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To
Brigadier Sunil Kumar
President, Residents Welfare Association (RWA)
Chander Kunj Army Towers (CKAT)
Vytilla, Kochi

Subject: Report on visual inspection of CKAT, Vytilla on Jan 19, 2021 and prior inputs

Dear Brigadier Sunil Kumar,

As requested by the authorities at CKAT, I visited the CKAT on January 19, 2021 (between about 11 and 1 pm). I was accompanied by Prof. Elson John and Er. Abhilash. Following is a brief on the key observations made during the visit.

In the presence of the RWA authorities, walk-through inspections of Towers B and C were conducted. Severe corrosion-induced cracking of structural elements, associated patch repairs (repeated patch repairs at same locations, as informed by tenants), signs of leakages etc. were observed. As a particular case and to confirm the corrosion condition, the cracked/delaminated location of one of the long beams in the basement was autopsied (i.e., delaminated cover concrete was removed using a hammer and chisel). This region was found to be an already repaired region and significant steel rust/corrosion products were observed (see Figure 1).

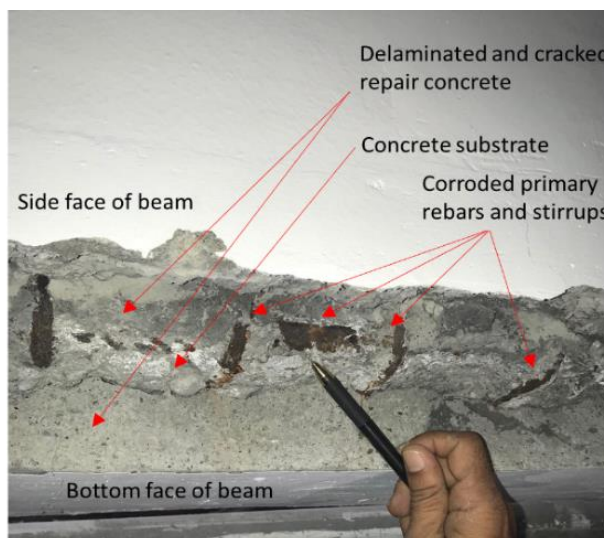


Figure 1 Ongoing corrosion in the repaired beam in the basement

This cracking and delamination might have occurred because the prior repair could not arrest the corrosion of the primary reinforcement and stirrups. This is due to the possible presence of sufficient chlorides in the concrete in contact with the steel. As informed and observed, it seemed that the repair was done by covering the substrate concrete and steel using repair concrete (without any undercutting and electrochemical treatments). The lack of coarse aggregates in this repair concrete indicated that this was possibly microconcrete. Such patch repairs with microconcrete and without undercutting and electrochemical treatments cannot

control corrosion due to (i) the residual chloride effect and (ii) the halo effect. The residual chloride effect is due to the possible chlorides in the substrate concrete and the inadequately cleaned steel surface/rust present and the halo effect is due to the difference in the chemistry between the repair and substrate concretes. The microconcrete was about 2-inch thick, which seemed more than required cover thickness for such members. Also, non-metallic mesh for confinement was observed at the side faces (it seemed that mesh was not present at the bottom face), questioning the effectiveness of mesh in confining the concrete.

Also, several exterior columns, beams, and other elements in the basement and other floors were found to have numerous patch repairs, as already reported in earlier report by Prof. Elson John (dated September 15, 2020). A few photographs from the same is provided in Figure 2 and the full report is enclosed, for your quick reference. During my visit on January 19, 2021, these locations were easily identifiable because of the plaster and paint with slightly different texture and colour, respectively. Also, I was also informed of the propagation of earlier cracks and formation of new cracks at various locations and associated repeated repairs - indicating ongoing active corrosion and implementation of inadequate repair procedures. It was also informed to us that multiple repair works have been going on at the same locations (say, repeated repairs).



Figure 2. Leaking of basement wall
(performance of recent repair must be checked during the upcoming monsoon)



Figure 3. Fire pipes passing through the beams
(the consequences must be checked by a structural consultant)



Figure 4. Patch repair of cracks in columns



Figure 5. Cracks on patch repaired columns
(indicate inadequate repair practice)



(a)



(b)

Figure 6. Repaired beams, columns, sunshades, etc. at many floors (see the changes in texture and colour) exhibiting additional cracks - indicating inadequate repair practice

Based on these and the results from the prior laboratory tests conducted by IITM and other inputs, the possible root cause of this premature corrosion seems to be the presence of chlorides in the concrete used. In this context, I am also attaching a copy of the earlier report by me and Prof Elson (dated December 14, 2020) with the evaluation of BV Report and the test results from IITM labs, for your quick reference. The source of chlorides could be the mixing and/or curing water and/or fine aggregates. To confirm the level of contamination at various parts of the building and advice on a suitable repair strategy, further sample collection and field/laboratory tests are required.

The total fee for the site visit and this report is Rs. 25,000 plus GST and payable to “Registrar, IIT Madras”. Please find enclosed the invoice. If you need further information, please feel free to contact me.

Sincerely,

Radhakrishna G. Pillai

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Enclosures:

- 1) Report (dated September 15, 2020) on visual inspection by Prof Elson John and Mr. Naveen Krishnan
- 2) Report dated Dec. 14, 2020 with the evaluation of BV Report
- 3) Invoice