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Rethinking Aged Care Construction - Consider Timber

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Contents

1 Introduction

Timber's sustainability credentials are attracting world-wide interest and advancements in timber engineering have made timber an increasingly cost-competitive proposition.

Encouraging the construction industry to adopt innovative approaches needs information and evidence. Attention to technical design, construction costs and site processes is critical to show the value proposition of timber construction to customers and optimise its use.

This Guide aims to help those involved in the decision chain (such as cost managers, estimators, design professionals, building developers and project managers) gain a better understanding of the value that timber construction systems offer aged care projects.

The Guide is based on a research project that developed a model aged care building and a corresponding lightweight timber-framed solution, and compared it with a corresponding lightweight steel-framed solution. The timber solution was designed to optimise functional performance, constructability and cost effectiveness and provides guidance for compliance under the National Construction Code (NCC). This Guide provides an explanatory understanding of decision making issues when developing timber solutions.

2

What Drives Decisions When Choosing a Construction System for Aged Care

A key objective of the project was to provide an understanding of the decision drivers along the customer/supply chain for the selection of construction systems for aged care projects. Key areas of exploration included:

- Gathering information about customer needs and how construction systems affect decision making.
- Benchmarking against existing construction systems typically used in aged care projects, especially lightweight steel framing as used in brick veneer construction. The steel-framed solution for the model building is provided for comparative purposes in Appendix A.
- Understanding the nature of the overall delivery supply chain and related work flows, especially construction scheduling, productivity and prefabrication issues.
- Optimising the regulatory framework where it affects the viability of timber solutions.

3

Project Development

The research project was developed by a series of expert/stakeholder meetings, interviews, concept development sessions, design charrettes, cost planning studies, construction programming studies and detailed design studies aimed at developing the model building and a cost-effective timber solution for it.

A team of experts worked together to provide input to the development process. Core collaborators included:

- **The Timber Development Association:** A market development association for the timber industry and the project leader for this work, on behalf of the timber industry.
- **The University of Technology Sydney:** A technology-driven university with an integrated understanding of the building industry and specific expertise in timber construction. The university co-developed the research method and mediated the strategic direction of the timber solutions in terms of detailed design, cost and site productivity issues.
- **BCIS**: A global subsidiary of the Royal Institute of Chartered Surveyors who specialise in gathering building cost data used for reporting on cost trends for a variety of building forms. BCIS provided quantity surveying, cost estimating and cost planning input for both the timber solution and the corresponding concrete solution.
- **Engineered timber manufacturers, suppliers and industry associations** (including Tilling Timber, Hyne Timber, Meyer Timber, Nelson Pine Industries, Carter Holt Harvey Wood Products, MiTek): Their input helped ensure the practical viability, design properties and availability of appropriate timber componentry.
- **Plan Source**: A building designer with good knowledge of framed construction systems.

A concept design was developed to represent a typical aged care project, including development of the previously mentioned timber and steel-framed solutions for the model.

4

A Model Aged Care Building - the Basis for Comparison and Solution Development

The model aged care building (Figure 1) demonstrates a prototypical situation for modelling spatial, loading, fire and noise resistance conditions, providing a neutral base for creating both the timber and competing steel solutions. The full design drawings are in Appendix B. The model's basic spatial characteristics are provided in Table 1.

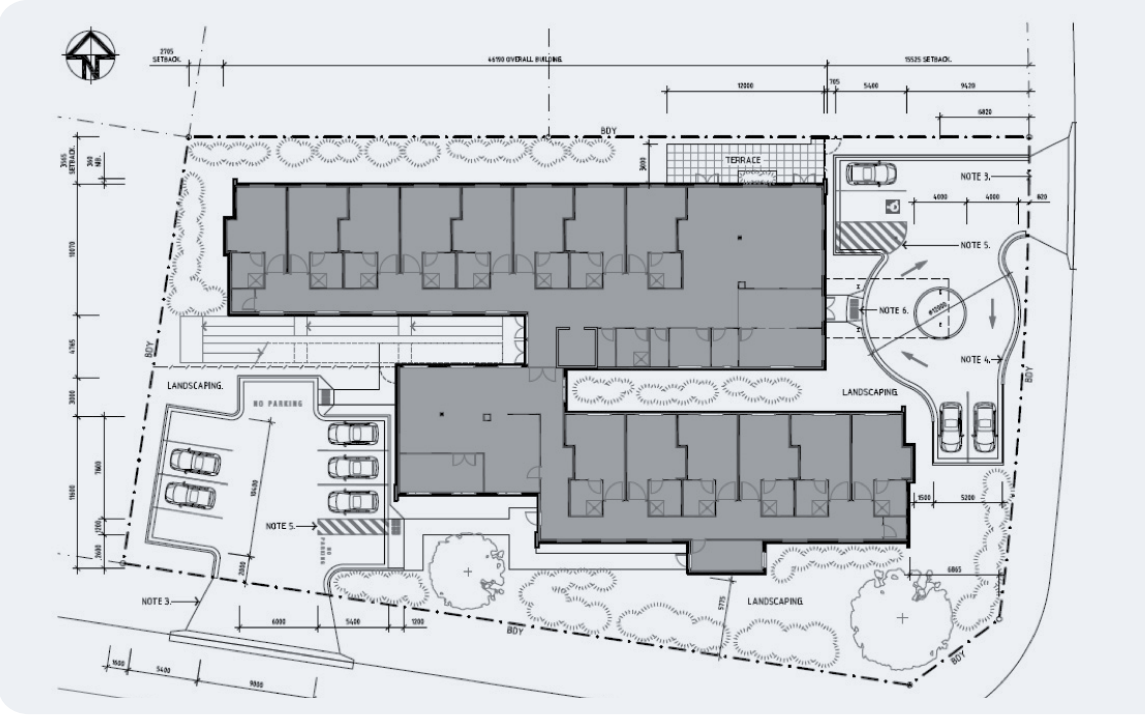


Figure 1: Site plan of two storey aged care building.

Item	What was used in the model	Relevance and reasons
Height	• Two storey construction • 6.85 m overall height • 6.0 m to underside of eaves	• This represents a typical height for buildings of this style
Area	• Gross Floor Area - 1,681 m^2 • Floor Space Ratio - 0.67	• The area and floor to space ratio aim to be indicative of common aged care building situations
Setbacks	• External wall distances are at least 3.0 m from property boundaries	• The location of the building relative to other buildings/properties affects façade fire-resistance requirements
NCC Building classification	• Class 9c building, i.e. aged care buildings	• The classification influences performance and compliance requirements

Table 1: Key spatial characteristics of the model shed building.

4.1 Core Differences between the Timber and Concrete Solutions

The only difference between the timber solution and steel-framed solution concerns the wall and floor structure throughout the apartment levels of the building (i.e. the levels above the ground floor slab). Parameters pertaining to fire, acoustic and building services requirements (that affect both the timber and steel solutions) are provided under dedicated headings below. Other aspects of the two competing solutions are essentially the same and provide relative neutrality for comparisons. Discussions of the solutions that are identical have been excluded.

4.2 Structural Themes

Parameters applied to the model:

- Deemed-to-satisfy loading was taken from AS 1170, e.g. applied imposed wind loads.
- Wind speed: N2 (AS 4055).
- Load paths are managed in the apartment levels via load bearing walls and beams.
- Weathered shale soil conditions have been applied in the structural design.

Reasons:

- The selected wind speed deals with typical conditions the model building would likely face in real world conditions.
- The selected foundation is common in large parts of the greater Sydney basin and other parts of Australia where these buildings would often be found.

4.3 Building Acoustics

Parameters applied to the model:

- Walls between bed-sitters, between bed-sitters and bathrooms, and between bed-sitters and kitchen, laundry and plant or utility rooms are required to have an Rw of not less than 45, as per NCC Clause F5.5.
- Walls must be two separate leaves with at least a 20 mm gap between each leaf. There is to be no mechanical linkage between leaves except at the periphery, i.e. top and bottom plate (NCC Clause F5.3).
- Floors between bed-sitters must have an Rw of not less than 45.

4.4 Fire Resistance (based on NCC Requirements)

Parameters applied to the model:

- The Type of construction used was Type C, therefore the building's Deemed-to-Satisfy (DTS) fire resistance requirements are:
  - **external walls**: no fire resistance requirements as they are more than 3.0 m from the boundary
  - **external columns:** not applicable
  - **common or fire wall**: not applicable
  - **internal wall**: no fire resistance required
  - **roof**: no fire resistance required.

- Additional NSW-based requirements
  - Sprinklers are installed
  - Internal walls to be covered in 13 mm plasterboard
  - Where insulation is used, the insulation must be non-combustible
  - Internal walls must be smoke-proof.

Reasons:

- The building is assumed to be located in NSW and therefore needs sprinklers installed in accordance with NSW planning requirements.
- The building is two storeys in height and has two exits. NCC Provision Clause C1.5 allows 9c buildings to be defined as Type C fire resistant construction, i.e. where having two exits and sprinklers installed.
- Type C construction does not have any fire resistance requirements for:
  - external walls or columns (as they are more than 3.0 m from a fire source)
  - internal walls bounding corridors, between bed-sitters and stairs
  - stairs (not required to be 'fire isolated' under ncc clause d1.3)
  - floors
  - roofs.
- NSW Variation to the NCC (Clause C2.5) additionally requires
  - 13 mm plasterboard and non-combustible insulation to walls and ceilings are required.
  - NSW's Environmental Planning and Assessment Regulation 2000 Division requires aged care facilities to have fire sprinklers installed in accordance to the NSW Planning and Infrastructure Fire Sprinkler Standard.
- Smoke-proof walls are required in areas not more than 500 m^2 in size, and also between certain-sized kitchens, laundry and storage rooms (refer to NSW Variation to Clause C2.5).

5 The Timber Solution

This section presents core design information for the timber solutions.

5.1 Internal and External Walls

Wall systems used in the timber solution (see Table 2):

- For all walls separating bed-sitters with bed-sitter, neighbouring bed-sitter bathrooms, corridors or common rooms, staggered stud walls used wall system Type 1.
- Remainder of internal walls are wall system Type 2.
- External walls are wall system Type 3.

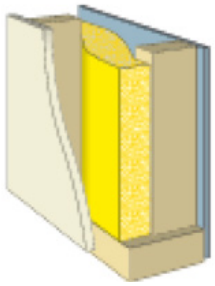
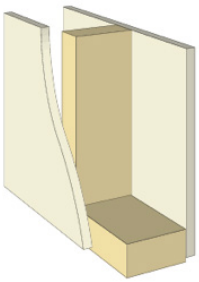
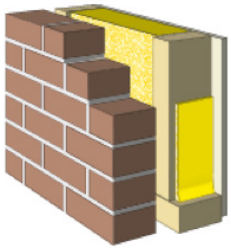
Wall Type	Diagram of Wall System	Description		Acoustic Rw	Fire rating
		Structural	Linings & Insulation		
1		Staggered stud walls consisting of 90 x 45 mm top and bottom plates and 70 x 35 mm mm studs at 300 mm centres	13 mm impact grade plasterboard for the first 1,200 mm from floor with 13 mm standard grade plasterboard above this height. Moisture-resistant 13 mm plasterboard was used in wet areas. 75 mm non-combustible glass wool batts	49[1]	Construction is Deemed-to-Satisfy
2		Loadbearing: 90 x 35 mm timber framed Non-Loadbearing: 70 x 45 mm timber framed	13 mm impact grade plasterboard for the first 1,200 mm from floor with 13 mm standard grade plasterboard above this height.	No rating required	No rating required
3		Loadbearing: 90 x 35 mm timber framed Non-Loadbearing: 70 x 45 mm timber framed	Inside: 13 mm impact grade plasterboard for the first 1,200 mm from floor with 13 mm standard grade plasterboard above this height. Outside: Brick veneer	No rating required	No rating required

Table 2: Wall Systems.

[1] CSR Red Book System Number 422

5.2 Floor Structure

What was used in the timber solution:

Floor systems used in the timber solution (see Table 3):

- Floors
  - Internal floor general areas (excluding wet areas) – Type 1
  - Internal floor wet areas – Type 2
  - External floor – Type 3.

Beams were used over opening in walls or rooms to break up the floor joist spans.

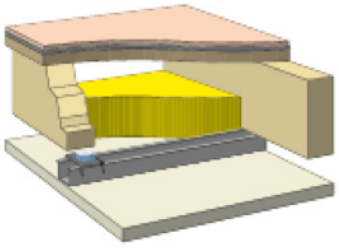
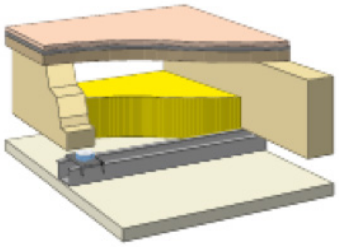
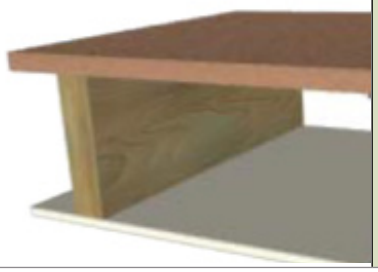
Type	Diagram of Floor System	Description	Acoustic		Fire rating
			Rw	Ln,w (Ci)	
1		• 240 mm deep I-beam floor joists at 450 crs • Particleboard flooring to all interior areas • 19 mm fibre cement to all wet and balcony areas • Noise-resilient ceiling mounted furring channel under joists • 13 mm standard plasterboard ceilings.	46[1]	NA	Construction is Deemed-to-Satisfy
2		• 240 mm deep I-beam floor joists at 450 crs • Fibrecement based flooring to all interior wet areas • Noise-resilient ceiling mounted furring channel under joists • 13 mm standard plasterboard ceilings.	46[1]	NA	Construction is Deemed-to-Satisfy
External Floor		• 240 mm deep I-beams at 450 crs • 19 mm fibre cement sheet. • 13 mm standard plasterboard ceilings	NA	NA	NA

Table 2 – Floor Systems.

[1] CSR Red Book System Number 821

5.3 Roof/Ceiling Space to Top Most Storey

Applied to the model

- 75 mm non-combustible glass wool batts are used 1200 mm either side of the acoustic rated wall (Figure 2).

Reasons:

- All systems used meet NCC minimum requirements and therefore require acoustic treatment to this zone.
- Systems configuration between steel and timber are effectively the same.

Comparison to steel design:

- The system configuration is effectively the same.

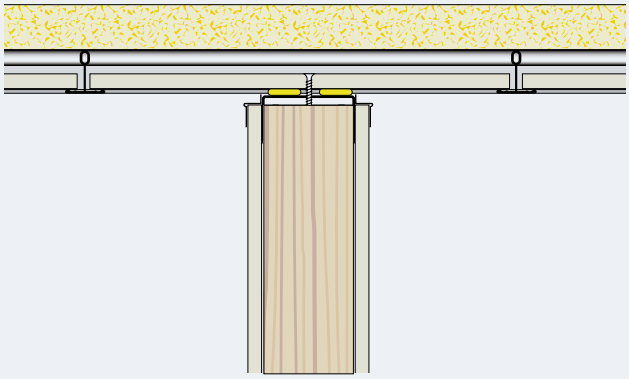


Figure 2: Sound-rated insulation above top-most ceiling.

6

Cost Plan Results – Comparing the Timber and Concrete Solutions

Cost comparison of the two competing solutions involved two approaches:

1. A cost plan developed for both the timber frame and steel frame solutions (as developed by BCIS)

2. Quotations provided by both timber and steel frame suppliers active in the marketplace.

The aim was to provide multiple sources of comparison, on the basis that both scenarios used essentially the same site installation approaches, which were subsequently considered to be a constant in the comparison. The main difference concerned the cost of materials (including prefabricated frames and trusses, where appropriate). Other aspects of construction were considered to be the same under both scenarios.

6.1 Cost Plan Conclusions

Table 4 below compares major items considered in the cost plan. Detailed cost information is contained in Appendix C.

Element	Timber	Steel	Variance
Columns	$2,646	$3,330	-$684
Upper Floors	$63,138	$226,357	-$163,219
Roof	$259,611	$300,635	-$41,024
Walls	$371,625	$279,298	+$92,327
Total	**$697,020**	**$809,620**	**-$112,600**

Table 4: Cost comparison between each building considered.

Note: Costs include the wall and ceiling coverings

The timber solution shows costs that are $112,600 (16%) lower than the steel frame solution.

Reduced costs for the timber solution were mainly in the:

- upper floor framing: $163,219 (72% lower than steel solution)
- roof framing: $41,024 (15% lower than steel solution).

Additional costs were in the wall framing: $92,327, a 33% increase.

6.2 Quotes from the Marketplace

Cost plan findings were independently verified by quotations from the market place. Quotes were obtained from lead frame suppliers as a package delivered to site. The quotes are for framing materials only, and do not include wall and ceiling coverings in the cost.

- Steel price: $231,000
- Timber price: $193,133

Like the cost planning exercise, these figures indicate that the timber solution is cheaper, but at the lesser amount of $37, 867, which is 20% cheaper than steel. The savings were identified to mainly exist in the upper floor framing, which parallels the main findings from the cost planning exercise.

7

Conclusion

The timber solution was found to be cheaper than the steel framing solution in both a cost planning exercise and a market quotation-based study.

All aspects of the model aged care building were the same, except for the competing framing systems used. Of note, the timber solution used stud walls, roof trusses and I-beam floor joists; the steel solution used studs, trusses and C section joists.

The deep timber floor joists for the upper floor construction was the main differentiating feature between the two options (being much less expensive than steel joists). Of less impact, timber wall frames were more expensive than steel wall framing.

Timber aged care building should be considered a viable alternative to steel frame construction.

A

Appendix A: Comparison Design: The Steel Framed Solution

A1 Internal and External Walls

Wall systems used in the timber solution:

- For all walls separating bed-sitters with bed-sitter, neighbouring bed-sitter bathrooms, corridors or common rooms: staggered stud walls used wall system Type 1 (refer Table A1).
- Remainder of internal walls are wall system Type 2 (refer Table A1).
- External walls are wall system Type 3 (refer Table A1).

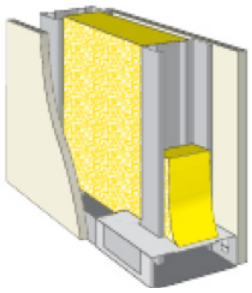
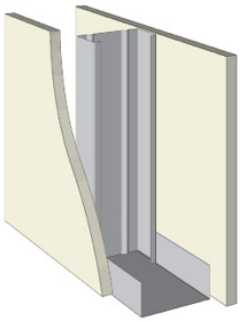
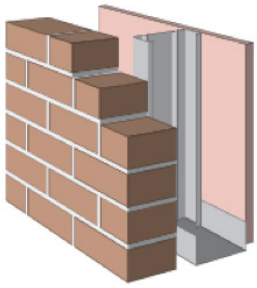
Wall Type	Diagram of Wall System	Description		Acoustic Rw	Fire rating
		Structural	Linings & Insulation		
1		Staggered stud walls consisting 92 track and 70 studs at 300 mm centres	13 mm impact grade plasterboard for the first 1,200 mm from floor with 13 mm standard grade plasterboard above this height. Moisture-resistant 13 mm plasterboard was used in wet areas. 75 mm non-combustible glass wool batts	47[1] Construction is Deemed-to-Satisfy	Construction is Deemed-to-Satisfy
2		90 mm steel track and stud wall framing	13 mm impact grade plasterboard for the first 1200 mm from floor with 13 mm standard grade plasterboard above this height.	No rating required	No rating required
3		90 mm steel track and stud wall framing	Inside: 13 mm impact grade plasterboard for the first 1200 mm from floor with 13 mm standard grade plasterboard above this height. Outside: Brick veneer	No rating required	No rating required

Table A1: Internal and external walls.

[1] CSR system 110

A2 Floor Structure

What was used in the timber solution:

- Floors
  - Internal floor general areas (excluding wet areas) – Type 1
  - Internal floor Wet areas – Type 2
  - External floor – Type 3.
  - Beams were used over opening in walls or rooms to break up the floor joist spans.

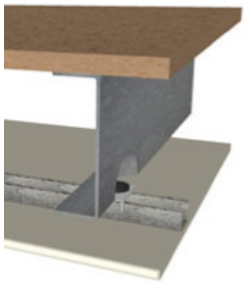
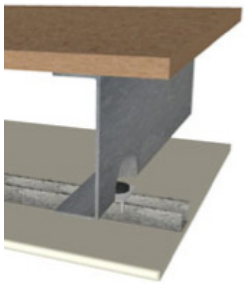
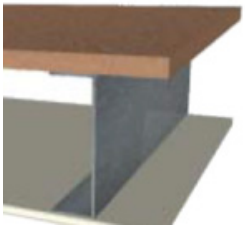
Type	Diagram of Floor System	Description	Acoustic		Fire rating
			Rw	Ln,w (Ci)	
1		• 240 mm deep C-section floor joist at 450 centre • Particleboard flooring to all interior areas • 19 mm fibre cement to all wet and balcony areas • Noise resilient ceiling mounted furring channel under joists • 13 mm standard plasterboard ceilings.	46[2]	NA	NA
2		• 240 mm deep C-section floor joist at 450 centre • Fibrecement based flooring to all interior wet areas • Noise resilient ceiling mounted furring channel under joists • 13 mm standard plasterboard ceilings.	46[2]	NA	NA
External		• 240 mm deep C-section floor joist at 450 centre • 19 mm fibre cement sheet. • 13 mm standard plasterboard ceilings	NA	NA	NA

Table A2: Floor Systems.

[2] Knaff Technical Manual Plasterboard System number KF34

A3 Roof/Ceiling Space to Top Most Storey

What was applied to the model:

- Floors
  - 75 mm non-combustible glass wool batts are used 1200 mm either side of the acoustic rated wall, refer Figure A1.

Reasons:

- All system used meets NCC minimum requirements
- Systems configuration between steel and timber are effectively the same.

How does this compare with the timber design?

- The system configuration is effectively the same for both materials considered in the cost comparison.
- All other cost has been assumed to be the same although there maybe variations, they were too insignificant to consider.

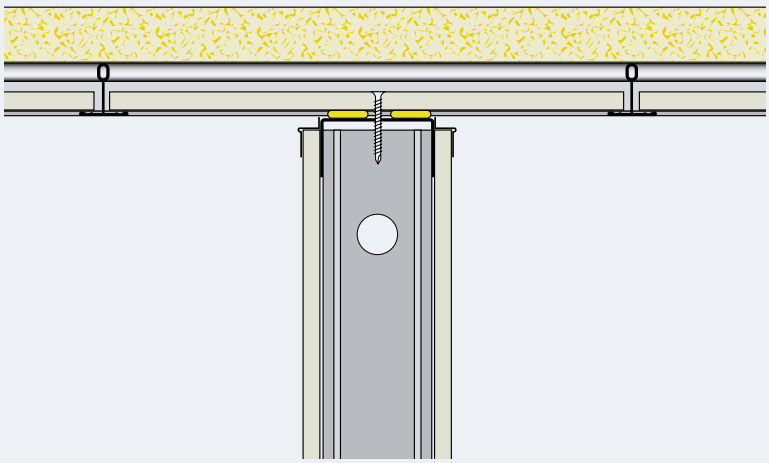
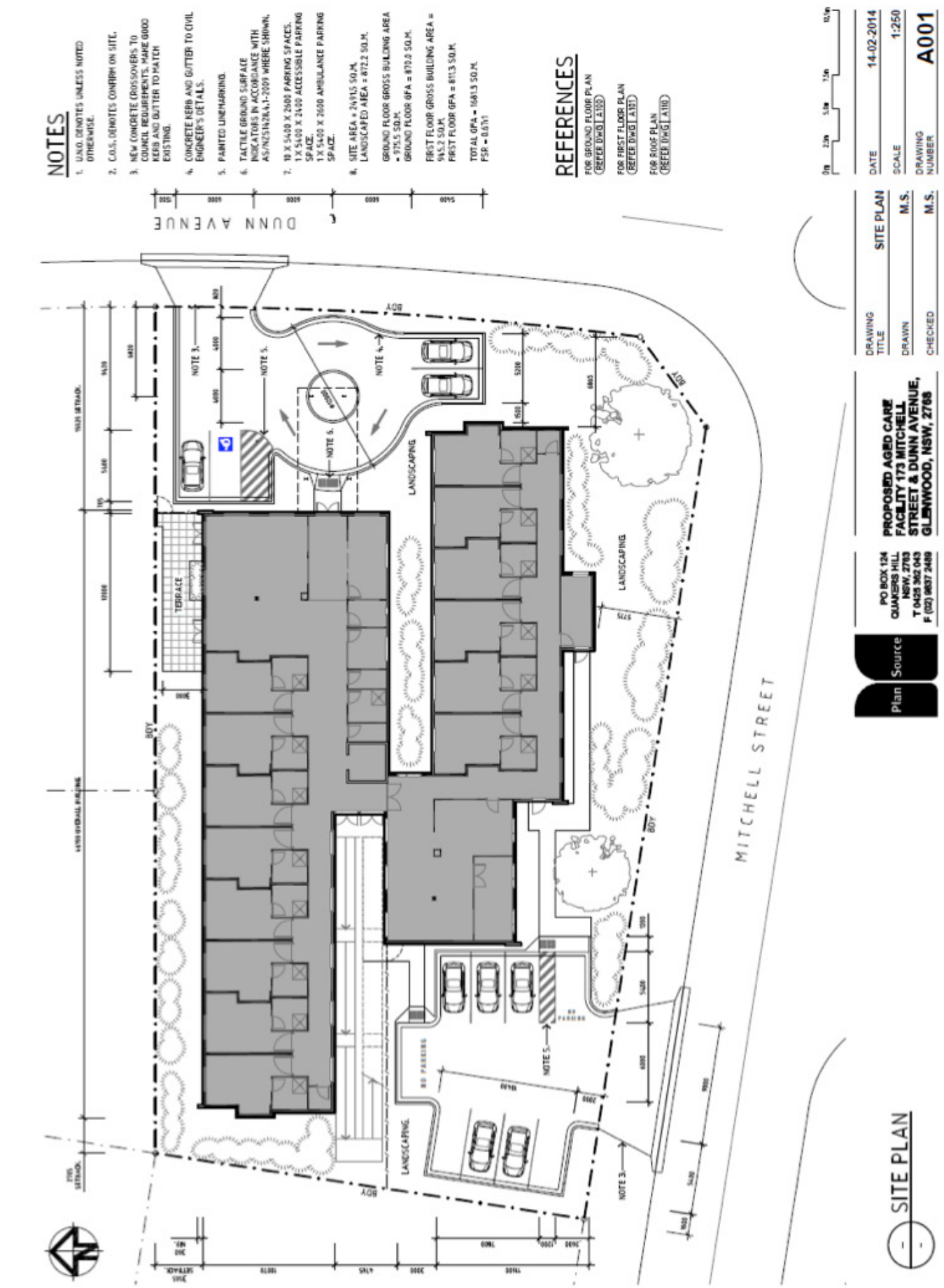
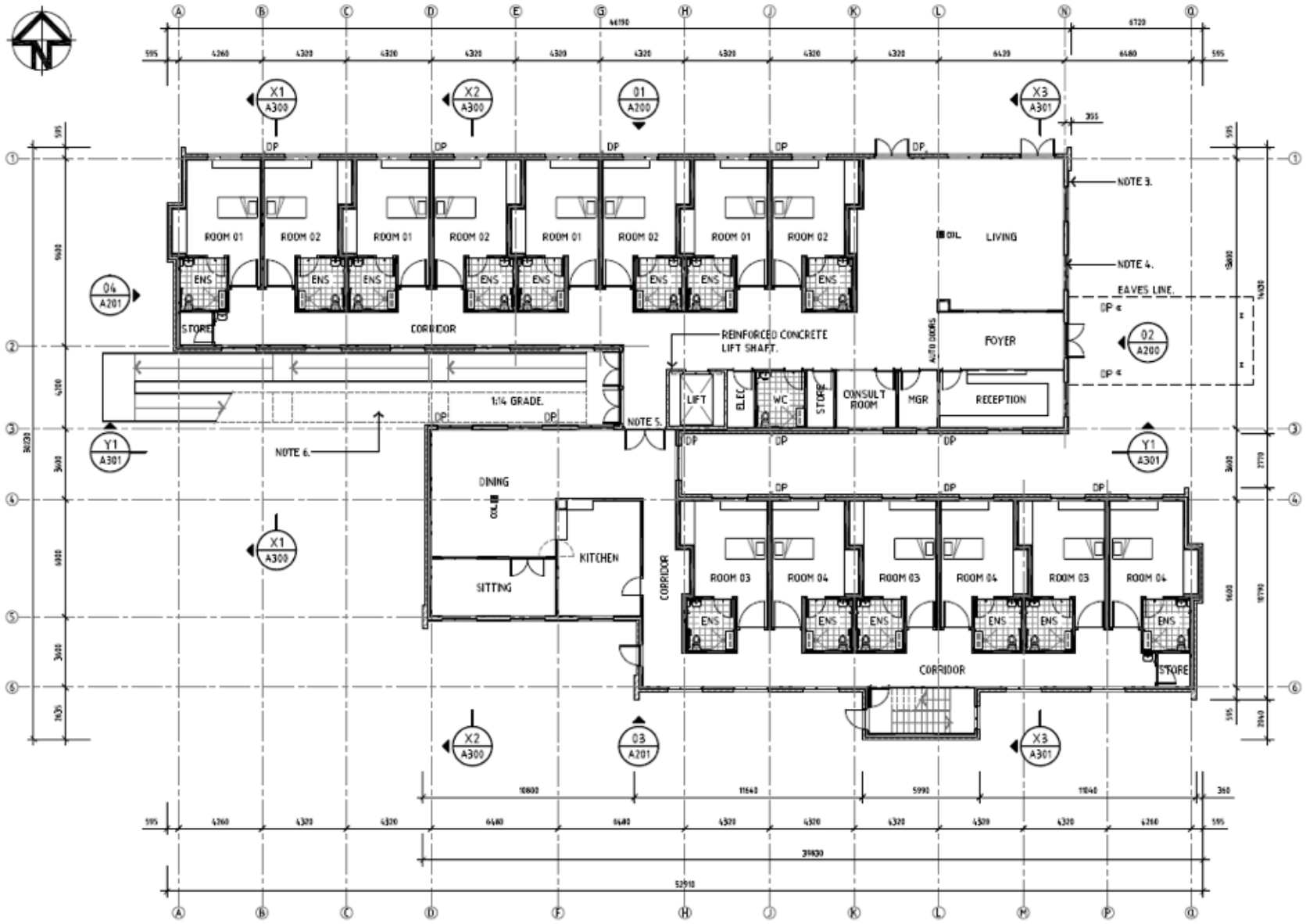


Figure A1: Sound rated insulation above top most ceiling.

[3] CSR system 110

Appendix B: Complete Architectural Drawings





NOTES

1. U.N.O. DENOTES UNLESS NOTED OTHERWISE.
2. C.O.S. DENOTES CONFIRM ON SITE.
3. BRICK VENEER WALL CONSTRUCTION TO GROUND FLOOR PERIMETER WALLS.
4. RYLOCK AA SERIES DOUBLE GLAZED WINDOWS & DOORS TYPICAL. BREEZEWAY LOUVRE WINDOW GALLERY INSERTS WHERE SHOWN.
5. SMOKE-PROOF WALLS AND SELF-CLOSING OR AUTOMATIC CLOSING -/60/30 FIRE DOORS IN THIS LOCATION TO BCA REQUIREMENTS.
6. REINFORCED CONCRETE ACCESS RAMP TO STRUCTURAL ENGINEERS DETAIL.

LEGEND

DP - DOWNPIPE.

REFERENCES

FOR EXTERNAL FINISHES SCHEDULE
REFER DWG | A200

FOR EXTERNAL DOOR & WINDOW SCHEDULE
REFER DWG | A300

DESIGN CRITERIA

A. BUILDING CLASSIFICATION: 9C AGED CARE BUILDING.

B. THE BUILDING SHALL BE CONSTRUCTED TO MEET THE REQUIREMENTS FOR TYPE C CONSTRUCTION IN ACCORDANCE WITH BCA CLAUSE C1.5 (B).

C. THE BUILDING SHALL BE PROTECTED THROUGHOUT WITH A SPRINKLER SYSTEM COMPLYING WITH BCA SPECIFICATION E1.5.

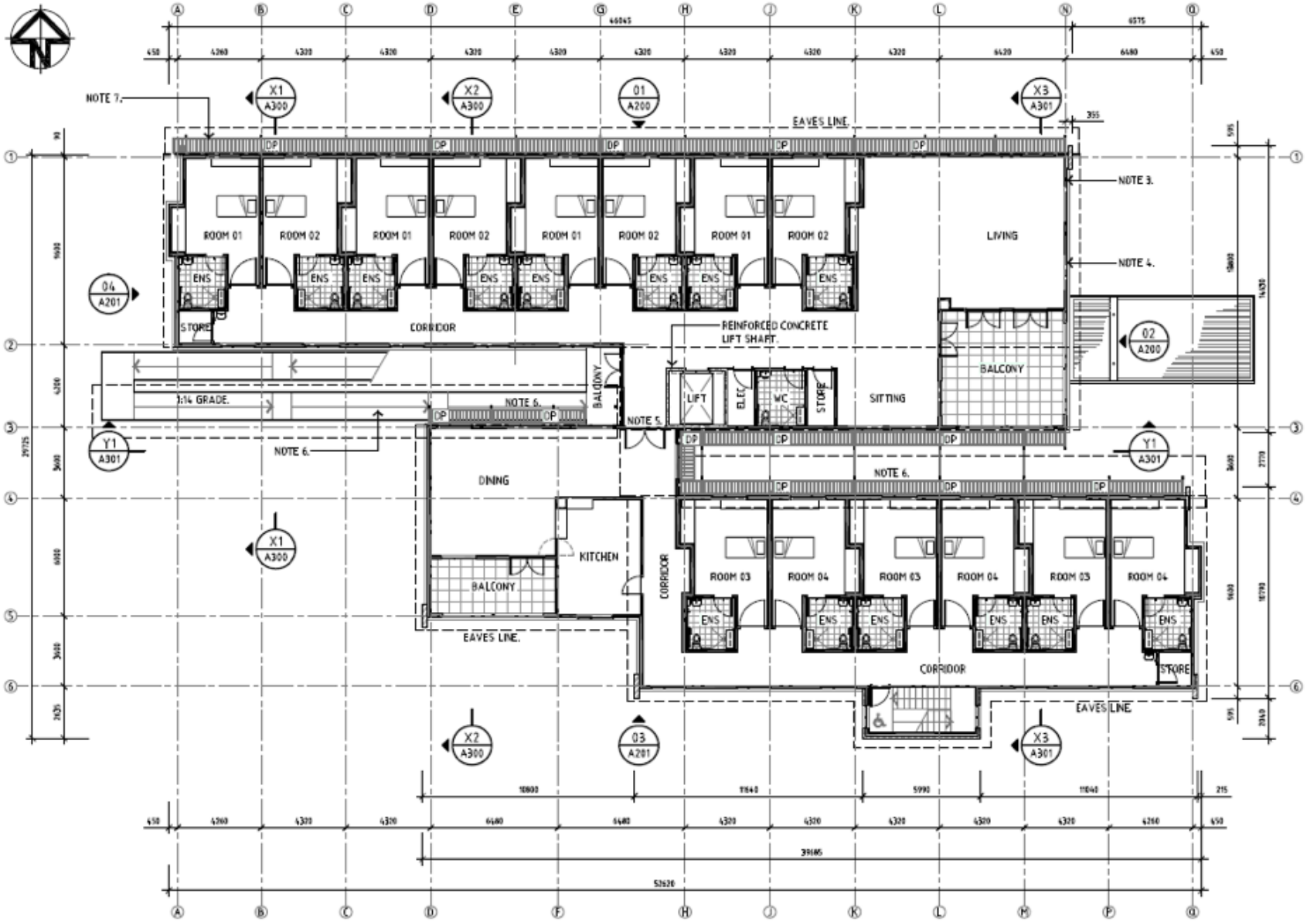
0m 2m 4m 6m 10m

OVERALL GROUND FLOOR PLAN

Plan Source
PO BOX 124
QUAKERS HILL
NSW, 2763
T 0425 362 043
F (02) 9837 2489

PROPOSED AGED CARE FACILITY 173 MITCHELL STREET & DUNN AVENUE, GLENWOOD, NSW, 2768

DRAWING TITLE	OVERALL GROUND FLOOR PLAN
DRAWN	M.S.
CHECKED	M.S.
DATE	14-02-2014
SCALE	1:200
DRAWING NUMBER	A100



NOTES

1. U.N.O. DENOTES UNLESS NOTED OTHERWISE.
2. C.O.S. DENOTES CONFIRM ON SITE.
3. CLAD FRAME WALL CONSTRUCTION TO FIRST FLOOR PERIMETER WALLS.
4. RYLOCK AA SERIES DOUBLE GLAZED WINDOWS & DOORS TYPICAL. BREEZEWAY LOUVRE WINDOW GALLERY INSERTS WHERE SHOWN.
5. SMOKE-PROOF WALLS AND SELF-CLOSING OR AUTOMATIC CLOSING -/60/30 FIRE DOORS IN THIS LOCATION TO BCA REQUIREMENTS.
6. REINFORCED CONCRETE ACCESS RAMP TO STRUCTURAL ENGINEERS DETAIL.
7. STRUCTURAL STEEL SUNSHADES & MAINTENANCE PLATFORMS.

LEGEND

DP - DOWNPIPE

REFERENCES

FOR EXTERNAL FINISHES SCHEDULE (REFER DWG | A200)

FOR EXTERNAL DOOR & WINDOW SCHEDULE (REFER DWG | A300)

FOR BUILDING DESIGN CRITERIA (REFER DWG | A100)

OVERALL FIRST FLOOR PLAN

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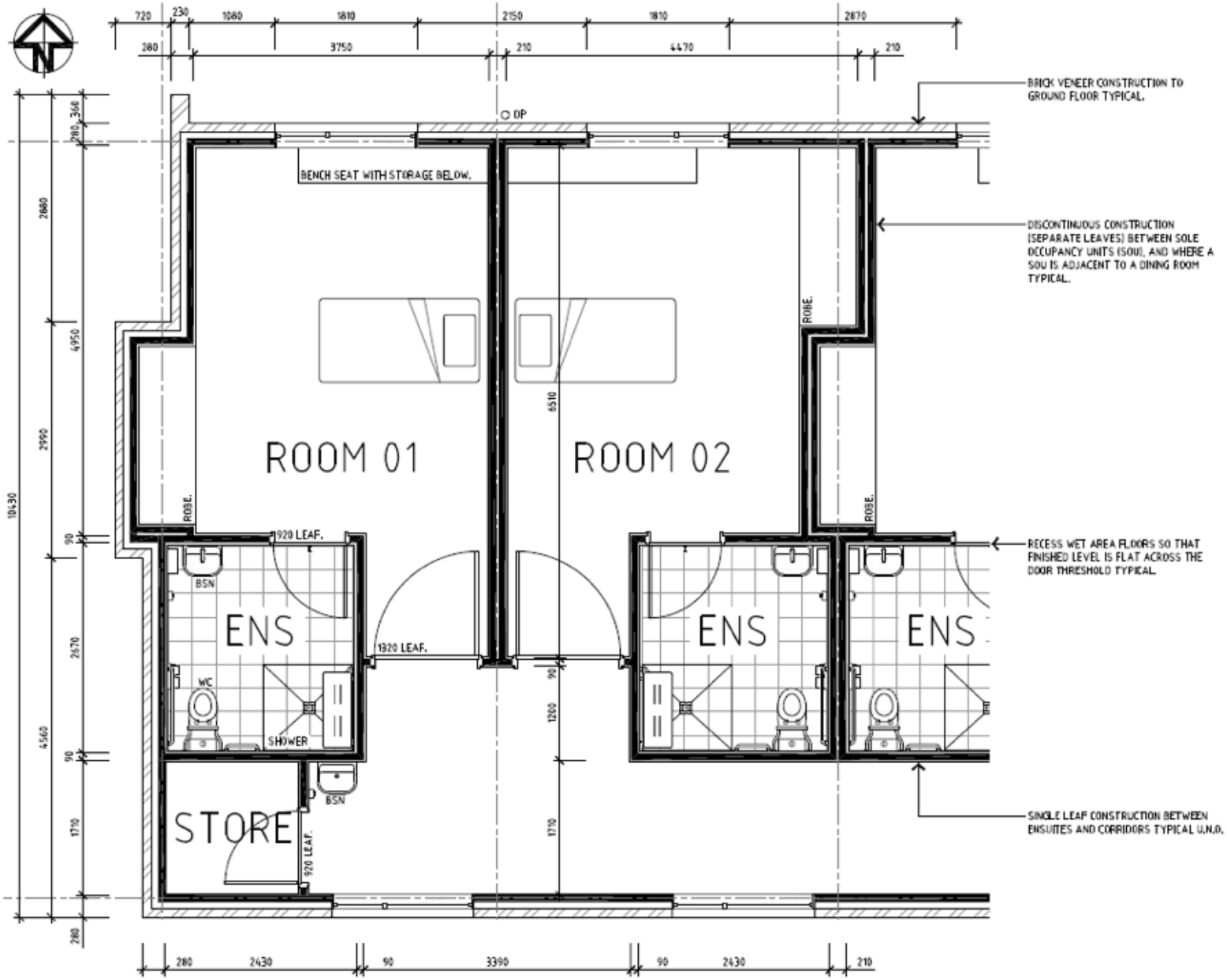
SCALE	1:200
DRAWING NUMBER	A101



NOTES

1. U.N.O. DENOTES UNLESS NOTED OTHERWISE.
2. C.O.S. DENOTES CONFIRM ON SITE.
3. SETOUT DIMENSIONS ARE MEASURED TO THE UNLINED FACE OF WALL FRAMING OR BRICKWORK.
4. GENERALLY ALL OPENINGS ARE SIZED TO SUIT STANDARD BRICKWORK MODULAR SIZES.

LEGEND

BSN - BASIN.
DP - DOWNPIPE.
WC - WATER CLOSET.

TYPICAL GROUND FLOOR RESIDENT ROOM PLAN

0m 0.5m 1.0m 1.5m 2.5m

Plan Source
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DRAWING TITLE	TYPICAL ROOM PLANS
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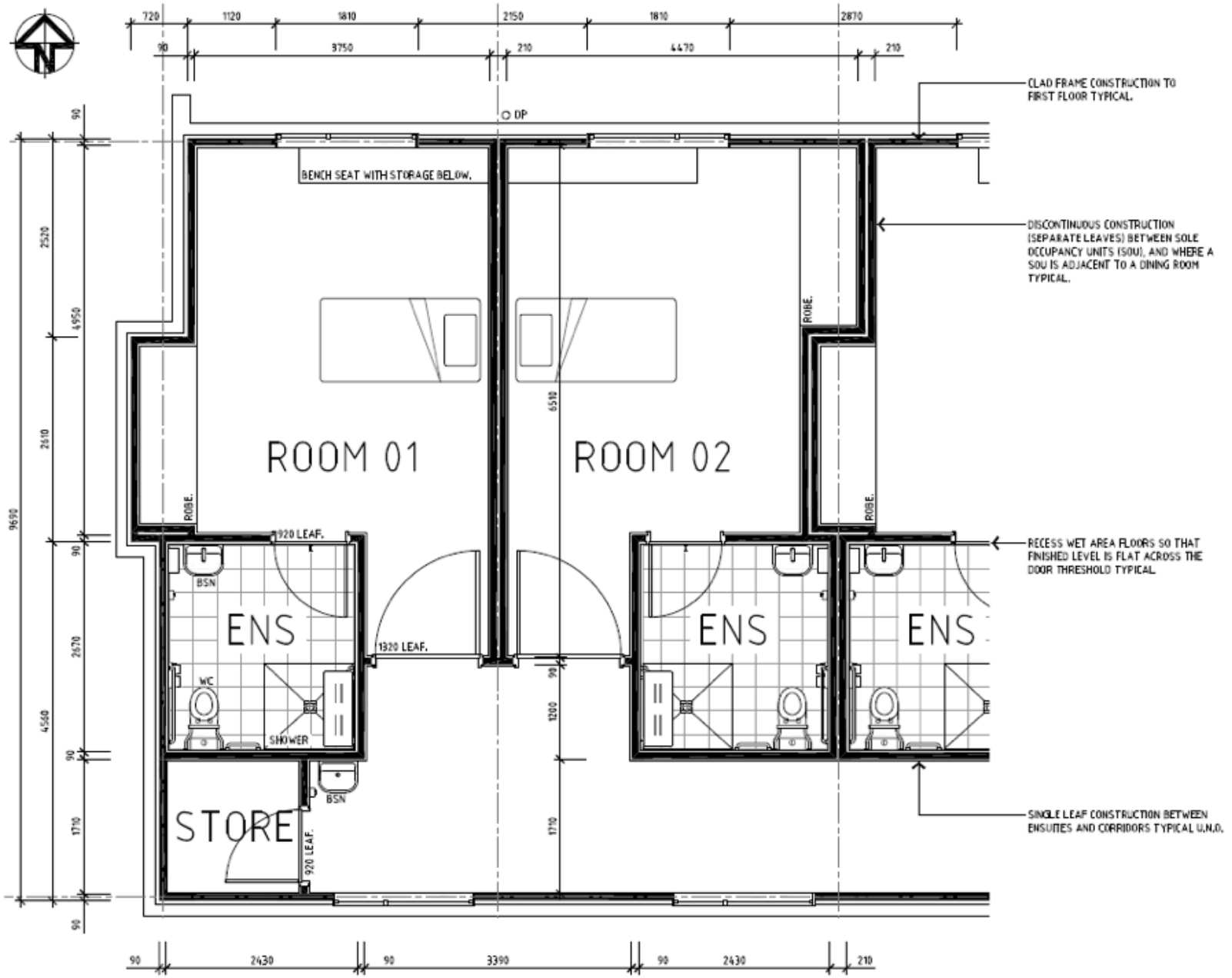
CHECKED	M.S.
DATE	14-02-2014
SCALE	1:50
DRAWING NUMBER	A102



NOTES

1. U.N.O. DENOTES UNLESS NOTED OTHERWISE.
2. C.O.S. DENOTES CONFIRM ON SITE.
3. SETOUT DIMENSIONS ARE MEASURED TO THE UNLINED FACE OF WALL FRAMING.

LEGEND

BSN - BASIN.
DP - DOWNPIPE.
WC - WATER CLOSET.

TYPICAL FIRST FLOOR RESIDENT ROOM PLAN

0m 0.5m 1.0m 1.5m 2.5m

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DRAWING TITLE	TYPICAL ROOM PLANS
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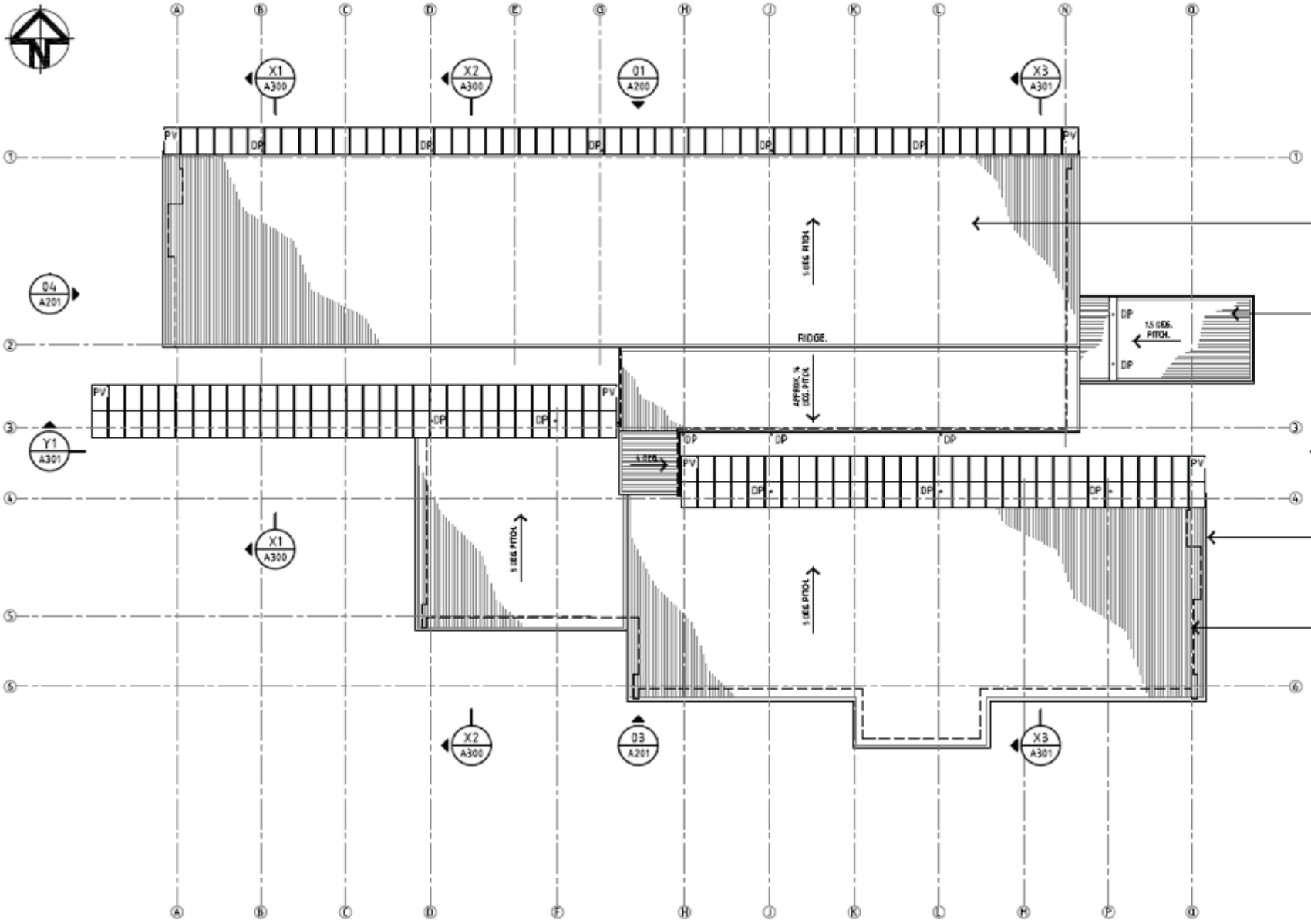
CHECKED	M.S.
DATE	14-02-2014
SCALE	1:50
DRAWING NUMBER	A103



NOTES

1. U.N.O. DENOTES UNLESS NOTED OTHERWISE.
2. C.O.S. DENOTES CONFIRM ON SITE.

LYSAGHT CUSTOM ORB 0.48mm BMT METAL DECK ROOFING TYPICAL U.N.O.

LYSAGHT KLIP-LOK 406 0.48mm BMT METAL DECK ROOFING TYPICAL FOR PITCHES LESS THAN 5 DEGREES.

COLORBOND FINISH GUTTERS, FLASHINGS & DOWNPIPES TYPICAL.

OUTLINE OF FIRST FLOOR WALLS BELOW.

LEGEND

DP - DOWNPIPE.
PV - PHOTVOLTAIC PANELS.

0m 2m 4m 6m 10m

ROOF PLAN

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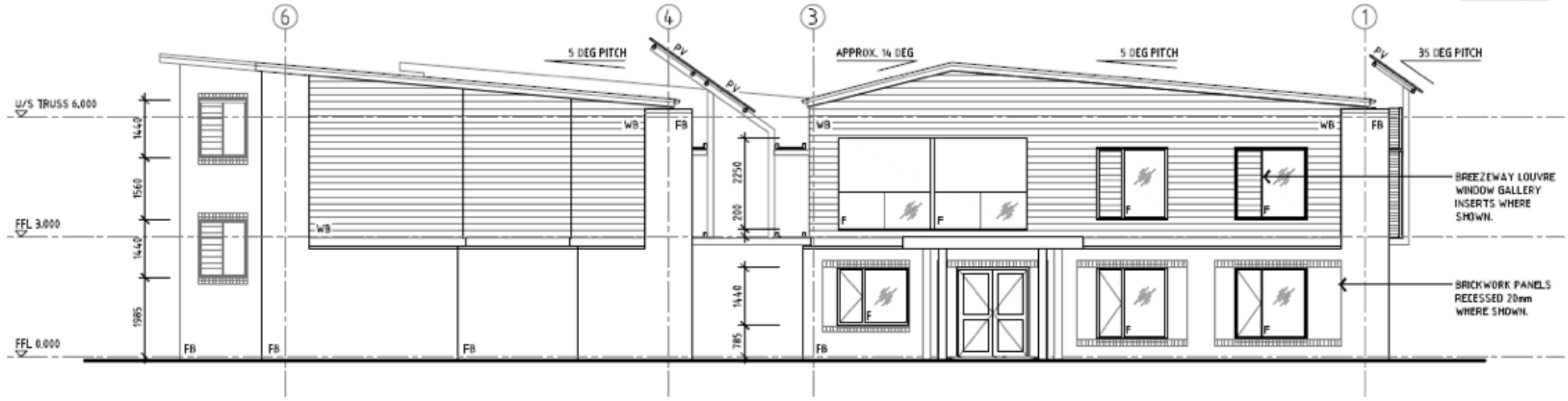
DRAWING TITLE	ROOF PLAN
DRAWN	M.S.
CHECKED	M.S.
DATE	14-02-2014
SCALE	1:200
DRAWING NUMBER	A110

NORTH ELEVATION (PARTIAL)



EAST ELEVATION

REFERENCES

FOR EXTERNAL DOOR & WINDOW SCHEDULE (REFER DWG | A300)

0m 1m 2m 3m 5m

LEGEND

DP – DOWNPIPE.
F – FIXED GLAZING.
FB – FACE BRICKWORK.
PV – PHOTVOLTAIC PANELS.
WB – WEATHERBOARD CLADDING.

EXTERNAL FINISHES SCHEDULE	
TAG	DESCRIPTION
FB	BOWRAL BRICKS MURRAY GREY & ST PAULS CREAM RECESSED PANELS
WB	WEATHERTEX PRIMELOK SHADOWOOD SMOOTH

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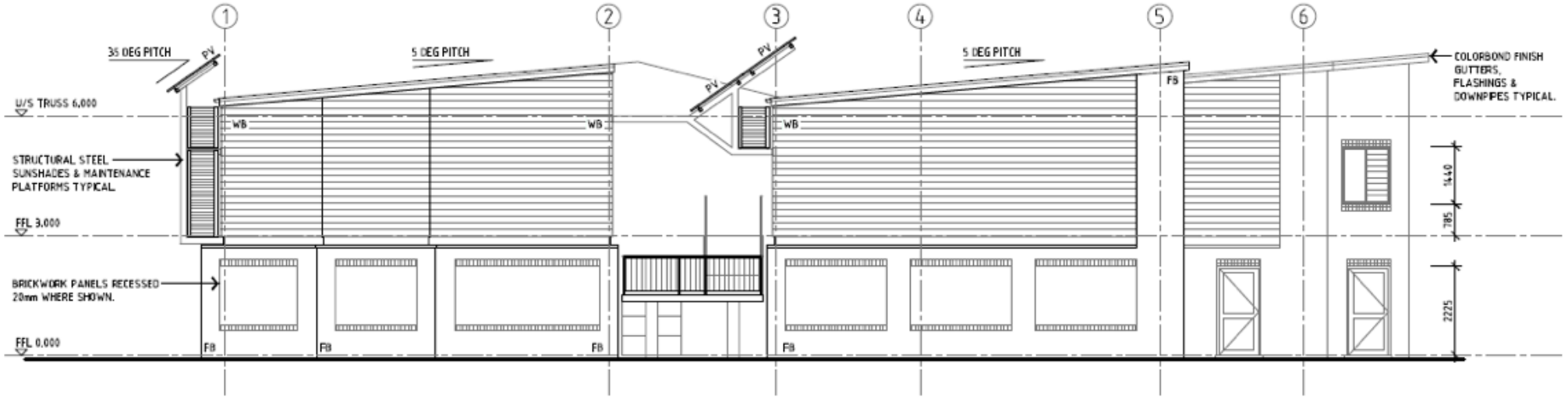
DRAWING TITLE	ELEVATIONS
DRAWN	M.S.
CHECKED	M.S.
DATE	14-02-2014
SCALE	1:100
DRAWING NUMBER	A200

SOUTH ELEVATION (PARTIAL)



WEST ELEVATION

0m 1m 2m 3m 5m

LEGEND

DP – DOWNPIPE.
F – FIXED GLAZING.
FB – FACE BRICKWORK.
PV – PHOTVOLTAIC PANELS.
WB – WEATHERBOARD CLADDING.

REFERENCES

FOR EXTERNAL FINISHES SCHEDULE
REFER DWG | A200

FOR EXTERNAL DOOR & WINDOW SCHEDULE
REFER DWG | A300

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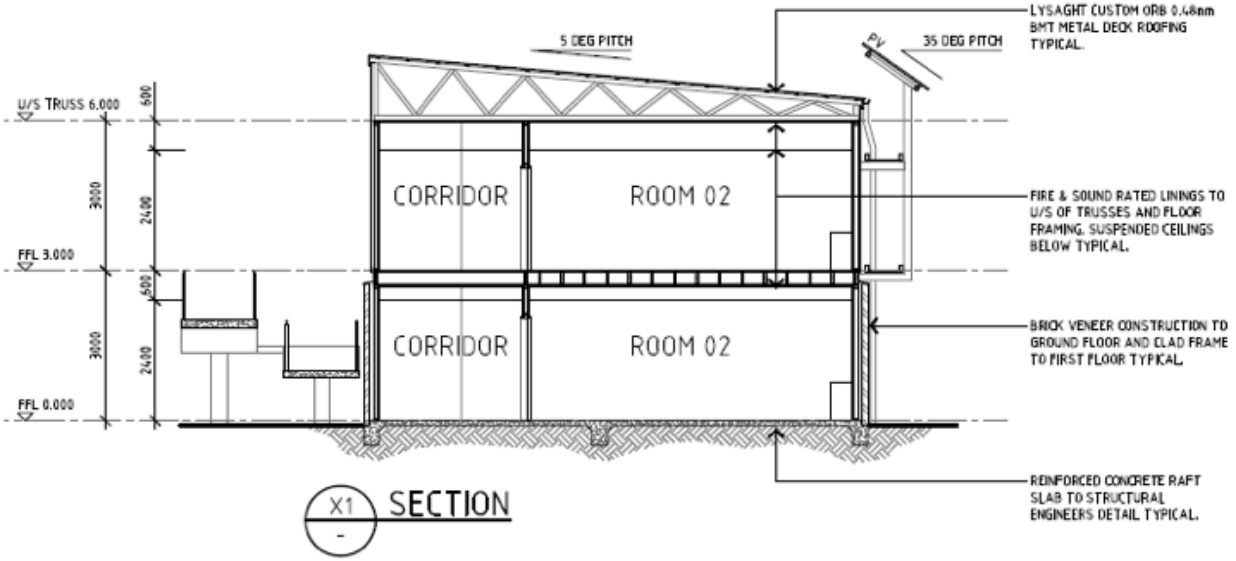
DRAWING TITLE	ELEVATIONS
DRAWN	M.S.
CHECKED	M.S.
DATE	14-02-2014
SCALE	1:100
DRAWING NUMBER	A201



X1 SECTION
-

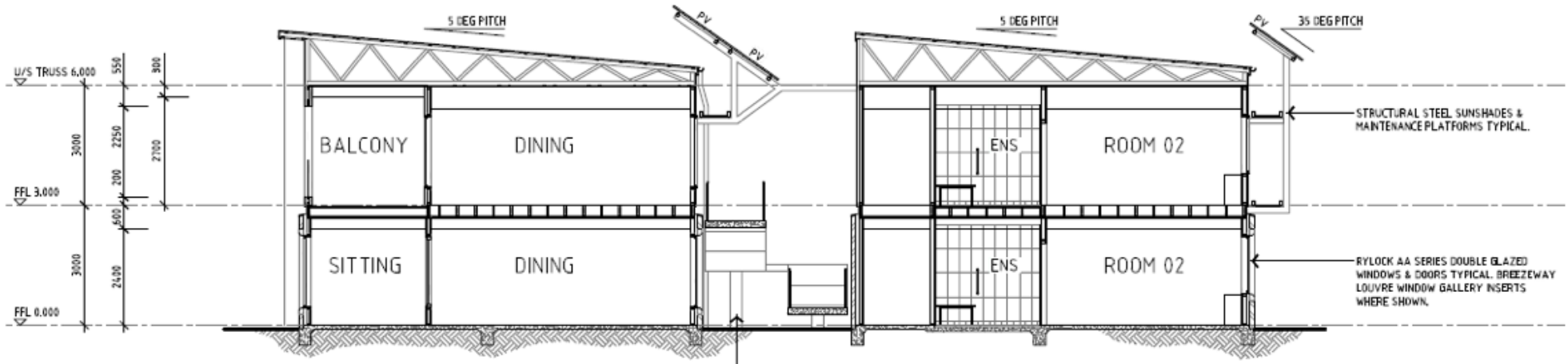
EXTERNAL DOOR & WINDOW SCHEDULE			
DESCRIPTION	QTY.	FRAME OPENING HEIGHT	FRAME OPENING WIDTH
FRENCH DOORS: LIVING, FOYER, CORRIDOR TO ACCESS RAMP, FIRST FLOOR BALCONIES	10	2240	1810
DOORS: SOUTHERN WING CORRIDOR & STAIRWELL	2	2240	1090
WINDOWS: RESIDENT ROOMS, RECEPTION, CORRIDOR OPPOSITE DINING ROOM, KITCHEN	34	1465	1810
WINDOWS: CORRIDOR, LIVING, DINING, CONSULT ROOM, SITTING ROOM, BALCONIES	41	1810	1810
MANAGER	1	1810	610
SOUTHERN WING STAIRWELL	3	1810	1210

LEGEND

DP - DOWNPIPE.
F - FIXED GLAZING.
FB - FACE BRICKWORK.
PV - PHOTVOLTAIC PANELS.
WB - WEATHERBOARD CLADDING.

REFERENCES

FOR EXTERNAL FINISHES SCHEDULE
(REFER DWG | A200)



X2 SECTION
-

0m 1m 2m 3m 5m

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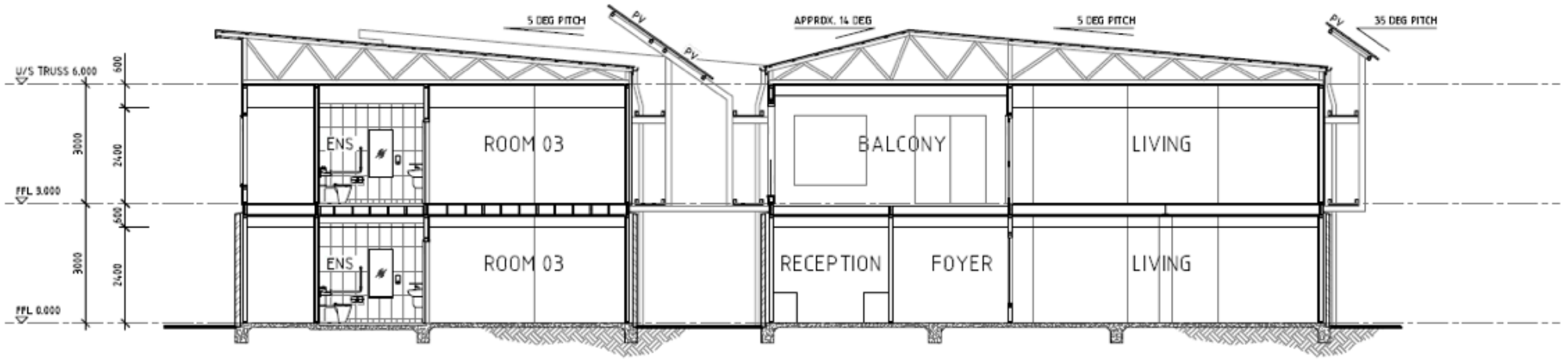
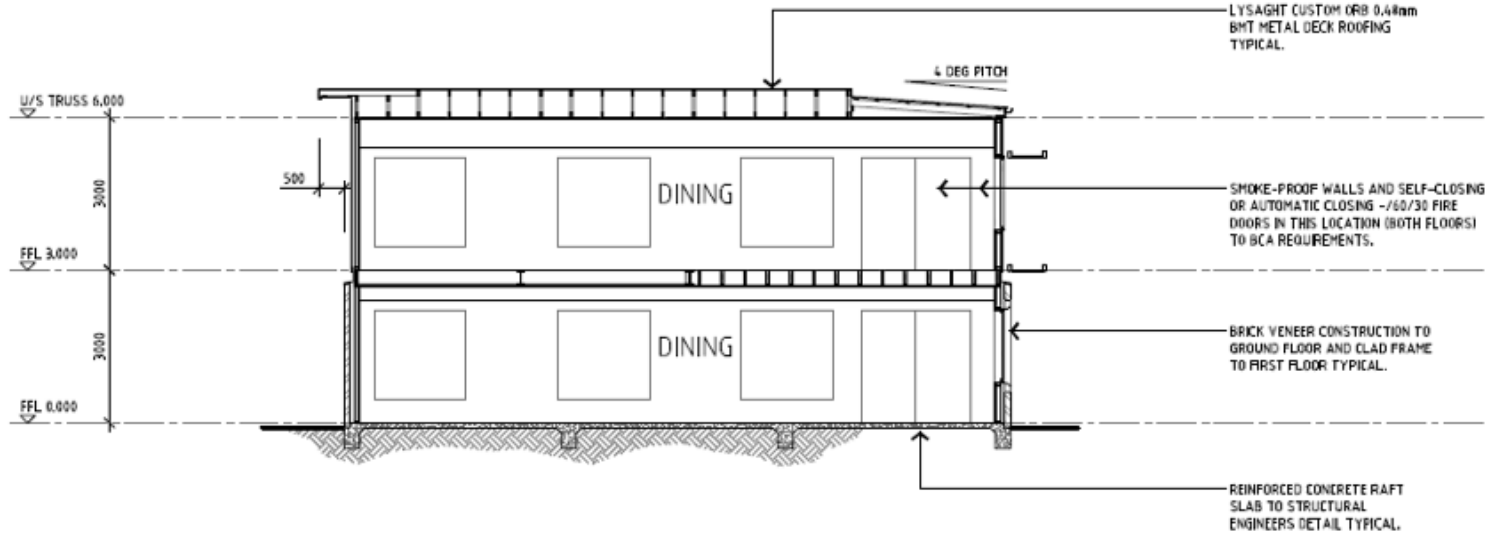
PROPOSED AGED CARE FACILITY 173 MITCHELL STREET & DUNN AVENUE, GLENWOOD, NSW, 2768

DRAWING TITLE	SECTIONS
DRAWN	M.S.
CHECKED	M.S.
DATE	14-02-2014
SCALE	1:100
DRAWING NUMBER	A300



X3 SECTION



Y1 SECTION

LEGEND

DP - DOWNPIPE.
F - FIXED GLAZING.
FB - FACE BRICKWORK.
PV - PHOTVOLTAIC PANELS.
WB - WEATHERBOARD CLADDING.

REFERENCES

FOR EXTERNAL FINISHES SCHEDULE
REFER DWG | A200

FOR EXTERNAL DOOR & WINDOW SCHEDULE
REFER DWG | A300

0m 1m 2m 3m 5m

Plan Source
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PROPOSED AGED CARE FACILITY 173 MITCHELL STREET & DUNN AVENUE, GLENWOOD, NSW, 2768

DRAWING TITLE	SECTIONS
DRAWN	M.S.
CHECKED	M.S.
DATE	14-02-2014
SCALE	1:100
DRAWING NUMBER	A301

Appendix B: Detailed Cost Information

Project Name: **Aged Care Building - Timber Framed**

Client Name: Timber Development Association for Forest and Wood Products Australia

Element		$/m² GFA	Quantity	Unit	Unit Rate ($)	Cost ($)
Aged Care - Timber Framed			**1,501**	**m²**	**$464.37**	**$697,020**
Columns		**$1.76**				**$2,646**
1	115 x 115 LVL15 column, 3,000 long (14No.), including protective treatment	$1.76	42	m	$63	$2,646
Upper Floors		**$326.92**				**$4,254,500**
1	Beam; 3/300 x 58 LVL 15, Ref B1, 3,000 long; including protective treatment	$0.37	1	No.	$561	$561
2	Beam; 2/240 x 42 LVL 15, Ref B2, 3,000 long; including protective treatment	$0.72	4	No.	$270	$1,080
3	Beam; 2/240 x 58 LVL 15, Ref B3, 3,000 long; including protective treatment	$1.32	6	No.	$330	$1,980
4	Beam; 170 x 58 LVL 15, Ref B4, 2,000 long; including protective treatment	$0.31	5	No.	$94	$470
5	Beam; 2/240 x 42 LVL 15, Ref B5, 4,000 long; including protective treatment	$0.48	2	No.	$360	$720
6	Beam; 240 x 75 LVL 15, Ref B6, 3,500 long; including protective treatment	$0.47	3	No.	$235	$705
7	Beam; 2/240 x 75 LVL 15, Ref B7, 4,000 long; including protective treatment	$0.71	2	No.	$536	$1,072
8	SmartJoist SJ36090 to Upper Floors	$8.04	345	m	$35	$12,075
9	SmartJoist SJ20044 to Upper Floors	$29.63	1779	m	$25	$44,475
Roof		**$172.96**				**$259,611**
1	Prefabricated timber truss, 13,700 long, unequal pitch 5 degrees and 14 degrees, Dwg A301 Section X3	$55.96	40	No.	$2,100	$84,000
2	Prefabricated timber truss, 9,600 long, pitch 5 degrees, 600 overhang at head, Dwg A301 Section X3	$57.16	78	No.	$1,100	$85,800
3	Prefabricated timber truss, 12,100 long, pitch 5 degrees	$13.10	13	No.	$1,512.50	$19,663
4	Prefabricated timber truss, 9,600 long, pitch 5 degrees, Dwg A300 Section X1	$28.58	39	No.	$1,100	$42,900
5	Prefabricated timber truss, 3,000 long, pitch 4 degrees, Dwg A301 Section Y1	$2.24	7	No.	$481.25	$3,369
6	Timber bracing to trusses	$15.91	597	m	$40.00	$23,880

Project Name: **Office Building - Timber Framed**

Client Name: Timber Development Association for Forest and Wood Products Australia

Element		$/m² GFA	Quantity	Unit	Unit Rate ($)	Cost ($)
External Walls		**$106.83**				**$160,350**
1	90 x 35 treated softwood stud members	$100.75	5041	m	$30	$151,230
2	90 x 35 treated softwood stud members, bolted to concrete	$6.08	228	m	$40	$9,120
Internal Walls		**$140.76**				**$211,275**
1	90 x 35 treated softwood stud members	$76.57	3831	m	$30	$114,930
2	90 x 35 treated softwood stud members, bolted to concrete	$9.94	373	m	$40	$14,920
3	70 x 45 treated softwood stud members	$50.75	3047	m	$25	$76,175
4	70 x 35 treated softwood stud members, bolted to concrete	$3.50	150	m	$35	$5,250
Preliminaries Adjustment		**$0**				**$0**
	Provision of time related preliminaries based on the duration of structure construction time.					
	Preliminaries based on reduced Construction duration of:	$0.00	0			$0
Total Cost						**$697,020**

Notes

1. The cost estimates are priced at September 2014 prices and based on construction in the Sydney Region.
2. Timber Frame construction will have a marginally faster construction program than Steel, but this has been ignored in this comparison.
3. The timber frame rates are based on feedback from the Sydney market.

Client Name: Timber Development Association for Forest and Wood Products Australia

Element		$/m² GFA	Quantity	Unit	Unit Rate ($)	Cost ($)
Aged Care - Steel Framed			**1,501**	**m²**	**$539.39**	**$809,620**
Columns		**$2.22**				**$3,330**
1	89 x 89 x 3.5 SHS column, 3,000 long; 9.06kg/m (10No.)	$1.42	30	m	$71	$2,130
2	Fire rated cladding to structural steel columns	$0.80	12	m²	$100	$1,200
Upper Floors		**$150.80**				**$226,357**
1	Beam; 180UB16.1, Ref B1, 3,000 long	$0.22	1	No.	$330	$330
2	Beam; Stramit B23519; RHS 125 x 75 x 3.0; Ref B2, 3,000 long; 24kg/m	$1.51	4	No.	$567	$2,268
3	Beam; Stramit B23519; RHS 125 x 75 x 3.0, Ref B3, 3,000 long; 24kg/m	$2.27	6	No.	$567	$3,402
4	Joist; Stramit B23519, RHS 125 x 75 x 3.0; Ref B4, 2,000 long, 24kg/m	$1.26	5	No.	$378	$1,890
5	Beam; 150UB14, Ref B5, 4,000 long	$0.51	2	No.	$382	$764
6	Beam; Stramit B23519; RHS 125 x 75 x 3.0, Ref B6, 3,500 long; 24kg/m	$1.32	3	No.	$662	$1,986
7	Beam; 180UB16.1, Ref B7, 4,000 long	$0.69	2	No.	$516	$1,032
8	Joist; Stramit J28324; 283 x 64; to Upper Floors, 8.04kg/m	$14.48	345	m	$63	$21,735
9	Joist; Stramit J28319; 283 x 64; to Upper Floors, 6.37kg/m	$59.26	1779	m	$50	$88,950
10	Intumescent sprayed fire protection to structural steelwork (excluding columns).	$69.29	1,600	m²	$65	$104,000
Roof		**$200.29**				**$300,635**
1	Prefabricated steel truss, 13,700 long, unequal pitch 5 degrees and 14 degrees, Dwg A301 Section X3	$66.62	40	No.	$2,500	$100,000
2	Prefabricated steel truss, 9,600 long, pitch 5 degrees, 600 overhang at head, Dwg A301 Section X3	$64.96	78	No.	$1,250	$97,500
3	Prefabricated steel truss, 12,100 long, pitch 5 degrees	$19.49	13	No.	$2,250	$29,250
4	Prefabricated steel truss, 9,600 long, pitch 5 degrees, Dwg A300 Section X1	$35.08	39	No.	$1,350	$52,650
5	Prefabricated steel truss, 3,000 long, pitch 4 degrees, Dwg A301 Section Y1	$2.22	7	No.	$475	$3,325
6	Steel bracing to trusses	$11.93	597	m	$30	$17,910
7	Intumescent sprayed fire protection to structural steelwork (excluding Columns).	$0	-	m²	$0	excl.

Project Name: **Aged Care Building - Steel Framed**

Client Name: Timber Development Association for Forest and Wood Products Australia

Element		$/m² GFA	Quantity	Unit	Unit Rate ($)	Cost ($)
External Walls		**$77.99**				**$117,058**
1	92 steel stud members	$73.89	5041	m	$22	$110,902
2	92 steel stud members, bolted to concrete	$4.10	228	m	$27	$6,156
Internal Walls		**$108.09**				**$162,240**
1	92 steel stud members	$56.15	3831	m	$22	$84,282
2	92 steel stud members, bolted to concrete	$6.71	373	m	$27	$10,071
3	76 steel stud members	$42.63	3047	m	$21	$63,987
4	76 steel stud members, bolted to concrete	$2.60	150	m	$26	$3,900
Preliminaries Adjustment		**$0**				**$0**
	Provision of time related preliminaries based on the duration of structure construction time.					
	Preliminaries based on reduced Construction duration of:	$0	0	Weeks		$0
Total Cost						**$809,620**

Notes

1. The cost estimates are priced at September 2014 prices and based on construction in the Sydney Region.
2. Timber Frame construction will have a marginally faster construction program than Steel, but this has been ignored in this comparison.
3. The timber frame rates are based on feedback from the Sydney market.

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