WEGC Block 4

Structural Condition Survey

MINISTRY OF EDUCATION

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Contents

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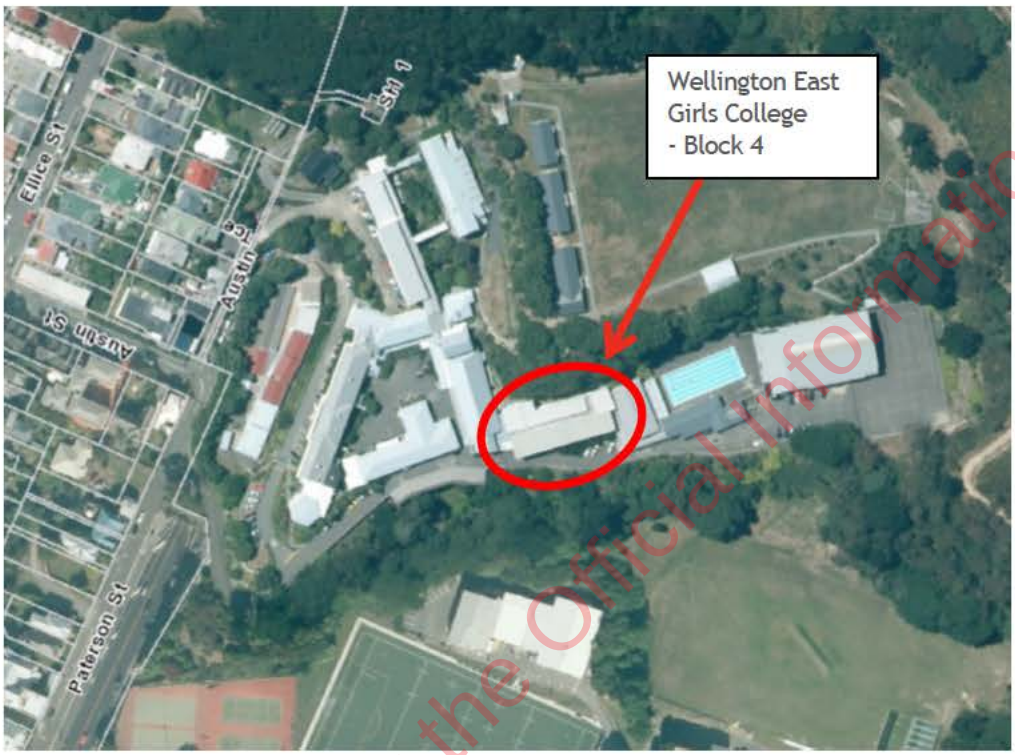
Section 1.0 Background and Scope

1.1 Scope

This report aims to outline the current condition of the structural elements of Block 4 of Wellington East Girls College, in Mt Victoria, Wellington.

This investigation and report was requested by the Ministry of Education in order to identify existing structural defects or condition issues and recommend structural repair or maintenance works. The aim is to integrate these works into the already identified weathertightness and seismic strengthening works that are to be completed in 2017. Integration of these works will ensure that all issues are dealt with while access is enabled and ensure minimal maintenance works are required in the future.



1.2 Background

Reports have been produced on this building detailing the building fabric condition, weathertightness defects and issues and the seismic capacity of the building. It was one of these reports that noted there were signs of deterioration to the structural members.

Wellington East Girls College was established in 1925. There are a number of different blocks and buildings built at varying times. Block 4 was originally built in 1964 and was extended in 1999. The 1999 extension included some strengthening work as well as internal alterations and timber framed extensions.

1.3 Documents reviewed

The documents reviewed were sourced from the Wellington City Council archives property file and also as provided by Opus who have completed a DSA on this building. A good level of structural and architectural documentation is available for both the original buildings and the later alterations. It is assumed for the purposes of this report that these drawings accurately represent this building as it stands today.

The Detailed Seismic Assessment completed by Opus in Jan 2016 was also reviewed as part of this report, but only for the purpose of identifying critical elements and areas where proposed repair works may be affected by seismic strengthening works. The Opus Geotechnical report for the site was also reviewed for information only.

Section 2.0 Structural System

2.1 Foundations and Slopes

The building is generally supported on shallow pad footings and ground beams except at the northern side if the building. The building platform is a bench cut into the original slope, at the northern side of the building there is a small area of fill, piles were installed at this location to provide founding on competent material rather than fill.

2.2 Building Frame

The building structural system is a mix of concrete and block walls and a concrete frame.

The ground floor slab is a suspended slab that spans between ground beams.

The first floor slab is made up of an in-situ concrete slab that spans between the concrete frames.

The roof is a lightweight steel cladding supported on timber purlins which span between concrete frames.

2.3 Cladding

The external cladding of the walls is generally glazing and lightweight panels. The original precast cladding panels remain at the ground floor at the rear of the building and as partial height spandrel panels at the front of the building.

The precast spandrel panels to the front of the building do not contribute to the seismic or gravity load resisting capacity of the building. The precast panels are attached to the concrete frames with steel dowels and there is a movement gap between the concrete frame and panel.

2.4 Seismic Capacity

Seismic and lateral capacity is provided by the concrete frames and concrete/block infill walls. Cross bracing at roof level distributes lateral forces to the frames. The concrete slab at first floor level acts as a diaphragm as does the ground floor concrete slab. The concrete frames act as portal frames in the transverse directions and in the perpendicular direction infill walls transfer lateral forces to the ground.

Pictures 1 and 2 - External view of the front and rear of Block 4

Section 3.0 Building Condition

3.1 Site Visit

A site visit to assess the condition of the building was conducted by Jennifer Critchley on 30-11-16

All rooms in the building were accessed but inspection was limited to visible elements only. No finishes were removed during this investigation and limited inspection at height was undertaken.

There were some indicators of hidden structural deterioration (rust staining etc.) and it is expected that some defects will be discovered during opening up for the weathertightness and seismic strengthening works. It is recommended works that some contingency be allowed within budgets both for physical works and engineering support to identify and investigate these defects and specify appropriate repairs/treatment as required. Assessment of Structural Condition

3.2 Foundations and Slopes

The slope to the rear of the building has been cut back to a safer angle at the rear of the building. There are signs of fretting from this slope but steel fences are assumed to catch any larger sections that come loose. Also, the area to the rear of the building is not generally accessible to students and is used for maintenance access only as a rule.

The slopes to the front of the building are steep but there are no signs of instability and the top of the slope is a reasonable distance away from the front face of the building.

Geological maps produced by Opus suggest that the boundary of fill placed in front of the cut into the bank to create the building platform is unlikely to extend far if at all under Block 4.

In general, there are no visible signs of settlement of the building. There are no visible cracks or deformations of the ground adjacent to the building. The columns and floors appear straight and level. Little of the ground floor slab was visible but it is likely that any significant deformations would be detectable through the linoleum flooring.

3.3 Building Frame

The building frame appears to be in generally in good condition except for a couple of isolated areas and the junctions between the original and later concrete structure.

A-Build sheet S4 notes a new soffit has been cast against the original concrete at grids 1, 5 and 11. However, from review on-site it appears that this detail was installed at Grids 1, 4, 5 and 11. At each of these locations, there are signs of moisture ingress at the concrete cold-joint and cracking of the concrete and rust staining are evident. Moisture ingress is evident at all of these locations and it appears that moisture has been tracking into the building along this joint detail. It appears that these areas have been cleaned and painted a number of times so the extent of the underlying damage is difficult to determine. However, as long as no concrete has spalled and there are no cracks greater than 5mm, the repair methodology will not change.

Additionally, even where no new soffit has been installed, the joint between the new column and the underside of the original beam/column is showing similar signs of moisture ingress at all locations where this detail occurs. Less severe corrosion and staining than at the soffits is evident but it is possible defects have been hidden under new coatings. Sealing of this joint is required.

Picture 1 - Typical example of damage at junction between new/original concrete.

3.4 Cladding

The roof cladding is assumed to be being replaced as part of the weathertightness works so neither the frame or cladding has been assessed as part of this report. Similarly, the glazing and lightweight cementitious board cladding is considered to be outside of scope as this is to be addressed by others.

The precast spandrel panels show a number of areas of cracking, some with signs of underlying reinforcing corrosion. It is possible that recent painting of this area may have concealed any signs of deterioration at some locations e.g. rust staining etc. The locations of cracks are generally as per Appendix A. It is noted that repainting of this area may have hidden smaller cracks, also, inspection was from ground level so smaller cracks may not have been sighted. It is recommended that the larger cracks be sealed and grouted to prevent moisture ingress and corrosion of underlying reinforcing which would lead to progressive delamination and spalling of the concrete.

3.5 Roof

Inspection within the roof structure was not possible as no access to the roof void was available. However, review of existing building drawings suggests the purlins are likely undersized for current standards. Timber strengths in New Zealand were found to have been overestimated and design strengths were revised down in 2007. It is possible that undersized timber members have been deflecting and flexing under high wind loads and it is possible that this may have contributed to moisture ingress and weathertightness problems.

It is noted that all roof cladding is to be replaced hence it is recommended that the purlins be replaced or upgraded at the same time while access is available to reduce future risk to the building.

If there has been any moisture ingress it is likely that the timber purlins will be heavily damaged as they will have only minimal treatment and resistance to moisture and rot. Allowance for substantial repair, replacement and strengthening should be allowed in the budget and is noted on the repair schedule as a provisional item.

Section 4.0 Repair Schedule

Refer to Appendix A for plans and elevations showing locations of defects.

DEFECT NO.	DESCRIPTION	REPAIR/REMEDIATION
1 to 4	Deterioration of the new to original concrete joint at the underside of the original cantilever beam. Moisture ingress through this "cold-joint" has tracked moisture inside the building, damage finishes and caused deterioration of the reinforcing across the joint and has caused efflorescence and minor spalling at the face of the joint.	Concrete in this area should be cleaned of all finishes to both internal and external faces. Assess condition of concrete once exposed. Assuming no major spalling and cracks less than 5mm, pressure grout and seal the joint from both sides. Refer to Appendix B for detailed specification for repair.
5	Deterioration of the new to original concrete joint at the interface of the top of the new concrete column and the underside of the original cantilever beam. Moisture ingress through this "cold-joint" has caused efflorescence. There is potential for there to be rust staining and deterioration of the reinforcing across this joint but re-painting of the surface will have obscured this.	As per Defects 1 to 4.
6	Small vertical crack and small isolated spall in precast spandrel cladding panel. Spall is likely to be due to moisture ingress through the crack into an area where there is a section of shallow reinforcing. Movement joints at ends of precast panel are to be reviewed as part of the detailed design of seismic strengthening. Original detailing of a stiff mortar joint at the ends of these panels may have contributed to the cracking noted in the precast panels on this elevation.	As per Defects 1 to 4.
7	Small horizontal crack and rust staining. Similar to defect 6 except there are signs of deeper seated cracking given the level of rust staining.	Defect to be more closely inspected during construction. May require a more intrusive repair or removal of the window panel to allow sealing of a hidden crack as per Defects 1 to 4.
8	Minor vertical crack. Similar to defect 6 except no spalling present in this area.	As per Defects 1 to 4.
9	Large spall and exposed reinforcing to lower edge of a concrete spandrel panel. Similar to defect 6 but has deteriorated.	Clean area of finishes, remove any additional loose concrete and scabble surface. Wire brush clean and coat any exposed reinforcing with Sika MonoTop 910N. Patch concrete with Sika MonoTop Rapid.
10	Minor horizontal crack. Similar to defect 6 except no spalling present in this area.	As per Defects 1 to 4.
11	Bulging of paint finishes in the concrete lintel above the window to the stairwell. It is noted that there are water ponding issues to	Remove finishes from concrete in this area to establish if any cracking or reinforcing corrosion is present.

	the adjacent roof and timber parapet above has deteriorated and is expected to be fully replaced. No evidence of rust staining but removal of finishes is required to confirm this. Suggest apply a sealant coating to reduce likelihood of reoccurrence of efflorescence.	Assuming no corrosion is present, coat surface of concrete with Sikagard 740 S and allow to cure before applying architectural finishes.
12	Rust staining and cracking to a small patch of concrete beneath a downpipe. Likely due to a localised area of shallow reinforcing and exacerbated by dripping water from the downpipe.	As per defect 9.
13	Rust staining to an extended length of concrete beam. Not clear where this staining originates, does not appear to be any concrete deterioration (cracking, spalling etc.). Suggest re-assess when adjacent finishes are removed, corrosion of fixings behind claddings could be the cause of the staining.	Remove finishes to concrete to assess if any cracking or spalling of concrete beneath coatings. Investigate potential sources of rust staining once local cladding finishes are removed. Any repair (if required) is likely to be as per defects 1 to 4.
14	Small but deep spall to concrete with exposed and corroding reinforcing. Likely due to a localised area of shallow reinforcing.	As per defect 9.
Roof purlins	Likely to be presence of rot in some or all of timber purlins. Timber purlins are also undersized and may be contributing to movement of claddings and weathertightness issues.	Allow a provisional sum for replacement of 50% of timber purlins and infill between with additional purlins. OR Replace all timber purlins with stronger sections

Section 5.0 Conclusions and Recommendations

5.1 Key Structural Condition Findings

- The structural elements of the building are generally in a good condition
- Not all areas could be accessed and it is expected that some additional defects will be discovered during the opening up works for the seismic strengthening and weathertightness remediation.
- Isolated defects not currently reducing structural capacity but will if left to deteriorate.
- Workmanship and detailing of new/original structural interfaces is noted as a risk element and these are to be carefully considered when carrying out strengthening design.

5.2 Recommended Works

- Carry out repairs as per the schedule
- Make allowance in budgets for defects discovered during opening up works
- Make allowance for upgrade of the roof structure (purlins) to prevent future issues and protect the asset
- Allow for engineering inspection during opening up works to identify defects and specify repairs as required

Section 6.0 Signatures

Written By:

9(2)(a)

Name: 9(2)(a)

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Job title: Group Manager - Structural Engineering

For and on behalf of Hampton Jones Property Consultancy Ltd

Appendices

Appendix A Plans and elevations of defect locations

Defect 1 to 4 - Deteriorated new to original concrete joints that require sealing (underside of original cantilever beam)

Defect 5 - Deteriorated new to original concrete joints that require sealing (joint between new column and END of original cantilever beam)

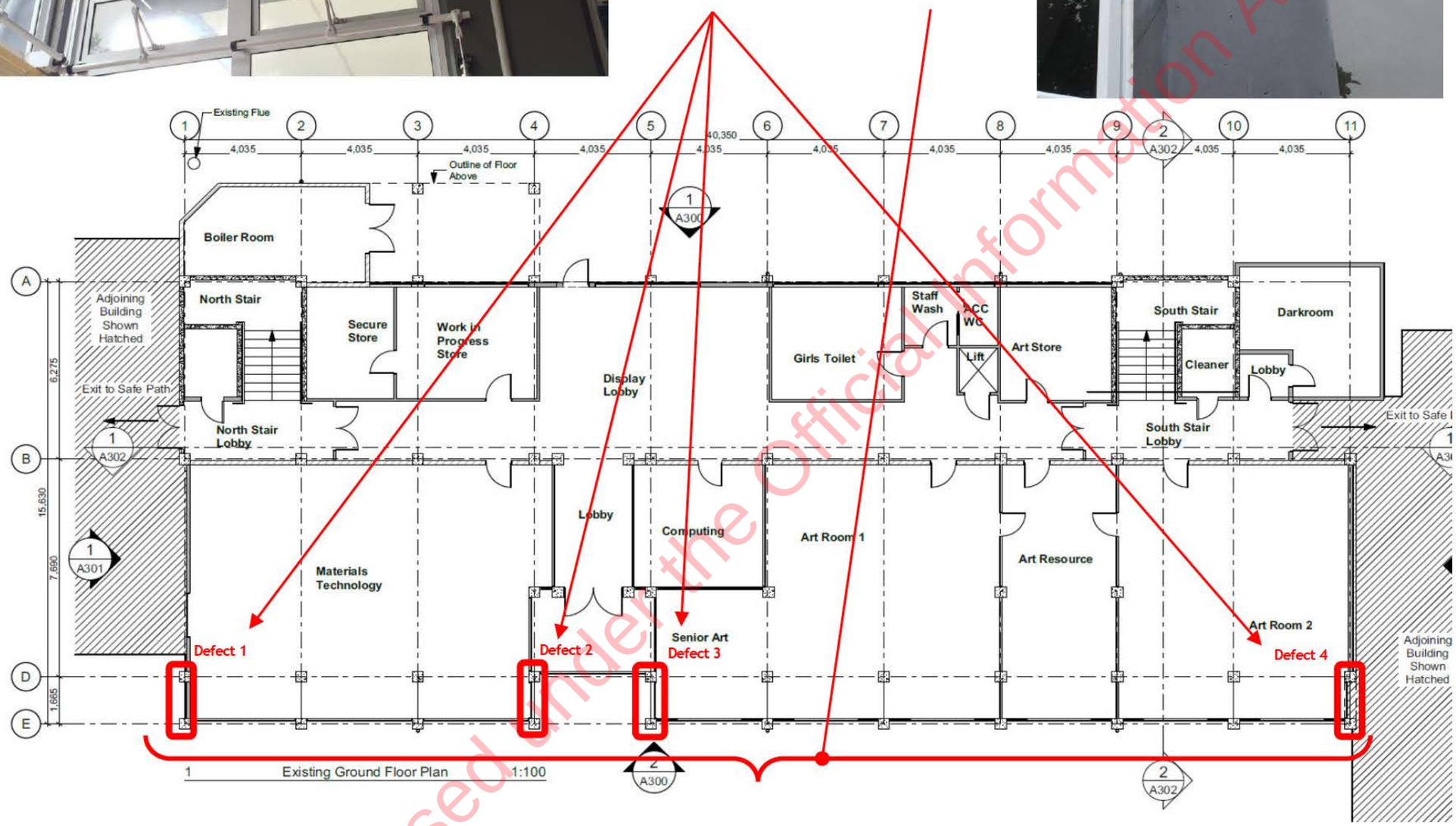
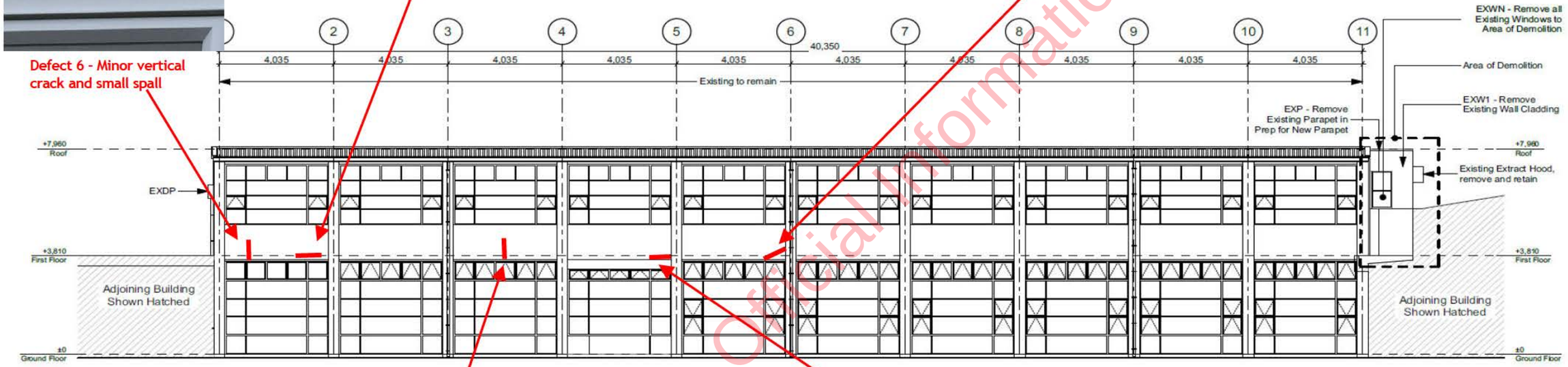


Figure 1. Plan of ground floor of existing building with location of defects

Defect 7 - Horizontal crack and rust staining

Defect 10 - Minor horizontal crack

Defect 6 - Minor vertical crack and small spall

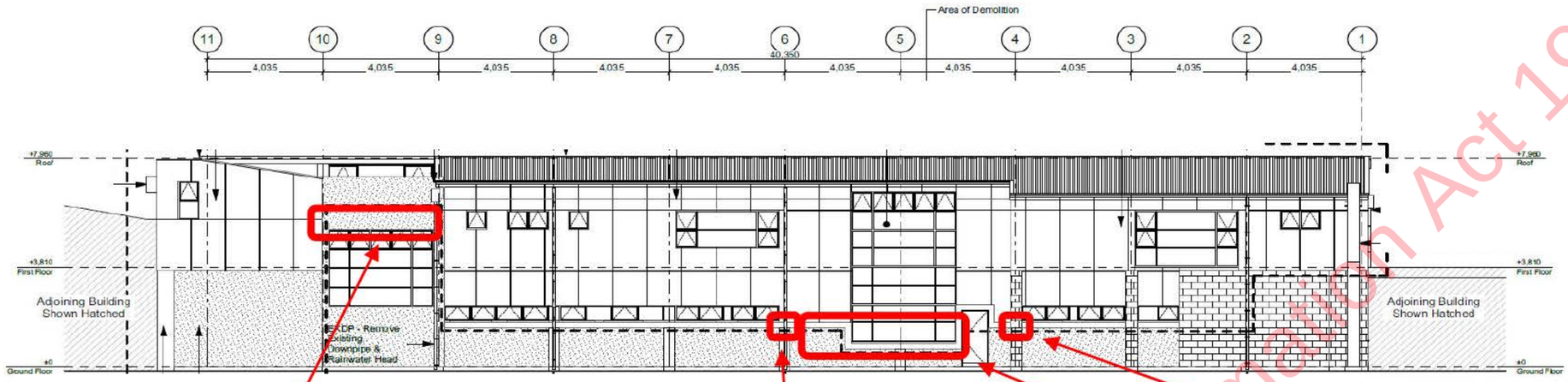


Defect 8 - Minor vertical crack

Defect 9 - Large spall and crack with reinforcing visible

2 Existing / Demolition West Elevation 1:100

Figure 2. West Elevation of existing building with location of defects



Defect 11 - Bulging of paint finishes, no sign of rust staining so currently assumed to be efflourescence. To be investigated when timber parapet above is removed.

Defect 12 - Rust staining and cracking to small area beneath downpipe

Defect 13 - Rust staining to top of beam, source not clear, minor cracks to finishes only.

Defect 14 - Small but deep spall and corroded reinforcing to top of column (original concrete column not later blockwork column)

Figure 3. West Elevation of existing building with location of defects

Appendix B Specification for pressure grouting of cracks/joints

All cracks identified in concrete elements are to be carefully recorded as per the requirements of section 4.1.

Cracks to concrete: 0-0.2mm

Isolated hairline cracks of 0 to 0.2mm are considered superficial and no risk to structural integrity and are note required to be noted on the Contractors Inspection. However, if a large number of closely spaced cracks are found, please inform the engineer.

If cracks are external, sealing of cracks for durability only is required. Use an epoxy adhesive sealant such as Sikadur 31CF and follow all manufacturer's instructions on preparation and application etc.

If cracks are internal, no repair is required other than to repair and reinstate the surface finishes as per the architectural requirements.

Cracks to concrete: 0.2-2mm

Isolated small cracks are not general considered to be a risk to structural integrity. If the scale and number of cracks found is beyond that anticipated in the schedule of works, the engineer must be informed before work commences.

All cracks 0.2-2mm will require repair by injection of an epoxy resin.

Where access is restricted and sealing around the crack is not possible, use a thixotropic epoxy resin such as Sikadur Injectokit - TH

Where access is possible to both sides of the crack, use a low viscosity epoxy resin such as Sikadur Injectokit - LV or Sikadur 52.

Cracks to concrete: 2-5mm

Large cracks 2-5mm will likely require repair by injection of an epoxy resin identical to specification for cracks 0.2-2mm. However, it is currently assumed that none of the cracks observed on-site appear to be greater than 2mm wide (except cracking to plaster render to Green Room Foundations which is non-structural) and additional structural capacity and integrity checks and additional works may be required.

All cracks 2-5mm are to be noted on the Contractors Inspection and highlighted to the engineer BEFORE repair works commence.

Cracks to concrete: 5+mm

Very large cracks greater than 5mm will likely require special consideration. These must be noted on the Contractors Inspection and highlighted to the engineer BEFORE repair works commence.

Assuming no overriding structural integrity issue requires more invasive repairs, it is likely that repair specification will take the form of injection with Sikadur 42 or Sika Grout 212.