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No. CED-6372/22-23/1D
Date: 15.09.2023

To

The Chief Executive Officer,
Unitech Group of Companies
8th Floor, Tower-B, Signature Towers,
Gurugram

Subject: Proof-checking and Structural Health Safety Audit of G+13-Storeyed Residential towers No. 13 (D1, D2, E1, E2, E3, F1, F2, F3, G1, G2, G3, H1, H2) of Unitech "THE RESIDENCES" Group Housing Project at Sector 33, Gurugram Haryana.

Kindly refer to your letter bearing No. REPL/Unitech/22-23/0228 dated 17th June 2022_ whereby IIT, Roorkee was engaged for the assignment of undertaking Proof-checking of Structural Drawings and Structural Health Safety Audit of 19-Storeyed Residential Towers No. 13 (D1, D2, E1, E2, E3, F1, F2, F3, G1, G2, G3, H1, H2) of Unitech "The residences" Housing Project at Sector 33, Gurugram Haryana .

2. Having completed the assignment, we are pleased to submit our report as follows:

2.1 The proof-checking of Structural Designs has been done and the same is generally found to be in order. Separate Certificate is being issued in this behalf.

2.2 The Structural Health Safety Audit has been carried out as per NBC and relevant IS Codes applicable at the time of first approval of plans, both based on visual inspections and scientific tests.

3. Executive summary of the Report:

The structures of 13 Towers in the residences Project are found to be safe and liveable, subject to rectification of construction related deficiencies wherever observed and mentioned in the detailed report. Random NDT test has been conducted, on behalf of report concrete quality not standing as per design consideration some where it found more than 50% deficient.

3.1 Observations/ Findings from Visual Inspection:

As the structures/ incomplete buildings are standing in situ for a few years, the same have been exposed to the adverse effects of weathering, deterioration and normal wear & tear. We have observed the following:

(i) Plaster found damaged, with cracks observed in internal and external plaster, and of poor quality at certain places as mentioned in the detailed report, which needs repairs/ replacement;

(ii) Problems in proper closure of doors and windows;

(iii) Column and beam steel exposed at certain places and the rusted parts would need retrofitting;

(iv) Random Core cut test conducted in many towers at doubtful location result not satisfactory;

(v) Somewhere quality of concrete observed very poor which need strengthen by appropriate solution with concrete jacketing /steel jacketing, whatever suitable as per deficiency as mentioned in detailed report;

(vi) columns and beams damaged at some location need to retrofitting.

(vii) Deflection/ sagging at beam at a few places as mentioned in the detailed report;

(viii) Water proofing damaged observed at places in terrace;

(ix) Parapet and terraces damaged at certain places;

(x) Chajjas/ balcony projections and external phase beam show falling of concrete at a few places – need recasting/ retro-fitting.

(xi) Visual inspection has been not conducted in tower (D1&D2) these towers occupied and fully furnished.

3.2 Tests carried out on structures:

We have conducted/ got the following tests carried out:

(i) Ultrasonic pulse velocity Test

(ii) Rebound hammer Test

(iii) Half Cell Potential Test

(iv) Carbonation Depth Test

(v) Tomography

(vi) Chemical Analysis

(vii) Sand cement mortar Ratio in plasters

(viii) Core test

3.3 Overall Observations and Remedial measures:

(i) The standing structures are found to be safe and liveable with subject to rectification of deficient member. The distress and damages observed at places are repairable. No propping of structures is required;

(ii) No slab recasting is required, however, damaged chajjas require repair/ recasting at a few places as pointed out in the detailed report;

(iii) Need retrofitting of damaged members with appropriate solution, wherever observed as per detailed report;

(iv) Need to repair the plaster after removing the existing poor-quality plaster at places as per detailed report;

(v) Jacketing/ strengthening of deficient members required as per the detailed report;

(vi) Need to strengthen the column by concrete jacketing whatever required as mentioned in detailed report;

(vii) Need to strengthen the beam by fixing of steel girder / carbon fibre laminate as mentioned in detailed report;

(viii) RCC cover needs replacement in exposed members at a few places – refer to detailed report;

(ix) Chemical Test Carbonation & Sulphate results found satisfactory;

(x) The half-cell Potential Test found satisfactory except some spaces;

(xi) The retro-fitting proposals based on the report be prepared and executed at site.

3.4 Strengthening of short falling member shall be done by:

(i) Concrete Jacketing;

(ii) Carbon fibre wrapping;

(iii) Injection grouting;

(iv) Repaired by polymer modified mortar;

(v) Strengthening by steel girder;

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(Rajib Chowdhury)