BUILDING DIGEST

CENTRAL BUILDING RESEARCH INSTITUTE, INDIA

SOME TYPICAL ENQUIRIES AND THEIR REPLIES

Introduction

This Institute receives about 1000 enquiries every year from building industry, Government and Semi-government organisations and private individuals, covering all aspects of building design and construction, many of which relate to defects or failures or use of new materials. On a review of the enquiries it has been noticed that many of the enquiries are of similar nature relating to most frequent sources of trouble. Sometimes the enquiries are of very common nature, the answers of which may already be known by practising Engineers and Architects. But, from the frequency of such enquiries, it is felt that these problems also require further emphasis.

Improper use of a material or sometimes negligence in some of the aspects of design and renderings required for a particular climatic condition leads to problems which constitute a large portion of the enquiries. Since various new materials are coming in the market like admixtures to cement and concrete, gypsum, plastics, resins, special paints etc. suitability and use of these materials also constitute the subject for a good number of enquiries.

In this building digest a few of the typical enquiries and their answers have been included.

Water-proofing Fine Cracks in the Cement Plastered Surface on the Roof

The roof surface should be saturated with commercial sodium silicate (80 percent solution in water) till the solution gets proper access to the cracks. This should be followed by a 5 percent solution of calcium chloride sufficient to precipitate calcium silicate within the cracks. The roof should then be allowed to dry. To reinforce the treatment further, a thin spray of sodium siliconate solution (3 percent) may be subsequently applied.

Pitch for a Timber Boarded North Light Roof in a Snow Fall Region

A slope of 1 : 1 may be provided with some water-proofing. In this case snow load need not be considered on roof, but high wind load has to be taken into account in the design. The slope may be reduced to 1 : 2 with proper bituminous felt water-proofing. But in this case snow load should be considered in the design.

Suitable Protective System to Protect Structural Steel in Coastal Region

Some of the protective systems to protect structural steel in coastal region are as follows :

(i) Sprayed aluminium metal of thickness 0.127 mm.

(ii) Sprayed aluminium metal of thickness 0.076 mm followed by a coat of zinc chromate primer, and finished with a durable top coat such as an alkyd gloss paint.

(iii) Zinc-rich epoxy primer and top coats based on epoxy-coal tar.

(iv) Two coats of red lead primer (BS:2523 type C) followed by two coats of exterior grade aluminium paint.

Before the application of any of the above mentioned systems the steel should be cleaned adequately by shot blasting or phosphate treatment.

Repairing and Averting Further Development of Crack in R.C.C. Members due to Rusting in Saline Atmosphere

On the spot study of such a problem is needed before suggesting a specific recommendation. Some guidelines for repair and protection are given below. Repair and protective measures will be effective only if the structure is dry before their application. Hence work should be done in dry season when humidity is at the lowest level.

(i) All loose mortar, concrete and salt deposits, if any, should be removed and exposed surface rubbed down. Only mortar which is firmly adhering to the reinforcement should be retained.

(ii) The exposed reinforcing rods should be derusted preferably by sand blasting. Degreasing is also desirable. Trichloroethylene may be used for the latter purpose.

(iii) A coat of a suitable epoxy resin should be applied on the derusted reinforcement as well as to concrete surfaces exposed in step(i) Epoxy resin which acts as an adhesive may be brushed on, but spray application is better. The

suppliers, for example M/s CIBA Dyes, Bombay, should be consulted regarding grade, period of cure etc.

(iv) Apply guniting with a rich mortar (1:3). Reinforcement should be given adequate cover (8 cm).

(v) Very narrow cracks may be sealed with a suitable epoxy resin which can be applied by gravity, vacuum or pressure technique. Suppliers may be consulted for details.

(vi) Finally the columns may be given a shielding treatment to keep out wind-borne spray and salt. The shield may be of bricks or tiles in rich mortar, preferably cavity type of construction.

Reasons for Breakages of Bricks during Manufacture and Firing

Breakages of bricks during manufacture can be attributed to the characteristic nature of the soil, improper processing of raw material for moulding bricks and defective firing. Lime bursting also contributes to poor durability in bricks. This occurs in fired bricks on exposure to weathering. It is not possible to assign any particular reason without examining the clay, the manufacturing process and the kiln. Some of the common causes of firing cracks, however, are:

(i) The clay is too sandy and lacks green strength.

(ii) The clay mineral present is montmorillonite (e.g. in black cotton soils).

(iii) Bricks are loaded in the kiln before they are fully dry.

(iv) Too fast heating or cooling of bricks.

(v) In-leakage of cold air in the firing or cooling zones of the kiln.

(vi) Careless handling of bricks during loading or unloading in the kiln.

(vii) Condensation of moisture in the pre-heating and drying zones of the kiln. If the chimneys are placed on the brick setting itself, water condensing in the chimney base may trickle down to the bricks set immediately below the chimneys and damage them.

Method of Damp-proofing the Walls of a Basement Hall

Waterproofing by plastering can be done by thoroughly wetting the walls and brushing a coat of neat portland cement. It must be freshly mixed in small quantities every few minutes and followed by the plaster before it has set. Immediately after this apply a plaster composed of equal parts of cement and sand, and a waterproofing compound (2 percent by weight of cement). The work should be done in dry weather.

Basement walls subjected to water pressure should be tanked on the outside with asphalt or with bitumen sheeting as per IS : 3067 on damp-proofing of basements.

Suitable Materials and Methods of Providing Expansion Joint

In order to be effective, expansion joints should extend throughout the height of the building, forming independent units. Joints should preferably extend through foundations also. Reinforcement should not pass through these expansion joints. Wall and roof joints must be made continuous over parapets. Thickness of joint varies from 0.625 cm to 3.75 cm. If a building is constructed in summer, 1 25cm is sufficient.

Materials used for expansion joints are bitumen impregnated preformed fibre filler, copper strips, non-extending cork, self expanding cork, sponge rubber, cork rubber etc.

Expansion joints in roof slabs are generally given over a wall or a beam, in which case asphalt or bitumen can be used in the expansion joints as shown in figs. 1 and 2. However, if expansion joint

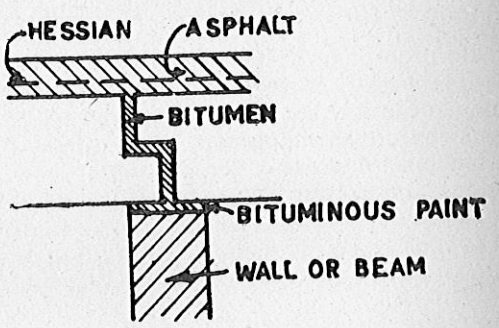

FIG. 1

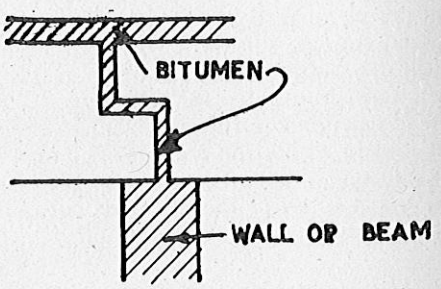

FIG. 2

is put in the mid-span of roof slab, it is advisable to use a crimped copper strip. Holes of 1.25 cm diameter at 20 cm centres should be punched near the edges of the copper strip to securely anchor it to the concrete. A copper strip is preferable to mastic or bitumen. The joints are shown in figs. 3,4 and 5.

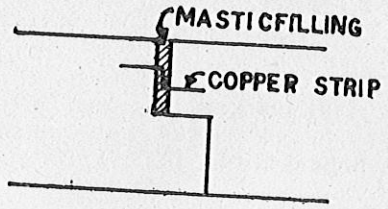

FIG. 3

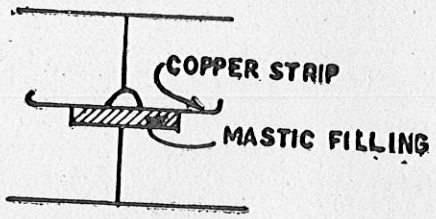

FIG. 4

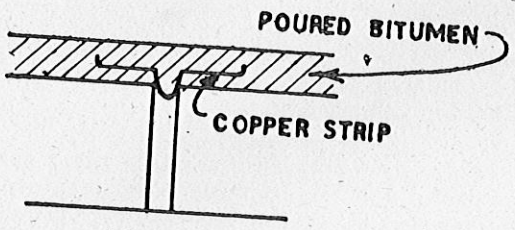

FIG. 5

Method to Clean and Prevent Vegetable Growth on Clay Tiles

The surface of tiles should first be soaked with water, preferably hot, and then the vegetable growths removed by scraping and wirebrushing. Chemical methods of cleaning the vegetable growth are not desirable. After cleaning the tiles the surfaces should be sterilised with a solution containing 30 gm copper carbonate and 340 ml solution of liquor ammonia in 4 5 litres of water. To prevent future accumulation of such growth this treatment may be repeated before the onset of every monsoon.

Use of Portland Blast Furnace Slag Cement in place of Normal Portland Cement

Portland blast furnace slag (PBFS) cement can be used for most of the applications for which normal portland cement is used. It is suitable for both plain and reinforced cement concrete structures. Strength and other physical requirements of PBFS cement as per IS : 455-1967 are similar to those of normal portland cement as per IS:269-1967. When cement develops strength, it generates heat and, in mass concrete structures, it is frequently necessary to instal elaborate cooling equipment to remove the heat in order to prevent cracking or deterioration of the concrete. PBFS cement does not liberate as much heat and the rate of liberation of heat is also much slower. Thus PBFS cement is particularly suitable for the construction of mass concrete structures such as concrete dams. PBFS cement requires a continued supply of water for good curing. It should therefore not be used under conditions where curing is likely to be unsatisfactory or where drying out of exposed sections can take place.

Drainage and Water-proofing of Flat R.C.C. Roof with Lightweight Material

Lightweight concrete can be used for insulation and to achieve the desired slope for drainage. Cement cinder (1:10) concrete may be used to achieve the desired slope since it is a cheaper material. It will have a density of about 1.28 gm/cm^3 against 1.92 gm/cm^3 for brick jelly. For water proofing the following treatment may be carried out.

(i) R C C. slab coated with hot bitumen of grade 85/40 at the rate of 1.73 kg/m^2 and blinded with 0.6 m^3 of coarse sand for 100 m^2 surface before laying cinder concrete.

(ii) Over cinder concrete either two coarses of flat tiles 1 to 1.25 cm thick set in gauged mortar (1:1:6) mixed with 5 percent crude oil by weight of cement should be used or bitumen felt should be laid as per IS:1346–1959.

Laying the Floor of a Vehicle Factory on Soil of Sufficient Bearing Capacity

Plain cement concrete floor (1 : 3 : 6 concrete) can be laid over boulder soling. For surface finish, plain concrete with surface hardener or a granolithic concrete finish may be used. Thickness of floor finish should be 2.5 cm when it is laid monolithically with base concrete and 3.8 cm where it is laid separately. Floor can be laid in either one or two layers. The floor finish should be laid within 3 hours of the laying of the concrete if laid monolithically (a shorter time is advisable in hot weather). The laying of the finishing layer monolithically is the most reliable method of construction and should be adopted whenever possible.

In order to reduce curling it is advisable to limit the area of the bay in relation to the thickness. When floor finish is laid monolithically on a concrete base of 15 cm thickness, the area of each bay should not exceed 28 sqm. If the base thickness is 10 cm the area of bay should not exceed 14 sqm. In case of floor finish laid separately the bay size should not exceed 14 sqm. It is advisable to limit the length of the bay to 1½ times the width to reduce the chances of cracking.

There is a demand for short notes summarising available information on selected building topics for the use of Engineers and Architects in India. To meet the need, this Institute is bringing out a series of Building Digests from time to time and the present one is the 88th in the series. Readers are requested to send to the Institute their experience of adopting the suggestions given in this Digest.

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