AS 1170.4-2007 *Earthquake actions in Australia* for earthquake design category EDC II, the most common design category for commercial buildings constructed in Australia under 15m in height.

- The patented precast concrete structural system has been used in Invercargill, New Zealand, where it was required to comply with the more stringent New Zealand seismic design code NZS 1170.5-2004 *Earthquake loads – New Zealand*.

4. The additional projected life cycle costs incurred to achieve the increased extreme weather durability including potential design costs, material costs, building costs and maintenance requirements

The following items are provided to achieve the increased extreme weather durability. These items can be considered as additions to the base building.

- Cost of providing heavier gauge roofing 0.6mm BMT per square meter extra over standard 0.42mm BMT. $ 1,900.00
- Cost of providing 13mm fire rated plasterboard over rafters and gable walls. $ 1,290.00
- Cost of providing fire resistant metal roller shutters. $ 20,000.00
- Cost of providing one hour fire rated door and frame to garage / lobby doorway. $ 1,200.00
- **Total cost of additional items:** **$ 24,390.00**

Note: No allowance for maintenance as the building envelope has been designed to require no maintenance.

The above are the only additional costs to meet durability criteria as the precast construction system inherently exceeds these requirement without modification. The flexibility inherent in the design will allow a number of reconfigurations and adjustment for site slop without significant redesign. It is envisaged that design and documentation cost would be consistent for all projects and would be significantly less (approximately 60%) than that required for an equivalent one off Architect designed dwelling.

Detailed costings for construction of a typical precast dwelling are enclosed in Appendix 4.

Source of costings: Rawlinsons construction cost guide 2011.

5. General aesthetic and architectural appeal of the design as a broad measure of its likely appeal to community members

The building has been designed to appeal to a broad selection of the residential housing market. The design will integrate into a variety of residential built contexts. The building is not designed as an immediate stand out but embodies good design in a subtle and cost effective manner.

The building has been designed to incorporate the following features which typify the way that we occupy our houses in Australia.

- Garage integrated into the body of the dwelling, provides for ease of access and security.
- Living spaces do not directly front the street.
- Building form provides privacy for outdoor / indoor living spaces.
- Living spaces orientated to provide good solar access.
- External living spaces immediately adjacent and at same level as internal living spaces. This plan arrangement in combination with a strong connection from internal to external living area allow these spaces to function as outdoor rooms.
- Kitchen is strongly connected to the major living space.

The building form has been generated to reflect the following conventional domestic Australian Architectural language:

- Semi enclosed entry porch orientated to the street.
- Pitched roof forms.
- Conventional domestic double fronted scale.

6. Sustainable Design Principles

With growing world-wide concern for sustainability and energy conservation the building has incorporated the following key sustainable design principles. These are accounted for within the construction budget. To demonstrate thermal performance of the budgeted design a NatHERS assessment is enclosed.

6.1 Thermal Design

For a thermal design in Newcastle the building is modelled with 600mm eaves which can be extended to 1000mm providing significant shading opportunities to external walls and windows.

All windows and doors are provided with fire shutters which can be utilised to shade windows.

The roof is provided with two layers of insulation and external walls are provided with an insulated independent lining which provides a cavity and insulation to create a thermal break between the precast panels and the building interior.

Glazing can be specified to provide additional thermal resistance.

6.2 Passive Ventilation

The plan and sectional arrangement options all provide significant opportunity for passive cross ventilation throughout the building. For NatHERS modelling the building has been positioned to particularly utilise the east and west breezes.

6.3 Material Selection

The design of the building utilises sustainable materials for long building life and adaptability with the following features:

- The durability of the building in cyclone, flood, fire and earthquake is demonstrated in the design criteria.
- The building has no load bearing internal walls and so is inherently flexible with regard to an earthquake.
- The building only utilises paint finish on external walls for cosmetic reasons. If require, this could be deleted and the building would have a no maintenance envelope.
- The building has only fibre cement internal walls which will not need replacing is the event of a flood.

The strategic material selection reduces embodied energy of the overall building. The predominant use of concrete with low embodied energy ensures the building materials are much less energy intensive compared to other types of construction. For example:

- The building uses concrete external walls, floor and foundations, which is has a lower embodied energy compared to brick or timber.
- Roof and internal wall framing is proposed as timber, which has less embodied energy when compared to steel.

Figure 1 compares the embodied energy of estimated quantities of construction materials of the Durable House and conventional construction materials, namely brick. Embodied energy figures for each material were source form the Your Home Technical Manual - 5.2 Embodied Energy.

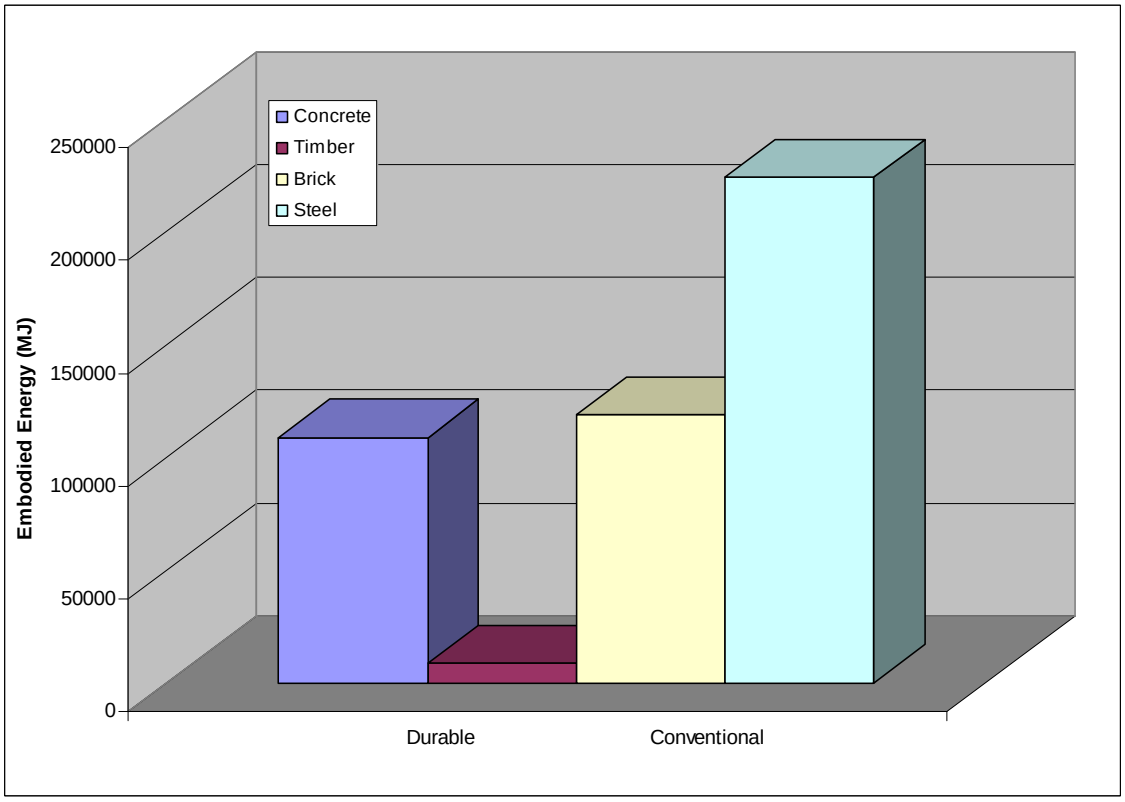


Figure 1 Embodied Energy

The building offers a high thermal performance building envelope in a budget form. The design is well insulated and provided with appropriate shading to all external openings and walls. The NatHERS report (refer Appendix 2) confirms a star rating of 5.9 stars. Comparison models of a conventional building, i.e. brick veneer, have been performed and achieved a star rating of 5.5.

It is clear in Figure 2 that the Durable House has a lower total energy consumption then conventional construction. It is interesting to note that while the heating energy requirements of the Durable House are slightly higher than a conventional construction the cooling requirements are significantly lower. With the innovative use of concrete, the Durable House has the ability to inexpensively improve thermal performance.

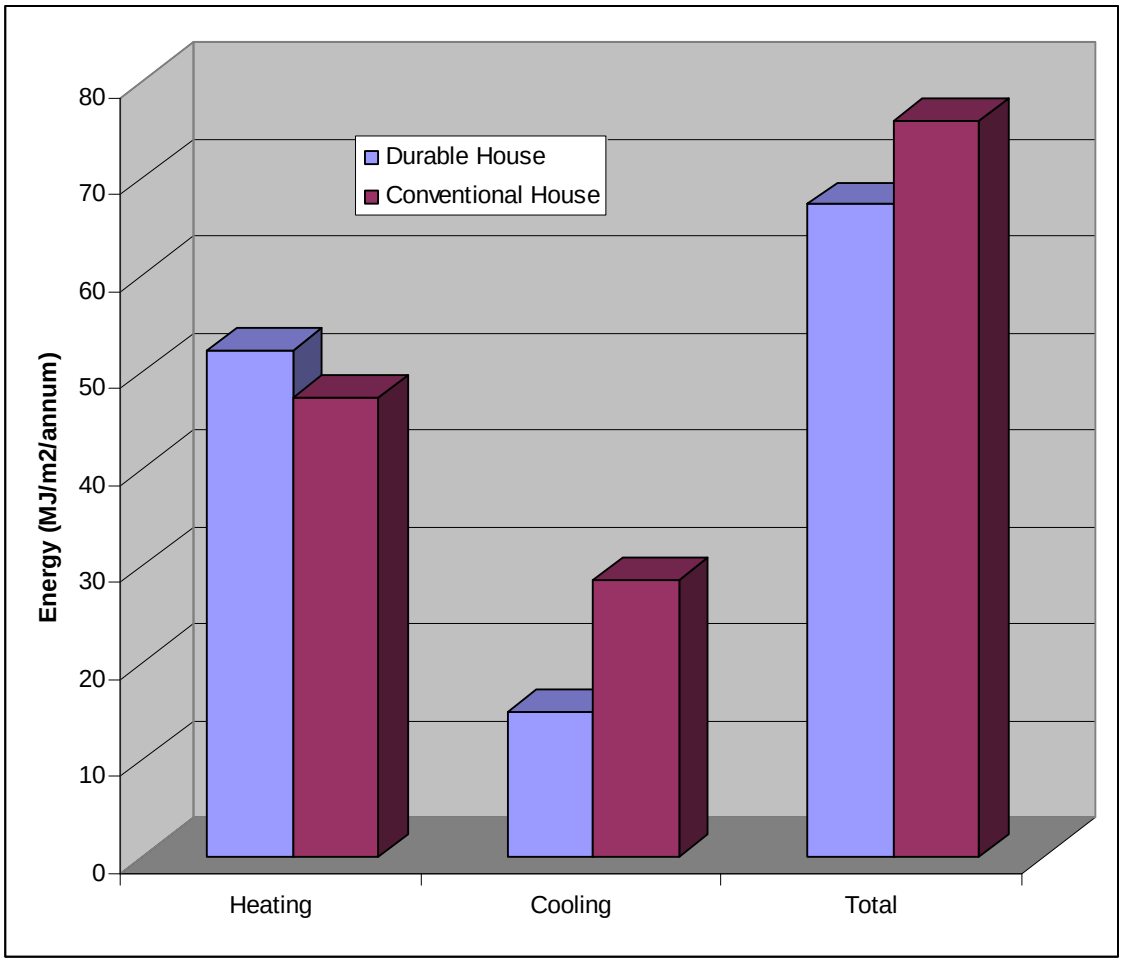


Figure 2 Predicted Energy Consumption

The following are additional sustainable design features incorporated in the design:

- Roof water retention and re-use. Roof water is retained in two 7000 litre tanks to provide non potable water for irrigation and toilet flushing.

The building specifications can be amended to increase the sustainability of the design.

Options for increasing sustainable design not provided for within the construction budget are as follows:

- Solar power: Roof form and structure and orientation provides opportunity for installation of Solar panels.
- Grey water re-use: Incorporation of greywater recycling can be provided for.
- Glazing and window frame specification can be modified to provide increased thermal resistance.

7. Conclusion

The project seeks to provide a durable building which is cost effective to construct and is well designed. The added benefit of this type of construction is that overall project durations are reduced from 26 weeks (for construction of a similar building utilising brick veneer construction) to 15 weeks.

The construction technology inherently meets the durability design criteria as well as meeting earthquake design codes.

The design and construction technologies integrate to provide significant opportunity the design to be based on a template which provides for flexibility in response to site and occupant requirements. This allows each dwelling to be designed to specific site constraints such as orientation and gradient and to respond to occupant requirements regarding plan arrangement and level of sustainable design.

The design provides a very durable well designed building which is cost effective to construct.

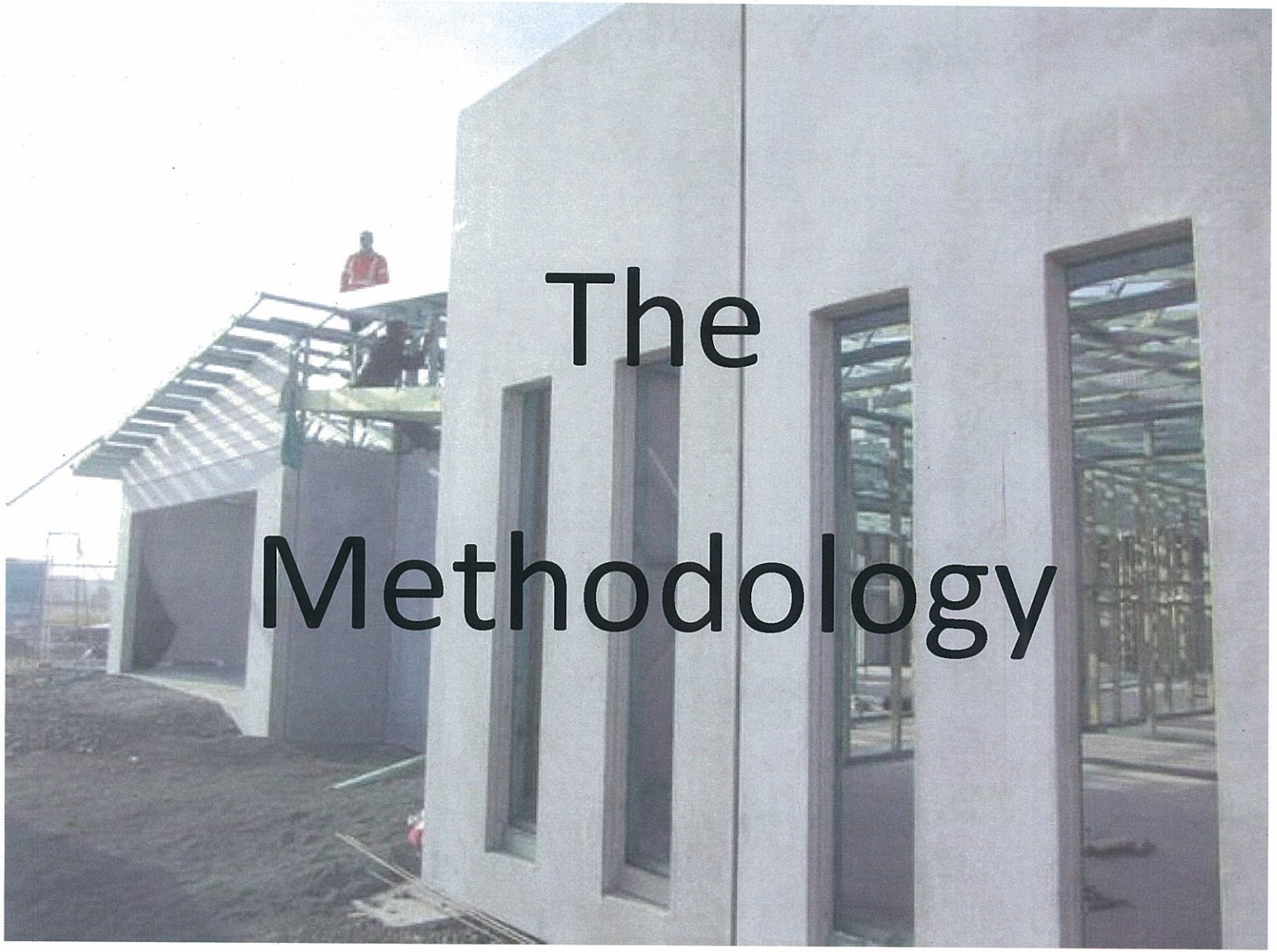
Appendix 1

Construction Sequence

Panel Homes

"The new technology in building"

(Australian Patent 2007100601)



The Methodology

Day 1 Level Block & Install pre-cast concrete footings

Start 7:00am completed 12:00noon *one house 18 panels*

Pour concrete waffle raft slab

Day 7

LOCK-UP!!

Day 10

FINISHED - 280m2 House– only worked Monday to Friday normal hours

Week 8

FINISHED - 280m2 House– only worked Monday to Friday normal hours

Week 8

The Benefits

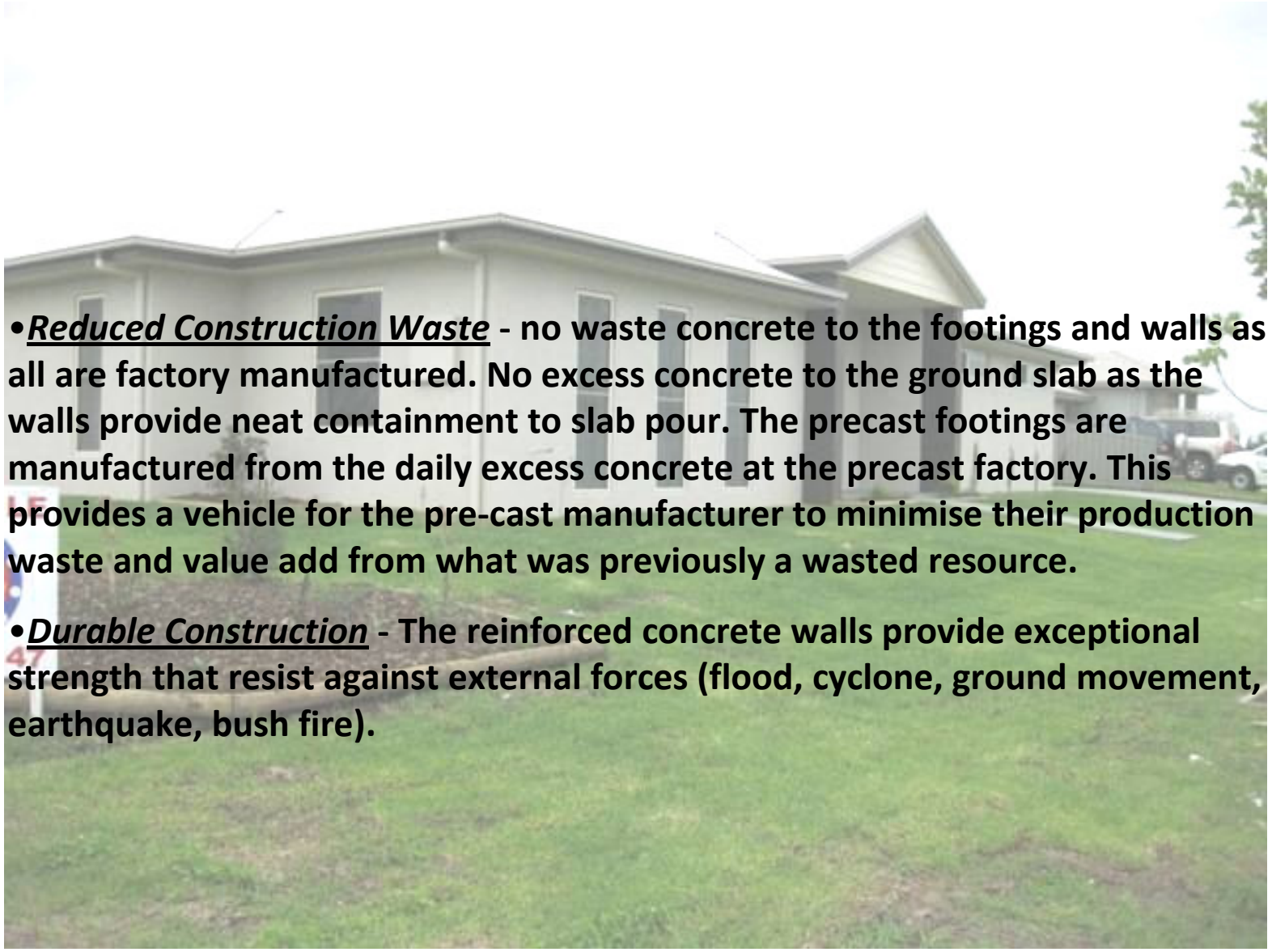
- ***Thermal Mass*** - with the thermal mass properties of concrete, combined with internally insulated walls and roof, the cost of the energy to heat and cool is up to 50% less than a conventional brick venerer dwelling.

- ***Acoustic Mass*** - the well know acoustic properties of concrete produce a significantly quieter environment inside the homes.

- ***White Ant Resistant*** - As the external concrete walls are the load bearing elements (combined with steel or suitably treated timber frames) there is no further White Ant barrier or future treatment required for the buildings. A significant cost saving and environmentally friendly feature.

- ***Straight & True*** - As the wall panels are factory manufactured the resultant construction is very precise. Other trades following (tilers, plasters, joiners) repeatedly comment on the ease of working with these buildings. When you start straight you finish straight.

- ***Speed of Construction*** – A 4 bedroom house can be built inside 8 weeks. The methodology of Panel Homes construction technique allows many trades to work in parallel. This speed reduces risk and improves cash flow.



•***<u>Reduced Construction Waste</u>*** **- no waste concrete to the footings and walls as all are factory manufactured. No excess concrete to the ground slab as the walls provide neat containment to slab pour. The precast footings are manufactured from the daily excess concrete at the precast factory. This provides a vehicle for the pre-cast manufacturer to minimise their production waste and value add from what was previously a wasted resource.**

•***<u>Durable Construction</u>*** **- The reinforced concrete walls provide exceptional strength that resist against external forces (flood, cyclone, ground movement, earthquake, bush fire).**

Appendix 2

NaTHERS Report

AccuRate V1.1.4.1

Nationwide House Energy Rating Scheme

Project Details	
Project Name: Durable House	
File Name: G:\22\0905813\Technical\AccuRate\AccuRate - durable house.PRO	
Postcode: 2300	**Climate Zone:** 15
Design Option: Durable House	
Description: Concrete Precast Panels - R2.5 R2.5 insulation in Ceiling Concrete Slab on Ground	

Client Details		
Client Name: Insurance Council of Australia		
Phone: xxxx xxx xxx	**Fax:** xxxx xxx xxx	**Email:** xxxxx@xxx.com
Postal Address: Australian Institute of Architcts		
Site Address: Newcastle		
Council submitted to (if known by assessor):		

Assessor Details			
Assessor Name: Katy Gregory			**Assessor No.** 20776
Phone: 0249799986	**Fax:** 0249799988	**Email:** katy.gregory@ghd.com	
Assessment Date: 13/04/2011			**Time:** 12:23
Project Code:			
Assessor Signature:			

CALCULATED ENERGY REQUIREMENTS*				
Heating	**Cooling (sensible)**	**Cooling (latent)**	**Total Energy**	**Units**
54.9	12.7	3.0	70.6	MJ/m².annum

* These energy requirements have been calculated using a standard set of occupant behaviours and so do not necessarily represent the usage pattern or lifestyle of the intended occupants. They should be used solely for the purposes of rating the building. They should not be used to infer actual energy consumption or running costs. The settings used for the simulation are shown in the building data report.

AREA-ADJUSTED ENERGY REQUIREMENTS				
Heating	**Cooling (sensible)**	**Cooling (latent)**	**Total Energy**	**Units**
52.3	12.1	2.9	67.3	MJ/m².annum
Conditioned floor area	166.9 m²			

Star Rating

★★★★★☆ **5.9 STARS**

Area-adjusted star band score thresholds									
1 Star	**2 Stars**	**3 Stars**	**4 Stars**	**5 Stars**	**6 Stars**	**7 Stars**	**8 Stars**	**9 Stars**	**10 Stars**
349	232	159	114	86	67	50	34	19	6

AccuRate V1.1.4.1

Nationwide House Energy Rating Scheme

Project Details	
Project Name: Durable House	
File Name: G:\22\0905813\Technical\AccuRate\AccuRate - durable house.PRO	
Postcode: 2300	**Climate Zone:** 15
Design Option: Conventional House	
Description: Brick Veneer - R2.5 R2.5 insulation in Ceiling Concrete Slab on Ground	

Client Details		
Client Name: Insurance Council of Australia		
Phone: xxxx xxx xxx	**Fax:** xxxx xxx xxx	**Email:** xxxxx@xxx.com
Postal Address: Australian Institute of Architcts		
Site Address: Newcastle		
Council submitted to (if known by assessor):		

Assessor Details			
Assessor Name: Katy Gregory			**Assessor No.** 20776
Phone: 0249799986	**Fax:** 0249799988	**Email:** katy.gregory@ghd.com	
Assessment Date: 13/04/2011			**Time:** 12:22
Project Code:			
Assessor Signature:			

CALCULATED ENERGY REQUIREMENTS*				
Heating	**Cooling (sensible)**	**Cooling (latent)**	**Total Energy**	**Units**
49.7	26.2	3.8	79.7	MJ/m².annum

* These energy requirements have been calculated using a standard set of occupant behaviours and so do not necessarily represent the usage pattern or lifestyle of the intended occupants. They should be used solely for the purposes of rating the building. They should not be used to infer actual energy consumption or running costs. The settings used for the simulation are shown in the building data report.

AREA-ADJUSTED ENERGY REQUIREMENTS				
Heating	**Cooling (sensible)**	**Cooling (latent)**	**Total Energy**	**Units**
47.4	24.9	3.6	75.9	MJ/m².annum
Conditioned floor area	166.9 m²			

Star Rating

★★★★★☆ **5.5 STARS**

Area-adjusted star band score thresholds									
1 Star	**2 Stars**	**3 Stars**	**4 Stars**	**5 Stars**	**6 Stars**	**7 Stars**	**8 Stars**	**9 Stars**	**10 Stars**
349	232	159	114	86	67	50	34	19	6

Appendix 3

Engineering Details

GENERAL

1. These drawings shall be read in conjunction with architectural and other consultants drawings and specifications. Any discrepancies shall be reported to the Engineer before proceeding with the work.
2. Dimensions shall not be obtained by scaling.
3. Any setout dimensions shown on the drawings shall be verified by the builder.
4. During construction the structure shall be maintained in a stable condition and no part shall be overstressed.
5. All work shall be in accordance with the B.C.A
6. A site specific geotechnical report shall be forwarded to the engineer prior to construction.
7. All roof flashing to panels by builder.

DESIGN CRITERIA

1. Wind Loading :
   - 1.1. C4 to AS4055.
   - 1.2. Site specific wind classification to be confirmed by suitably qualified persons and the results forwarded to Burke Engineering Servives for approval prior to construction.

2. Live Loads:
   - 2.1. Roof non– trafficable 0.25KPa
   - 2.2. Floor Residential – 1.5 KPa

3. Geotechnical: Site classification to AS2870 – Class H

EXCAVATION

1. Any Vertical or near vertical permanent excavation within 2m of the building and greater than 0.6m deep in material other than rock shall be adequately retained or battered.
2. Temporary excavations parallel to the footings shall only be carried out after giving due consideration to the following: – The stability of the soil – The need to maintain support for the footing – The need to maintain the necessary strength, compaction and permeability of the backfill.
3. Where footings are placed near existing services to which future access will be required, consideration shall be given to the stability of the footing.
4. Generally excavations shall not extend below the following limits without the consultation of an Engineer: – For a non–cohesive soil, a line drawn 30 degrees to the horizontal from the bottom edge of the footing . – For a cohesive soil, a line drawn 45 degrees to the horizontal from the bottom edge of the footing.
5. Excavations near the edge of a footing system shall be backfilled with a method that prevents access of water to the foundations.
6. Footings shall not be allowed to pond water for an extended period of time.
7. Footings shall be de–watered and cleaned prior to concrete placement so that no softened or loose material remains.

FOUNDATIONS

1. Foundations have been designed for an allowable bearing pressure of 100 KPa.
2. Building slab area to be proof rolled and any soft areas treated as unsuitable material. Unsuitable material to be removed, replaced and compacted with suitable fill material to the approval of the Engineer.
3. Foundations and slab are to be founded on natural ground U.N.O

PANEL NOTES

1. General
   - 1.1. All workmanship and materials shall be in accordance with AS3850 2003.
   - 1.2. Dimensions and profiles of panels shall obtained from the structural drawings.
   - 1.3. Minimum structural panel thickness to be 125mm, unless noted otherwise, refer plan thickness. All panel rebates etc to be approved by BURKE ENGINEERING SERVICES P/L.
   - 1.4. Panel thicknesses shown are minimum structural thicknesses, architectural rebates, etc, are in addition to thicknesses shown (Refer below). Construction joints in panels are not permitted.
   - 1.5. Joints between panels shall be filled with a flexible sealant. In bushfire prone areas the sealant shall be fire resistant.

2. CONCRETE FOR PRECAST PANELS
   - 2.1. Minimum concrete strength 32 MPa U.N.O
   - 2.2. Addition of chemical admixtures & in particular chlorides shall comply with AS3600 & AS3610. Admixtures are to be submitted to the superintendent for approval.
   - 2.3. Acid etching will not permitted. Other surface treatments are to be submitted to the superintendent for approval. The contractor shall obtain the specified finish in strict accordance with the architectural specifications.
   - 2.4. Sample panels may be required to establish surface finish requirements. The first panel may constitute a "sample" if the surface finish achieved is acceptable.

3. STRUCTURAL DESIGN
   - 3.1. The panels have been designed for the lifting and in–service conditions (ie. The loads, the Precast Panels are subject to after erection on site).
   - 3.2. The precast fabrication. Lifting, storage, Transportation, erection and temporary propping are the responsibility of the builder.
   - 3.3. No alteration to the structural design of panel is permitted unless approved in writing by Burke Engineering Services P/L.
   - 3.4. The Precast Panel fabricator is to submit minimum of two sets of fully detailed shop drawings of all panels. Shop Drawings shall indicate reinforcement, inserts. Fixings, anchors, bolts and ferrules, etc. that are required for connection to structure in the in–service conditions. Drawings shall be submitted to Burke Engineering Services P/L via the superintendent for review prior to commencement of fabrication.

4. The precast panel fabricator and builder are to co–ordinate additional fixing points for temporary support of the panels during constructions.

5. FIXING
   - 5.1. All connections and fixings to be hot dipped galvanized and/or stainless steel. Refer details.
   - 5.2. Lifting ferrules are to be approved lifting eyes in accordance with the relevant Australia standard.
   - 5.3. Grouting of dowels and joints shall be done with a waterproof pre packed cement–based product which shall be mixed with water on site to the recommended consistency. Compressive strength of non–shrink grout must exceed 32MPa at 7 days and 50MPa at 28 days. The product shall be stored, hanDAed and placed strictly in accordance with the manufactures instructions and recommendations.

6. Where panels are temporarily supported on non corrosive shims the gap is to be fully grouted with a water proof non–shrink grout.

STRUCTURAL STEEL

1. All work to be in accordance with AS4100
2. The builder shall prepare workshop drawings and submit them for approval before fabrication commences.
3. All bolts shall be M20 grade 8.8 snug UNO.
4. All fillet welds shall be 6mm continuous UNO.
5. All butt weld shall be full strength UNO.
6. All base and end plates shall be 10mm plate UNO.
7. All cleats shall be 10mm plate UNO.
8. Protective coatings shall be :
   - 8.1. Internal : grey oxide zinc primer to 75 microns DFT.
   - 8.2. External : Hot dipped galvanized.
   - 8.3. Purlins & Girts : galvanized as produced.
9. 20mm structural grout to all column base plates UNO.

GROUND SLAB

1. Slab is to be founded in natural ground min bearing 100 KPa.
2. All work to AS2870.
3. Consult engineer prior to construction if fill material or rock is encountered.
4. Plumbing and drainage works to be in accordance with section 5 of AS.2870.

CONCRETE

1. All work shall be in accordance with AS3600 and AS3610 UNO.
2. Concrete Schedule:

Element	Strength	Max Aggregate Size	Slump
Footings	20 Mpa	20mm	80mm
Building Slabs	25 Mpa	20mm	80mm
Precast Panels	32 MPa	20mm	80mm

3. Reinforcement Cover Schedule:

Description	Cover (mm)
Precast Panels	AS DETAILED
Footings	50
Building Slabs.	30 Top & 40 Btm (Min)
External Pavement	40 Top & Btm (no membrane)

4. All concrete shall be mechanically vibrated
5. All concrete to be cured for a minimum of 7 days. Curing methods suitable are: –
   - 5.1. Curing compound approved by the Engineer.
   - 5.2. Impermeable plastic membrane that adequately seals the concrete from exposure and drying.
   - 5.3. Continuous and total wetting of the concrete by spray, ponding or other means.
6. Sizes of concrete elements do not include applied finishes
7. Reinforcement sheet mesh shall be lapped so that two outermost transverse wires of one sheet overlap the two outermost transverse wires of the sheet being lapped.
8. Reinforcement laps shall be 500mm U.N.O
9. Trench mesh shall be lapped 800mm.
10. Welding of reinforcement is not permitted. "Tack" welding for fabrication is allowable.
11. Reinforcement is represented diagrammatically. It is not necessarily shown in its true position.
12. Service penetrations are to be approved by the Engineer. Generally the penetration shall be taken into account by the provision of extra concrete depth and reinforcement. Penetrations in edge beams and footings shall be sleeved to allow for movement.
13. Construction joints where not shown shall be to the approval of the engineer.

STRUCTURAL DRAWING SCHEDULE

DWG No.	TITLE
J1929 S01	GENERAL NOTES & DRAWING SCHEDULE
J1929 S02	PANEL LAYOUT PLAN : SHEET 1
J1929 S03	PANEL LAYOUT PLAN : SHEET 2
J1929 S04	PANEL ELEVATIONS : SHEET 1
J1929 S05	PANEL ELEVATIONS : SHEET 2
J1929 S06	SECTIONS & DETAILS : SHEET 1
J1929 S07	SECTIONS & DETAILS : SHEET 2

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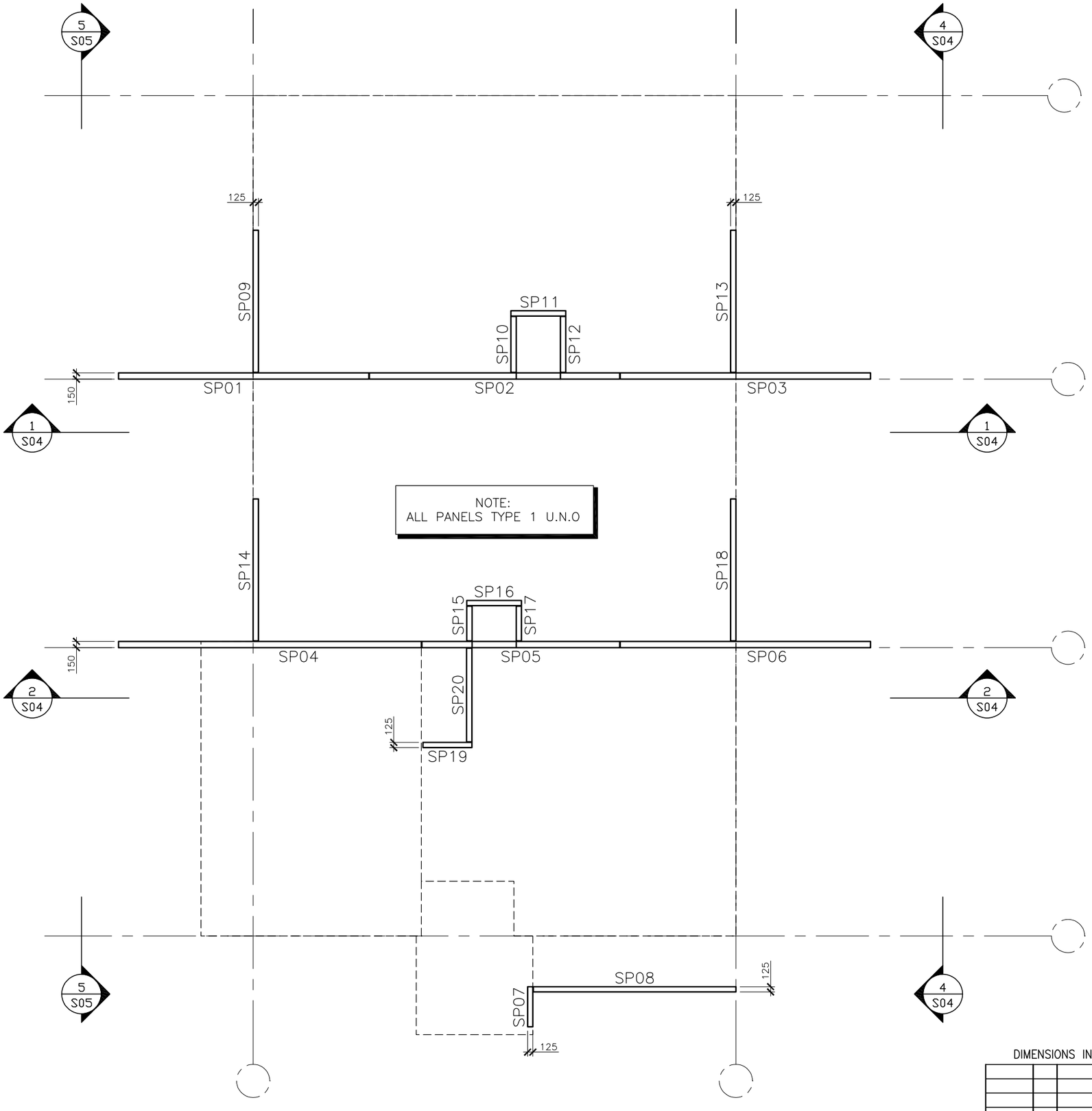
DIMENSIONS IN MILLIMETRES DO NOT SCALE

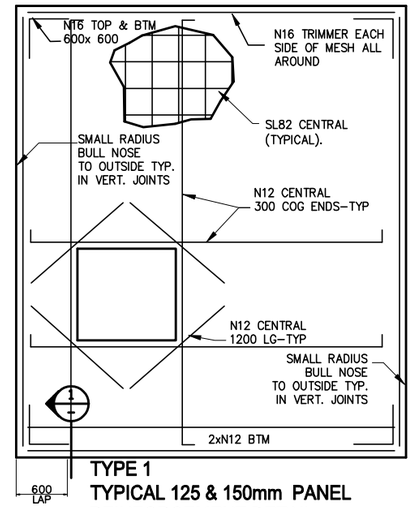
DATE	REV	ISSUE	DRAWN	APPROVED
14–04–11	A	PRELIMINARY	DA	JB

BURKE ENGINEERING SERVICES P/L
PO BOX 330 EAST MAITLAND, N.S.W. 2323, AUSTRALIA
TELEPHONE (02) 49 661511
FAX (02) 49 661711

PROJECT	DURABLE HOUSE				
CLIENT	GHD				
SITE ADDRESS	AUSTRALIA – 1 in 4 SLOPING SITE				
DRAWING NAME	GENERAL NOTES & DRAWING SCHEDULE				
SCALE	N/A			A3	J1929 S01
DRAWN	DA	DATE	14–04–11		
CHECKED	JB	DATE			A
APPROVED		DATE		REVISION NUMBER	



PANEL LAYOUT PLAN : SUB-FLOOR (1:100)



TYPE 1
TYPICAL 125 & 150mm PANEL REINFORCEMENT DETAIL SCALE N.T.S.

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14-04-11	A	PRELIMINARY	DA	JB

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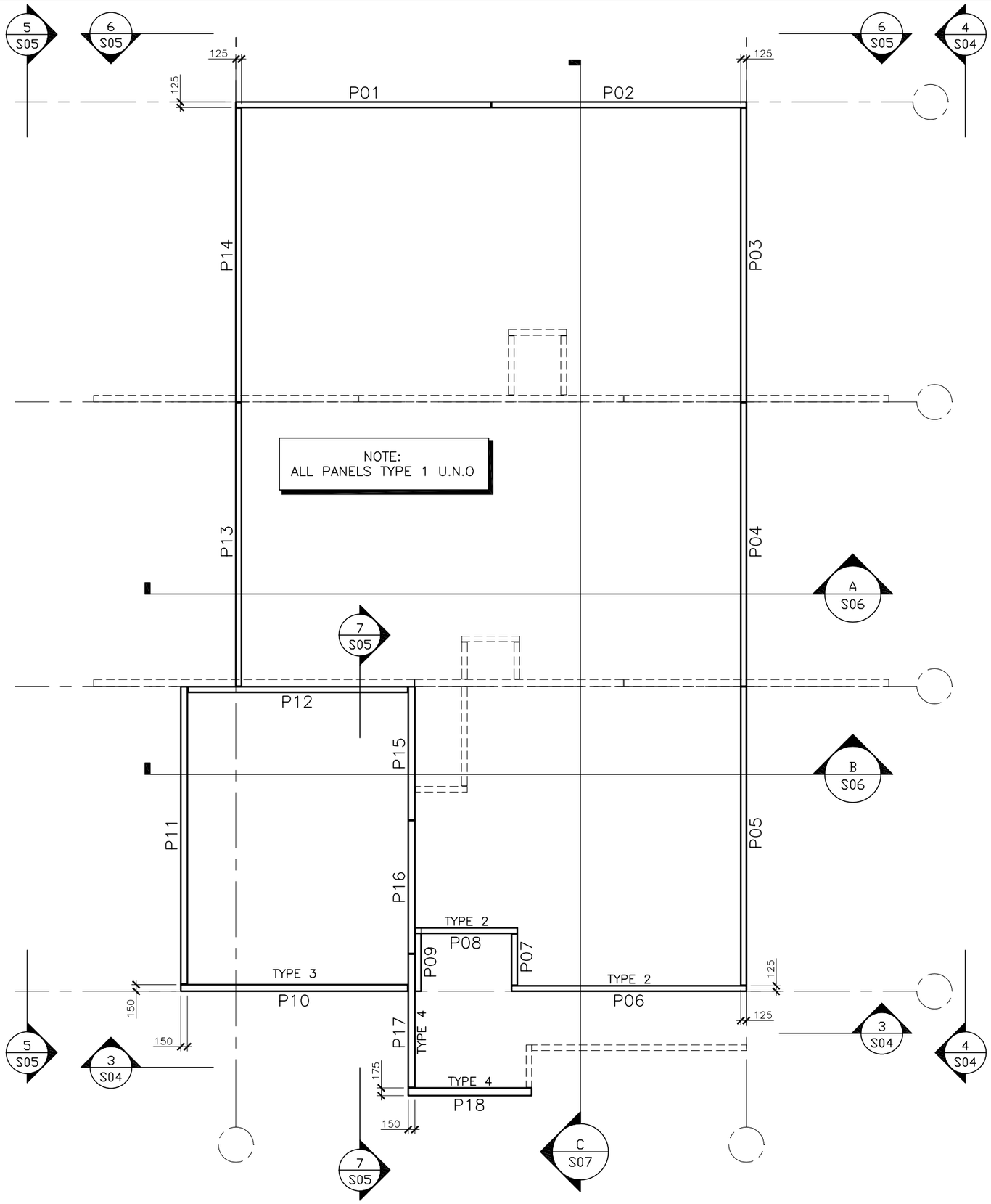
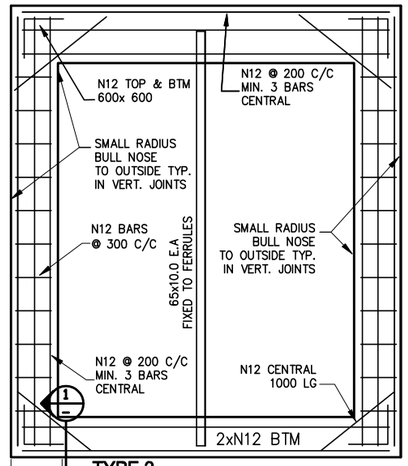
PO BOX 330 EAST MAITLAND, N.S.W. 2323, AUSTRALIA
TELEPHONE (02) 49 661511
FAX (02) 49 661711

PROJECT	DURABLE HOUSE
CLIENT	GHD
SITE ADDRESS	AUSTRALIA – 1 in 4 SLOPING SITE
DRAWING NAME	PANEL LAYOUT PLAN : SHEET 1

SCALE	1:100			A3	J1929 – S02
DRAWN	DA	DATE	14-04-11		
CHECKED	JB	DATE			A
APPROVED		DATE		REVISION NUMBER	



PANEL LAYOUT PLAN (1:100)



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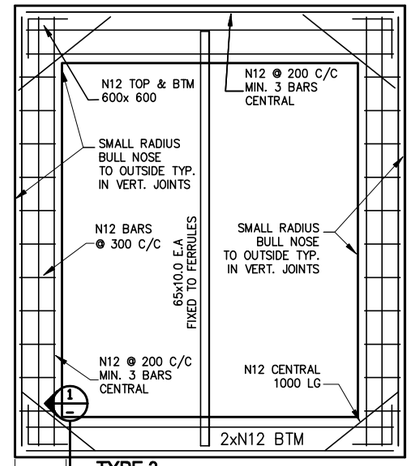

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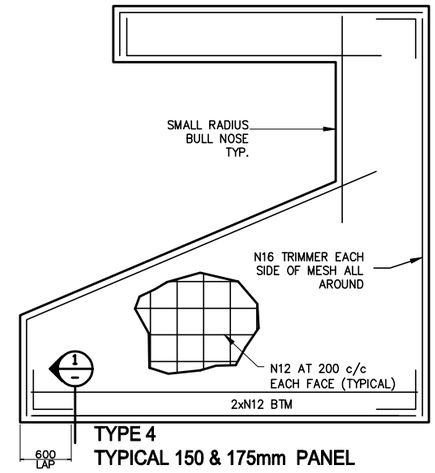
REINFORCEMENT DETAIL SCALE N.T.S.



TYPE 4
TYPICAL 150 & 175mm PANEL
REINFORCEMENT DETAIL SCALE N.T.S.

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DATE	REV	ISSUE	DRAWN	APPROVED
14-04-11	A	PRELIMINARY	DA	JB

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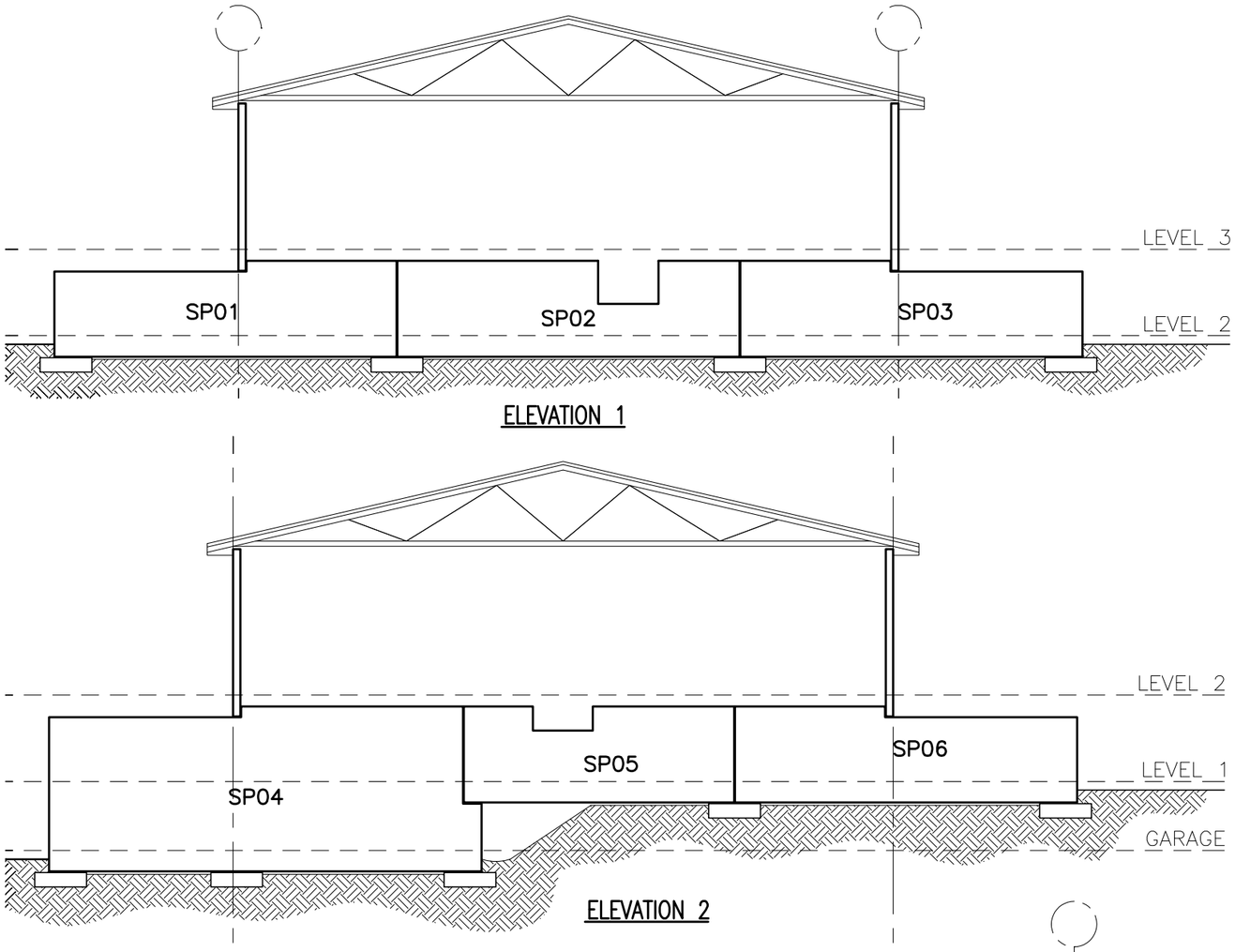
PO BOX 330 EAST MAITLAND, N.S.W. 2323, AUSTRALIA
TELEPHONE (02) 49 661511
FAX (02) 49 661711

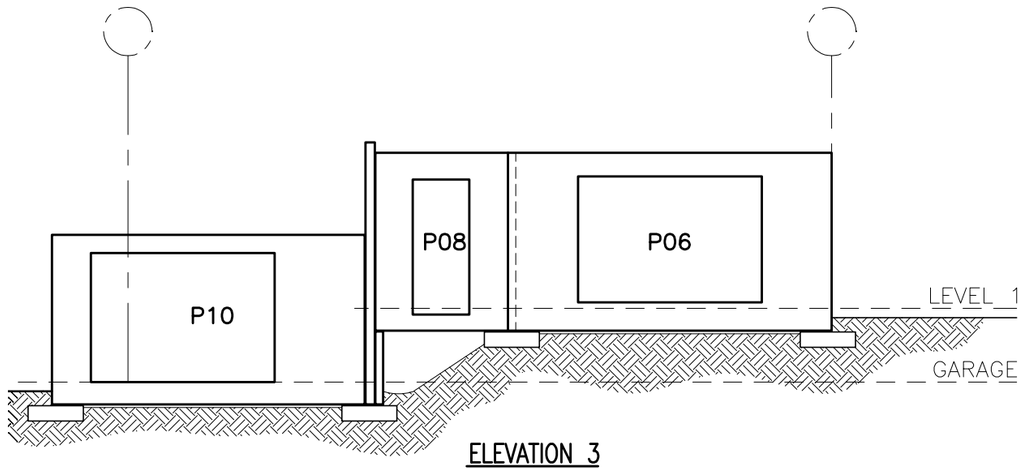
PROJECT	DURABLE HOUSE
CLIENT	GHD
SITE ADDRESS	AUSTRALIA – 1 in 4 SLOPING SITE
DRAWING NAME	PANEL LAYOUT PLAN : SHEET 2

SCALE	1:100			A3	J1929 – S03
DRAWN	DA	DATE	14-04-11		
CHECKED	JB	DATE			A
APPROVED		DATE			REVISION NUMBER



ELEVATION 1

ELEVATION 2



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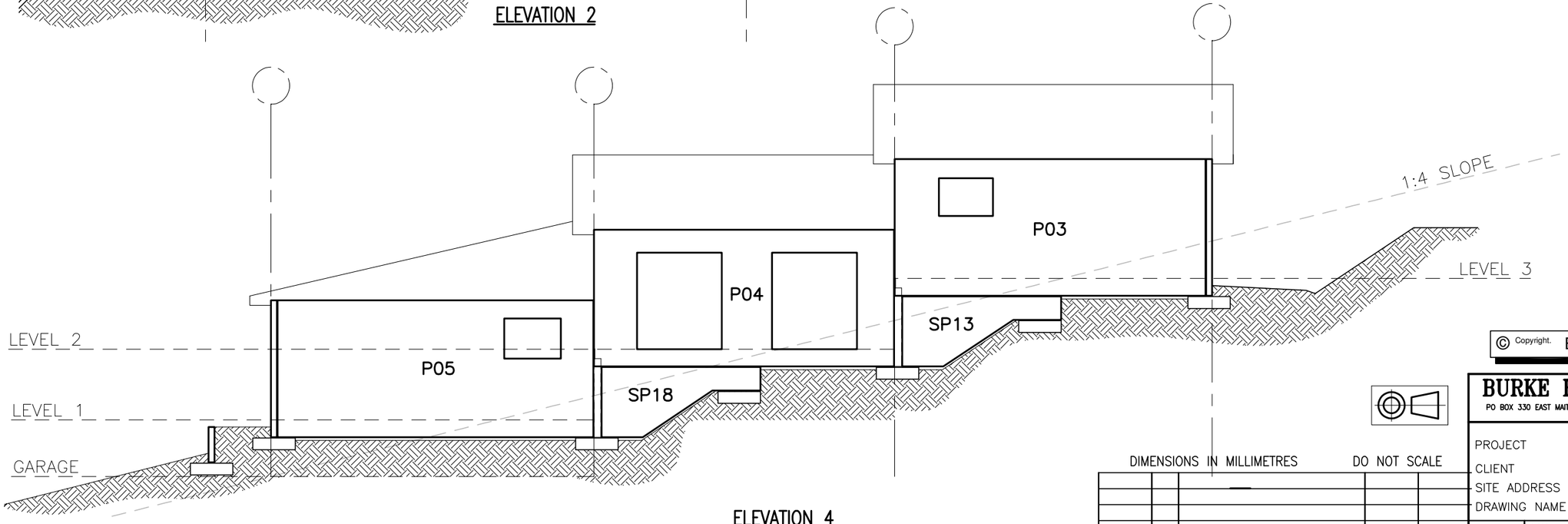

ELEVATION 4

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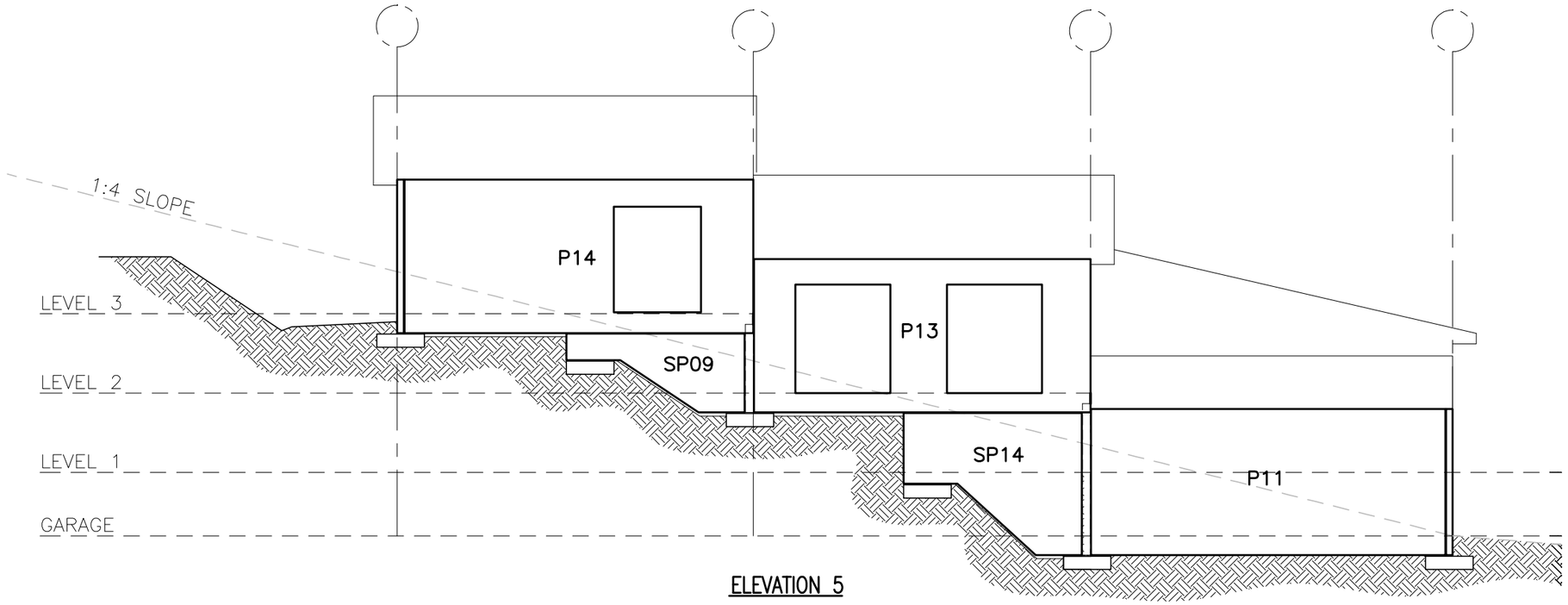
DIMENSIONS IN MILLIMETRES DO NOT SCALE

DATE	REV	ISSUE	DRAWN	APPROVED
14-04-11	A	PRELIMINARY	DA	JB

PROJECT	DURABLE HOUSE		
CLIENT	GHD		
SITE ADDRESS	AUSTRALIA – 1 in 4 SLOPING SITE		
DRAWING NAME	PANEL ELEVATIONS : SHEET 1		
SCALE	1:100	A3	J1929 – S04
DRAWN	DA	DATE	14-04-11
CHECKED	JB	DATE	
APPROVED		DATE	
			A
			REVISION NUMBER



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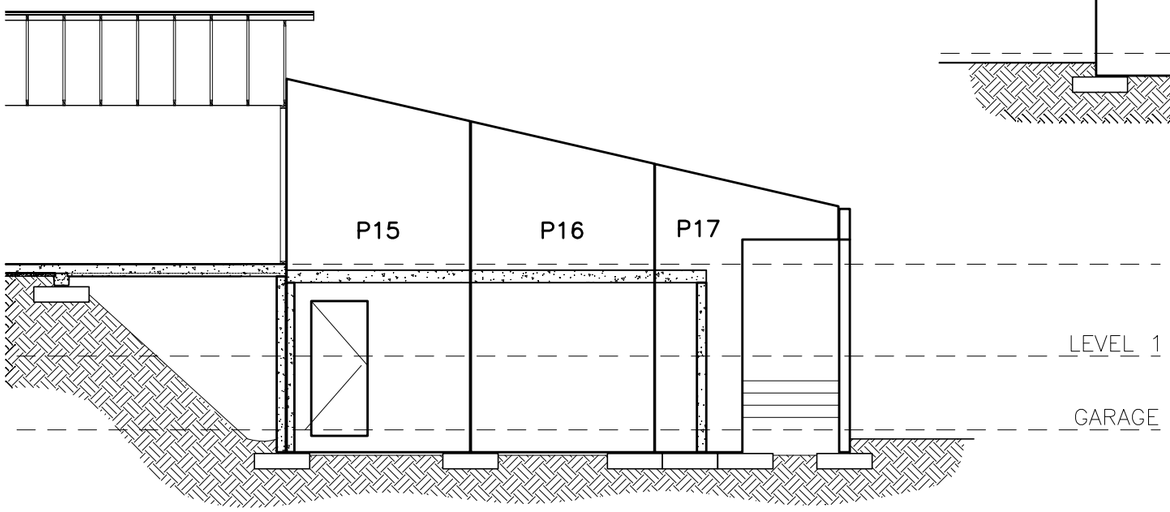

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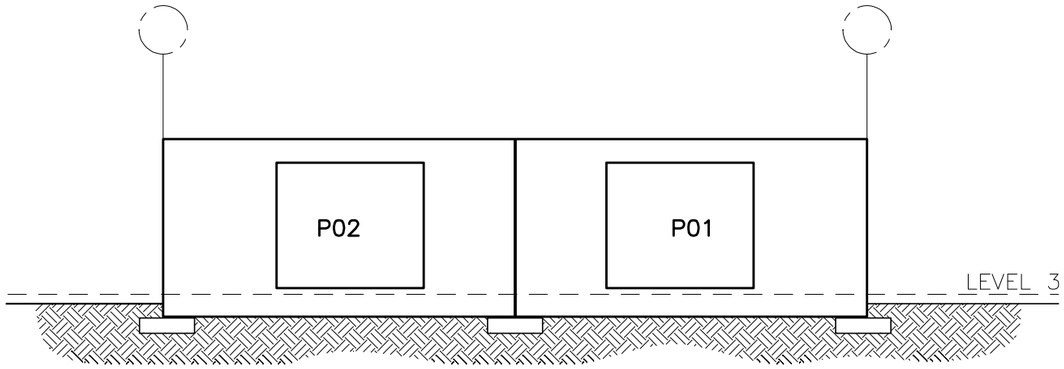

ELEVATION 6

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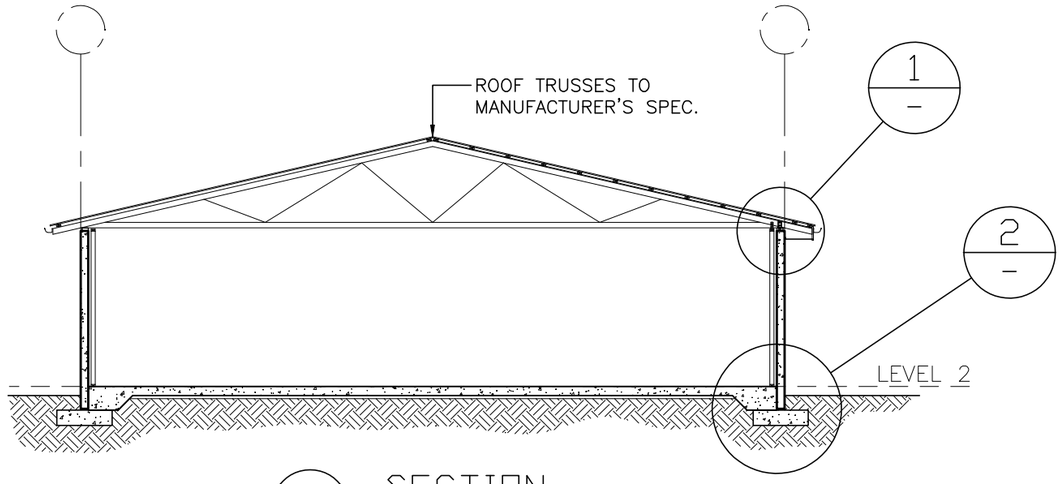
TELEPHONE (02) 49 661511
FAX (02) 49 661711

DIMENSIONS IN MILLIMETRES DO NOT SCALE

DATE	REV	ISSUE	DRAWN	APPROVED
14-04-11	A	PRELIMINARY	DA	JB

PROJECT	DURABLE HOUSE			
CLIENT	GHD			
SITE ADDRESS	AUSTRALIA – 1 in 4 SLOPING SITE			
DRAWING NAME	PANEL ELEVATIONS : SHEET 2			
SCALE	1:100		A3	J1929 – S05
DRAWN	DA	DATE 14-04-11		
CHECKED	JB	DATE		A
APPROVED		DATE		REVISION NUMBER



A SECTION
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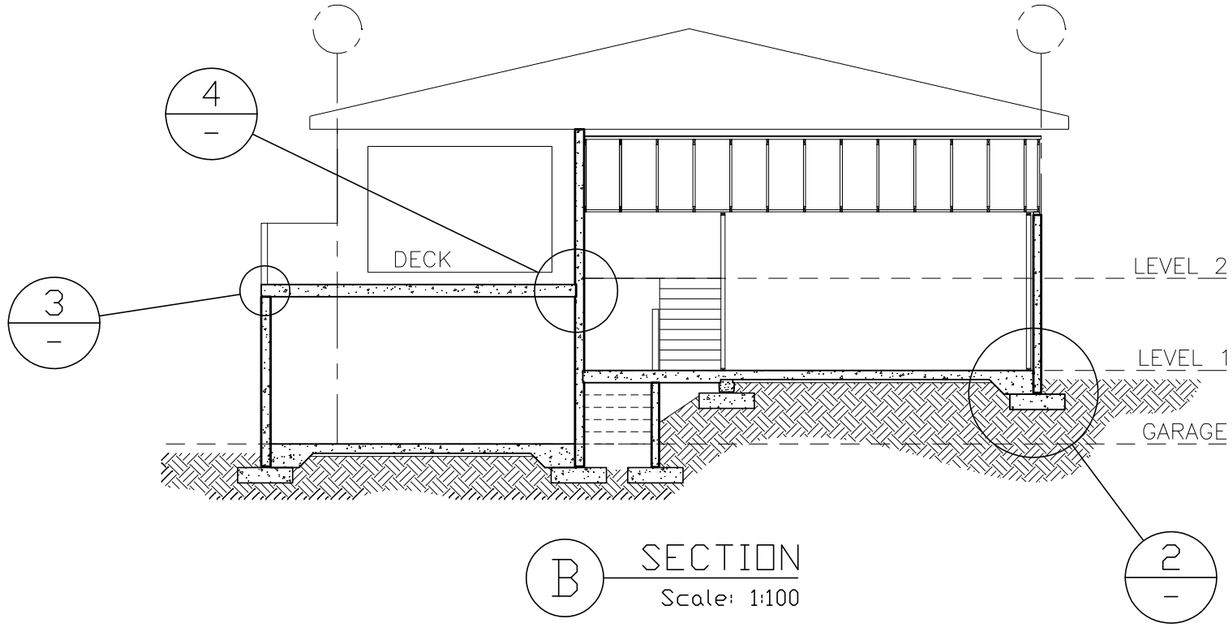
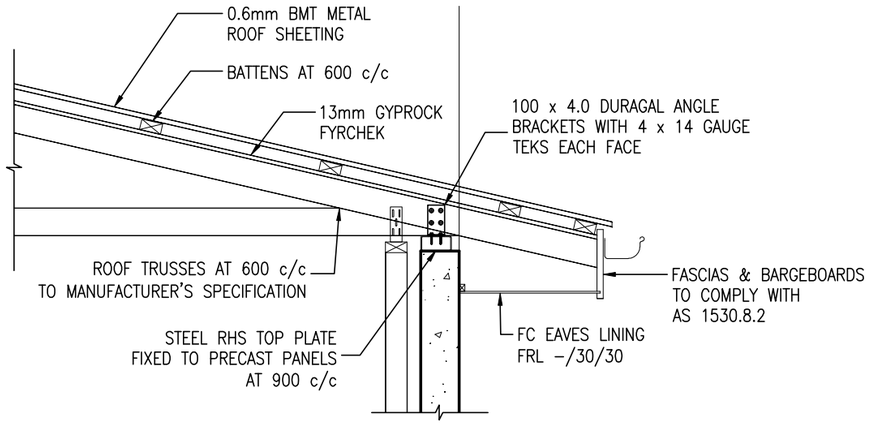
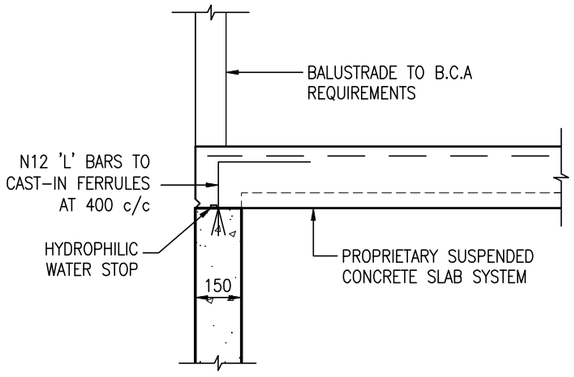


B SECTION
Scale: 1:100



1 DETAIL
Scale: 1:20



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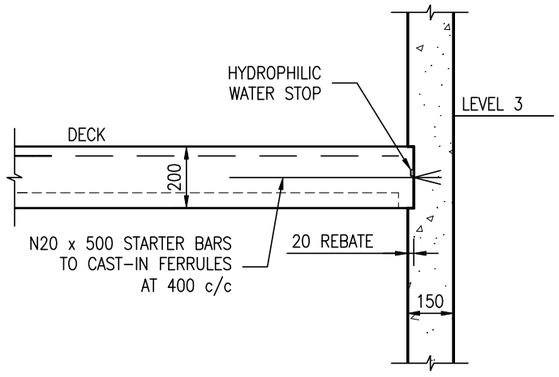
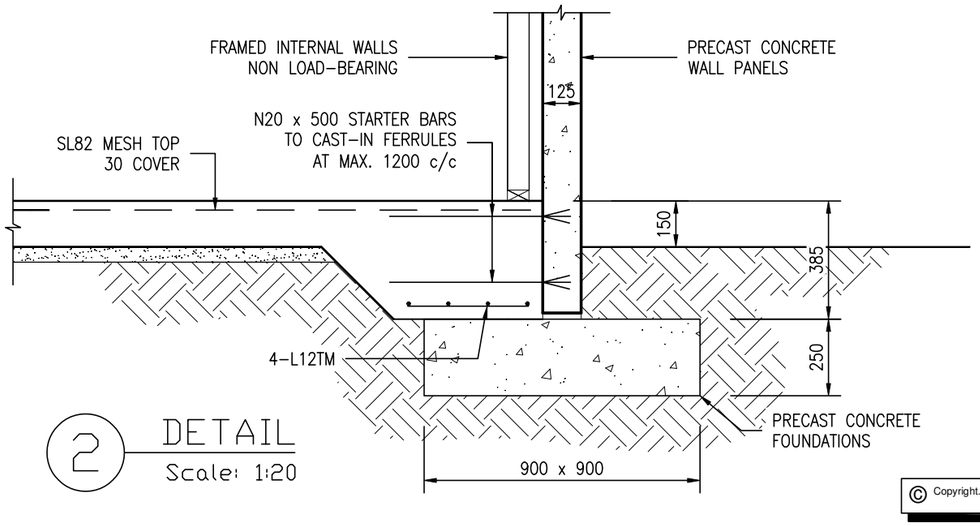
Scale: 1:20



4 DETAIL
Scale: 1:20



2 DETAIL
Scale: 1:20

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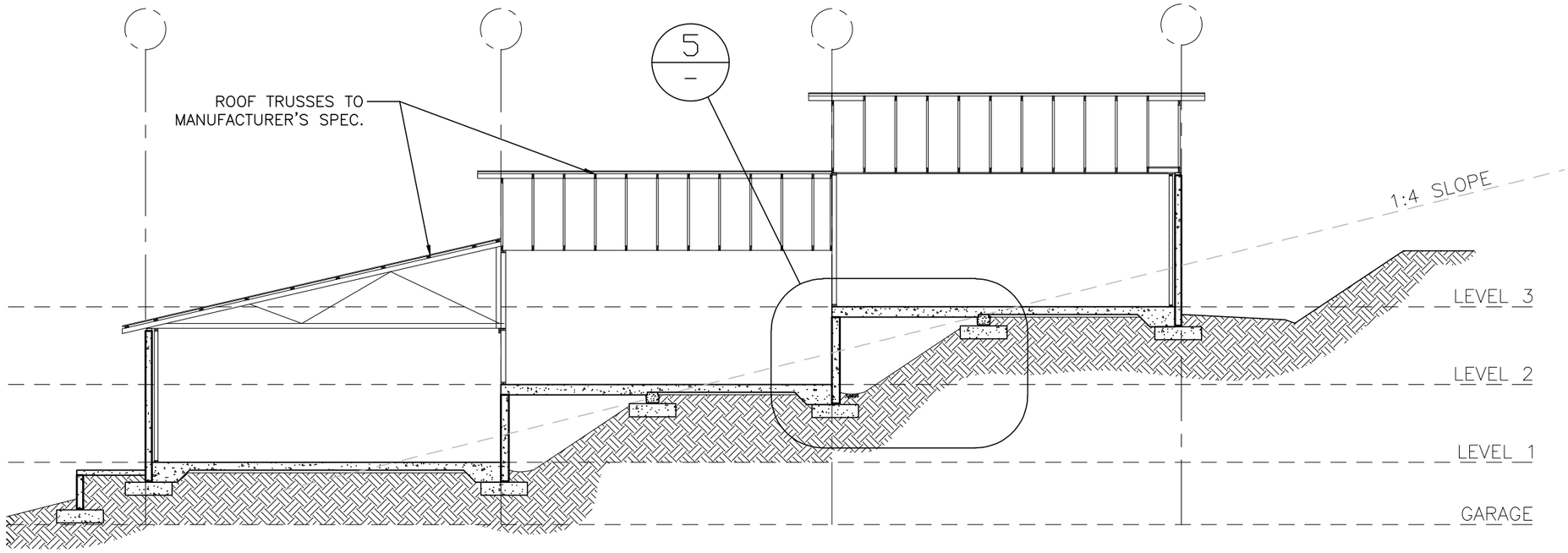
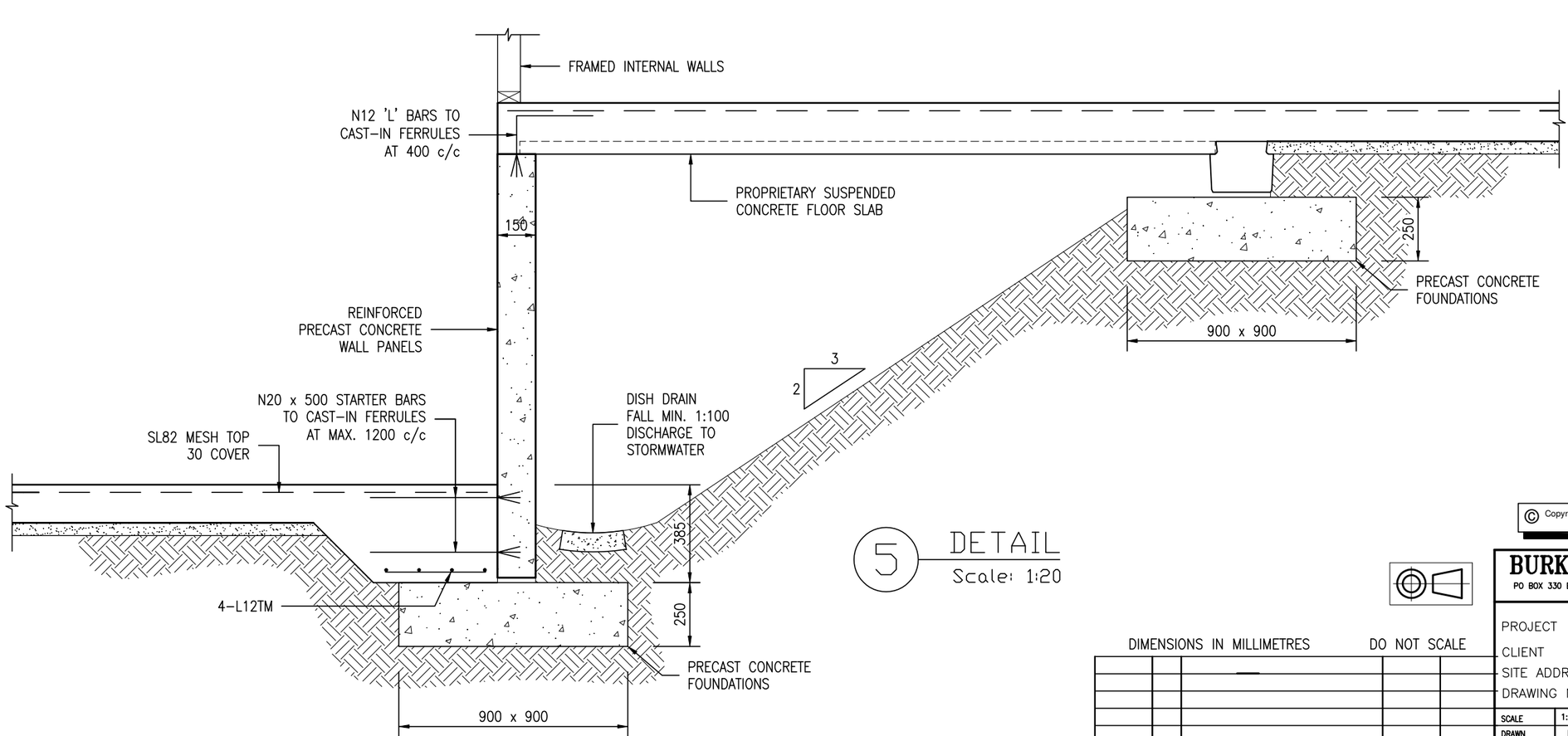
TELEPHONE (02) 49 661511
FAX (02) 49 661711

PROJECT	DURABLE HOUSE
CLIENT	GHD
SITE ADDRESS	AUSTRALIA – 1 in 4 SLOPING SITE
DRAWING NAME	SECTIONS & DETAILS : SHEET 1

SCALE	1:100, 1:20			A3	J1929 – S06
DRAWN	DA	DATE	14–04–11		
CHECKED	JB	DATE			A
APPROVED		DATE			REVISION NUMBER



C SECTION
Scale: 1:100



5 DETAIL
Scale: 1:20

DIMENSIONS IN MILLIMETRES DO NOT SCALE

DATE	REV	ISSUE	DRAWN	APPROVED
14-04-11	0	PRELIMINARY	DA	JB

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PO BOX 330 EAST MAITLAND, N.S.W. 2323, AUSTRALIA
TELEPHONE (02) 49 661511
FAX (02) 49 661711

PROJECT	DURABLE HOUSE
CLIENT	GHD
SITE ADDRESS	AUSTRALIA – 1 in 4 SLOPING SITE
DRAWING NAME	SECTIONS & DETAILS : SHEET 2

SCALE	1:100, 1:20			A3	J1929 – S07
DRAWN	DA	DATE	14-04-11		
CHECKED	JB	DATE			A
APPROVED		DATE			REVISION NUMBER

Appendix 4

Construction Cost Documentation

14/04/2011

Panel Homes

Pre-cast Concrete single storey house

4 Bedroom
Bathroom
Ensuit & walk-in robe
Living room
Rumpus
Dining
Double Garage
Alfresco area
245m2 inside walls

Price Schedule - Building Works

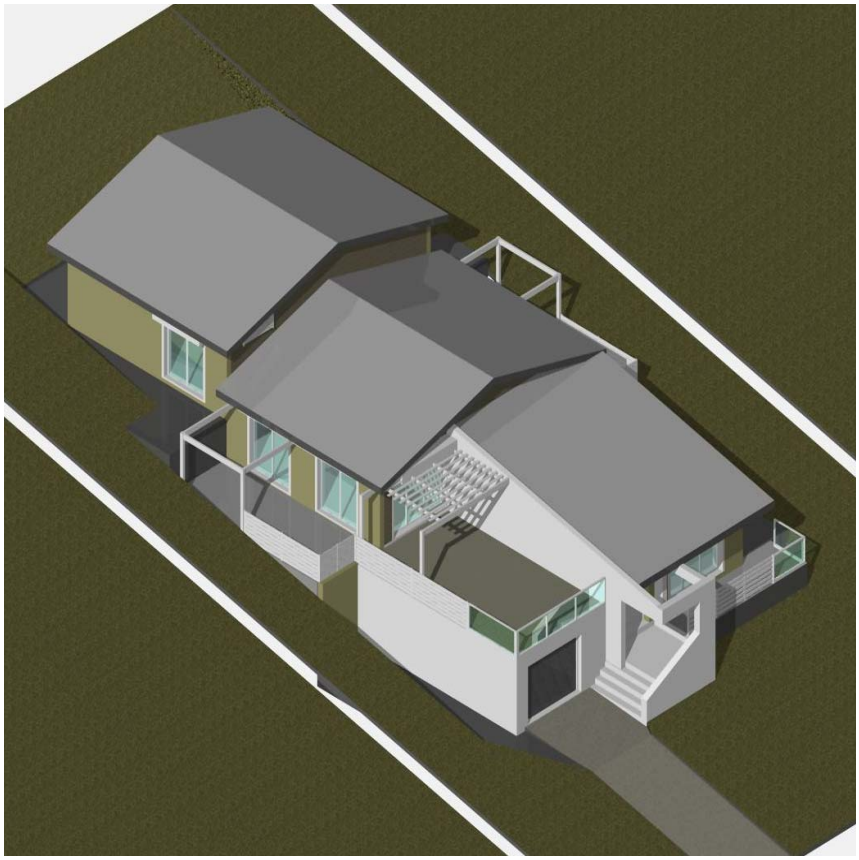
Description	Quantity	Unit	Rate	Amount
PRELIMINARIES				
Design & Documentation	1	Item	$ 4,500.00	$ 4,500.00
Construction amenities & services	1	item	$ 3,800.00	$ 3,800.00
Survey	1	item	$ 900.00	$ 900.00
Construction insurances	1	item	$ 2,500.00	$ 2,500.00
Home Owners Warranty Insurance	1	item	$ 1,500.00	$ 1,500.00
BUILDING WORKS				
Site Prep. & Bulk Earthworks	1	sc	$ 1,000.00	$ 1,000.00
Footings - Precast	18	No	$ 200.00	$ 3,600.00
Walls - Precast	194	m2	$ 185.00	$ 35,890.00
Concrete Building Slabs	236	m2	$ 110.00	$ 25,960.00
Frame & Trusses (Hunter Frame & Truss)	1	sc	$ 17,632.29	$ 17,632.29
Install Trusses & Frames	1	sc	$ 3,200.00	$ 3,200.00
Top Plate & connections	1	item	$ 1,200.00	$ 1,200.00
Roof & DPs & Fascia	1	sc	$ 14,000.00	$ 14,000.00
Windows (supply)	1	item	$ 5,480.00	$ 5,480.00
Windows (install)	1	sc	$ 1,200.00	$ 1,200.00
Garage panel lift Doors	1	sc	$ 1,800.00	$ 1,800.00
Architraves	350	m	$ 8.00	$ 2,800.00
Doors				
- external - plain	2	No	$ 450.00	$ 900.00
- external - entry	1	No	$ 950.00	$ 950.00
- internal	16	No	$ 280.00	$ 4,480.00
Plaster lining	1	item	$ 13,000.00	$ 13,000.00
Painting	1	ac	$ 9,000.00	$ 9,000.00
Kitchen				
- Joinery	1	Item	$ 5,500.00	$ 5,500.00
- Appliances	1	item	$ 1,400.00	$ 1,400.00
Bathrooms				
- Fit out	1	item	$ 1,000.00	$ 1,000.00
- Tiling (wall & floor)	15	m2	$ 110.00	$ 1,650.00
- Waterproof	1	item	$ 1,900.00	$ 1,900.00
SERVICES				
Electrical	1	sc	$ 6,500.00	$ 6,500.00
Plumbing - excludes PC items	1	sc	$ 8,500.00	$ 8,500.00
PC items	1		$ 4,500.00	$ 4,500.00
Commercial Clean	1	sc	$ 1,200.00	$ 1,200.00

Direct Cost (excl GST)		$ 187,442.29
Builder's Profit & Overheads	20%	$ 37,488.46
TOTAL (excl. GST)		**$ 224,930.75**
TOTAL (incl. GST)		**$ 247,423.82**
Equivalent rate per m2 (incl. GST)		***$ 1,009.89***

Appendix 5

Additional Shots of the Architectural Model

Title: Front View



Title: Oblique View

Title: Street View

Title: Construction View