

SKYVIEW APARTMENTS

**Independent Advice to
NSW Building Commissioner
Confidential Report – under Original Engagement Terms**

11 June 2021

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SKYVIEW APARTMENTS

Executive Summary

The NSW Building Commissioner requested an independent review of remedial structural works carried out at the site of Skyview Apartments, located at 51-53 Old Castle Hill Road, Castle Hill, NSW. This review involved providing commentary on the findings of Rincovitch Consulting, as expressed in their report entitled 'Overall Assessment of Defects for 51-53 Old Castle Hill Road, Castle Hill', designated as Report No#: 20062-002 (Rev 2) dated 27 May 2021 and revised 4 June 2021 and 9 June 2021 (Rev 3).

The results of this independent investigation are as follows:

1. With some qualifications and commentary, we generally agree with the findings of the Rincovitch report. These qualifications and commentary include the following:
 - (a) In our opinion continual monitoring of the condition and behaviour of the measures adopted to rectify the permanent expansion joints should be conducted for at least the next 10 years but ideally for the life of the building. The purpose of such monitoring would be to ensure that the rectification works perform their assumed function. Namely, that the stitch plates and beams continue to provide adequate structural support while enabling expansion and contraction of the suspended slabs.
 - (b) Any future saw cuts to the slab on ground would have little effect in arresting further cracking.
 - (c) In our opinion the structural adequacy of the rectifications made to the permanent expansion joint has been demonstrated in the current climatic conditions (June 2021) by the recent proof testing, in combination with calculations. However, we are not satisfied that the potential movement of the slabs in all climatic conditions and seasons has been adequately accounted for in design and that all spider plates and bolts, as installed, are fit for purpose, especially the need to allow adequate movement during the life of the structure. We also note that there appears to have been no oversight and verification of the proof testing by an independent engineer. Hence, our statements regarding structural adequacy are based upon reported outcomes of unverified testing.
2. Furthermore, we note the need for the following as a part of the mandated quality control processes for building construction:
 - (a) Independent third party checking and certification of engineering designs and subsequent changes to the design of critical elements by a Registered Engineer, including confirmation of what are the critical elements for all major construction projects.
 - (b) Critical stage, on-site checking and certification by a Registered Engineer that construction is as per the design for all major construction projects. All changes to identified critical structural elements that are proposed and made during construction should also be certified by an independent Registered Engineer.

If such checks had been undertaken it is likely the issues observed here would not have occurred.

Introduction

At the request of the NSW Building Commissioner an independent review was conducted of remedial works carried out at the site of Skyview Apartments, located at 51-53 Old Castle Hill Road, Castle Hill, NSW. It is understood that the Skyview development is being undertaken by 51 OCHR P/L, who has engaged Toplace as builder of the project.

Defects in recently constructed works at this site noted by Rincovitch Consulting (Rincovitch) are understood to have included the following:

1. B1-B2 basement slab cracks around building permanent movement joints;
2. Diagonal cracks at B3-B1 basement slab at discrete slab locations around columns;
3. Concrete spalling at Block A lift core wall/LG slab interface; and
4. B3 slab on ground diagonal cracks.

Options for the rectification of the suspended basement slabs have been proposed including strengthening by steel stitch plates (two types) and 9 types of bracket/corbel mounted steel beams around the columns to support the slab and full spanning steel beams.

We understand Toplace had previously engaged an external party, Smart Structures Australia (SSA), to review the remedial works and design proposed by Australian Consulting Engineers (ACE). Following the issuing of a Written Directions Notice (WDN) by the certifier (Brendan Bennett of City Plan Services P/L) in April 2021, Rincovitch was engaged as an independent assessor of the proposed rectification works.

Subsequently, the NSW Building Commissioner engaged us as an independent engineering advisory team to review the rectification works conducted to date and the recommendations of Rincovitch. This report presents the findings of our independent investigation.

Terms of Reference

The terms of reference of this study and the scope of works provided by the NSW Building Commissioner are as follows:

“The Building Commissioner is aware of the issue by the certifier of a Written Direction to the developer at Skyview Apartments relating to issues with the 4 slabs (one ground and 3 suspended). The issue is to be addressed by the engagement of independent engineering advisor team who will review the proposed design including calculations, the work as done and the proposed remediation. The Service Provider is engaged by the NSW Building Commissioner to provide to the Building Commissioner independent advice on the approach by that independent engineer from commencement of the review to issue of the report”.

Investigation Activities

Our investigations included the following activities:

1. A site visit conducted on Sunday 30 May 2021, to inspect the rectification works conducted to that date;
2. Review of reports describing the building defects and the proposed rectification measures. These include:
 - a. Rincovitch, Overall Assessment of Defects for 51-53 Old Castle Hill Road, Castle Hill, Report No#: 20062-002, Rev2 Issued 27.05.2021 (updated 04.06.2021 and 09.06.2021).
 - b. Australian Consulting Engineers (NSW) P/L, Structural Adequacy Certificate, 22 February, 2021 (Ref 160155.SC52).
 - c. Australian Consulting Engineers (NSW) P/L, Structural Design Certificate, 20 August, 2018 (Ref 160155.SDC2).
 - d. Australian Consulting Engineers (NSW) P/L, Condition Assessment Report, 14 April, 2021 (Ref 160155.CAR1.R2).
 - e. Smart Structures Australia, Peer Review of Expansion Joints Rectification Methods for “51-53 Old Castle Hill Rd, Castle Hill, NSW 2154”, Reference: 210079.R2, 14/04/2021.
 - f. Smart Structures Australia, Peer Review of Concrete Slab/Wall Adequacy “51-53 Old Castle Hill Rd, Castle Hill, NSW 2154”, Reference: 210079.2.R3, 14/04/2021.
 - g. Structural drawings, S0300, S0301, S0302, S0400, S0401, S0500 and S0501.

The major output of this independent review involved providing commentary of the report prepared by Rincovitch, dated 4 June 2021 (updated 9 June 2021), in which several findings were stated. We address each of these findings in the following section.

Response to Rincovitch Findings

In their report to City Plan Service P/L, dated 4 June 2021, Rincovitch made 7 major findings. Our assessment of and response to these findings is provided below. For completeness, each of our responses is preceded by a statement of the relevant Rincovitch finding.

1. *“Suspended basement cracks presented near the PMJ locations can be attributable to inadequate slab isolation obtained on site. This was caused at discrete basement slab locations due to improper installation of PMJ connectors as specified by ACE structural drawings or lack thereof or completely missing the connectors or a combination of all. This was identified and verified from numerous site inspection reports conducted by ACE and site interviews undertaken by Rincovitch Consultants. Furthermore, we identified an alternative movement joint detail provided to Toplace by ACE Consulting, which is not a recommended solution (due to its potential to act as a ‘temporary movement joint’ through interlocking mechanism in lieu of its intended purpose of allowing permanent movement). Our*

understanding is that the alternative detail may have either confused site crew or provided unintended leniency to deviate from original design intent and use this indiscriminately across PMJ locations. Based on the rectification works carried to date we conclude that these cracks will not affect the overall structural integrity of the building. A continuous monitoring regime has been outlined in this report.”

We generally agree with this finding, in particular the statement of the second last sentence that *“the alternative detail may have either confused site crew or provided unintended leniency to deviate from original design intent and use this indiscriminately across PMJ locations.”*

2. *“We are of the opinion that concrete spalling issue at Block A lift core wall at LG slab interface is minor in nature. This can be attributable to inadequate installation of formwork leading to incorrect dowel installation between slab and core wall. Based on the rectification works carried to date we conclude that these cracks will not affect the overall structural integrity of the building. A continuous monitoring regime has been outlined in this report.”*

We generally agree with this finding. However, we assume the intention was to recommend continual monitoring rather than “continuous monitoring”. Furthermore, in our opinion such monitoring should be conducted for at least the next 10 years but ideally for the life of the building. The purpose of such monitoring would be to ensure that the rectification works perform their assumed function. Namely, that the stitch plates and beams continue to provide adequate structural support while enabling expansion and contraction of the suspended slabs.

3. *“We are of the opinion that the diagonal cracks at the suspended basement slabs (B1-B2) can be attributable to a couple of factors working in isolation or in tandem:-*
 - a. *Net increase in tensile stresses over the cross section at the column locations due to compromised overall slab compression (P/A) level,*
 - b. *Plastic shrinkage cracking due to a combination of factors – inadequate localised vibration, excessive wet mixture, excessive hot weather and high strength puddle concrete pour.*

Based on the rectification works carried to date we conclude that these cracks will not affect the overall structural integrity of the building. A continuous monitoring regime has been outlined in this report.”

We generally agree with this finding, but note that monitoring should be continual, as previously described in response to (2) above.

4. *“Slab on ground (B3) concrete diagonal cracks can be attributable to a combination of inadequate joint design and incorrect site installation of sawn joints. We note that design joint spacing and ‘panel aspect ratio’ are 50-100% over in many locations compared to industry best practice and recommended guidelines. Furthermore, sawn joint detail was not installed on site as per design drawings. Based on the rectification works carried to date we conclude that these cracks will not affect the overall structural integrity of the building. A continuous monitoring regime has been outlined in this report.”*

We generally agree with this finding and note that any future saw cuts to the slab on ground would have little effect in arresting further cracking. This slab has been in existence now for approximately 2 years, so most of its potential shrinkage (approximately 80-90%) will have been realised already. Indeed, each basement slab pour was intended to be saw cut as specified in structural drawings S0300-H and S0301-G within 16 hours of casting, but this was not done. This fact fully explains the extent of cracking that consequently occurred. We concur with Rincovitch that the repaired cracks are cosmetic and not structural. Further saw cutting is unlikely to significantly improve the slabs performance. Cracking should be monitored throughout the building's statutory warrantee period and repaired as needed.

5. *"Suspended slab design expected deflections may have been exacerbated due to further deflection allowed by the 50 mm dowel sleeve (due to gap between sleeve and reinforcement) nominated by ACE as site instruction."*

In our opinion the structural adequacy of the rectifications made to the permanent expansion joint has been demonstrated in the current climatic conditions (June 2021) by the recent proof testing combined with calculations (see later qualification in (7)). However, we are not satisfied that the potential movement of the slabs in all climatic conditions and seasons has been adequately accounted for in design and that all spider plates and bolts, as installed, are fit for purpose, especially the need to allow adequate movement during the life of the structure. We have seen no design calculations or analysis relating to likely slab movements, and no indication as to any minimisation of any frictional restraint that may occur between the slab and the bearing plate or bolts and slotted holes that may arise over time. If inadequate provision is made in the rectification measures for slab expansion and contraction, then damage to the slabs could eventuate. Such damage is unlikely to be catastrophic but is likely to be costly to repair. Again, it is emphasised that ongoing inspection and maintenance will be required for the life of the building to ensure that adequate provision is being maintained for slab movement at these permanent joints and seizure of the joints does not occur.

6. *"Retrofitted 'stitch plates' and various spanning steel beams are structurally adequate to support slab at movement joint locations. We do note that 'stitch plate' connections are flexible in nature compared to concrete slab and their original design premise might have been that all stitch plates will be loaded uniformly. However, due to slab deflection pattern, uneven formwork positions and variations in floor load path, some plates were loaded more than others, thus resulted in visible plate deflections identified in our original site inspection (Appendix - A). This, coupled with retrofitted oversized dowel sleeve issue mentioned in item 5 above, may lead to increased slab deflection due to service loading at the carparks in the longer term."*

We generally agree with this finding. But, yet again as stated in (2), we emphasise the need for ongoing inspection to ensure the rectifications works are capable of maintaining their intended function.

7. *"Load tests were conducted over 5 locations and monitored over 24-hour period to satisfy both strength and service loading criteria set out in AS3600. Based on the plate test results conducted by Toplace on 4th June 2021, we are of the opinion that slab performance will be within the acceptable limit as specified by AS 3600. Maximum deflection achieved was 2 mm and no damages to the structures were*

reported. Refer Appendix – D for full details. We note however under service loading condition, slab behaviour near the PMJs needs to be monitored as recommended in this report. Based on this satisfactory proof test results dated 4th June 2021, we conclude that the above will not affect the overall structural integrity of the building. A continuous monitoring regime has been outlined in this report.”

Proof testing of the type described here was useful. We do note that it was not undertaken strictly in accordance with Appendix B of AS3600 – 2018 and AS3600 Supplement 1:2014, which one would have expected. Nevertheless, in our opinion it has been sufficient to demonstrate the structural adequacy of the implemented rectification measures when coupled with other calculations provided. However, we also note that there appears to have been no oversight and verification of the proof testing by an independent engineer. Hence, our statements regarding structural adequacy are based upon outcomes of unverified testing.

Other Comments

We are of the view that the problems encountered on this particular site are likely to be symptomatic of problems that are more widespread in the building construction industry. These involve inadequate checking of structural designs and inadequate checking that construction is carried out according to those designs. We note for example that critical proof testing was undertaken as a part of this review process without independent verification as noted in (7).

As recommended in our prior review of structural design and constructions issues in the Opal Tower, we reiterate the following:

1. Independent third party checking and certification of engineering designs and subsequent changes to the design of critical elements by a Registered Engineer, including confirmation of what are the critical elements for all major construction projects.
2. Critical stage, on-site checking and certification by a Registered Engineer that construction is as per the design for all major construction projects. All changes to identified critical structural elements that are proposed and made during construction should also be certified by an independent Registered Engineer.

Should these practices have been in place it is unlikely that the issues identified in this review of the Skyview complex would have occurred.

John Carter, Mark Hoffman and Stephen Foster

Date: 11 June 2021