5.2 REPAIR OF STRUCTURES DUE TO LEAKAGE

Leakage in the concrete structures causes inevitable damage to the reinforcement. Construction joints, shrinkage and restraint cracks may form leak paths. The amounts of water involved vary from damp-patches which tend to evaporate as they are formed, to running –leaks which may eventually form un drained surfaces. Damp patches may also be formed when water passes through the voids along reinforcing bars formed due to **plastic settlement.**

The other common routes for larger volume leaks are **honeycombed concrete, movements joints** like expansion and contraction joints. In case of water-retaining structures, the extent of leakage may be measured by monitoring loss of liquid from the structure.

Techniques

Conventional leak-sealing methods Leak-sealing by injection techniques

Conventional methods

Some sources of minor leakage may dry up by autogenously healing which is an accumulation of calcium salts along the leak path. This will obstruct the passage of water over period of time and reduce the leakage to negligible proportions. Once leak spots have been identified, the remedial action may involve the application of local or complete surface seal in the form of a coating system.

Surface preparations

Filling of surface imperfections with resin-based grouts

Application of primer

Application of two coats of high-build paint

The procedure may require quite extensive preparatory work including the injection of suspect joints and random shrinkage cracks with allow viscosity resin. Honey combed concrete if not particularly extensive may be filled out using a resin based mortar. Laitance and surface contaminants may be removed by sand blasting and power wire brush

Injection Sealing

From liquid flow and pressure considerations the simplest and most cost effective

way is to seal the leakage from the water-retaining side of the structure. When the wet side is inaccessible, the leakage must be tackled from the dry side which is considerably more difficult. Successful leak sealing requires injection of sealant to fill water passages completely, and it is necessary to attain relatively high flow velocity to achieve this, because of short pot-life or working time of the typical repair material. The first basic step is to restrict or confine the water flow to tube through which the sealant any be introduced.

Due to possibility of concrete being stressed during injection, it is preferable to maintain lower pressures. The direct methods are very slow due to sealant being pumped slowly through very narrow passages against pressure, and the pressure cannot be maintained for long enough to achieve complete penetration. In many cases water may find another finer pathway leading from the same source. In contrast the indirect methods enable the work to be completed quickly because surface seals are not required and mechanical anchorages can be used.

Marine exposure

Durability of concrete exposed to sea-water again stresses that of all chemical and physical properties, permeability of concrete is the most important factor influencing performance. Concrete are achieved by using mixes having high cement contents and low water: cement ratios, through consolidation and control of thermal and shrinkage cracking, and limiting cracks due to mechanical loading.

Physic-chemical effects of sea water on hydrated cement as follows:

Chemical attack by sea water on cement only occurs in the case of permeable concrete

C4AF, in contrast to C3A has no deleterious effects

Portland cements with C3A contents lower than 10% resist chemical attack in sea-water

Cements containing more than 65% slag are most resistant to sea-water attack

The effects of pozzolan depend on their mineralogical composition and reactivity

Compressive or flexural strengths are not a good basis for assessing durability once reactions commence; a much better basis is the measurement of expansions as they continue

Application of materials

Mortar placement

Injection into cracks

Large-scale Repair