

REPORT
ON THE COLLAPSE OF THE BUILDING
AT 45J MA TAU WAI ROAD
TO KWA WAN, KOWLOON - K.I.L. 8627
ON 29 JANUARY 2010



Buildings Department

April 2010

Introduction

1. On 29 January 2010 at about 1:40pm, the front portion of the building at No. 45J Ma Tau Wai Road (45J) collapsed. The Buildings Department (BD) immediately mobilized its contractor to carry out emergency works to ensure safety of the remaining buildings and the public.

2. The building at 45J was a 5-storey (with a mezzanine floor) tenement building of reinforced concrete construction and was served by a front and a rear staircase. It was situated at the end of a row of tenement buildings of similar age and construction. The building comprised a G/F unit with an approved cockloft (or mezzanine floor) over and 1/F to 4/F approved with one flat on each floor for domestic use. Occupation permit was issued on 1 September 1955.

Recent Building Conditions

3. In response to a complaint, an inspection was carried out by staff of the BD on 18 November 2009. Cracks, loose plastering and spalled concrete were noted on the side elevation at the G/F and M/F level and the internal common area of the building. No signs of spalled concrete or obvious cracks were noted on the external wall of the building at upper floor level and no imminent structural danger was noted.

4. Another inspection was conducted by BD staff on 30 December 2009 to follow up the advisory letter for building repair issued to the owner after the inspection in November 2009. It was revealed that the condition of the building was the same as that recorded in the previous inspection on 18 November 2009.

Investigation

5. After the collapse of the building at 45J, investigation was carried out by the BD based on building records, site inspections, witness statements, interviews with relevant parties and structural analysis with a view to establishing the cause of the collapse.

6. From the evidence available, the following situations were revealed :

- (a) Alterations in the form of sub-divided flats were noted on all upper floors.
- (b) Repair works and removal of unauthorized building works on G/F commenced on 23 January 2010 and were still in progress in the morning of 29 January 2010.
- (c) Three columns, namely C11, C12 and C13, collapsed in the incident. Remnants of the three columns were noted at ground level after the collapse. The column layout diagram is at Annex.

Structural Assessment – Cause of Collapse

7. The collapse of the building was described by the witnesses to be in a progressive failure mode, instead of crumbling down all at once. Based on the BD records available so far, laboratory test results on concrete and reinforcement samples and witness statements collected, the structural analysis was focused mainly on the three collapsed columns C11, C12 and C13.

8. The re-assessment of the structural capacity of the building revealed that some of the balcony loads for column C11 were omitted in its original design. This was, however, counterbalanced by the surplus of the column reinforcement bars which were provided over and above that required.

9. The structural capacity of the building under the different scenarios of loading conditions, including additional loadings imposed by the sub-divided flats, material ageing conditions and appraised deteriorated condition, were then assessed. The factors of safety of the building structure under all of these different loading conditions were found to be acceptable. Therefore the above factors were not the causes of the building collapse.

10. When these columns were assessed under the condition of being subject to inadequate or improper repair with noticeable signs of deterioration, the reduction of the effective column sizes had led to a decrease in the bearing capacity of the columns. Based on the extent of defects of these columns, the factor of safety so evaluated was still found to be at an acceptable level and should not have caused the building to collapse.

11. A further scenario assessment was conducted. When column C13 was further disturbed by some external forces, its loading capacity would be reduced. Without the provision of any precautionary measures such as steel I-props and bracing ties to share out the loading, the loading that column C13 had to bear would have exceeded its ultimate loading capacity and the destructive effect spread to the nearby columns C11 and C12, thereby increasing the loading on these two columns.

12. The asymmetrical arrangement of the 5 main supporting columns (i.e. C8, C9, C11, C12 and C13) formed a less rigid portal-framed integral structure (i.e. the collapsed portion of 45J). With the simple supported column-beam joint connections, there was no moment transfer between the column and beam. This type of structure would not be able to withstand any lateral loading when comparing to the symmetrical arrangement of columns of the remaining buildings at 45G and 45H. The symmetrical arrangement of the columns of 45G and 45H formed a more rigid multi-framed integral structure to withstand lateral movement.

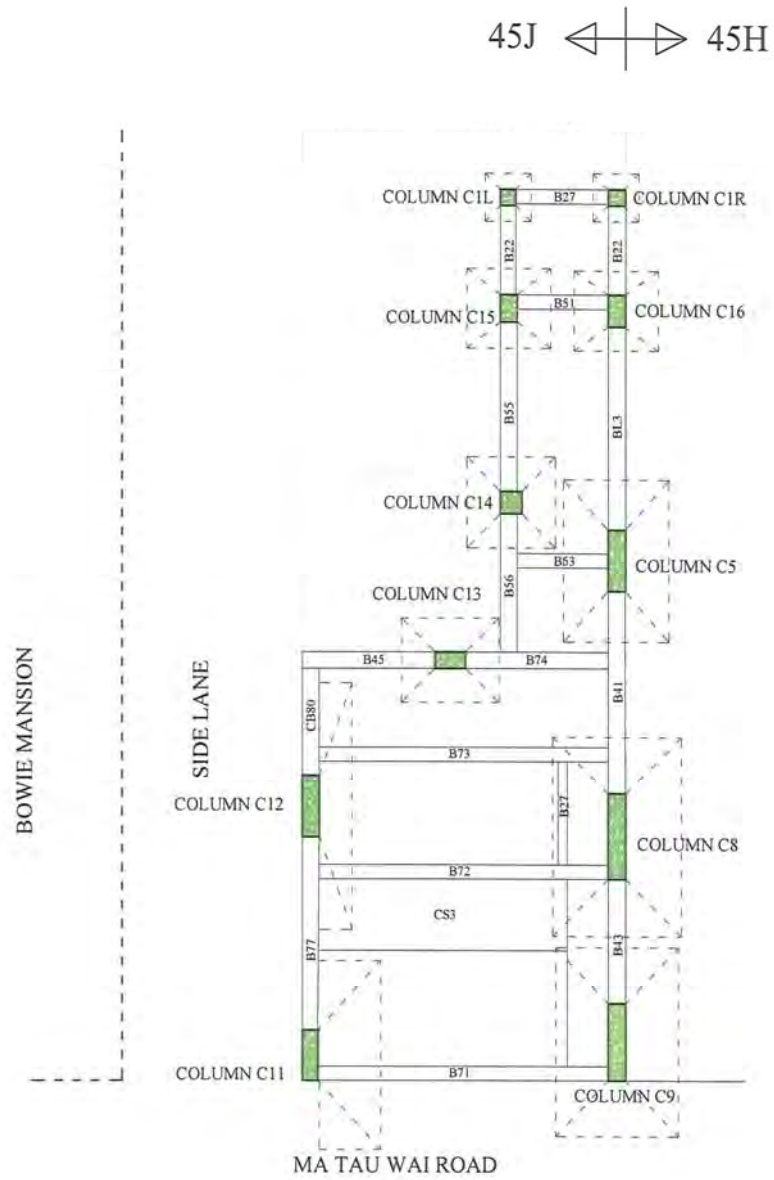
13. Once the three structurally unbalanced columns C11, C12 and C13 reached their ultimate failure state, they would have crushed progressively within a very short period of time and failed to support the loading of the 5-storey building. This would have caused the lower portion, about two storeys, of the building to collapse first.

14. The pull-down force forming unusual lateral movement would have then caused the remaining structure, including the overhanging portion of the storeys above, to collapse afterwards.

15. The structural design adopted for the building structure of 45J was simple-supported arrangement and the front portion of 45J was partially structurally detached from the rear staircase portion. Therefore the rear staircase of 45J and the adjoining building at 45H (albeit column C9 at 3/F level of 45H was severely damaged and dislocated) had remained standing after the collapse of the front portion of 45J.

Conclusion

16. Based on the site inspections, structural analysis and statements obtained from the interviewees, the collapse of the building at 45J was likely to be triggered by the disturbance of column C13 by some external forces. As for the identification of the origin of these forces, further investigation has to be conducted including building material testing and forensic study.



Column Layout Diagram-
No.45J Ma Tau Wai Road