URBIS

TEMPORARY HERITAGE PROTECTION PLAN

Atlassian Central

Prepared for
BUILT
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Urbis acknowledges the important contribution that Aboriginal and Torres Strait Islander people make in creating a strong and vibrant Australian society.

We acknowledge, in each of our offices, the Traditional Owners on whose land we stand.

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EXECUTIVE SUMMARY

Urbis has been engaged by Built to prepare this Temporary Heritage Protection Plan (THPP). This THPP is required by Condition of Approval C6 of the Atlassian Central State Significant Development (SSD) Application no. 10405.

The significant fabric within the subject site is approved to be dismantled, removed from site and partly reconstructed/reinstated in accordance with the accompanying with the Salvage and Reuse of Distinctive Elements Plan (SRDEP). However, there is a high degree of significant fabric associated with Central Station surrounding the site which will be retained in situ. Therefore, this THPP is primarily concerned with ensuring the protection of the heritage items/significant fabric surrounding the site during construction.

This THPP constitutes a summary of heritage specific information in the substantial volume of construction management documentation referenced in Section 1.5. The client/Built will ensure that all works are undertaken in accordance with these management plans or their approved superseded versions.

This THPP concerns protection of heritage fabric surrounding the subject site during the works and not the long-term conservation of specific elements through repair and maintenance. Such conservation is addressed in the Conservation Management Plans for the site and for Central Station generally, and will be identified throughout the construction process as required in accordance with the accompanying heritage documentation.

Where there is any doubt about this THPP, works shall cease, and the advice of the site engineer and the heritage consultant appointed to the project shall be sought.

The condition is reproduced below.

Temporary Protection Plan

C6 No work shall commence on the demolition and dismantling of the heritage item until a Temporary Heritage Protection Plan (THPP) is prepared by a suitably qualified and experienced heritage practitioner and submitted to and approved by the Planning Secretary. The THPP must:

> *(a) be prepared in consultation with, and endorsed by, Heritage NSW;*
>
> *(b) include protection systems to ensure significant historic fabric is not damaged or removed, potential impacts due to vibration are minimised, and traffic is appropriately managed during the works;*
>
> *(c) ensure the monitoring and repair of any damage of significant items (including the former Parcels Post Office building) as a result*
>
> *(d) provide a protection strategy for the duration of the construction works detailing how the proposed works will ensure that heritage buildings are to be suitably protected and stabilised during the construction process including from any construction waste, dust, damp, water runoff, vibration or structural disturbance or damage, including:*
>
> > *(i) details of temporary hydraulic drainage works to ensure that all water both in ground and above ground is channelled to the street and that no such water is channelled onto the adjacent property fabric or interiors;*
> >
> > *(ii) construction debris on neighbouring properties, in drainage lines or in cavities between the boundary walls of the adjacent buildings, is to be removed progressively as the works progress;*
> >
> > *(iii) a geotechnical report detailing the investigation of the location and depth of footings of the adjacent buildings. This report should address details of lateral ground movement, advice of any additional boundary offsets that may be required as a result of the location of footings and on the suitability of structural engineer's proposals for underpinning or other support to adjacent footings; and*
> >
> > *(iv) details of the proposed protection of party walls from damp and water ingress during the works.*

1. INTRODUCTION

1.1. BACKGROUND

Urbis has been engaged by Built to prepare this Temporary Heritage Protection Plan (THPP). This THPP is required by Condition of Approval C6 of the Atlassian Central State Significant Development (SSD) Application no. 10405.

This THPP concerns protection of heritage fabric surrounding the subject site during the works and not the long-term conservation of specific elements through repair and maintenance. Such conservation is addressed in the Conservation Management Plans for the site and for Central Station generally.

Where there is any doubt about this Protection Strategy, works shall cease, and the advice of the site engineer and the heritage consultant appointed to the project shall be sought.

1.2. SITE IDENTIFICATION

The Site is known as 8-10 Lee Street, Haymarket. It is an irregular shaped allotment. The allotment has a small street frontage to Lee Street; however, this frontage is limited to the width of the access handle. The Site comprises multiple parcels of land which exist at various stratums.

The five components of the site are identified (and mapped in the image below). However, this report is primarily concerned with protecting significant fabric surrounding the subject site as identified in Section 2.

- Inwards Parcel Shed and Basement (blue)
- Ambulance Avenue Retaining Wall including northern awnings (purple)
- Northeast Baggage Tunnel
- Devonshire Street Tunnel
- Platform 1 Canopy

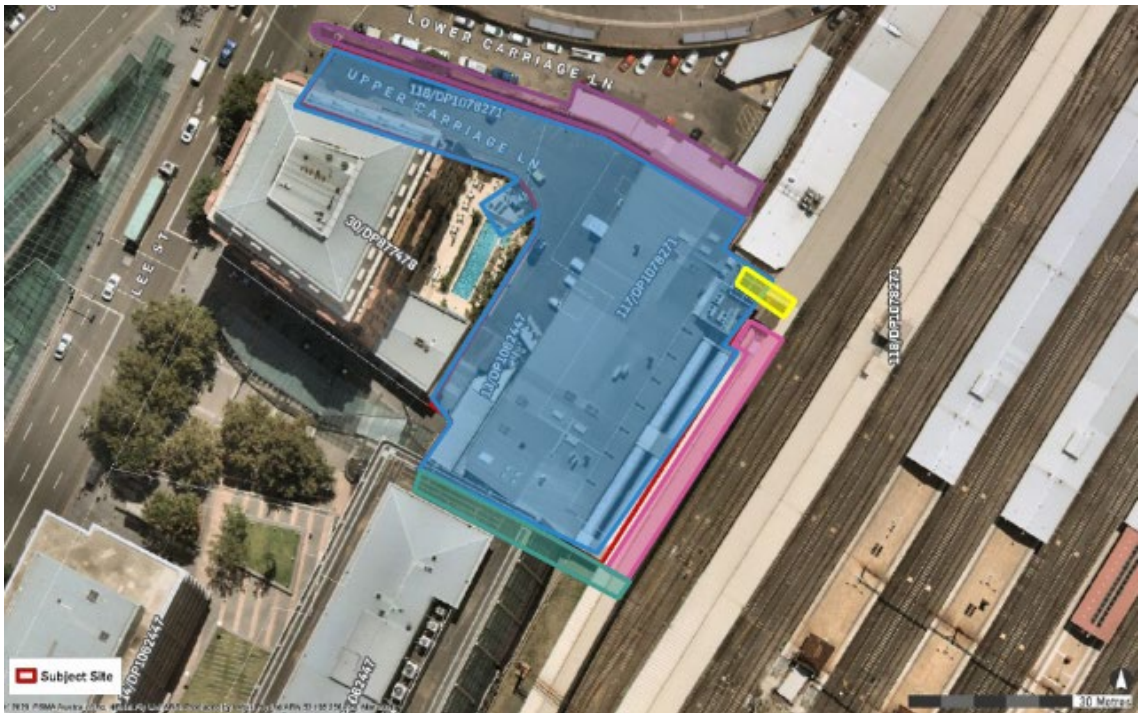

Figure 1 – Aerial image with the subject site outlined in red.

1.3. SCHEDULE OF COMPLIANCE WITH CONDITION C6

Condition C6 comprises 7 subsections which outlines the minimum required components of the THPP. The below schedule references the section of this THPP which addresses each requirement.

Table 1 – Schedule of Compliance with Condition C6

Subsection Reference	Subsection Requirement	SRDEP Section Reference	Response Summary
C6 (a)	be prepared in consultation with, and endorsed by, Heritage NSW;	Section 1.4.	As set out in Section 1.4, an initial meeting was undertaken with HNSW in January 2022 before submission of the draft document in February and the final issue in March 2022. Confirmation was received from HNSW on 11 April 2022 that the report sufficiently addresses the conditions for the purposes of commencing works for Design Package 1 (Dismantling, Salvage and Demolition Works). This report was submitted to Transport for NSW on 26th February – no comments were received.
C6 (b)	include protection systems to ensure significant historic fabric is not damaged or removed, potential impacts due to vibration are minimised, and traffic is appropriately managed during the works;	Sections 6, 7, 10 and 11	Protection systems to ensure significant heritage fabric is not damaged include: • Shoring of Ambulance Avenue masonry façade • General monitoring of western extension • Temporary over sail to protect the western extension • Temporary shoring of north east Baggage Tunnel which will also support adjacent heritage structures • Shoring of Adina Hotel masonry wall • Pile walls to retain Platform 1 and Devonshire Street Tunnel Minimisation of impacts due to vibration will be achieved through the installation of vibration monitors and monitoring of the readings during construction. The readings will be monitored to ensure that the vibration limits set out in the relevant reports are not exceeded. Traffic will be appropriately managed during construction through the utilisation of Railway Colonnade Drive for a loading zone. This is currently accessible by vehicles which would maintain a 5m buffer zone around significant fabric to minimize impact of the weight of the trucks. Further operational recommendations from a heritage perspective are set out in Section 7.1 of this report.

Subsection Reference	Subsection Requirement	SRDEP Section Reference	Response Summary
			The east end of Ambulance Avenue and Upper Carriage Lane will each have turntables. Vehicular traffic through these areas is appropriate during construction as it is permitted at present. Section 7.2 of this report requires signage to be constructed to note where heritage items exist and requires that scaffolding is to be implemented in a sensitive way. Section 7.4 establishes that the cranes required on site will have non slewing zones which avoid the bulk of proximate significant fabric including the Adina and the western extension.
C6 (c)	ensure the monitoring and repair of any damage of significant items (including the former Parcels Post Office building) as a result of construction and include inspection before, during and after completion of the works;	Section 11	Minimisation of impacts due to vibration will be achieved through the installation of vibration monitors and monitoring of the readings during construction. The readings will be monitored to ensure that the vibration limits set out in the relevant reports are not exceeded. The Movement Monitoring Alert and Response Plan establishes that a traffic light alert system be implemented to record the condition of the assets and act as an early warning system. The system is noted in Section 11.5. Section 11.6 requires the inspection before, during and after completion of works. The project team will undertake Condition and Dilapidation surveys prior to commencement of works on site. Inspection during the works is to be undertaken in accordance with the monitoring methodologies set out in Section 11. Reporting and repairs is to be undertaken in accordance with the general guidelines below. Note that any damage is to be reported to the relevant members immediately. The project team is required to undertake a Condition and Dilapidation survey following completion of works. The survey is to make direct reference to the survey undertaken prior to the commencement of works on site. All issues to be rectified are to be rectified in accordance with the guidelines in Section 11.6.
C6 (d)(i)	details of temporary hydraulic drainage works to ensure that	Section 8	The typical measures that would be implemented to ensure proper drainage include: • Provision of sediment and erosion controls at locations downstream of construction area (e.g.

Subsection Reference	Subsection Requirement	SRDEP Section Reference	Response Summary
	all water both in ground and above ground is channelled to the street and that no such water is channelled onto the adjacent property fabric or interiors;		sediment fences, sediment basins, other as required). • Provision of stormwater diversion around the construction site for run-off from upstream undisturbed areas. • Identified of stockpile location. • Identification and location of sediment control barriers. • Protection of existing stormwater using geotextile filters, sandbags or similar. • Identified of work staging to limit the area and duration of soils exposure. • Identify suitable location for construction vehicle access and wheel wash facilities. Urbis has set out minimum standards for the treatment of water disposal in the vicinity of heritage items, including: • No water is to be diverted on a path which brings it into direct contact with any significant fabric. • No water is to pool adjacent to any significant fabric as a result of any activities associated with the project (i.e. there is no obligation under this report to rectify existing pooling issues). • No temporary built elements for the purpose of managing erosion, sediment, or water run-off is to directly impact (i.e. be fixed to) significant fabric. Where this is necessary, this must be reported to Urbis for comment.
C6 (d)(ii)	construction debris on neighbouring properties, in drainage lines or in cavities between the boundary walls of the adjacent buildings, is to be removed progressively as the works progress;	Section 4.5	Section 4.5 requires that the places and items are protected from dust, debris and water from construction processes on this site or on neighbouring construction sites. This includes on surfaces, in drainage lines and in cavities between boundary walls. Any such contamination or accumulation will be removed immediately from the vicinity of the nominated heritage places/items.

Subsection Reference	Subsection Requirement	SRDEP Section Reference	Response Summary
C6 (d)(iii)	a geotechnical report detailing the investigation of the location and depth of footings of the adjacent buildings. This report should address details of lateral ground movement, advice of any additional boundary offsets that may be required as a result of the location of footings and on the suitability of structural engineer's proposals for underpinning or other support to adjacent footings; and	Section 9 and the following reports which are referenced in Section 9 and provided with this THPP. Impact Assessment – TfNSW Assets (ref: DP-RPT-0023, 86767.04.R.013, Rev1, dated 15 February 2022 Supplementary Geotechnical Investigation (ref: DP-RPT-0006, 86767.00.R.006, Rev5, dated 26 November 2020 Site Retention drawing set prepared by Taylor Thomson Whitting (NSW) Pty Ltd (TTW) (ref: Design Package 2, Rev A – AFC, dated 15 February 2022)	DP has undertaken footing investigations for the following structures adjacent to the proposed development: • The brick retaining wall along Ambulance Avenue; and • The existing concrete underpins along the western site boundary within the Adina Hotel basement. Subsequently, an impact assessment was carried out by DP for the proposed development. The impact assessment included the assessment of • lateral ground movements at TfNSW assets surrounding the site including: • Central multi storey building located next to the northern shoring wall (near the eastern end) and the eastern shoring wall (near the northern end); • Baggage Tunnel and Baggage Lift (to the east of the site, on the northeast corner); • Central Station Platform 01 and then Central Station Railway corridor next to the eastern shoring walls; • Devonshire Pedestrian Tunnel Slab next to the southern shoring walls; and • Adina Hotel to the west of the proposed main basement. DP's impact assessment relied on the information provided on the Site Retention drawing set prepared by Taylor Thomson Whitting (NSW) Pty Ltd (TTW) (ref: Design Package 2, Rev A – AFC, dated 15 February 2022), and in particular on: • The locations and depths of the footing of the adjacent buildings that have not been directly investigated by DP; and • The details of the proposed underpinning and support works to these footings which are to be carried out prior to the site excavation. The results of our impact assessment indicated that very minor impact is expected on the adjacent assets, as indicated by assessments of "Very Slight" to "Slight" damage categories. Based on our investigations and impact assessment, we consider that the pinning and support works proposed by TTW will provide adequate lateral support to the existing adjacent footings.

Subsection Reference	Subsection Requirement	SRDEP Section Reference	Response Summary
C6 (d)(iv)	details of the proposed protection of party walls from damp and water ingress during the works.	Section 8	The typical measures that would be implemented to ensure proper drainage include: • Provision of sediment and erosion controls at locations downstream of construction area (e.g. sediment fences, sediment basins, other as required). • Provision of stormwater diversion around the construction site for run-off from upstream undisturbed areas. • Identified of stockpile location. • Identification and location of sediment control barriers. • Protection of existing stormwater using geotextile filters, sandbags or similar. • Identified of work staging to limit the area and duration of soils exposure. • Identify suitable location for construction vehicle access and wheel wash facilities. Urbis has set out minimum standards for the treatment of water disposal in the vicinity of heritage items, including: • No water is to be diverted on a path which brings it into direct contact with any significant fabric. • No water is to pool adjacent to any significant fabric as a result of any activities associated with the project (i.e. there is no obligation under this report to rectify existing pooling issues). • No temporary built elements for the purpose of managing erosion, sediment, or water run-off is to directly impact (i.e. be fixed to) significant fabric. Where this is necessary, this must be reported to Urbis for comment.

1.4. HERITAGE NSW CONSULTATION

Condition C6 requires that this report is prepared in consultation with Heritage NSW (HNSW). The following records consultation undertaken with HNSW. This Section is to be updated throughout the construction process as the plans are resolved.

- Briefing meeting with HNSW (dated 19/01/2022) to discuss expectations for the delivery and review of all heritage reports required by the consent.
- Final draft THPP submitted to HNSW on 28 February.
- Final THPP submitted to HNSW on 1 April 2022 following receipt of comments received from HNSW on 21 March 2022.

- Confirmation was received from HNSW on 11 April 2022 that the report sufficiently addresses the conditions for the purposes of commencing works for Design Package 1 (Dismantling, Salvage and Demolition Works).
- This report was revised in June 2022 following comments received from the NSW Department of Planning on 30 May 2022.

Note that this report was submitted to Transport for NSW on 26th February – no comments were received.

1.5. RELATIONSHIP TO OTHER DOCUMENTS

A series of Construction Management Plans have already been prepared for the project. This Protection Plan and further methodologies resulting from this strategy shall be prepared and followed during construction works.

Any revisions to THPP or any of the documentation below insofar as they concern heritage fabric are to be approved by the Project Manager, Site Architect and Heritage Consultant prior to works commencing.

This document serves to provide a summary of the below documents and highlight information relevant from a heritage perspective. The below documents are to take precedence and are to be referred to for a complete methodology for the protection of the elements on and around the site.

Where there are discrepancies between this strategy and any contract documents inform the Project Manager.

Post Approval Construction Documentation

- Atlassian Building Central, Construction Management Plan, Built Obayashi, November 2021 Revision 15
- Atlassian Building Central, Railway Colonnade Drive Management Plan, Built Obayashi, November 2021
- Atlassian Building Central, Tower Eastern Elevation Management Plan, Built Obayashi, November 2021
- Atlassian Building Central, Devonshire Street Tunnel Demolition Management Plan, Built Obayashi, November 2021
- Atlassian Building Central, Health Safety and Environment Management Plan, Built Obayashi, February 2022
- Atlassian Building Central, Alert and Response Plan, Built Obayashi, November 2021
- Civil SSDA Report - Update for 75% Design Development, TTW, 16 December 2021
- Preliminary Construction Noise, Vibration and Dust Management Plan, Acoustic Logic, 24 November 2021
- Impact Assessment – TfNSW Assets (ref: DP-RPT-0023, 86767.04.R.013, Rev1, dated 15 February 2022
- Supplementary Geotechnical Investigation (ref: DP-RPT-0006, 86767.00.R.006, Rev5, dated 26 November 2020
- Site Retention drawing set prepared by Taylor Thomson Whitting (NSW) Pty Ltd (TTW) (ref: Design Package

The involvement of Urbis, and this report, shall not be misconstrued as relieving the building contractor and any other party of their contractual responsibilities.

1.6. AUTHOR IDENTIFICATION AND ACKNOWELDGEMENTS

This report has been prepared by Alexandria Barnier (Associate Director).

2. ADJACENT HERITAGE ITEMS

The significant fabric within the subject site is approved to be dismantled, removed from site and partly reconstructed/reinstated (refer SRDEP). Therefore, this THPP is primarily concerned with ensuring the protection of the heritage items/significant fabric surrounding the site during construction.

Significant fabric addressed in this report is outlined below and grouped in relation to the areas identified in the Central Station CMP (2013).

2.1. WESTERN FORECOURT

Location

Figure 2 – Western Forecourt Location Plan

Source: Central Station CMP (Rappoport, 2011)

Significant Fabric in Vicinity of Construction Works

Significant fabric within the Western Forecourt of Central Station which is in the vicinity of the construction work includes:

- Sandstone piers at the entrance to the garden path
- Brick retaining wall to north of Ambulance Avenue
- Glass brick pavement lights at ambulance entrance
- Dwarf wall with decorative wrought iron posts and heavy iron link chain
- Lightwells adjacent to West Wing of station (now filled in)

2.2. PARCELS AREA

Location

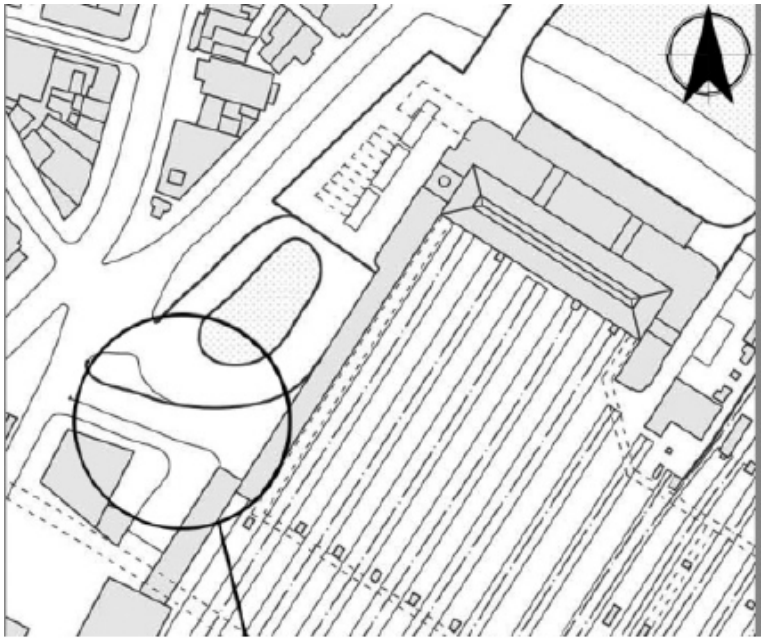

Figure 3 – Parcels Area Location Plan

Source: Central Station CMP (Rappoport, 2011)

Significant Fabric in Vicinity of Construction Works

Significant fabric within the Parcels Area of Central Station which is in the vicinity of the construction work includes:

- Sandstone walls, bricks walls and awning (note these elements to the south of Ambulance Avenue are approved to be dismantled in accordance with the DDHFM)
- Fabric associated with West Wing Basement (specifically offices)

2.3. FORMER PARCELS POST OFFICE

Location

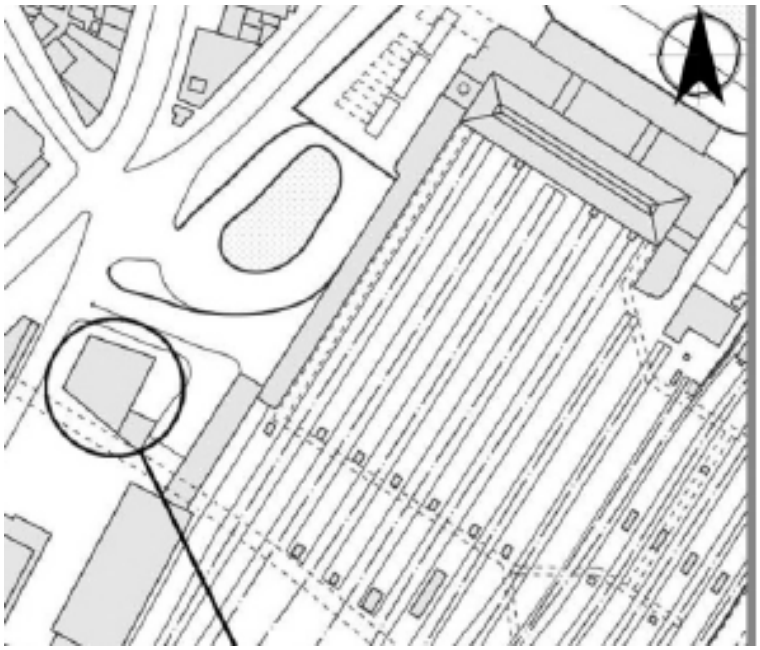

Figure 4 – Former Parcels Post Office Location Plan

Source: Central Station CMP (Rappoport, 2011)

Significant Fabric in Vicinity of Construction Works

Significant fabric within the Former Parcels Post Office site which is in the vicinity of the construction work includes:

- Brick retaining wall at boundary with subject site
- Glass brick pavement lights adjacent to Adina

2.4. WEST WING EXTENSION

Location

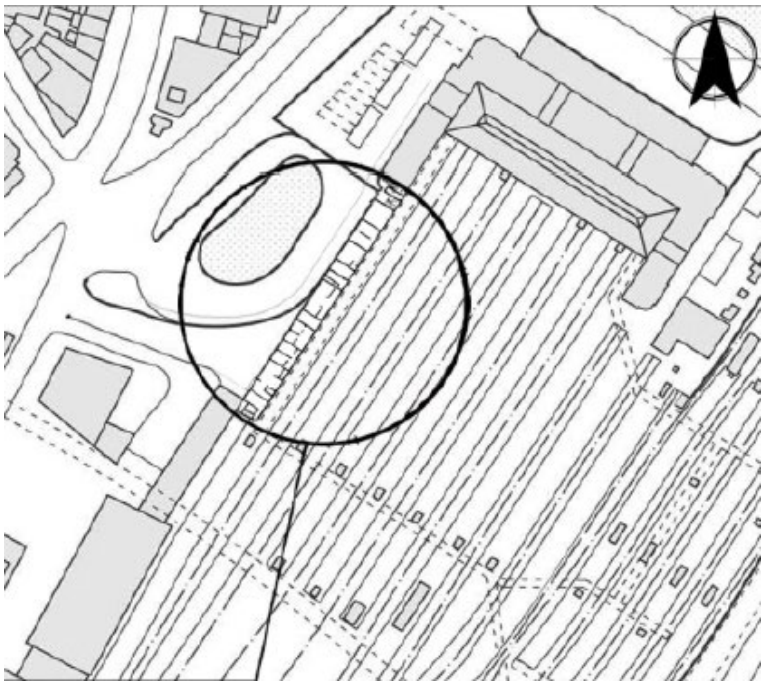

Figure 5 – West Wing Extension Location Plan

Source: Central Station CMP (Rappoport, 2011)

Significant Fabric in Vicinity of Construction Works

Significant fabric within the West Wing Extension which is in the vicinity of the construction works includes:

- Facades

3. GENERAL HERITAGE CONSERVATION NOTES

3.1. RELATIONSHIP TO CONTRACT DOCUMENTS

Where there are discrepancies between this document and the contract documents, the Project Manager is to be informed.

3.2. EXPERIENCED TRADESPEOPLE

Any works impacting on heritage fabric shall be carried out by a tradesperson with proven qualifications and experience in relevant heritage works. Induction and training are addressed in Section 12.0 of the HSW CEMP. Any tradespeople working directly in the vicinity of significant heritage fabric is to be provided with an induction document (prepared by Urbis) which is to be included within BOJVs induction. Provision of this document is to be noted on the induction record.

3.3. MANDATORY HERITAGE INDUCTION

The Construction Manager is to ensure that all workers carrying out work under the Contract at the subject site have attended a mandatory induction which includes information on best practice heritage conservation, legislative controls, the required conservation approach to each type of work, the process for seeking further direction on conservation during the works, statutory archaeological procedures and the Unexpected Finds Procedure. Urbis is to provide heritage induction content to BOJV, BOJV to amalgamate heritage induction with standard induction.

3.4. ARCHIVAL RECORDS

A Stage 1 photographic archival record of the subject site has been prepared. The photographic archival records shall be updated as works progress and on completion of the works. Allow for such photography prior to covering over of heritage fabric with protective material.

3.5. CONDITION AND DILAPIDATION REPORTING

As identified in the principal CEMP (Section 2.1), the project team will undertake Condition and Dilapidation surveys prior to commencement of works on site. These surveys should include significant fabric in the vicinity of the subject site in the area of construction (or associated) works. The condition in these surveys is to be treated as the condition that is to be maintained throughout and at the end of construction.

Existing cracks in masonry (brick or stone) identified as part of the Condition and Dilapidation Surveys shall be checked recorded and monitored by the structural engineer. Crack monitoring gauges will monitor both horizontal and vertical movement. Masonry walls will also be continuously monitored during the works for the appearance of new cracks.

3.6. MONITORING DEVICES

Note that monitors are required to be installed to the surrounding heritage structures in accordance with the accompanying Construction Management Plans which are required as a condition of the approval. These monitors are necessary to ensure the integrity of the buildings in the context of the approved works. The monitors will be installed in the same manner as existing vibration monitors around the Station (mechanical fixings for buildings and adhesive for track monitoring). There is no heritage impact because of the mechanically fixed monitors, any penetrations can be easily patched, and monitors are generally to be attached to structure rather than decorative elements. Track monitoring devices would be fixed using adhesive and are designed to have no permanent impact on the tracks.

Figure 6 – Existing track monitors adjacent to platform.

Source: Provided by BOVJ

Figure 7 – Existing vibration monitors within Central Station.

Source: Provided by BOVJ

4. PROTECTION

4.1. SCAFFOLD AND HOARDINGS

The methodology for installation of scaffolding generally is established in Section 19.0 of the HSE plan.

Hoarding and scaffolding anticipated for the project during heritage dismantle and demolition phase are shown in the figure below. A-Class hoarding is to be established before the commencement of the approved IP Shed dismantling process.

The below is to be considered in addition to the methodologies established under the CEMPs:

- For heritage buildings, the preference is for scaffold, hoardings and the temporary protective “boarding-up” of openings, to be free standing or only stabilised by using bracing through the existing or proposed facade openings.
- Where this cannot be achieved then any proposed temporary fixings into masonry or woodwork will be documented and approved by the HC prior to implementation. Where bracing into masonry is unavoidable (e.g. no existing or planned openings available in the external wall), then whole stones or brick areas will be temporarily removed by hand and stored for reinstatement on removal of the scaffold.
- Do not saw cut stones or brickwork for temporary stabilisation or other construction activity. Ensure steel scaffold members and hoarding materials are not in direct contact with masonry or timber heritage fabric avoiding vibration impacts and staining.

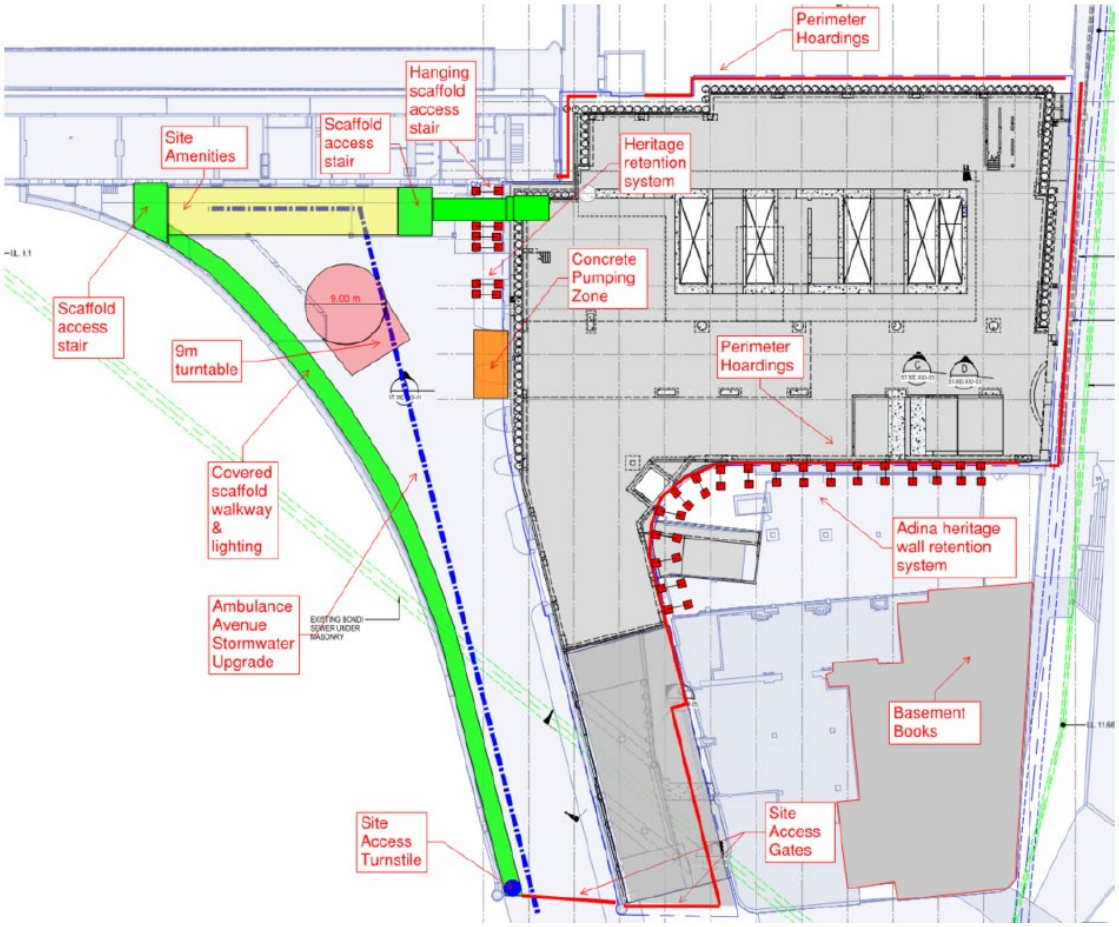

Figure 8 – Site plan showing locations of hoarding and scaffolding.

Source: Railway Colonnade Drive Management Plan (Built Obayashi, November 2021)

4.2. PROTECTION DURING SITE SET UP, ACCESS

Provide substantial protection around all fabric adjacent to site access points (including access from Ambulance Avenue) i.e. boxing out with plywood.

Pay particular attention to the protection of walls at lower levels of buildings adjacent to the subject site; at access points; and otherwise in the pathway of construction machinery and equipment.

As noted above stabilisation of protective sheeting or scaffold shall use bracing through existing openings.

4.3. SECURITY OF SITE AND SALVAGED ELEMENTS

Refer to Section 2.7 of the HSE CEMP. Ensure the site always remains secure from theft or vandalism. Make sure unsecured items, such as temporarily salvaged heritage materials for future re-use is kept secure within the site until it is relocated per the DDHFM.

4.4. PROTECTION FROM WEATHER

This section is particularly relevant during the dismantling of the IP Shed.

Ensure there is protection from inclement weather entering the Heritage Buildings or their structural systems. This includes the need for temporary roof cladding and drainage systems during roof works; and the need to provide weather protection at openings where there is no fenestration in place.

Do not allow rainwater to penetrate masonry elements, which may result in falling damp and salt decay in the stone or brick masonry.

During reconstruction of masonry elements, ensure new lime-based mortar and render is protected from rapid drying out in hot or windy weather.

4.5. CLEANING AND PROTECTION FROM DUST AND DEBRIS RESULTING FROM BUILDING WORKS

Note this Protection Strategy concerns protection of the heritage elements surrounding the subject site as identified in Section 2.

Ensure that the places and items are protected from dust, debris and water from construction processes on this site or on neighbouring construction sites. This includes on surfaces, in drainage lines and in cavities between boundary walls.

Ensure there is no accumulation of dust, debris, or ponding of water or other liquids, in areas which may cause rising or falling damp, masonry salt decay or other corrosion (e.g., that may result in deterioration of significant fabric). In particular pay attention to debris from cleaning and processes involving abrasive blasting or the use of chemicals.

Any such contamination or accumulation will be removed immediately from the vicinity of the nominated heritage places/items.

Methodologies developed by specialists to respond to these requirements (and Condition E18 of SSD 10405) are set out in Section 6 and 8 of this report.

5. ARCHAEOLOGY

5.1. ABORIGINAL CULTURAL HERITAGE AND ARCHAEOLOGY

All tangible Aboriginal Cultural Heritage resources, including any Aboriginal objects are to be managed in line with the recommendations of the Aboriginal Cultural Heritage Assessment Report (ACHAR) prepared by Urbis in 2020, and Condition E15/h, E41-43, F38-39 and F40 Unexpected Finds Protocol of the SSD 10405.

5.2. NON-ABORIGINAL ARCHAEOLOGY

All Non-Aboriginal archaeological resources, including any physical remains of the Benevolent Asylum are to be managed in line with the Historical Archaeological Assessment and Research Design (HAARD) prepared by AMBS in 2020 and Condition E44-49 and F41 Unexpected Finds Protocol of the SSD 10405.

6. VIBRATION AND DUST MANAGEMENT

It is important to manage vibration and dust during construction as these construction impacts have the potential to create structural disturbance and/or damage the finish/condition of individual significant elements.

These impacts would be mitigated through the measures set out in the below documents. This section summarises the measures set out in these documents as relevant to heritage. Refer also to Section 11 of this report which sets out monitoring standards for vibration.

- Noise, Vibration and Dust Management Plan (Acoustic Logic, November 2021)
- Tower Eastern Elevation Management Plan (Built Obayashi, November 2021)

6.1. VIBRATION

As set out in Section 2.4.1 of the Tower Eastern Elevation Management Plan (Built Obayashi, November 2021) the following vibration dust and noise management provisions are to be put in place in conjunction with enabling works:

- *…dust monitoring and suppression procedures put in place during enabling works will continue to be tracked and implemented to minimise airborne dust during bulk excavation.*
- *BOJV will implement a noise & vibration monitoring strategy for the project.*
- *Vibration monitors will be installed during enabling works and prior to main works construction commencing.*
- A baseline for noise and vibration will be measured.

Vibration monitors installed during enabling works (as shown in the image below) will be monitored during construction.

Note that the monitors required to be installed to the surrounding heritage structures are necessary to ensure the integrity of the buildings in the context of the approved works. The monitors will be installed in the same manner as existing vibration monitors around the Station. There is no heritage impact because of the mechanically fixed monitors, any penetrations can be easily patched. Track monitoring devices would be fixed using adhesive and are designed to have no permanent impact on the tracks.

The Noise, Vibration and Dust Management Plan identifies where a series of receivers are located in order to monitor vibration impact. The assessment of acceptable levels of vibration on items are based on the following provisions as set out in that report:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures.*
- For human exposure to vibration, the evaluation criteria presented in NSW Environmental Protection Authority (EPA) *"Assessing Vibration: A Technical Guideline"* guideline.
- Vibration limit requirements of Sydney Water detailed in the *'Sydney Water Specialist Engineering Assessment'.*
- Vibration limit requirements of TfNSW detailed in the *'NSW Transport Asset Standards Authority Development Near Rail Tunnels'.*

Identified Recommended Vibration Limits as assessed in the report. It should be noted that based on available information at this point in time, existing heritage structures and assets surrounding the construction site have a vibration limit of equal to or less than 3mm/sPPV.

The report establishes that demolition, excavation and piling works all have potential to produce significant ground vibration. It also states that at this stage it is not possible to predict the vibrations generated by the works and therefore a recommendation is made that vibration monitoring is undertaken in a series of locations throughout the construction of the project.

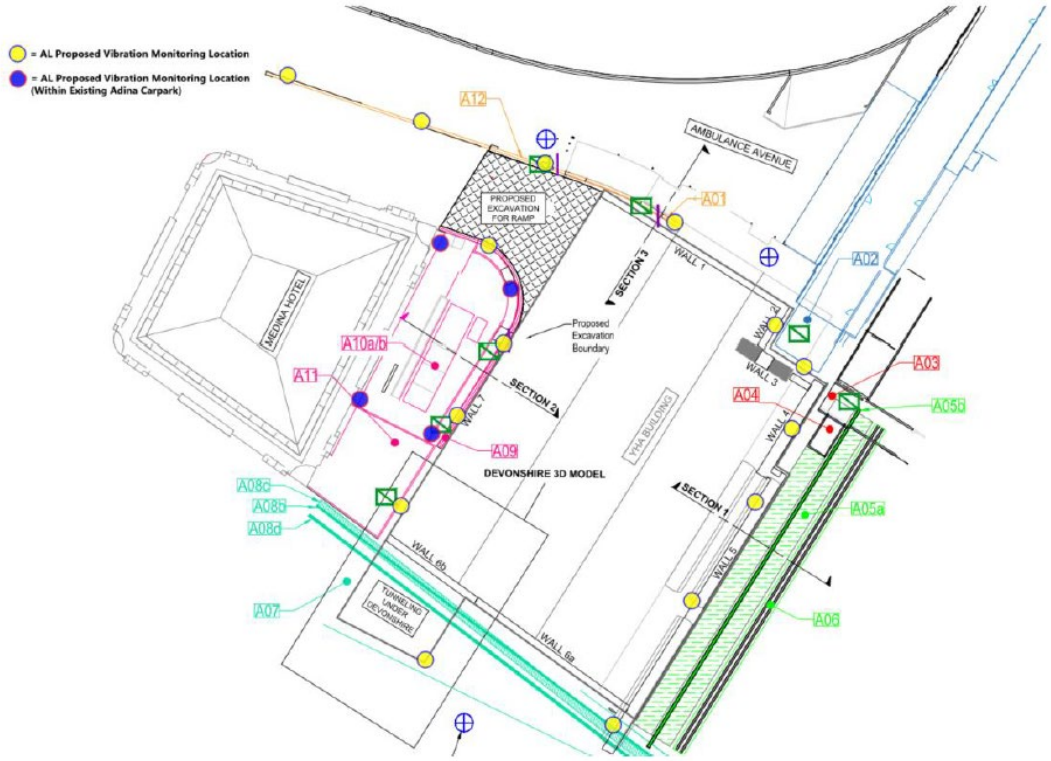

Figure 9 – Recommended vibration monitoring locations

Source: Preliminary Construction Noise Vibration and Dust Management Plan (Acoustic Logic, November 2021)

The report requires the following monitoring methodology:

- Receivers are to be constantly monitored and have an SMS notification capability when vibration limits are reached.
- Vibration monitor data is to be downloaded on a regular basis and where the criteria is exceeded, it is to be downloaded on a more frequent basis.
- Vibration results are to be monitored and reported per the plan.

Any exceedance of vibration monitoring is to be subject to the mitigation measures outlined in the reports to ensure that there is no risk to the structural integrity of the adjacent significant fabric.

6.2. DUST MANAGEMENT

The Noise, Vibration and Dust Management Plan identifies the following pollutants impact assessment criterion applicable to the project site with regards to health concerns. The report acknowledges that a significant source of dust would be potentially associated with the demolition and excavation stage and proposes a complaints procedure is set out in the report, locations where dust monitoring will be implemented and the requirement for water to be used to suppress dust.

Note that dust monitors are required to be installed to adjacent fabric per the below figure. This report recommends that dust monitors are fixed using construction grade adhesive where possible. Mechanical monitor fixings which may be used are to have minimal penetrations which can be easily patched.

It is also appropriate that excess dust is managed in order to avoid damage or visual degradation to significant fabric in the vicinity. Heritage fabric that is subject to dust exposure is to be cleaned as required. Clean gently with water of mild surfactants only.

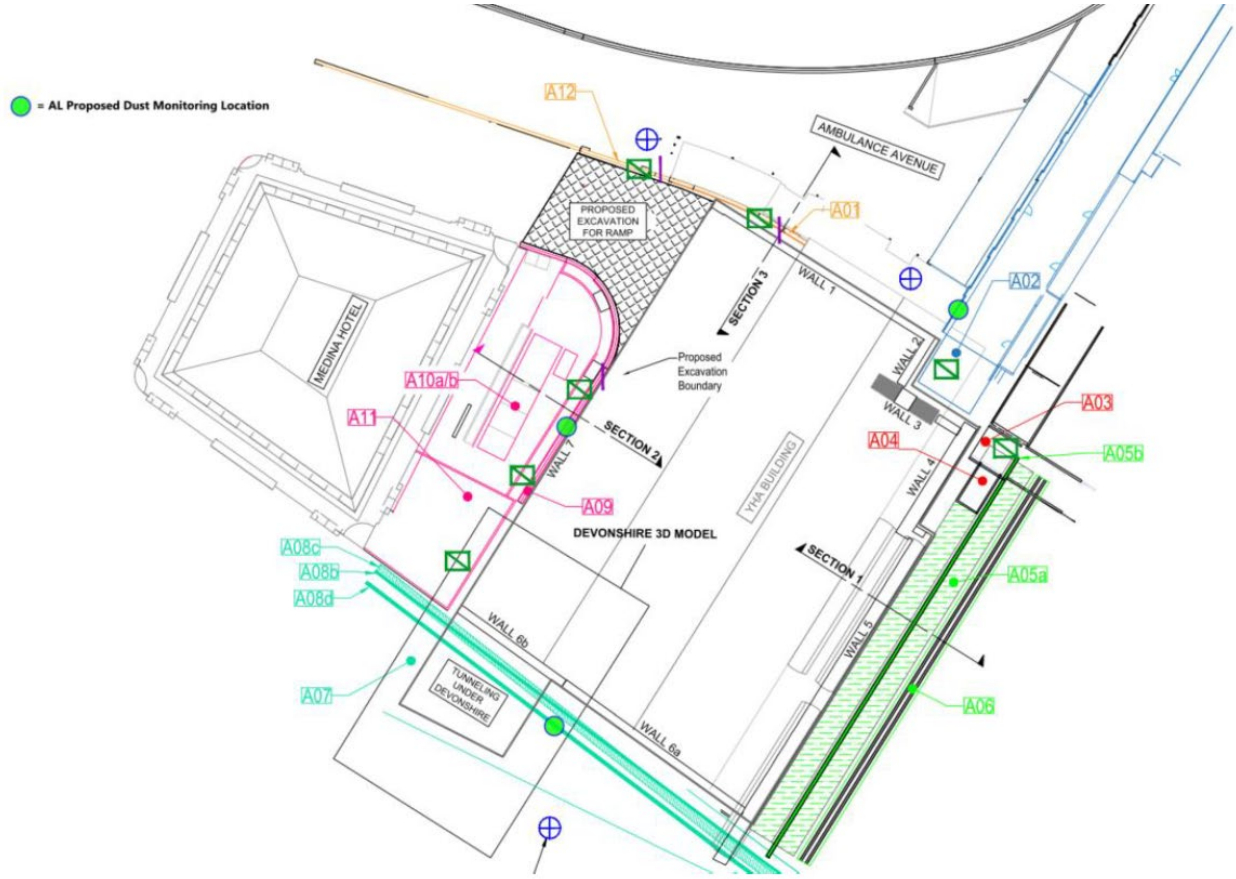

Figure 10 – Recommended dust monitoring locations

Source: Preliminary Construction Noise Vibration and Dust Management Plan (Acoustic Logic, November 2021)

7. TRAFFIC MANAGEMENT AND VERTICAL TRANSPORTATION

Three areas are nominated for deliveries/loading zones including Railway Colonnade Drive (RCD), Ambulance Avenue and Upper Carriage Lane. These areas are shown in dark blue, red and orange (circled) respectively in the image below.

This section sets out the requirements for each area from a traffic perspective and outlines heritage protection considerations relevant to each with consideration for the RCD Management Plan.

It is understood that prior to construction works commencing, a detailed CTPMP will be developed by an authorised traffic consultant (JMT). This document should appropriately acknowledge the location of significant fabric in the area of vehicle movement as demonstrated in this report and be in accordance with the heritage recommendations set out in this report.

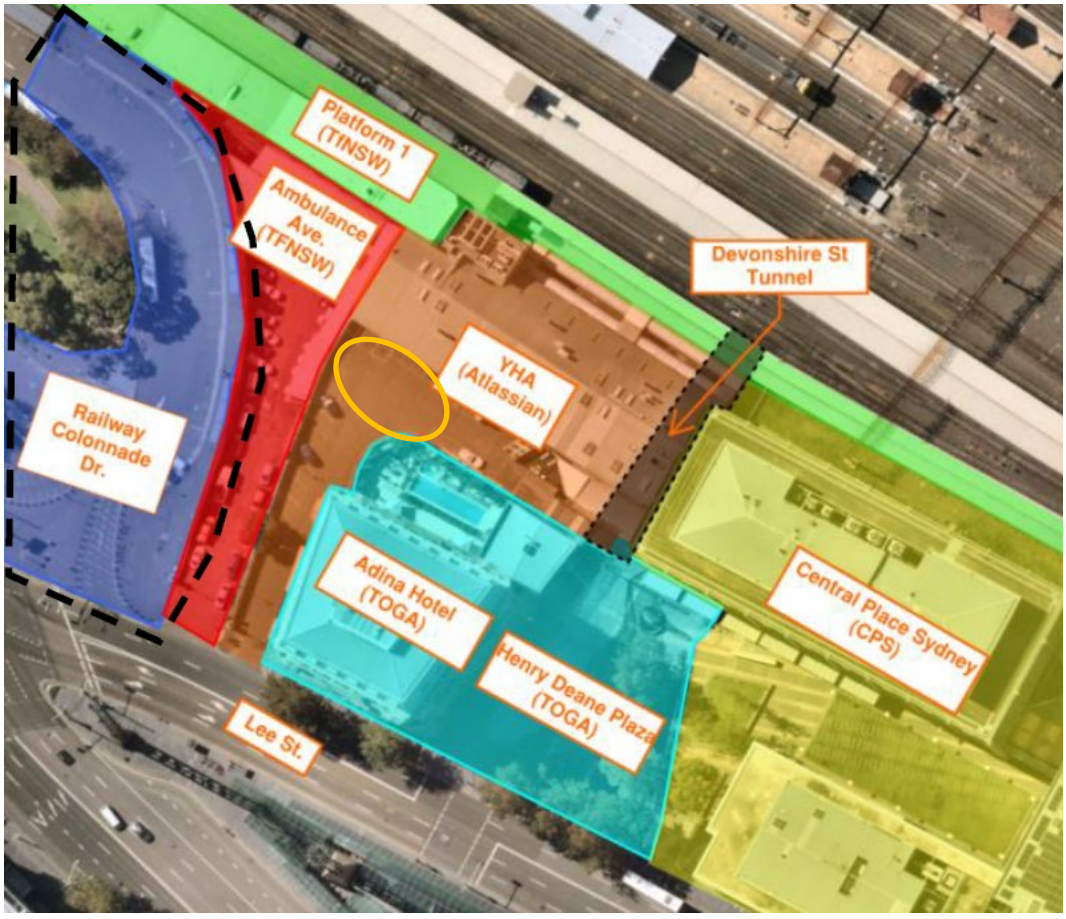

Figure 11 – Aerial image showing areas requiring traffic management in and around the subject site.

Source: Railway Colonnade Drive Management Plan (Built Obayashi, November 2021)

7.1. RAILWAY COLONNADE DRIVE LOADING ZONE TRAFFIC MANAGEMENT

Requirement

The Railway Colonnade Drive Management Plan (Built Obayashi, November 2021) outlines the requirement for a loading zone within the Railway Colonnade Drive (RCD) and how this loading zone can be managed. It is understood that the loading zone within the RCD is required for larger deliveries prior to the installation of the larger turntable to the east end of Ambulance Avenue. The areas nominated for vehicle and pedestrian movement are shown in the image below.

The Management Plan notes that:

RCD will be required to be used intermittently for mobilisations and dismantles of key temporary works such as tower cranes and jumpforms. BOJV will undertake extensive consultation with TfNSW to obtain the necessary approvals for the use of this area, refer to figure 1-5 below.

Vehicle access to RCD will be under the guidance of traffic control, which will be identified within the forthcoming CTPMP. In addition, a structural integrity assessment has been undertaken for RCD based on the size and loading requirements of the proposed vehicles in the area.

As outlined in the reproduced Load Assessment section below, the route of traffic movement has been chosen as it would allow required access without impacting existing fabric in the area (assume including significant fabric).

Loading Zone Configuration 1

The below is the configuration for most activities within the RCD.

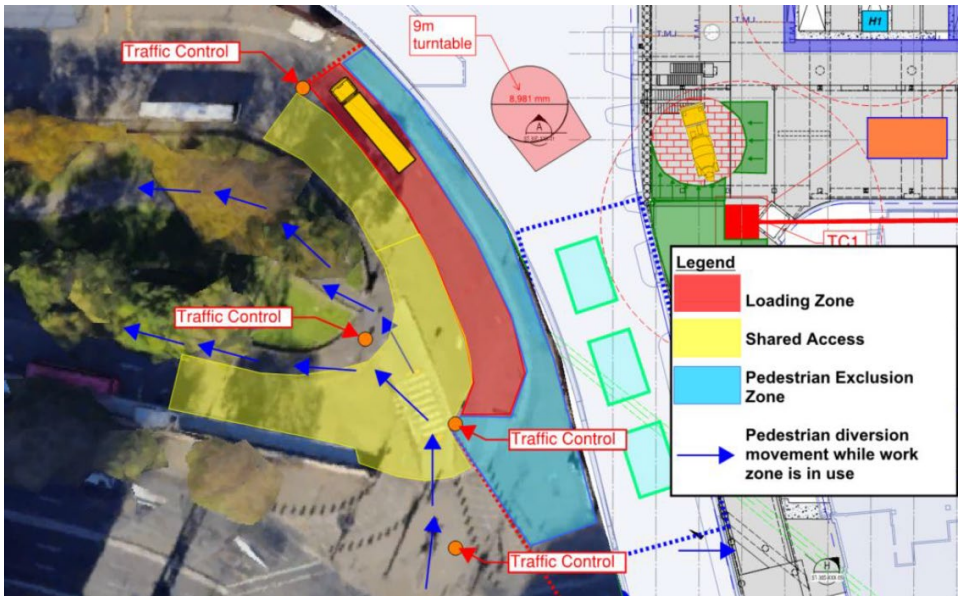

Figure 12 – Aerial image showing traffic management in the RCD per loading zone configuration 1.

Source: Railway Colonnade Drive Management Plan (Built Obayashi, November 2021)

Loading Zone Configuration 2

Configuration for crane install and dismantle

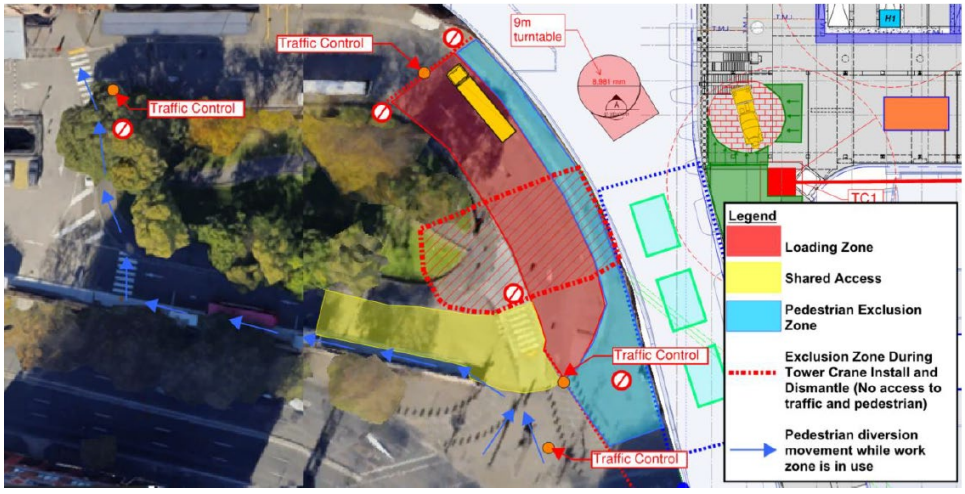

Figure 13 – Aerial image showing traffic management in the RCD per loading zone configuration 2.

Source: Railway Colonnade Drive Management Plan (Built Obayashi, November 2021)

Load Assessment

"As mentioned on Section 3.4, the AEO accredited engineer TTW have been engaged to undertake a load assessment of Railway Colonnade Drive. The results of this assessment can be seen in Appendix A. This load assessment was undertaken in response to early coordination with TfNSW, where the issue of the capacity of the suspended structure toward the northern end of RCD was raised.

This assessment found that vehicles such as semi-trailers would be able to access the proposed loading zone in accordance with the Swept Path assessment shown in figure 1-6, safely and without causing damage to RCD or any other surrounding infrastructure. In response to these findings the route has been selected to avoid the portion of RCD that is supported by a suspended structure."[1]

Heritage Considerations

The following heritage considerations are relevant to the use of the RCD loading zone:

- Significant fabric within the RCD (southern section of the Western Forecourt of Central Station) includes Sandstone piers at the entrance to the garden path, brick retaining wall to north of Ambulance Avenue, glass brick pavement lights at ambulance entrance, dwarf wall with decorative wrought iron posts and heavy iron link chain, lightwells adjacent to West Wing of station.
- A 5m buffer zone has been allowed from the retaining wall to minimise the impact of the weight of the trucks. It is understood that this is subject to further investigations, any changes to the necessary requirements are to be reported to the Heritage Consultant with confirmation that the solution would not compromise the retaining wall.
- The traffic controller should be made aware of the significant fabric in the area and ensure there is no damage to these items because of vehicular movement.
- Contractors unloading deliveries should be made aware of the significant fabric in this area and ensure there is no damage to these items.
- Pedestrian diversion is through the Western Forecourt in both configuration 1 and 2. This is currently a publicly accessible area, and no additional controls are required to allow public access from a heritage perspective. If any infrastructure is proposed for this purpose, the Heritage Consultant is to be notified to determine appropriate treatment.

7.2. AMBULANCE AVENUE TURNTABLE DELIVERIES TRAFFIC MANAGEMENT

Requirement

This area and Upper Carriage Lane constitute the primary area for materials handling.

Heritage Considerations

The following considerations are relevant to the use of Ambulance Avenue for deliveries:

- The entirely of the retaining wall to the north of Ambulance Avenue is required to be retained in situ. This retaining wall is to be appropriately protected from vehicle traffic. Consider whether the original sandstone pier to the west end is required to have additional protection to ensure no impact from vehicles.
- The scaffold walkway is to be constructed in line with the principles set out in this plan. There is to be no permanent impact on the retaining wall.
- Appropriate and clear signage is to be included throughout the site to note where heritage items are remnant behind scaffolding/hoarding.

[1] Railway Colonnade Drive Management Plan (Built Obayashi, November 2021

7.3. UPPER CARRIAGE LANE MATERIALS LOADING ZONES

Requirement

This area and Ambulance Avenue constitutes the primary area for materials handling.

Heritage Considerations

The following considerations are relevant to the use of Upper Carriage Lane for deliveries:

- The brick retaining wall between the subject site and the Former Parcels Post Building is to be retained in situ.
- The brick retaining wall is to be propped and protected during construction in line with Section 10.1 and 10.3 of this report.

7.4. VERTICAL CIRCULATION (CRANES)

Requirement

Materials Handling and Vertical Transportation is outlined in Section 5 of the RCD Management Plan and Section 2 of the Tower Construction Management Plan.

The use of cranes (x3) is identified in the Tower Construction Management Plan with one crane (TC1) being installed on a pad footing within the existing Upper Carriageway Lane zone adjacent to the Adina brick retaining wall. TC1 is to be installed using a mobile crane established in Ambulance Avenue and utilising the RCD in accordance with the methodologies set out in the RCD Management Plan.

The Tower Construction Management Plan establishes non slewing zones for the cranes (diagram reproduced below) which minimises slewing over significant fabric. The non slewing zones will be established by slew restriction systems to the tower cranes.

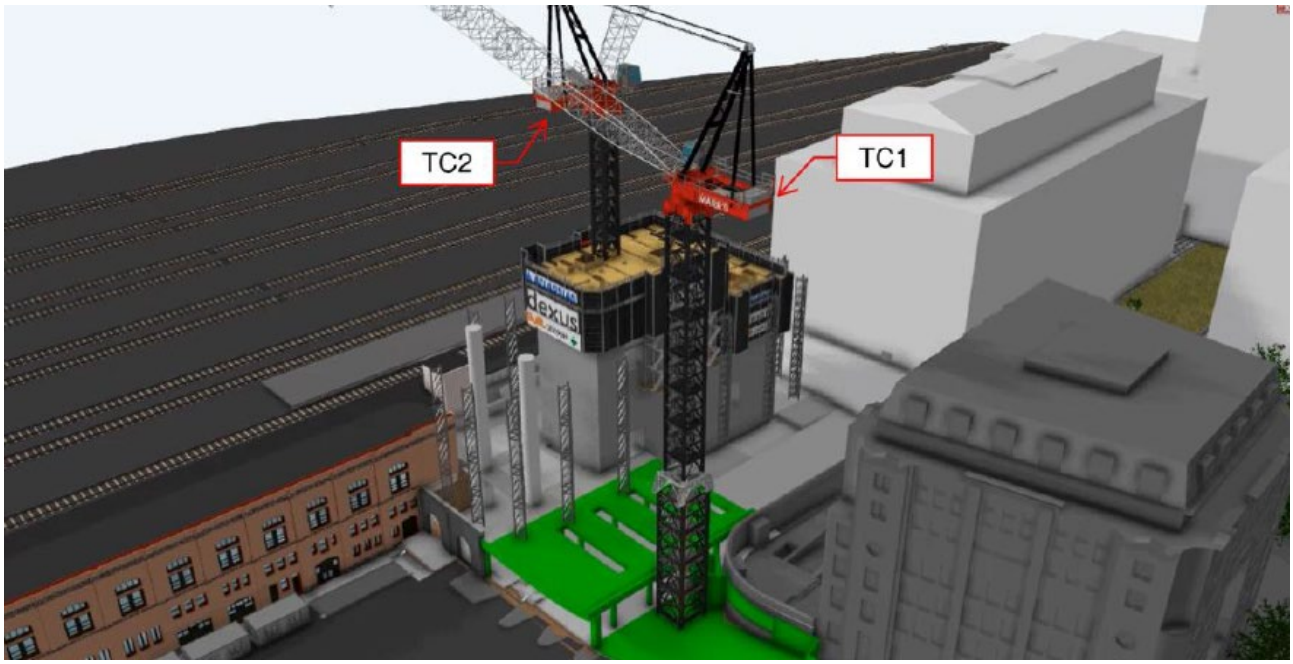

Figure 14 – Tower Crane Overview – note TC1 adjacent to heritage brick wall.

Source: Eastern Tower Management Plan (Built Obayashi, November 2021)

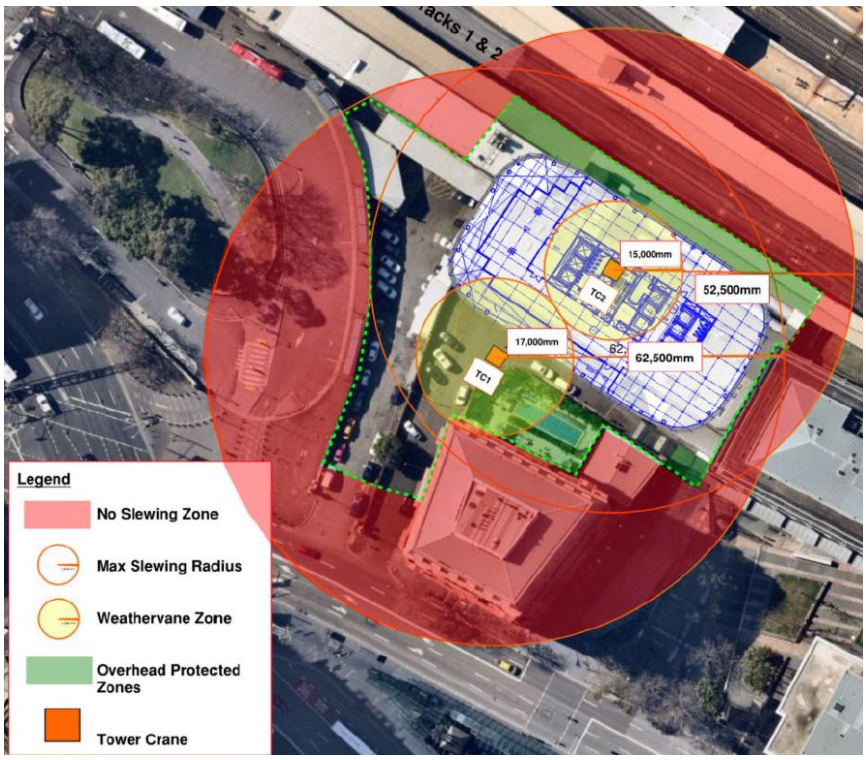

Figure 15 – Tower crane no slewing zone diagram.

Source: Eastern Tower Management Plan (Built Obayashi, November 2021)

Heritage Considerations

- Cranes are to be erected with no impact on surrounding fabric including any temporary protection systems as summarised in this report and established in all Construction Management Plan.
- Installation of cranes/arch is to consider any archaeological requirements established by others.
- It is understood that no overheard works would be carried out over the rail corridor. It is recommended that similarly overhead works are minimised over significant heritage fabric. Significant components within the RCD and Ambulance Avenue are likely to require overhead works however works should be avoided over the West Wing Extension.

8. TEMPORARY HYDRAULIC DRAINAGE WORKS

8.1. GENERALLY

Hydraulic drainage works are being developed in conjunction with the finalisation of the Civil SSDA Report - Update for 75% Design Development (TTW, 16 December 2021) and the development of a detailed erosion and sediment control plan. The Civil SSDA Report summarises the typical measures that would be implemented. These measures are reproduced below.

- *Provision of sediment and erosion controls at locations downstream of construction area (e.g. sediment fences, sediment basins, other as required).*
- *Provision of stormwater diversion around the construction site for run-off from upstream undisturbed areas.*
- *Identified of stockpile location.*
- *Identification and location of sediment control barriers.*
- *Protection of existing stormwater using geotextile filters, sandbags or similar.*
- *Identified of work staging to limit the area and duration of soils exposure.*
- *Identify suitable location for construction vehicle access and wheel wash facilities.*

The following heritage considerations are to be addressed in the final detailed erosion and sediment control plan.

- No water is to be diverted on a path which brings it into direct contact with any significant fabric.
- No water is to pool adjacent to any significant fabric as a result of any activities associated with the project (i.e. there is no obligation under this report to rectify existing pooling issues).
- No temporary built elements for the purpose of managing erosion, sediment, or water run-off is to directly impact (i.e. be fixed to) significant fabric. Where this is necessary, this must be reported to Urbis for comment.

Confirmation of the above is to be provided to Urbis prior to works commencing on site.

8.2. PARTIAL REMOVAL OF PLATFORM 1 AWNING

The construction methodology for the partial removal of the Platform 1 awning and the remnant section of awning allows for the current stormwater and downpipe system to remain operational. There are therefore no anticipated impacts on heritage fabric as a result of the partial removal of the Platform 1 Awning.

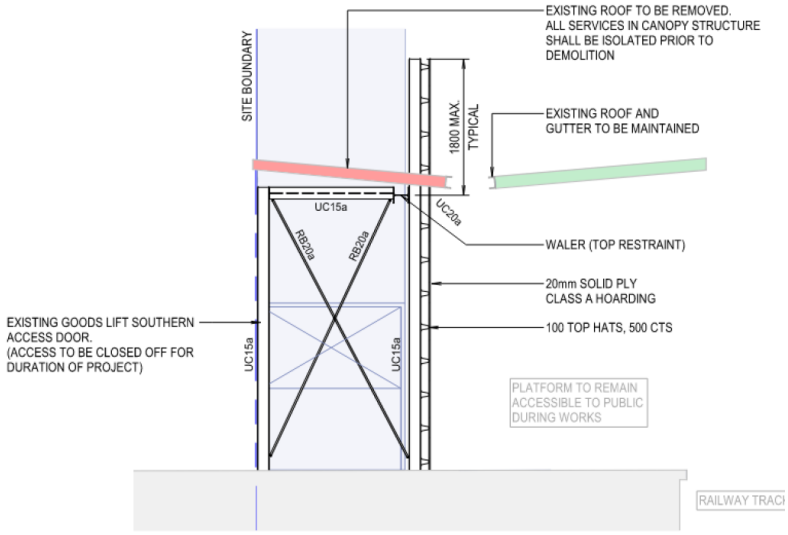

Figure 16 – Construction detail for Partial Removal of Platform 1 awning.

Source: Tower Eastern Elevation Management Plan (Built Obayashi, November 2021)

9. GEOTECHNICAL INVESTIGATIONS

The below information has been summarised from the Memo prepared by Douglas Partners 17 May 2022.

DP has undertaken footing investigations for the following structures adjacent to the proposed development:

- The brick retaining wall along Ambulance Avenue; and
- The existing concrete underpins along the western site boundary within the Adina Hotel basement.

The results of the above investigations were detailed in Douglas Partners Pty Ltd (DP) report titled "Supplementary Geotechnical Investigation" (ref: DP-RPT-0006, 86767.00.R.006, Rev5, dated 26 November 2020).

Subsequently, an impact assessment was carried out by DP for the proposed development, with the results presented in the report titled "Impact Assessment – TfNSW Assets" (ref: DP-RPT-0023, 86767.04.R.013, Rev1, dated 15 February 2022). The impact assessment included the assessment of lateral ground movements at TfNSW assets surrounding the site including:

- Central multi storey building located next to the northern shoring wall (near the eastern end) and the eastern shoring wall (near the northern end);
- Baggage Tunnel and Baggage Lift (to the east of the site, on the northeast corner);
- Central Station Platform 01 and then Central Station Railway corridor next to the eastern shoring walls;
- Devonshire Pedestrian Tunnel Slab next to the southern shoring walls; and
- Adina Hotel to the west of the proposed main basement.

The impact assessment predicted the effects on these adjacent structures likely to be induced by the proposed development, and the evaluation of potential damage category for each asset.

DP's impact assessment relied on the information provided on the Site Retention drawing set prepared by Taylor Thomson Whitting (NSW) Pty Ltd (TTW) (ref: Design Package 2, Rev A – AFC, dated 15 February 2022), and in particular on:

- The locations and depths of the footing of the adjacent buildings that have not been directly investigated by DP; and
- The details of the proposed underpinning and support works to these footings which are to be carried out prior to the site excavation.

The results of the impact assessment indicated that very minor impact is expected on the adjacent assets, as indicated by assessments of "Very Slight" to "Slight" damage categories. Based on the investigations and impact assessment, it is assessed that the pinning and support works proposed by TTW will provide adequate lateral support to the existing adjacent footings.

The Reports referenced above have been provided with this THPP.

10. PROTECTION OF PARTY WALLS/RETENTION SYSTEMS/TEMPORARY PROTECTION SYSTEMS

A range of methodologies for protection and structural retention of all components in and around the site are set out in the accompanying Construction Management Plans and associated technical documentation. Note that these methodologies vary across site establishment/demolition/construction stages.

This section set out key works which are planned to be undertaken both for safety and to protect significant heritage fabric.

10.1. AMBULANCE AVENUE MASONRY FAÇADE SHORING

The significant masonry wall in the Southeast corner of Ambulance Avenue is in poor condition and is reinforced, therefore is it understood to be susceptible to slight ground movements and ground borne vibration from excavations. Therefore, the wall will be temporarily shored with a proprietary/bespoke façade retention system to ensure its stability and to limit the effects of the surrounding construction activities.

In order to avoid the above risks, the below shoring plan has been developed in conjunction with TTW. Any change to this plan must be reported to Urbis for comment.

The monitoring criteria and methodology for the wall is established in Section 11.4.2 of this report.

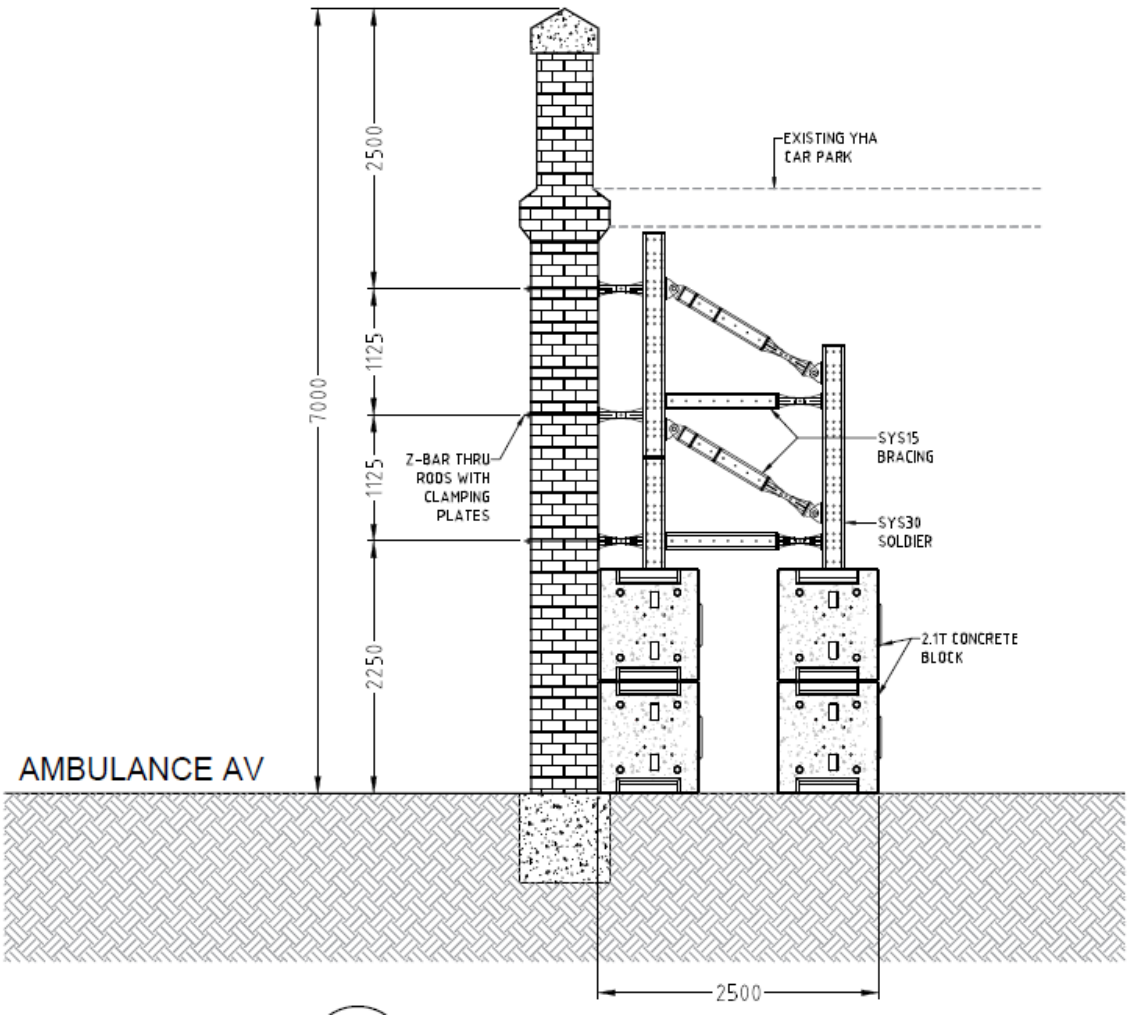

Figure 17 – Section showing propping of Ambulance Avenue masonry facade.

Source: Coates Hire (received February 2022)

10.2. NORTHEAST BUILDING (CENTRAL STATION WESTERN EXTENSION)

This structure adjoins the Inwards Parcel Shed and is adjacent to the northeast corner of the subject site. the structure is to remain operational during the works. The structure is unreinforced masonry and is susceptible to slight ground movements and ground borne vibration from excavation.

The monitoring criteria and methodology for the Northeast Building is established in Section 11.4.3 of this report.

10.3. ADINA HOTEL (MASONRY WALL)

Significant elements of the Adina Hotel, including the masonry wall are located adjacent to the access ramp to the existing YHA. The wall was visually inspected by TTW in September 2021 to inform a due diligence inspection which concluded the following:

- *From visual inspection the wall appears to be in reasonable condition for age with no obvious signs of deterioration or cracking.*
- *The Wall appears to have been previously repaired from a suspected truck impact along the northeast corner of the wall as indicated in Figure 8 and 9 below.*
- *The sandstone coping is in a poor condition with several mortar repairs noted along the surface.*

Figure 18 – Extent of Adina Wall inspected by TTW in September 2021.

Source: Memo (TTW, 15 October 2021)

As set out in the Monitoring and Alert Plan, the unreinforced masonry makes the Adina hotel susceptible to slight ground movement and ground borne vibrations from excavation. Of particular risk is the toppling of masonry at the top of the arch structure/in part of arch structure and complete out of plan failure of arch structure.

In order to avoid the above risks, the below shoring plan has been developed in conjunction with TTW. Any change to this plan must be reported to Urbis for comment.

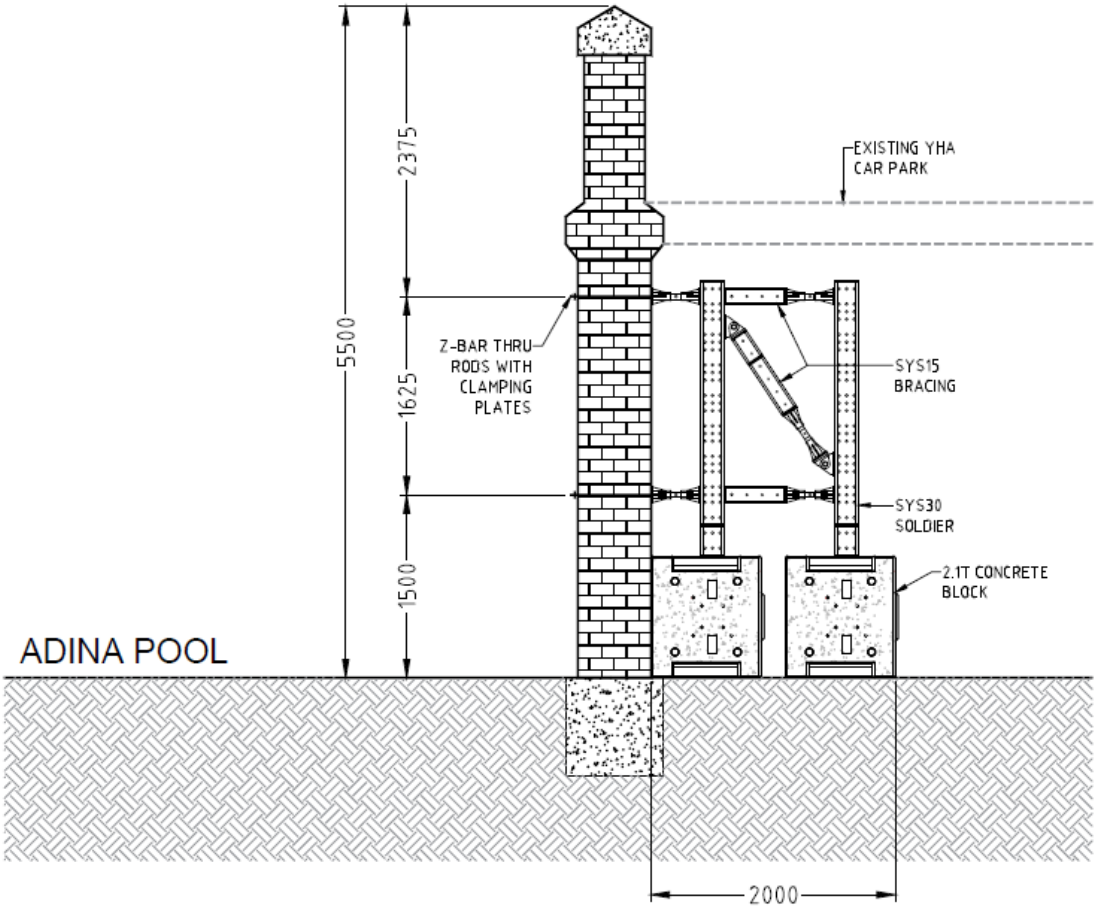

Figure 19 – Section showing propping of Adina Wall.

Source: Coates Hire (received February 2022)

10.4. PLATFORM 1 RETENTION (PILE) WALL

Following the demolition of the existing Railway Square YHA structure, an Eastern pile retention wall will be constructed adjacent to Platform 1. A piling rig will be situated directly on the Western side of platform 1 behind the A-Class hoarding. The piling operations to be undertaken are demonstrated in the image below.

This system will ensure the integrity of the adjacent operational areas of Central Station during bulk excavation which, while not significant in themselves, are part of a significant site which requires safe continuance of use.

Section 2.3 of the Tower Eastern Elevation Management Plan establishes risk mitigation measures that have been put in place to manage the piling works. Mitigation measures relevant to heritage are based around monitoring strategies for vibration, noise and dust. These strategies are reproduced in Section 6 of this report. Mitigation measures also relate to monitoring of movement during piling operations and subsequent bulk excavation on site by AEO certified structural advice including periodic review of monitoring data to ensure the retention structures is performing as expected (in line with the Structural Monitoring Alert and Response Plan – appended).

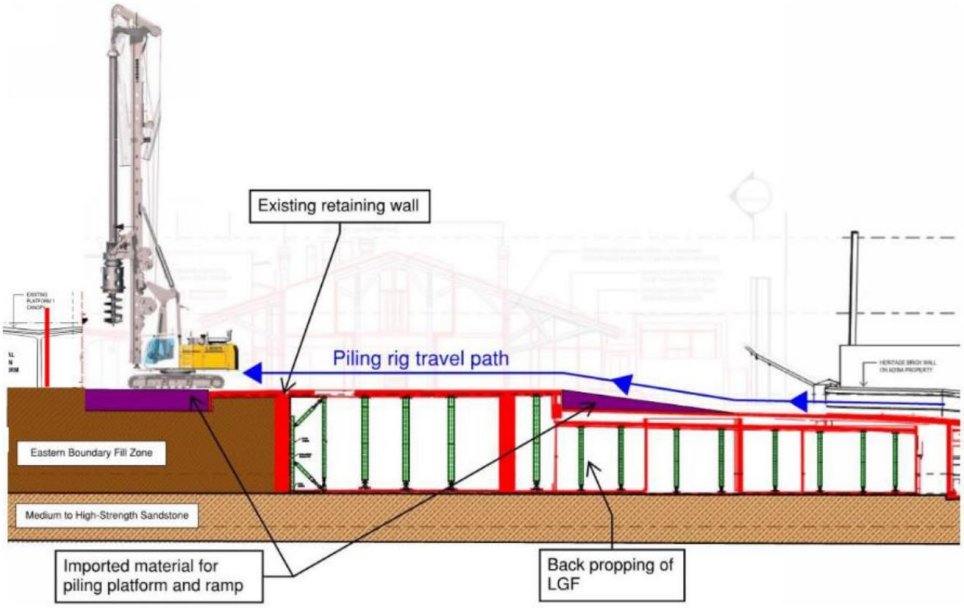

Figure 20 – Sectional view of piling operations on Eastern boundary.

Source: Tower Eastern Elevation Management Plan (Built Obayashi, November 2021)

The monitoring criteria and methodology for Platform 1 is established in Section 11.4.3 of this report.

10.5. BAGAGGE TUNNEL

During bulk excavation, existing fill over the Baggage Tunnel will be removed and the section of the tunnel within the Atlassian site boundary (which is of no significance) will be demolished and removed from the site. the below images (included at Figure 2 – 22 of the Tower Eastern Elevation Management Plan) demonstrate the temporary retention system for the remaining structure of the Baggage Tunnel, train platforms and surrounding heritage items (specifically the West Wing Extension) which are located outside the subject site.

The monitoring criteria and methodology for the retained sections of the Baggage Tunnel is established in Section 11.4.4 of this report.

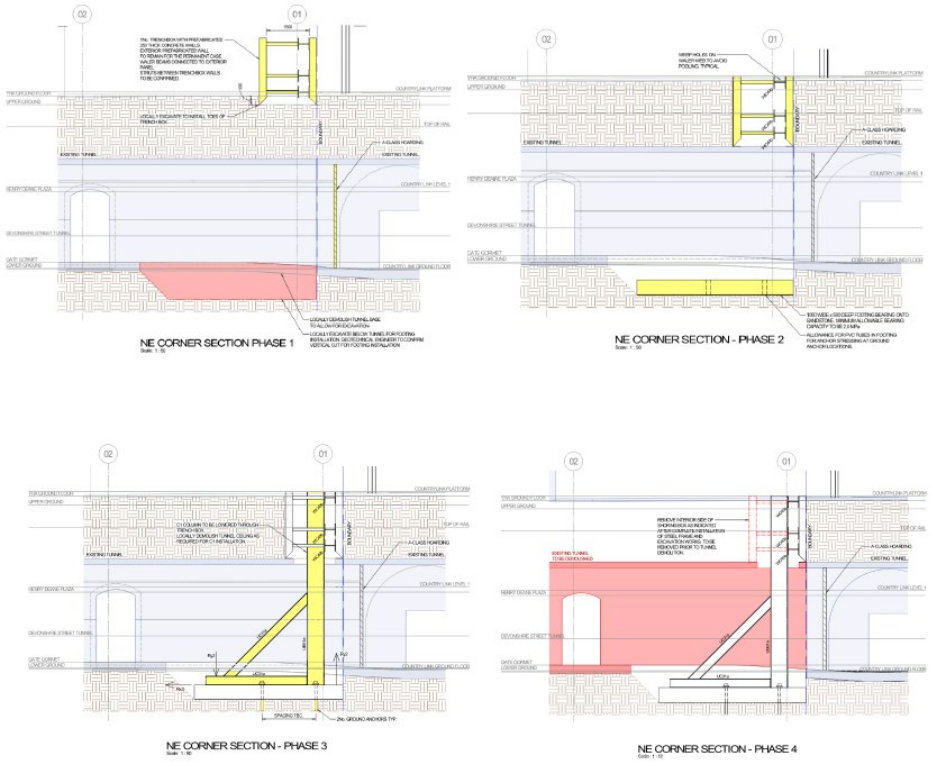

Figure 21 – North East Baggage Tunnel Temporary Retention and Demolition

Source: Tower Eastern Elevation Management Plan (Built Obayashi, November 2021)

10.6. DEVONSHIRE STREET TUNNEL

Excavation will be undertaken adjacent to the Devonshire Street Tunnel and partial demolition of the tunnel will be undertaken progressively as approved and agreed with TfNSW. The Devonshire Street Tunnel Demolition Management Plan outlines how demolition and adjacent excavation will be managed in the context of the retained sections of the Devonshire Street Tunnel. Please refer to that document if required.

10.7. NORTH EAST OVERSAIL

The northeast corner of the Atlassian tower extends over the existing SRA offices which are part of Central Station and the significant Western Extension identified in the Central Station Conservation Management Plan. The facades of this element and its form overall are significant and therefore a temporary structure supported off the tower core is proposed to protect the fabric below. The protection screen itself would have no physical impact on the heritage fabric.

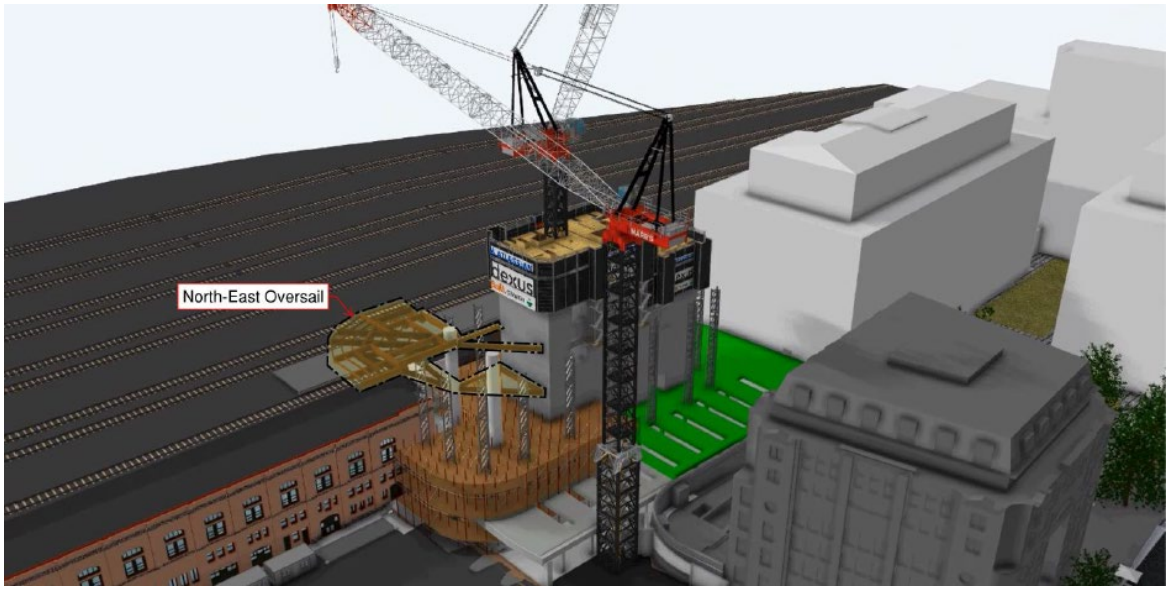

Figure 22 – North east over sail structure protecting the significant Western Extension.

Source: Tower Eastern Elevation Management Plan (Built Obayashi, November 2021)

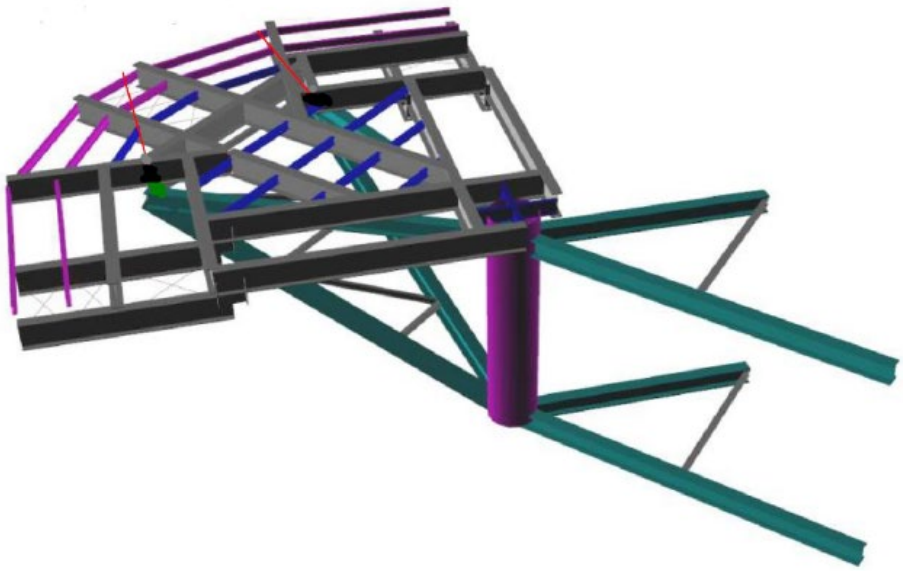

Figure 23 – Detail of north east sail structure protecting the significant Western Extension.

Source: Tower Eastern Elevation Management Plan (Built Obayashi, November 2021)

10.8. PERIMETER SCREENS AND EDGE PROTECTION FOR CONSTRUCTION OF TOWER

Specific areas of protection and retention are outlined individually below in this section. However, Section 2.9 of the Tower Conservation Management Plan establishes tower perimeter screens and edge protection as part of the overall overhead protection strategy to encapsulate the structure.

While developed for the safety of works and pedestrians in the area the screens and edge protection also serve the purpose of protection the high volume of surrounding heritage fabric from falling objects.

11. MONITORING AND REPAIR

11.1. ITEMS/PHASES OF WORKS TO BE MONITORED

Monitoring will be required and is planned for the following specific items/phases of work:

- Piling operations and Bulk excavation (Refer Section 11.2)
- Temporary protection works (Refer Section 11.3)
- Assets and structures surrounding the Development which may be affected by the proposed construction activities. (Refer Section 11.4 – note that only the monitoring of elements of significance or contributory value are addressed in this report).

11.2. MONITORING OF PILING AND BULK EXCAVATION FACE

The methodology for monitoring piling and bulk excavation works is set out in the Structural Monitoring Alert and Response Plan (TTW).

The monitoring criteria and vibration limits for piling and bulk excavation are as follows. Note this requires updates once finalised movements for piling and excavation are published. The position of monitors is to be finalised in conjunction with monitor providers.

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
N/A	Piles	New Structure	Vertical	Movement Monitor	TBC*	TBC*	TBC*	TBC*
			Horizontal	Movement Monitor	TBC*	TBC*	TBC*	TBC*
			Inclination	Movement Monitor	TBC*	TBC*	TBC*	TBC*

*To be coordinated with geotechnical input, forming part of Package 2 - Excavation

Figure 24 – Recommended movement monitoring limits for piled walls and excavation face.

Source: Movement Monitoring Alert and Response Plan (Built Obayashi, November 2021)

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

Figure 25 – Recommended vibration monitoring limits for piled walls and excavation face.

Source: Movement Monitoring Alert and Response Plan (Built Obayashi, November 2021)

11.3. MONITORING OF TEMPORARY PROTECTION WORKS

The methodology for monitoring temporary works is set out in Section 18.2 of the HSE CEMP. In summary, the methodology establishes the below:

- Temporary elements and the structures they support are to be monitored on a weekly basis.

- Details of the inspection are to be recorded on the Temporary Works Register.
- No alterations to the Temporary Works, including any part of the structure or element supporting the Temporary Works, is to be carried out without written authorisation from Built and approval from the Temporary Works designer

In addition to the above, any changes to temporary works directly impacting protection of significant fabric are to be reported to Urbis for comment.

11.4. MONITORING OF SURROUNDING ASSETS

The methodology for structural monitoring for assets surrounding the development work is set out in the Alert and Response Plan. In summary, the methodologies for each are set out below in this section. Note that the limits and trigger levels set out in this section are understood to be appropriate at the time of writing this report based on the information available to the relevant specialists at the time.

11.4.1. Monitoring Devices

Note that monitors are required to be installed to the surrounding heritage structures in accordance with the accompanying Construction Management Plans which are required as a condition of the approval. These monitors are necessary to ensure the integrity of the buildings in the context of the approved works. The monitors will be installed in the same manner as existing vibration monitors around the Station (mechanical fixings for buildings and adhesive for track monitoring). There is no heritage impact because of the mechanically fixed monitors, any penetrations can be easily patched. Track monitoring devices would be fixed using adhesive and are designed to have no permanent impact on the tracks.

11.4.2. Ambulance Avenue Masonry Wall

The location of the element is shown in the image below.

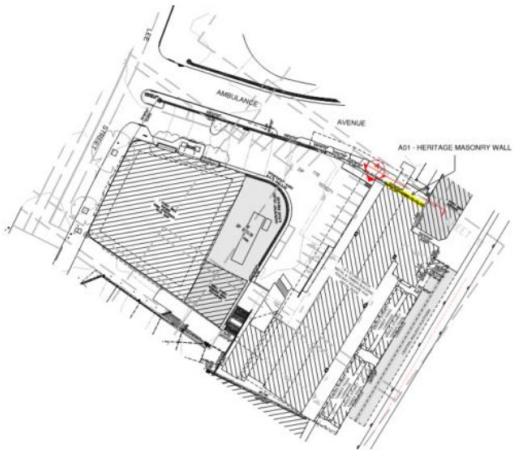

Figure 26 – Location of Ambulance Masonry Wall

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

The monitoring criteria and vibration limits for this item are as follows. Note this requires updates once finalised movements for piling and excavation are published. The position of monitors is to be finalised in conjunction with monitor providers.

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A01	Heritage masonry wall (Ambulance Avenue)	Buildings/ structures	Vertical	Movement Monitor	4*	<2.0*	≥2.0*	≥3.0*
			Horizontal	Movement Monitor	8	<4.0	≥4.0	≥7.0
			Inclination	Movement Monitor	8	<4.0	≥4.0	≥7.0

*Based on previous Mott MacDonald report, pending geotechnical input, which will require updates

Figure 27 – Recommended movement monitoring limits for Ambulance Masonry Wall

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

Figure 28 – Recommended vibration monitoring limits for Ambulance Masonry Wall

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

11.4.3. North East Building (Central Station Western Extension)

The location of the element is shown in the image below.

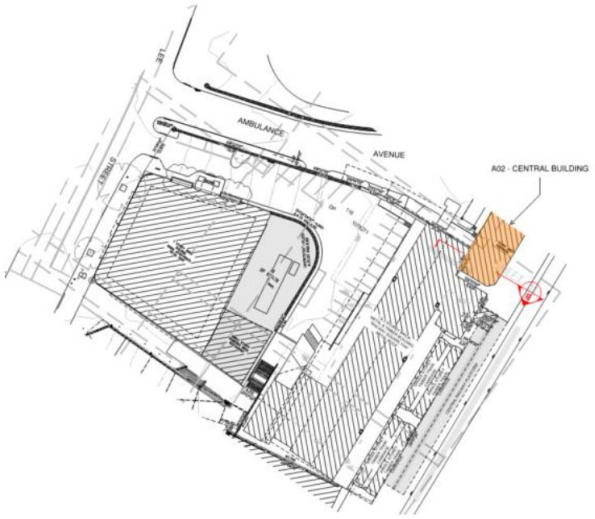

Figure 29 – Location of North East Building.

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

The monitoring criteria is as follows. Note this requires updates once finalised movements for piling and excavation are published.

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A08a	Devonshire Street 'Tunnel'	Buildings/ structures	Vertical	Movement Monitor	8*	<4*	≥4*	≥6.5*
			Horizontal	Movement Monitor	18	<9	≥9	≥15
			Inclination	Movement Monitor	18	<9	≥9	≥15

*Based on previous Mott MacDonald report, pending geotechnical input, which will require updates

Figure 30 – Recommended movement monitoring limits for North East Building.

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

Figure 31 – Recommended vibration monitoring limits for North East Building.

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

11.4.4. Baggage Tunnel

The location of the element is shown in the image below.

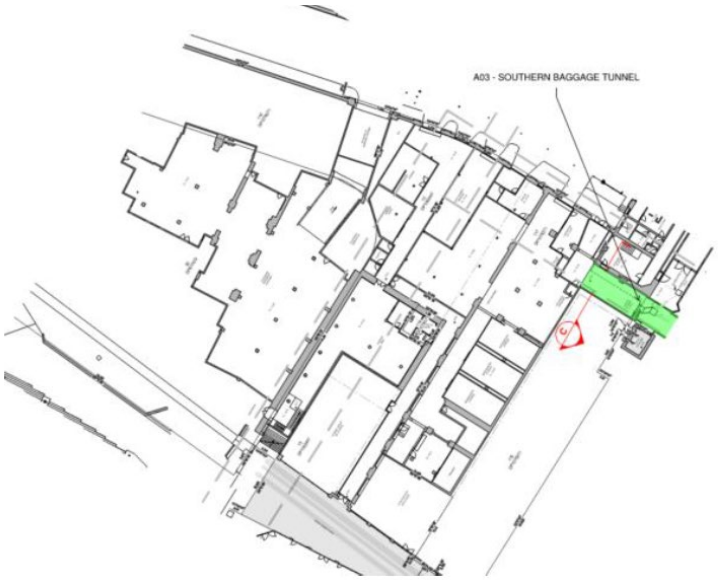

Figure 32 – Location of the Baggage Tunnel.

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

The monitoring criteria is as follows. Note this requires updates once finalised movements for piling and excavation are published.

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A03	(Southern) Baggage	Buildings/ structures	Vertical	Movement Monitor	7*	<3.5*	≥3.5*	≥5.5*
			Horizontal	Movement Monitor	5	<3	≥3	≥4
			Inclination	Not required	NA	-	-	-

Figure 33 – Recommended movement monitoring limits for the Baggage Tunnel.

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

Figure 34 – Recommended vibration monitoring limits for the Baggage Tunnel.

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

11.4.5. Platform 1

The location of the element is shown in the image below.

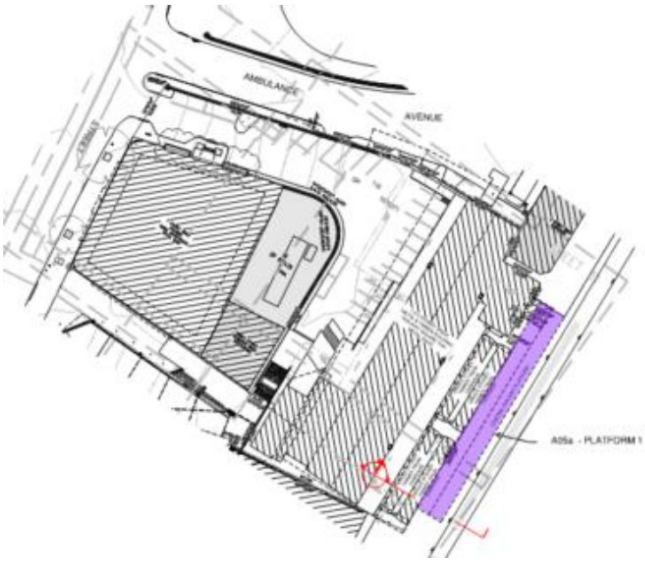

Figure 35 – Location of Platform 1.

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

The monitoring criteria is as follows. Note this requires updates once finalised movements for piling and excavation are published.

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A05a	Platform 1	Buildings/ structures	Vertical	Movement Monitor	8*	<4*	≥4*	≥6.5*
			Horizontal	Movement Monitor	3	<1.0	≥1.0	≥3.0
			Inclination	Not required	NA	-	-	-

*Based on previous Mott MacDonald report, pending geotechnical input, which will require updates

Figure 36 – Recommended movement monitoring limits for Platform 1.

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

Figure 37 – Recommended vibration monitoring limits for Platform 1.

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

11.4.6. Adina Hotel Masonry Wall

The location of the element is shown in the image below.

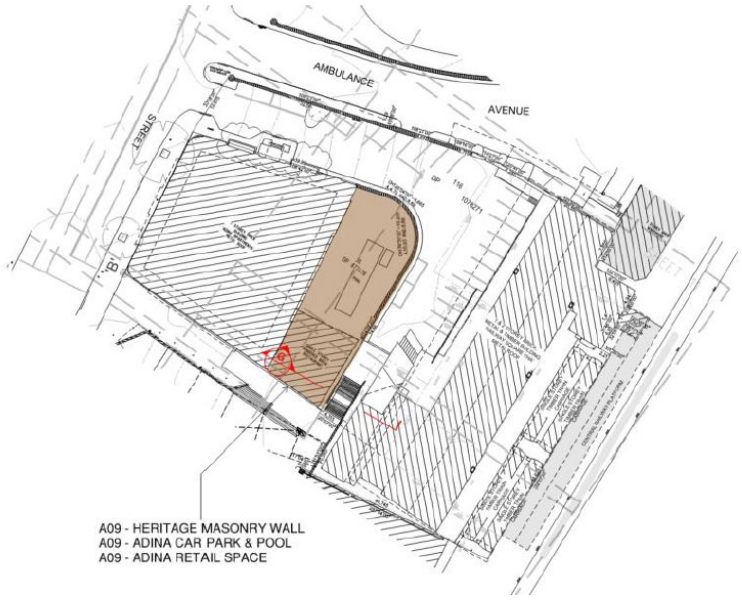

Figure 38 – Location of Adina Heritage Masonry Wall etc.

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

The monitoring criteria is as follows. Note this requires updates once finalised movements for piling and excavation are published.

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A09	Heritage masonry Adina	Buildings/ structures	Vertical	Movement Monitor	3*	<1.5*	≥1.5*	≥2.5*
			Horizontal	Movement Monitor	9	<4	≥4	≥8
			Inclination	Movement Monitor	9	<4	≥4	≥8

*Based on previous Mott MacDonald report, pending geotechnical input, which will require updates

Figure 39 – Recommended movement monitoring limits for Adina Hotel

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

Figure 40 – Recommended vibration monitoring limits for Adina Hotel.

Source: Movement Monitoring Alert and Response Plan (TTW, November 2021)

11.5. MONITORING PLAN

11.5.1. Traffic Light System

The Movement Monitoring Alert and Response Plan establishes that a traffic light alert system be implemented to record the condition of the assets and act as an early warning system. The system is noted to be as follows:

- *GREEN - Indicates that the construction activity may proceed as planned,*
- *AMBER - Indicates that the construction activity may proceed with caution. To proceed, contingency measures shall be implemented (which may include, but not be limited to, an increase in the frequency of monitoring and/or exclusion zoning), and*
- *RED - Indicates that the construction activity shall stop immediately. The site shall be made safe and contingency measures shall be implemented to prevent further change in the condition of the asset*

The above traffic light system relates to the preliminary alert levels established in Section 5.4 of the report which also establishes the alert levels for extent structures and assets and required frequency of monitoring. These numbers have been identified by vibration specialists and the construction works will be undertaken in line with the ongoing advice of these specialists to ensure the integrity of the significant fabric.

11.5.2. Monitoring Action Plan

The monitoring action plan is set out in Section 5.8 and summarised in the reproduced table below.

Table 4: Alert level response and actions

Alert Level	Description	Response and action
GREEN	Movements and values are less than 50% of the maximum predicted value	• If steady/constant trend of recorded movements/values is observed; no further response/action required
		• Progress of Works and monitoring to continue as planned
		• If a noticeable increase in recorded movements/values is observed:
		– Monitoring data reviewed; consideration given to increasing monitoring frequency. Reassessment of predicted movements may be required.
		– Increase vigilance during Works
		• If construction works are complete and a steady/constant trend is observed, consideration can be given to reducing/ceasing monitoring
AMBER	Movements and values are greater than 50% but less than 80% of the maximum predicted value	• Monitoring data to be reviewed and interpreted
		• Works process to be reviewed
		• Monitoring to continue as planned
		• Designer's Representative to be informed. Reassessment of predicted movement required to be undertaken based on latest recorded data
		• Construction works may continue subject to process review findings. Process may include
		– Review of construction methodology and consideration to adjusting methodology where and as necessary
		– Based on review and interpretation of monitoring data, monitoring frequency to be increased where and as necessary
		• If a noticeable increase in recorded movements and values is observed then remedial and mitigation measures will need to be developed, documented and implemented where and as necessary
		• Comprehensive risk assessment/re-evaluation review with appropriate contingency planning to be undertaken
RED	Movements and values are greater than 80% of the maximum predicted value	• Construction Manager notified of exceedance and consideration given to immediately and temporarily ceasing construction works
		• Designer's Representative and all relevant parties to be notified of trigger level exceedance as per Table 5
		• Monitoring data to be reviewed and interpreted
		• State Transit Duty Managers and Customer Area Managers to be alerted for transport assets.
		• Works process to be reviewed. Review to define if construction works can proceed and what other actions are required, including:
		– Risk assessment/contingency plan to be implemented as appropriate
		– Monitoring frequency to be increased where and as necessary
		– Remedial and mitigation measures developed, documented and implemented where and as necessary
		• Reassessment of predicted ground movements to be undertaken by Design Team using latest monitoring data

11.6. REPAIR (INSPECTION BEFORE, DURING AND AFTER COMPLETION OF WORKS)

Inspection Before Works

As identified in the principal CEMP (Section 2.1), the project team will undertake Condition and Dilapidation surveys prior to commencement of works on site. These surveys should include significant fabric in the vicinity of the subject site in the area of construction (or associated) works. The condition in these surveys is to be treated as the condition that is to be maintained throughout and at the end of construction at a minimum (notwithstanding any conservation works that may be identified and undertaken throughout).

Urbis has undertaken a Photographic Archival Recording (2022) which is also to be used to reference the condition of the place at the outset of the project.

Inspection During Works

Inspection during the works is to be undertaken in accordance with the monitoring methodologies set out above in this section. Reporting and repairs is to be undertaken in accordance with the general guidelines below. Note that any damage is to be reported to the relevant members immediately.

Inspection Following Completion of Works

The project team is required to undertake a Condition and Dilapidation survey following completion of works. The survey is to make direct reference to the survey undertaken prior to the commencement of works on site.

The project team is to invite Urbis to similarly undertake a site visit following completion of the works, including access to all surrounding buildings. Urbis to provide a summary of any conditions issues to be rectified.

All issues to be rectified are to be rectified in accordance with the below guidelines.

General Guidelines

Damage to significant fabric is to be avoided. Damage because of deviation from the methodologies established in the comprehensive suite of documents supporting this SSD approval is not acceptable.

Repair of any significant elements damaged as part of any stage of the construction works associated with this project is subject to the following heritage considerations/process:

- Damage to heritage fabric for the purpose of this section means any effect that has compromised the structural integrity of heritage fabric or an effect which has had a cosmetic impact on any fabric. Heritage fabric is that which is defined in Section 2 of this report.
- All damage is to be reported to the Project Manager, Heritage Consultant and any associated technical specialist (including specifically engineers) immediately upon identification.
- Where damage has compromised the structural integrity of an element a suitably qualified engineer is to review the issue and provide advice on the most appropriate method for rectification. This method is to be reported to Urbis for review and comment and consideration will be given to consulting with HNSW.
- Cosmetic damage is to be reported to Urbis and specialists where required and where identified by Urbis (e.g. stonemason). Specialist and/or Urbis to provide appropriate repair methodology.
- All damage to heritage fabric as a result of the project's construction works is to be rectified in the manner agreed with Urbis as part of the project.

DISCLAIMER

This report is dated 6 June 2022 and incorporates information and events up to that date only and excludes any information arising, or event occurring, after that date which may affect the validity of Urbis Pty Ltd **(Urbis)** opinion in this report. Urbis prepared this report on the instructions, and for the benefit only, of BUILT **(Instructing Party)** for the purpose of the protection of heritage fabric **(Purpose)** and not for any other purpose or use. To the extent permitted by applicable law, Urbis expressly disclaims all liability, whether direct or indirect, to the Instructing Party which relies or purports to rely on this report for any purpose other than the Purpose, and to any other person which relies or purports to rely on this report for any purpose whatsoever (including the Purpose).

In preparing this report, Urbis was required to make judgements which may be affected by unforeseen future events, the likelihood and effects of which are not capable of precise assessment.

All surveys, forecasts, projections and recommendations contained in or associated with this report are made in good faith and on the basis of information supplied to Urbis at the date of this report, and upon which Urbis relied. Achievement of the projections and budgets set out in this report will depend, among other things, on the actions of others over which Urbis has no control.

In preparing this report, Urbis may rely on or refer to documents in a language other than English, which Urbis may arrange to be translated. Urbis is not responsible for the accuracy or completeness of such translations and disclaims any liability for any statement or opinion made in this report being inaccurate or incomplete arising from such translations.

Whilst Urbis has made all reasonable inquiries it believes necessary in preparing this report, it is not responsible for determining the completeness or accuracy of information provided to it. Urbis (including its officers and personnel) is not liable for any errors or omissions, including in information provided by the Instructing Party or another person or upon which Urbis relies, provided that such errors or omissions are not made by Urbis recklessly or in bad faith.

This report has been prepared with due care and diligence by Urbis and the statements and opinions given by Urbis in this report are given in good faith and in the reasonable belief that they are correct and not misleading, subject to the limitations above.

TTW Structural Civil Traffic Façade

Structural Monitoring Alert and Response Plan

Atlassian Central

Built Pty Ltd / 11 February 2022

191797

Revision D

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Your Partner in Engineering

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1.0 Document Register

AUTHOR	REVIEWED	APPROVED	ISSUE	STATUS	DATE
Angus Busuttil	Martin Folan		Rev. A	AFC Package 1*	24/11/21
Angus Busuttil	Martin Folan		Rev. B	75% Package 2*	13/12/21
Angus Busuttil	Martin Folan		Rev. C	AFC Package 1* 75% Package 2*	28/01/22
Angus Busuttil	Martin Folan		Rev. D	AFC Package 1* AFC Package 2*	11/02/22

*Note: Phase 2 is for excavation and retention and is based off draft geotechnical input. This report is subject to change with development from geotechnical limits and analysis. This report has been issued with the 75% Package 2 drawings for Earthworks and Retention. Amendments have been made to sections within the Package 1 portion of this report to reflect newly available geotechnical information

This document supersedes previously issued report titled '191797-TTW-CE-RP-0102-D-Atlassian Central Stage Movement Monitoring Alert and Response Plan'.

2.0 About this document

This document looks to provide a framework for the structural monitoring, alert and response plan for assets and structures surrounding the Development which may be affected by the proposed construction activities.

TTW has reviewed the Preliminary Monitoring, Alert and Response Plan (413353-MMD-XX-RP-G-0002) prepared by Mott MacDonald, 8th April 2021. This document looks to expand on the on this with due consideration for the proposed construction methodologies of Built Obayashi JV (BOJV). Several sections and items have been removed from this report to more specifically target key elements.

The Gate 3 submission has been broken up into 6 Design Packages which include;

1. **Parcel Shed Dismantle, Heritage and Demolition**
2. **Earthworks and Retention**
3. Core Basement and Podium Structure
4. Superstructure

   4.1 YHA Structure

   4.2 Tower Structure

5. Façade and Services

   5.1 External facade

   5.2 Tower Building Services and Internal façade

6. Finishes, Heritage Reconstruction/External works, OSD and Lobbies

3.0 Background Information

3.1 Atlassian Central site

The ‘Site’ is directly adjacent to the Western wing extension of Central Station, and forms part of the ‘Western Gateway Sub-precinct’ of the Central Railway Station lands. It is situated between the existing CountryLink and Intercity railway platforms to the east and the Adina Hotel (former Parcel Post Office) to the west.

Existing vehicle access to the Site is via Lee Street, however the Lee Street frontage of the Site is only the width of the access handle. Current improvements on the Site include the Parcels Shed, which operated in association with the former Parcels Post Office (now the Adina Hotel). The Site is currently used as the Railway Square YHA. The Site also includes the Western entryway to the Devonshire Street Pedestrian, which runs East-West through Central Station under the existing railway lines.

The Site is situated in one of the most well-connected locations in Sydney. It is directly adjacent to Central Station Railway which provides rail connections across metropolitan Sydney, as well as regional and interstate connections and a direct rail link to Sydney Airport. The Site is also within proximity to several educational institutes and is a city fringe location which provides access to key support services.

Central Railway Station is currently undergoing rapid transformation to allow for integration of rail, metro, and light rail transport infrastructure. This will elevate the role of Central Station not only for transport but also enhance opportunities for urban renewal and revitalisation of the surrounding precinct. This is one of the key drivers for the identification of the Central SSP and the Western Gateway Sub-precinct to accommodate an innovation and technology precinct.

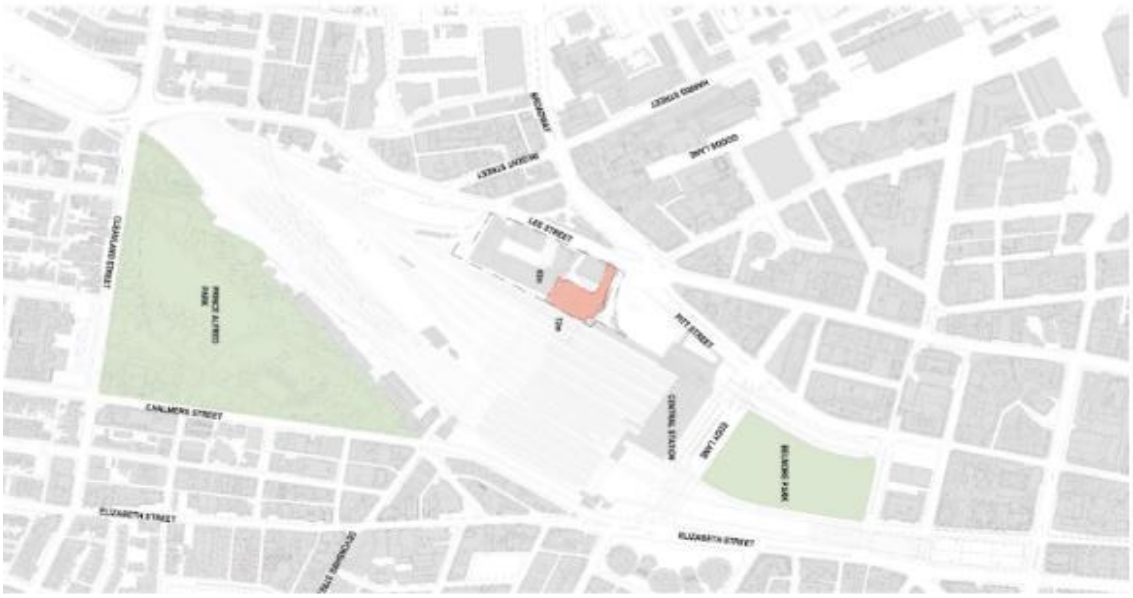


Figure 1 – The Site, Atlassian Central

3.2 Project Description

The proposed building will facilitate the development of a new mixed-use development comprising ‘tourist and visitor accommodation’ (in the form of a ‘backpackers’) and commercial office space within the tower. Retail, lobby and food and drink premises are located at the Lower Ground and Upper Ground levels.

Atlassian Central at 8-10 Lee Street, the ‘Development’ will be the new gateway development at Central Station which will anchor the new Technology Precinct proposed by the NSW Government. The new building will be purpose-built to accommodate the Atlassian Headquarters, a new TfNSW Pedestrian Link Zone, and the new Railway Square YHA backpacker’s accommodation, in addition to commercial floorspace to support Tech Start-ups.

The new development is to be built over the existing heritage former Inwards Parcels Shed (the Parcels Shed) located on the western boundary of Central Station with the Adina hotel to the west. The works includes a 38-storey mixed-use tower with basement loading dock facilities and EOT facilities accessed off Lee Street, 2 storey lobby utilising the Parcels Shed building, lower ground and upper ground retail, YHA hostel and commercial tower with staff amenities to the mid-level and roof top areas and a pedestrian Link Zone works for TfNSW.

The building design is part of a site plan designed to connect with future developments to both the south and east and integrate with a cohesive public realm for the broader Sydney community in accordance with NSW government strategic planning.

The existing Parcels Shed will be adaptively re-used in accordance with best practice heritage process and form the upper level of a 2-storey entry volume that connects visually with the 2 level Link Zone. Over the roof of the Parcels Shed, a new privately owned publicly accessible landscaped area will be created as the first part of a new upper-level public realm that may extend to connect to a future Central Station concourse or future Over Station Development.

Interfaces from the overall site and especially the State works Link Zone have been designed in consultation with the adjoining stakeholders. These stakeholders include TfNSW to the north and south, Toga and the Adina Hotel operator to the west and the Dexus Fraser’s site to the south. Connections via the Link Zone, through the basements, and off the proposed new Link Zone dive ramp will be designed to enable existing and future developments to function in both the day 1 scenario and end state when all developers have completed their works.

The overall project aspiration is to create a world class tech precinct with effective pedestrian links through the Atlassian site to the Central Station western forecourt to Central Walk west and adjoining stakeholder’s sites.

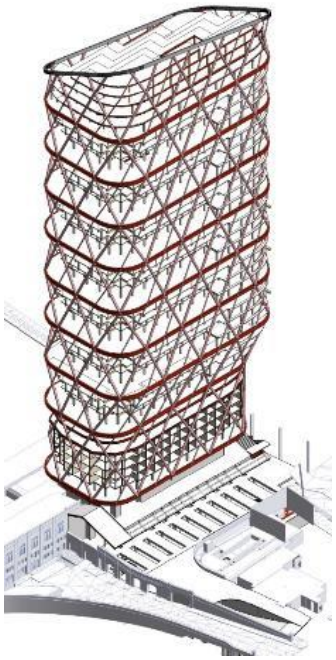


Figure 2: Proposed Development

3.3 Structural Overview

The tower floors are supported by a reinforced concrete core, a steel exoskeleton and two mega-columns. The exoskeleton is supported at L7 by a series of diagonal struts that take the load from the perimeter back to the core at L1. Only the core and mega columns come to ground. The basement is a post tensioned structure supported on columns.

Lateral stability is provided by the RC core with the lateral load path down to the core pad footings. The retention system consists of soldier piles on the northern, eastern and southern boundaries, and an RC wall on the western boundary. Retention anchors are used in the temporary condition. In the permanent condition, the piles and RC walls are braced by the slabs and unbalanced retention loads resisted by the core. On the south is an access tunnel which will provide access to the Dexus Fraser development at a future date.

3.4 Demolition Phase 1 and Excavation Phase 2 Preamble

As part of the Demolition Phase 1 package, monitoring requirements for demolition have been included. Further work is required from geotechnical modelling for the lateral analysis of excavation to predict lateral and vertical movements on the existing structures to provide appropriate monitoring limits. It is anticipated that this information will be provided for the AFC excavation package of works (Package 2). Please note that if displacements from geotechnical reports differ from previously anticipated, the limits in this report are subject to change.

3.5 Report Structure

This report has been developed from a previously issued Mott MacDonald report with the intention of providing a guide to monitoring that can be measured by contractors with specific experience in heritage structures and rail developments. Several monitoring items have been removed from this report due to assessments conducted and design / demolition changes. These include:

- A07 - Henry Deane Plaza
- A08d – HV Cables (where tunnelling beneath)
- A10a – Adina Carpark (has been incorporated into A09)
- A10b – Adina Pool (has been incorporated into A09)
- A11 – Adina Retail Space (has been incorporated into A09)
- A12 – Heritage Arch / Adina carpark access ramp (to be demolished)

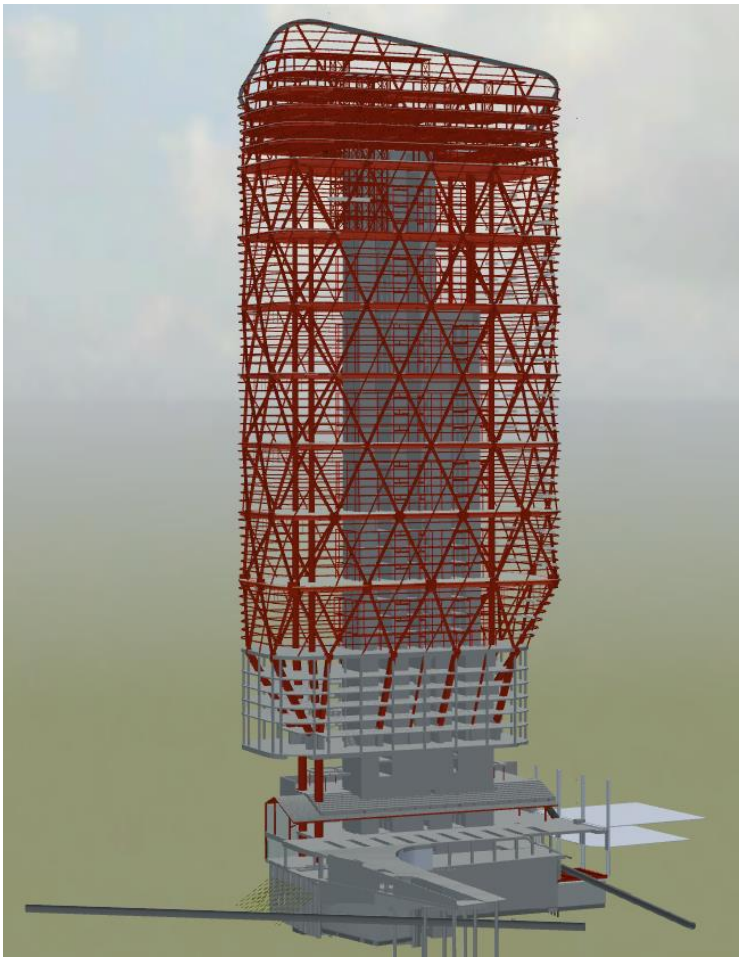


Figure 3: Tower Structure

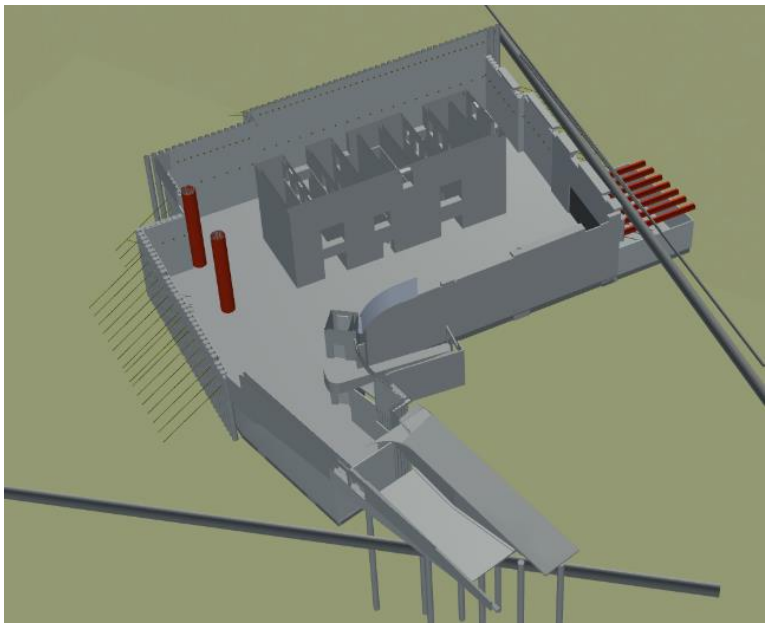


Figure 4: Retention System (Basement Slabs Not Shown for Clarity)

4.0 Identified Assets & Structures

4.1 Heritage Masonry Facade (Ambulance Avenue) - A01

4.1.1 Description: Part of Building/Structure

- This is a portion of the existing heritage masonry wall in the South-East corner of Ambulance Avenue. The intent is to temporary shore the wall with a proprietary/bespoke façade retention system to ensure stability and limit the effects of the surrounding construction activities.
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.1.2 Construction

- The heritage facade is of unreinforced masonry construction with brickwork and sandstone feature arches. The façade is generally in a poor condition
- The unreinforced masonry construction makes the masonry facade susceptible to slight ground movements and ground borne vibrations from excavation.

4.1.3 Potential Impact of Construction Activities:

- Development of cracks/propagation of existing cracks in masonry and/or mortar
- Movement in wall
- Toppling of masonry at top of wall/in part of wall
- Complete out-of-plane failure of wall

4.1.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information. The criteria for the masonry wall is based on a wall span / 750 deflection criteria identified in CIRIA C579 Retention of Masonry Facades – Best Practice Guides (2003). The height of the structure has been taken from the assumed footing depth of fine to medium grain sandstone.

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A01	Heritage masonry wall (Ambulance Avenue)	Buildings/ structures	Vertical	Movement Monitor	4*	<2.0*	≥2.0*	≥3.0*
			Horizontal	Movement Monitor	15	<8.0	≥8.0	≥12.0
			Inclination	Movement Monitor	15	<8.0	≥8.0	≥12.0

*Based on previous Mott MacDonald report, pending geotechnical input, which will require updates

Recommended Vibration Monitoring Limits

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

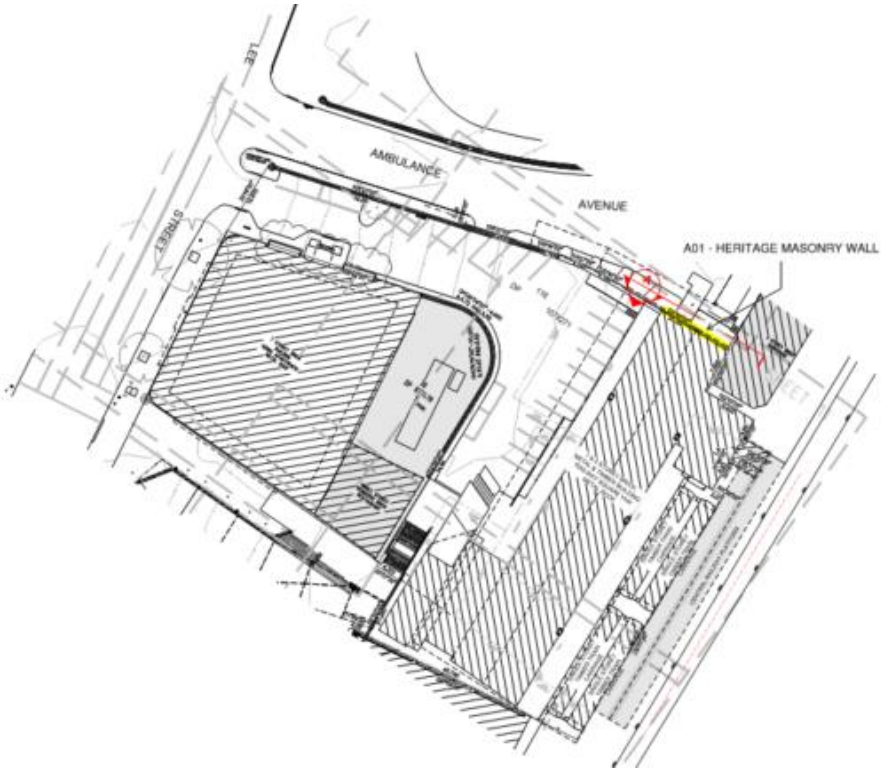


Figure 5: Plan View of Heritage Masonry Wall on Ambulance Ave

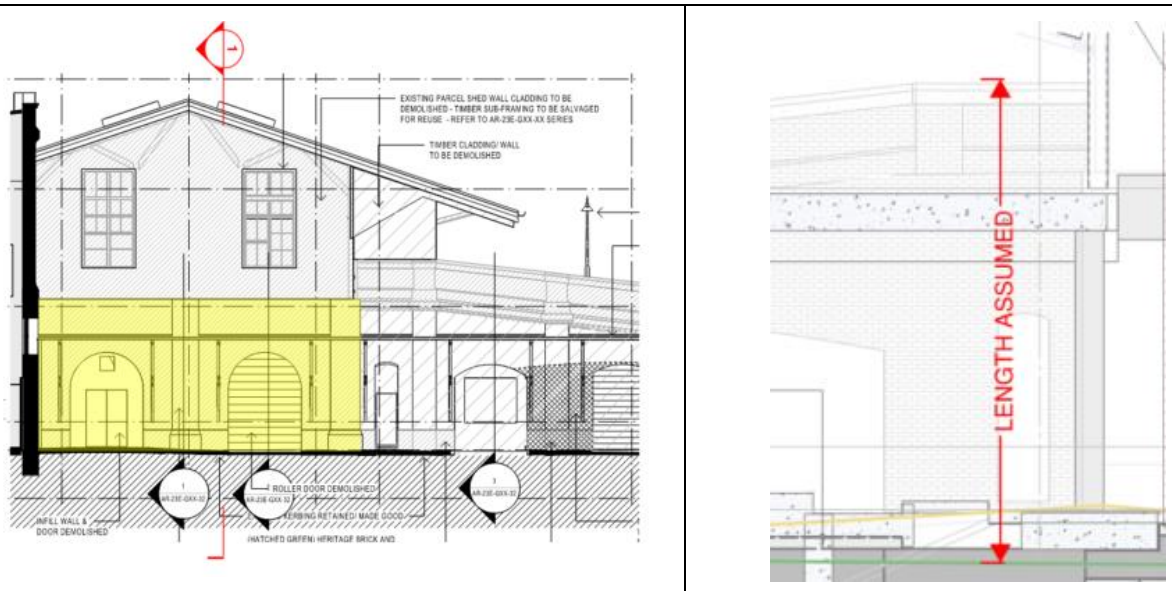


Figure 6: Elevation View of Heritage Masonry Wall on Ambulance Ave (BVN Dwg.AR-23B-G01-02[5]) With Assumed Footing Depths for Characteristic Height

4.2 Central Building - A02

4.2.1 Description: Building/Structure

- Heritage building/façade structure at the North-East of the Development, adjoining existing YHA timber "Inwards Parcels Shed", Parallel to Platform 1. This structure will be operational during the expected construction activities.
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.2.2 Construction

- The heritage façade of the central building is of unreinforced masonry construction with brickwork and sandstone feature arches. The façade is generally in a reasonable condition for age.
- The unreinforced masonry construction makes the masonry facade susceptible to slight ground movements and ground borne vibrations from excavation.

4.2.3 Potential Impact of Construction Activities:

- Increase in level of noise
- Development of cracks/propagation of extant cracks in façade structure/masonry and/or mortar
- Excessive vibration
- Movement in façade structure/wall
- Toppling of masonry at top/part of façade structure/wall
- Complete out-of-plane failure of façade structure/wall
- Damage to window glazing

4.2.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information. The criteria for the masonry building is based on a wall span / 750 deflection criteria identified in CIRIA C579 Retention of Masonry Facades – Best Practice Guides (2003). The height of the structure has been taken from the assumed footing depth of fine to medium grain sandstone.

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A08a	Devonshire Street 'Tunnel'	Buildings/ structures	Vertical	Movement Monitor	2*	<2*	≥2*	≥2*
			Horizontal	Movement Monitor	20	<10	≥10	≥16
			Inclination	Movement Monitor	20	<10	≥10	≥16

*Based on Douglas Partners Draft Impact Assessment date February 2022 (86767.04.R.013.DftA)

Recommended Vibration Monitoring Limits

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

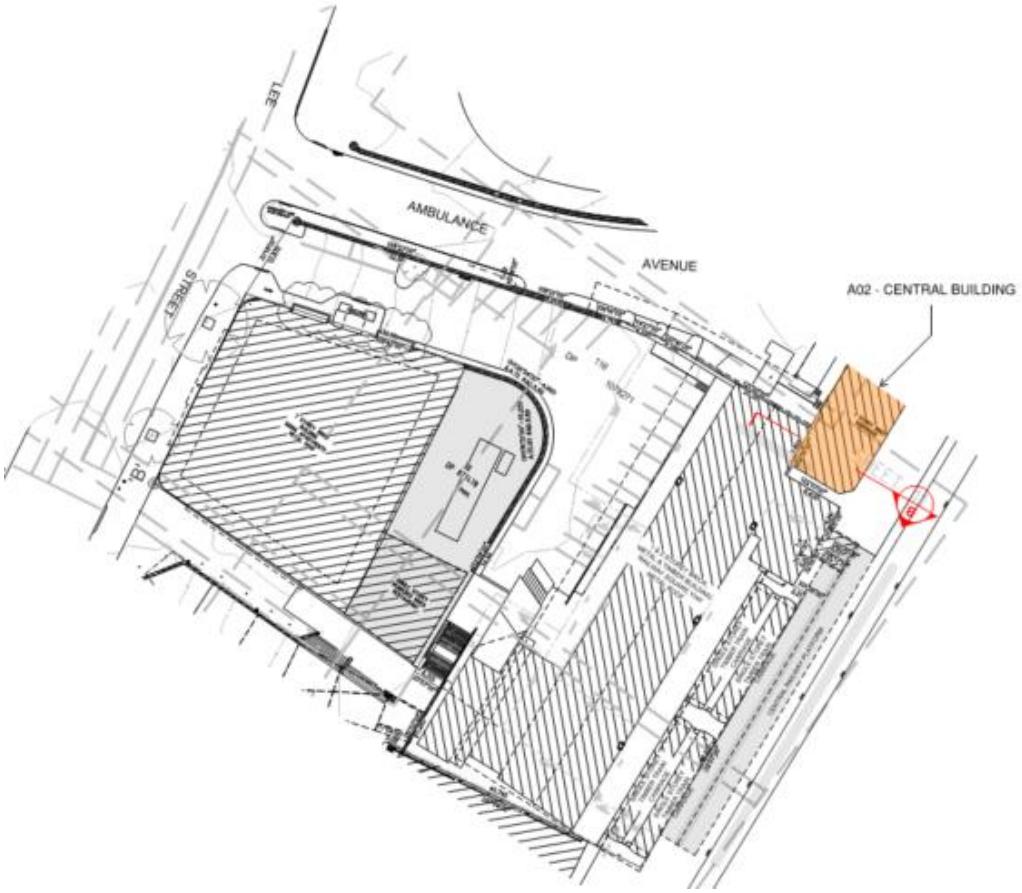


Figure 7: Plan View of Central Building

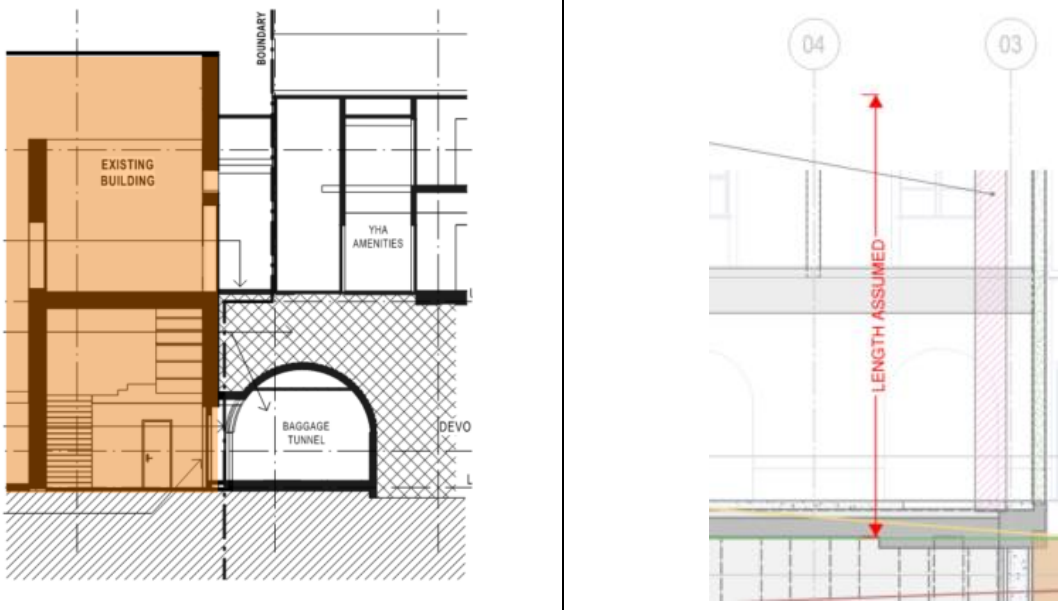


Figure 8: Cross-Section Elevation View of Central Building (BVN Dwg. AR-23D-GXX-03[2]) With Assumed Footing Depths for Characteristic Height

4.3 Baggage Tunnel - A03

4.3.1 Description: Part of Building/Structure

- Existing access tunnel at level of basement/Ambulance Avenue at the North-East of the Development, providing access to the existing goods lift at Platform 1 and Western Baggage Tunnel which extending beneath Platform 1.
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.3.2 Construction

- The baggage tunnel is of unreinforced arched concrete construction. The tunnel structure is generally in a reasonable condition for age.
- The unreinforced concrete construction makes the baggage tunnel susceptible to slight ground movements and ground borne vibrations from excavation.

4.3.3 Potential Impact of Construction Activities:

- Increase in level of noise
- Damage to support(s) of tunnel
- Development of cracks/propagation of extant cracks in concrete structure
- Excessive vibration
- Unintentional load transfer to goods lift

4.3.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information. The criteria for the masonry wall is based on a wall span / 750 deflection criteria identified in CIRIA C579 Retention of Masonry Facades – Best Practice Guides (2003).

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A03	(Southern) Baggage	Buildings/ structures	Vertical	Movement Monitor	7*	<3.5*	≥3.5*	≥5.5*
			Horizontal	Movement Monitor	5	<3	≥3	≥4
			Inclination	Not required	NA	-	-	-

*Based on previous Mott MacDonald report, pending geotechnical input, which will require updates

Recommended Vibration Monitoring Limits

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

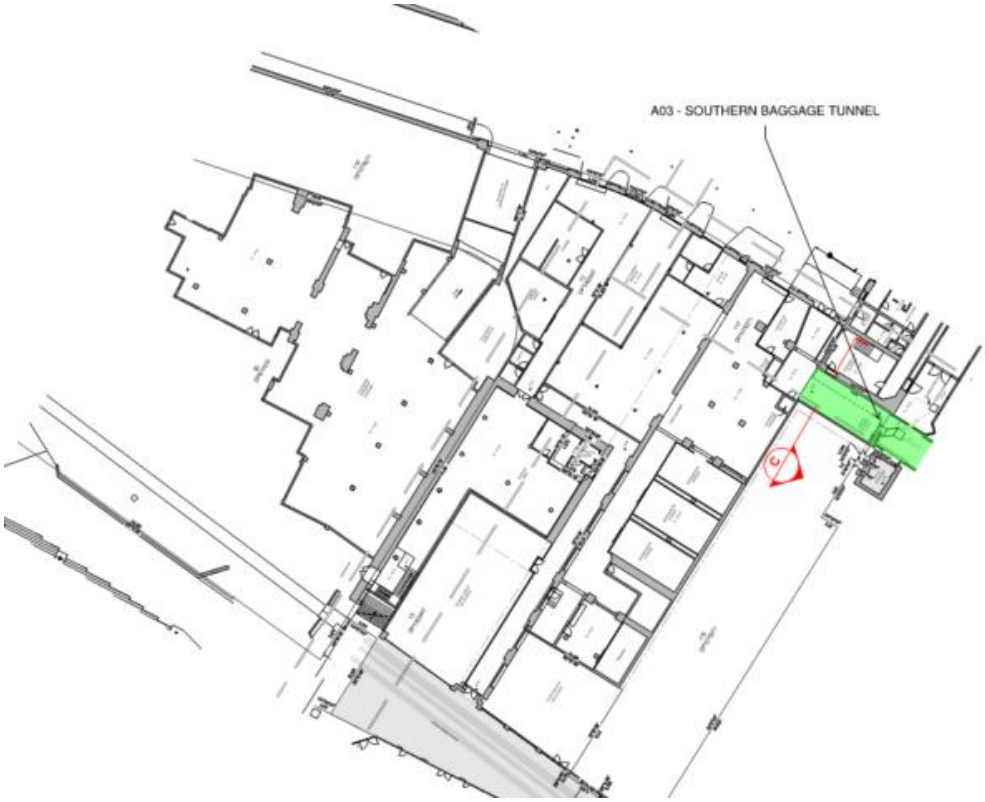


Figure 9: Plan View of Baggage Tunnel

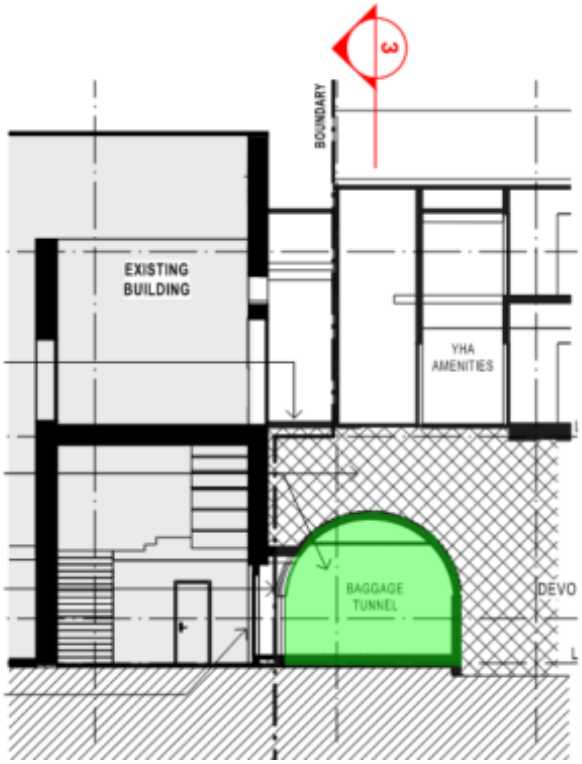


Figure 10: Cross-Section Elevation View of Baggage Tunnel (BVN Dwg. AR-23D-GXX-04[2])

4.4 Goods Lift - A04

4.4.1 Description: Part of Building/Structure

- Lift core extending from level of basement to Platform 1, located at the North-East of the Development. This structure will be operational during the expected construction activities, with some limited closure during piling operations.
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.4.2 Construction

- The baggage tunnel is understood to be of unreinforced concrete construction. The lift structure is awaiting investigations to confirm however appears to generally be in a reasonable condition for age.
- The unreinforced concrete construction makes the goods lift susceptible to slight ground movements and ground borne vibrations from excavation.

4.4.3 Potential Impact of Construction Activities:

- Increase in level of noise
- Damage to support(s) of lift
- Development of cracks/propagation of extant cracks in concrete structure
- Excessive vibration

4.4.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information. The criteria for the masonry wall is based on a wall span / 750 deflection criteria identified in CIRIA C579 Retention of Masonry Facades – Best Practice Guides (2003). The height of the structure has been taken from the assumed footing depth of fine to medium grain sandstone.

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A04	Goods lift core	Buildings/ structures	Vertical	Movement Monitor	5*	<2.5*	≥2.5*	≥4*
			Horizontal	Movement Monitor	20	<10	≥10	≥16
			Inclination	Not required	NA	-	-	-

*Based on previous Mott MacDonald report, pending geotechnical input, which will require updates

Recommended Vibration Monitoring Limits

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

Figure 11: Plan View of Goods Lift Core

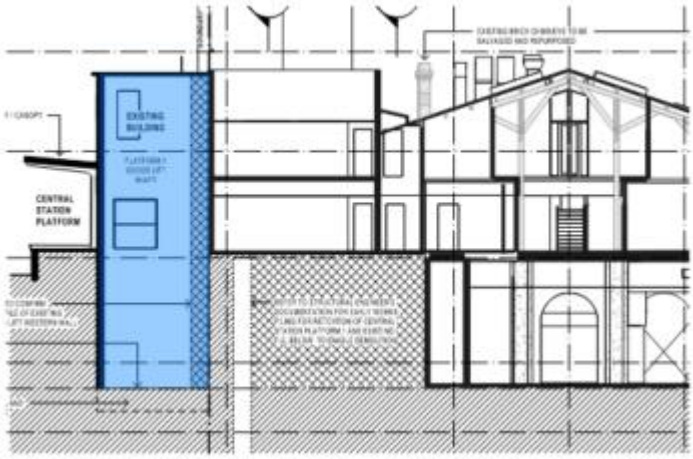


Figure 12: Cross-Section Elevation View of Goods Lift Core (BVN Dwg. AR-23D-GXX-01[5])

4.5 Platform 1 – A05a

4.5.1 Description: Part of Building/Structure

- 'Country Link' platform located at Eastern boundary of the Development, comprising platform structure, stair and elevated walkway and canopy, all at Platform 1. This structure will be operational during the expected construction activities, with temporary delineation provided between site and pedestrians.
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.5.2 Construction

- Platform 1 is understood to consist of a reinforced concrete slab bearing onto unreinforced masonry walls with unreinforced concrete footings. The platform structure appears to be in reasonable condition for age.
- The unreinforced masonry construction makes the platform susceptible to slight ground movements and ground borne vibrations from excavation.

4.5.3 Potential Impact of Construction Activities:

- Increase in level of noise
- Damage to platform structure(s), including but not limited to vibration in structures; excessive deflection in stair, walkway, canopy, and secondary elements; damage to welded connections and/or loosening of mechanical/bolted connections
- Settlement of existing ground, including but limited to compaction and/or consolidation, heaving, and liquefaction

4.5.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information. The criteria for the masonry wall is based on a wall span / 750 deflection criteria identified in CIRIA C579 Retention of Masonry Facades – Best Practice Guides (2003). The height of the structure has been taken from the assumed footing depth of fine to medium grain sandstone.

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A05a	Platform 1	Buildings/ structures	Vertical	Movement Monitor	13*	<7*	≥7*	≥11*
			Horizontal	Movement Monitor	11	<6.0	≥6.0	≥9.0
			Inclination	Not required	NA	-	-	-

*Based on Douglas Partners Draft Impact Assessment date February 2022 (86767.04.R.013.DftA)

Recommended Vibration Monitoring Limits

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

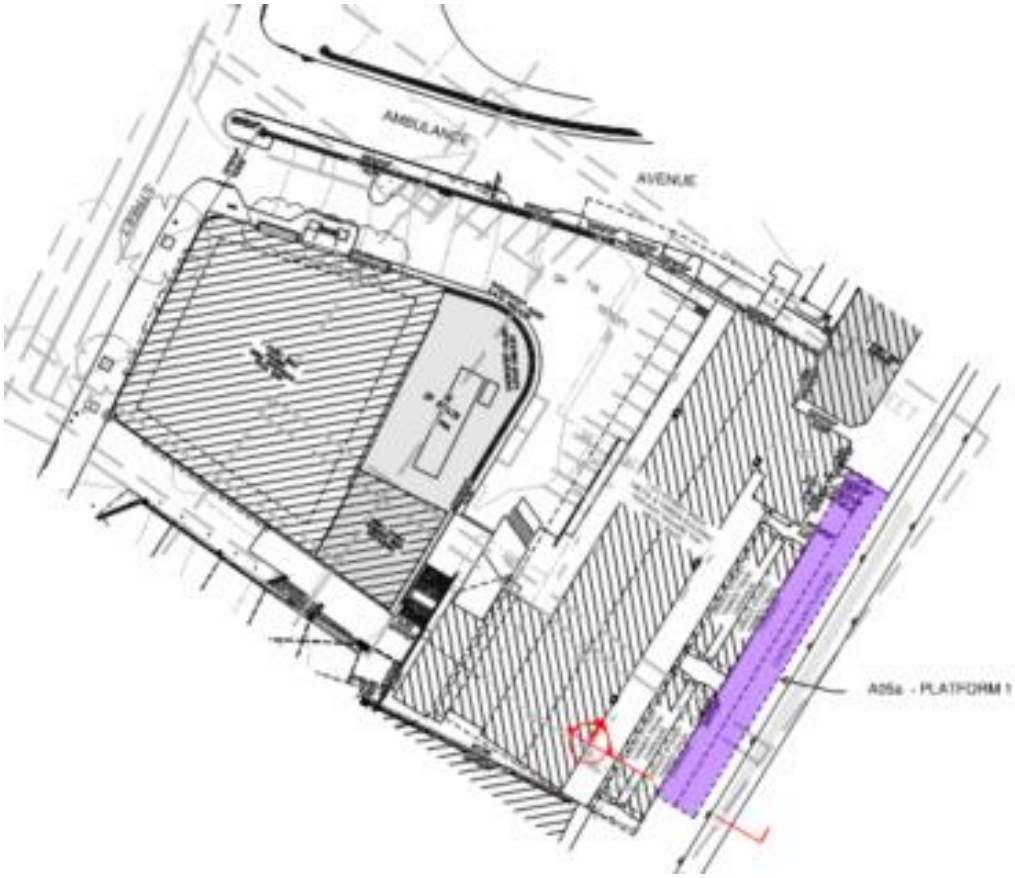
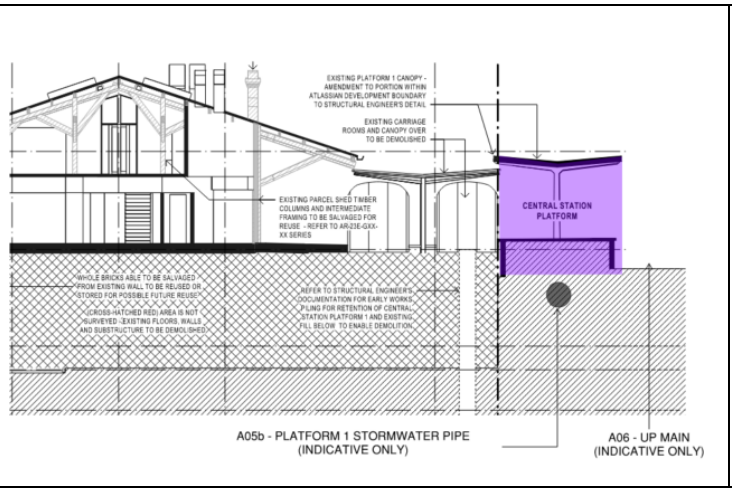


Figure 13: Plan View of Platform 1



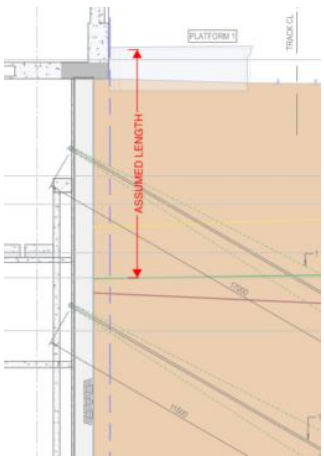


Figure 14: Cross-Section Elevation View of Platform 1 (BVN Dwg, AR-23D-GXX-02[5]) With Assumed Footing Depths for Characteristic Height

4.6 Platform 1 Stormwater Pipe – A05b

4.6.1 Description: Part of Building/Structure

- The Platform 1 stormwater pipe runs under the platform in a north south direction.
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.6.2 Construction

- Platform 1 stormwater pipe is assumed to be constructed of unreinforced concrete
- The unreinforced concrete construction makes the pipe susceptible to slight ground movements and ground borne vibrations from excavation.
- Based on the underground location, it is recommended that monitoring for this asset is based on platform movement / vibration or a similar rigid adjacent structure

4.6.3 Potential Impact of Construction Activities:

- Movement to pipe
- Disruption of design falls
- Cracking / deterioration of connections from ground vibrations

4.6.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information. The criteria for the stormwater pipe is based on a Memo by TTW, SEA Structural Analysis Approach, dated 23/08/2021, which asses allowable deflections based on permissible strains in accordance with SEA guidelines.

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A05b	Stormwater drain	Pipes/ services	Vertical	Movement Monitor	20	<10.0	≥10.0	≥16.0
			Horizontal	Movement Monitor	20	<10.0	≥10.0	≥16.0
			Inclination	Not required	NA	-	-	-

Recommended Vibration Monitoring Limits

Criteria	Vibration At the Asset Location	
	Continuous	Intermittent
In line with Table 6 of the SEA guidelines	5mm/s	10mm/s

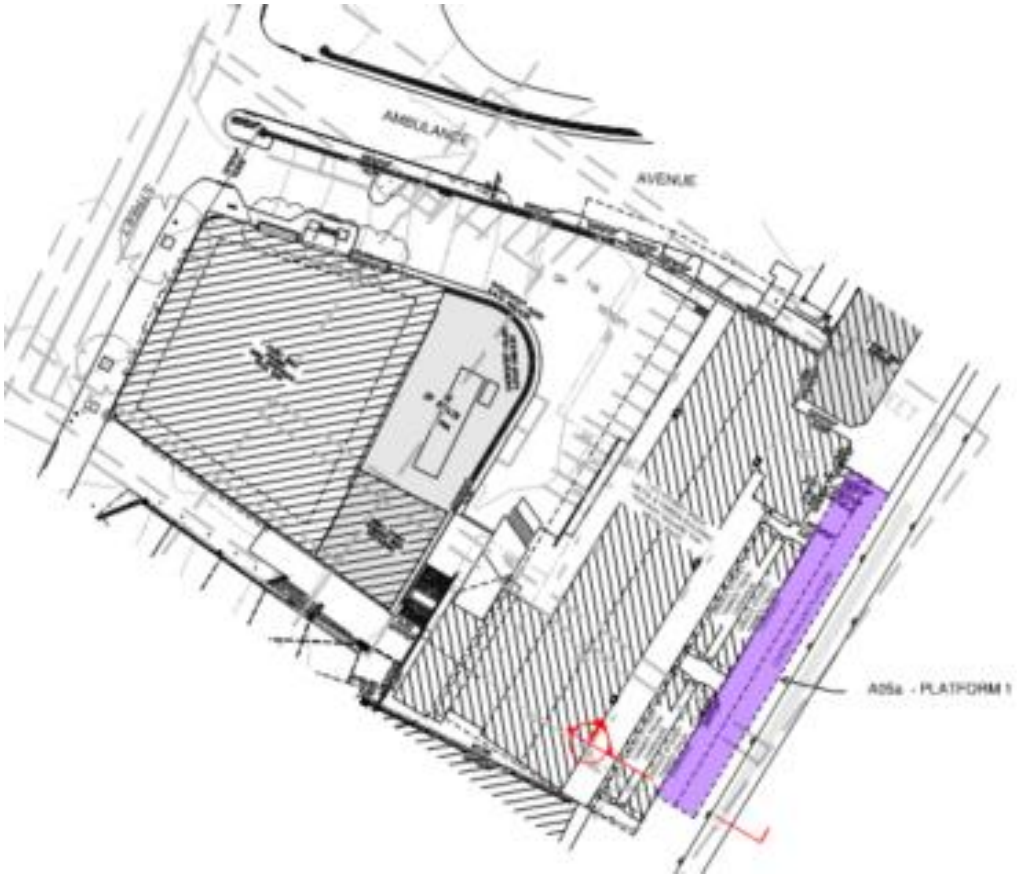


Figure 15: Plan View of Platform 1

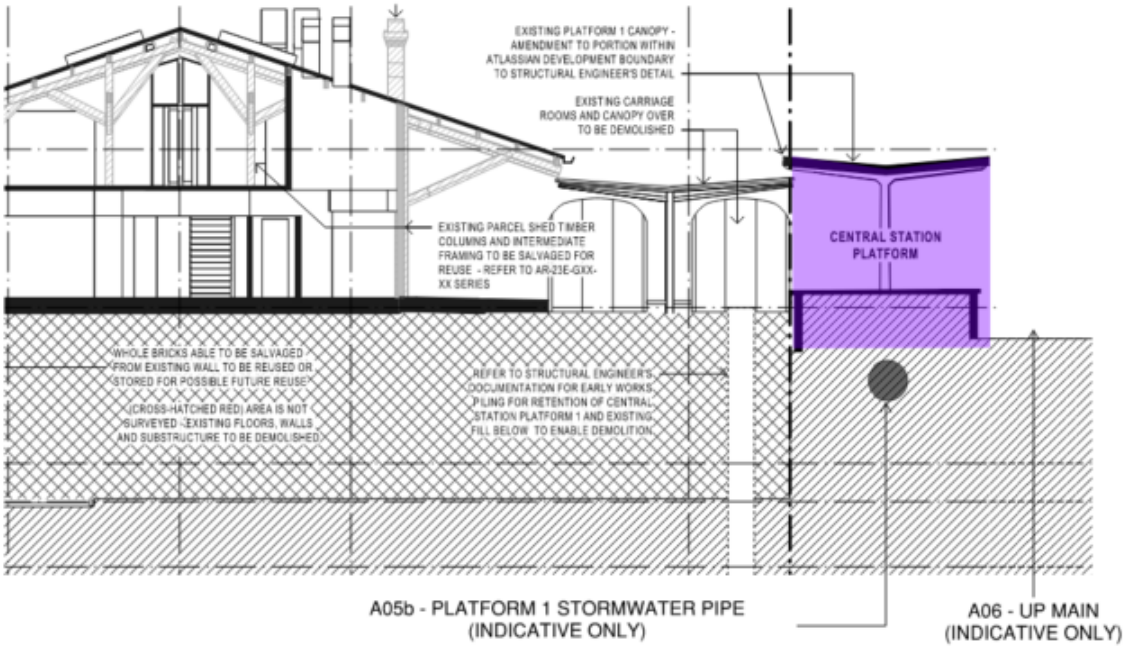


Figure 16: Cross-Section Elevation View of Platform 1 (BVN Dwg, AR-23D-GXX-02[5])

4.7 Track (Up MAIN) – A06

4.7.1 Description: Part of Building/Structure

- 'UP MAIN' track at Platform 1 is located at the Eastern boundary of the Development. This structure will be operational during the expected construction activities.
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.7.2 Construction

- The tracks consist of steel sections fastened to concrete sleepers, bearing onto basalt
- The Up Main is expected to take the full operational weight of trains during the proposed works. Critical criteria for monitoring are the torsion / twist differentials.

4.7.3 Potential Impact of Construction Activities:

- Movement of track affecting operation of track
- Damage to track, including but not limited to vibration in track; excessive deflection in track and secondary elements; damage to welded connections and/or loosening of mechanical/bolted connections

4.7.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information. The criterion for the Track is based on Section 6.1 of SPC 207 – Track Monitoring Requirements for Undertrack Excavation. Surveyor to familiarise themselves with this section of the standard for specific requirements. Track monitoring to extend a further minimum of 10m north and south of the site boundary.

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm) Based on 25% limits of Section 6.1		
						GREEN	AMBER	RED
A06	UP MAIN	Rail	Vertical	Track monitoring points	12	≥3.0	≥6.0	≥9.0
			Short twist (differential)	Track monitoring points	8	≥2.0	≥4.0	≥6 or sudden >4
			Long twist (differential)	Track monitoring points	23	≥6.0	≥12.0	≥18 or sudden >12

Recommended Vibration Monitoring Limits

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

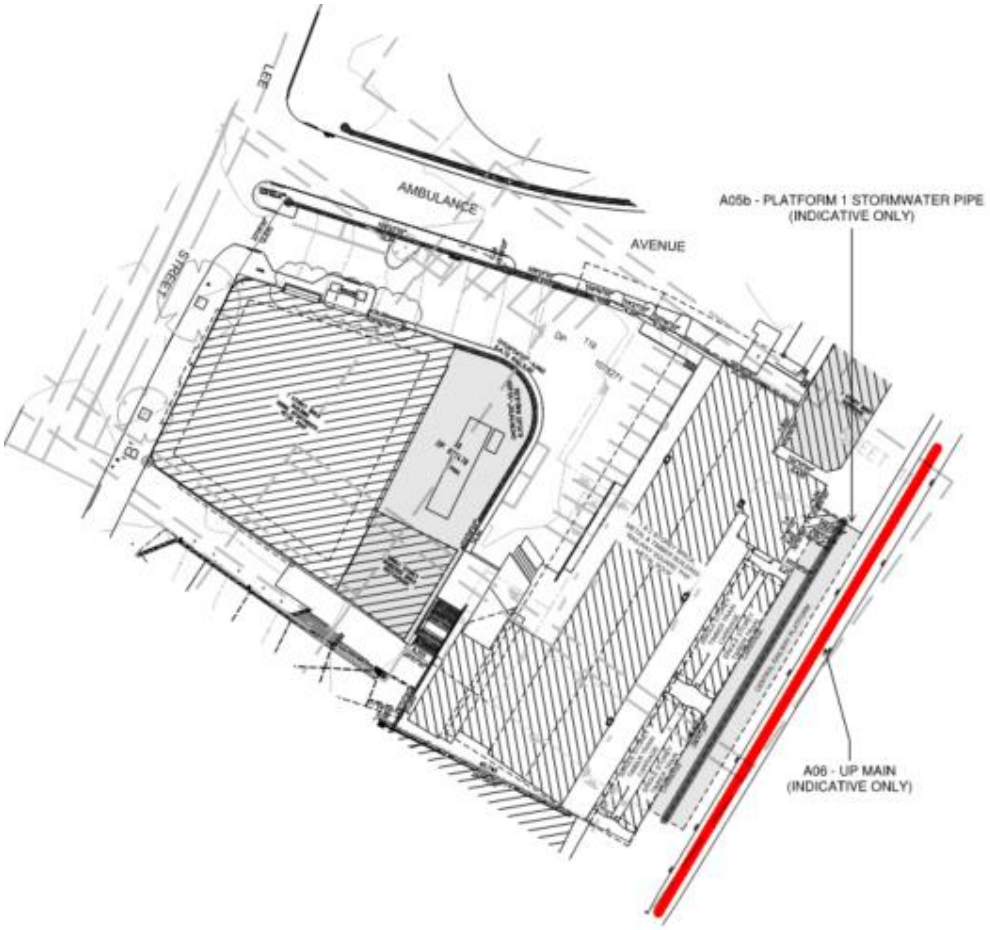


Figure 17: Plan View of UP MAIN

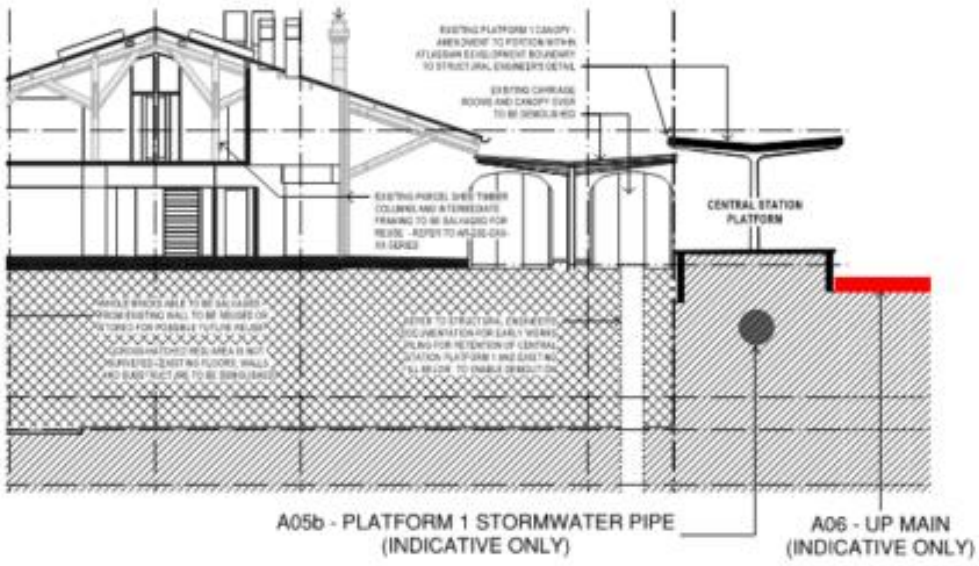


Figure 18: Cross-Section Elevation View of UP MAIN (BVN Dwg, AR-23D-GXX-02[5])

4.8 Devonshire Street Tunnel – A08a

4.8.1 Description: Part of Building/Structure

- Pedestrian access runs perpendicular to Central Station platforms, to the South of the Development and includes retail outlets in vicinity of proposed works which are intended to remain operational during construction, with some closure during demolition activities.
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.8.2 Construction

- The Devonshire tunnel consists of unreinforced concrete arches and steel beams, spanning onto unreinforced concrete end walls.
- The tunnel is immediately adjacent to a neighbouring building, sharing a southern wall. Vibration will have to be limited to limit impact on the building occupants

4.8.3 Potential Impact of Construction Activities:

- Increase in level of noise
- Damage to support(s) of 'tunnel'
- Development of cracks/propagation of extant cracks in concrete structure
- Damage to tunnel structure(s), including but not limited to vibration in structures; excessive deflection (sag) in steel beams, and secondary elements; damage to welded connections and/or loosening of mechanical/bolted connections

4.8.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information. The criteria for the masonry wall is based on a wall span / 750 deflection criteria identified in CIRIA C579 Retention of Masonry Facades – Best Practice Guides (2003).

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A08a	Devonshire Street 'Tunnel'	Buildings/ structures	Vertical	Movement Monitor	5*	<3*	≥3*	≥4*
			Horizontal	Movement Monitor	6	<3	≥3	≥5
			Inclination	Not required	NA	-	-	-

*Based on Douglas Partners Draft Impact Assessment date February 2022 (86767.04.R.013.DftA)

Recommended Vibration Monitoring Limits

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

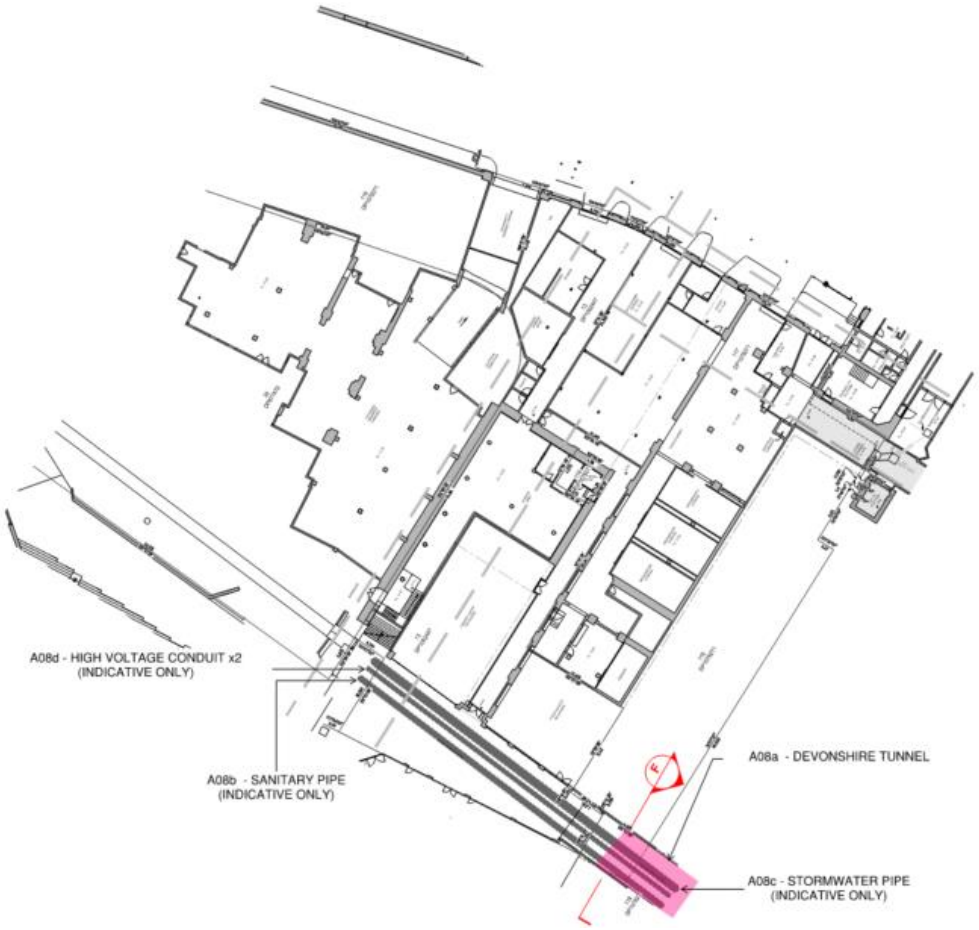


Figure 19: Plan View of Devonshire Street Tunnel

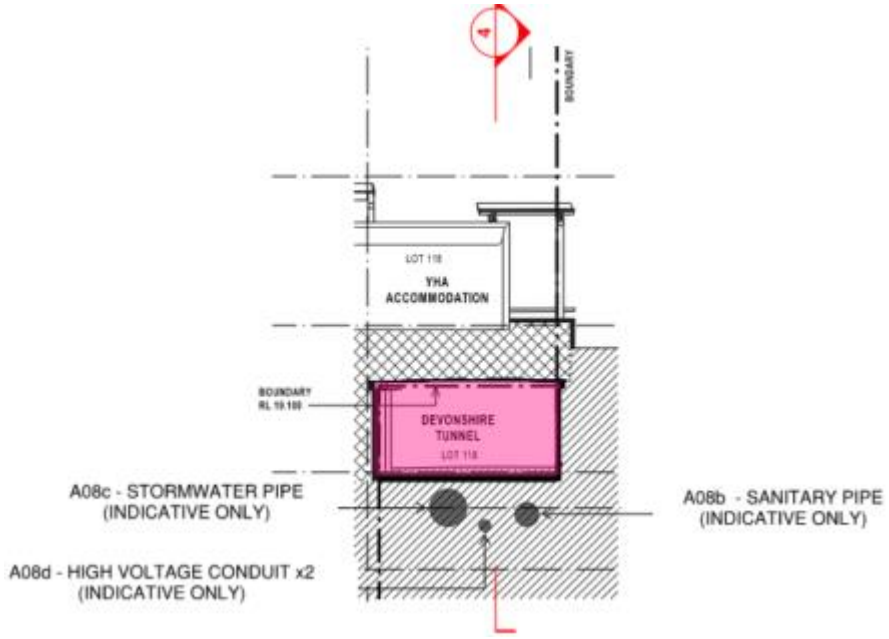


Figure 20: Cross-Section Elevation View of Devonshire Street Tunnel' (BVN Dwg. AR-23D-GXX-04[2])

4.9 Sewer Pipe – A08b

4.9.1 Description: Part of Building/Structure

- The sewer pipe under the Devonshire tunnel is a 400 mm diameter pipe known as the Clisdell St Carrier running approximately east west underneath the Devonshire St tunnel
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.9.2 Construction

- Existing drawings for the 400 mm sewer pipe (Clisdell St Carrier) show it is vitrified clay pipe laid in a trench and cast completely in concrete with a minimum thickness of 150 mm.
- A CCTV condition assessment of the sewer pipe was undertaken by SureSearch. The results of which show that the sewer pipe has been relined and is in generally good condition.
- The vitrified clay construction makes the pipe susceptible to slight ground movements and ground borne vibrations from excavation and piling.
- Based on the underground location, it is recommended that monitoring for this asset is based on movement / vibration from an adjacent rigid structure

4.9.3 Potential Impact of Construction Activities:

- Movement to pipe
- Disruption of design falls
- Cracking / deterioration of connections from ground vibrations

4.9.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information. The criteria for the stormwater pipe is based on a Memo by TTW, SEA Structural Analysis Approach, dated 23/08/2021, which asses allowable deflections based on permissible strains in accordance with SEA guidelines. This asset will be critically monitored during the excavation of B2 Access which has been described in the Tunnelling Solutions Methodology.

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A08b	Sewer pipe (where tunnelling beneath)	Pipes/ services[4]	Vertical	Movement Monitor	20	<10	≥10	≥16
			Horizontal	Movement Monitor	20	<10	≥10	≥16
			Inclination	Not required	NA	-	-	-

Recommended Vibration Monitoring Limits

Criteria	Vibration At the Asset Location	
	Continuous	Intermittent
In line with Table 6 of the SEA guidelines	5mm/s	10mm/s

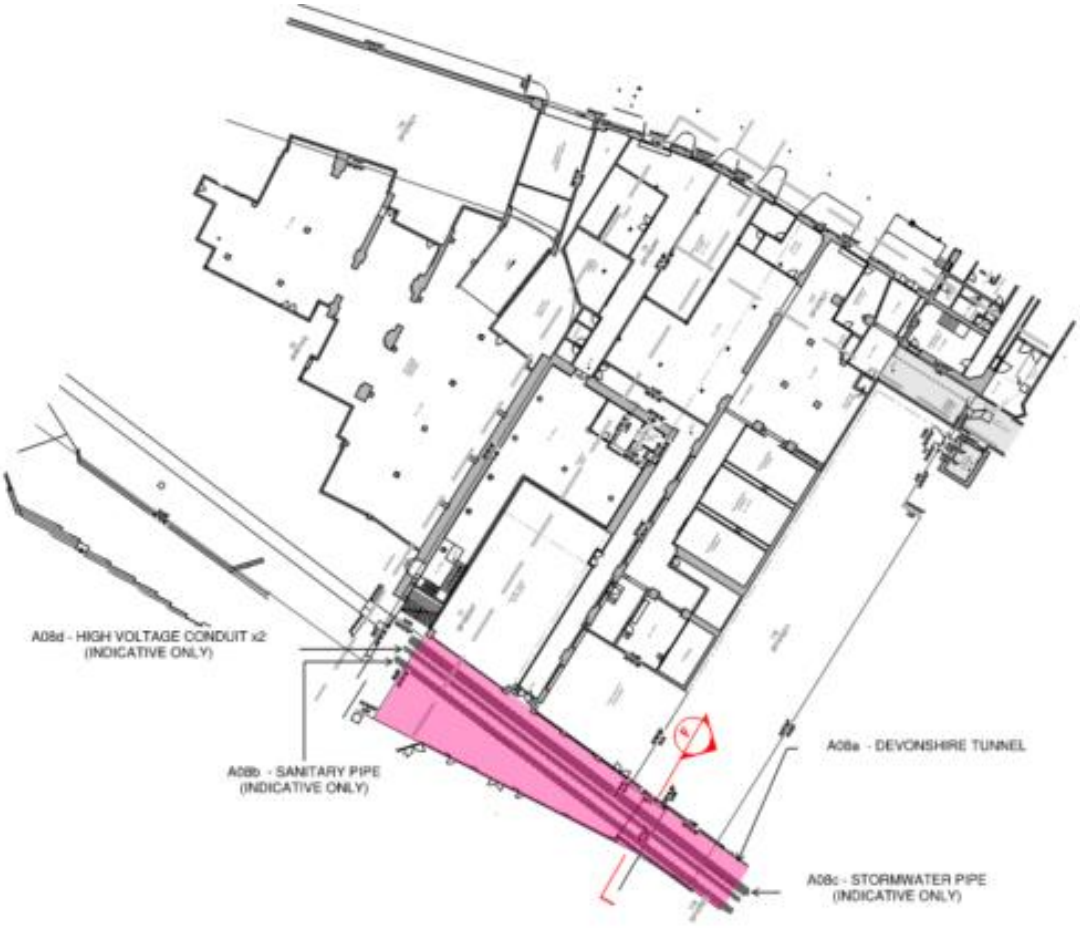


Figure 21: Plan View of Devonshire Street Tunnel and Sewer Piper Below

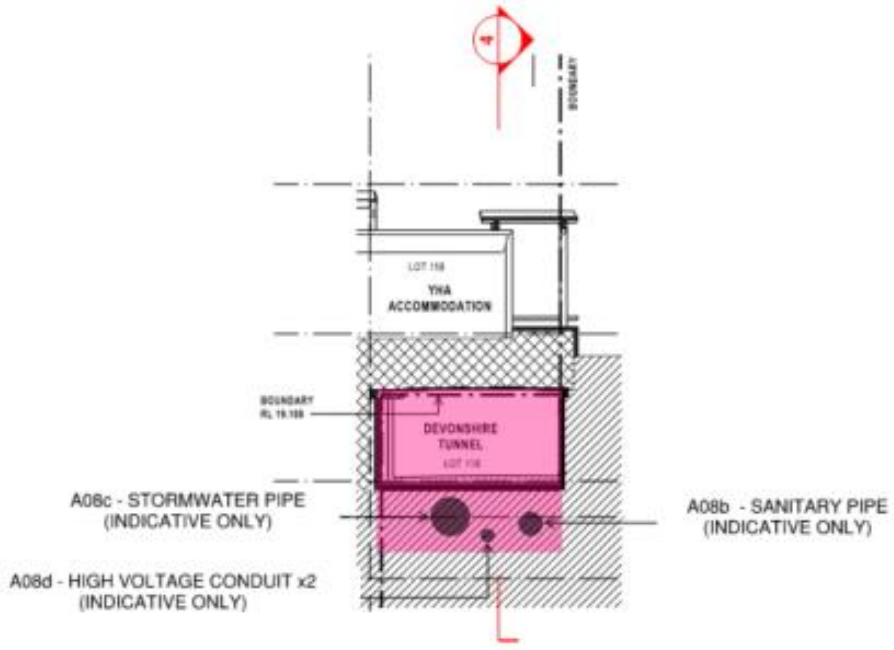


Figure 22: Cross-Section Elevation View of Devonshire Street Tunnel' (BVN Dwg. AR-23D-GXX-04[2])

4.10 Stormwater Pipe – A08c

4.10.1 Description: Part of Building/Structure

- The stormwater pipe under the Devonshire tunnel is a 1500 mm diameter pipe known as the Clisdell St Carrier running approximately east west underneath the Devonshire St tunnel
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.10.2 Construction

- Existing drawings indicated that the 1500mm diameter pipe is of reinforced concrete construction and embedded in a trench surrounded by a minimum of 150 mm concrete. There is a reference made to 'O' class concrete on a drawing within the set, but no reference to this nomenclature can be found in the standards of the time, and it is not known what this means for concrete strength.
- A CCTV condition assessment of the stormwater pipe was undertaken by SureSearch. From the assessment, the stormwater pipe appears to be in good condition generally except for localised areas where there are either minor cracks or exposed reinforcement. Drilling at the mouth of the tunnel on the sides at on the roof showed the tunnel to be reinforced and 200 mm thick.
- The vitrified clay construction makes the pipe susceptible to slight ground movements and ground borne vibrations from excavation and piling.
- Based on the underground location, it is recommended that monitoring for this asset is based on movement / vibration from an adjacent rigid structure

4.10.3 Potential Impact of Construction Activities:

- Movement to pipe
- Disruption of design falls
- Cracking / deterioration of connections from ground vibrations

4.10.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information. The criteria for the stormwater pipe is based on a Memo by TTW, SEA Structural Analysis Approach, dated 23/08/2021, which asses allowable deflections based on permissible strains in accordance with SEA guidelines. This asset will be critically monitored during the excavation of B2 Access which has been described in the Tunnelling Solutions Methodology.

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A08c	Stormwater drain (where tunnelling beneath)	Pipes/ services[4]	Vertical	Movement Monitor	20	<10	≥10	≥16
			Horizontal	Movement Monitor	20	<10	≥10	≥16
			Inclination	Not required	NA	-	-	-

Recommended Vibration Monitoring Limits

Criteria	Vibration At the Asset Location	
	Continuous	Intermittent
In line with Table 6 of the SEA guidelines	5mm/s	10mm/s

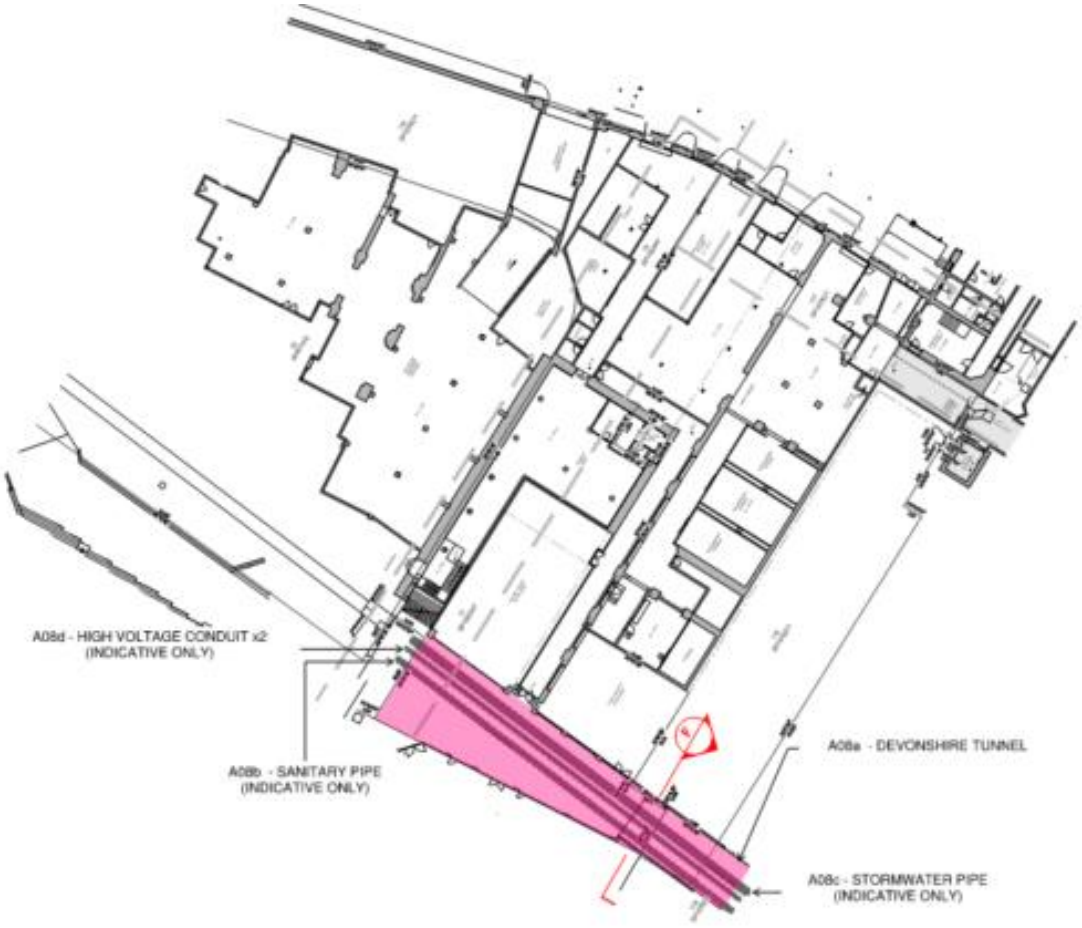


Figure 23: Plan View of Devonshire Street Tunnel and Sewer Piper Below

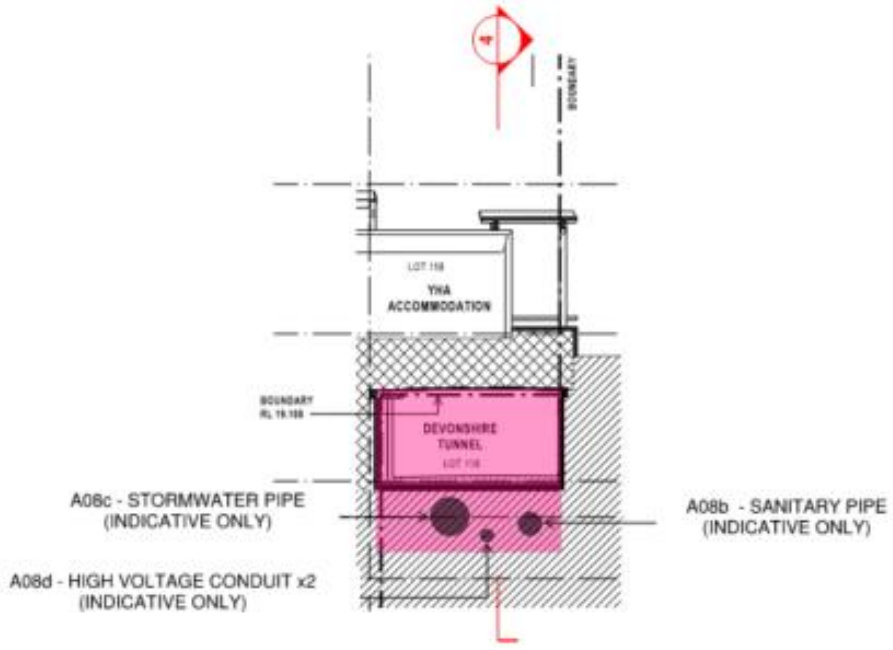


Figure 24: Cross-Section Elevation View of Devonshire Street Tunnel' (BVN Dwg. AR-23D-GXX-04[2])

4.11 Adina Hotel – A09-11

4.11.1 Description: Part of Building/Structure

- Pool/retail space/heritage arch structure/basement adjacent to access ramp to YHA. The Adina Hotel and property is located to the West of the Development and is intended to remain operational during construction activities.
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.11.2 Construction

- The hotel is of masonry construction with brickwork and sandstone section along the façade. The façade is in a poor condition with sandstone cornices appearing loose from visual inspection.
- The unreinforced masonry construction makes the Adina hotel susceptible to slight ground movements and ground borne vibrations from excavation.

4.11.3 Potential Impact of Construction Activities:

- Failure of pool structure, including leaking of pool structure
- Damage to façade structure(s)/shopfronts
- Damage to structure(s), including but not limited to vibration in structures; excessive deflection in structures, including floor slabs; damage to non-structural parts and portions of structures; damage to welded connections and/or loosening of mechanical/bolted connections
- Development of cracks/propagation of existing cracks in masonry and/or mortar
- Movement in arch structure
- Toppling of masonry at top of arch structure/in part of arch structure
- Complete out-of-plane failure of arch structure

4.11.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information. The criteria for the masonry wall is based on a wall span / 750 deflection criteria identified in CIRIA C579 Retention of Masonry Facades – Best Practice Guides (2003). The height of the structure has been taken from the assumed footing depth of fine to medium grain sandstone.

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A09	Heritage masonry Adina	Buildings/ structures	Vertical	Movement Monitor	11*	<6*	≥6*	≥8*
			Horizontal	Movement Monitor	15	<8	≥8	≥12
			Inclination	Movement Monitor	15	<8	≥8	≥12

*Based on Douglas Partners Draft Impact Assessment date February 2022 (86767.04.R.013.DftA)

Recommended Vibration Monitoring Limits

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

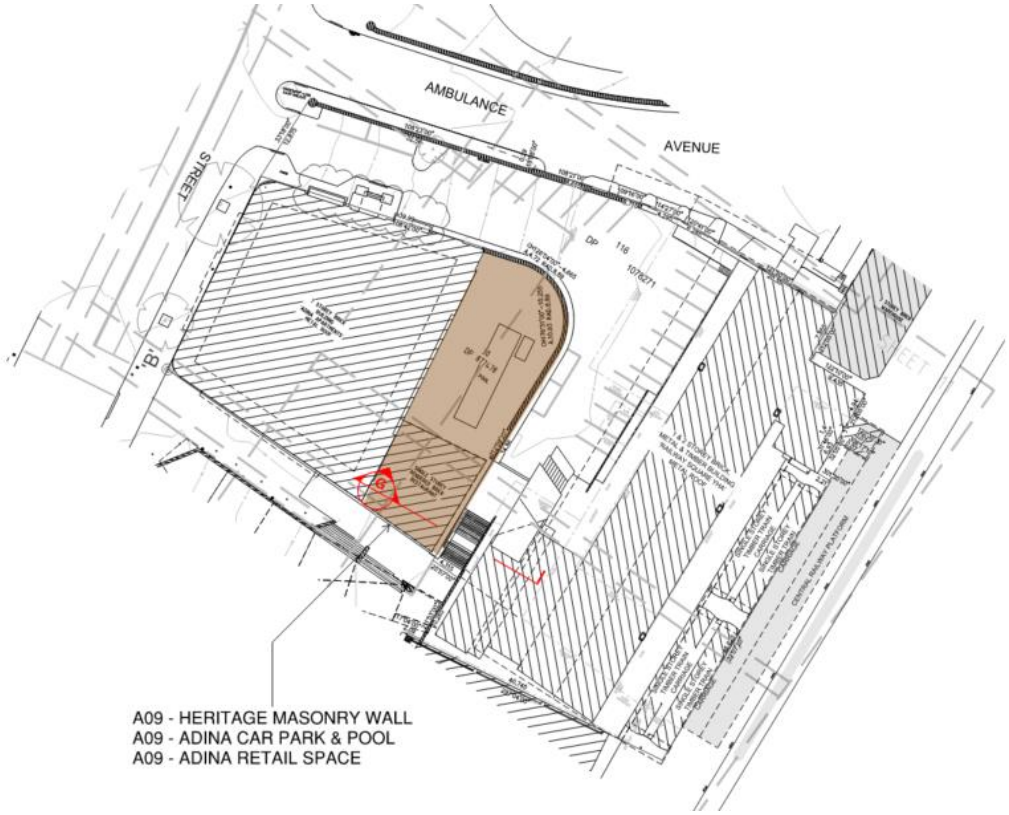


Figure 25: Plan View of Adina Masonry Wall, Car Park, Pool, And Retail Space

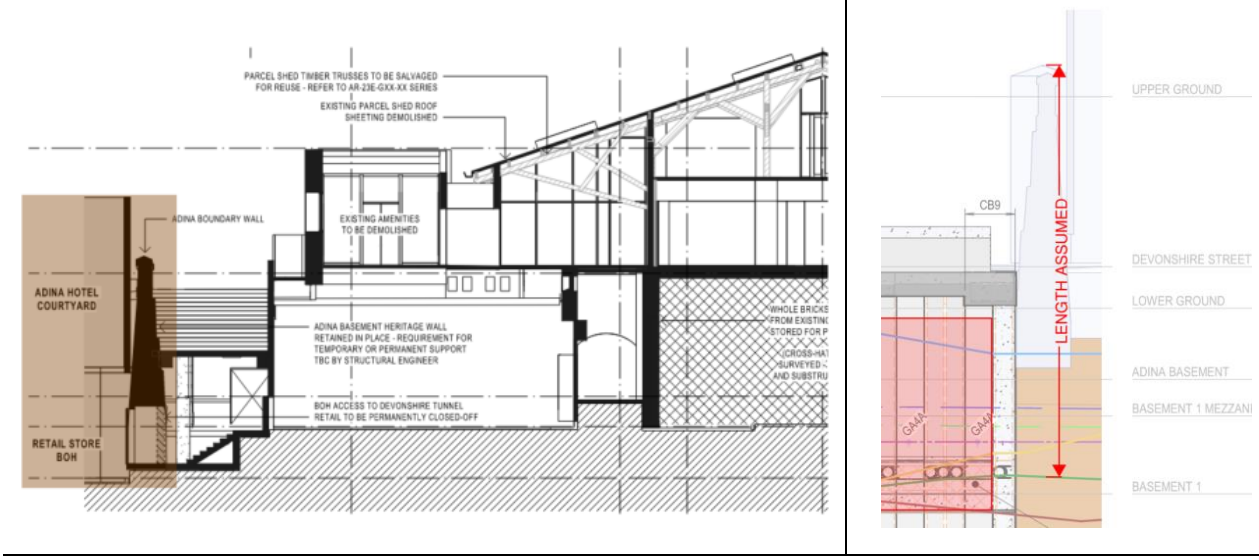


Figure 26: Cross-Section Elevation View of Adina Hotel Boundary Wall (BVN Dwg. AR-23D-GXX-02[5]) With Assumed Footing Depths for Characteristic Height

4.12 Piled Walls and Excavation Face

4.12.1 Description: Part of Building/Structure

- As part of the development, the site will require anchored piling with capping beams to excavate down and build the proposed basement
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.12.2 Construction

- The pile walls are currently designed as reinforced concrete piles with reinforced concrete capping beams running across with anchors laterally tying the piles back.

4.12.3 Potential Impact of Construction Activities:

- Increase in level of noise
- Movement of assets beyond the retained envelope
- Damage to assets from movement

4.12.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which is based on expected movement during excavation in the temporary case. The movement considered does not include seismic load, in the event of a seismic event, a specific survey will need to be carried out to ensure structures remain within acceptable limits and no damage has occurred. Movements nominated are based on draft geotechnical input listed in report '86767.04.R.011.DftD Tables' Jan 2022 at the time of this report. In the event that the referenced report is amended, these values will need to be reviewed accordingly.

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
N/A	SW2	New Structure	Horizontal	Movement Monitor	10*	<5*	≥5*	≥8*
			Inclination	Movement Monitor	10*	<5*	≥5*	≥8*
N/A	SW3	New Structure	Horizontal	Movement Monitor	19*	<10*	≥10*	≥16*
			Inclination	Movement Monitor	19*	<10*	≥10*	≥16*
N/A	SW4	New Structure	Horizontal	Movement Monitor	14*	<7*	≥7*	≥12*
			Inclination	Movement Monitor	14*	<7*	≥7*	≥12*
N/A	SW5	New Structure	Horizontal	Movement Monitor	28*	<14*	≥14*	≥23*
			Inclination	Movement Monitor	33*	<17*	≥17*	≥23*
N/A	SW7	New Structure	Horizontal	Movement Monitor	21*	<11*	≥11*	≥17*
			Inclination	Movement Monitor	21*	<11*	≥11*	≥17*

Recommended Vibration Monitoring Limits

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

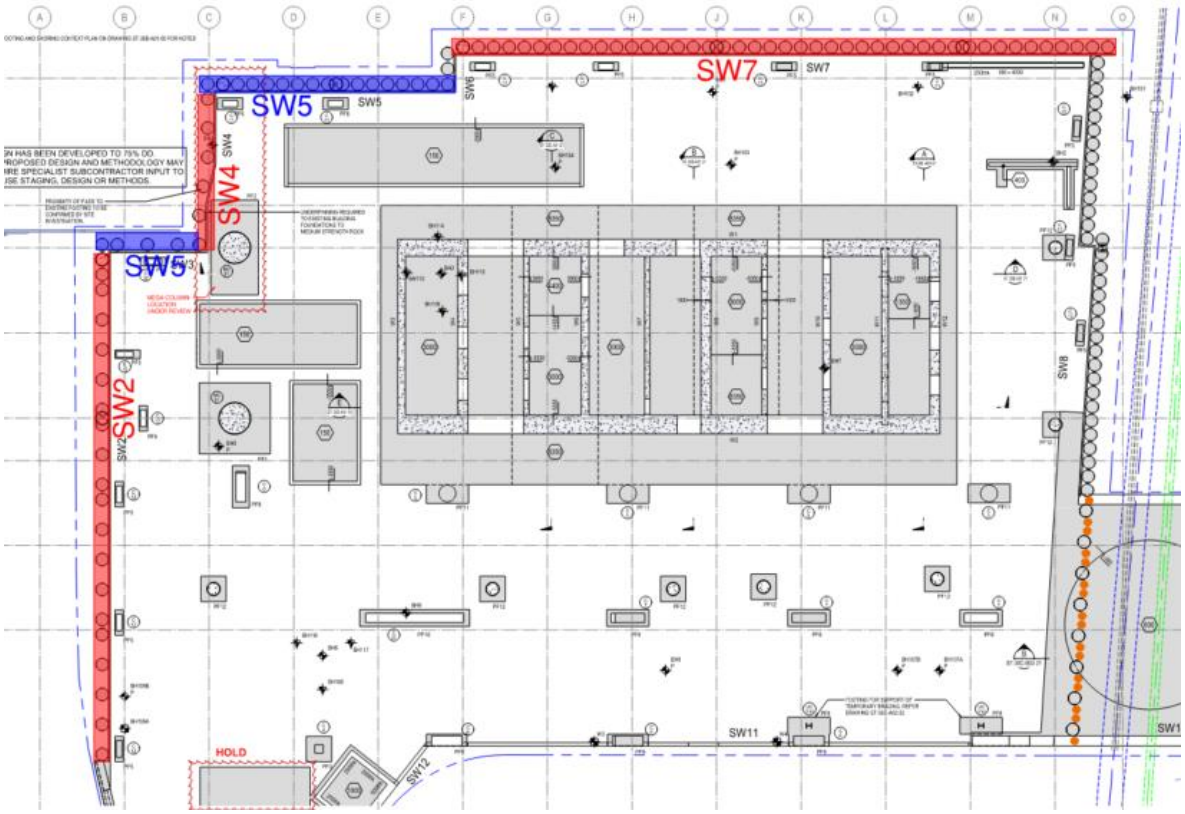


Figure 27: Plan View of the Site

4.13 B2 Access Tunnel

4.13.1 Description: Part of Building/Structure

- As part of the development, an access tunnel will be excavated under the existing Devonshire tunnel.
- The positioning of monitors is to be coordinated with monitor providers to yield the best results and reduce false readings

4.13.2 Construction

- The tunnel is proposed to be constructed with steel canopy tubes while tunnelling and transitioning into reinforced concrete.

4.13.3 Potential Impact of Construction Activities:

- Increase in level of noise
- Movement of assets beyond the retained envelope
- Damage to assets from movement

4.13.4 Recommended Monitoring Criteria

The monitoring criteria listed below is for Package 1 demolition which does not consider the effects of excavation at this point. Once finalised movements for piling and excavation are published, movement limits can be updated to reflect this information.

Recommended Movement Monitoring Limits

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
N/A	Piles	New Structure	Vertical	Movement Monitor	20	<10	≥10	≥16
			Horizontal	Movement Monitor	20	<10	≥10	≥16
			Horizontal	Movement Monitor	20	<10	≥10	≥16

*To be coordinated with geotechnical input, forming part of Package 2 - Excavation

Recommended Vibration Monitoring Limits

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
3	Structures that are particularly sensitive to vibration and cannot be classified above.	3	3 - 8	8 - 10

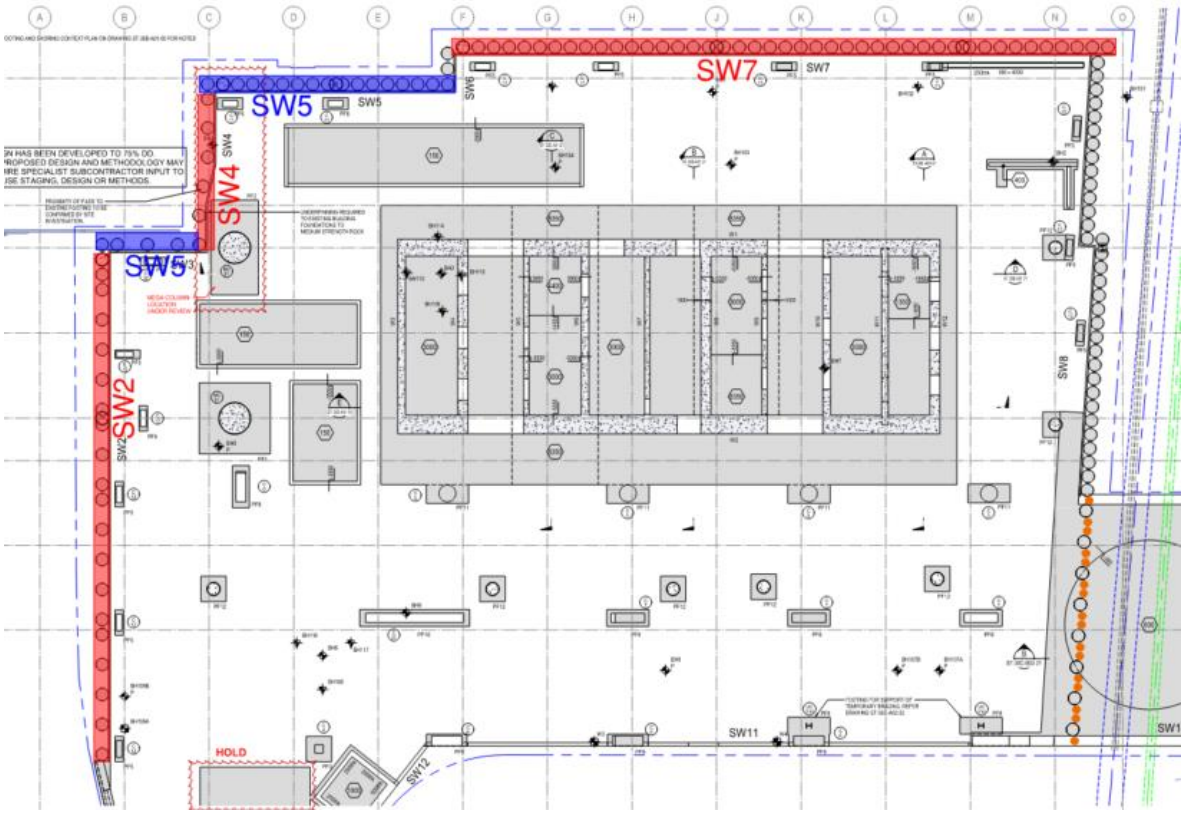


Figure 28: Plan View of the Site

5.0 Monitoring Plan

5.1 Objectives

Buildings, structures, and associated components shall be monitored as part of the overall strategy to protect existing assets within the proximity of the Development. Design has been developed to 75% DD. The proposed design and methodology may require specialist Subcontractor input to finalise staging, design or methods.

The following section describes the measures required to prepare for any contingencies that have been identified and provides information on how/when these contingency plans are effective. Constant monitoring should confirm that the existing ground and surrounding assets exhibit measurable and predictable behaviour. This should allow construction activities to proceed in a safe, controlled manner.

It is recommended that a survey of the dilapidation of existing assets (dilapidation survey) be undertaken in an area around the perimeter of the intended construction site, with the perimeter of the survey maintained at a distance not less than 30 m from the perimeter of the construction activity. For the assets listed in Section 4.0, the survey shall also establish the condition, location, and position (globally and relative to other assets) of the asset prior to the commencement of any construction activity. Any damage or deflection – structural and non-structural – shall be identified, marked, and recorded so that any change in damage or deflection shall be measured and monitored throughout critical stages. Examples of damage could include existing cracks in masonry and/or mortar, or noticeable deflection (e.g., sagging) in structural and non-structural elements. The results of the dilapidation survey shall be itemised and summarised in a report, provide by the specialist subconsultant. Before any construction activity commences, the owner of the asset and the developer shall agree in the intended assessment and the contents of the report. Otherwise, if any asset cannot be accessed and/or examined in the survey, then a methodology for monitoring and protecting the asset shall be drafted.

It is recommended that a 'traffic light' alert system be implemented to record the condition of the assets and act as an early warning system, where:

- **GREEN**
  Indicates that the construction activity may proceed as planned,
- **AMBER**
  Indicates that the construction activity may proceed with caution. To proceed, contingency measures shall be implemented (which may include, but not be limited to, an increase in the frequency of monitoring and/or exclusion zoning), and
- **RED**
  Indicates that the construction activity shall stop immediately. The site shall be made safe and contingency measures shall be implemented to prevent further change in the condition of the asset (further detail is given in Section 5.3 below).

5.2 Monitoring Systems and Instrumentation

TTW has assessed movement and vibration limits based on the constriction and sensitivity of existing assets in accordance with relevant standards and accepted practice. The measurement and monitoring of these effects shall be compared to the limiting criteria and appropriate action(s) taken.

The system of measurement and monitoring prescribed herein shall comprise a combination of measuring and monitoring movement of the ground within the excavation and basement structure and surveying the assets surrounding these activities. Where a dilapidation survey has identified existing damage (e.g., cracking in masonry), measurement and monitoring specific to the that type of damage shall be undertaken.

Measurement and monitoring shall be required for each asset prescribed in Table 1 with monitoring equipment endorsed and supplied by a specialist monitoring contractor who has experience in both heritage construction and rail assets. Specific instrumentation to be used shall be in accordance with T MU CI 12140 GU – Geotechnical Instrumentation and Monitoring Guidelines (24/03/2021) for TfNSW Assets. For listed assets outside the TfNSW area, contractor to advise the most appropriate equipment to capture the specified movements. Monitoring equipment shall be in compliance with TN 001: 2016 Platform Circulation Requirements (updated from ESB 003), in Reference to Figure 29 below.

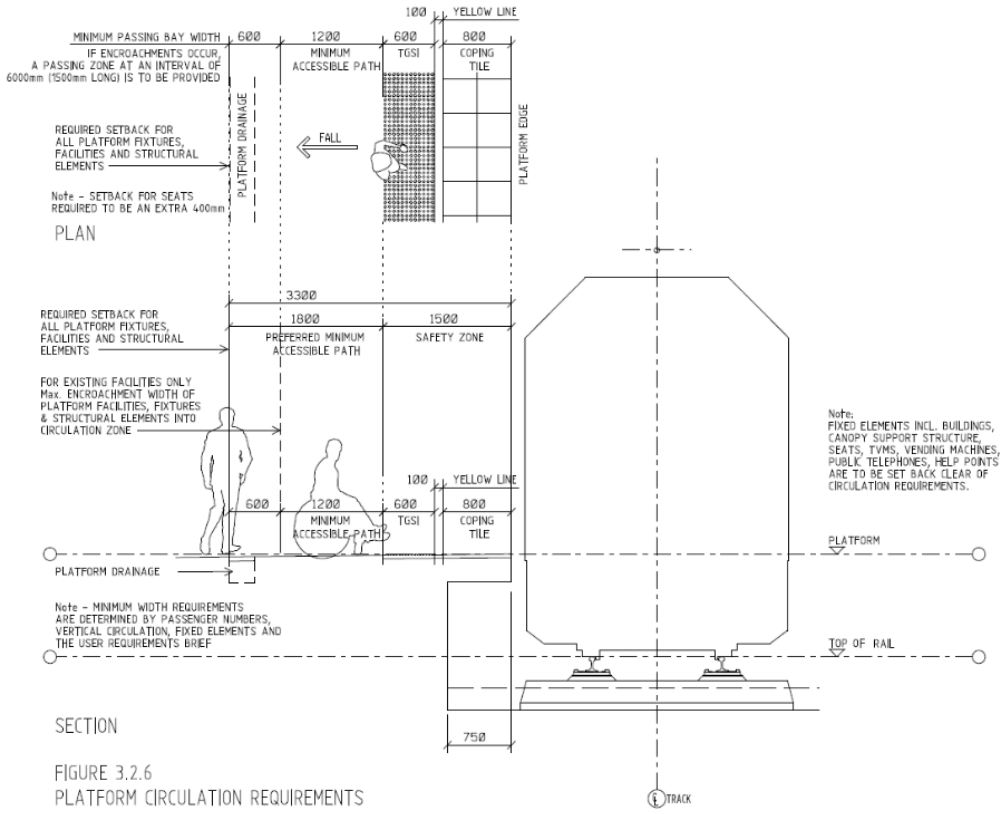


Figure 29: Platform Circulation Requirements, (TN 001: 2016) Updated from ESB 003

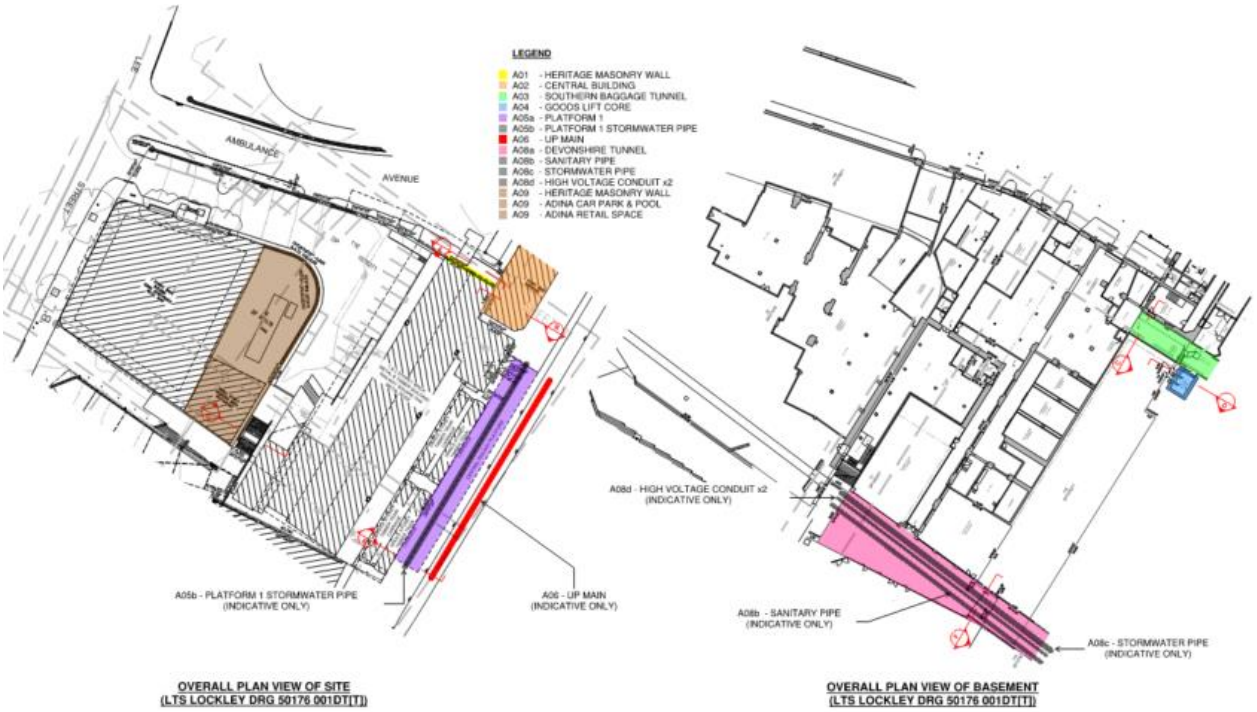
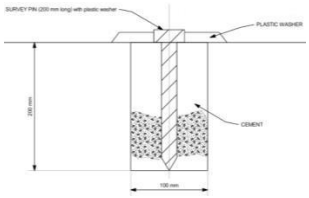
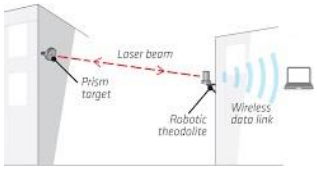
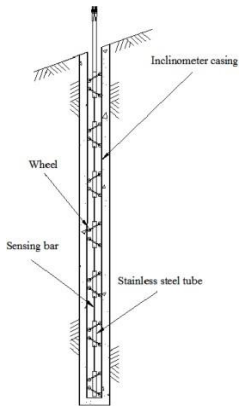


Figure 30: Asset Locations Requiring Monitoring

5.3 Typical Monitoring Instrument Type and Installation

The following typical monitoring instruments may be used in accordance with T MU CI 12140 GU – Geotechnical Instrumentation and Monitoring Guidelines (24/03/2021) for TfNSW Assets.

Instrument type	Example	Function	Installation and monitoring
Ground surface/ precise level monitoring point		Measure ground surface movement generally in vertical direction but monitoring point can be configured to measure horizontal movement too Measurements undertaken at defined intervals Repeatability and accuracy are based on the survey equipment collecting the readings.	Installation undertaken by surveyor in agreement with engineer and contractor. Monitoring by surveyor using digital level.
Building or structure monitoring point		Measure movement of existing buildings and assets in either two or three dimensions depending on the type of monitoring point or target Measurements undertaken at defined intervals Repeatability and accuracy are based on the survey equipment collecting the readings.	Installation undertaken by surveyor in agreement with engineer and contractor. Monitoring by surveyor using total station.
Track monitoring point		Survey point/prism to measure movement of rail track Measurements undertaken at defined intervals Repeatability and accuracy are based on the survey equipment collecting the readings.	Installation undertaken by surveyor in agreement with engineer and contractor and TfNSW. Monitoring by surveyor using total station.
Automatic deformation monitoring system (ADMS)		High precision measurement of prism/target in three dimensions Measurements undertaken continuously over pre-programmed time interval Robotic total station typical accuracy and measurement times Prism 0.6mm +1ppm; time 2.4s Surface 2mm +1ppm; time 2s	Installation undertaken by surveyor in agreement with engineer and contractor. Monitoring by surveyor as per monitoring plan.

Inclinometer		Installed within grouted boreholes, within piled foundations or piled walls Measures lateral movement (displacement) with depth Values recorded are compared against baseline reading taken on initial installation (pre-excavation) Measurements undertaken at defined intervals or an automated system can be installed for continuous readings Typical accuracy of ±0.25mm/reading	Installation by geotechnical investigation contractor under instruction from geotechnical engineer and contractor. Monitoring by surveyor/ geotechnical engineer.

5.4 Alert levels

Preliminary alert levels have determined, by asset as defined in Section 4.0, in accordance with the 'traffic light' alert system in Section 5.1. These are based on an assessment of the likely effects that critical construction activities would have on existing assets/structures (impact assessment, prepared by Avenor, under Mott MacDonald, 413353-MMD-XX-RP-GE-0001). This identified that the impact on assets owned by TfNSW would likely be only aesthetic. More notable impacts are summarised below:

1. The assessment found that masonry wall (A09) on the western boundary of the proposed excavation will likely require underpinning during construction activities.
2. The heritage arch (A12) comprising part of the Adina Hotel façade will likely require monitoring and structural support during construction activities.
3. Services A08b, A08c, and A08d above the Devonshire truck turning bay will likely exceed the deformation failure criteria under this assessment.

The guidance, with respect to technical guidance and industry best practices, has been employed to establish the alert levels for each asset in Table 1. These are based on the probability that a movement, δ, being measured exceeds a defined level which is set for heritage structures a span / 750 in accordance with the CIRIA C579 – Retention of Masonry Facades – Best Practice Guide.

- **GREEN**

  $\delta \leq 50$ % of the movement limit

- **AMBER**

  $50\ \% < \delta \leq 80\ \%$ of the movement limit

- **RED**

  $\delta > 80$ % of the movement limit

Note:

- The characteristic horizontal movements in Table 1 are based on spans, and incorporate predicted movements based on geotechnical assessment.
- The actual movement of each asset may be lower or higher than in Table 1.

Reference shall be made to the impact assessment report for further information on the assessment of movement of the ground (prepared by Avenor, under Mott MacDonald, 413353-MMD-XX-RP-GE-0001).

It is recommended that the retaining structure be monitored during construction activities, in addition to monitoring extant assets. The instrumentation to do so may comprise inclinometers installed in specific piles at critical locations, and survey points along the length of the retaining structure. All trigger levels are to be reviewed with monitor providers to understand sensitivity and tolerance of equipment to ensure the risk of false readings is mitigated.

Table 1: Alert Levels for Extant Structures and Assets

Asset ID	Asset	Asset Type	Movement Type	Monitoring Method	Movement Limit (mm)[1]	Suggested Trigger Levels (mm)		
						GREEN	AMBER	RED
A01	Heritage Masonry Wall (Ambulance Avenue)	Buildings/ structures	Vertical	Movement Monitor	2**	<2.0**	≥2.0**	≥2.0**
			Horizontal	Movement Monitor	15	<8.0	≥8.0	≥12.0
			Inclination	Movement Monitor	15	<8.0	≥8.0	≥12.0
			Vibration	Vibration Monitor	3mm/s	NA	NA	3mm/s
A02	Central building	Buildings/ structures	Vertical	Movement Monitor	8*	<4*	≥4*	≥6.5*
			Horizontal	Movement Monitor	20	<10	≥10	≥16
			Inclination	Movement Monitor	20	<10	≥10	≥16
			Vibration	Vibration Monitor	3mm/s	NA	NA	3mm/s
A03	(Southern) Baggage	Buildings/ structures	Vertical	Movement Monitor	7*	<3.5*	≥3.5*	≥5.5*
			Horizontal	Movement Monitor	5	<3	≥3	≥4
			Inclination	Not required	NA	-	-	-
			Vibration	Vibration Monitor	3mm/s	NA	NA	3mm/s
A04	Goods Lift Core	Buildings/ structures	Vertical	Movement Monitor	5*	<2.5*	≥2.5*	≥4*
			Horizontal	Movement Monitor	20	<10	≥10	≥16
			Inclination	Not required	NA	-	-	-
			Vibration	Vibration Monitor	3mm/s	NA	NA	3mm/s
A05a	Platform 1	Buildings/ structures	Vertical	Movement Monitor	13**	<7**	≥7**	≥11**
			Horizontal	Movement Monitor	11	<6.0	≥6.0	≥9.0
			Inclination	Not required	NA	-	-	-
A05b	Stormwater drain	Pipes/ services	Vertical	Movement Monitor	20	<10.0	≥10.0	≥16.0
			Horizontal	Movement Monitor	20	<10.0	≥10.0	≥16.0
			Inclination	Not required	NA	-	-	-
			Vibration	Vibration Monitor	10mm/s	NA	NA	10mm/s
A06	UP MAIN	Rail	Vertical	Track Monitoring Points	12	≥3.0	≥6.0	≥9.0
			Short Twist (differential)		8	≥2.0	≤4.0	≥6.0 or sudden ≥4.0
			Long Twist (differential)		23	≥6.0	≤12.0	≥18.0 or sudden ≥12.0
A08a	Devonshire Street 'Tunnel'	Buildings/ structures	Vertical	Movement Monitor	5**	<3**	≥3**	≥4**
			Horizontal	Movement Monitor	6	<3	≥3	≥5
			Inclination	Not required	NA	-	-	-
			Vibration	Vibration Monitor	3mm/s	NA	NA	3mm/s
A08b	Sewer pipe (where	Pipes/ services[4]	Vertical	Movement Monitor	20	<10.0	≥10.0	≥16.0
			Horizontal	Movement Monitor	20	<10.0	≥10.0	≥16.0

	tunnelling beneath)		Inclination	Not required	NA	NA	NA	NA
			Vibration	Vibration Monitor	10mm/s	NA	NA	10mm/s
A08c	Stormwater drain (where tunnelling beneath)	Pipes/ services[4]	Vertical	Movement Monitor	20	<10.0	≥10.0	≥16.0
			Horizontal	Movement Monitor	20	<10.0	≥10.0	≥16.0
			Inclination	Not required	NA	NA	NA	NA
			Vibration	Vibration Monitor	10mm/s	NA	NA	10mm/s
A09-11	Heritage masonry Adina	Buildings/ structures	Vertical	Movement Monitor	11**	<6**	≥6**	≥8**
			Horizontal	Movement Monitor	15	<8	≥8	≥12
			Inclination	Movement Monitor	15	<8	≥8	≥12
			Vibration	Vibration Monitor	3mm/s	NA	NA	3mm/s
N/A	SW2	New Structure	Horizontal	Movement Monitor	10*	<5*	≥5*	≥8*
			Inclination	Movement Monitor	10*	<5*	≥5*	≥8*
N/A	SW3	New Structure	Horizontal	Movement Monitor	19*	<10*	≥10*	≥16*
			Inclination	Movement Monitor	19*	<10*	≥10*	≥16*
N/A	SW4	New Structure	Horizontal	Movement Monitor	14*	<7*	≥7*	≥12*
			Inclination	Movement Monitor	14*	<7*	≥7*	≥12*
N/A	SW5	New Structure	Horizontal	Movement Monitor	28*	<14*	≥14*	≥23*
			Inclination	Movement Monitor	33*	<17*	≥17*	≥23*
N/A	SW7	New Structure	Horizontal	Movement Monitor	21*	<11*	≥11*	≥17*
			Inclination	Movement Monitor	21*	<11*	≥11*	≥17*

Notes:

1. Characteristic movement based on predicted movement from impact assessment by Mott McDonald
2. Crack meters fitted to existing cracks observed during dilapidation survey. Crack meters may also be fitted to cracks which appear during construction.
3. Movements of pipes/services may be inferred from the movement of the surrounding ground or the adjacentretaining structure of the excavation. Extent of monitoring services will need to be considered when the finalmonitoring plan for construction is prepared.
4. Recommended trigger levels shall be reviewed and revised in the final monitoring plan when geotechnical information is available for the shoring excavation.
5. *Based on previous Mott MacDonald reporting, pending geotechnical input, which will require updates
6. ** Based on Douglas Partners Draft Impact Assessment date February 2022 (86767.04.R.013.DftA)

5.5 Frequency of Monitoring

The frequency of monitoring should be determined by specialist surveyor contractor(s) with due consideration to the effects of construction activities, their duration and the associated risk, to enable a rationalised strategy.

5.5.1 Baseline Survey

Prior to commencement works associated with the Development a specialist surveyor contractor shall be engaged to undertake a full set of monitoring readings and survey to determine a baseline. Surveys, such as this and dilapidation surveys, establish and understanding of the existing asset condition prior to commencement of the works. Track monitoring baselines are to be checked with the local Track Engineer.

Recommended two staged baseline survey, prior to the commencement of construction:

1. An initial dilapidation survey and inspection.
2. Collection of baseline readings daily for up-to a two-week period.

5.5.2 Construction Monitoring

Throughout the duration of enabling works (i.e demolition, piling, etc.), it is recommended that ongoing monitoring/inspection are undertaken for each asset. The rigor of the monitoring will be dictated by the asset's sensitivity, condition, work phase. Records shall include a site diary of activities taking place, photographs of works and monitoring equipment as well as a record of general atmospheric conditions (i.e wind speed, temperature, etc.).

A preliminary monitoring frequency is suggested in the Table 4.3 below. This should be reviewed during development of the final construction monitoring plan, taking account of the predicted movements, proposed construction methodologies and risk to existing assets. Changes to the monitoring frequencies shall be coordinated with Sydney Trains.

5.5.3 Post-excavation Monitoring

Throughout construction activities for the Development, ongoing monitoring/regular inspection shall be undertaken.

Monitoring of existing assets should continue through the superstructure works until movement has stabilised, the duration and frequency of monitoring shall be determined in consultation with a specialist surveyor contractor(s).

Should movement continue to be recorded post-construction, the TTW should be informed. Additional assessment/inspections may be required to understand the cause of supplementary movement as well as any associated risk to existing assets of the Development.

A post-construction dilapidation survey should be completed when stable results confirmed. A copy of this survey should made available to the asset owner(s) for acceptance, and to close monitoring period. Post monitoring frequencies shall be coordinated with Sydney Trains.

Table 2: Proposed Frequency of Monitoring by Asset and Construction Stage

Asset ID	Asset	During piling[1]	During excavation			Superstructure works[1,4]
			GREEN[2]	AMBER	RED	
A01	Heritage masonry wall (Ambulance Avenue)	Weekly – start of shift	Daily – start of shift	Twice daily – start and end of shift	Hourly[3]	Weekly – start of shift
A02	Central building	Weekly – start of shift	Daily – start of shift	Twice daily – start and end of shift	Hourly[3]	Weekly – start of shift
A03	(Southern) Baggage Tunnel	Weekly – start of shift	Daily – start of shift	Twice daily – start and end of shift	Hourly[3]	Weekly – start of shift
A04	Goods lift core	Weekly – start of shift	Daily – start of shift	Twice daily – start and end of shift	Hourly[3]	Weekly – start of shift
A05a	Platform 1	Weekly – start of shift	Daily – start of shift	Twice daily – start and end of shift	Hourly[3]	Weekly – start of shift
A05b	Stormwater drain*	Weekly – start of shift	Weekly – start of shift	Daily – start of shift	Hourly[3]	Fortnightly – start of shift
A06	UP MAIN	Weekly – start of shift	Daily – start of shift	Up to hourly	Hourly[3]	Weekly – start of shift
A08a	Devonshire 'Tunnel'	Weekly	Daily – start of shift	Up to hourly	Hourly[3]	Weekly – start of shift
A08b	Sanitary pipe*	Weekly – start of shift	Weekly – start of shift	Daily – start of shift	Hourly[3]	Fortnightly – start of shift
A08c	Stormwater drain*	Weekly – start of shift	Weekly – start of shift	Daily – start of shift	Hourly[3]	Fortnightly – start of shift
A09	Heritage masonry wall	Weekly – start of shift	Daily – start of shift	Twice daily – start and end of shift	Hourly[3]	Weekly – start of shift
NA	Piled walls and excavation faces	NA	Daily – start of shift	Twice daily –	Hourly[3]	NA[4]

				start and end of shift		
NA	B2 Access Tunnel	Weekly – start of shift	Daily – start of shift	Twice daily – start and end of shift	Hourly[3]	Weekly – start of shift

Notes:

1. Monitoring levels assume movement within **GREEN** trigger level. **AMBER** movements are not anticipated at this stage. Should **AMBER** movements be noted, frequency should be increased to daily and the designer informed.
2. For pipes/services, monitoring may be less frequent, as stated, if surrounding assets and structure remain within **GREEN** trigger zone and monitoring results remain stable, if agreed with asset owner.
3. At **RED** trigger level, Works shall cease; however, monitoring should continue up to hourly, if it is safe to do so, until contingency measures are in place. Monitoring should recommence once contingency measures are in place to confirm movement has stabilised. Monitoring should continue to confirm contingency measures are working as intended.
4. It is assumed that piled walls and excavation faces will be covered by permanent works at this stage and directmonitoring will not be feasible. Movement of surrounding assets could indicate continuing movement of the retaining structures and additional assessment may be required.
5. *Ground surrounding assets will be monitored, no devices within assets

5.6 Vibration Monitoring

The level of acceptable vibration and its effect on existing structures/assets is dictated by a number of factors including:

- Type of building structure (eg reinforced concrete, brick)
- Condition of asset/structure, vibration transmitting medium
- The frequency range of vibrations
- The natural frequency of the building

Similarly, humans are also sensitive to vibrations, and are more sensitive to vibration levels which are considered insignificant for buildings.

Work should be undertaken in a way that results in the following values not being exceeded, in accordance with DIN 4150 Group 3 due to the significance and sensitive nature of the structure. This is subject to review and assessment by specialist consultants to confirm acceptable limits.

Table 3: Guideline Values for Vibration Velocity to Be Used When Evaluating the Effects of Short-Term Vibration on Structures

Line	Type of Structure	Vibration at the foundation at a frequency of		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*
1	Commercial / Industrial Buildings	20	20 - 40	40 - 50
2	Dwellings and Buildings of similar design and occupancy	5	5 - 15	15 - 20
3	**Structures that are particularly sensitive to vibration and cannot be classified above.**	**3**	**3 - 8**	**8 - 10**

*) At Frequencies above 100Hz, the values given in this column many be used as minimum values.

Similarly, for heritage structures adjacent to the Development a trigger level of 3mm/s should be considered. All trigger levels to be reviewed with monitoring providers to understand sensitivity and tolerances of equipment to ensure the risk of false readings is mitigated.

It is recommended that a Vibration Monitoring Specialist is engaged throughout to monitor vibrations throughout eh duration of the early-works construction activities. The specialist shall provide guidance on the installation, maintenance of monitoring equipment, taking readings, distributing/reporting results.

Should the vibration levels exceed the trigger levels nominated, the Contractor shall change construction methodologies to ensure the vibration limits are satisfied.

Finally, it is recommended that an acoustic and vibration assessment report is prepared by an experienced in accordance with Clause 9.4 in ASA Standard for Development Near Rail Tunnels.

5.7 Response Methodology and Processes

Monitoring strategy proposed for the Development is broken into three main stages:

1. Plan, procure, install:
    a. Source/review the proposed instruments.
    b. Procure and check functionality of instruments (i.e. functioning as intended).
    c. Install and calibrate instruments.
    d. Obtain and record baseline readings.
    e. Assign alert and response trigger levels to each instrument, by monitoring phase as required.
    f. Prepare and maintain records documenting the installation, calibration, baseline reading and trigger level specification for future use and reference.
2. Monitoring, review, interpretation
    a. Monitor in accordance with monitoring frequency.
    b. Obtain and record data from instruments and site observations.
    c. Review, interpret and analyse data.
        i. Are instruments functioning correctly? If not, repair/remove/replace/re-calibrate within 12 hours and re-monitor.
    d. Undertake a comparison of results to alert and response trigger levels.
3. Respond and action, as required.
    a. Results within **GREEN** trigger level zone
        i. Implement response and actions required for **GREEN** movements
    b. Results exceeding the **AMBER** trigger level zone
        i. Implement response and actions required to suit **AMBER** trigger level
    c. Results exceeding the **RED** trigger level zone
        i. Works suspended
        ii. **RED** trigger level actions as detailed.

5.7.1 Review and Interpretation of Data

The recorded data is to be compared against the determined alert and response trigger levels such that appropriate action(s) can be undertaken, as required. With due consideration given to: environmental factors, instrument drift, cross sensitivity, calibration, and time between maintenance.

5.7.2 Reporting

The requirements of the reporting shall be determined/agreed with the specialist subcontractors, once awarded.

5.8 Monitoring Action Plan

Table 4 provides a summary of the response as well as actions to be executed respective of the trigger level (**GREEN**, **AMBER**, **RED**).

Table 4: Alert level response and actions

Alert Level	Description	Response and action
GREEN	Movements and values are less than 50% of the maximum predicted value	● If steady/constant trend of recorded movements/values is observed; no further response/action required
		● Progress of Works and monitoring to continue as planned
		● If a noticeable increase in recorded movements/values is observed:
		– Monitoring data reviewed; consideration given to increasing monitoring frequency. Reassessment of predicted movements may be required.
		– Increase vigilance during Works
		● If construction works are complete and a steady/constant trend is observed, consideration can be given to reducing/ceasing monitoring
AMBER	Movements and values are greater than 50% but less than 80% of the maximum predicted value	● Monitoring data to be reviewed and interpreted
		● Works process to be reviewed
		● Monitoring to continue as planned
		● Designer's Representative to be informed. Reassessment of predicted movement required to be undertaken based on latest recorded data
		● Construction works may continue subject to process review findings. Process may include
		– Review of construction methodology and consideration to adjusting methodology where and as necessary
		– Based on review and interpretation of monitoring data, monitoring frequency to be increased where and as necessary
		● If a noticeable increase in recorded movements and values is observed then remedial and mitigation measures will need to be developed, documented and implemented where and as necessary
		● Comprehensive risk assessment/re-evaluation review with appropriate contingency planning to be undertaken
RED	Movements and values are greater than 80% of the maximum predicted value	● Construction Manager notified of exceedance and consideration given to immediately and temporarily ceasing construction works
		● Designer's Representative and all relevant parties to be notified of trigger level exceedance as per Table 5
		● Monitoring data to be reviewed and interpreted
		● State Transit Duty Managers and Customer Area Managers to be alerted for transport assets.
		● Works process to be reviewed. Review to define if construction works can proceed and what other actions are required, including:
		– Risk assessment/contingency plan to be implemented as appropriate
		– Monitoring frequency to be increased where and as necessary
		– Remedial and mitigation measures developed, documented and implemented where and as necessary
		● Reassessment of predicted ground movements to be undertaken by Design Team using latest monitoring data

In an emergency, the Contractor will immediately cease works and notify the Train Operations directly as well as the key contacts listed below.

5.9 Responsibility Matrix

Below is a template for key personnel, by organisation, and level of responsibility. The finalise details shall be agreed with the asset owners and station operator prior to commencement of construction activities.

Table 5: Key Contacts

Organization	Position	Company	Name	Email address	Contact number
Contractor	Construction Manager	Built	Jahaan Rowder	*jahaanrowder@built com.au*	*TBC*
	Project Manager	Built	Whitney Forse	*Whitneyforse@built com.au*	*TBC*
	Senior Project Engineer	Built	Miles Nagle	*MilesNagle@built com.au*	*TBC*
	Site Engineer	Built	James Campbell	*jamescampbell@built com.au*	*TBC*
Surveyor	Survey Manager		*TBC*	*TBC*	*TBC*
	Surveyor		*TBC*	*TBC*	*TBC*
TfNSW	Station Manager		*TBC*	*TBC*	*TBC*
	Station Duty Manager		*TBC*	*TBC*	*TBC*
	Customer Area Manager		*TBC*	*TBC*	*TBC*
	Appointed Person		*TBC*	*TBC*	*TBC*
	Local Track Representative, for John Mcleod - Professional Head Track		Anthony Lee	*TBC*	*TBC*
Contractor's Engineer	Geotechnical Engineer	Douglas Partners	Joel Huang	*Joel.Huang@douglaspartners.com.au*	*TBC*
	Structural Engineer	TTW	Kevin Berry	*kevinb@ttw.com.au*	*TBC*
Client's Engineer	Geotechnical Engineer	Douglas Partners	Joel Huang	*Joel.Huang@douglaspartners.com.au*	*TBC*
	Structural Engineer	TTW	Kevin Berry	*kevinb@ttw.com.au*	*TBC*
Client's Project Manager	Project Manager/ Client's Representative	Generate	Chris Adam / Neil Mcleod	*Neil@generateproperty.com.au*	*TBC*

Table 6: Emergency Contact List

Organization	Position	Name	Contact number
Sydney Trains Operations	Station Duty Manager	*TBC*	*TBC*
	Superintendent	*TBC*	*TBC*
	Local Track Representative	*TBC*	*TBC*
Emergency Services	-	-	*000*
TfNSW	Appointed Person	*TBC*	*TBC*
Contractor	Project Manager	*TBC*	*TBC*

In the event of an emergency the Contractor shall manage/coordinate all tasks to ensure safe operations on site and trains whilst Sydney Trains initiate their Emergency Response Procedure.

6.0 Recommendations

This monitoring, alert and response plan shall be updated as the design of the Development continues to progress with the final monitoring plan being finalised in collaboration with specialist surveyor contractor(s) upon completion of design and confirmation of construction methodologies.

The final monitoring plan will provide details associated with set-out and type of monitoring instruments as well as the frequency of measurement/monitoring during the duration of critical construction phases. Alerts and response trigger levels shall be detailed in the final monitoring plan.

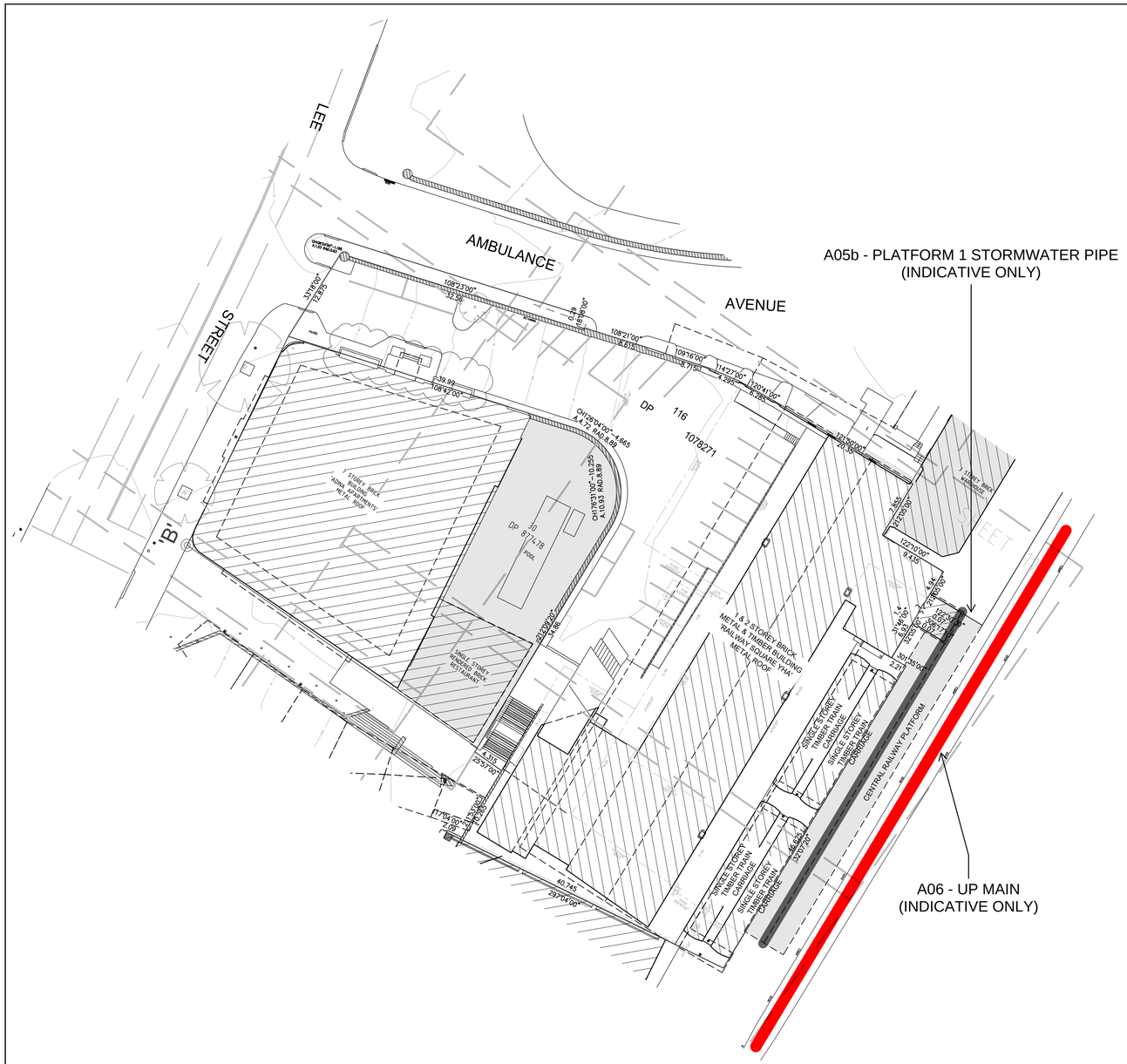
TTW recommend that monitoring should continue until the superstructure is completed at reduced frequency once critical construction phases are complete. Once the Development is complete, a post-construction survey and inspection is recommended; TfNSW to provide sign-off as required.

7.0 References

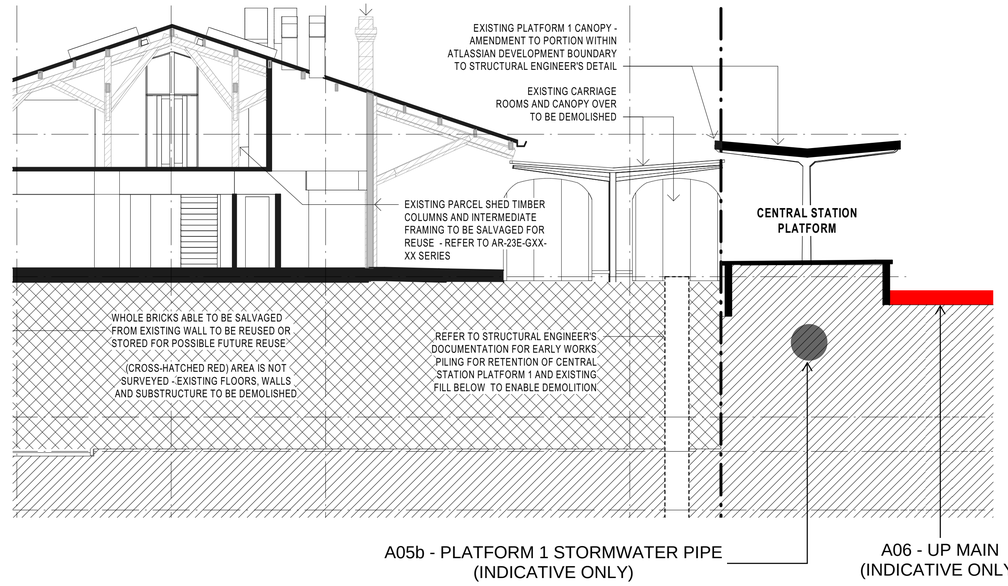
- C579 Retention of Masonry Facades – Best Practice Guide, CIRIA (2003)
- C760 Guidance on embedded retaining wall design, CIRIA (2017)
- SPC 207 Track monitoring requirements for undertrack excavation, TfNSW (2019)
- T HR CI 12051 ST Development near rail tunnels, TfNSW (2018)
- T HR CI 12080 ST External developments, TfNSW (2019)
- T HR TR 13000 ST Railway surveying, TfNSW (2016)
- T MU CI 12140 GU Geotechnical instrumentation and monitoring guidelines, TfNSW (2016)
- T MU MD 20002 ST Risk criteria for use by organisations providing engineering services, TfNSW (2016)

Appendix A

Monitoring Plans



PLAN VIEW OF PLATFORM 1 STORMWATER PIPE AND UP MAIN (LTS LOCKLEY DRG 50176 001DT[T])



SECTION E: CROSS-SECTION ELEVATION VIEW PLAN VIEW OF PLATFORM 1 STORMWATER PIPE AND UP MAIN (BVN DRG AR-23D-GXX-02[5])

LEGEND

- A01 - HERITAGE MASONRY WALL
- A02 - CENTRAL BUILDING
- A03 - SOUTHERN BAGGAGE TUNNEL
- A04 - GOODS LIFT CORE
- A05a - PLATFORM 1
- A05b - PLATFORM 1 STORMWATER PIPE
- A06 - UP MAIN
- A08a - DEVONSHIRE TUNNEL
- A08b - SANITARY PIPE
- A08c - STORMWATER PIPE
- A08d - HIGH VOLTAGE CONDUIT x2
- A09 - HERITAGE MASONRY WALL
- A09 - ADINA CAR PARK & POOL
- A09 - ADINA RETAIL SPACE

REVISION		DATE
RA	PRELIMINARY	28/09/21

CLIENT: BUILT
ARCHITECT: BVN

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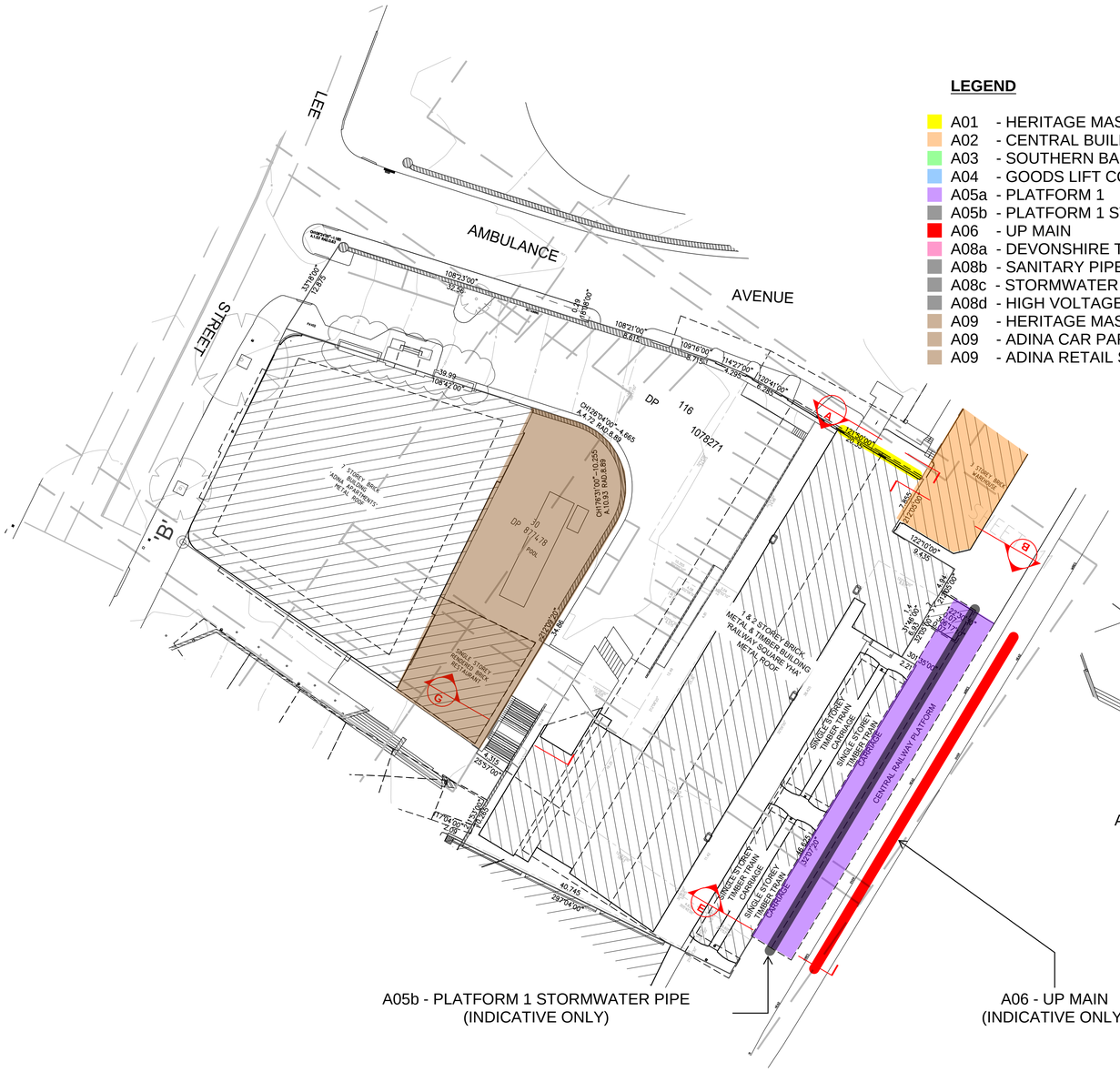
Level 6/73 Miller St, North Sydney NSW 2060 | +61 2 9439 7288 | ttw.com.au

PROJECT: ATLASSIAN MOVEMENT MONITORING & ALERT RESPONSE PLAN
TITLE: UP MAIN

DRAWN	DESIGNED	CHECKED
RC	RC	-
DATE	APPROVED	SCALE
28/09/21	-	NTS

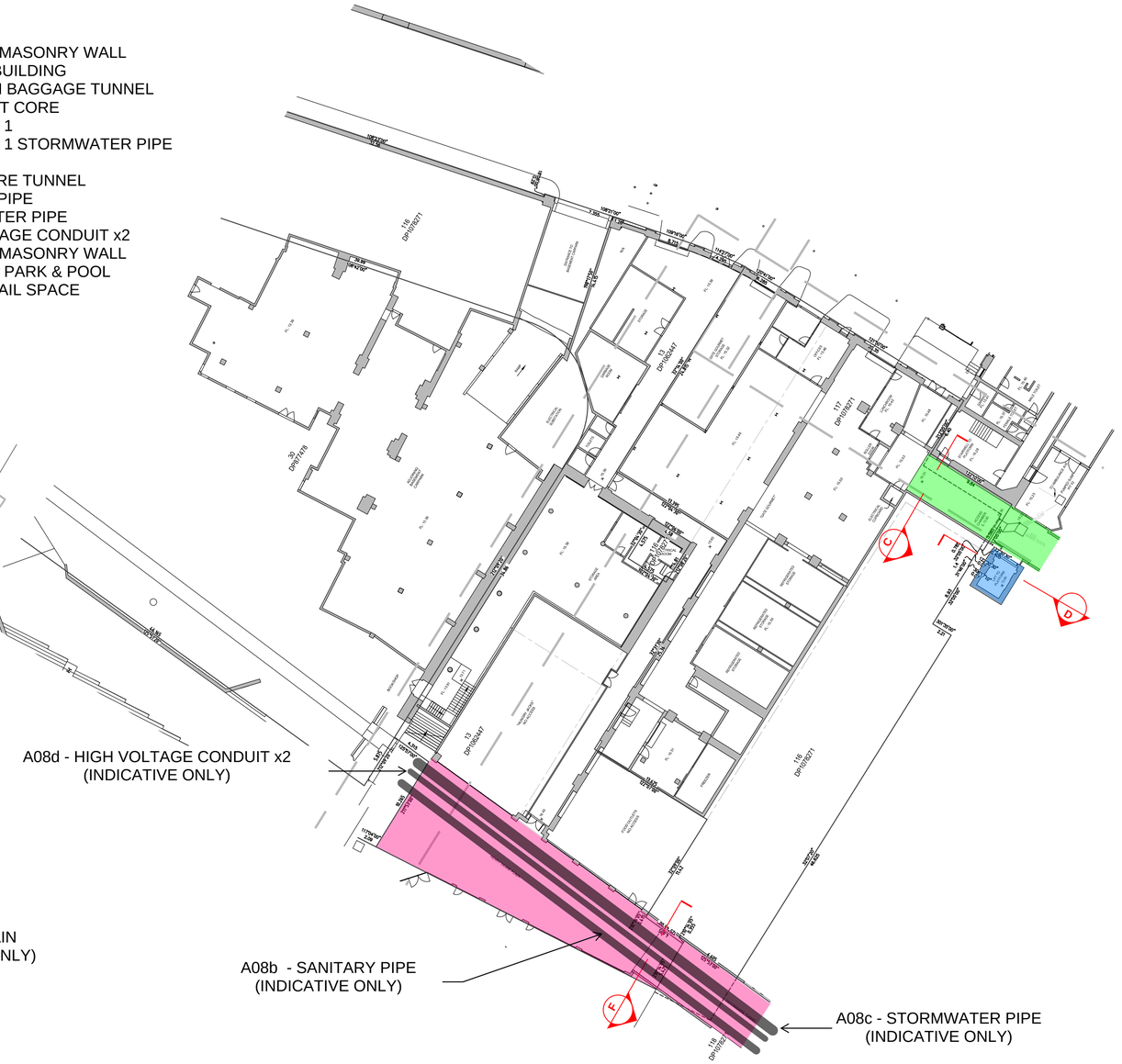
DRAWING NUMBER: 191797-TTW-CE-SK-0100.7
REVISION: RA



LEGEND

- A01 - HERITAGE MASONRY WALL
- A02 - CENTRAL BUILDING
- A03 - SOUTHERN BAGGAGE TUNNEL
- A04 - GOODS LIFT CORE
- A05a - PLATFORM 1
- A05b - PLATFORM 1 STORMWATER PIPE
- A06 - UP MAIN
- A08a - DEVONSHIRE TUNNEL
- A08b - SANITARY PIPE
- A08c - STORMWATER PIPE
- A08d - HIGH VOLTAGE CONDUIT x2
- A09 - HERITAGE MASONRY WALL
- A09 - ADINA CAR PARK & POOL
- A09 - ADINA RETAIL SPACE

OVERALL PLAN VIEW OF SITE
(LTS LOCKLEY DRG 50176 001DT[T])



OVERALL PLAN VIEW OF BASEMENT
(LTS LOCKLEY DRG 50176 001DT[T])

LEGEND

- A01 - HERITAGE MASONRY WALL
- A02 - CENTRAL BUILDING
- A03 - SOUTHERN BAGGAGE TUNNEL
- A04 - GOODS LIFT CORE
- A05a - PLATFORM 1
- A05b - PLATFORM 1 STORMWATER PIPE
- A06 - UP MAIN
- A08a - DEVONSHIRE TUNNEL
- A08b - SANITARY PIPE
- A08c - STORMWATER PIPE
- A08d - HIGH VOLTAGE CONDUIT x2
- A09 - HERITAGE MASONRY WALL
- A09 - ADINA CAR PARK & POOL
- A09 - ADINA RETAIL SPACE

			CLIENT: BUILT
			ARCHITECT: BVN
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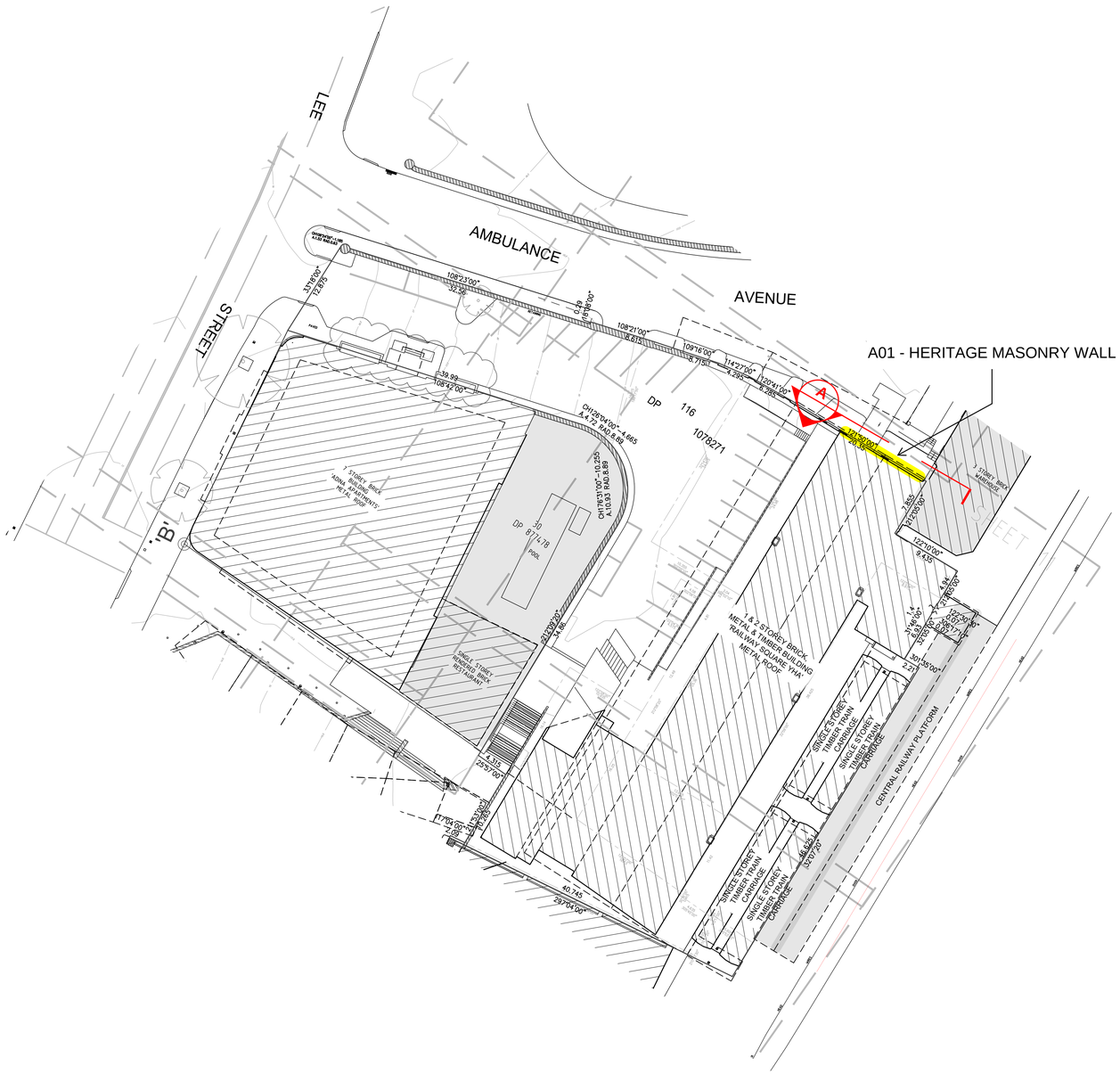
PROJECT: ATLASSIAN
MOVEMENT MONITORING & ALERT RESPONSE PLAN

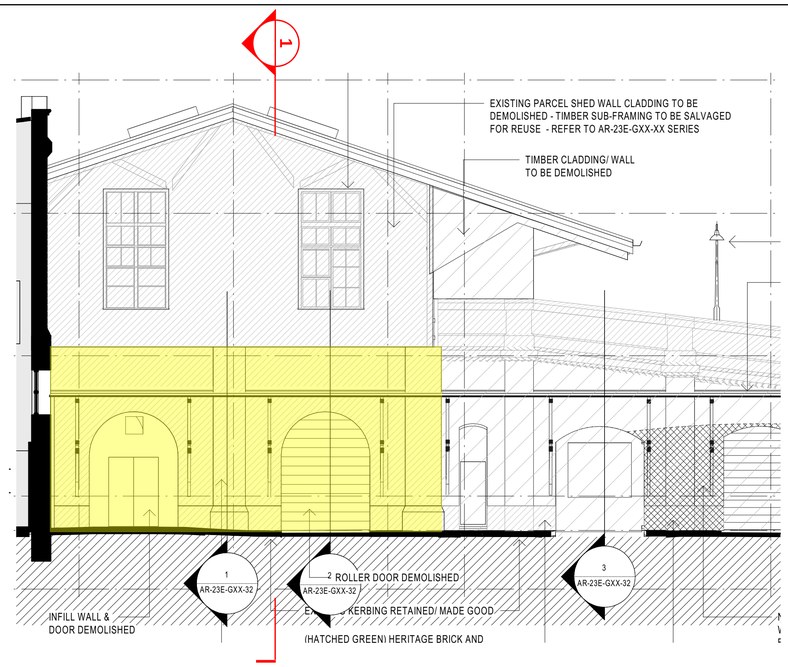
TITLE: OVERALL PLAN VIEW OF SITE

DRAWN	DESIGNED	CHECKED
RC	RC	-
DATE	APPROVED	SCALE
28/09/21	-	NTS

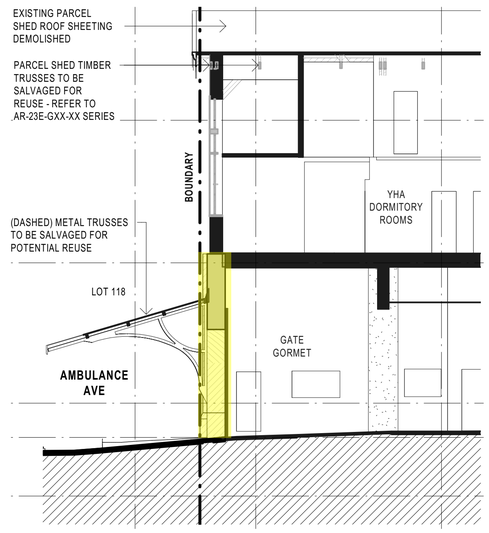
DRAWING NUMBER: 191797-TTW-CE-SK-0100.0
REVISION: RA



PLAN VIEW OF HERITAGE MASONRY WALL ON AMBULANCE AVE (LTS LOCKLEY DRG 50176 001DT[T])



SECTION A: ELEVATION VIEW OF HERITAGE MASONRY WALL ON AMBULANCE AVE (BVN DRG AR-23B-G01-02[5])



SECTION 1: ELEVATION CROSS-SECTION VIEW OF HERITAGE MASONRY WALL (BVN DRG AR-23D-GXX-03[2])

LEGEND

- **A01 - HERITAGE MASONRY WALL**
- A02 - CENTRAL BUILDING
- A03 - SOUTHERN BAGGAGE TUNNEL
- A04 - GOODS LIFT CORE
- A05a - PLATFORM 1
- A05b - PLATFORM 1 STORMWATER PIPE
- A06 - UP MAIN
- A08a - DEVONSHIRE TUNNEL
- A08b - SANITARY PIPE
- A08c - STORMWATER PIPE
- A08d - HIGH VOLTAGE CONDUIT x2
- A09 - HERITAGE MASONRY WALL
- A09 - ADINA CAR PARK & POOL
- A09 - ADINA RETAIL SPACE

RA	PRELIMINARY	28/09/21
REVISION		DATE

CLIENT: BUILT
ARCHITECT: BVN

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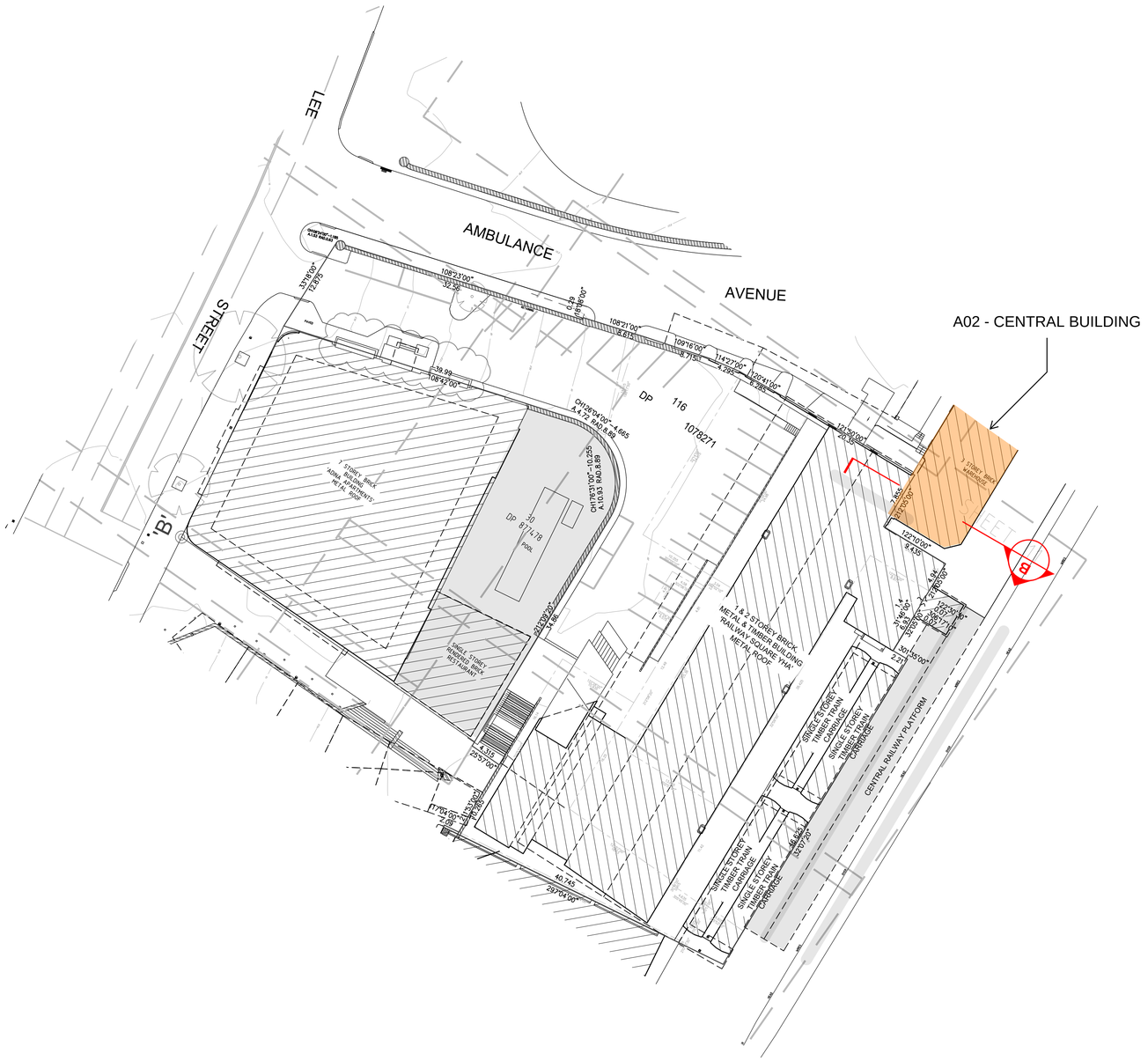
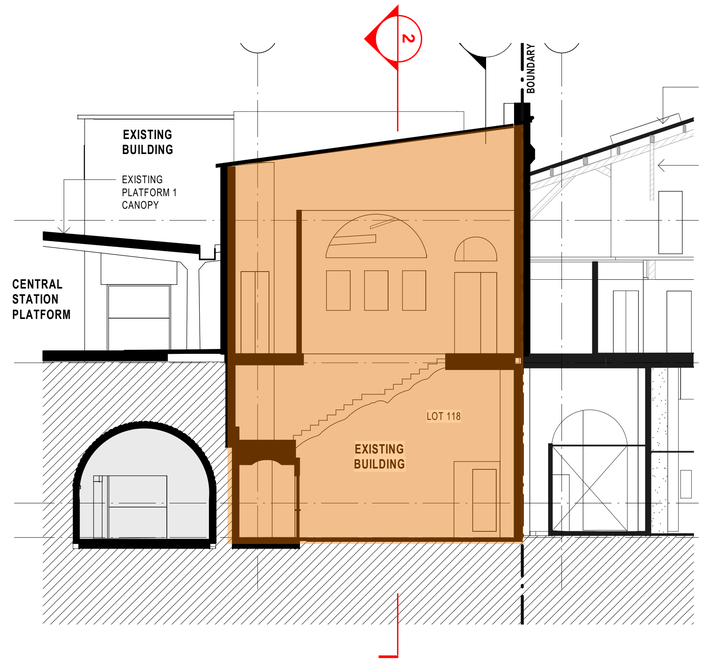
PROJECT: ATLASSIAN MOVEMENT MONITORING & ALERT RESPONSE PLAN
TITLE: HERITAGE MASONRY WALL ON AMBULANCE AVE

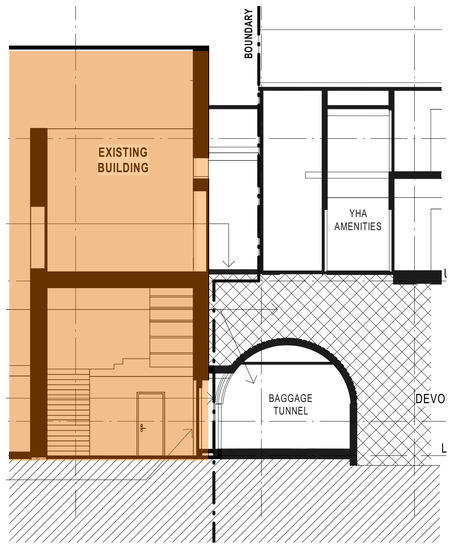
DRAWN	DESIGNED	CHECKED
RC	RC	-
DATE	APPROVED	SCALE
28/09/21	-	NTS
DRAWING NUMBER		REVISION
191797-TTW-CE-SK-0100.1		RA



PLAN VIEW OF CENTRAL BUILDING (LTS LOCKLEY DRG 50176 001DT[T])



SECTION B: CROSS-SECTION ELEVATION VIEW OF CENTRAL BUILDING (BVN DRG AR-23D-GXX-03[2])



SECTION 2: CROSS-SECTION ELEVATION VIEW OF CENTRAL BUILDING (BVN DRG AR-23D-GXX-04[2])

LEGEND

- A01 - HERITAGE MASONRY WALL
- **A02 - CENTRAL BUILDING**
- A03 - SOUTHERN BAGGAGE TUNNEL
- A04 - GOODS LIFT CORE
- A05a - PLATFORM 1
- A05b - PLATFORM 1 STORMWATER PIPE
- A06 - UP MAIN
- A08a - DEVONSHIRE TUNNEL
- A08b - SANITARY PIPE
- A08c - STORMWATER PIPE
- A08d - HIGH VOLTAGE CONDUIT x2
- A09 - HERITAGE MASONRY WALL
- A09 - ADINA CAR PARK & POOL
- A09 - ADINA RETAIL SPACE

REVISION		DATE
RA	PRELIMINARY	28/09/21

CLIENT: BUILT
ARCHITECT: BVN

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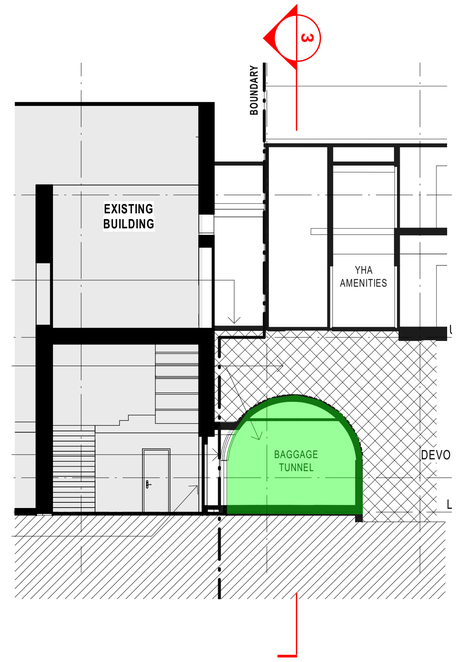
PROJECT: ATLASSIAN MOVEMENT MONITORING & ALERT RESPONSE PLAN
TITLE: CENTRAL BUILDING

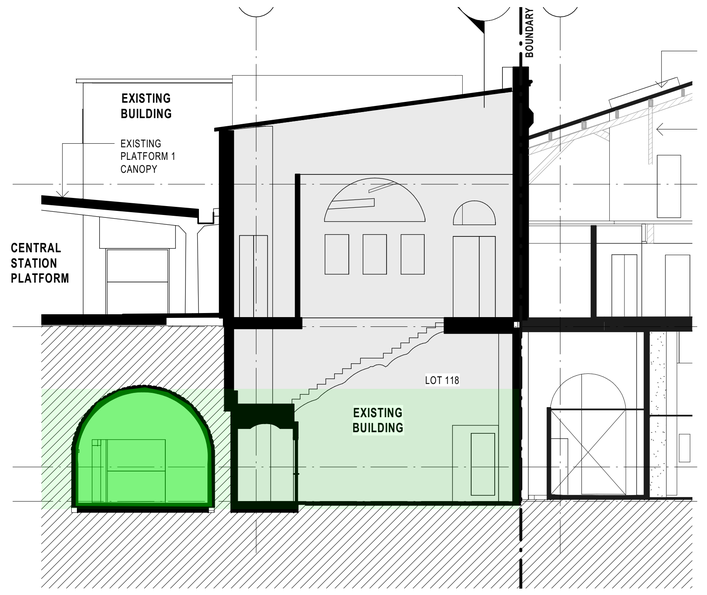
DRAWN	DESIGNED	CHECKED
RC	RC	-
DATE	APPROVED	SCALE
28/09/21	-	NTS

DRAWING NUMBER: 191797-TTW-CE-SK-0100.2
REVISION: RA

PLAN VIEW OF BAGGAGE TUNNEL
(LTS LOCKLEY DRG 50176 001DT[T])



SECTION C: CROSS-SECTION ELEVATION VIEW OF BAGGAGE TUNNEL
(BVN DRG AR-23D-GXX-04[2])



SECTION 3: CROSS-SECTION ELEVATION VIEW OF BAGGAGE TUNNEL
(BVN DRG AR-23D-GXX-04[2])

LEGEND

- A01 - HERITAGE MASONRY WALL
- A02 - CENTRAL BUILDING
- **A03 - SOUTHERN BAGGAGE TUNNEL**
- A04 - GOODS LIFT CORE
- A05a - PLATFORM 1
- A05b - PLATFORM 1 STORMWATER PIPE
- A06 - UP MAIN
- A08a - DEVONSHIRE TUNNEL
- A08b - SANITARY PIPE
- A08c - STORMWATER PIPE
- A08d - HIGH VOLTAGE CONDUIT x2
- A09 - HERITAGE MASONRY WALL
- A09 - ADINA CAR PARK & POOL
- A09 - ADINA RETAIL SPACE

REVISION		DATE
RA	PRELIMINARY	28/09/21

CLIENT: BUILT
ARCHITECT: BVN

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PROJECT: ATLASSIAN
MOVEMENT MONITORING & ALERT RESPONSE PLAN

TITLE: BAGGAGE TUNNEL

DRAWN	DESIGNED	CHECKED
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DATE	APPROVED	SCALE
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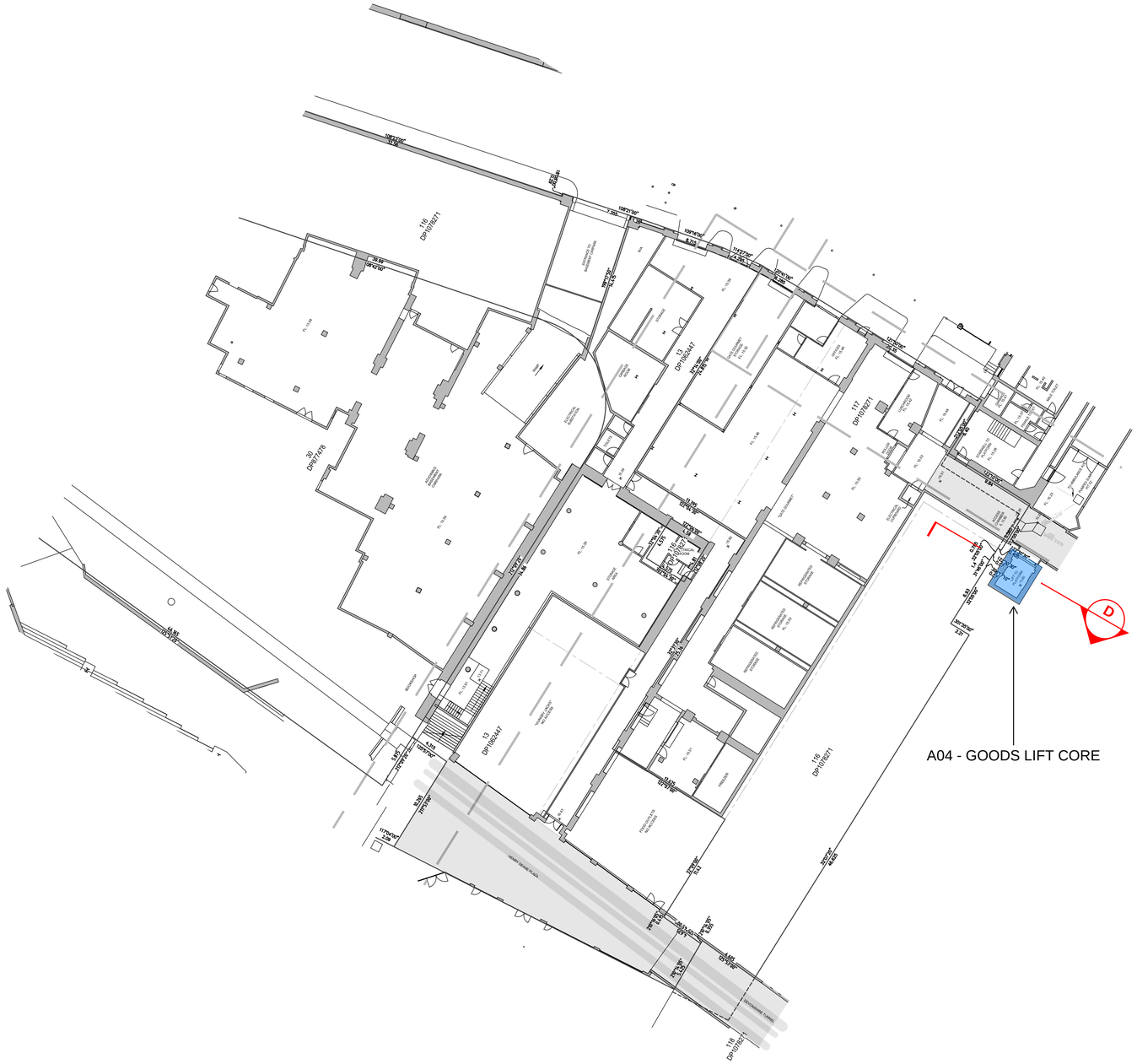
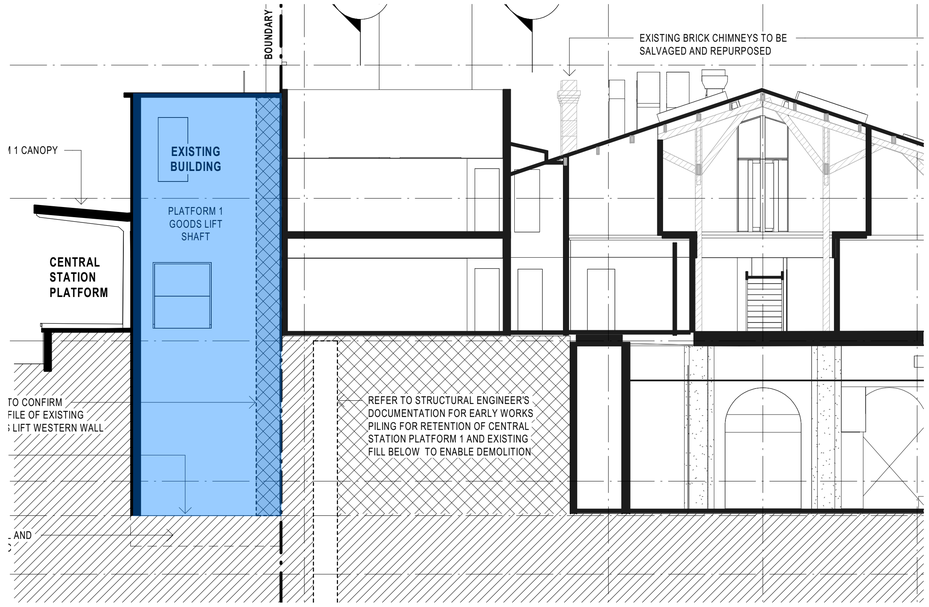
DRAWING NUMBER: 191797-TTW-CE-SK-0100.3
REVISION: RA



PLAN VIEW OF GOODS LIFT CORE (LTS LOCKLEY DRG 50176 001DT[T])



SECTION D: CROSS-SECTION ELEVATION VIEW OF GOODS LIFT CORE (BVN DRG AR-23D-GXX-01[5])

LEGEND

- A01 - HERITAGE MASONRY WALL
- A02 - CENTRAL BUILDING
- A03 - SOUTHERN BAGGAGE TUNNEL
- **A04 - GOODS LIFT CORE**
- A05a - PLATFORM 1
- A05b - PLATFORM 1 STORMWATER PIPE
- A06 - UP MAIN
- A08a - DEVONSHIRE TUNNEL
- A08b - SANITARY PIPE
- A08c - STORMWATER PIPE
- A08d - HIGH VOLTAGE CONDUIT x2
- A09 - HERITAGE MASONRY WALL
- A09 - ADINA CAR PARK & POOL
- A09 - ADINA RETAIL SPACE

REVISION		DATE
RA	PRELIMINARY	28/09/21

CLIENT: BUILT

ARCHITECT: BVN

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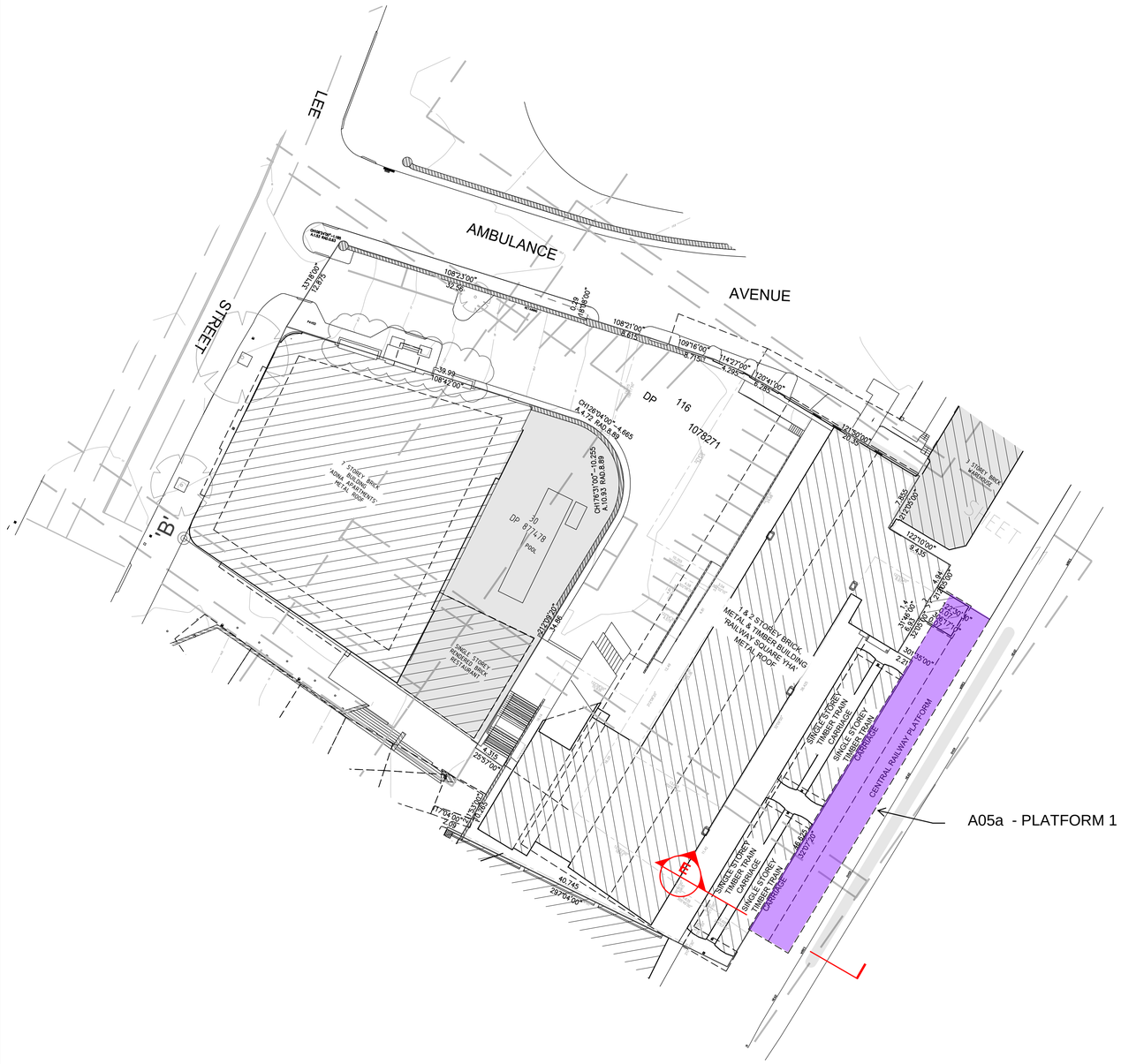
PROJECT: ATLASSIAN
MOVEMENT MONITORING & ALERT RESPONSE PLAN

TITLE: GOODS LIFT CORE

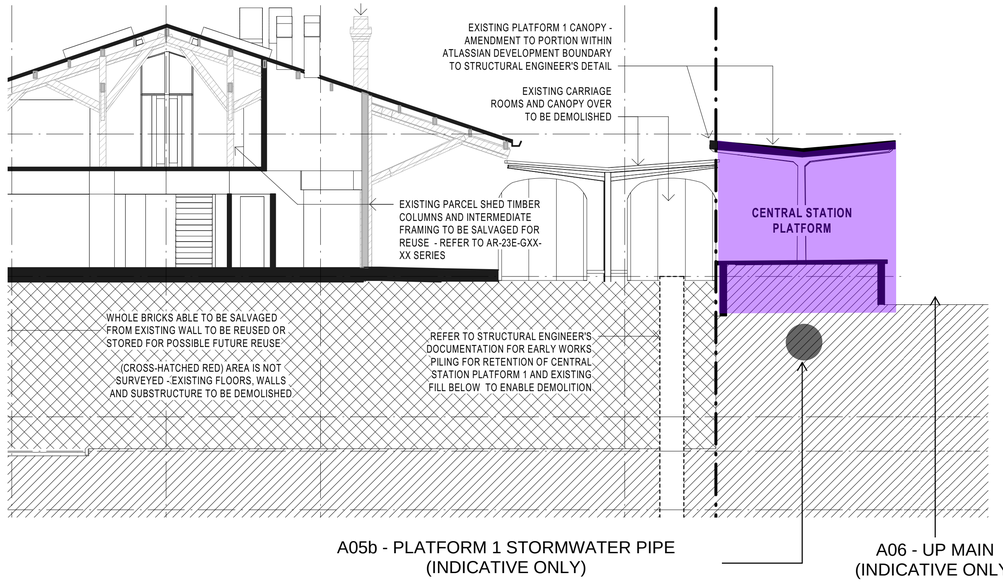
DRAWN	DESIGNED	CHECKED
RC	RC	-
DATE	APPROVED	SCALE
28/09/21	-	NTS

DRAWING NUMBER: 191797-TTW-CE-SK-0100.4

REVISION: RA



PLAN VIEW OF PLATFORM 1
(LTS LOCKLEY DRG 50176 001DT[T])



SECTION E: CROSS-SECTION ELEVATION VIEW OF PLATFORM 1 INCLUDING A05b (PLATFORM 1 STORMWATER PIPE) AND A06 (UP MAIN) (BVN DRG AR-23D-GXX-02[5])

LEGEND

- A01 - HERITAGE MASONRY WALL
- A02 - CENTRAL BUILDING
- A03 - SOUTHERN BAGGAGE TUNNEL
- A04 - GOODS LIFT CORE
- **A05a - PLATFORM 1**
- A05b - PLATFORM 1 STORMWATER PIPE
- A06 - UP MAIN
- A08a - DEVONSHIRE TUNNEL
- A08b - SANITARY PIPE
- A08c - STORMWATER PIPE
- A08d - HIGH VOLTAGE CONDUIT x2
- A09 - HERITAGE MASONRY WALL
- A09 - ADINA CAR PARK & POOL
- A09 - ADINA RETAIL SPACE

REVISION		DATE
RA	PRELIMINARY	28/09/21

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PROJECT: ATLASSIAN MOVEMENT MONITORING & ALERT RESPONSE PLAN
TITLE: PLATFORM 1

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DATE	APPROVED	SCALE
28/09/21	-	NTS

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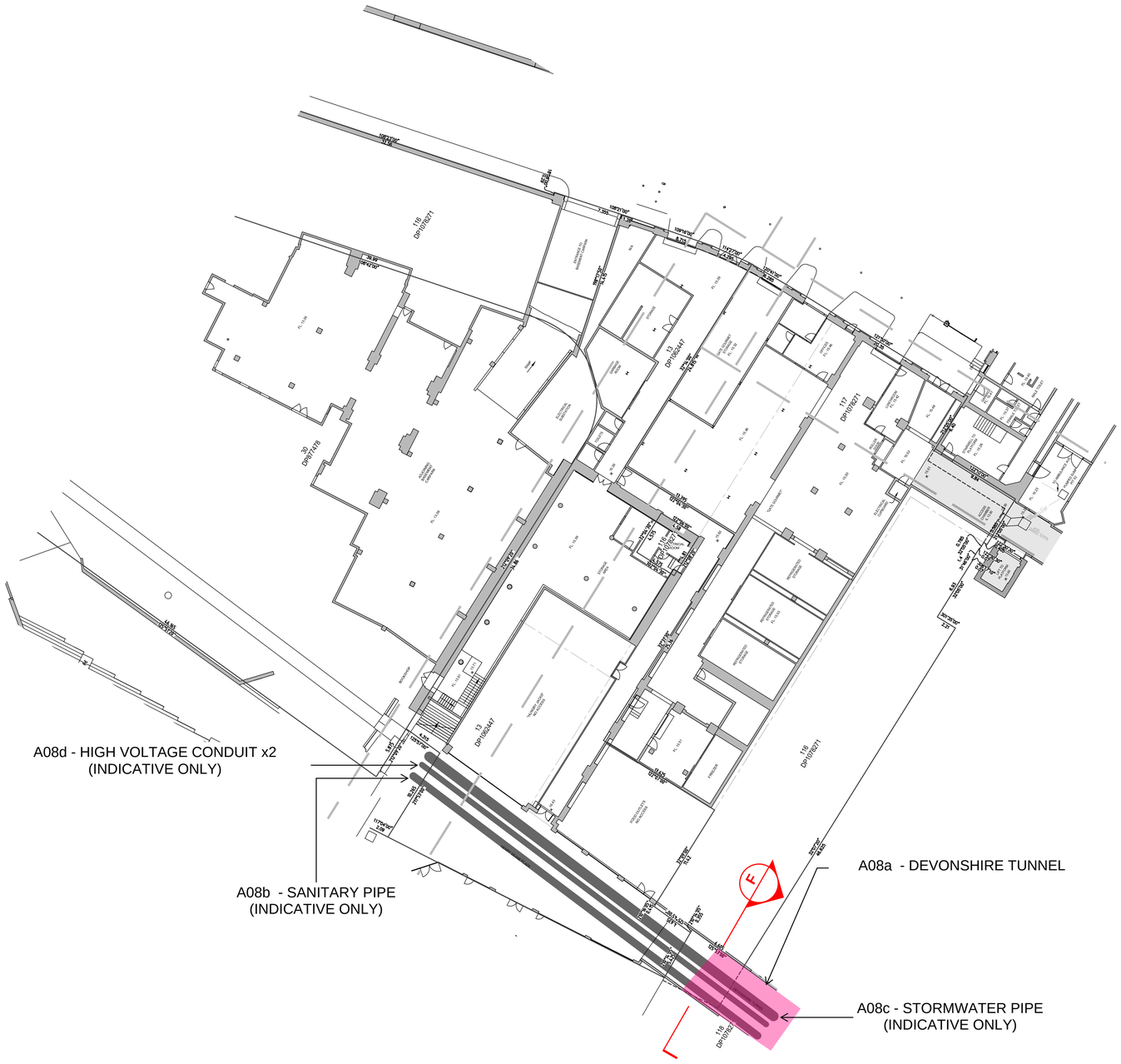
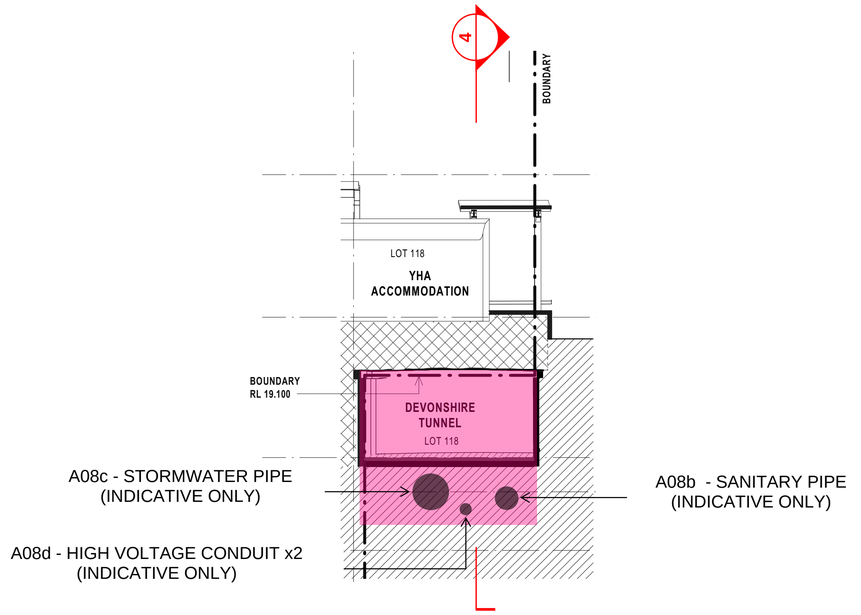
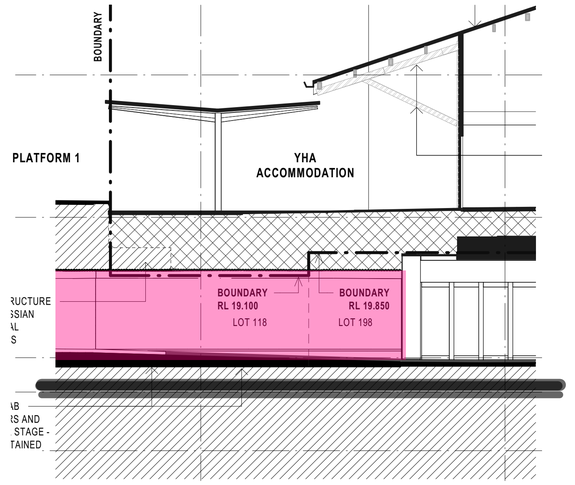
REVISION: RA



PLAN VIEW OF DEVONSHIRE STREET TUNNEL AND INDICATIVE LOCATION OF SERVICES (LTS LOCKLEY DRG 50176 001DT[T])



SECTION F: CROSS-SECTION ELEVATION VIEW OF DEVONSHIRE STREET TUNNEL (BVN DRG AR-23D-GXX-04[2])



SECTION 4: CROSS-SECTION ELEVATION VIEW OF DEVONSHIRE STREET 'TUNNEL (BVN DRG AR-23D-GXX-04[2])

LEGEND

- A01 - HERITAGE MASONRY WALL
- A02 - CENTRAL BUILDING
- A03 - SOUTHERN BAGGAGE TUNNEL
- A04 - GOODS LIFT CORE
- A05a - PLATFORM 1
- A05b - PLATFORM 1 STORMWATER PIPE
- A06 - UP MAIN
- **A08a - DEVONSHIRE TUNNEL**
- A08b - SANITARY PIPE
- A08c - STORMWATER PIPE
- A08d - HIGH VOLTAGE CONDUIT x2
- A09 - HERITAGE MASONRY WALL
- A09 - ADINA CAR PARK & POOL
- A09 - ADINA RETAIL SPACE

REVISION		DATE
RA	PRELIMINARY	28/09/21

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ARCHITECT: BVN

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PROJECT: ATLASSIAN MOVEMENT MONITORING & ALERT RESPONSE PLAN
TITLE: DEVONSHIRE STREET TUNNEL AND SERVICES

DRAWN	DESIGNED	CHECKED
RC	RC	-
DATE	APPROVED	SCALE
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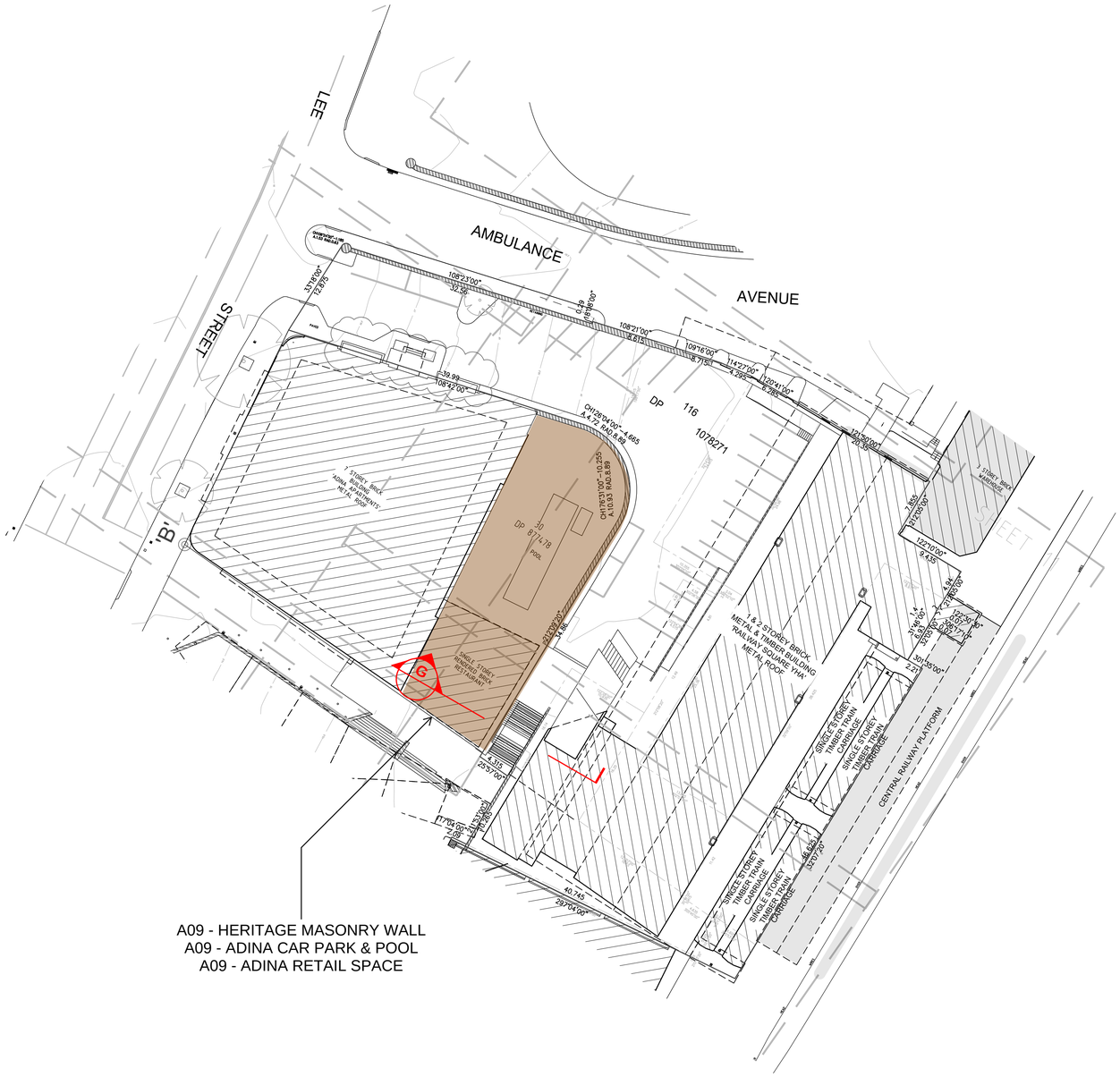
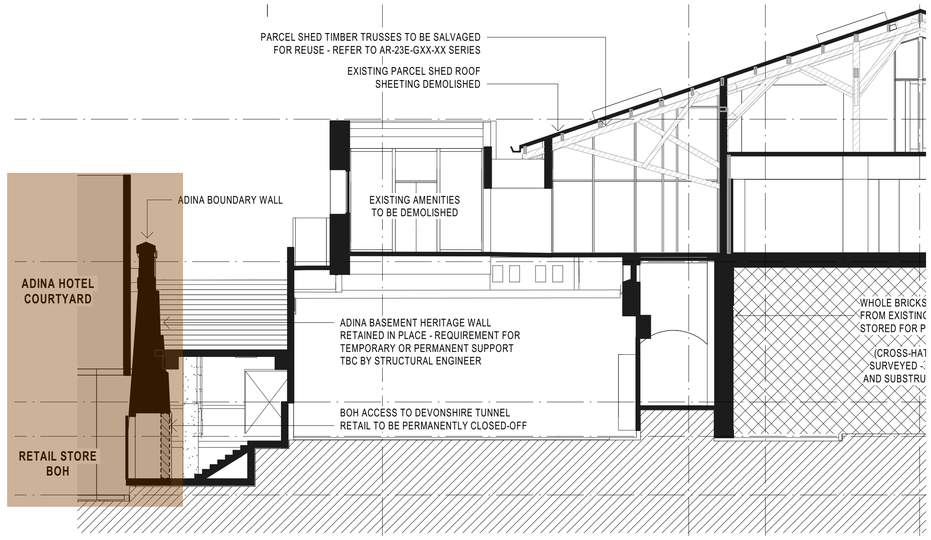
DRAWING NUMBER: 191797-TTW-CE-SK-0100.6
REVISION: RA



PLAN VIEW OF ADINA MASONRY WALL, CAR PARK, POOL, AND RETAIL SPACE (LTS LOCKLEY DRG 50176 001DT[T])



SECTION G: CROSS-SECTION ELEVATION VIEW OF ADINA HOTEL BOUNDARY WALL (BVN DRG AR-23D-GXX-02[5])

LEGEND

- A01 - HERITAGE MASONRY WALL
- A02 - CENTRAL BUILDING
- A03 - SOUTHERN BAGGAGE TUNNEL
- A04 - GOODS LIFT CORE
- A05a - PLATFORM 1
- A05b - PLATFORM 1 STORMWATER PIPE
- A06 - UP MAIN
- A08a - DEVONSHIRE TUNNEL
- A08b - SANITARY PIPE
- A08c - STORMWATER PIPE
- A08d - HIGH VOLTAGE CONDUIT x2
- **A09 - HERITAGE MASONRY WALL**
- **A09 - ADINA CAR PARK & POOL**
- **A09 - ADINA RETAIL SPACE**

REVISION		DATE
RA	PRELIMINARY	28/09/21

CLIENT: BUILT
ARCHITECT: BVN

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PROJECT: ATLASSIAN
MOVEMENT MONITORING & ALERT RESPONSE PLAN

TITLE: ADINA MASONRY WALL, CAR PARK, POOL, AND RETAIL SPACE

DRAWN	DESIGNED	CHECKED
RC	RC	-
DATE	APPROVED	SCALE
28/09/21	-	NTS

DRAWING NUMBER: 191797-TTW-CE-SK-0100.8
REVISION: RA

URBIS