88, Christie Street, St Leonards. Report on preliminary impact assessment of proposed commercial development near RailCorp infrastructure

June 2010

WINTEN PROPERTY GROUP

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Author	Reuben Lamack	Principal Engineer		04/06/10
Reviewer	Paul Hewitt	Technical Executive Geotechnical		04/06/10
Project Manager	Paul Hewitt	Technical Executive Geotechnical		04/06/10

Revision	Details	Date	Amended By
A	Final Issue	07/6/10	P.Hewitt

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Executive summary

This report presents an initial assessment of the potential impact associated with construction of a proposed commercial development at 88, Christie Street St Leonards. The proposed development is sited within 20m of the existing RailCorp rail corridor at St Leonards and within 14m of the proposed CBD rail link tunnels.

Winten Property Group has submitted preliminary environmental plans and subsequently the Department of Planning has declared the project as a Major Project to which Part 3A of the Act applies and has authorised the submission of a concept plan.

Part of the concept plan submission as outlined in the Director General's letter dated 31st March 2010, includes a requirement to provide an impact assessment report of the proposed development to the nearby existing RailCorp infrastructure and to review possible impacts to proposed RailCorp plans with respect to rail quadruplication project and the CBD Rail Link project (CBDRL), previously referred to as the Harbour Rail Link project.

The proposed development eastern boundary is sited approximately 20m from the RailCorp rail corridor. With respect to SEPP(Infrastructure 2007) Clause 86, the proposed development falls within the horizontal distance of 25m from RailCorp corridor hence triggering the need to provide an impact assessment as outlined in the NSW Department of Planning 'Development Near Rail Corridors and Busy Roads- Interim Guideline 2008'.

This concept submission is limited to highlighting the possible impacts to the existing RailCorp corridor and any limitation to the practicability of the construction of the proposed RailCorp projects. Detail adherence to the stated guidelines will form part of the works submission. The works submission stage will include a detail geotechnical and structural assessment report, noise and vibration report and the electrolysis impact report.

The findings in this report indicate that construction associated with the proposed development will have negligible impact on the existing RailCorp infrastructure and is unlikely to have an adverse impact on the practicability of future rail infrastructure development.

This report provides conclusions which will assist in providing confidence to stakeholders that the development can proceed without impacting RailCorp existing and future infrastructure and provides a basis for obtaining RailCorp's non-objection to the proposed development.

1. Introduction

1.1 Background

This report presents an initial assessment of the potential impacts of a proposed multi-storey development at 88,Christie Street, St Leonards on RailCorp's existing and future developments plans. The primary purpose of this report is to:

- examine possible impacts of the multi-storey development on the existing rail corridor
- examine possible impacts of the multi-storey development on RailCorp proposed development namely the quadruplication project and the CBD Rail Link project
- assess whether construction associated with the proposed development will adversely affect practicability of future rail development
- obtain RailCorp's non-objection to the proposed development.

This assessment assumes that the multistorey development would be constructed in advance of the proposed RailCorp infrastructure, and is based on the following available data and supporting information:

- Halcrow Drwg TTSRCP-801 (Ver 1) - Assumed Track & Tunnel Alignment
- Halcrow Drwg TTSRCP-802 (Ver 1) - CBD Rail Link Cross Section
- Halcrow Drwg TTSRCP-803 (Ver1) - Loading Requirements
- Bates Smart architectural drawings of the proposed multistorey development (PA06-01, PA02-001, PA02-002 dated 6th May 2010)
- Hyder Desktop Study Report – Geotechnical and Groundwater (14 May 2010)

1.2 Development details

The development is a commercial development of 36,000m^2 at St Leonards. The proposed development is located south of St Leonards station. The site traverses Christie Street on the east boundary and Lithgow Street on the west boundary. The north of the site is a row of commercial buildings. Further north is the Pacific Highway.

©GoogleEarth / SKM 2010 – Acquired 20th January, 2007

Figure 1-1 Site of 88, Christie Street proposed commercial development

Plans and sections have been developed from the above information showing general layouts of the respective developments.

Details of the development are summarised below;

- 16 storey building with 7-level basement
- basement excavation proposed to extend up to 24.15m deep to RL 54.85 (includes 0.3 m excavation zone)
- finished floor level RL 55.15m
- approximately 47.5m long street frontage on east of Lithgow Street
- pad footings approximate dimensions of 3m by 3m and 1.0 m in depth

Details are presented on PB Drawings 201013915-GEO-SK-0010, 201013915-GEO-0015 and 201013915-GEO-SK-0016. Figure 1-2, is an extract from drawing 201013915-GEO-SK-0016, which is a northern cross- sectional view of the proposed development at the point nearest to the proposed basement edge.

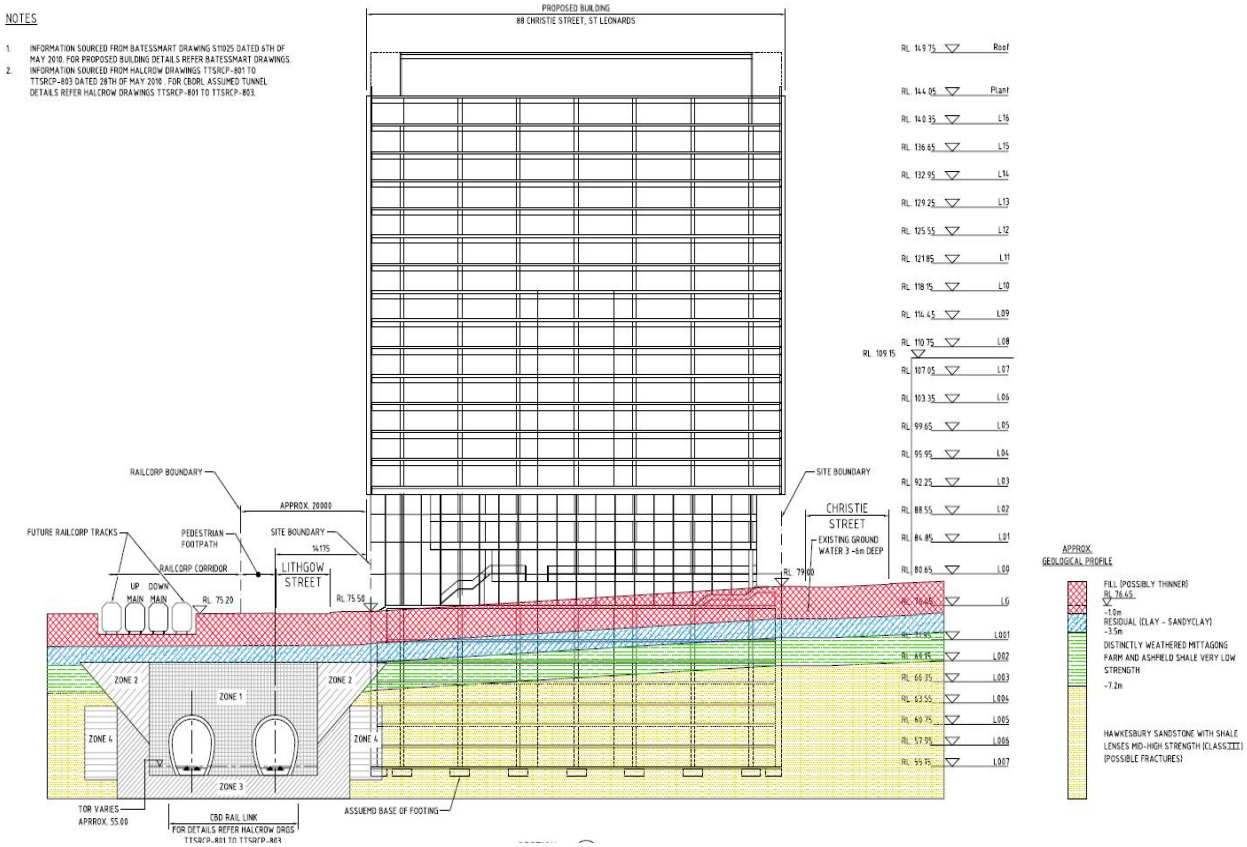


Figure 1-2 Development cross-section showing RailCorp corridor and proposed CBDRL tunnels

1.3 RailCorp infrastructure

1.3.1 Existing

The RailCorp corridor is located to the west of the proposed development. The horizontal distance between the edge of the proposed development and the RailCorp corridor varies with the minimum distance of approximately 20m.The horizontal distance between the edge of the proposed development and the nearest edge of RailCorp tracks is approximately 29m.

1.3.2 RailCorp proposed quadruplication project

In a meeting held on 18th of May 2010 attended by Parsons Brinckerhoff, Enstruct, RailCorp and RailCorp's consultant Halcrow. RailCorp stated, that it would be reasonable, for the developer to assume, that the proposed quadruplication project will involve the addition of 2 tracks i.e. one on each side of the existing lines and within the existing protection corridor.

1.3.3 Proposed CBD Rail Link (Harbour Rail Link) project

RailCorp has provided details of the proposed plans of a tunnel system as part of the CBD Rail Link project (CBDRL). The tunnel system envisaged would be a twin driven single track tunnels. The tunnels have defined protection zones and RailCorp through their consultants have provided the protection zones and narrative on each zone.

These drawings are presented in Appendix B.

1.4 Previous investigations and expected geology

A limited desktop study was undertaken by Jeffery & Katauskas of four sites in the vicinity of the development. The deskstop study was then summarised by Hyder.

Key findings include the following:

- The proposed development site is underlain by fill to a nominal 1-2m depth, overlying residual soil of approximately 1 to 4 m thickness followed by shale of varying weathering and strength overlying Hawkesbury sandstone.
- Natural groundwater levels are predicted to be at a depth of 3 to 6m depth with high probability that the water table is lower than predicted due to the existing Australand deep basement excavation within 150m from the proposed development.

Based on published geological information and local knowledge of conditions in the St Leonards area it can reasonably be expected that medium to high strength sandstone will be encountered at the foundation footing level. The foundation footing level is approximately the same as the track level of the proposed CBDRL project.

It is considered reasonable to assume that sandstone over this interval is likely to be of Class III or better (based on the Sydney rock classification system - Pells et al, 1998). Shale lenses and shale breccia zones may be present within the sandstone over this interval.

2. Protection zones

2.1 CBD Rail Link protection zones

Based on data provided in RailCorp Drawing TTSRCP-802, the maximum horizontal internal tunnel dimension of the CBDRL tunnels is approximately 6.1m. These tunnels are expected to be excavated with roadheaders with temporary and permanent supports using rockbolts, shotcrete and cast insitu linings.

The minimum distance between the proposed tunnels and the edge of the basement is approximately 14.2 m. Allowing 3.1m horizontal distance from the track centreline to tunnel edge, there is approximately a rock pillar width of 11.1m to the basement excavation.

Halcrow drawing TTSRCP-803 (Ver 1) presents the proposed protection reserves around the running tunnels at St Leonards. This drawing is presented in full in Appendix B.

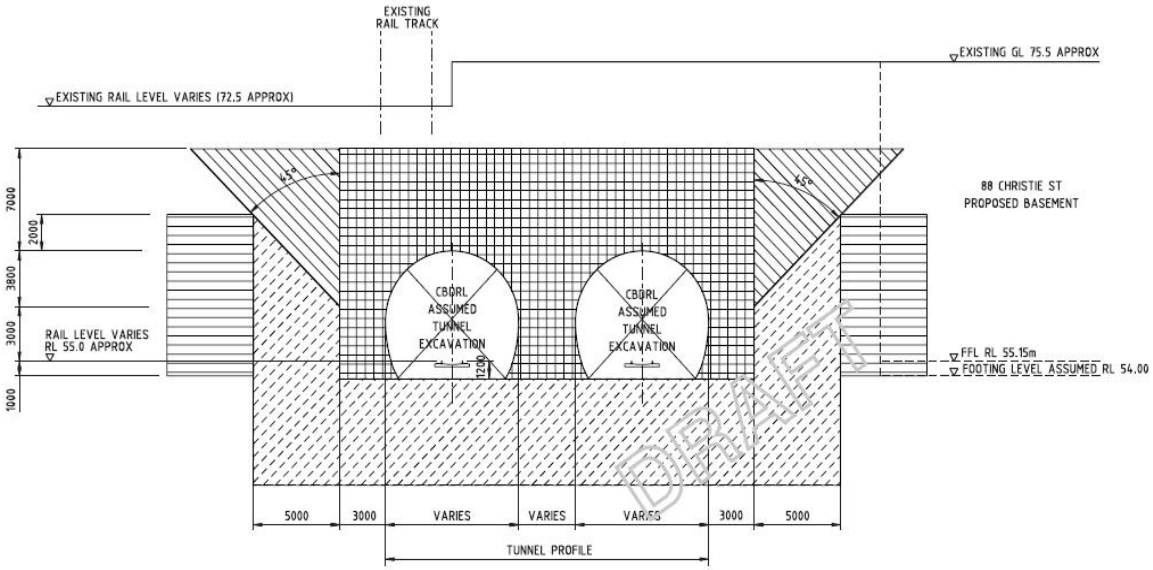


Figure 2-1 Proposed protection zones for CBDRL running tunnels

The general restrictions specified on Halcrow Drawing TTSRCP-803 (Ver 1) are as follows:

- Type 1 Zone

  Excavations, structures or structures applying loading directly to rock mass are not permitted in this zone, except for transfer structures and ground anchors applying loads generally away from the tunnel and located more than 5m above the assumed tunnel crown level. Horizontal loading effects either from structures and foundations bearing directly on zone 1 or foundations outside zone 1 and acting through the ground shall not cause significant horizontal loading to act on zone 1 below or within 2m of the tunnel crown level.

- Type 2 Zone

  Foundations applying vertical loading directly to rock mass are not permitted in this zone except for transfer structures and ground anchors applying loads generally away from the tunnel. Excavation and construction of structures permitted but must avoid deterioration of rock structure in adjacent rock mass.

- Type 3 Zone

  Vertical downwards loads from structures permitted. Loading to be verified and shall allow for assumed tunnel excavation. Vertical upwards loads (and components thereof) to be designed to allow for removal of rock mass in assumed tunnel zone. Horizontal loads permitted below level of tunnel invert.

- Type 4 Zone

  Significant horizontal loading towards the proposed CBDRL tunnel is not permitted. (Refer to Zone 1 notes).

3. Geotechnical and structural impacts

3.1 General

Issues associated with assessment of interaction between the proposed 88, Christie Street, development and the existing RailCorp infrastructure include

- stress redistribution effects around the proposed deep basement and impacts on the proposed running tunnel design
- foundation loads and impacts on stresses on existing RailCorp infrastructure
- point loads from ground anchors and other support
- ground movement effects
- construction impacts including vibration and staging
- changes to the groundwater regime.

3.2 Stress redistribution & ground movement

The development's basement excavation will alter the in-situ stress regime (causing stress relief or concentration) in surrounding ground strata thereby causing displacements within the ground mass which will generally be concentrated along geological structures. Based on the separation distance from the edge of the basement to the edge of the RailCorp corridor which is 20m and the predicted geology, the influence of the excavation is likely to result in displacements of less than 5mm.

We anticipate that soldier piles will be socketed to rock with concrete/shotcrete infill panels as the prime means of excavation support. This method will ensure minimal ground movement at the edges of the excavation in the upper weathered materials. Movement of ground deformation will be restricted due to the fact that protection measures will have to be employed to ensure no damage occurs to adjacent buildings.

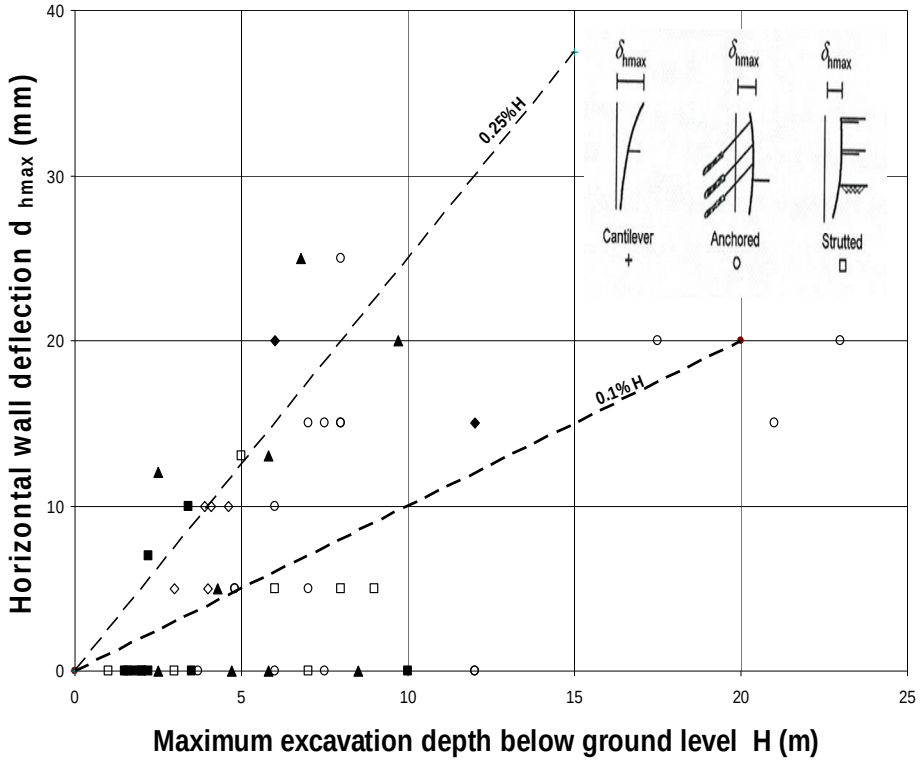


Figure 3-1 Site retention system displacement prediction(Hewitt et al,2007)

Based on the figure 3.1, it can be seen that the predicted maximum horizontal movement at the top of the wall for a 20m deep excavation would be in the range between 25-35mm for an anchored system.

Based on published analysis of stress relief behaviour in vertical rock cuts[3], the horizontal stress-relief displacement induced by the basement excavation is expected to be less than 5 mm within the RailCorp corridor. This magnitude of displacement is not expected to have a significant effect on rock mass or defect shear strengths in the area surrounding the proposed running tunnels.

The influence of the stress relief is anticipated to taper off to negligible within 15 metres of the basement excavation boundary. Hence it would be reasonable to anticipate that movement within RailCorp corridor will be negligible.

Further analysis is required at project submission stage following geotechnical investigation when more detailed geotechnical conditions are known to:

- confirm the magnitude and location of ground stress changes which can be expected from the basement excavation
- assess whether these stress concentrations can develop yield conditions in the rock
- assess the impact of the excavation of the CBDRL running tunnel on the proposed development with a 11.1m separation between the tunnel edge and the basement.

3.3 Foundations and site retentions

We envisage that pad foundations will be utilised for the building foundation. The excavation basement wall and the edge foundations slightly encroach the tunnel protection zone 4. Based on the separation distance of the basement and tunnels, we is anticipate that the horizontal load transfer to the proposed tunnels will be low. This will be investigated at the work submission stage. If the horizontal loads are not acceptable, than a possible solution, is to increase the depth of the foundation to below the protection zone.

Temporary anchors will be utilised for support works during the excavation and these anchors will be destressed on completion. There will be no horizontal loads on the anchors on completion of the basement. If permanent rock anchors are utilised, the horizontal load transfers will be limited to acceptable limits as outlined in protection Zone 4.

In general, the development foundation details and loading do not limit the practicability of constructing the proposed tunnels.

3.4 Construction impacts

Basement excavation methods are expected to be limited by local restrictions on ground vibration and noise. It is expected that impact hammering or saw-cutting methods will likely be employed. These methods are not expected to adversely impact ground conditions in the rock.

Expected peak ground acceleration impacts are addressed in a preliminary assessment report on noise and vibration given in the Appendix C. Preliminary findings indicate that there will be negligible impact to RailCorp infrastructure.

3.5 Changes to groundwater regime

Local groundwater levels around the proposed development are presently not known. Hyder's desktop study indicates that the groundwater level could be in within 3m to 6m deep. It is likely that the groundwater level is lower, due to a recent constructed deep basement within 150m west of the proposed development. It is expected that the groundwater variation within the RailCorp corridor would be minimal resulting in a possible settlement of less than 5mm due to consolidation settlement.

4. Conclusions and recommendations

Based on available information, the following conclusions and recommendations are made:

- Basement excavation at 88, Christie Street, St Leonards can be expected to result in minor changes to existing ground stress, groundwater regime and deformation in the ground within the RailCorp corridor. These effects are negligible and are not expected to impact the existing RailCorp infrastructure and the future construction of the proposed CBDRL and the quadruplication project in St Leonards.

- The proposed basement excavation encroaches Zone 2 and Zone 4 of the proposed protection zone for the CBDRL project. However it is anticipated that this encroachment is minor and low transfers will be within acceptable limits. Numerical analysis will be carried out in the works submission stage to confirm this.

- Temporary anchors that extend to within the protection zone will be destressed hence no horizontal loads from to the basement will be present when the CBDRL tunnel is built.

- Following geotechnical investigations, numerical modelling is recommended to confirm the preliminary findings of this report and should be submitted as part of the works submission.

- Numerical modelling is recommended to confirm likely ground deformation and settlement effects that the proposed CBDRL running tunnel may have on the multi-storey development. Provision should be made within the building design to allow for these expected displacements.

- An instrumentation and monitoring program is required to measure ground movements and stresses of the proposed development to confirm the findings of the numerical model. The monitoring systems should measure internal ground movements including lateral bedding plane shear and bedding plane dilation, and excavation sidewall convergence. A monitoring plan should be submitted as part of the works submission.

- Detail submission addressing all issues as outlined the NSW Department of Planning ‘Development Near Rail Corridors and Busy Roads- Interim Guideline 2008‘, should be submitted as part of the works submission.

5. Limitations

This report has been prepared on behalf of Winten Property Group to address specific project requirements. By necessity, this report has been limited to a conceptual assessment of the geotechnical and structural constraints associated with development in close proximity to the proposed 88, Christie Street, St Leonards. Further assessment of these issues would be required at later stages of project development. Winten Property Group will provide an undertaking to study the noise and vibration impacts and the electrolysis impacts as per Interim Guidelines in the project application stage of the development application process.

The proposed CBDRL alignment provided by RailCorp is limited in its accuracy and will be subject to further review during the works submission stage.

6. References

1. Development Near Rail Corridors and Busy Roads – Interim Guidelines 2008

2. Glastonbury& Fell (2002) *Report on the analysis of the deformation behaviour of excavated rockslopes. UNICIV Report 403,UNSW*

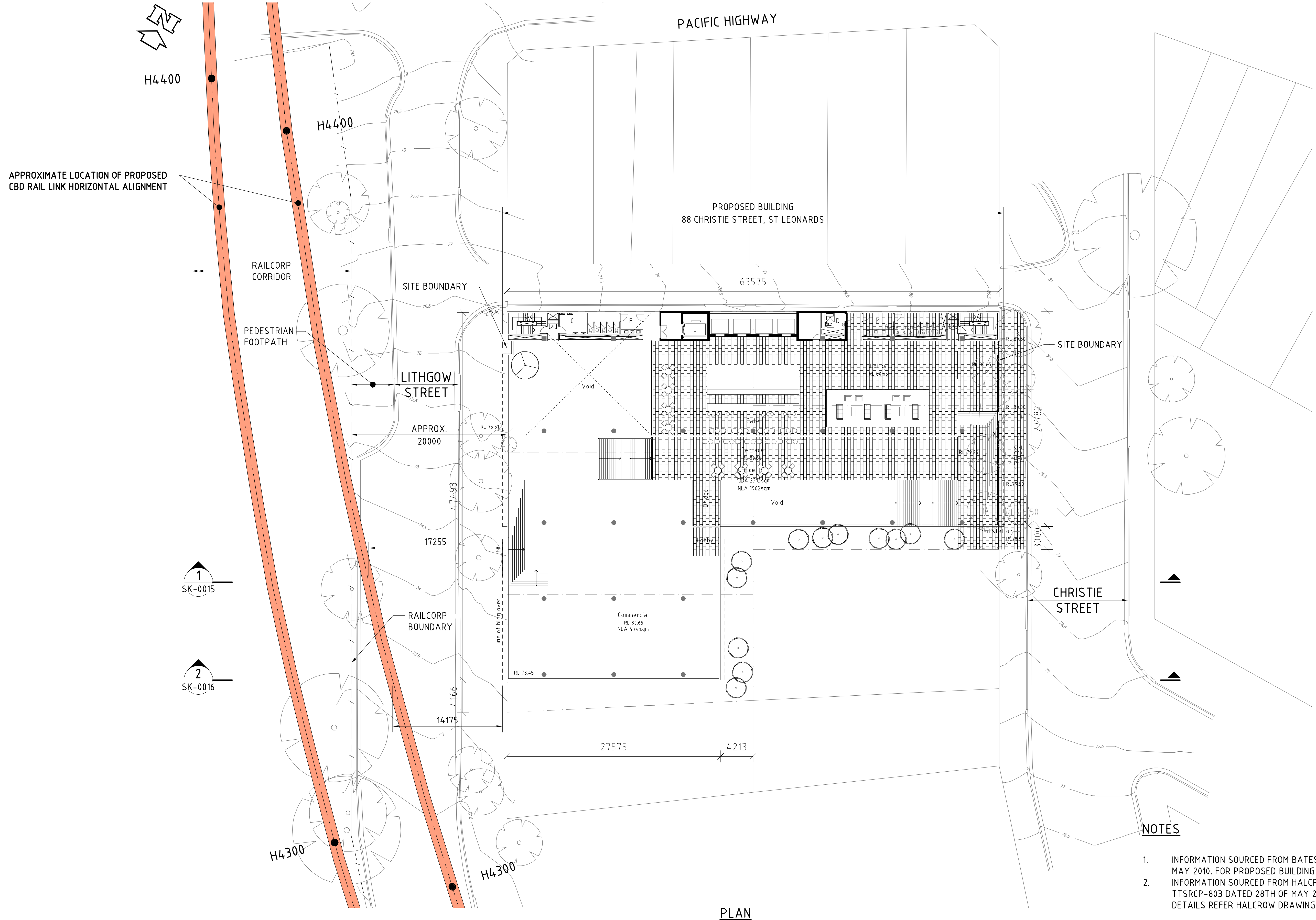
3. [2]Hewitt PB, Burkitt S & Baskaran B (2007), *Design and construction of retaining structures for Lane Cove Tunnel*, 10th ANZ conference on geomechanics, Brisbane. 626-631; and Australian Geomechanics. v43. n1. 55-60 (2008)

4. Hyder – Desktop Study Report- Geotechnical and Groundwater

5. [1]PJN Pells, G Mostyn, and BF Walker, 1998. *Foundation on sandstone and shale in Sydney region,* Australian Geomechanics, December 1998.

Appendix A

Parsons Brinckerhoff Drawings



PLAN
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NOTES

1. INFORMATION SOURCED FROM BATESSMART DRAWING S11025 DATED 6TH OF MAY 2010. FOR PROPOSED BUILDING DETAILS REFER BATESSMART DRAWINGS.
2. INFORMATION SOURCED FROM HALCROW DRAWINGS TTSRCP-801 TO TTSRCP-803 DATED 28TH OF MAY 2010 . FOR CBDRL ASSUMED TUNNEL DETAILS REFER HALCROW DRAWINGS TTSRCP-801 TO TTSRCP-803.

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PROJECT
88, CHRISTIE STREET ST LEONARDS

IMPACT ASSESSMENT TO RAILCORP INFRASTRUCTURE
GENERAL ARRANGEMENT

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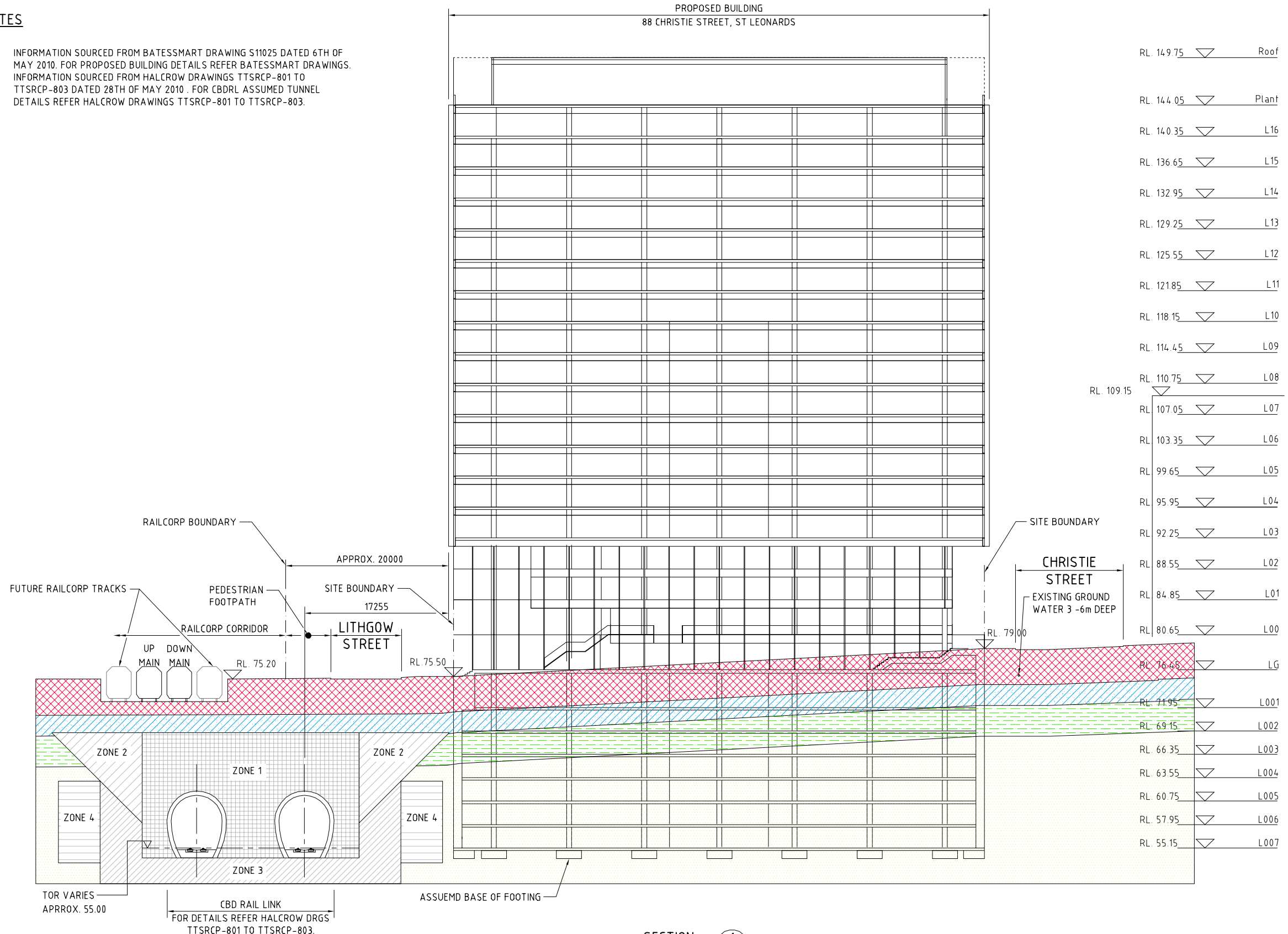
2. INFORMATION SOURCED FROM HALCROW DRAWINGS TTSRCP-801 TO TTSRCP-803 DATED 28TH OF MAY 2010 . FOR CBDRL ASSUMED TUNNEL DETAILS REFER HALCROW DRAWINGS TTSRCP-801 TO TTSRCP-803.



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-7.2m
HAWKESBURY SANDSTONE WITH SHALE LENSES MEDIUM-HIGH STRENGTH (CLASS III) (POSSIBLE FRACTURES)

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PROJECT
88, CHRISTIE STREET ST LEONARDS

IMPACT ASSESSMENT TO RAILCORP INFRASTRUCTURE
TYPICAL SECTION

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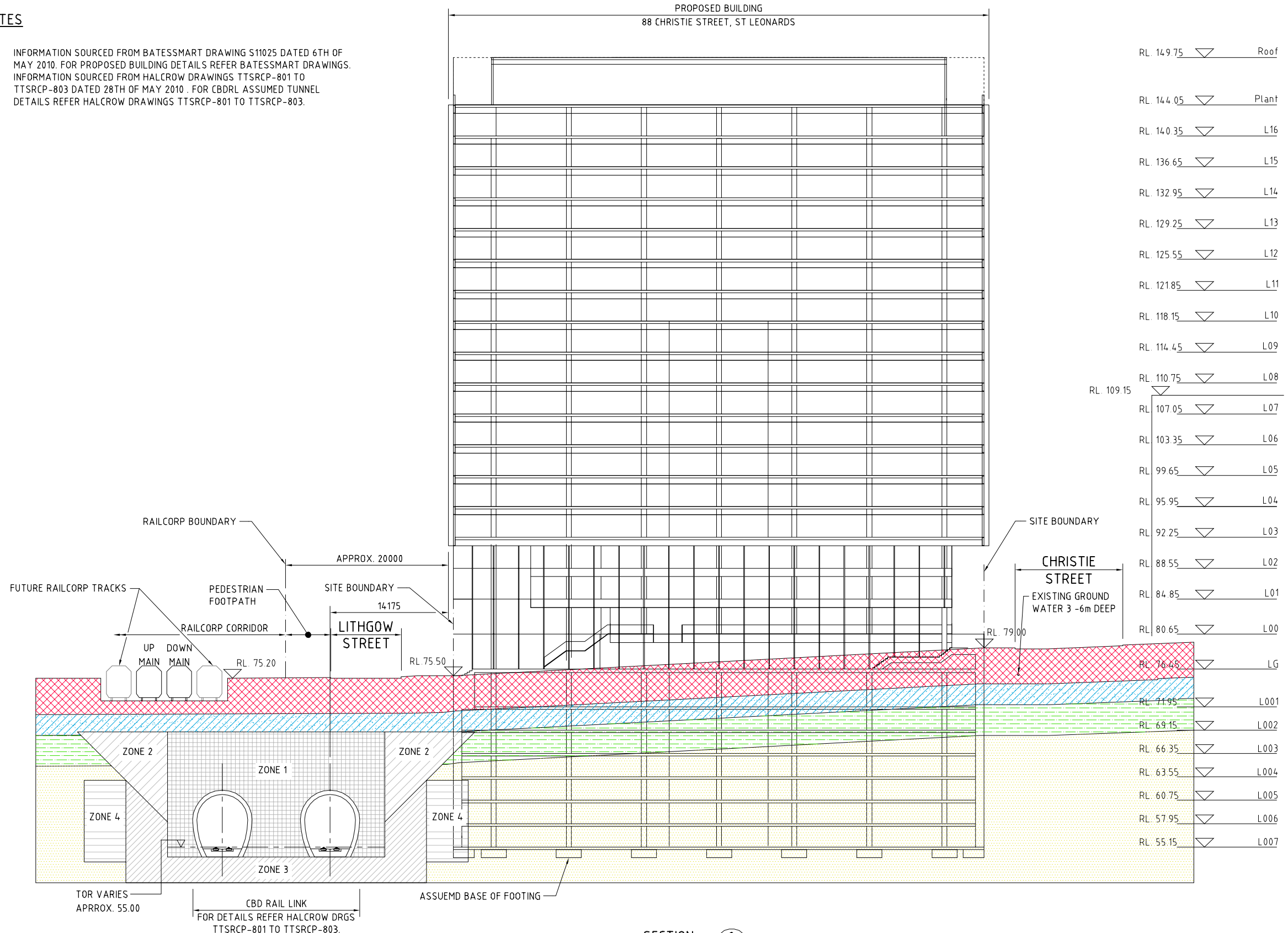
2. INFORMATION SOURCED FROM HALCROW DRAWINGS TTSRCP-801 TO TTSRCP-803 DATED 28TH OF MAY 2010 . FOR CBDRL ASSUMED TUNNEL DETAILS REFER HALCROW DRAWINGS TTSRCP-801 TO TTSRCP-803.



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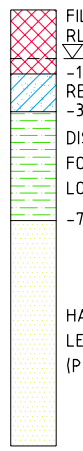

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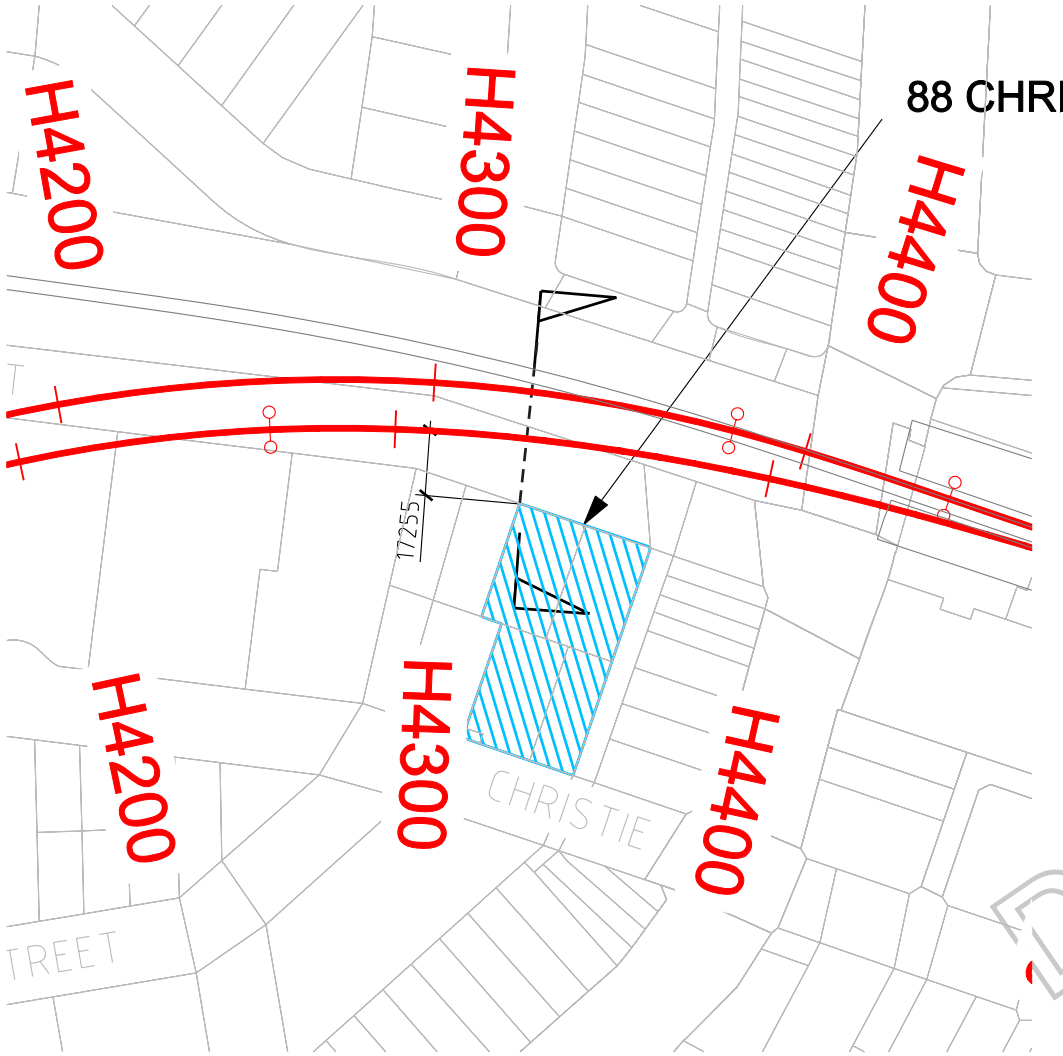
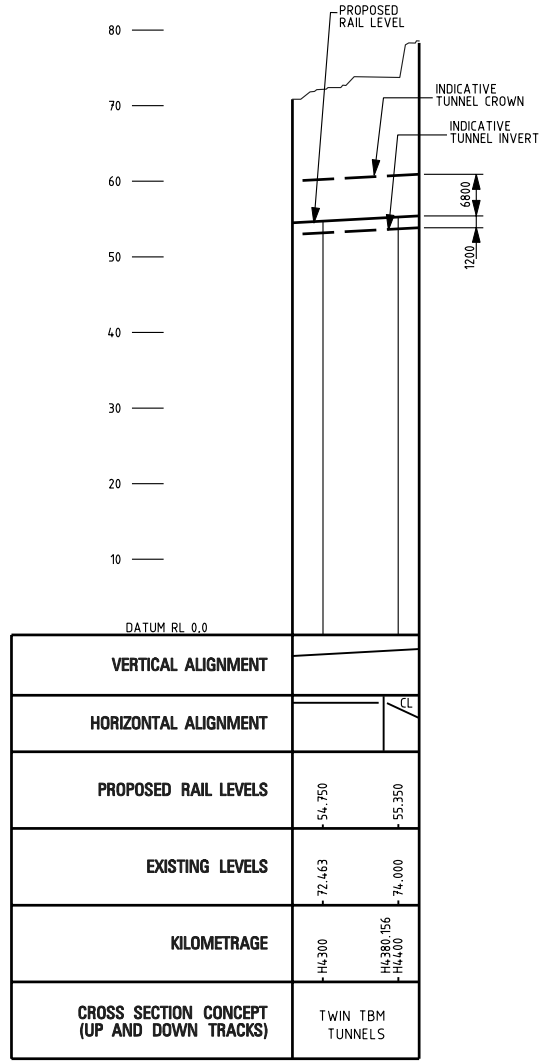
Appendix B

RailCorp Drawings





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HORIZONTAL ALIGNMENT	CL
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CROSS SECTION CONCEPT (UP AND DOWN TRACKS)	TWIN TBM TUNNELS

LEGEND

	INDICATIVE CBDRL RAILWAY TRACK CENTRELINE
KM= 0+000	RAILWAY KILOMETRAGE
	88 CHRISTIE ST, ST LEONARDS DEVELOPMENT SITE

GENERAL NOTES:

FOR GENERAL NOTES REFER TO DRAWING TTSRCP-803.

NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUCTION WITH DRAWINGS TTSRCP-802 AND TTSRCP-803.

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Issue	Revision - Revise on CAD do not amend by hand	Chk'd	App'd	Date
1	DRAFT FOR RAILCORP COMMENTS	RH		26.05.10

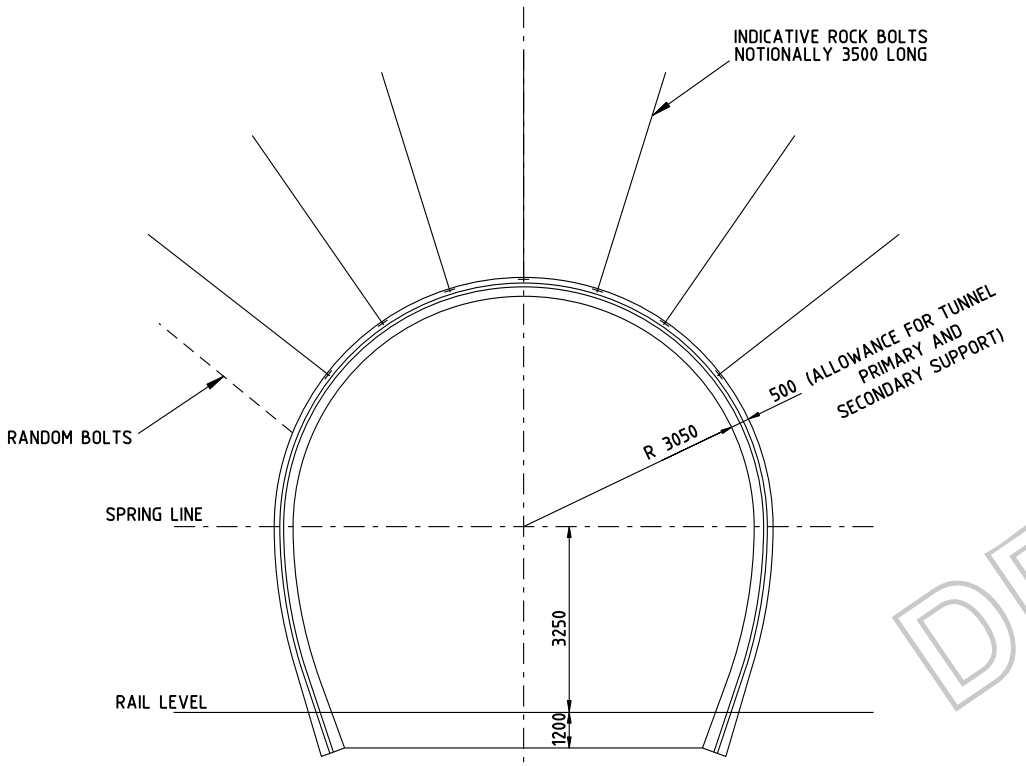
Halcrow
CONSULTING IN RAILWAY PLANNING, OPERATIONS, MAINTENANCE, DESIGN AND ENGINEERING
A Halcrow Business, Halcrow Pacific Pty Limited - Registered Office Level 1, 542 Station Street, Box Hill, Melbourne, VIC 3128 ABN 45 061 920 849
Level 22, 68 Pitt Street, Sydney, NSW 2000
Tel: +61 2 9250 9900 Fax: +61 2 9241 2228
Email: sydney@halcrow.com.au

Project: RAILCORP CORRIDOR PROTECTION

Title: 88 CHRISTIE STREET, ST LEONARDS
CBD RAIL LINK (CBDRL)
ASSUMED TRACK & TUNNEL ALIGNMENT

Drg No: TTSRCP-801

Version: 1



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GENERAL NOTES:
G1. FOR GENERAL NOTES REFER TO DRAWING TTSRCP-803

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Halcrow
CONSULTING IN RAILWAY PLANNING, OPERATIONS, MAINTENANCE, DESIGN AND ENGINEERING
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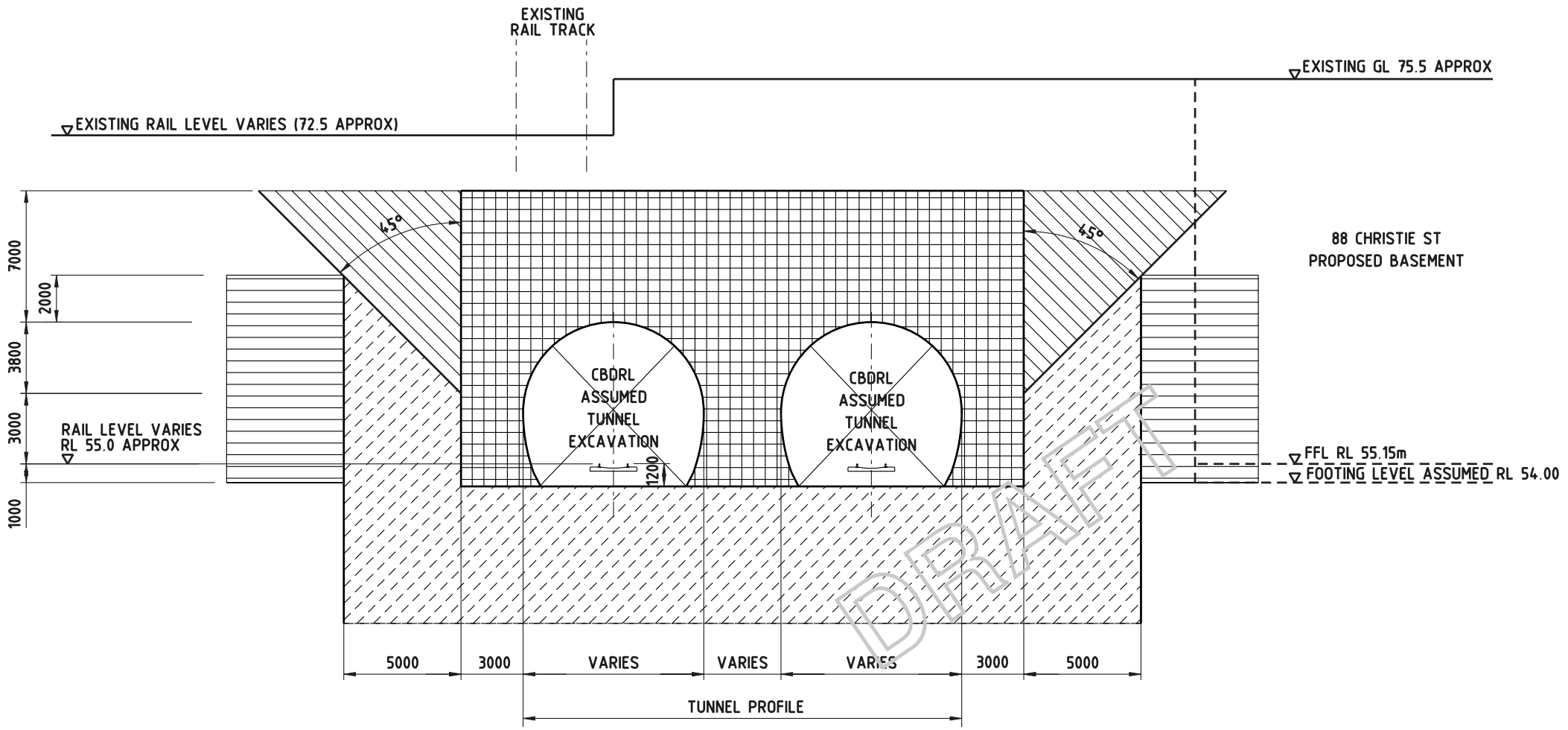
Project: RAILCORP CORRIDOR PROTECTION

Title: 88 CHRISTIE STREET, ST LEONARDS
CBD RAIL LINK (CBDRL)
CROSS SECTIONS

Drg No: TTSRCP-802

Version: 1



GENERAL NOTES:

G1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED
G2. ALL LEVELS ARE IN METRES TO A.H.D UNLESS OTHERWISE NOTED
G3. DRAWINGS 801, 802 AND 803 TO BE READ TOGETHER.
G4. ALL RAILWAY KILOMETRAGES ARE IN METRES.
G5. RAILWAY ALIGNMENT AND TUNNEL DETAILS SUBJECT TO CHANGE AT SUBSEQUENT CBDRL DESIGN STAGES.

NOTES:

1. SUPPORT OF LOADS FROM PROPERTY FOUNDATIONS TO ALLOW FOR ASSUMED TUNNEL EXCAVATION. LOADS OF A DYNAMIC NATURE (SUCH AS FROM WIND) ARE NOT TO HAVE A NEGATIVE IMPACT ON THE TUNNEL SUPPORT INCLUDING SANDSTONE BEDDING PLANES AND ROCK BOLT DESIGN.
2. SITE INVESTIGATION OF GROUND CONDITIONS SHALL BE UNDERTAKEN AND RECORDED.
3. INDICATIVE LOADING AND TUNNEL PROFILE ASSUME ZONE 1 IS CLASS 3 HAWKESBURY SANDSTONE WITH POSSIBLE INTERBEDDED SHALE LAYERS
4. EXCAVATION FACE TO BE INSPECTED AND MAPPED PRIOR TO COVERING BY PROPERTY DEVELOPER.
5. REQUIREMENTS ARE BASED ON PART 3A APPLICATION MP09_0210.
6. LOADING REQUIREMENTS ARE BASED UPON ASSUMPTION THAT EXCAVATION IS WITHIN FAVOURABLE ROCK CONDITIONS.
7. CONSTRUCTION METHOD SHALL AVOID DETERIORATION OF ROCK STRUCTURE IN ZONE 1.
8. ALLOWANCE SHALL BE MADE IN THE DESIGN OF STRUCTURES FOR POSSIBLE ROCK FALLS DURING CONSTRUCTION OF THE CBDRL TUNNEL. THE PROPERTY DEVELOPER SHALL MAKE HIS OWN DETERMINATION IN THIS REGARD BUT SHALL ALLOW FOR POSSIBLE ROCK FALLS OF BLOCK AT LEAST 1m DEEP IN THE TUNNEL CROWN OR 1m WIDE IN THE TUNNEL SIDE WALL.

KEY:

STRUCTURE EXCLUSION ZONES:

ASSUMED CBDRL TUNNEL EXCAVATION ZONE

TYPE 1 ZONE — EXCAVATION, STRUCTURES, OR STRUCTURES APPLYING LOADING DIRECTLY TO ROCK MASS ARE NOT PERMITTED IN THIS ZONE, EXCEPT FOR TRANSFER STRUCTURES AND GROUND ANCHORS APPLYING LOADS GENERALLY AWAY FROM THE TUNNEL AND LOCATED MORE THAN 5m ABOVE THE ASSUMED TUNNEL CROWN LEVEL.
HORIZONTAL LOADING EFFECTS EITHER FROM STRUCTURES AND FOUNDATIONS BEARING DIRECTLY ON ZONE 1 OR FOUNDATIONS OUTSIDE ZONE 1 AND ACTING THROUGH THE GROUND SHALL NOT CAUSE SIGNIFICANT HORIZONTAL LOADING TO ACT ON ZONE 1 BELOW OR WITHIN 2m OF THE TUNNEL CROWN LEVEL.

TYPE 2 ZONE — FOUNDATIONS APPLYING VERTICAL LOADING DIRECTLY TO ROCK MASS ARE NOT PERMITTED IN THIS ZONE EXCEPT FOR TRANSFER STRUCTURES AND GROUND ANCHORS APPLYING LOADS GENERALLY AWAY FROM THE TUNNEL.
EXCAVATION AND CONSTRUCTION OF STRUCTURES PERMITTED BUT MUST AVOID DETERIORATION OF ROCK STRUCTURE IN ADJACENT ROCK MASS.

TYPE 3 ZONE — VERTICAL DOWNWARDS LOADS FROM STRUCTURES PERMITTED. LOADING TO BE VERIFIED AND SHALL ALLOW FOR ASSUMED TUNNEL EXCAVATION.
VERTICAL UPWARDS LOADS (AND COMPONENTS THEREOF) TO BE DESIGNED TO ALLOW FOR REMOVAL OF ROCK MASS IN ASSUMED TUNNEL ZONE.
HORIZONTAL LOADS PERMITTED BELOW LEVEL OF TUNNEL INVERT.

SIGNIFICANT HORIZONTAL LOADING TOWARDS THE PROPOSED CBDRL TUNNEL IS NOT PERMITTED. (REFER TO ZONE 1 NOTES)

NOT FOR CONSTRUCTION

Issue	Revision - Revise on CAD do not amend by hand	Chk'd	App'd	Date
1	DRAFT FOR RAILCORP COMMENTS	RH		26.05.10

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Project: RAILCORP CORRIDOR PROTECTION

Title: 88 CHRISTIE STREET, ST LEONARDS
CBD RAIL LINK (CBDRL)
LOADING REQUIREMENTS

Drg No: TTSRCP-803

Version: 1

88 Christie Street, St Leonards
Report of preliminary noise and vibration assessment of proposed commercial development near RailCorp infrastructure

June 2010

WINTEN PROPERTY GROUP

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General Description	Noise and Vibration assessment of development constraints and potential impacts of proposed multi-storey commercial development at 88, Christie Street on RailCorp Infrastructure.			
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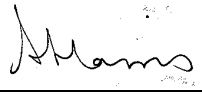
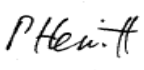
Approval	**Name**	**Position**	**Signed / Approved**	**Date**
Author	Shane Harris	Principal Environmental Engineer		08/06/10
Reviewer	Reuben Lamack	Principal Engineer		08/06/10
Project Manager	Paul Hewitt	Technical Executive Geotechnical		08/06/10

Revision	Details	Date	Amended By
A	Issue	08/6/10	P.Hewitt

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Executive summary

This report presents an initial assessment of potential noise and vibration impact to RailCorp infrastructure with the construction of the proposed commercial development at 88 Christie Street St Leonards. The proposed development is sited within 20m of the RailCorp rail corridor.

Winten Property Group has submitted preliminary environmental plans and subsequently the Department of Planning has declared the project as a Major Project to which Part 3A of the Act applies and has authorised the submission of a concept plan.

Part of the concept plan submission as outlined in the Director General's letter dated 31st March 2010, includes a requirement to provide an impact assessment on noise and vibration of the proposed development to the nearby existing RailCorp infrastructure.

The proposed development's eastern boundary is sited approximately 20m from the RailCorp rail corridor. With respect to SEPP(Infrastructure 2007) Clause 88, the proposed development falls within the horizontal distance of 25m from RailCorp corridor hence triggering the need to provide impact assessments as outlined in the NSW Department of Planning 'Development Near Rail Corridors and Busy Roads- Interim Guideline 2008'.

This concept submission is limited to highlighting the possible impacts to the existing RailCorp corridor and any limitation to the practicability of the construction of the proposed RailCorp projects.

Detail adherence to the stated guidelines will form part of the Project Plan submission.

The findings in this report indicate that the construction noise and vibration associated with the proposed development will have negligible impact to the existing and proposed RailCorp infrastructure.

This report provides conclusions which will assist in providing confidence to stakeholders that the development can proceed without impacting RailCorp's existing and future infrastructure and provides a basis for obtaining RailCorp's non-objection to the proposed development.

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1. Background

A commercial project, comprising approximately 36,000 square metres, is being proposed t at 88 Christie Street, St Leonards.The proposed development is located south of St Leonards station. The site traverses Christie Street on the east boundary and Lithgow Street on the west boundary. The north of the site is a row of commercial buildings. Further north is the Pacific Highway.

©GoogleEarth / SKM 2010 – Acquired 20th January, 2007

Figure 1-1 Site of 88, Christie Street proposed commercial development

The proposed development is sited within 20m of the existing RailCorp rail corridor at St Leonards and within 14m of the proposed CBD rail link tunnels. The proposed track quadruplication is within the existing RailCorp corridor.

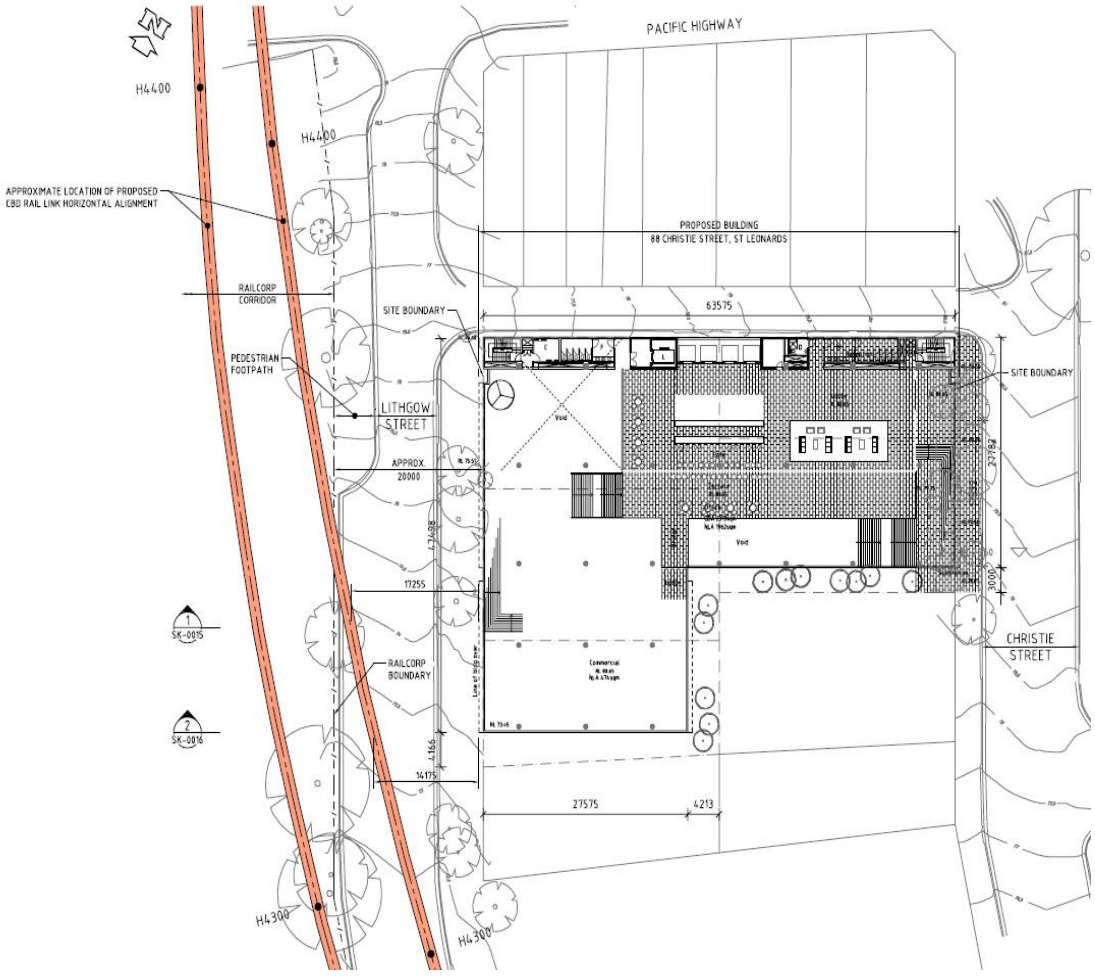

Figure 1-2 Site of 88, Christie Street proposed commercial development with proposed CBDRL alignment.

The focus of this assessment is the impact to the structural degradation of RailCorp's existing infrastructure due to the proximity of the rail infrastructure to the development and potential impacts for the future RailCorp projects.

The excavation of the basement will be the key noise and vibration generating activity. We anticipate that soldier piles with shotcrete/concrete panels will be used for the weaker section of the excavation of residual soils and distinctly weathered shale. Sandstone and weak fractured zones (including the shale lenses), support will be provided by rock bolts and/or steel fibre reinforced shotcrete.

Boring rigs, excavators, D9 dozer (ripper), rock breakers and rock saws will be utilised for the works. Day time construction works will be undertaken and blasting is not expected to be required. Final excavation sequencing and plant numbers have not been detailed out for the concept plan submissions and will be detailed out in the project plans stage.

2. Construction noise issues

2.1 Goals

DECCW provides guidance for the assessment of construction noise and vibration in the Interim Construction Noise Guidelines (DECCW, ICNG, 2009). The interim ICNG adopts construction noise goals (LAeq) based upon the measured background noise level (LA90).

Noise monitoring was undertaken on Wednesday 12 May 2010 at number 86 and number 88 Christie Street, St Leonards. Fifteen minute measurements were carried out with a RION NA27 precision sound level meter. The instrument was in manufacturers' calibration, with pre and post checks indicating no shift in reference tone.

A day time baseline LA90 noise level of 52 dB(A) was measured at 88 Christie Street and 53 dB(A) was measured at 86 Christie Street.

With consideration to the requirements for the ICNG, the following construction noise design goals have been adopted:

- Day time core hours:RBL + 10 dB(A) = 52 dB(A) + 10 dB(A) = 62 dB(A) (L_{Aeq})
  (Monday to Friday 7am-6pm, Saturday 8am-1pm, No work on Sundays or public holidays)
- Offices, retail outlets:= 70 dB(A) (L_{Aeq})

The construction noise design objectives will need to be confirmed prior to commencement of works.

Adopting a best practice philosophy to minimise potential disturbance and preserve the acoustic amenity of the local environment the ICNG has been adopted for the assessment of construction noise and vibration impact potential.

The recommended criteria are planning goals only. Factors such as the social benefits of the activity, economic constraints, and the nature and duration of the proposed construction program need to be considered when assessing potential noise and vibration impacts from construction works.

2.2 Impact potential

The construction plant items and associated maximum LAeq sound power levels (SWLs) used in the prediction of potential construction noise impacts are summarised as follows:

- Road transport truck (20 tonne): 102 dB(A)
- Excavator: 100 dB(A)
- D9 dozer (ripper): 112 dB(A)
- Concrete/tip truck: 108 dB(A)
- Concrete vibrator: 103 dB(A)
- Mobile crane: 100 dB(A)
- Hand tools: 98 dB(A)
- Generator: 99 dB(A).

By assuming unidirectional hemispherical propagation during neutral atmospheric conditions, taking into account attenuation due to distance alone, Table 3–1 presents worst-case noise levels predicted at the nearest residences during each adopted construction phase of a typical construction project.

Table 2-1 Construction noise levels (basement)

Location	Predicted noise level (worse-case) (dB(A))					adopted goal (dB(A))	
	10m	20m	40m	80m	160m	resident	office
Road transport truck (20 tonne)	74	68	62	56	50	**62**	**70**
Excavator	72	66	60	54	48	**62**	**70**
D9 dozer (ripper)	84	78	72	66	60	**62**	**70**
Concrete/tip truck	80	74	68	62	56	**62**	**70**
Concrete vibrator	75	69	63	57	51	**62**	**70**
Mobile crane	72	66	60	54	48	**62**	**70**
Hand tools	70	64	58	52	56	**62**	**70**
Generator	71	65	59	53	47	**62**	**70**

The results indicate that for residences or other noise sensitive receivers located at distances of 160 metres and closer, received noise levels would likely exceed the adopted daytime construction noise design goal of 62 dB(A).

For office and retail receivers, it is expected that the basement construction noise impacts would be above the adopted noise design goal of 70 dB(A) at distances of 80 metres and closer.

To mitigate the impacts and to reduce the excavation noise to within the limits prudent management measures will be adopted. The management of the noise limits will be detailed in the project plan stage.

It is however noted that construction noise is transient and if limited to the levels as shown in Table 2.1, it is highly unlikely that at these limits there will be structural degradation of RailCorp's existing infrastructure and future projects.

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3. Construction road transport noise

Construction road traffic movements have not been determined at this stage and will be detailed out in the project plan stage. During construction, access will be provided to/from Christie Street and/or Lithgow Street. The principle haulage route from the subject site would be via the Pacific Highway.

3.1 Goals

The NSW EPA document Environmental Criteria for Road Traffic Noise (ECRTN, 1999) provides guidance for the assessment of road traffic noise impacts. While the criteria recommended for use as long term planning goals, the recommended criteria are useful for assessing potential impacts from a short term construction activity.

Land use developments with potential to create additional traffic on a collector road (with the Pacific Highway being identified as the principal haulage route), the following base criteria applied:

- Day time core hours: = 60 dB(A) (LAeq(1hr))
  (Monday to Friday 7am-6pm, Saturday 8am-1pm, No work on Sundays or public holidays)

In all cases, traffic arising from the development should not lead to an increase in existing levels of more than 2 dB (allowance criteria).

3.2 Impact potential

Existing traffic along the Pacific Highway is up to 4,000 vehicles during the morning peak hour period.

At a distance of 20 metres between a given façade and the middle of the near side road carriageway, assuming a sound exposure pass-by level of 110 dB(A), and adopting an assumed maximum 60 truck movements per hour during the construction works, hourly LAeq levels from truck movements would be well below the Environmental Criteria for Road Traffic Noise recommended goal of 60 dB(A).

There are no particularly sensitive receptors located along the proposed route, and although road truck noise may be audible, the potential for adverse impacts is not considered likely.

Similar to construction noise impact, the traffic noise is transient and if limited to the levels discussed in 3.1, it is highly unlikely that at these limits there will be structural degradation of RailCorp's existing and future infrastructure.

4. Construction vibration issues

4.1 Goals

Vibration during construction activities is associated with two main types of impact; disturbance at receivers from intermittent vibration and potential architectural/structural damage to buildings.

Human comfort and structural damage limits vary across the frequency spectrum, although they are generally a constant level across the frequency range generated by most construction activities.

Potential annoyance from vibration can be a subjective response dependent upon received vibration level, dominant frequency of vibration and duration of intermittent vibration events.

The NSW Department of Environment and Conservation (now DECC) *Environmental Noise Management Assessing Vibration*: a technical guideline (2006) provides recommendations for vibration goals.

Peak particle velocity levels for impulsive events (vibration that builds up rapidly to a peak followed by a damped decay) should remain below the following levels:

- Residence: 6 mm/s (preferred)
- Offices, retail outlets: 13 mm/s (preferred)

Given that if disturbance issues are controlled, there is limited potential for structural damage to buildings.

4.2 Impact potential

Vibration impacts are primarily subject to ground conditions (type of ground material, strata within the ground, faults within the rock) and distance of separation. Geometric loss (due to spreading in the ground) and damping losses occur. With respect to potential annoyance to residents, a combination of vibration level, frequency and duration (termed the dose level) is generally considered.

During the basement construction works, vibration would be generated by the operation of plant and machinery. The operation of earth moving machinery can result in vibration levels consistent with values presented in Table 4–1:

Table 4-1 Typical vibration levels from construction plant

Plant	PPV vibration level (mm/s) at distance from plant		
	10m	20m	30m
Excavator	1	0.4	0.2
Rock sawing	0.5	0.3	0.2
Excavator with hammer	3	1.5	1
Jack hammering	7-11	not measured	not measured

Note: all vibration levels as PPV to nearest 0.5 mm/s

Vibration impacts are expected to be minor at a distance of 20 metres and immeasurable beyond 50 metres.

At distances of 10 metres and beyond, ground vibration levels from the construction equipment are expected to be below the 6 mm/s, which for the purposes of the preliminary assessment, is the adopted 'safe limit' for structural damage. Ground vibration may be perceptible in close proximity to the construction works for relatively short periods of time when construction activities are immediate adjacent to sensitive structures.

Regenerated noise issues will need to be assessed at the Project Plan stage.

It is concluded that if vibration limits are limited to 6mm/s, it is highly unlikely that vibration from the basement excavation would cause structural degradation of RailCorp existing. There will be no impact to the future RailCorp projects as it is assumed that this development will be completed prior to any planned RailCorp projects.

5. Recommendations

In order to mitigate potential construction noise and vibration impacts the Project shall develop and implement a Construction Noise and Vibration Management Plan (CNVMP). The CNVMP will provide a framework for addressing noise and vibration levels associated with construction works. The CNVMP would identify and address noise impact profiles for all potentially affected receivers and provide procedures, noise mitigation measures and noise management practices proposed throughout the duration of the works program. The CNVMP will be part of the of the future project plan application.

The CNVMP will detail out the monitoring procedures and the construction phase, compliance monitoring to confirm impacts and implement additional procedures to mitigate these impacts, and to allow an opportunity for liaison with the relevant stakeholders..

Typical measures that would be implemented during construction (to be confirmed following completion of the detailed assessment, and incorporated within the site-specific CNVMP prepared):

5.1 Construction noise

- Undertake construction activities in accordance with Australian Standard AS 2436 1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites. All equipment used on-site would need to demonstrate compliance with the noise levels recommended within AS 2436 1981.
- Schedule construction activities between Monday to Friday, 7am to 6pm, and Saturdays, 8am to 1pm. No intensive works to be undertaken on Sunday or public holidays. Works outside these would be permissible only where a task specific assessment indicates that the relevant components are either not audible or below the specific noise design goal.
- Provide information to potentially affected local residents at least two weeks prior to the commencement of noisy activities. Construction methods, duration and timing of events would be outlined in the information provided.
- Provide a contact number to the public so that information can be received or complaints made in relation to noise. A log of complaints would be maintained and the contractor would take action. A complaint handling procedure would be formulated and adhered to.
- Use of residential class mufflers, and where applicable, engine shrouds (acoustic lining). Noise emissions would be an important consideration when selecting equipment for the site. All equipment would be maintained in good order including mufflers, enclosures and bearings to ensure unnecessary noise emissions are eliminated.
- Use plant and equipment appropriately. This includes reasonable work practices with no extended periods of ‘revving’, idling or ‘warming up’ in proximity of existing residential receivers. Any excessively loud activities would be scheduled during periods of the day when higher ambient noise levels are apparent.

5.2 Construction road transport noise

- Road transport truck movements to be scheduled to occur during the core hours of Monday to Friday, 7am to 6pm, and Saturdays, 8am to 1pm.
- No more than 60 road transport truck movements per hour.
- No queuing of road transport trucks external to the site.
- Truck routes will be restricted to those identified within the Traffic Management Sub-Plan. The dedicated principle haul route (following main roads will be used) as will a dedicated ingress / egress points.
- Use of air brakes within built up areas should be avoided.

5.3 Construction vibration

- No construction activities to be undertaken within 10 metres of a sensitive structure (without more detailed assessment being undertaken).
- A single construction activity only (one source) to be carried out within 20 metres of a sensitive structure (without more detailed assessment being undertaken).
- Pre construction condition surveys are recommended to be undertaken for any sensitive structure within 50 metres from the vibration generating works.
- Monitoring of vibration trials will be undertaken to determine upper limit component peak particle velocity for relevant building types.
- Vibration monitors during construction works will include visual triggers for peak particle velocity component exceedance for building types.
- Further monitoring will be undertaken as the result of an investigation into vibration complaints or as required by the regulating authorities.

6. Conclusion

There is potential for vibration and noise from the construction works to impact nearest receivers such the commercial buildings on either side of the development. The severity of impact will be dependent on the final construction methodology, process and staging. Impacts are expected to be short-term only and would be adequately mitigated by the implementation of reasonable and feasible mitigation and safeguard measures. This measure will be detailed in the CNVMP at the project planning stage.

Control measures will be adopted to limit the impacts to the immediate surrounding commercial developments. These measures will ensure that the limits will be at an acceptable level and should not reach a level that could cause degradation of RailCorp's infrastructure.

Addition to the assessment of impact potential from the construction works, the design of the proposed development will also need to consider following in the project plan stage:

- Operational noise impacts (from fixed plant and equipment and vehicular access).
- The development is acoustically designed to ensure internal noise levels (within habitable rooms) meet the requirements of AS/NZS 2107:2000 *Acoustics - Recommended design sound levels and reverberation times for building interiors.*
- NSW Government Department of Planning -Development near rail corridors and busy roads- Interim guidelines.

Based on the results of this preliminary impact assessment, and with consideration of the recommendations proposed, it is concluded that the proposed development is unlikely to result in adverse impacts on existing RailCorp infrastructure and nearest sensitive receptors. However as part of the project plan for the development, detailed studies will be carried out to confirm the preliminary conclusions.

It is also concluded that it is highly unlikely that will be an impact to the future RailCorp projects as it is assumed that this development will be completed prior to any planned RailCorp projects.