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Dear Greg

UTS Central - Development Application
Structural Statement

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AECOM Australia Pty Ltd have been appointed by the University of Technology, Sydney (UTS) to carry out Structural Engineering design for the proposed UTS Central project.

This Structural Statement outlines the proposed structural works associated with the proposed UTS Central project and has been prepared for UTS to assist in the project Development Application (DA).

1.0 Introduction

This report supports a State Significant Development Application (SSDA) submitted to the Department of Planning and Environment pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

The SSD Application relates to the Concept Plan Approval for the University of Technology Sydney (UTS) City Campus Broadway Precinct, which was approved in December 2009 (MP08_0116).

The proposed works relate specifically to the UTS Central Project, more specifically the extension of Building 1 (podium) and redevelopment of Building 2 at the City Campus, Broadway Precinct.

As the development has a capital investment value of more than $30 million as an educational establishment, it is identified as State Significant Development under the State Environmental Planning Policy (State and Regional Development) 2011, with the Minister for Planning the consent authority for the project.

This report has been prepared having regard to the Secretary's Environmental Assessment Requirements issued for the project.

2.0 Background

UTS recognised the need to upgrade the City Campus back in 2000, and undertook a number of visioning and master planning projects culminating in the City Campus Masterplan 2020 (BVN, 2008) which provides a framework for refurbishments and new building works across the campus (comprising the Broadway Precinct and other sites in the Sydney CBD) in order to provide improved facilities and to accommodate future expected student and staff growth.

The long term strategic vision for UTS is 'to be one of the world's leading Universities of Technology'.

On 23 December 2009 a critical step in realising UTS's vision and identity for the Broadway Precinct was realised, with approval of the UTS City Campus Broadway Precinct Concept Plan (BPCP) – approved under the former Part 3A of the EP&A Act (MP 08_0116). The approved Concept Plan supports the significant redevelopment of the Broadway Precinct providing for new buildings, alternations and additions to existing buildings, along with associated landscaping and public domain works.

Since approval of the Concept Plan in 2009 UTS has secured the necessary detailed planning approvals and delivered a number of state of the art and iconic learning, research and social facilities across the Broadway Precinct, including:

- Faculty of Engineering and IT Building, designed by Denton Corker Marshall Architects.
- Multi-Purpose Sports Hall.
- Alumni Green, designed by ASPECT Studios Landscape Architects.
- Faculty of Science and Graduate School of Health Building, designed by Durbach Block Jaggers in association with BVN Architecture.
- Library Retrieval System.
- Great Hall and Balcony Room Upgrade, Designed by DRAW Architects in association with Kann Finch Architects.

As part of the staged delivery of the Concept Plan and as expected in its natural evolution, there have been a number of modifications to the Concept Plan. Of note, Modification No 5 to the Concept Plan provides for the complete redevelopment of Building 2, including additional floors above a new podium building.

OVERVIEW OF PROPOSED DEVELOPMENT

This SSD Application seeks approval for the following components of the development:

- Site preparation works, including demolition and clearance of existing Building 2 down to approximately ground level and associated tree removal;
- Retention and re-use of existing basement Level 1 and Level 2;
- Construction and use of a new podium building fronting Broadway (Building 1 extension and new Building 2);
- Construction and use of new floors above new Building 2 podium;
- Public domain improvements surrounding the site;
- Landscaping works to roof levels;
- Retention of existing vehicle access and parking arrangements; and
- Extension and augmentation of physical infrastructure / utilities as required.

The new floor space will accommodate a range of educational and ancillary educational uses, such as:

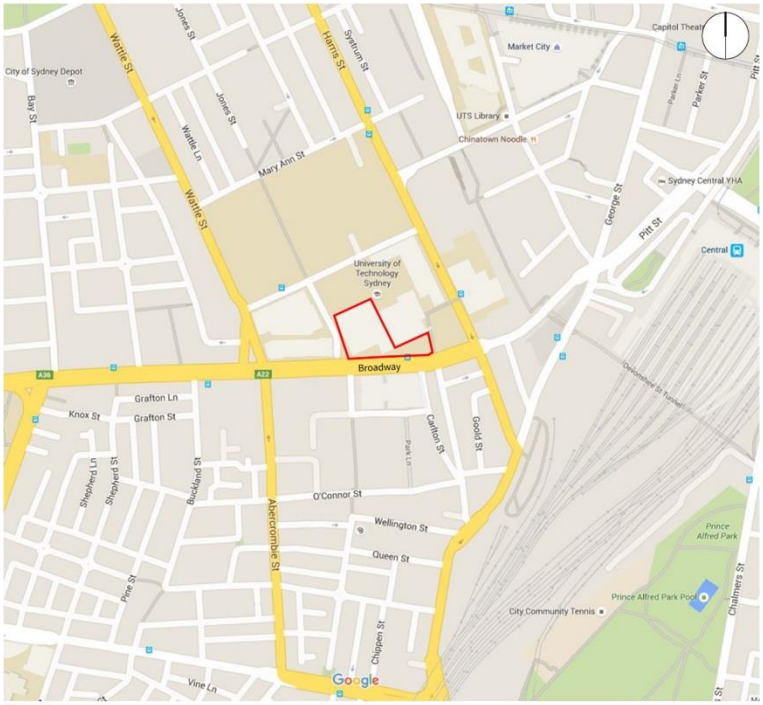
- Library
- Research
- Teaching Space
- Informal Learning Space
- Student Centre
- Student Union Spaces
- Food and Beverage Outlets
- Academic (including Faculty space)

A more detailed and comprehensive description of the proposal is contained in the Environmental Impact Statement (EIS) prepared by JBA.

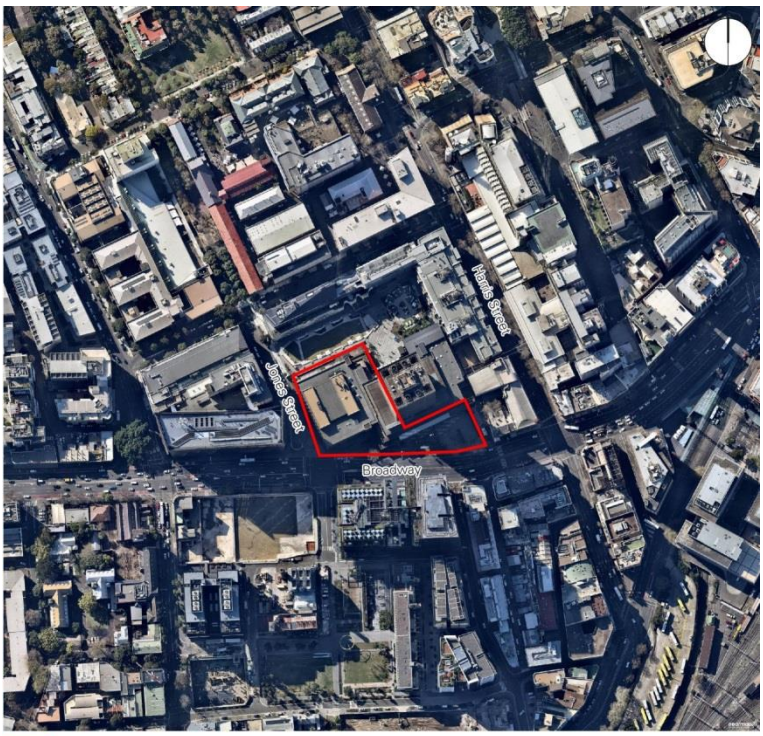
3.0 The site

The Broadway Precinct of the UTS City Campus is located on the southern edge of the Sydney Central Business District with frontages to Broadway, and Thomas, Wattle and Harris Streets (see Figure 1). Central station is located less than 500m to the east.

More specifically the UTS Central project site relates to Building 1 (excluding the Building 1 tower) and Building 2 of the Broadway Precinct, refer to **Figure 2**.



The Site



The Site

4.0 Structure

Structurally, the project broadly consists of the demolition of the existing CB02 building from Level 03 to Roof (plus some areas of Levels 01 to 03), to allow construction of new podium and tower levels above, which are proposed to extend to Level 17. The proposed new levels will be podium levels up to Level 08 and tower levels from Level 09 to Level 17. The form of the tower levels above Level 08 rotates and steps away from Broadway resulting in a reduced floor plate area as the tower rises.

An assessment of the existing structure and foundations is required to determine their capacity to carry additional loads and to determine the extent of strengthening that may be required to support the proposed new structure above.

4.1 Existing CB02 Building

The existing CB02 building was designed and constructed circa 1972 to 1978 and we are in receipt of copies of the original design drawings prepared by Messrs Bond, James, Laron & Reid and Messrs Wargon Chapman & Associates Pty Ltd.

The existing building has three basements, Levels L01, L02 and L03 (a partial basement due to the change in levels across the site) and five podium levels, Level 04 through Level 08, which forms the Roof Level.

The structural arrangement of the existing building typically comprises:

- Slabs on grade at Level 01, with suspended slabs in local areas over services typically
- Suspended Levels 02 to Level 07 are one-way reinforced concrete slabs and beams typically
- Roof Level includes precast pre-tensioned T-beams, spanning over the atrium space
- Vertical loads are supported on reinforced concrete columns and reinforced concrete lift and stair cores
- Footings are reinforced concrete pad footings typically, founded on rock
- Stability of the structure is provided by a combination of the existing reinforced concrete stair and lift cores; a number of reinforced concrete blade walls and by frame action. Lateral loads from wind and earthquake are transferred through shear and bending in the core, frame and blade walls
- Non-structural walls comprise a mixture of non-load bearing masonry and lightweight partitions

4.2 Structural Investigations

Initial Structural investigations have been carried out to assess the capacity of existing columns and footings.

Column concrete strength testing works included ultrasonic pulse velocity (UPV) and core sampling and testing on a number of columns within Levels 01 to 03 generally, with testing limited to levels where elements are proposed to be retained and support additional loading due to the building's expansion above. The concrete testing report provides representative concrete strengths for each concrete grade tested.

Geotechnical and footing investigations have been undertaken and included nine boreholes and nine test pits of representative footings. Test results provide dimensions and concrete strength of each footing tested and representative foundation design parameters.

Further investigations and testing will be carried out during later stages of the project, to confirm capacity of specific elements where required.

4.3 Demolition Works

Demolition works are to be developed by the Temporary Works Engineer. The complexity of the works will depend upon the Builder's proposed construction sequence and will need to include assessment of temporary works, temporary stability, sequence of works, safety, preparation of Safe Work Method Statements, etc.

Additional studies of the building access and evacuation (open doors, waste handling, stairs and emergency exits); and serviceability (vibrations issues) shall be considered by the Builder in areas where the buildings is due to maintain operational during demolition.

4.4 Design Parameters

In accordance with the Building Code of Australia (BCA), the Design Life of the building is proposed to be 50 years and a Building Importance Level of 3 is nominated, to allow for auditorium areas required to accommodate large numbers of people.

The proposed design loads have been assessed in accordance with AS1170 Structural Design Actions and include dead loads (total weight of all structural components) superimposed dead load of 1.5kPa (finishes and self-weight of permanent and movable partitions) and a general live load allowance of 5kPa to provide flexibility for UTS within the proposed new facilities. Lateral loads from wind and earthquake have been assessed based on AS1170.2 and AS1170.4 respectively.

4.5 Proposed Structural Arrangement

Building CB02 extension will comprise the reuse and strengthening (where required) of the existing structure on Levels 01, 02 and 03; and the construction of new structure for the additional levels from Level 04 to Level 17.

The proposed new structure typically consists of one way post-tensioned slabs, supported by post-tensioned band-beams, supported on reinforced concrete columns and walls. The building stability for lateral loads will be provided by the concrete core walls.

The form of the tower levels above Level 08 rotates and steps away from Broadway, resulting in a reduced floor plate area as the tower rises. The structural approach to the proposed architectural form is to have vertical columns where possible in internal/ central areas; and a combination of raking columns and cantilever beams (up to 5-6 m long) to accommodate the changing slab edge layout and to support the larger slab extents of the levels below L17. Where the cantilevers are larger than 6 m, new columns on the edge of the façade will be introduced. These columns will step for 2-3 levels until aligned with the typical column grid, then extend vertically below. The raking and stepping columns will induce lateral forces on the structure that will be transmitted through the floor as diaphragm forces and ultimately, resisted by the RC core. These lateral forces will induce lateral displacements of the building under gravity loads. However, given the form of the tower these forces are relatively balanced in opposing directions and preliminary analysis indicates that RC core walls will be adequate to resist these actions and control long-term movements. We note that the new core will extend through the existing levels to found on rock below the existing Level 01 structure.

Dependent upon the specific location and loading of new columns and their layout relative to the existing structure, there are a number of options for the support of the new columns above L03 including:

- Introduction of new columns and footings by penetrating new columns through existing levels to the foundation
- Align new columns with existing columns and support directly onto existing columns
- Build new transfer structure spanning between existing columns to support the new structure above

A detailed assessment of each existing column supporting new structure over will be carried out to determine if strengthening is required. Preliminary calculations indicate that a number of columns will require strengthening. Two options are currently under consideration for strengthening of existing columns: concrete jacketing, or additional steel columns to augment the existing capacity.

Results of the geotechnical investigations indicate that the allowable bearing capacity of the founding material (good quality rock generally) will be significantly higher than the allowable capacity assumed in the original design and preliminary analysis indicates that the existing footings are unlikely to require strengthening.

In areas where large column-free spaces, such as lecture theatres, auditoria are required, transfer structures are proposed. Depending on the level and location of theses spaces, a number of tower columns may need to be transferred. Preliminary analysis indicates that P/T transfer beams (in the order of 1600 or more deep), or storey-deep structural steel trusses may be required to transfer the tower columns over these column-free spaces.

4.6 Conclusions

Investigations of the existing structure have been carried out and preliminary calculations have been prepared to assess the capacity of the existing structure and we have identified a number of existing columns that are likely to require strengthening.

We have carried out preliminary structural modelling, analysis and design and provided structural scheme design information to the Architect for inclusion in their DA scheme, including sizing and layout of main structural elements such as columns, walls, slabs and beams.

The proposed structural arrangement is feasible and will comply with relevant sections of the BCA and relevant Australian Standards. The information and practices/ standards noted above have formed the basis of the structural design which has been incorporated into the final design by FJMT.

Kind regards,

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