2.3.3 Degradation of construction materials

For causes of material degradation see 2.3.1 Properties of materials 2

Methods to prevent and reduce degradation

Reinforced concrete

- Ensuring adequate concrete cover to the reinforcement bars in order to reduce moisture or salt penetration.
- Use of an impermeable concrete mix with a low water-to-cement ratio to protect the steel by preventing moisture penetration.
- Use of corrosion-inhibiting materials, such as epoxy coatings and penetrating sealers, to help ensure that the steel will remain effective.

Steel

- Use of paint or powder coating to prevent corrosion and reduce exposure to rain or seawater.
- More complex measures, such as controlling the amounts of sulphur, chlorine, or oxygen in the surrounding environment.
- Use of corrosion inhibiting chemicals that react with the metal's surface or the surrounding gases to suppress the electrochemical reactions that cause corrosion.

Timber

- Correct detailing and ventilation to prevent moisture ingress, that can initiate fungal growth.
- Use of surface preservative treatments to protect against decay and insect attack.
- Pressure treating timber where preservatives are forced into the timber, not just surface coating it, in order to enhance protection.

Brick

- Brickwork must be designed and detailed, particularly around openings, junctions and at ground level, to prevent rain and snow penetration, and water damage.
- Brickwork can be treated with masonry sealant designed to allow bricks to breathe, whilst reducing moisture ingress.

Solving issues caused by material degradation

Reinforced concrete

- Treating exposed steel reinforcement to prevent corrosion.
- Filling fissures or holes caused by cracking or left after the loss of spalled or damaged concrete.
- Strengthening concrete structures to increase the load-carrying capacity, including increasing the concrete cross-section and adding material such as steel plate or fibre composites.

Steel

- Removing rust by grinding, treating surface with rust converting chemical primer and finishing with water resistant topcoat.
- Measures to protect metals from corrosion (oxidation) include metallic methods, such as hot dip galvanizing.
- Replacing defective and/or loose fixings.

Timber

- Dry rot is caused by the most destructive wood decaying fungus found in building timber. It commonly arises in internal timbers bearing into damp masonry, and will spread considerable distances in timber and masonry, and destroy wood very quickly.
  Traditionally, a dry rot attack is handled by eliminating all sources of moisture, removing the decayed wood, and wood from a specified safety zone (approx. 1m all around), and burning the removed timber. It also involves removing wall plaster and raking brickwork joints within the safety zone; blow-torching exposed surfaces to remove underlying fungus; treating with fungicide, and then reinstating pressure impregnated timber.
  Alternative methods for dealing with dry rot include heat treatment and the use of microwaves, to kill small attacks.

Solving issues caused by material degradation (cont.)

Timber

- Wet rot does not spread from the source of moisture and therefore is easier to treat once the cause of the damp has been identified and repaired. The treatment will involve cutting out and replacing effected timbers and treating all remaining timber in the vicinity with a suitable fungicide.

Brick

- Replacing broken or heavily spalled bricks to prevent moisture penetration.
- Repairing mortar joints, by raking out and re-pointing to reduce the entry of water, or by face grouting to repair hairline cracks.
- Installing damp proof courses to prevent the movement of moisture by capillary action.
- Installing wall ties where cavity walls have been constructed without enough anchors or where the existing anchors have failed.

Impacts of material degradation on the environment

Here are examples of air, soil or water pollution:

- Aesthetic – staining, such as that caused by run-off from corroded metals, and the loss of details caused by the erosion of stonework accelerated by acid rain.
- Asbestos dust released accidentally during maintenance or refurbishment work, which is hazardous and must be dealt with by specialists.
- Vibration at levels causing noise and nuisance to occupants can arise from metal fatigue due to repeated cyclic loading of structural connections.
- Resources and CO_2 – greenhouse gas emissions arising from the manufacture and transportation of replacement and repair materials.