

TYPES AND REASONS OF CRACKS IN CONCRETE COLUMN

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NON-STRUCTURAL CRACK AND STRUCTURAL CRACK

Building defects exist in various forms and it is inevitable. Crack is the most common defect in the building, they are developed in building elements when the stress exceeds the material strength^[1]. The crack in a building can be classified as the non-structural crack and structural crack.

Non-structural crack is a fine crack that has little or negligible effect on the strength and integrity of the building. They are generally less than 2.00 mm in width, exist as a thin hairline crack at any part of the building^[2]. They typically arise in the old building, created as internal stress forms in the building material due to varying humidity, surrounding temperature, and weather conditions^{[1][2]}. They may be caused by creep damage, vegetation or trees, shifting or moving foundations, settlement, and hydrostatic pressure. Non-structural cracks tend to develop as structural cracks if it is not well controlled. Water will seep through it, generate internal pressure, and thereby force or expand the crack.

Structural crack endangers the building structure and it will affect the building strength and stability. Structural cracks are generally wider than 2.00 mm width, they may occur in the pattern of continuous horizontal cracks on walls, vertical cracks with relatively wider at the top or bottom, diagonal cracks, and stair-step cracks^[2]. Formation of structural crack may due to incorrect design, building material deterioration due to chemical attack, overloading, soil settlement, and unbalanced soil pressure due to expansion of soil. They occur at structural components such as foundation walls, beams, columns, slabs, etc.

TYPES OF CRACKS IN CONCRETE COLUMN

Column is an important element in the building framing structure and it transfers the load from the upper floor towards the foundation. Cracks in the column can be categorised according to their crack pattern or propagation. The 4 types of cracks in the concrete column are listed below^{[3][4]}:

- a) **Diagonal Crack:** The crack propagation is diagonal along the entire column face. This crack formed due to incorrect design causing the column to have inadequate load-carrying capacity. Diagonal cracks in the column indicate that the column may have not enough reinforcement area or inadequate cross-section of the column. Figure 1 shows the diagonal crack in the concrete column.

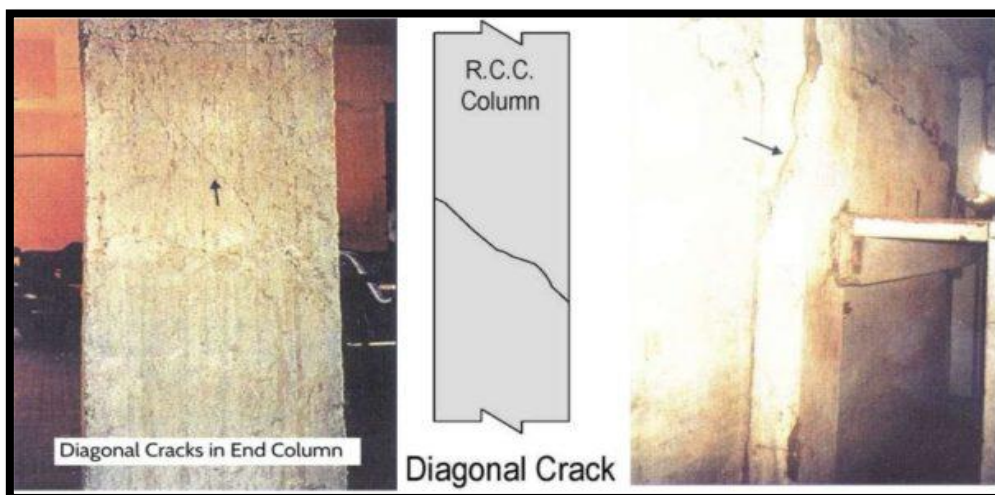


Figure 1: Diagonal Crack In The Concrete Column^{[3][4]}

- b) **Horizontal Crack:** Horizontal cracks within the concrete column are typically seen on the beam-column joint and on the column face where tensile stress is high. Columns with insufficient moment restraint, low reinforcement area or incorrect arrangement of reinforcement may result in horizontal cracking because of the impact of shear force, direct load, and uniaxial bending. Figure 2 is the horizontal cracks within the concrete column.

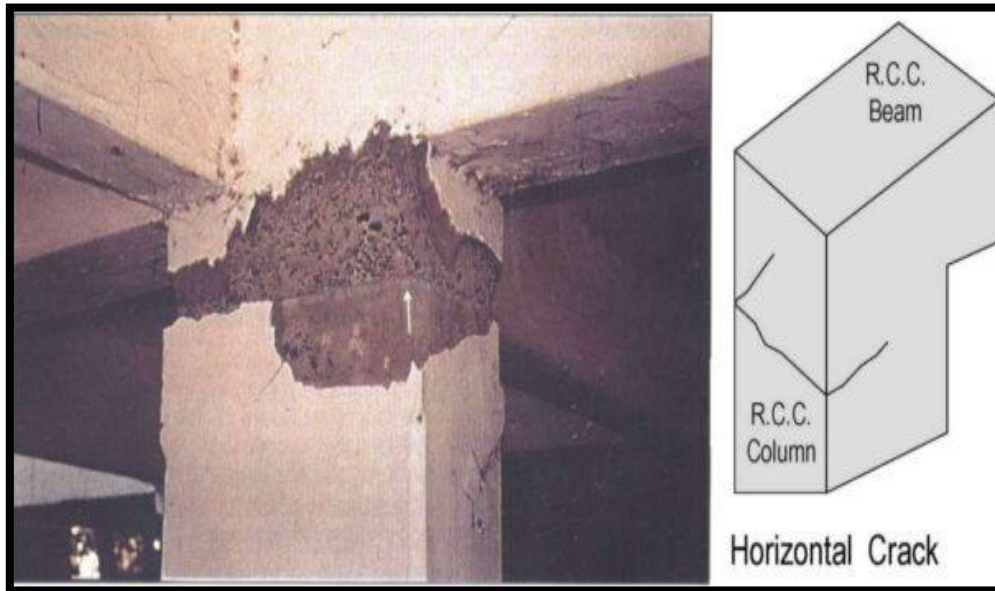


Figure 2: Horizontal Crack In The Concrete Column ^[3]^[4]

- c) **Splitting Crack:** Splitting cracks at the concrete columns are short and parallel vertical cracks of varying width. These types of cracks can occur in columns with insufficient steel bar reinforcement and low concrete strength. Splitting crack happens as the load acting on it reaches its ultimate load-bearing capacity. In other words, this is a compression failure of the concrete column. An example of the splitting crack in the concrete column is shown in Figure 3.

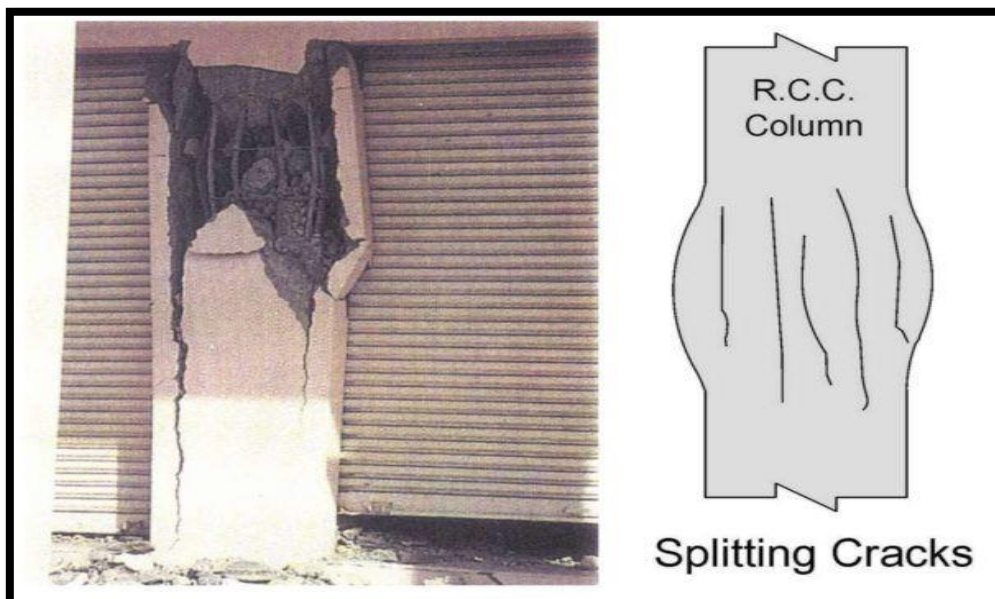


Figure 3: Splitting Crack In The Concrete Column ^[3]^[4]

- d) **Corrosion Crack:** Corrosion crack is a crack formed by rusting the concrete reinforcement bar. The crack propagation follows the pattern or the line of the steel bar. The reinforcement bar normally corrodes due to the inadequate concrete cover, hairline cracking on the concrete surface, and exposure to high humidity or chemical attack. If these types of cracks cannot be properly treated, the degradation of the steel reinforcement bars can worsen exponentially. Figure 4 shown the corrosion cracks in the concrete column.



Figure 4: Corrosion Crack In The Concrete Column ^[3] ^[4]

CONCLUSION

Crack in the column can be non-structural or structural crack and can be categorised according to its crack pattern. Structural cracks (crack width of more than 2.00 mm) in the column are difficult to handle because it serves a vital role in building frame structure. The rectification work of cracks should be based on its type and the root cause of the failure. It is recommended to appoint a competent or professional contractor with engineering background to carry out proper defects assessment in order to recommend the best solution for defect repairing.

References:

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