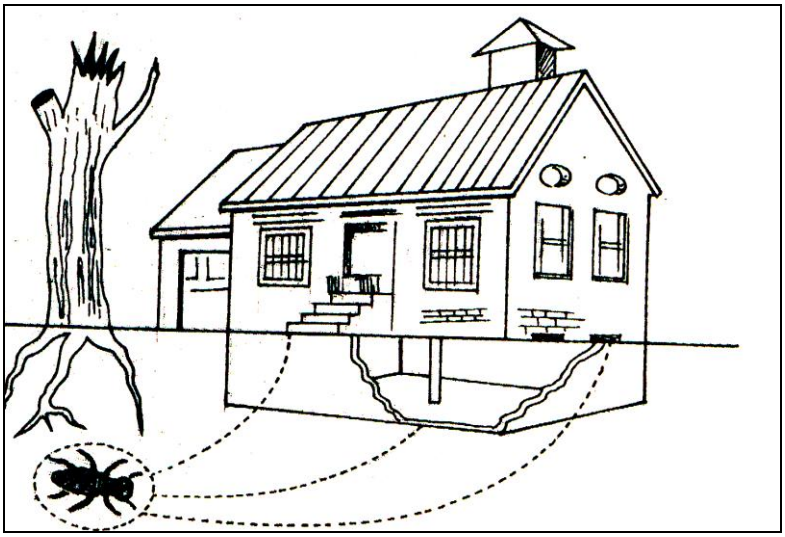
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सत्यमेव जयते

GOVERNMENT OF INDIA

MINISTRY OF RAILWAYS

ANTI-TERMITE TREATMENT



CAMTECH/2007/C/TERMITE/1.0

February - 2007

Centre

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ANTI - TERMITE TREATMENT



Preface

Indian Railway having a lot of stations, buildings, offices and residential accommodations is vast network spread all over India. Large number of buildings facing problem of termite attack, the need of a suitable ready reference book on anti termite treatment has been felt.

Objective of this book is to provide information about anti termite treatment, chemical to be used and rate of application etc. Every effort has been made to make this handbook useful to civil engineering personnel.

This handbook does not supersede any existing information from Railway Board, IRWM, RDSO etc. *This handbook is not statutory & contents are for the purpose of guidance only.* Most of the data, sketch and information mentioned herein available in some form or the other in various books or printed matter.

I am grateful for the assistance given by Shri D.K.Shrivastava, CTA/Civil/CAMTECH and Shri Ramesh Bhojwani, Console Operator, CAMTECH.

We welcome valuable suggestions from our readers for further improvements.

CAMTECH/Gwalior ***A. K.Dadarya***
Date :23.02.2007 ***Director/Civil***

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ISSUE OF CORRECTION SLIPS

The correction slips to be issued in future for this handbook will be numbered as follows:

CAMTECH/2007/C/TERMITE/1.0/CS. # XX date …….....

Where "XX" is the serial number of the concerned correction slip (starting from 01 onwards).

CORRECTION SLIPS ISSUED

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Chapter - 1

Introduction

1.0 General

Termites constitute a separate order of insects called 'ISEPTORA'. Although, they are commonly called white ants, they are not related to ants. The front pair of wings of the ants is longer than their hind pair whereas in termites, both pairs are equal. There is over 2300 species of termites of which about 220 are found in India. All these species are not considered to be serious pests.

A termite colony consists of a pair of reproductive, the so-called king and queen and a large number of sterile workers, soldiers, and nymphs. If, however, the queen is lost or destroyed, her place taken by a number of supplementary reproductive in some group of termites; thus by removing the queen, the colony will not be destroyed. The workers carry out all the work of the colony. The adult workers and soldiers are wingless.

The food of the termite is cellulosic material like timber, grass, stumps of dead trees, droppings of herbivorous animals, paper, etc. Once termites have found a suitable foothold in or near a building, they start spreading slowly from a central nest through underground and over ground galleries in the case of subterranean termites, and galleries within the structural member. Once they get direct access to them in the case of dry wood termites. In then search for food they by pass any obstacle like concrete or resistant timber to get a suitable food many metres away.

1.1 Types of Termites

According to their habits, termites can be divided into two well-defined groups.

(a) Subterranean or ground nesting termites
(b) Non-subterranean or wood nesting termites

(a) Subterranean termites or ground nesting termites

Subterranean termites require moisture to sustain their life. They normally need access to ground at all times. They build tunnels between their nest and source of food through covered runways. These covered tunnels provide humidity conditions thus preventing desiccation and protection against predators, darkness necessary for their movement and for maintaining contact with earth. The subterranean termites enter a building from ground level, under the foundation, working their way upwards through floors, destroyed all before them. So little is seen of these termite operations that some times the structural member attacked is found to be merely a shell with the inside completely riddled and eaten away.

(b) Non-subterranean wood nesting termites

Non- subterranean or wood nesting species comprise dry wood and damp wood termites. Dry wood termites, which predominate, are able to live even in fairly dry wood and with no contact with soil. These frequently construct nests within large dimensional timbers such as rafters, posts, door and window frames, etc. which they destroy, if not speedily exterminated. However, they are not as prevalent and common as subterranean termites, and are generally confined to coastal regions and interiors of eastern India.

1.2 Development of Termite Colony

At certain periods of the year, particularly after a few warm days followed by rain, emergence of winged adults on colonising flights occurs. This swarming, also called the nuptial flight, may take place any time during the monsoon or post monsoon period. The flight is short and most of the adults perish due to one reason or the other. The surviving termites soon find their mates, shed their wings and establish a colony if circumstances are favourable. This colony may increase in size comparatively rapidly. Any serious damage that may occur in a short time is perhaps due to heavy infestation in the initial stages due to large population of termites existing in the soil before the building is constructed.

1.3 Recognizing the presence of Termite Infestation in Buildings

Swarms of winged reproductive flying from the soil or wood are the first indication of termite infestation in a building. Often the actual flight may not be observed but the presence of wings discarded by them wills a positive indication of a well-established termite colony nearby. Termite damage is not always evident from the exterior in the case of subterranean termite, since they do not reduced wood to a powdery mass of push particles like some of the woodborers or dry wood termites. These termites are also recognised by the presence of earth-like shelter tubes, which afford them the runways between soil and their food.

Dry wood termites on the contrary may be recognised by their pellets of excreta. Non-subterranean termites excrete pellets of partly digested wood. These may be found in tunnels or on the floor underneath the member, which they have attacked. These termites may further be noticed by blisters on wood surfaces due to their forming chambers close to the surface by eating away the wood and leaving only a thin film of wood on the surface. Also the hollow sound on tapping structural timber will indicate their destructive activity inside.

Termite control in buildings is very important as the damage like to be caused by the termites is huge. Wood is one of the cellulosic materials which termites damage, cellulose forming their basic nutrient. They also damage materials of organic origin with a cellulosic base, household articles like furniture, furnishings, clothing, stationery etc. Termites are also known to damage non-cellulosic substances in their search for food. Termites damage rubber, leather, plastic, and neoprene as well as lead coating used for covering of underground cables. The widespread damage by termites, high constructional costs of buildings have necessitated evolving suitable measures for preventing access of termites to buildings.

In the absence of adequate data, it is rather difficult to estimate the exact loss due to termite attack. The total figure could, however, be assumed to run into several millions of rupees every year.

The termite breeds and spread so fast. Keeping in view the enormous damage causes by the termites it is desirable to take suitable measures for preventing ingress of termites into the buildings.

In situation where the termites have already attacked a building, suitable treatments should be given to ensure their extermination and to protect the building and its contents from further damage.

The commonly adopted method of preventing attack of termites to building consists in treating the soil beneath the building and around the foundation with soil insecticide. This treatment serves to create a chemical barrier between the ground and the parts of the building in contact with the ground thereby preventing the termites from approaching or attacking the building and its contents.

In this book we given suitable treatments for the various stages like pre constructional, constructional measures and also treatment for existing buildings or post constructional.

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Chapter - 2

Pre-constructional Treatment

2.0 General

This is process in which soil treatment is applied to a building during the early stages of its construction. Chemical treatment of soil for the protection of the building from attack by subterranean termites may be done by adopting possible type of treatments such as chemical barrier & soil treatment.

Chemical Barrier, which is the chemically treated soil in immediate contact with the foundation and floor structure of a building, which kills or repels termites thus forming a barrier, which is impervious to termite entry.

Soil Treatment, is the application of chemicals (toxicants) to the soil adjacent to and under a building to form a chemical barrier, which is lethal or repellent to termites.

2.1 Chemicals and Rate of Applications

Chemical toxic to subterranean termites may be used effectively to check termite's infestation in the soil. These are useful in the treatment of new building sites and may also be used to eradicate existing infestation in buildings and to prevent re infestation. The effectiveness and/or residual activity depends upon the choice of the chemicals, the dosages adopted and the thoroughness of application. The chemical solutions or emulsions are required to be dispersed uniformly in the soil and of the required strength so as to form an effective chemical barrier, which is lethal and repellent to termites.

2.1.1 Mound Treatment

If termites mounds are found within the plinth area of the buildings these should be destroyed be means of insecticides in the form of water suspension or emulsion which should be poured into the mounds at several places after breaking open the earthen structure and making holes with crow-bars. The quantity to be used will depend upon the size of the mound. For a mound volume of about 1 m^3, 4 litres of an emulsion in water of one percent Chlorphrifos 20 EC or Lindane 20 EC may be used.

2.1.2 Soil Treatment

Treating the soil beneath the building and around the foundations with a soil insecticide is a preventive measure. The purpose of the treatment is to create a chemical barrier between the ground from where termites come and woodwork or other cellulosic materials in the buildings. The following chemicals conforming to relevant IS in water emulsion are effective when applied uniformly over the area to be treated.

Chemical	Relevant Indian Standard	Concentration by weight, percent (active ingredient)
Chlorphrifos 20 EC	IS 8944	1.0
Lindane 20 EC	IS 632	1.0

2.2 Essential requirements for Barrier and Method of Application

2.2.1 Conditions of Formation

Barrier shall be complete and continuous under the whole of the structure to be protected. All foundations shall be fully surrounded by and in close contact with the barrier or treated soil. Each part of the area treated shall receive the prescribed dosage of chemical.

2.2.2 Time of Application

Soil treatment should start when foundation trenches and pits are ready to take mass concrete in foundations. Laying of mass concrete should start when the chemical emulsion has been absorbed by the soil and the surface is quite dry. Treatment should not be carried out when it is raining or when the soil is wet with rain or sub-soil water. The foregoing requirement applies also in the case of treatment to the filled earth surface within the plinth area before laying the sub-grade for the floor.

2.2.3 Disturbance

Once formed, treated, treated soil barriers shall not be disturbed. If, by chance, treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and completeness of the barrier system.

2.3 Pre-constructional Treatment

The pre-constructional treatment could be summarised as Site preparation and Soil treatments.

2.3.1 Site Preparation

The removal of trees, stumps, logs or roots from a building site reduce the hazards from subterranean termites. Similarly, the sub-floor area should be kept from all debris in which new colonies of termites might be established. In order to ensure uniform distribution of the treating solution and to assist penetration, some site preparation, may be necessary.

2.3.2 Heavy soils and sloping sites

On clay and other heavy soils where penetration is likely to be slow and on sloping sites where runoff of the treating solution is likely to occur, the surface of the soil should be scarified to a depth of at least 75 mm.

2.3.3 Sandy or Porous soils

On loose, sandy or porous soils where loss of treating solution through piping or excessive percolation is likely to occur, preliminary moistening to fill the capillary spaces in the soil is recommended.

2.3.4 Levelling, Excavations and filling

All sub floor levelling and grading should be completed; all cuttings, trenches and excavations should be completed with backfilling in place, borrowed fill must be free from organic debris and should be well compacted. If this is not done supplementary treatments should be made to complete the barrier.

2.3.5 Concrete formwork

All concrete formwork, levelling pegs, timber off-cuts and other builder's debris should be removed from the area to be treated.

2.4 Treatment

Treating the soil beneath the building and around the foundations with a soil insecticide is a preventive measure. The purpose of the treatment is to create a chemical barrier between the ground from where termites come and woodwork or other cellulosic materials in the buildings. The following chemicals conforming to relevant IS in water emulsion are effective when applied uniformly over the area to be treated.

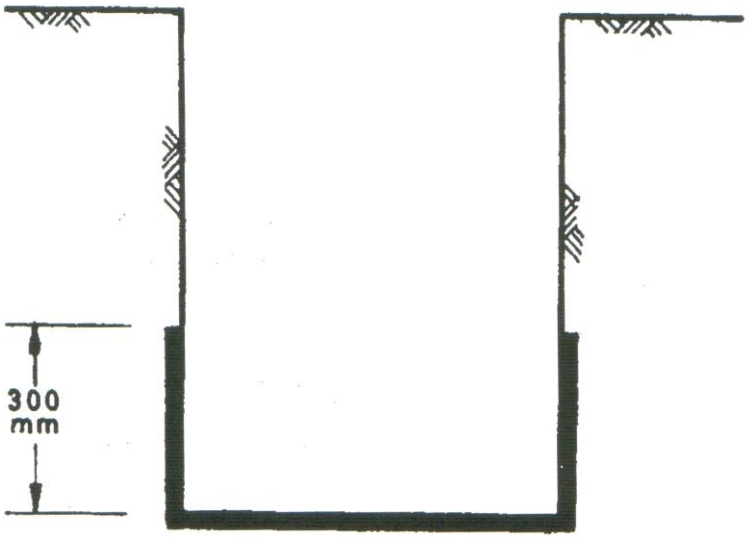
2.4.1 Soil treatment

The chemical emulsions described in above shall be applied uniformly at the prescribed rate in all the stages of treatment. A suitable hand operated compressed air sprayer or watering can should be used to facilitate uniform disposal of the chemical emulsion. On large jobs, a power sprayer may be used to save labour and time.

In the event of water logging of foundation, the water shall be pumped out and the chemical emulsion applied when the soil is absorbent. Treatment are to be given at various stages of building components are as follows.

(a) Treatment for masonry foundations and basements

The bottom surface and the sides (up to a height of about 300 mm) of the excavations made from masonry foundations and basements shall be treated with the chemical at the rate of 5 litre/m^2 surface area. (Figure - 1)

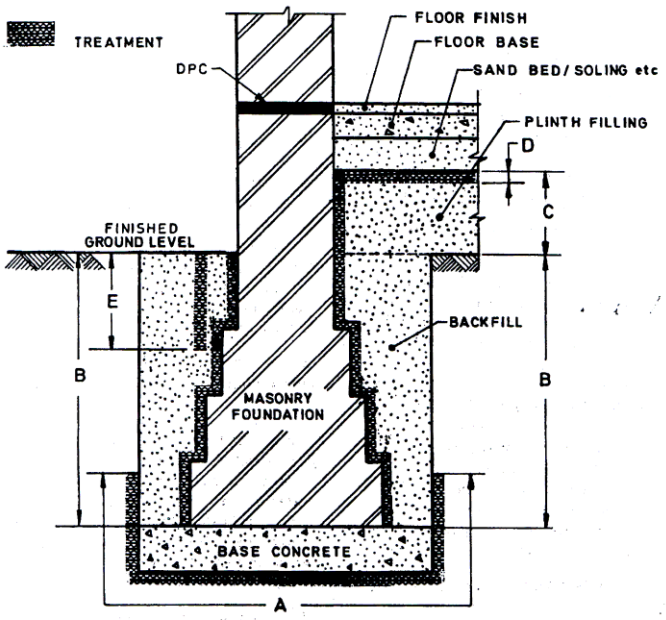


TREATMENT OF TRENCH BOTTOM AND SIDE

Figure – 1

After the masonry foundations and the retaining wall of the basements come up, the backfill in immediate contact with the foundation structure shall be treated at the rate of 7.5litre/m^2 of the vertical surface of the sub-structure for each side. If water is used for ramming the earth fill, the chemical treatment shall be carried out after the ramming operation is done by rodding the earth at 150 mm centres close to parallel to the wall surface and spraying the chemical emulsion at the above dosage.

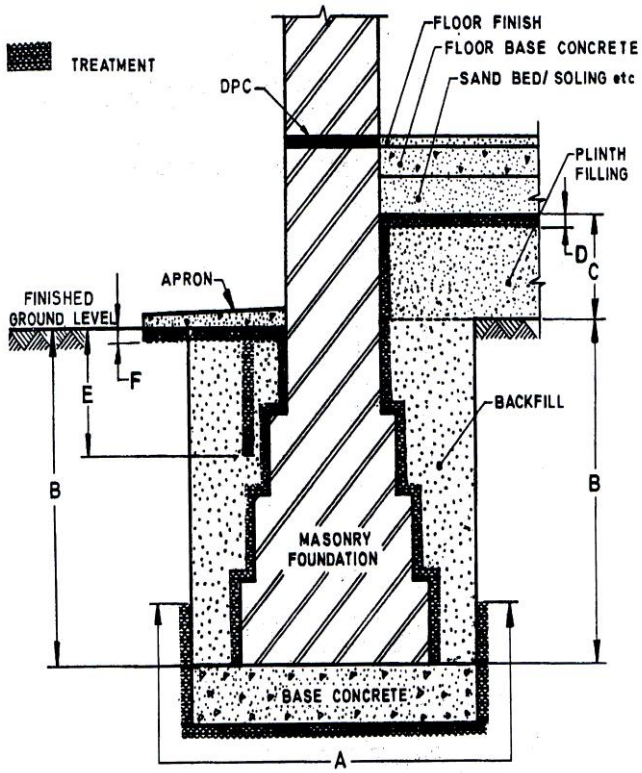
After the treatment, the soil should be tamped in place. The earth is usually in similar stages. The chemical emulsion shall be directed towards the masonry surfaces so that the earth in contact with these surfaces is well treated with the chemical. (Figure - 2 & 3)



A- Bottom and sides of trenches
B- Backfill in immediate contact with foundation walls.
C- Junction of wall and floor.
D- Top surface of plinth filling.
E- External perimeter of building.

TREATMENT FOR MASONRY FOUNDATION WITHOUT APRON

Figure – 2



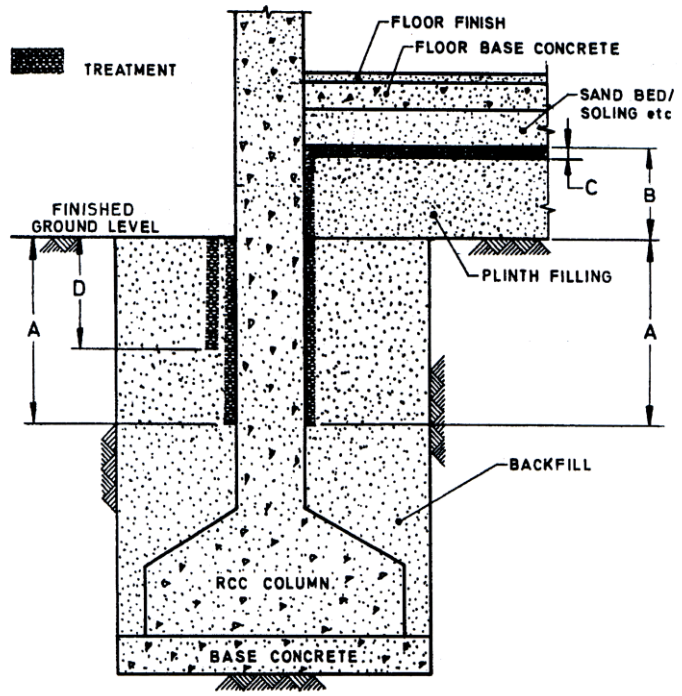
A- Bottom and sides of trenches
B- Backfill in immediate contact with foundation walls.
C- Junction of wall and floor.
D- Top surface of plinth filling.
E- External perimeter of building.
F- Soil below apron.

TREATMENT FOR MASONRY FOUNDATION WITH APRON ALONG EXTERNAL PERIMETER

Figure – 3

(b) Treatment for RCC Foundations and Basement

The treatment described in above applies essentially to masonry foundations where there are voids in the joints through which termites are able to seek entry into buildings. Hence the foundations require to be completely enveloped by a chemical barrier. In case of RCC foundations, the concrete is dense being a 1:2:4 (cement: fine aggregates: coarse aggregates, by volume) mix or richer, the termites are unable to penetrate it; it is therefore, unnecessary to start the treatment from the bottom of excavations. The treatment shall start at a depth of 500 mm below the ground level except when such ground level is raised or lowered by filling or cutting after the foundations have been cast. In such cases, the depth of 500 mm shall be determined from the new soil level resulting from the filling or cutting mentioned above, and soil in immediate contact with the vertical surfaces of RCC foundations shall be treated at the rate of 7.5 litre/m^2. (Figure -4)



A- Backfill in immediate contact with foundation structure.
B- Junction of wall and floor..
C- Top surface of plinth filling.
D- External perimeter of building.

TREATMENT FOR RCC FOUNDATION

Figure – 4

(c) Treatment of top surface of plinth filling

The top surface of the consolidated earth within plinth walls shall be treated with chemical emulsion at the rate of 5 litre/m^2 of the surface before the sand bed or sub-grade is laid. If the filled earth has been well rammed and the surface does not allow the emulsion to seep through, holes up to 50 to 75 mm deep at 150 mm centres both ways may be made with 12 mm diameter mild steel rod on the surface to facilitate saturation of the soil with the chemical emulsion.

(d) Treatment of junction of the wall and the floor

Special care shall be taken to establish continuity of the vertical chemical barrier on inner wall surface from ground level (where it had stopped with the treatment described above) up the level of the filled earth surface. To achieve this, a small channel 30 mm x 30 mm shall be made at all the junctions of wall and columns with the floor (before laying the sub-grade) the rod holes made in the channel up the ground level 150 mm apart and the iron rod moved backward and forward to break up the earth and chemical emulsion poured along the wall at the rate of 7.5 litre/m^2 of vertical wall or column surface so as to soak the soil right to the bottom. The soil should be tamped back in to the place after the operation.

(e) Treatment of soil along external perimeter of building

After the building is complete, the earth along the external perimeter of the building should be rodded at intervals of 150 mm and to a depth of 300 mm. The rods should be moved backward and forward parallel to the wall to break up the earth and chemical emulsion poured along the wall at the rate of 7.5 litre/m^2 of vertical surfaces. After the treatment, the

earth should be tamped back into the place. Should the earth outside the building be graded on completion of building, this treatment should be carried out on completion of such grading.

In the event of filling being more than 300 mm, the external perimeter treatment shall extend to the full depth of filling up the ground level so as to ensure continuity of the chemical barrier.

(g) Treatment of soil under apron along external perimeter of building

Top surface of the consolidated earth over which the apron is to be laid shall be treated with chemical emulsion at the rate of 5 litre/m^2 of the surface before the apron is laid. If consolidated earth does not allow emulsion to seep through, holes up to 50 to 75 mm deep at 150 mm diameter mild steel rod on the surface to facilitate saturation of the soil with the chemical emulsion (figure - 3)

(h) Treatment of walls retaining soil above floor level

Retaining walls like the basement walls or outer walls above the floor level retaining soil need to be protected by providing chemical barrier by treatment of retained soil in the immediate vicinity of the wall, so as to prevent entry of termites through the voids in masonry, cracks and crevices, etc above the floor level. The soil retained by the walls shall be treated at the rate of 7.5 litre/m^2 of the vertical surface so as to affect a continuous outer chemical barrier, in continuation with that of the one formed under treatment for masonry foundations and basements as above.

(i) Treatment of soil surrounding pipes, wastes and conduits

When pipes, wastes and conduits enter the soil inside the area of the foundations, soil surrounding the point of entry shall be loosened around each such pipe, waste or conduit for a distance of 150 mm and to depth of 75 mm before treatment is commenced. When they enter the soil external to the foundations, they shall be similarly treated at a distance of over 300 mm unless they stand clear of the walls of the building by about 75 mm.

(j) Treatment for expansion joints

Expansion joints at ground floor level are one of the biggest hazards for termite infestation. The soil beneath these joints should receive special attention when the treatment under "treatment of top surface of plinth filling" above is carried out. This treatment should be supplemented by treating through the expansion joint after the sub-grade has been laid at the rate of 2 litres per linear metre.

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Go to index

Chapter - 3

Constructional Measures

3.0 Preliminary Constructional Operations

3.1 Presence of Termites

The presence of termites in an area where it is proposed to construct buildings may be recognised by either carrying out stake test at the site or by depending upon the experience of the inhabitants of that area. The site shall then be graded so that the drainage is maintained all round the building. Care shall be taken to see are not accumulated or buried near the foundation or under the floor of the building. If the site is covered by soil rich in decaying matter, the top layer of soil (about 50 to 100 mm) shall be removed.

3.1.1 Stake Test

A number of stakes 50 X50 mm of timber species which are susceptible to termites, such as chirr, kail, mango, etc, should be buried at least 150 mm in the ground, spaced at 1 m centre to centre at the proposed construction site. After a period of 3-4 months, the stakes may be taken out and the infestation of termites observed. The presence of termites in the area will damage the stakes.

3.2 Measures for Elimination of Moisture

Drainage around the building site shall be ensured so that water does not stagnate in the vicinity of the building. Access of water to the underside of the ground floor shall be prevented through proper constructional measures, such as construction of concrete apron around the building.

3.3 Foundation and Sub-base of Ground Floor

Every effort shall be made in the construction of foundation so as to avoid voids. The earth and sand filling around the foundations and in the sub-base should be fully rammed so as to prevent any subsidence in the soil. Where joint less sub base is not possible, precautions may be taken to prevent cracks formation and the joints are sealed.

If concreting of sub-base has to be resumed on a surface which has hardened, such surfaces shall be roughened, swept clean, thoroughly wetted and covered with a 15 mm layer of mortar composed of cement and sand in the same ratio laid immediately before placing of concrete. When concrete has not fully hardened all laitance shall be removed by scrubbing the wet surface with wire or bristly brushes, care being taken to avoid dislodgement of particles of aggregates. The surface shall be thoroughly wetted and all free water removed and then coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150 mm in thickness and shall be well rammed against old work, particular attention being paid to corners and close spots.

3.4 Selection of Timber

Seasoned timber which is naturally durable in heartwood and which is treated to withstand the attack of subterranean termites, should be used in the building structure.

3.5 Design Consideration

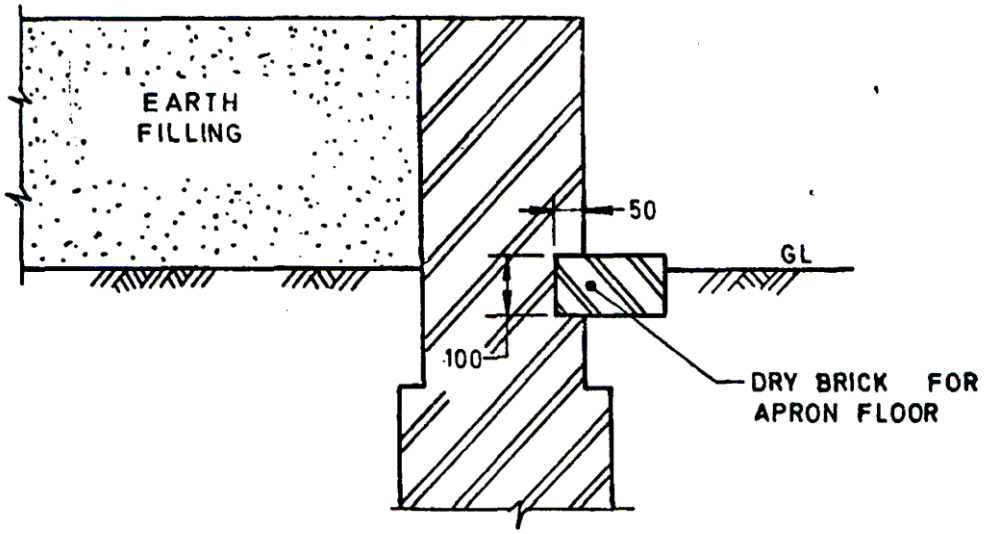
In a conventional building not protected by anti termite measures, the probability of attack by external entry of termites from plinth and foundation walls is very little, whereas the probability of internal attack of termites through floors and plinth filling is great.

Anti-termites constructional measures will only be effective if both external and internal protections are adequately provided. The external protection refers to prevention of termite access on the surrounding are of the building and internal protection refers to access from the soil under the floor area. For external protection, provision of metal shields or masonry grooves around the periphery of the building and cement concrete apron around the building is recommended. To act efficiently as a termite barrier, the shape of the metal shield shall be properly maintained. For internal protection the concrete sub-base shall be extended under the walls so that the entire plinth area is fully covered without any break. In case of depressed floors like lift wells, bathrooms, garage pits, etc, the sub-base should be continuous. Furthermore, the concrete flooring shall be laid over a layer of coarse sand (of size larger than 3 mm) as the sand layer checks the soil moisture rising up. The details of construction for protection against termites are covered below.

Termites generally do not penetrate masonry or concrete in which there are no voids. Masonry with lime mortar of mix leaner than 1:3 shall not be used to be in contact with where the concrete roof has not been laid. If the floor construction gives rise to vertical joints between the floor and the plinth masonry, these joints may be filled with heavy grade coal tar pitch conforming to IS to minimize the tendency of termites to infiltrate through these joints.

3.6 Anti-termite Constructional Methods

The following construction measures specified should be adopted for protection against subterranean termites originating both internally from within the plinth and externally from the area surrounding the building. Earth free from roots, dead leaves, or other organic matter shall be placed and compacted in successive horizontal layers of loose material not more than 200 mm thick. Dry brick shall be inserted at least 50 mm in brick masonry for providing apron floor all-round the periphery. (Figure –5)

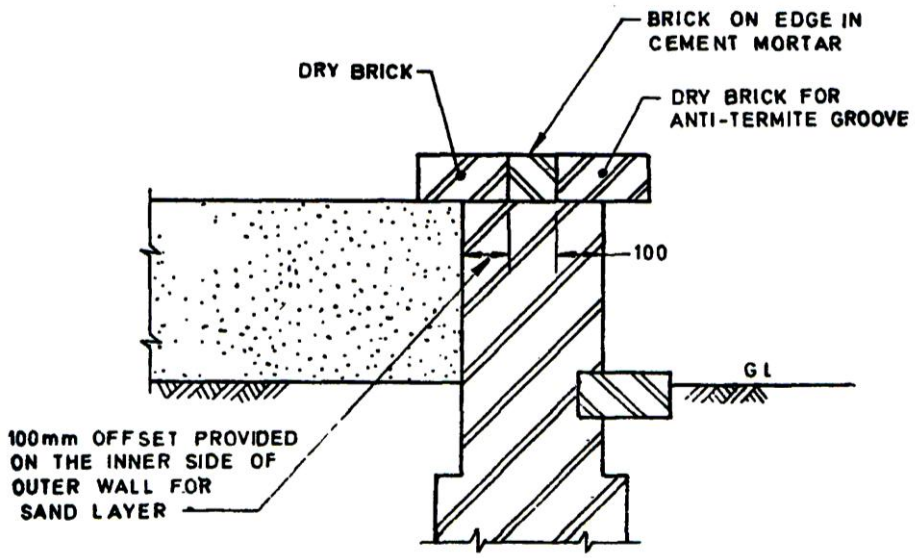


All the dimensions in millimeters

ANTI TERMITE CONSTRUCTION – STAGE 1

Figure – 5

Brick on edge masonry in cement mortar shall be laid on the plinth wall. Dry brick shall be placed on the inner side of plinth wall for getting anticipated offset space for coarse sand and on the other side for in staining anti-termite masonry groove. In the case intermediate walls, dry bricks are placed on either side of the brick on edge masonry for getting offset space for coarse sand layer. (Figure –6)



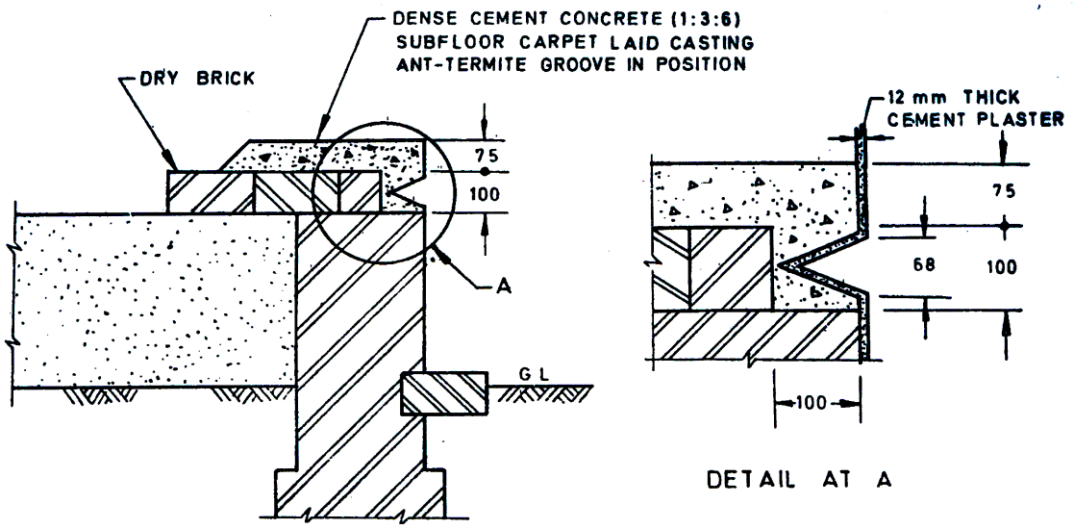
All the dimensions in millimeters

ANTI TERMITE CONSTRUCTION – STAGE 2

Figure – 6

The dry brick for the anti-termite groove shall be taken out and dense cement concrete 1:3:6 (1 cement: 3 sand : 6 coarse aggregate, by volume) sub-floor carpet shall be laid casting the anti-termite groove in position. In case of internal partition walls, the cement concrete sub-

floor shall be laid on either side over the dry bricks to sufficient extent for getting staggered vertical joints over the joint of plinth wall and earth filling. (Figure –7)

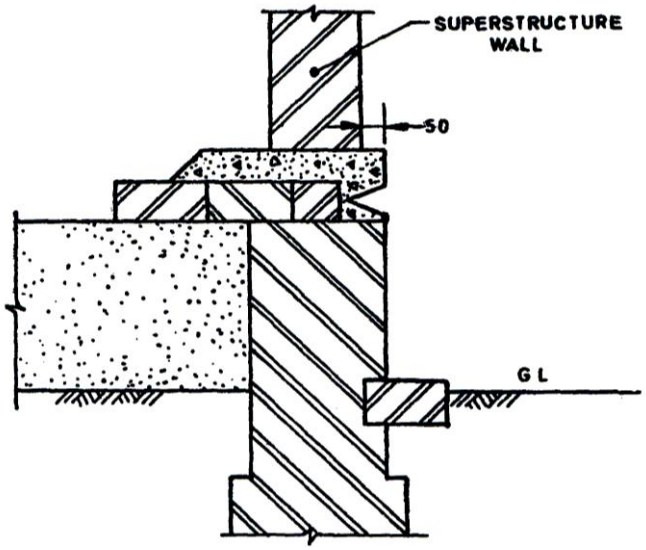


All the dimensions in millimeters

ANTI TERMITE CONSTRUCTION – STAGE 3

Figure – 7

Superstructure masonry shall be raised over the dense cement concrete sub-floor carpet and overhead jobs completed. (Figure –8)

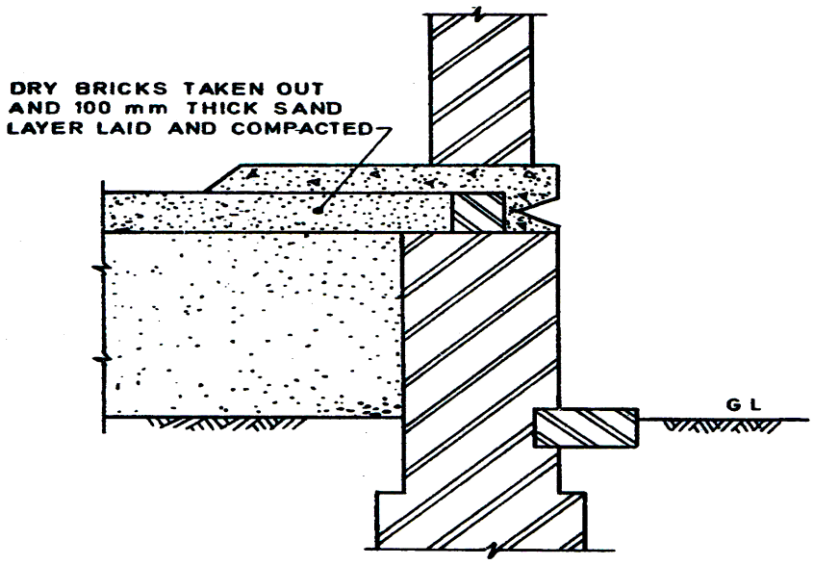


All the dimensions in millimeters

ANTI TERMITE CONSTRUCTION – STAGE 4

Figure – 8

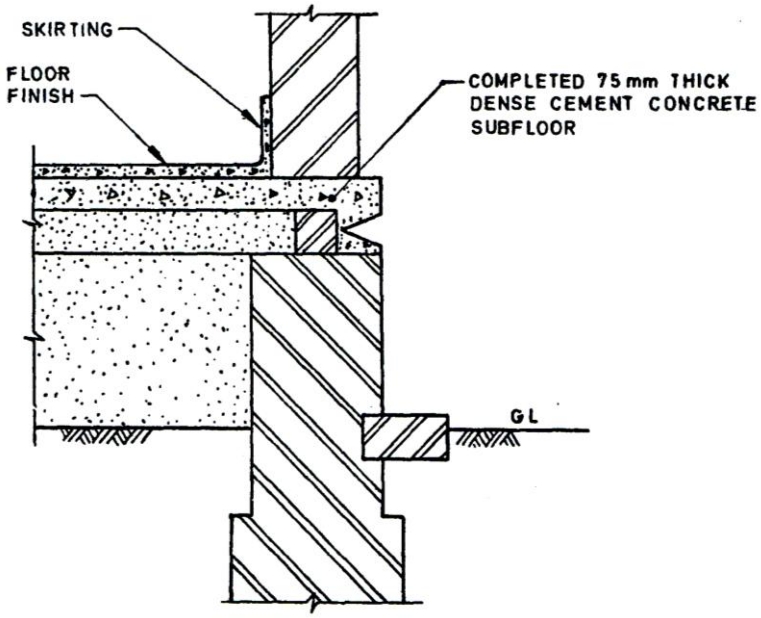
The dry brick for coarse sand layer shall be removed and graded sand (of size 3 to 5 mm) layer at least 100 mm thick shall be compacted over the earth filling and underneath the partially laid dense cement concrete sub-floor carpet. (Figure –9)



ANTI TERMITE CONSTRUCTION – STAGE 5

Figure – 9

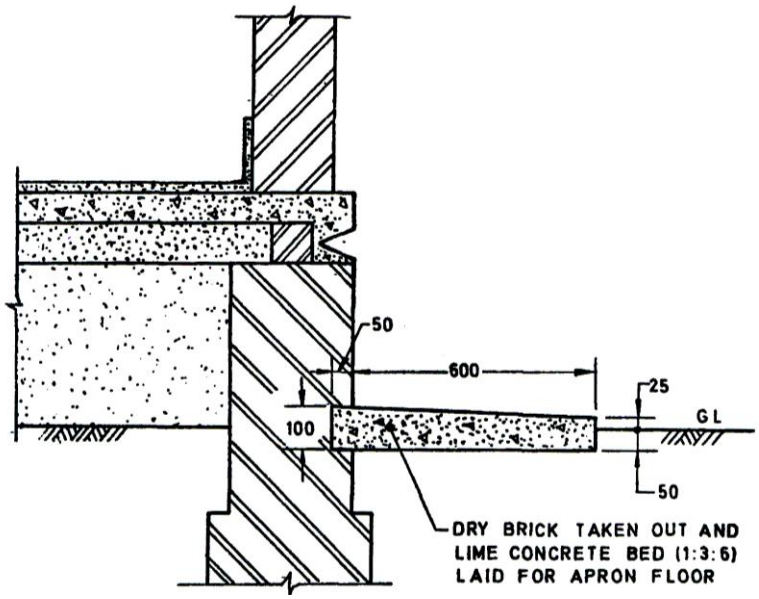
Dense cement concrete (1:3:6 mix) sub-floor at least 75 mm thick shall be laid over the sand filling. Necessary finish may be provided to the cement concrete sub-floor carpet. (Figure – 10)



ANTI TERMITE CONSTRUCTION – STAGE 6

Figure – 10

Dry brick provided for apron floor shall be taken out and 600 mm wide formation of earth in 1:30 slope shall be made. Over the formation, 75 mm thick lime concrete 1:3:6 (1 lime: 3 sand: 6 coarse aggregate, by volume) shall be laid. (Figure –11)

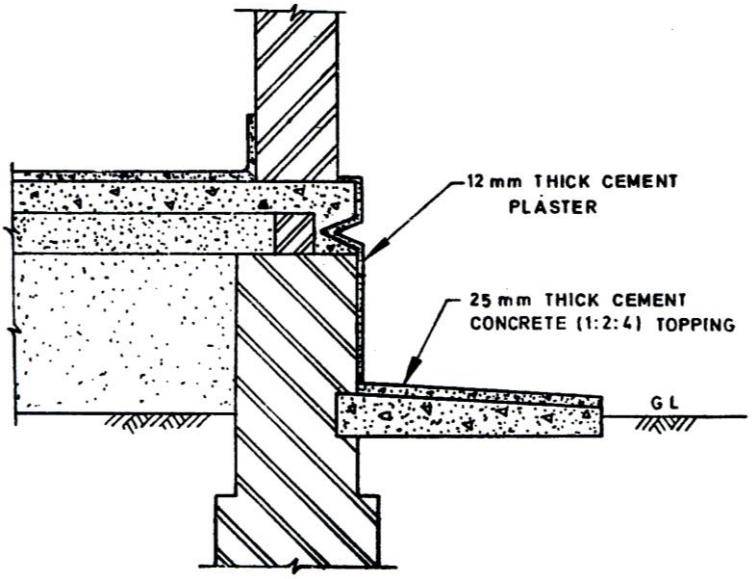


All the dimensions in millimeters

ANTI TERMITE CONSTRUCTION – STAGE 7

Figure – 11

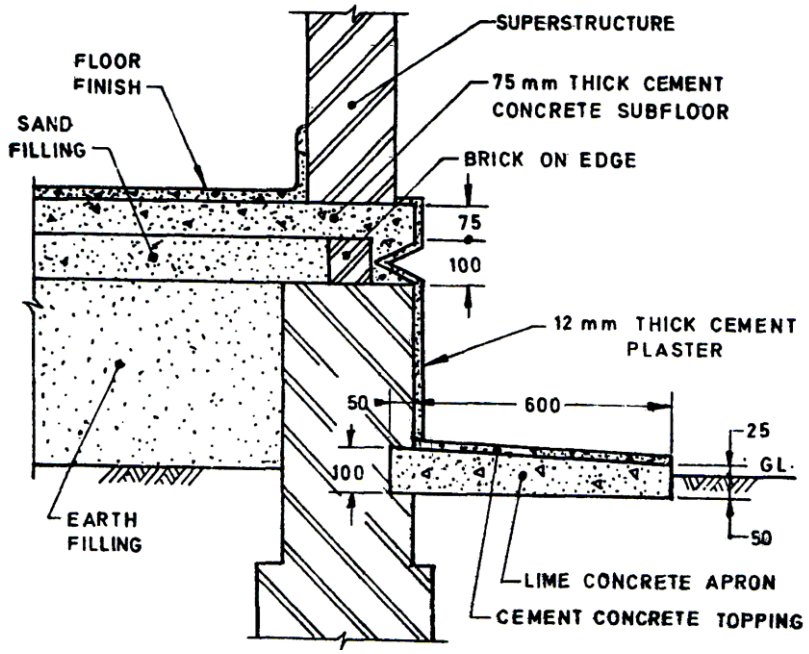
Over the 75 mm thick lime concrete bed at least 25 mm thick cement concrete topping 1:2:4 (1 cement: 2 sand: 4 fine aggregate, by volume) shall be laid and 12 mm thick cement plaster shall be applied on foundation and plinth. (Figure –12)



ANTI TERMITE CONSTRUCTION - STAGE 8

Figure – 12

The final recommendations incorporating the constructional details given above are shown in figure - 13.

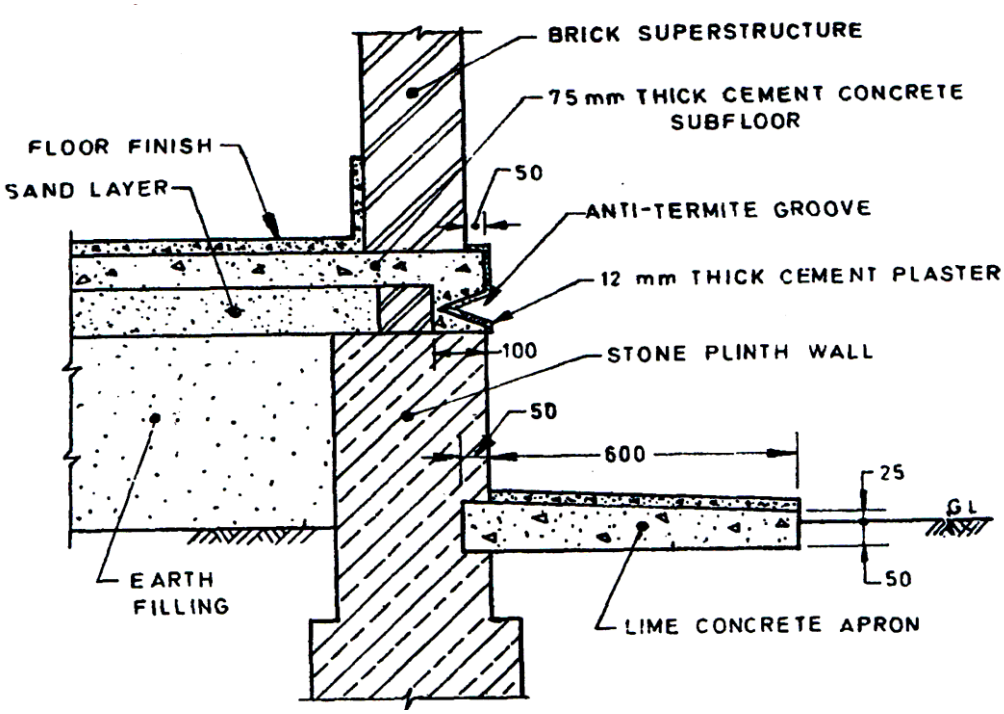


All the dimensions in millimeters

ANTI TERMITE CONSTRUCTION – FINAL RECOMMENDATIONS

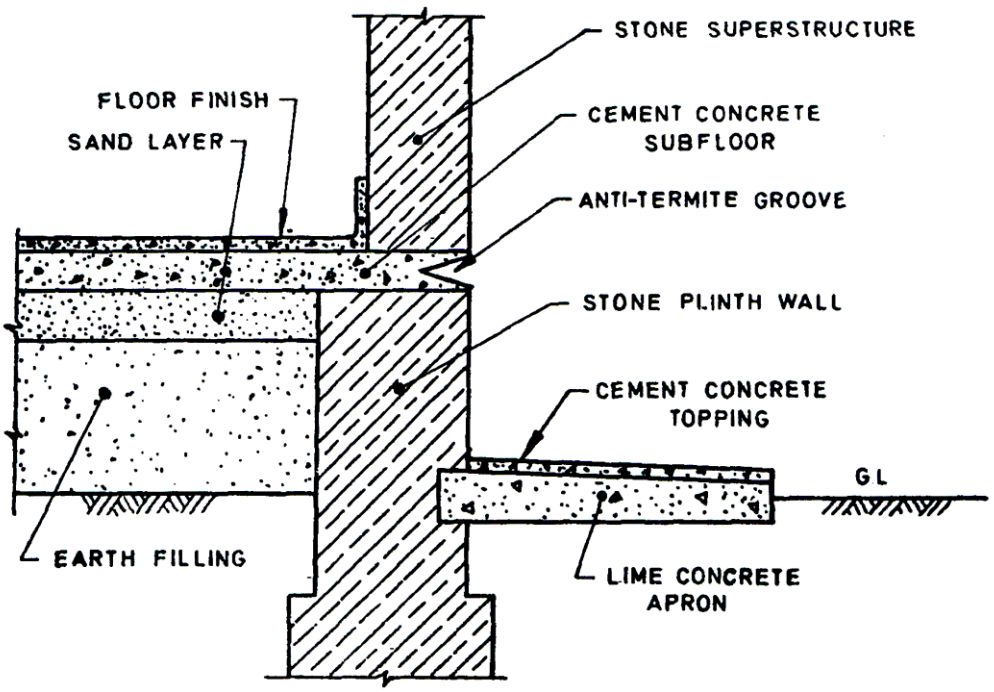
Figure – 13

The anti termite constructional details recommended in the case of stone masonry are shown in figure - 14 & 15.



All dimensions in millimeters

Figure – 14



ANTI TERMITE CONSTRUCTION IN STONE MASONRY WALL

Figure – 15

3.7 Installation of Termite Shields, Caps and Frames

Function of termite shields, caps, frames and masonry grooves – The function of termite shields, caps, frames and masonry grooves is to cause termites to build their entry tunnels in positions where they can be detected during regular or to her inspections and so facilitate appropriate control measures being taken. It is stressed that to give complete protection, regular and periodical inspections of the barriers are always necessary. The time interval between inspections should be determined by the local hazards.

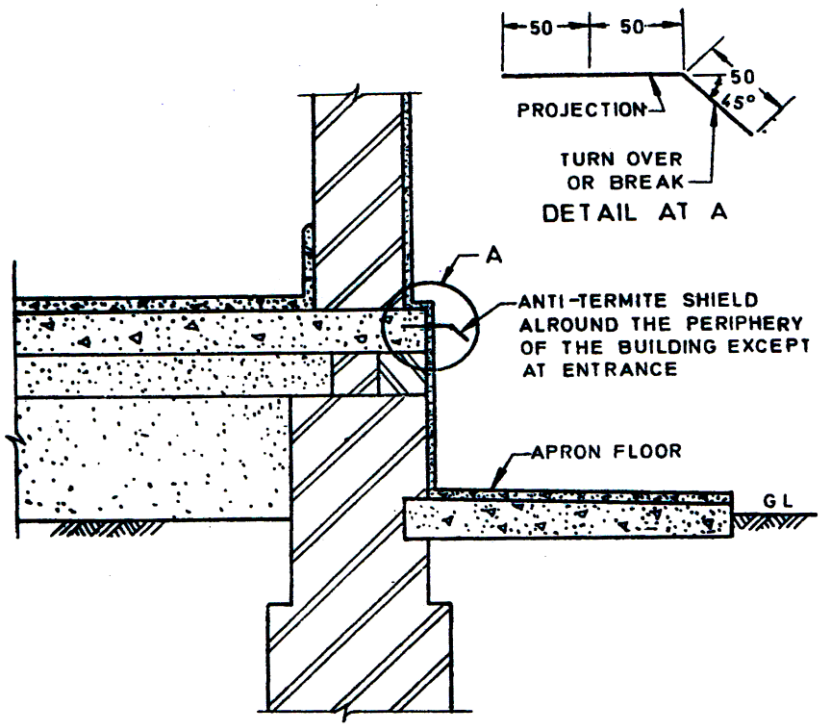
3.7.1 Termite shields

Termite shields may be installed round the periphery of a building where infestation of termite is high. Provision of metal shields takes care of external protection only. For the metal shield to function effectively, it is essential that it is installed correctly and the shape of the shield shall be maintained property, which requires periodical inspection after installation.

Note: *The initial high cost of installation, frequent maintenance, occasional replacement after installation and also sharp edge of the metal shield projecting out causing injuries to the children playing near by, are some of the disadvantages for adopting metal shields in residential buildings. The metal termite shields may be conveniently used for grain storage godowns, warehouses, etc.*

Termite shield shall be made out of galvanised steel sheets of thickness not more than 0.63 mm and confirming to IS 277-1969. At least 50 mm width of termite shield shall be properly embedded in the cement concrete sub-floor with 50 mm horizontal projection on the external side of the wall and further projection of 50 mm bent downwards at an angle of 45^0. The 50

mm embedment of termite shield in concrete sub-floor facilitates its easy replacement whenever required. (Figure –16)

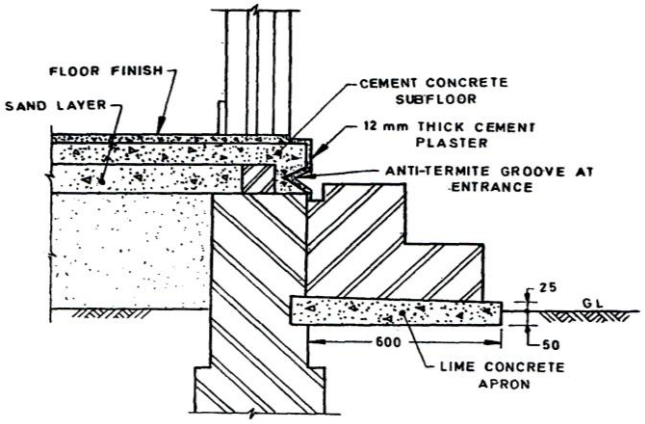


All the dimensions in millimeters

TERMITE SHIELD AT PLINTH LAVEL

Figure – 16

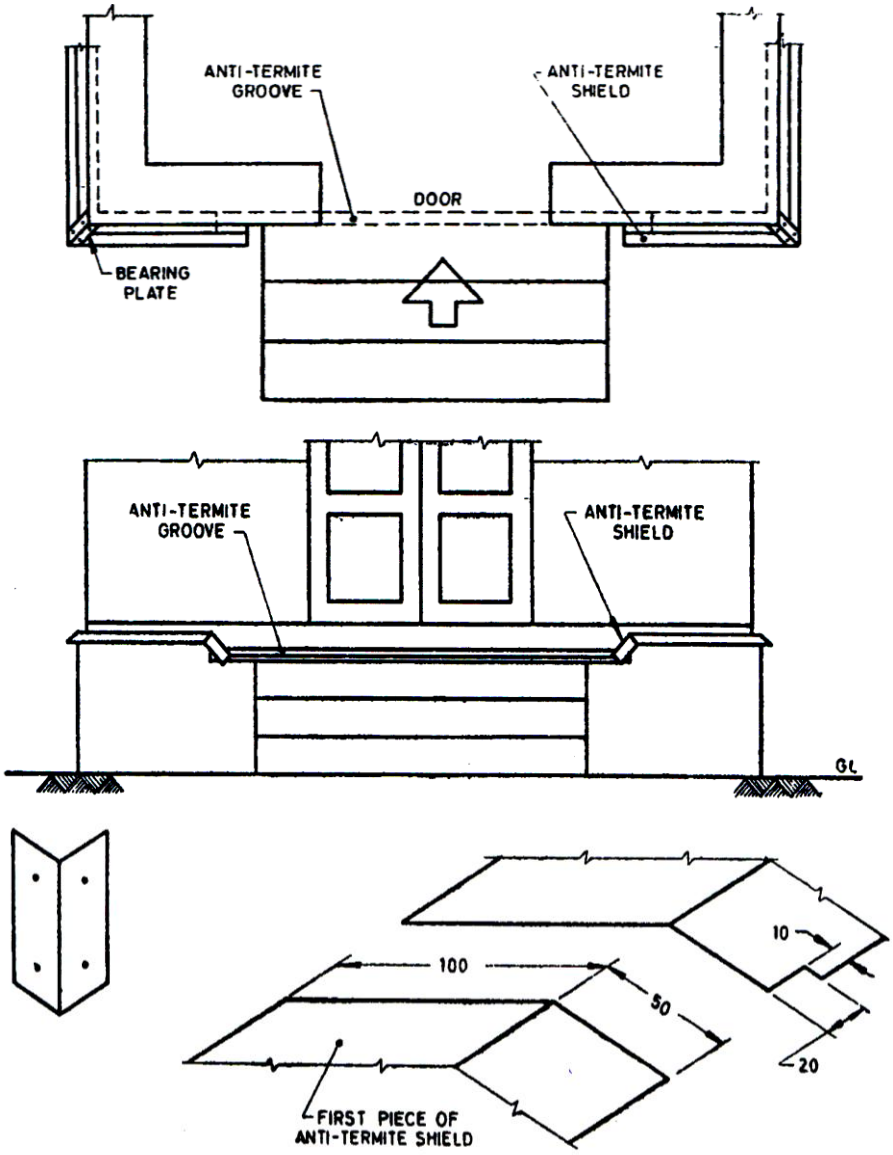
At entrance and ways, where installation of termite shields is not practicable anti termites masonry grooves is installed. (Figure 17) Necessary construction arrangements shall be made at the junction of termite shield and groove to ensure that entry of termite is prevented. (Figure - 18)



All the dimensions in millimeters

ANTI TERMITE GROOVE AT ENTRANCE

Figure – 17



All the dimensions in millimeters

CONSTRUCTION ARRANGEMENT AT THE JUNCTION OF TERMITE SHIELD AND GROOVE

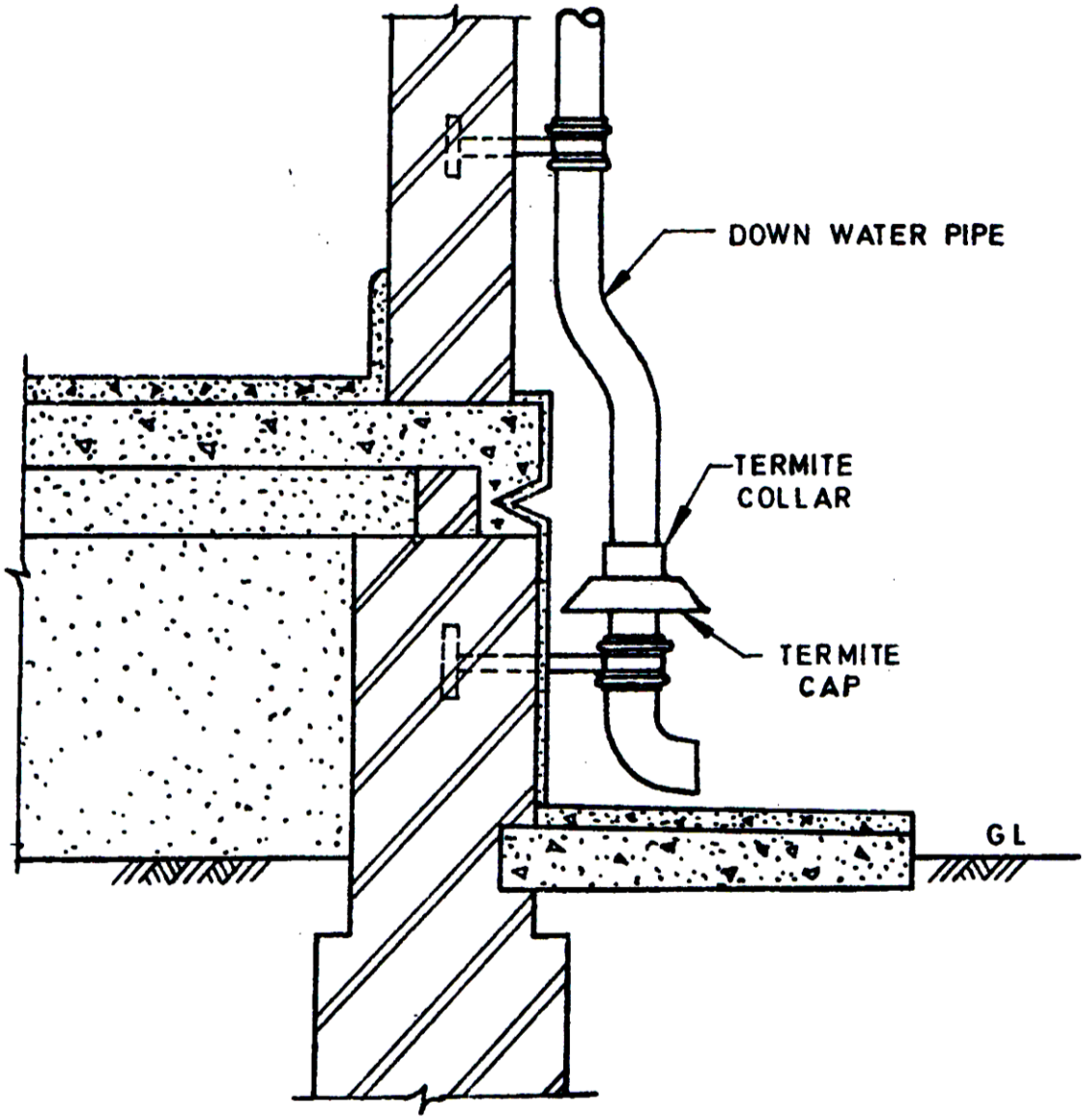
Figure – 18

Joints in termite shields shall be made by lapping ends at least 20 mm lengthwise and soldering them. A piece of 20 X 10 mm shall be cut off from the lower end portion of one of the pieces before soldering the two ends so that the thickness of the free edge remains constant throughout as specified. It is necessary that the free edge is maintained thin, as termites are capable of negotiating around blunt edges.

3.7.2 Installation of termite caps

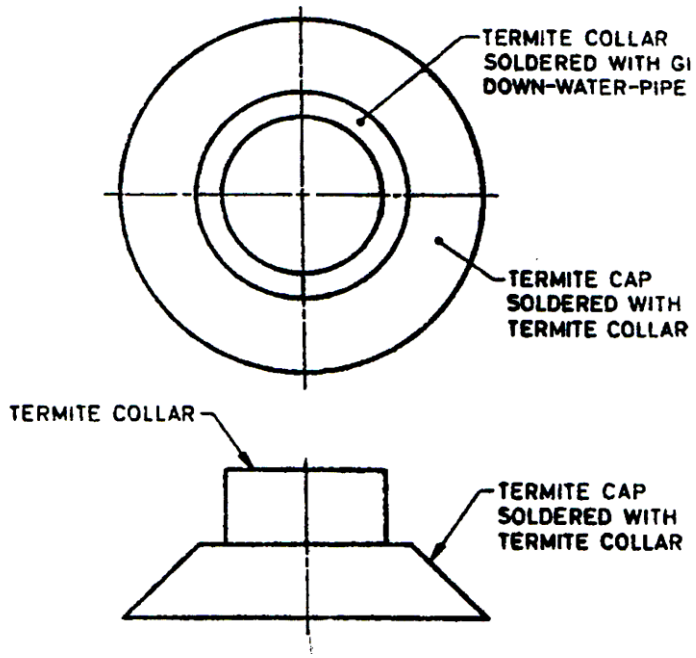
Termite caps shall be used in the case of basement with support where timber sections occur over them in the case of columns. The termite caps shall be kept at plinth level covering the whole of the section in the plinth below providing the necessary projection of 50 mm beyond the outer edge of the column on all sides and also the turnover of 50 mm width.

In case of down-water pipes the termite cap shall be fitted on the pipe in the form of a ring. The projection and turnover shall be the same as specified for termite shields in general. The bottom portion of down-water-pipe should be at least 200 mm away from wall. (Figure –19 & 20)

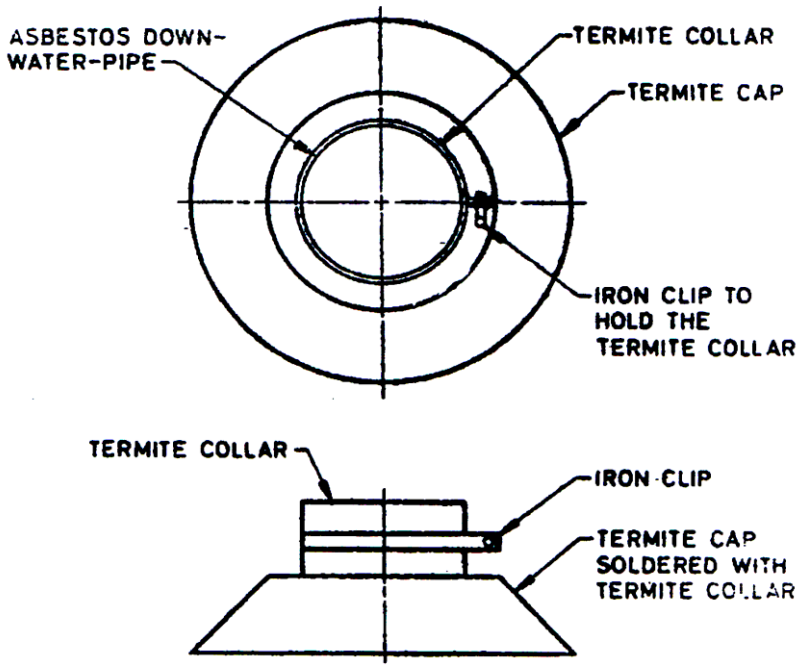


DETAILS SHOWING TERMITE COLLAR AND TERMITE CAP

Figure – 19



DETAILS OF TERMITE CAP WITH GI DOWN-WATER-PIPE



DETAILS OF TERMITE CAP WITH ASBESTOS CEMENT DOWN WATER PIPE

Figure – 20

3.7.3 Installation of Termite Frames

Termite frames are shaped out of metal sheet and are used to cover all the sides of an opening. Termite frames shall have its edges projecting and bent as in the case of termite shields, to serve as an external barrier against termite entry. Termite frames shall be provided in the case of honey-combed wall openings or other ventilators in walls of basements. They shall project 50 mm beyond all sides of ventilator and shall also have the turnover of 50 mm.

Where holding down bolts pass through shields the joint between the bolt and shield shall be sung fit and coal tar pitch shall be used to seal the joint. Similarly termite caps fitted to pipes shall be tight fit on the pipe and coal tar pitch shall be applied at the joint to close any gaps between the pipe and the cap.

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Go to index

Chapter - 4

Treatment for Existing Buildings

4.0 Termite Detection in Buildings

A termite control operator must be able to find out the existence or termites in a building. A certain amount of technical knowledge and experience is necessary to determine if there is termite infestation in a building, particularly in the early stages when the attack has just started or it is confined to remote locations in the building. The operator should know the habits termites in general, the manner in which they work, the places where they are likely to be found and the signs which go to show that they are present.

A bright light is essential for termite inspection. A bright electric bulb protected by a wire cage and an extension cord would be useful. If this is not available, a flashlight may be used. The operator should also carry with him a knife with a sharp pointed blade to probe into woodwork.

As subterranean termites emerge from the soil to seek entry into a building, the portion of the building in contact with or adjacent to the soil should be the first to be inspected. These would include the basement, ground floor, steps leading from the ground, columns, porches, etc. Locations where there is dampness or where humid conditions prevail, such as bathrooms, lavatories, or other places where there are leaky pipes or drains are likely places of termite infestation. Woodwork at basement or ground floor level, particularly in damp locations, should be examined. The places which demand careful scrutiny are the points where woodwork is embedded in the floor or in the wall as termites seek entry through crevices in the concrete or brickwork in which the wooden frames are fixed.

The signs of presence of termites in a building are the tell-tale shelter tubes which are termites runways. As termites have soft bodies, which cannot withstand the drying effects of air, they move about in sheltered mud tubes, which they build when they have to cross open spaces, which are exposed, to the air. These are, therefore, not easily noticed and may go undetected except to the trained eye of an experienced termite control operator.

Termites work inside timber without breaking the surface. They are known to eat away a board completely leaving only the film of paint on the surface. If they break open the surface at any point accidentally, they quickly seal it up, and their activity continues beneath the surface without detection.

Woodwork in the vulnerable locations mentioned above should be carefully examined to find out if termites have attacked the wood. In the absence of any external signs of damage, the woodwork should be tapped to see if it is hollow having been eaten up from inside. A sharp pointed instrument or the sharp end of a pen-knife may be used to pierce the woodwork to determine if there are cavities in the wood.

There is nothing as certain as termite runways to establish that infestation exists. However, an operator should be able to distinguish between old runways and new ones. The old runways are brittle and break away easily while the new ones will be moist and stronger. It is not advisable to remove or destroy termite runways during inspection.

If termite activity is noticed in any one location of a building, it becomes necessary to make a thorough search in the entire building. In a multi-storeyed building, if infestation has occurred at the ground floor, all the upper floors must be subjected to thorough scrutiny. There have been instances where termite activity was noticed in one of the upper floors, with no visible signs of attack in the lower floors except perhaps the ground floor. This is explained by the fact that the termites had travelled from floor to floor under cover through lift wells or casings covering electric wiring, telephone cables, utility pipes, etc. Such covered conduits should, therefore, be examined carefully as they are ideal routes for termites. Other places which should be examined are woodwork, wooden panelling on staircases and walls, are behind picture frames huge on walls, false ceiling, special attention being paid to locations where dampness prevails, such as bathrooms, toilets and kitchen sinks.

Whenever termite infestation is detected in a building, appropriate steps should be adopted for their extermination. Once the termites have ingress into the building, they keep on multiplying and destroy the wooden and cellulosic materials, and as such it becomes essential to take measures for protection against termites. Periodic inspection and control measures are the most important steps in checking termite damage to buildings. Often, the damage may be slight and the removal of affected material and breaking off the shelter tubes constructed by termites may suffice to protect the property. In other cases these simple remedies may have to be supplemented by the application of chemical toxicants. The chemical treatment to soil gives good results if it is carried out properly. The success of the treatment depends largely on the extent to which the prescribed methods of treatment are feasible in a particular building. This again depends upon the type of construction of the building, the amount of woodwork in it and the manner in which the woodwork is installed. If there are signs of reinfestation after treatment, it may be necessary to repeat appropriate treatment depending upon the termite infestation.

The post construction treatment measures to be provided in an existing building for protection from attack by subterranean termites. The application of chemical insecticides to buildings to eliminate existing termite infestation and to make them resistant to termite attack.

Wood treatment i.e. the application of chemical termiticides to woodwork and wood based materials to eliminate existing termite infestation and to make it resistant to termite attack.

Following *chemicals* conforming to relevant Indian Standard in water emulsion may be used for the soil treatment in order to protect a building form termite attack.

Chemical	**Relevant Indian Standard**	**Concentration by weight, percent (active ingredient)**
Chlorphrifos 20 EC	IS 8944	1.0
Lindane 20 EC	IS 632	1.0

Oil or kerosene based solution of Chlorphrifos 20 EC or Lindane 20 EC 1.0 percent (by weight) concentration is useful for treatment of wood.

4.1 Post Construction Treatment

4.1.1 Inspection

Before undertaking any type of treatment, a thorough inspection shall be made of the infestation in the building with a view to determine the extent to which it has spread, and the routes of entry of termites into the building. A study of structure of the foundation and the ground floor helps in finding out the routes of entry of termites from the soil and also in deciding the mode of treatment.

4.1.2 Extermination of termites in building

After making a study of the infestation in the building, the next step is to exterminate the termites located inside the building. This operation shall be carried out in a thorough manner, seeking the termites in their hideouts, such as ceilings behind wooden panelling, inside electrical wiring battens, conduits, switchboards and similar locations. Recourse shall be taken to inject chemicals as given above. All traces of termite tubes shall be removed so that any fresh infestation, which might occur at a later date, may be easily detected.

4.2 Preventive Measures

4.2.1 Soil treatment

The object of soil treatment is to establish chemical (toxic) barrier between the termites in the soil and the building to be protected. Basically, it consists of treating the soil adjacent to or under the building with a chemical toxicant, which kills or repels termites. Water emulsions of one of the chemical given above shall be used in soil treatment and applied uniformly at the prescribed rate.

4.2.2 Treatment along outside of foundations

The soil is contact with the external wall of the building shall be treated with chemical emulsion at the rate of 7.5 litres/m^2 of the vertical surface of the sub-structure to a depth of 300 mm. To facilitate this treatment a shallow channel shall be excavated along and close to the wall at 1.75 litres per running metre of the channel. Rodding with 12 mm diameter mild steel rods at 150 mm apart shall be done in the channel if necessary for uniform dispersal of the chemical to 300 mm depth from the ground level. The balance chemical of 0.5 litre per running metre shall then be used to treat the backfill earth as it is returned to the channel directing the spray toward the wall surface. If there is a concrete or masonry apron around the building, approximately 12 mm diameter holes shall be drilled as close as possible to the plinth wall at 300 mm apart, deep enough to reach the soil below, and the chemical emulsion pumped into these holes to soak the soil below at a rate of 2.25 litre per linear metre.

Note : In soil which do not allow percolation of chemicals to the desired depth, the uniform dispersal of the chemical to a depth of 300 mm shall be obtained by suitably modifying the mode of treatment depending on the site condition. The dosage of 2.25 litres per linear metre shall however remain the same.

The treatment described in above applies to masonry foundations. In the case of RCC foundation, the soil (backfill earth) in contact with the column sides and plinth beams along the external perimeter of the building shall be treated with chemical emulsion at the rate of 7.5 l/m^2 of the vertical surfaces of the structure. To facilitate this treatment, trenches shall be excavated equal to the width of the shovel exposing the sides of the column and plinth beams up to a depth of 300 mm or up to the bottom of the plinth beam if this level is less than 300 mm. The chemical emulsion shall be sprayed on the backfill earth as it is returned in to the trench directing the spray against the concrete surface of the beam of column as the case may be. If there is a concrete or masonry apron around the building, approximately 12 mm diameter holes shall be drilled as close as possible to the plinth wall about 300 mm apart, deep enough to reach the soil below and the chemical emulsion pumped into these holes to soak the soil below at a rate of 2.25 litre per linear metre.

4.2.3 Treatment of soil under floors

The points where the termites are likely to seek entry through the floor are the cracks at the following locations:

(a) At the junction of the floor and walls as a result of shrinkage or the concrete;
(b) On the floor surface owing to construction defects;
(c) At construction joints in a concrete floor, cast in sections; and
(d) Expansion joints in the floor.

Chemical treatment should be provided within the plinth area of the ground floor of the structure wherever such cracks are noticed, by drilling vertically 12 mm holes at the junction of floor and walls, constructional and expansion joints mentioned above at 300 mm interval to reach the soil below. Chemical emulsion shall be squirted into these holes using a hand operated pressure pump until refusal or to a maximum of one litre per hole. The holes shall be sealed. In general, the idea is to change the soil below the floor at the locations of cracks with toxicants so that termites in the soil are denied access through such cracks and opening in the floor.

4.2.4 Treatment to voids in masonry

Termites are known to seek entry into masonry foundations and work their way up through voids in the masonry and enter the building at ground and upper floors. The movement of the termites through the masonry walls may be arrested by drilling holes in the masonry walls at plinth level and squirting chemical emulsion into the holes to soak the masonry. The holes shall be drilled at a downward angle of about 45^0 preferably from both sides of the plinth wall at approximately 300 mm intervals and emulsion squirted through these holes to soak the masonry using a hand operated pressure pump. This treatment shall also be extended to internal walls having foundations in the soil. Holes shall also be drilled at critical points, such as wall corners and where door and window frames are embedded in the masonry or floor at

ground. Emulsion shall be squirted through the holes till refusal or to a maximum of one litre per hole. The treated holes shall then be sealed.

4.2.5 Treatment at points of contact of woodwork

All existing woodwork in the building which is in contact with the floor or walls and which is in contact with the floor or walls and which is infested by termites, shall be treated by spraying at the points of contacts with the adjoining masonry with the chemical emulsion of concentration given above by drilling 6 mm holes at a downward angle of about 45^0 at the junction of woodwork and masonry and squirting chemical emulsion in to these holes till refusal or to a maximum of half a litre per holes. The treated holes shall than be sealed.

4.2.6 Treatment of woodwork

For the purpose of treatment, woodwork may be classified as follows:

(a) Which is damaged by termites beyond repair and need replacements, and
(b) Which is damaged slightly by termites and does not need replacement.

The woodwork, which has already been damaged beyond repairs by termites, shall be replaced. The new timber should be dipped or liberally brushed at least twice with chemicals in oil or kerosene as in above. All damaged woodwork that does not need replacement shall be treated as indicated above.

Infested woodwork in frame, shelves, joints, purlins, etc, in contact with the floor or the walls shall be provided with protective treatment by drilling holes of about 3 mm diameter with a downward slant to the core of the woodwork on the inconspicuous surface of the frame. These holes should be atleast 150 mm centre to centre and should cover the entire framework. One of the chemicals given above shall be liberally infused in these holes. If the wood is not protected by paint or varnish two coats of the chemical given in above shall be given on all the surfaces and crevices adjoining the masonry.

4.2.7 Treatment of electrical fixtures

If infestation in electrical fixture (like switch boxes in the wall) is noticed, covers of the switch boxes shall be removed and inside of such boxes shall be treated liberally with 5 percent Malathion dusting powder. The covers of the switch boxes shall be refixed after dusting.

4.3 Inspection

Periodical inspection and vigilance are necessary after carrying out the preventive treatment measured described above. It is essential that follow up action be maintained during subsequent humid and hot seasons if termites appear.

4.4 Safety Precautions

All the chemicals mentioned in this book are poisonous and hazardous to health. These chemicals can have an adverse affect upon when absorbed through the skin, inhaled as vapours or spray mists or swallowed. Persons handling or using these chemicals should be warned of these dangers and advised that absorption through the skin is the most likely sources of accidental poisoning. They should be cautioned to observe carefully the safety precautions given above particularly when handling these chemicals in the form of concentrates.

These chemicals are brought to the site in the form of emulsifiable concentrates. The containers should be clearly labelled and should be stored carefully so that children and pets cannot get at them. They should be kept securely closed.

Particular care should be taken to prevent skin contact with concentrates. Prolonged exposure to dilute emulsions should also be avoided. Workers should wear clean clothing and should wash thoroughly with soap and water especially before eating and smoking. In the event of severe contamination, clothing should be removed at once and the skin washed with soap and water. If chemicals splash into the eyes they shall be flushed with plenty of soap and water and immediate medical attention should be sought.

The concentrates are oil solutions and present a fire hazard owing to the use of petroleum solvents. Flames should not be allowed during mixing.

Care should be taken in the application of soil toxicants to see that they are not allowed to contaminate wells or springs, which serve as sources of drinking water.

In case of poisoning, suitable measures shall be taken for protection accordingly.

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OUR OBJECTIVE

To upgrade Maintenance Technologies and Methodologies & achieve improvement in productivity and performance of all Railway assets and manpower which inter-alia would cover Reliability, Availability, and Utilisation.

*The contents of this handbook are for guidance only & are **not statutory**. It also does not supersede any existing specification and instructions from Railway Board, RDSO, and Zonal Railways & the provisions of IRWM, BIS Codes/Reports on the subject. If you have any suggestion & any specific comments, please write to us :*

Contact person: **Director (Civil)**

Postal Address: **Centre for Advanced Maintenance Technology (CAMTECH), Maharajpur, Gwalior (M.P.) (India) Pin code – 474 005**

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