

ANNEXURE 4: REPAIR METHODOLOGIES

Repair methodologies for different type of defects observed in this building are presented below in sub-sections.

Annexure 4A:

Treatment for corrosion of steel members/plates:

Wherever corrosion is observed in the steel members, it must be treated on priority as corrosion will eat away the steel section and reduce its load carrying capacity. Corrosion in steel members can be at various stages, and based on the extent of corrosion seen at the site, some structures will require a replacement of members, whereas for most other structures treatment to remove corrosion will sufficient.

Procedure to remove corrosion from structural steel is described below:

- Remove all pieces of rust and paint from the metal surface with a wire brush/emery paper and roughen the surface.
- Dust the metal with a dry cloth to remove metal dust from the surface.
- Apply Red oxide primer to the rusted metal surface and allow the paint to dry completely.
- Follow by two coats of Enamel paint.

Where bolts are found to be corroded, the bolts should be replaced as described below:

The corroded bolts must be removed and replaced. The replacement should be done using bolts of the same diameter and grade as the original drawings.

Removing the corroded bolts can be difficult, especially if the threads have become rusted or rust has degraded the metal head, making them hard to grip with a wrench or screwdriver. However if treatment is not carried out, the extent of corrosion will increase and it will become further difficult to remove and replace the bolts.

There are several options for helping to remove rusted fasteners, including:

Lubrication: Industrial lubricants can often reach a fastener's threads, which may be difficult for tools to grasp. Applying lubricant to the bolt, then tapping its head with a hammer, can help the lubricant penetrate the fitting and loosen the bolt sufficiently to be removed.

Cutting: If a fastener has rusted too severely, cutting it out may be the only alternative. A cut-off wheel can be used to remove the rusted fastener.

Torching: Using a moderate to low heat torch is another viable method for removing a rusted bolt.

Annexure 4B

Repair Honeycombs or Hollowness in RCC Members (Beams / Columns / Slabs / Walls)

Honeycombing occurs either due to excessive bleeding of cement slurry or insufficient compaction at time of concreting. Injection grouting can be carried out to rectify this condition. Following steps are to be followed:

- Mark points for grouting in the wall/beam at a spacing decided based on the condition of the effected member.
- Now, drill holes of 12 mm diameter at the predetermined points
- Fix MS nozzles in the grouting holes using a suitable putty & allow to set
- Inject Cementitious grout material mixed with reinforcement corrosion inhibitor such as EPCO-KP-100 of Krishna Conchem or similar
- Allow to cure for 24 hrs. & seal the grouting hole appropriately.
- After application of grout material the surface should be finished using PMM.

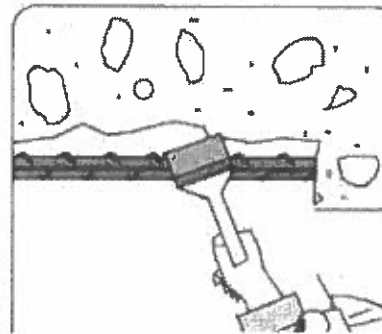
Annexure 4C:

**Treatment for Exposed Reinforcement and Spalling of Concrete / Cracks in concrete members due to corroded reinforcement
(When new reinforcement is not required to be added).**

When corrosion of reinforcement occurs, it exerts pressure on the concrete leading it to cracks in concrete. When the corrosion is severe, concrete portions break apart from the main member which is called spalling of concrete. Spalling of concrete will lead to complete exposure of reinforcement, which becomes susceptible to further corrosion. This makes the reinforcement ineffective and reduces the life of the concrete member.

Recommendation:

- Use light chipping hammers to remove concrete from the affected area. Clean the surface thoroughly and remove all dirt & loose dust and aggregate.
- Clean the exposed steel reinforcement with mechanical wire-brushing and by using a rust remover compound.
- The reinforcement should then be protected against corrosion by applying two coats of epoxy based zinc primer as per manufacturer's instructions.



- Apply an epoxy bonding agent to the existing concrete surface so that proper bonding of the existing concrete to the repair material can take place. The bonding agent has to be applied as per the manufacturer's instructions.
- Apply Polymer modified mortar (PMM) to repair the concrete member and bring it to its original shape and size. The PMM should be applied while the bonding agent is still tacky.
- Cure the repaired concrete member adequately.

Note:

- 1) Speed and time for application of any chemical or PMM should be as per manufacturer's instructions.
- 2) It is not advisable to place PMM above 30 deg Celsius. Newly prepared surface should be protected from rainfall and other source of water. However it should be moist cured for 1 to 3 days under ambient temperature or as per manufacturer's instructions.

Annexure 4D:

Retrofitting for strengthening the existing corroded web plate:

- Carry out corrosion removal treatment for the existing web plate as per the instruction provided in the Annexure 4A.
- Add a plate on top of the existing web plate and carry out fillet weld on all four edges (Two side edges to be welded to the flange & top/ bottom edges to be welded to the existing web plate).

- During repair works, top layer of concrete grade slab to be broken to check the condition of plate embedded in concrete. If it is found to be corroded, the new plate to be continued below for strengthening.
- Refer the Image below for details.

