REF 6 - Molecular Imaging

Plantroom Structural Report

RPAH Stage 1 Redevelopment

Prepared for CPB Contractors Pty Ltd / 05 June 2024

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Contents

1.0 Introduction

The REF6 Molecular Imaging Plantroom project involves the construction of a new covered plant area on the existing Level 6 slab within Area D of Building 89. The plantroom expansion will utilise the existing roof slab at Level 6 with a new lightweight roof to be built over this.

The extent of the plantroom expansion superimposed on the existing Level 6 slab Outline Plan can be seen in Figure 1.

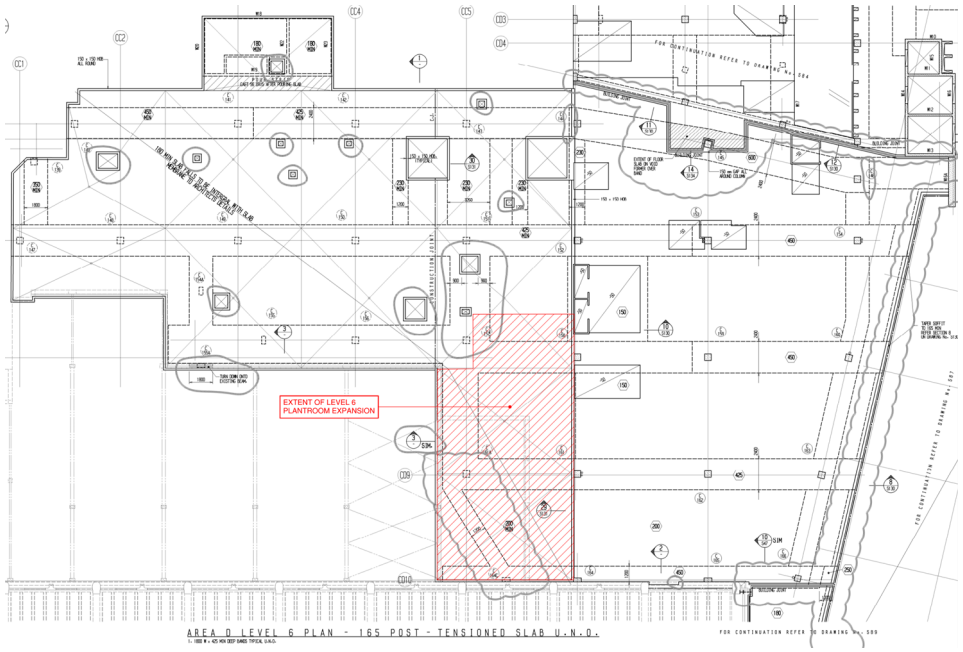

Figure 1 – Extent of Level 6 Plantroom Expansion

2.0 Proposed Structure

To minimise additional loads on the existing structure and foundations, the roof will be constructed in a relatively lightweight manner with structural steel rafters supporting steel purlins and metal roof sheeting. The western side of the roof is supported by steel columns which have generally been aligned with the existing reinforced concrete columns below Level 6. The eastern side of the roof is supported by fixing to the existing Level 7 slab. The roof is isolated from the building to the south with a permanent joint. Weather proofing of this joint by the architect will be crucial.

The roof has been designed for minimal access loads for maintenance access only in accordance with the loading requirements set out in Section 5.1.

The existing Level 6 slab was originally designed for a Live Load of 3.0kPa. The slab is not structurally sufficient to support prescribed plantroom loads of 5.0kPa in accordance with AS1170.1. The mechanical engineer must ensure that specification and setout of plant room equipment (including plinths) does not exceed 3.0kPa on any areas of the floor. It would be recommended that signage be installed within the plantroom to identify this load restriction.

It is understood that penetrations are required through the existing Level 6 slab for services reticulation. Penetrations through the existing post-tensioned banded slab must be carefully reviewed and approved by the Structural Engineer to ensure that the capacity of the retained slab is not compromised.

It is noted that the construction of the Level 6 plantroom expansion will inhibit the construction of any future vertical expansions over this area. Any further future vertical expansion would require the removal of the new steel columns and partial demolition of the new roof.

3.0 Existing Structures

The Level 6 Plantroom expansion sits on the existing Level 6 roof slab of Building 89. The existing Building 89 was designed and constructed between 1998 and 2002. Relevant structural design codes at the time of design were:

- AS 3600-1994 – Concrete Structures
- AS 4100-1998 – Steel Structures
- AS 1170-1989 – Part 0 – General principles
- AS 1170-1989 – Part 1 – Dead and Line Loads
- AS 1170-1989 – Part 2 – Wind actions
- AS 1170-1993 – Part 4 – Earthquake actions in Australia

The existing building was designed to accommodate two additional future levels. Existing columns and foundations below the new structure have generally been found to be adequate to support the increase in gravitational loads based on the proposed structural scheme as shown in Appendix A. As noted in Section 2.0, the existing roof slab was designed for a live load of 3.0kPa and so the mechanical engineer must ensure that specification of plant room equipment does not exceed a floor load of 3.0kPa.

Earthquake actions are predominantly the governing design criteria for the lateral stability of the existing building. The loadbearing elements of Building 89, including columns, walls and foundations, were originally designed for two additional levels in accordance with the loading code and design standards at the time (i.e. AS 1170.4-1993 and AS 3600-1994). It is however noted that substantial changes have been made to the relevant loading code (AS 1170.4-2007) and the concrete design standard (AS 3600-2018) since the time of construction that mean the existing structure below the plant room expansion will not comply with the current code requirements due to higher demand requirements and prescriptive restrictions on the seismic detailing and capacity.

As compliance with current loading and design standards for new buildings is not retrospectively achievable, TTW has taken the following approach to satisfy an acceptable seismic performance for the existing structure:

- The part of Building 89 supporting the plantroom expansion (“Area D”) has been analysed assuming current earthquake loads are applied to the existing structural arrangement (i.e. no vertical extension) to determine the demand on the existing structure.
- The same area of Building 89 has been analysed with the additional floors to assess the relative increase in seismic demand on the lateral load resisting elements including shear walls and frames.
- Further analyses have then been carried out with strengthening works added as part of the new works to supplement the existing structure such that the demand on the existing structure is not increased and the capacity of the existing structure is not reduced.
- The seismic capacity of the existing structure was assessed in accordance with AS 3826-1998 for the threshold 2/3 of design earthquake load required for new buildings as compliance with full EQ loading per AS 1170.4-2007 is retrospectively unachievable for the existing structure. AS3826 is regularly cited by Australian Engineering bodies as an appropriate approach to be adopted on existing structures. Both the Australian Earthquake Engineering Society (AEES) and the Association of Consulting Structural Engineers have guidance on its application. However, AS3826 was withdrawn by Standards Australia on the 6 June 2019 and has not been superseded by any other code of practice in Australia.

We understand there is no change in building use. In this case, for modifications to the building, Clause 143 of the EP+A Regulations 2000 requires that the “fire protection and structural capacity of the building will not be reduced”. The adopted approach, as outlined above, aims to address the compliance with this regulation as well as AS:3826-1998 from lateral load (earthquake) perspective.

Fire resistance levels of the existing structure relating to the Level 6 plantroom expansion have been reviewed relative to new and original design codes and assessed in collaboration with the fire engineer. Some changes in codes will result in different FRL’s when assessed to current codes. Under fire conditions, the additional vertical loads will not reduce the existing fire rating of the structural elements.

All new structural elements will be designed to meet the current requirements of the NCC and the current relevant Australian Standards.

4.0 Fire Strategy

The BCA type of construction required for this building will be Type A. Fire Resistance Levels (FRLs) for the new structural elements will need to be in accordance with Specification C1.1 of the BCA. Typically, the FRL for concrete structural elements and fire protected structural steel elements will be 120/120/120.

Fire separation between the plantroom and adjacent clinical spaces will be required via fire rated walls to be documented by the architect.

New structural steel columns will require a protective coating system to achieve the required FRLs.

5.0 Structural Design Criteria

5.1 Loads

In general, all loads and load combinations shall comply with AS/NZS 1170 Parts 0 to 4 Structural Design Actions. Live load reductions will be applied as permitted by AS/NZS 1170.1. Generally, the loads to be considered in the design of new elements are specified in the following sections and on the structural drawings contained within Appendix A. The plant live load on the Level 6 slab must not exceed the reduced loads shown below to ensure the capacity of the existing slab is not exceeded.

Permanent Actions – Dead Loads

Dead load shall be considered as the self-weight of the structure plus an allowance for services, toppings, walls and ceilings which vary significantly throughout the site.

The additional dead loads should not be less than the following:

Area	Services, ceilings, partitions etc.
Non-trafficable concrete roof (no steel roof over)	1.0 kPa

No façade or masonry wall loading is included in the above loads. We have allowed for a façade loading of 1.2 kPa which equates to approximately 5kN/m depending on the floor to floor heights. It is assumed that all internal partitions will be of lightweight stud construction.

Imposed Actions – Live Loads

Design live loads should not be less than the following;

Area	Uniformly Distributed Actions	Concentrated Actions
Plant Area	3.0 kPa	2.7 kN
Non-trafficable Roof	0.25 kPa	1.4 kN

Pattern loading will be considered when determining worst case scenarios for strength and serviceability where required by AS1170. Live load reductions will be considered for columns, walls and footing design in accordance with AS1170.1. No live load reductions are to be applied to any floor system elements.

Barriers

Barriers including parapets, balustrades and railings are to be designed in accordance with Table 3.3 of AS/NZS 1170.1.

Wind Loads

Wind loads are in accordance with AS1170.2 and based on the following parameters:

Wind Load Parameters	
Region	A2
Importance Level (BCA Table B1.2a)	4
Annual probability of exceeding (BCA Table B1.2b)	1:2500 (ultimate) 1:25 (serviceability)
Regional Wind Speed: Ultimate limit state Serviceability limit state	V_{2500} = 48m/s V_{25} = 37m/s
Terrain Category (all directions)	3

Earthquake Loads

Earthquake loadings shall be in accordance with AS1170.4 – 2007 (Earthquake actions in Australia) and AS/NZS1170.0 – 2002 and based on the following parameters:

Earthquake Load Parameters	
Hazard Factor (Z)	0.08
Site Sub-Soil Class	Ce
Importance Level (BCA Table B1.2a):	4
Annual probability of exceedance (BCA Table B1.2b)	1:2500
Site Sub-Soil Class	Ce
Earthquake Design Category	III

5.2 Serviceability

Deflection Limits

Deflection limits for the concrete structures are generally as follows;

	Maximum floor deflection			
	Dead	**Incremental**	**Live**	**DL + LL**
Floor areas	Span/360 (20mm max)	N/A	Span/500	Span/300 (25mm max)

Durability

For concrete elements this will be achieved by specifying all elements in accordance with section 4 of AS 3600 which sets out requirements for plain, reinforced and post tensioned concrete structures and members with a design life of 40 to 60 years. Exposure classifications are as follows;

Exposure Classification	Elements
A2	Internal
B1	External

Protective coatings to structural steel elements shall comply with AS/NZS 2312 and ISO 2063 for the long-term protection category.

5.3 Design Standards

New structural elements will be designed in accordance with the latest revision of all relevant Australian Design Standards, the Building Code of Australia and other statutory requirements. As a minimum requirement, the design shall be based on, but not limited to;

Number	Edition	Title
AS/NZS 1170.0	2002	Structural design actions Part 0: General Principles
AS/NZS 1170.1	2002	Structural design actions Part 1: Permanent, imposed and other actions
AS/NZS 1170.2	2002	Structural design actions Part 2: Wind Actions
AS 1170.4	2007	Structural design actions Part 4: Earthquake loads
AS 3600	2018	Concrete Structures
AS 4100	2020	Steel Structures
HI Design Guidance Note 1	Rev B 30 May 2018	Structural Design Criteria Guidelines

6.0 Construction Considerations

The hospital will continue to function during the construction of the Level 6 plantroom expansion. It is therefore important that any disruption to the services provided by the existing buildings is kept to a minimum. Key construction considerations relating to the Level 6 Plant Room expansion include:

- *Existing roof slab capacity*. The existing roof slab at Level 6 has a limited load capacity of 3.0kPa. Construction operations must ensure that temporary loading from plant or materials does not exceed 3.0kPa.
- *Disruption to existing hospital operations*. Installation of the new structural steelwork and demolition for new slab penetrations will require noisy and dusty drilling and cutting of existing concrete. It is likely that some clinical spaces will require temporary relocation whilst these works are being undertaken.
- *Overhead protection*. A risk-based assessment will be required to determine the requirement for a catch deck over the existing Level 6 slab if Level 5 is to be occupied during construction works. The existing roof would not satisfy the loading requirements for a Class B hoarding (minimum 10kPa) and as such a risk-based assessment will be required to determine the temporary construction requirements for building over a live hospital environment.

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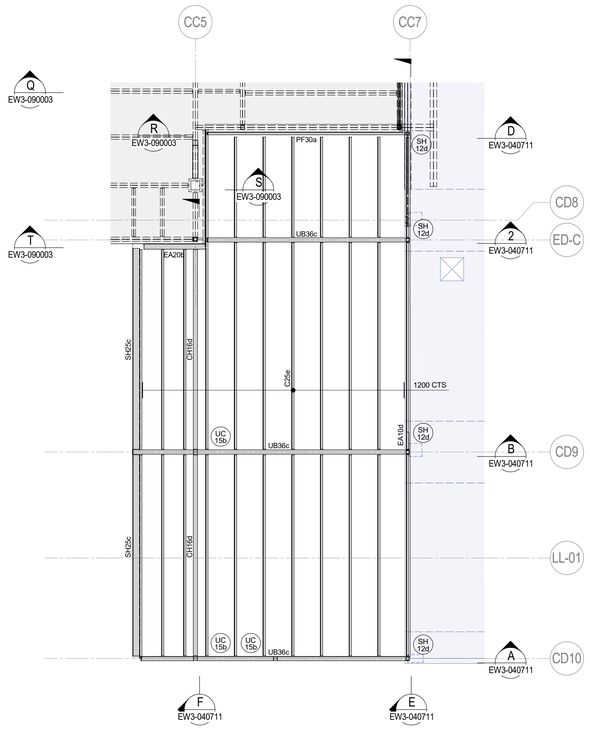
Appendix A

Structural Drawings



VERTICAL EXTENSION LEVEL 7 ROOF MARKING PLAN

Scale: 1 : 100

VERTICAL EXTENSION FRAMING SCHEDULE		
MARK	TYPE	COMMENTS
RB20a	20 dia. ROD	
CT07c	75CT18.6	
EA10d	100x100x12EA	
EA15a	150x150x10 EA	
CH16c	165.1x5.0 CHS	
CH16d	165.1x5.4CHS	
PF20a	200 PFC	
UB20b	200UB22.3	
UB20c	200UB25.4	
UB20d	200UB29.8	
UC20b	200UC52.2	
RH20b	200x100x5.0 RHS	
RH20c	200x100x6.0 RHS	
PF23a	230PFC	
PF25a	250 PFC	
UB25a	250UB25.7	
UB25b	250UB31.4	
UB25c	250UB37.3	
UC25a	250UC72.9	
RH25b	250x150x6.0 RHS	
SH25c	250x250x12.5 SHS	
PF30a	300 PFC	
UB31a	310UB32.0	
UB31b	310UB40.4	
UB36a	360UB44.7	
UB36c	360UB56.7	
PF38a	380 PFC	
UB41b	410UB59.7	
UB53b	530UB92.4	
C25e	C25024	
Z30f	Z30030	

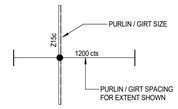
VERTICAL EXTENSION STEEL COLUMN		
MARK	TYPE	COMMENTS
SH10f	100x100x6.0 SHS	
SH12b	125x125x5.0 SHS	
SH12d	125x125x9.0 SHS	
UC15b	150UC30.0	
UC15c	150UC37.2	
SH15b	150x150x6.0 SHS	
UC20b	200UC52.2	
PF25a	250PFC	
UC25a	250UC72.9	

COLD FORMED PURLIN AND GIRT NOTES

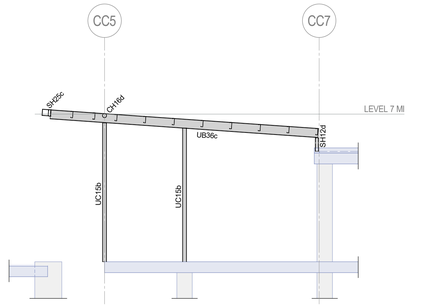
1. PURLIN / GIRT SIZES ARE BASED ON THE CURRENT LYSAGHT PURLIN DESIGN DATA, INCLUDING RESTRAINT FROM ROOF SHEETING AND BRIDGING.
2. PURLIN AND GIRT SPACINGS SHOWN ON PLAN ARE TO BE READ AS MAXIMUM SPACINGS.
3. PROVIDE BRIDGING/HANGERS TO PURLINS AND GIRTS IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS AS PER THE TABLE BELOW UNLESS NOTED OTHERWISE.

	MAXIMUM PURLIN SPAN	
PURLIN SIZE	1 ROW	2 ROWS
100	2000	4000
150	3000	6000
200	4000	7000
250	5000	8000

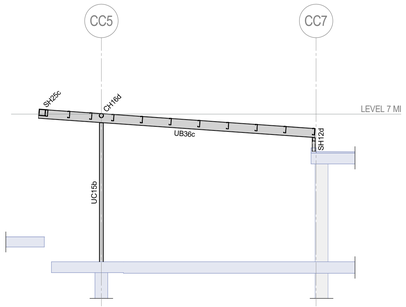
(4) - GRADE G500
(5) - GRADE G550



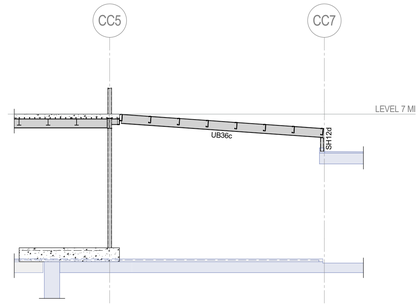
HOW PURLINS AND GIRTS ARE CALLED UP ON PLAN AND ELEVATION



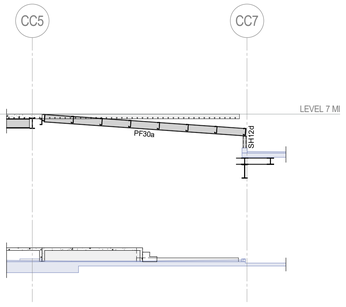
ELEVATION A
SCALE 1 : 100 EW3-040711



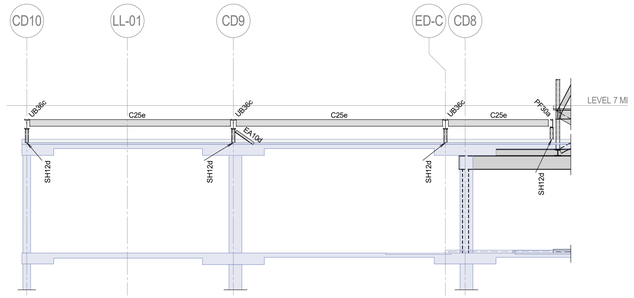
ELEVATION B
SCALE 1 : 100 EW3-040711



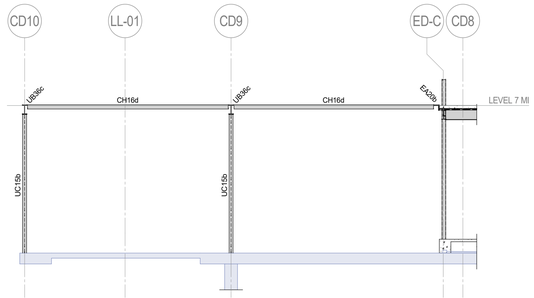
ELEVATION 2
SCALE 1 : 100 EW3-040711



ELEVATION D
SCALE 1 : 100 EW3-040711



ELEVATION E
SCALE 1 : 100 EW3-040711



ELEVATION F
SCALE 1 : 100 EW3-040711

TENDER NOTES

1. These drawings are preliminary drawings issued for tender as an indication of the extent of works only. They are not a complete construction set of drawings.
2. To determine the full extent of work, these drawings shall be read in conjunction with the architectural drawings and other contract documents. Allow for all items shown on architectural and other drawings as not all items are shown on the structural drawings.
3. Should any ambiguity, error, omissions, discrepancy, inconsistency or other fault exist or seem to exist in the documents, immediately notify in writing to the Superintendent.
4. Rates shown on the drawings are for the final structure in place and do not allow for any wastage, rolling margins, over supply or fabrication requirements, etc.

NOT TO BE USED FOR CONSTRUCTION

NOTES

1. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS GOVERN.
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3. ALL DIMENSIONS SHALL BE VERIFIED ON SITE BEFORE PROCEEDING WITH THE WORK. TTW SHALL BE NOTIFIED IN WRITING OF ANY DISCREPANCIES.
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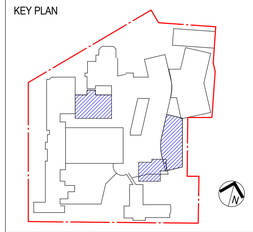
REV	DATE	AMENDMENT
B	19.04.24	ISSUED FOR TENDER
A	21.03.24	ISSUED FOR TENDER

KEY PLAN



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Job No
201957

PROJECT
ROYAL PRINCE ALFRED HOSPITAL REDEVELOPMENT STAGE 1

PROJECT NO. **201957**

DRAWING TITLE
MOLECULAR IMAGING - LEVEL 7 ROOF EXTENSION MARKING PLAN AND ELEVATIONS

STATUS **NOT TO BE USED FOR CONSTRUCTION**

FOR TENDER

DRAWN	DESIGNED
MAE	**RM**
CHECKED	APPROVED
Checker	**MB**

SCALE @ B1
As indicated

DRAWING NO. **RPA-STR-TTW-DRG-EW3-040711**

REVISION **B**