A STUDY OF THE BUILDING CONSTRUCTION PROBLEMS IN BANGLADESH

A PROJECT REPORT

BY

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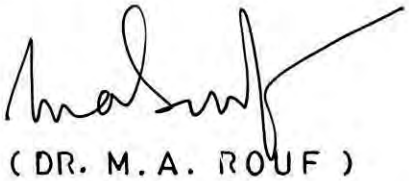

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C O N T E N T S

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A B S T R A C T

The project work considers the building construction problems in Bangladesh. The study has been carried out to evaluate the present state of building construction problems faced by the owners, builders and different construction agencies in Bangladesh. A field survey has been conducted among various construction firms and individuals engaged in various construction projects in order to gather information about construction problems being faced by them. This has been further substantiated by direct survey of construction sites at Rajshahi, Joypurhat, Natore, Kushtia, Jessore, Khulna and Dhaka city. To evaluate the type of problems, information were collected about construction materials, equipments and methods adopted by the various construction organizations. It has been observed that the level of mechanization in building construction practice in Bangladesh is still at a low ebb. Even proper and economic utilization of available materials and equipments could not be achieved due to lack of planned management.

A wide scope has been found to exist for introducing modern building construction techniques and methods. It has been established that most of the building construction problems are related with the socio economic conditions of the country. So, it is concluded that proper mechanization and implementation of modern building construction technique would bring significant economy in building construction by improving its quality and reducing construction time.

C H A P T E R 1

INTRODUCTION

1.1 GENERAL

Bangladesh is a newly born developing country. No development can be achieved without the development of the building industry. Building construction is very much essential in every sphere of industrial growth like commissioning of Mills, Factory, Industries etc. So construction industry of Bangladesh requires serious attention for further improvement. The study of building construction problems is needed in order to identify the shortcomings and find ways and means to overcome them.

The subject of building construction is rather complicated in a sense that it contains different topics which are apparently separate but are interrelated with each other. The various relevant components of Building construction are foundation, column, beam, roof, wall, floor, door, window, painting, colouring etc. All items have separate function but most of them are dependent on each other. If all the items are skillfully completed a building would function properly. If some or one of the components are defective or faulty, the purpose of the building will be seriously hampered.

There are many factors affecting the quality and durability of any structure. So defects and problems can not be avoided in all respects. But with proper care and investigation it can be minimized to a great extent. In this respect, we should try to evolve

a sort of technology that fits best to this country considering our own merits, skill and materials.

The nature of all the problems are not the same all over the world. It is different from country to country. Even it is different from one part of the country to the other. For example, some part of Bangladesh have salinity problems while most of the area is free from salinity, some part of Bangladesh are hilly while rest are almost plain. Again the bearing capacity of soil are not same all over Bangladesh. Even it may vary greatly over a single site. Some where it is possible to construct tall buildings economically while it may not be economically viable elsewhere. The quality of locally available materials like Bricks, Sand, Water etc. are not the same all over the country. On the other hand some common problems like non availability of proper equipment, lack of skilled technicians, financial constraints etc. are observed all over the country. There are many problems and defects found at the time of survey of various construction sites and also in buildings that has already been completed. The post construction problems which may be termed as defects of buildings has also been included in the study because most of the defects are due to faulty construction. These have been described in the relevant chapters.

1.2 OBJECTIVES

Day by day the number of buildings being constructed is increasing in Bangladesh. New concepts and constructional techniques are being introduced. Many beautiful and luxurious buildings are being erected in various places. These involve huge sum of money being spent

in the consturction business. Yet, many comstructional defects are quite frequently seen after construction of such buildings. Salinity in walls and floors, cracks in floors, walls, beams, roofs etc. soaking of water in roof slab, spalling of concrete around reinforcement of reinforced concrete works are only some of them to be mentioned. So it is very essential to investigate the causes behind these and the appropriate remedial measures to be taken.

Building engineering like many branches in the technical field is a matter of commonsense and the application of the specialised methods in the various lines of construction. Knowledge of science is very much dynamic and progressive and so is the case with the techniques in building construction. Without deviating much and not in a big scale the senior officers should think of better technique and more use of the indigenous materials of the country.

Different agencies, organizations, builders are thinking about the causes of the problems and defects of building construction facing the construction business and some research work is being carried out to over come these problems and defects.

So the object of this project is to survey the various constructional problems and defects faced by different agencies and builders involved in building construction and study the effectiveness of various remedial measures being adopted by them.

1.3 METHODOLOGY

A field survery has been conducted among various construction firms and individuals engaged in various construction projects in order to gather informations about construction problems faced by them. In this regard, written statements were collected from different catagories of persons involved in building construction. Persons who were unwilling or unable to provide written expressions were interviewed and their views were noted during discussion. A section of people also refused expressing their views for some moral bindings.

The different catagories of persons interviewed ranged widely in their experience in construction. Some of them were involved in construction as builders and contractors while some others were Engineers engaged in Government and semi-government organisation. The latter group of persons are primarily involved as supervisory staffs of the construction works. Even some house owners and inmates of buildings were interviewed to bring out the post construction problems they are facing as dwellers. A list of different catagories of persons interviewed is provided in Appendix A.

Fifteen construction sites has been inspected and the problems faced by different workers and site Engineers have been thoroughly discussed and carefully noted down. The fruitful construction procedures and which are currently being followed in Bangladesh by Public Works Department (PWD) and other organisations and builders for achieving better quality of work have been outlined.

Moreover, recently completed buildings(commissioned between last 2 to 5 years)have been inspected in places. The defects so far observed by the occupants have been noted along with the remedial measures taken by them or the maintenance authority. The causes of such kinds of defects have been studied and the way to overcome them has been illustrated.

1.4 LIMITATIONS

A field survey has been carried out to evaluate the present state of building construction problems in Bangladesh. For this a study has been conducted among various builder and individuals related to various construction projects. Such survey cannot be conducted throughout Bangladesh by an individual due to limitations of time and fund. The study was confined to Khulna and Rajshahi division town, Jessore, Natore and Joypurhat district town and the Dhaka City. The survey was conducted during the wet season of the year, 1990 (May to July). So, some of the problems which usually show up during the dry seasons might have gone un-mentioned. On the otherhand a few individuals did not entertain due to some moral bindings or other socio-economic limitations. A free and frank opinion and co-operation of all concerned in the construction business is necessary to bring the constructional problems to light and work out procedures for their solution.

C H A P T E R 2

FIELD SURVEY

2.1 INTRODUCTION

Field survey has been conducted in different places of Bangladesh. Survey encompassed multiple construction projects and individuals engaged in building construction industries in order to gather informations about various construction problems. Problems during the execution of the work and post construction problems has been considered at the time of survey. Some completed building has also been inspected and the defects so far observed due to improper construction has been noted.

The observation has been compiled to help the authorities, the architects, the owners, the engineers and the contractors involved in the building construction industry. It is anticipated that the information gathered would benifit all concerned in future to construct buildings which will be safer and free from avoidable defects. In this regard, it should be appreciated that there is no intention to point a finger at any one. If the reasons for a failure and the essence of the problems are understood and published, only then it may be said that the professionals involved in construction have truly done their job well to prevent a recurrence. It is not too much to say that all the customary safeguards-building codes, standards, inspection procedures, safety factors - stem from unfavourable experiences. And methods are being continuously improved as knowledge grows with experience.

2.2 SUMMARY OF THE SURVEY

Inspection of different construction projects in different places of Bangladesh has been carried out. Discussion with construction agencies, engineers and builders regarding the problems and defects has been held. Free and frank opinion of the occupants of the completed buildings were sought regarding the advantages and disadvantages of the building they are living in. The problems and defects, advantages and disadvantages so far observed at the time of inspection and discussion are as follows.

1) The quality of the construction materials was not found upto the standard specifications in many places of Bangladesh. The quality of bricks were found to vary widely and were found to be substandard in most places. Normally, the locally made bricks are used in the building construction. The quality of bricks greatly depend on the raw earth used and the procedure followed for its manufacture. As the local soils vary widely in quality and the manufacturing techniques are not standardized the quality of bricks are bound to be different in different places. Some builders informed that they are using sub-standard bricks because the standard bricks are not available in the locality and the carrying cost is too much if it is collected from outside the locality. Even, many people are ignorant of the importance of good quality of bricks and sometimes it is not possible to ascertain the quality of bricks because of inadequate testing facilities in the locality. Most of the people think that provision of a flat rate of bricks all over the country for the purchase is responsible for use of non-standard locally available bricks in construction.

2) It was found almost every where that low quality and undersized mild steel rods are being used in the construction. In some places it was found that the site engineer revised the design according

to the actual dimension of the mild steel rod. It has been reported by many and observed personally that higher size mild steel rod snaps during preparation of end hooks. This is obviously due to the use of poor quality steel for manufacture of steel rods. Testing facility in the country are very limited and the agency who would enforce the quality of rods that are being sold in the market are not doing their job properly. For this it is very difficult to ensure the quality of rods as well as construction works.

3) Different brands of cement and cement imported from different countries are being used in the construction work in Bangladesh. The strength and setting time of different brands of cement are found to be different. There is no standard specification to control the quality of portland cement in Bangladesh. So different agencies are importing different brands of cement as per their convenience. Besides storage facility are not standardized and so the importers are not storing the cement properly. Poorly stored cements rapidly deteriorate in quality. On the otherhand, the weight per bag of cement are not found as per standared measurement of 50 kg by weight though the work is being executed considering the standard measurement of the manufacturer. Dishonesty on the part of local businessman are also responsible for marketting cements which are poor in quality and in quantity. Adulteration of good cements with clay and other impurities are quite common malpractices which surely deteriorates the quality of cement. Taking out a few kilograms of cements from the imported bags and making new bags with this extracted cements for dishonest earnings is responsible for reduction in weight per bag of cement.

4) It was also found that the measuring boxes for coarse aggregates and sand are deliberately made larger than standard in some places due to the ill motive of the contractors as well as supervising staffs. So, the proportions of the cement are not controlled properly. All these bad practices are serious draw backs against good building construction.

5) The quality of sand found in different places of Bangladesh vary widely. In many places locally available sands are very fine (fineness modulus around 1.0) which are not suitable for use in structural construction . But most of the construction agency are using such type of unspecified fine sand on the plea of non availability. Some agencies are mixing coarser sand with the local sands in arbitrarily selected proportions to get the required fineness modulus. But, due to lack of testing facility in most places,the actual fineness modulus of the mixed sands remain undetermined.

6) The use of modern and important construction equipments are very much limited. Outside Dhaka their applications are rare. Multistoried buildings are being constructed without mixer machine and vibrator due to non-availability of the same in various places outside Dhaka. Although many Government departments have various constructional equipments in their store but most of them were found to be out of order during this survey, Lack of experience and skill of the operators handling these machines are mostly responsible for putting them out of order frequently. Also, non-availability of skilled mechanics keep these machines unrepaired for a long period of time.

7) Different types of shuttering materials are being used in various works by different agencies and builders. Most of them are using wooden shutters prepared from different types of timber.Use of low quality timbers for shuttering makes it difficult to maintain the size, shape and quality

of the structural work. High prices of good quality timber and steel shutters has increased the use of low quality shuttering materials and there-by deteriorating the quality of works remarkably.

8) As the soil condition of the country varies widely, it is necessary to investigate the exact condition of the underground soil before designing any structure. But at the time of survey it was observed that in most places, the buildings are being constructed without having any soil investigation. On the other hand soil test reports were found to be unreliable on many occations. This is due to improper methods of testing, negligence of testing agencies and sometimes due to shortage of time alloted by the client for investigation. Here it may be mentioned that the underconstruction building of central storage depo (CSD) at Khulna collapsed in one corner. After dismantling the collapsed part , fresh soil investigation revealed that the bearing capacity in that area was much lower than what has been found in other bore holes for that building. Accordingly, that part of the building was redesigned and the total structure completed and is functioning satisfactorily. Similar type of problems have been encountered during the construction of collectorate building and Dist. Judge court building at Natore.

9) Digging of foundation trenches can often create problems if proper methods are not followed, During rainy season, seepage of water into the foundation trench may severely hamper the foundation work. Sides of the trenches collapsed in some places due to improper excavation method. An accident which caused death to a worker by collapse of the trench has been reported in Natore.

10) It was gathered that construction labourers are not available during the harvesting season. Hence, progress of the construction work is greatly hampered during this period and this causes financial losses to the builders.

11) Normally different agencies are involved in the different types of work in completing a building such as civil construction work, electrical installations and sanitary and plumbing etc. Lack of co-operation among the various teams and inefficient supervision of the different types of works causes serious problems in this country only to delay the whole construction process. Sanitary contractors are suffering due to delayed construction of the building i. e., civil work. It is also observed that there is no co-ordination between the electrical work and civil work as a result patch marks are found in various buildings giving unpleasent looks to the structure.

12) Frequent rise in price of construction materials is one of the main problem in building construction industries. Many projects has been abundoned due to the sudden price hike of construction materials like cement, bricks, steel bars etc. Here it may be mentioned that the present schedule rate of cement in PWD is TK 140'00 (one hundred and forty) only per bag , whereas in the market it is Tk. 220/- to Tk. 230.00 per bag. For sudden rise in price of construction materials has forced many contractors to stop their works as there is no provision for price escalation in contract agreement in Bangladesh. On the otherhand many private building construction work are stopped before completion due to sharp rise in prices of the building materials and no new building construction project is being taken up as soaring prices enhances the project cost beyond the available fund.

13) Salinity of the building is very common in Bangladesh. This acute problem is increasing day by day. Most of the buildings in Khulna Zone has been affected by salinity. It has been found that the plaster has fallen off, paintings discoloured creating problems for the residents. Very old buildings have been affected seriously and recently completed buildings are also affected in some places of Bangladesh. So, salinity

has surfaced as an important problem in building industries demanding immediate attention.

14) It was found that the maintenance work of various buildings are very poor. Most of the people informed the author that the fund constraints is the main cause of poor maintenance. Some opined that the inadequate and traditional maintenance procedure is responsible for it.

15) Different types of cracking in the building was observed in various places. Floor crack, wall crack, beam crack, roof crack etc. creats various problems for the occupants. In some building water leakage was observed due to the roof cracking or defective lime terracing.

16) It has been found in some buildings that the doors of stair case (pent house) and outside windows has been fitted in such a way that it opens inside the room. For such wrong fixation of doors and windows, rain water enters the room during rain accompanied by moderate winds. The direction and slope of bath room floors has been found to be in the wrong direction for which it remains wet and creats problem for the users. Some times rainwater enter into the room for not maintaining proper slope in the open verandah. Omission of door seals in the outside doors and bathroom doors are also responsible for flow of water inside of the rooms. This type of problem occurs due to the ignorance and carelessness of the masons and superviesing staffs.

17) Many doors and windows were found to have been fixed up without proper buffer block, hinge clit, catch hook etc. Definitely, these improper fittings makes it difficult or even impossible to keep the doors and windows either open or closed or both.

18) It was found at the time of survey that some building in private sector(specially out side Dhaka) are constructed without being properly planned and designed by any approved architect and engineer. Many ancillary facilities were found to be absent in those categories of buildings planned by the owner and designed by some so called experienced mason(Raj-mistri). Reinforcement provided were found to be excessive while placements were improper. This certainly increases the cost of construction without adding any safety to the structure. On the contrary ,it may some time reduce the life of structure or call for additional cost for premature repair and maintenance.

19) Most of the contractors were found technically unsound. The technical staff of the construction agencies were found to be inadequate in number than what was required. On the top of that those present were inexperienced and lacked in technical know how although the so called paper list proved that the agency is well equiped with adequate man power. These lapses causes so many unwanted errors to show up during construction and the progress of the construction is seriously hampered.

20) Bangladesh is a poor country . The economic condition of the people is very bad. Poor economy entails many more social problems. Thus, the overall socio-economic condition of the country adversely affect the construction in-dustry in Bangladesh. Unemployment problem has grown disproportionately over the last decade. The lack of sincerity on the part of previous governments to solve these problems has caused the growth of mastans all over the country. These mastans directly and/ or indirectly in the name of local clubs and associations extort money from the contractors or building owners. This has seriously affected the contractors and the individuals engaged in building construction.

C H A P T E R 3

PROBLEMS OF CONSTRUCTION MATERIALS.

3-1 INTRODUCTION

The engineer can no longer be satisfied with a superficial knowledge of standard properties of commonly used materials. Many new and unusual conditions are met with and wide variation in properties are encountered in the practical field. For the construction of a building, the choice of materials is very important. The materials to be selected should prove superior. The choice must be based on several factors: availability of materials, economy, ease of handling and fabrication, strength, durability and workability. A structure must be a harmonious blend of beauty, strength, utility and economy. To achieve this, specification for construction materials must be laid down. In all engineering constructions, it is imperative in the interest of the safety and the durability of the structure that only materials of an acceptable quality and strength be used. The quality control of all construction materials is of prime importance to improve the quality of construction as a whole.

Selection of materials for construction depends first upon their properties in relation to intended use. The engineer should be alert for new materials that may be developed but he should also keep his mind receptive to possible new ways of using existing materials. The other important considerations are economy and availability. Preference should always be given to the locally available materials. Some times a materials might

be selected even though of inferior quality, because the right materials is not locally available and too expensive if procured from outside the locality. For this situation, proper care should be taken and where to use such materials to be contiously determined by the engineer without seriously damaging the quality of work. If absolutely necessary, the bare minimum quality of right materials must be procured though expensive. The commonly found problems and defects regarding construction materials in Bangladesh are described in short below.

3.2 BRICKS

Bricks available in Bangladesh are found not to comply with the standard laid down by Bangladesh Standard and Testing Institute. Size of bricks procured from the same brick field are found to vary in all dimensions. As such, plastering increases to 1" or even 1½" at plalces. In the same way mortars in the brick joints can not be kept as per specification.

Due to insufficient soaking of bricks before construction the strength of masonry work could not be achieved. The cause of this problem is that the water present in the mortar losses due to soaking the bricks for whick hydration hampered. As the mortar weakens, the brick wall permits to dampness in rainy reason and also helps to efflorescence indirectly. So, for better quality work all bricks should be soaked in water for at least 12 hours before use in masonry work. The cessation of bubbles through the water is an indication of saturation being complete.

3.3 CEMENT

Cement is one of the most important building construction materials. It exhibit different properties and characteristics depending upon their chemical compositions. By changing the fineness of grinding or the oxides compositions, cement can be made to exhibit different properties according to the requirement of work.

For using cement in important and major works it is better to test the cement in the laboratory to confirm the requirements of the standard specifications with respect to its physical and chemical properties. No doubt, such confirmations might have been done in the factory laboratory before marketing. But the cement may deteriorate in quality during transportation and storage prior to its use in work. This is frequently observed in Bangladesh. So, cement must be carefully stored. the bags being raised off the floor so as to keep them as free from moisture as possible. The godown for storing cement should be weather proof and the floor shall be damp proof. cement shall not be stored in contact with walls. No cement which has been stored through a monsoon or for more than 6 months shall be used for reinforced concrete untill samples have been tested and it is found to meet the requirements of the standard specification. When facility exists, (which is very much limited in Bangladesh) sample testing of cement should be done for each and every big consignment of receipt.

In proportioning cement mortar or concrete, cement should be measured on site by weight instead of considering 1.25 cft or 50 kg. of cement in a bag as because this standard measurement are seldom met in Bangladesh.

3.4. STEEL

Steel is the most widely used engineering materials in the world. This is because of its strength to weight ratio together with such a degree of toughness as may be required to make effective use of the strength available. The applications of steel are almost beyond count. Round mild steel bars are generally used as reinforcement in concrete. High tensile steel is almost universally used in prestressed concrete, bringing in considerable economy and elegance to the concrete structures.

[1]Steel is an iron-carbon alloy having a carbon content less than 2.0 percent and generally 1.5 percent. It is usually malleable as cast iron and exhibits properties of toughness as well as strength. Mild steel reinforcement is manufactured from the billet, axle steel and rail steel in almost all developed countries and their manufactures strictly maintain the standard sizes and strength of different catagories of mild steel bars as laid down by the appropriate standard institutions But here in Bangladesh, there are various types of mild steel rods available in the market, namely

a) deformed bar,
b) tor steel or twisted deformed bar,
c) plain m.s. bar made of billet.
d) plain m.s. bar made of billet plus scrap.
e) plain m.s. bar made of scrap only.
f) plain m.s. bar made of scrap plus in-got etc.

The uniform strength of the products of last 3 (three) types of rod are not achieved in Bangladesh. Thus, the test samples collected from the same consignment of rods produced through

identical process are found to show wide variations in results. As regard the sizes of the m.s. rod, the standards are deliberately violated by producers as per demand of the retailers . The so called commercial size available in the market are in fact undersized bars which are frequently used by many contractors and builders. The use of so called commercial sizes of rods are found in construction work due to the fact that the construction agencies are required (as per contract aggreement) to pay as per running feet measurement system considering standard weight of specified sizes of standard rods - while they pay the retailers for the actual weight they have bought. Thus, they try to make some illegal profit out of this.

The testing faciliteis in the country are very limited and there is no authority to enforce strict regulation of industrial products. As such what ever the manufacturer produce are sold through associated retailers. Therefore, it is very much essential to test the rods before use in any building construction as bars of non-standard size and quality are being sold in the open market. Though there is standard institution for testing materials in Bangladesh who specify the standard and certify about the quality of materials manufactured by various steel mills, yet there are many unknown reasons for which the actual quality differs from the standard specifications.

3.5 SAND

Sand plays an important role in engineering construction. It is a form of silica and may be of argillaceous, silicious or calcareous according to its composition. It is usually termed as fine aggregate and usually obtained from pits, shores, river beds and seas. The sand grain may be of sharp angular or rounded. Sea sand is the worst of all varities because it contains sea salts which absorb moisture from the atmosphere causing permanent dampness and efflorescence and thereby the work gradually disintegrates.

Different types of sand are required in different types of work. For example, fine sand (which pass through No-16 ASTM sieve) is suitable for plastering works, while moderately coarse sand (which pass through No-8 ASTM sieve) is preferable for mortar in masonry work and coarse sand (which pass through No- 4 ASTM sieve) is best suited for concrete work.

Another practical aspect known as bulking of sand is not considered at the time of construction on many occassions. Bulking is the increase in the volume of a given weight of sand due to the presence of moisture. It is known that presence of about 5 to 8 percent of moisture by weight of sand may cause an steady increase in volume by about 20 to 30 percent. The bulking of sand is due to the formation of thin film of water around the sand grains. Entrapped air between the sand grain and the water film add to the increase in volume. So, due consideration should be made for determining the actual amount of sand to be added with coarse aggregate and cement during preparation of the concrete mix at site. Otherwise the proportion of sand will fall short of the specified proportion and the desired quality of work may not be achieved.

Grading of sand is another important factor which is seldom considered at the time of construction of building works in Bangladesh. Sand should contain particles of uniformly varying sizes so as to get dense mortars. The grading of sand may be determined with the help of sieve analysis which is used to obtain the Fineness Modulus of sand. The fineness modulus value is an index of the coarseness of sand. The fineness modulus of the sand to be used should be determined before construction. If it is not very close to the design specification, a new sand from different source which closely match the design F.M. should be used. Alternatively, a higher quality sand may be mixed in determined proportion with low quality sand so that the F.M. of this mixed sand is close to design specification.

In some places, sand containing impurities are used in construction which deteriorate the quality of work. Sand for mortar work and concrete must be sharp and gritty to the feel and free from clay, silt, organic matter, shells and salts. When necessary sand should be washed in fresh water, but washing should only be resorted to when clean sand is not otherwise available as washing removes finer sand along with impurities.

CHAPTER 4

PROBLEMS OF CONSTRUCTIONAL EQUIPMENTS

4.1 INTRODUCTION

In the construction work, mechanical equipments of different design and type, are required to suit the nature of work. These equipments should be made available on site and kept in workable condition so as not to obstruct the progress of work. The success of a construction project depends entirely upon the choice of construction equipment and if right equipment is selected, the work can be completed in short time with lesser cost. As a matter of fact, easy availability of good constructional equipment proves to be an asset of any civil engineering project.

The most commonly required building construction equipments are Bulldozers, Concrete Buckets, Concrete Mixer Machines. Earth Rammers, Pile Driving Equipments, Crushers, Vibrators etc. Most of these machineries are not in frequent use in Bangladesh. A brief description of some of these equipments along with the associated shortcomings for not using or improperly using them are outlined below.

4.2 CONCRETE MIXER MACHINE

Mixer machine is used to mix the ingredients of concrete. Different types of these machines with varying capacities are available in the market. Their use in Bangladesh are also appreciable but some where its methods of application are not satisfactory. The following procedure are to be taken for getting

quality concrete and smooth running of the work though it is not properly followed everywhere in Bangladesh.[4]

a) In order to ensure even distribution of water, it is necessary to pour water in the drum at the sametime or before the other materials are placed.

b) The output of concrete mixer depends on the time of mixing, number of batches per hour, size of the mixer and conditions under which it operates. These should be considered at the site depending on the mixer machine.

c) The inside portion of the machine should be inspected at regular intervals. The damaged or broken blades should be replaced. The drum should be throughly washed just after completion of the work for better workability in future.

4.3 BATCH PLANTS AND MIXERS

Today, unless the project is in a remote location or is relatively large, more and more of the concrete is batched in a central batch plant and transported to the job sites in ready-mixed concrete trucks in all most all developed country. Although, the central batch plant concept is very useful for improving the building construction industries in Bangladesh, it has not been materialized any where in Bangladesh. Only a few field batch plants have been used on site by some local constructional agencies working in partnership with foreign contractors. The use of ready mixed concrete has bright future in Bangladesh though it is not being started at yet.

4.4 EARTH RAMMING MACHINE

Earth ramming machine is used to compact soil. It is a small machine which is used in places where it is not possible to use road rollars or sheep foot rollers as in case of congested areas, factory buildings, floors of buildings etc. Earth rammers may be static or vibrating. Static earth rammers compact soil close to the surface only. Hence vibrating earth rammers are generally used to achieve better compaction of soil. Depending upon soil condition, compaction depth of 12" to 15" may be achieved. Now-a-days, it is being used in Bangladesh but the proper methods of compaction are not being followed every where. This has caused floors to crack and settle unevenly.

4.5 VIBRATOR

Consolidation of concrete is normally achieved through the use of mechanical vibrators. Concrete being a heterogenous mixture of water and solid particles in a stiff condition, will normally contain a large quantity of voids when placed in to the forms. It is the purpose of consolidation to remove these entrapped air voids. Entrapped air can be reduced by compacting the concrete. The vibrator should never be used to move concrete laterally as segregation can easily occur. The vibrator should be rapidly inserted to the bottom of the layer (usually 12 to 18 inch maximum lift thickness) and at least 6 inch into the previous layer. It should then be held stationary for about 5 to 15 sec. until the consolidation is considered adequate. The vibrator should then be with drawn very

slowly. Where several layers are being placed, each layer should be placed while the preceding layer is still plastic.

Vibration accomplishes two actions. First, it slumps the concrete, removing a large portion of air that is entrapped when the concrete is deposited. Secondly, continued vibration consolidates the concrete, removing most of the remaining entrapped air. Generally it will not remove entrained air. While vibration is essential for good concrete work, over vibration should be avoided. Over vibration results in segregation as coarse aggregate moves away from the vibrating head. Another concern is the vibration of reinforcing steel. Such vibration improves the bond between the reinforcing steel and the concrete and thus is desireable. But undesirable side effects include damage to the vibrator and possible movement of the steel from its intended position. Hence, it should be avoided.

Vibrators are now in wide use all over Bangladesh. But they are not properly used by many contractors due to sheer negligence on the part of the contractor and supervising staff as well. Even the maintenance of these simple implements are not done properly. On many occasion these are found to remain out of order during casting. Thus, the quality of concrete remains as bad as it were twenty years back.

4.6 CONCLUDING REMARKS

From the above discussion it is clear that the utility of construction equipments improves the quality of works as well as reduce the completion time of the construction. But the limitations of various equipments in Bangladesh are to be consiered and their proper uses to be ensured. The technicians are to be trained up and proper method of maintenance of those available equipments are to be ensured otherwise the development of building construction industries can not march forward.

CHAPTER 5

EFFLORESCENCE

5.1 INTRODUCTION

Efflorescence is a problem that is growing in serious proportions as more and more buildings are being errected. Efflorescence, more commonly known as salinity of walls and concrete members, is a crystalline deposit of salts on stone and brick masonry. Even it may show up in the plaster works of various concrete members. Soaking of water and subsequent dampness helps to start the process of efflorescence. Various constituents of building construction e.g. sand, bricks, coarse aggregate etc. contain salts which gets dissolved under damp environment. Even the water that causes dampness may carry the soluble salts with it. These dissolved salts form scales of deposits when evaporation has removed the water. Also, the properties of soil on which the building rests has a significant influence on the efflorescence process.

Prevention of efflorescence is necessary as there are lot of other problems associated with it. These entailing problems are

a) Salinity helps dampness creating unhygenic living conditions.
b) It causes cracks in the plaster which ultimately falls a-part from the structural members.
c) Salinity spots are aesthetically unpleasant to look at.
d) Even if the salinity spots are replastered after scraping, it may show up again after some time.
e) Papers and documents, clothes, wooden furnitures etc. are seriously damaged, if by chance, they come in contact with efflorescent areas of the buildings.

5.2 FACTORS CAUSING EFFLORESCENCE

Efflorescence occurs due to the presence of soluble salts in the building materials themselves or in the nearby material. These salts go into solution in presence of water and forms the crystalline deposites on the surface of structure when water dries out. Thus, it may be said that the prime cause of efflorescence is the presence of salts and access of water to them. But, there are many other factors which in fact, influences severely to the cause of efflorescence. Some of these important factors are

a) Use of unburnt bricks.

b) Presence of excessive soluble salts in construction materials ($Ca\ SO_4$ $Na_2\ SO_4$ $Mg\ SO_4$ K_2SO_4 in excess of 2.5 %)

c) Non-provision of Damp proof coarse in the floor and foundation wall.

d) Unplanned drainage system.

e) Inadequate sunlight and aeration.

f) Construction defects.

g) Unrepaired leakages in the concealed water supply and sewarage line pipes etc.

5.3 PRECAUTIONS AGAINGS EFFLORESCENCE

Proper care should be taken before construction and also during construction to prevent the effect of salinity damaging a building. The following are the precautionery measures that would reduce the chances of efflorescence.

(1) Bricks, of course, remain one of the major sources of efflorescence. And hence before locating a brick field it might be a good idea to see if the local clay contains abnormal quantities of any soluble salts. Since it is known that a well burnt brick is less susceptible to efflorescence than an underfired one, the use of underburnt bricks must be avoided to minimize the chances of efflorescence. Even well burnt bricks may show up salinity problems. But test on random samples of bricks from a particular brick field may ascertain wheather these bricks are susceptible to efflorescence. The test consists of placing a brick head down in a flat bottomed glass container or stainless steel container (an enamelled or PVC dish would do) in to an inch or two of distilled water. The distilled water may be replenished from time to time if necessary. The water rises through the brick due to absorption and soluble salts, if present, comes out to the surface. Within a few days the surface of the brick near the top may become whitish due to salt deposition indicating strong tendency to efflorescence. Fig 5.1 shows one of the more expensive type of brick, available locally, after the test. Patches of white crystals covering the top portion of the brick can be clearly seen. Use of such bricks should be avoided especially for facing work.

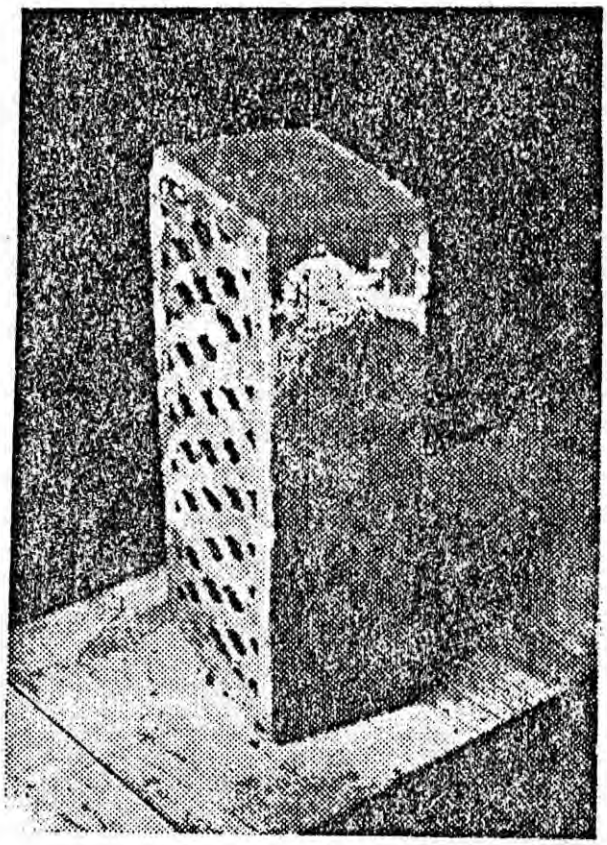


Fig 5-1 : Unused brick after efflorescence test.
(Reproduced from ref. 5)

(2) Use of lime and low-alkali portland cement reduces the capacity of mortar to contribute to efflorescence. Upward movement of ground water, which might carry salts, may be prevented by placing suitable damp-proof materials between the foundation and the wall and also in the floor as detailed below.

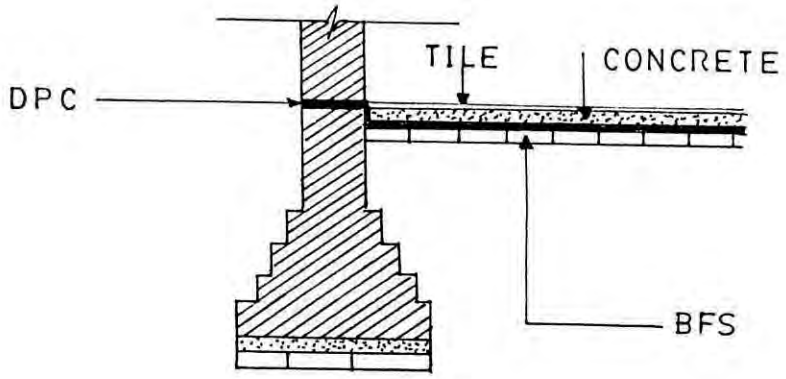


FIG.—5·2

Use of water repellants to supress efflorescence on the walls may be temporarily helpful but may prove harmful since the salt that deposites accumulate beneath the treated surface and may cause flaking of the brick or plaster. Design of building may also be made in such a way as to prevent masonry from excessive wetting. This is of course, a difficult job for a designer in Bangladesh because of the heavy monsoon rain lasting several months. Water drains should be so designed and placed as to cause minimum dampness. The roof should be properly sloped to drain out rain water easily. Sunsheds, cornice are to be provided to protect the wall from direct rainfall. We know that the water absorption capacity of bricks are too high. The flush pointing is better than rulled pointing to decrease the absorption where facing brick work is done. Some times cavity wall may be provided to eliminate dampness.

(3) Usually it has been noticed that some walls of a house are more exposed to sun light than others. The walls less exposed to sun and/or more affected by rain tend to be readily damped. So proper attention

to be paid during preparation of building plan. So that the walls having less exposure to sun enjoy better aeration facility. The doors and windows should be placed on opposite walls for well ventilation. The building should be placed in a way so that it gets less sun during summer than in winter.

(4) The salinity effect can be reduced by taking precaution on interior-surface or exterior surface of foundation walls. As because water penetrates into foundation trench from outside, hence the exterior surface treatment is more effective than the interior one. The easiest way to prevent dampness of the exterior surface is to make proper pointing of the brick joints and by subsequent plastering. The interior surface is usually treated by plastering with a coating of wax or silicate. However the treatment should be made at an interval of 2-3 years.

(5) Resistance to water absorption of walls may be significantly increased by adding water resisting agents and compounds with concrete or mortar. This is an effective method of resisting efflorescence. Efflorescence originates from dampness and to resist it the structure should be completely water resistant. And for that 2% washing soap by weight of cement may be mixed with concrete or mortar. The mixing is made by making a water-soap solution. The mixed soap react with cement and creats in-soluble compound which makes the structure water resistant. In this method the efflorescence can completely be removed. This method is widely used in Bangladesh and in many other countries.

(6) Concealed water supply and sewarage pipe line should be made completely water-tight. Otherwise concealed line may be avoided as far as possible so that it can be repaired easily.

5.4 REMEDY

Prevention is better than cure. So precautionary measures described earlier should be taken to minimize the chances of efflorescence. But strict adherence to the preventive measures can not ensure that salinity problem shall not crop up at all. Hence, remedial measures should be taken once efflorescence has shown up. Different remedial methods may have to be applied depending on the severity of salinity effect. But, first of all the source of dampness should be identified and appropriate steps should be taken to elimenate dampness. Then, the efflorescence should be removed by applying proper methods, such as[6]

(1) Slight efflorescence on the wall of a building may be removed by cleaning it thoroughly with steel or coconut brush. Then washing the area with clean water. If efflorescence reappears, then after following the previous two steps, the affected zone should be washed with 5% hydrochloric acid solution and finally with d solution of 5% amonia.

(2) If the wall of the building is severely affected by efflorescence, the plaster should be taken off. The exposed brick work should be cleaned with steel brush thoroughly. Then, the surface should be treated with 20% sodium silicate solution and after some time the treated surface to be washed with clean water .Water resistance of the affected wall may be increased by using stronger concentration of sodium silicate solution. But most importance should be attached

to proper cleaning of affected area before the application of sodium silicate coating presence of any dirt particles or oily substance may help moisture movement and restore the efflorescence.

3) For severely affected areas, the plaster should be taken off from the portion of the wall showing up salinity. The exposed brick work should be thoroughly brushed and cleaned with water. Then, new plaster should be done with the mortar using 2% washing soap by weight of cement. The solution of soap reacting with cement makes insoluble substance which help to make the wall water tight. As a result efflorescence is stopped. An experimental investigation (by the House Building Research Institute) has proved the effectiveness of this method.

CHAPTER 6

SOAKING AND DAMPNESS

6.1 INTRODUCTION

Soaking and dampness are two closely related terminologies often used interchangeably. Literally, there is a subtle difference between the two. Soaking is the entrance of water through pores and holes present in a material while dampness is the moist condition due to retention of water. Thus, when water permeate through the roof slab it is soaking and the soaked roof is the dampness of ceiling.

6.2 SOAKING

Soaking of roof slab and walls is a common problem in Bangladesh. Soaking damages the roof slab and reduces its life. The occupants suffer severely during the rainy season if they are to live under a leaking roof. Soaking of roof slab due to defective lime-terracing is very common in Bangladesh. Due to improper workmanship it may not stop seepage of water when it rains continously for a good number of days. The main causes of soaking of roof slabs are

1) Use of unspecified materials in the construction.

2) Adoption of improper techniques.

3) Construction of improper slopes in the roof slab.

4) Improper compaction of the roof slab and lime-terracing etc.

6.3 DAMPNESS

Dampness is another frequently encountered problem all over Bangladesh. A damp building creats unhealthy conditions for the occupants. Unsighty patches are formed on the wall surfaces and ceilings. Decay of timber takes place rapidly due to dry-rot in a damp atmosphere. The electrical fittings and the appliances are damaged. Embedded reinforcements corrode and presence of salts may initiate efflorescence in the walls. Dampness of floors may damage the floor coverings like carpets and mats. Besides, dampness of walls and floors brings with it various inconveniences to the inmates of a building.

Various causes which are responsible for the dampness of walls and floors are as follows:-

a) The ground on which the building is constructed may not easily allow water to pass away. So, water may be retained in contact with the floor for a longer time if the earth fill pores are very small. Usually, building materials used for foundations, absorb moisture by capillary action. Thus dampness finds its way to the floors through the substructure .

b) If the faces of wall, exposed to heavy showers of rain, are not suitably protected, water penetrates through the mortar cracks causing dampness of the wall.

c) The process of condensation takes place when warm humid air is cooled. This is due to the fact that warm air contain much more water vapour than cool air. Thus if warm air is allowed to cool down within a room then the moisture is deposited on the walls, floors and ceilings. This is one of the main reason of dampness in badly designed kitchens.

d) The orientation of a building is also an important factor. The walls exposed to less sunshine and heavy showers of rain are liable to become damp.

e) The dampness is also caused due to bad workmanship in construction such as defective rain water pipe connections, defective joints in the roof, improper connections of walls etc.

6.4 PREVENTIVE MEASURES AGAINST SOAKING

As mentioned earlier, soaking of roof slab is primarily due to faulty lime-terracing. Hence to prevent the problems of soaking, the proper method of lime-terracing construction should be followed. The standard method of construction is outlined below:-

The concrete mix will consist of lime, surki and khoa in the proportion 2:2:7 respectively by volume. The surki and khoa are locally used names of brick chips prepared from well burnt 1st class bricks. Under burnt and 3rd class bricks must not be used for making surki or khoa for lime concrete. The requisite quantity of lime and surki measured by volume shall be mixed dry on a separate platform by shovelling and turning over the materials several times till a uniformity of colour is achieved. This mix is then spread out evenly over the previously laid quantity of khoa and proceeding from one edge the whole mass is to be mixed together gradually. When the khoa has been throughly mixed up with the lime-surki, clean water shall be added gradually and the mixing shall be done untill a uniform consistency is obtained. The mixture should be kept wet and turned over twice a day for at least 7 consecutive days before using it on the roof. Care should be taken to keep green mix under cover to protect it against rain and the sun.

The lime concrete mix shall be carried on the roof top and laid on the roof to proper slope and grade. The thickness of the concrete shall be based on the roof area and the quantity of run off expected during peak rainfall. The normal thickness is 4 inch. But for relatively smaller sized roofs 3½ inch or even 3 inch thick lime terracing may be permitted. A minimum slope of 1 in 100 shall be maintained in all directions from the crown to the outlet points.

The fresh lime concrete laid on the roof has to be consolidated by tamping with wooden thappis, always maintaining the proper slope. Tamping shall be continued min. 7 days. The full compaction will be considered to have been attained when the thappis struck on the surface rebound with a metalic sound. The surface will be kept constantly wet when it is being beaten, by sprinkling lime water. The lime concrete shall be kept covered by putting a 3 inch thick layer of straw over it and by constantly wetting this by spraying water for a period of about 15 days.

Roof should be tested after completion on the metallic sound when beaten also by cutting the portion 3"x3"x2" and pouring water therein. Non-percolation of any amount of water inside the concrete gives the indication of correct compactness.

The following precautions must be observed for getting better lime concrete. i.e. to prevent soaking of roof slabs.

a) The mixing of khoa, lime and surki shall not be done on the roof, but invariably on the ground on a brick platform.

b) Parapet should be avoided unless it is so specified by the architect because it creats obstruction to the passage of rain water.

c) Normally rain water pipe should be avoided and sufficient number of holes in the parapet to be provided to allow the rain water pass over the cornice, if provision of parapet can not be avoided.
d) In repairing lime terracing roof coaltar or cement shall not be used. Repairing should be done with the same materials of lime terracing. Temporary relief in emergency cases only may be given by two coats of thin cement water mixed with cowdung in the ratio 1:2.

6.5 PREVENTIVE MEASURES AGAINST DAMPNESS

To prevent dampness various precautionery measures are to be taken during construction. Some of these important procedures has been described in the previous chapter-5 (art-5.3). For example, damp proofing coarse are provided below the floor and wall at plinth level to prevent dampness of the building. A layer of cement concrete 1½ inch thick not leaner than 1:1½:3 is to be laid on the brick work at plinth or over flat brick soling for floor. After proper curing and thorough drying, a coat of hard grade bitumen is to be laid over the coarse.

The damp proofing coarse under the floor may be dispensed with if thick polythene (weighing 1·67 kg. per 10 sq.metre) sheet is spread over the flat brick soling. Care must be taken so that these sheets do not extend in to the walls by more than 2 inches. The damp proofing coarse under walls must extend across the full width of the wall.

C H A P T E R 7

PROBLEMS ASSOCIATED WITH CONCRETE STRUCTURES

7-1 INTRODUCTION

Concrete has found use in nearly all types of construction. Major components of building construction are made of concrete. With the addition of reinforcement to supply the needed tensile strength, concrete has become the foremost structural material. Over the years improved practices and techniques have added greatly to produce good concrete. But here in Bangladesh, very bad quality of concrete is quite common. This is primarily due to carelessness and ignorance on the part of workers, technicians and designers. Thus, many structures in Bangladesh fail to give the service that can be expected. However, there are structures which were found to be satisfactory during commissioning, have developed serious problems of maintenance after being put into use for sometime. Development of cracks and spalling of concrete are the two main problems widely observed during the survey conducted for this study.

7-2 CAUSES OF DETERIORATION OF CONCRETE STRUCTURES

Deterioration of concrete structures is a natural phenomenon which pass through different stages like development of cracks, spalling of concrete and finally disintegration of the concrete structure. Shrinkage, occurances incident to construction, temperature stresses, chemical reactions, errors in design etc. are the principal causes initiating the deterioration process. One of the most objectionable defects in concrete is the presence of cracks.

One of the important factors that contribute to cracking is shirinkage. Shrinkage may be classified as plastic shrinkage, drying shrinkage, carbonation shrinkage, autogeneous shrinkage etc. The other possible causes of development of cracks in concrete are

a. Tensile stresses exceeding the tensile strength of concrete.
b. Use of unsound materials.
c. Bad workmanship.
d. Use of high water/cement ratio.
e. Bad joining techniques.
f. Freezing and thawing.
g. Thermal effect.
h. Heat of hydration.
i. Structural stresses.
j. Alkali aggregate reactions etc.

The various causes of deterioration of concrete has been summarized below while the physical symptoms of deterioration along with the associated cause of its occurance is presented in table 7.1. The different causes effecting deterioration of concrete are

1. Occurrences incident to construction operations.
   a. Localized settlements of the subgrade.
   b. Movement of the form work .
   c. Vibrations.
   d. Internal settlement of the concrete suspension.
   e. Setting shrinkage.
   f. Premature removal of shores.

2. Drying shrinkage.

3. Temperature stresses.
   a) Variations in atmospheric temperature.
   b) Variations in internal temperature.
4. Absorption of moisture by the concrete.
5. Corrosion of the reinforcement.
   a) Corrosion due to chemical agents.
   b) Corrosion due to electrolytic attack.
6. Chemical reactions.
7. Weathering.
8. Shock waves.
9. Erosion(abrasion).
10. Errors in design.
11. Poor design details.
    a) Abrupt changes in section.
    b) Rigid joints between precast slab units.
    c) Deflections.
    d) Leakage through joints.
    e) Inadequate drainage.
    f) Poorly detailed drips and scuppers.
    g) Neglect of plastic flow.
    h) Insufficient travel in expansion joints.
    i) Incompatibility of materials or sections.

TABLE 7.1 DETERIORATION OF CONCRETE AND PHYSICAL SYMPTOMS[8]

Basic causes	Principal symptoms produced			Probable status of deteriorating agent.
	Cracks	Spalling	Disintegration	
1. Occurances incident to construction operations.	X			Inactive.
2. Drying shrinkage	X			Inactive.
3. Temperatur stresses a) Variations in atmospheric temperature.	X			Inactive.
b) Variation in internal temperature.	X	X		Active or inactive.
4. Absorptionnof moisture by the concrete.	X			Active.
5. Corrosion of the reinforcement. a) Chemical.	X	X		Active.
b) Electrolytic.	X	X		Active.
6. Chemical reactions.	X	X	X	Active.
7. Weathering.		X	X	Active.
8. Shock waves.	X	X		Inactive.
9. Erosion.			X	Active.
10. Poor design details.	X	X		
11. Errors in design.	X	X		

7.3 PRECAUTION TOBE TAKEN IN CONCRETE WORKS

Cement should comply with the standard requirements. Cement which has become hard due to moisture or any other reason, should be discarded and not to be used in the work. The sand to be used as fine aggregate should be clean and coarse. It should be free from organic or vegetable matter. The sand should be washed, if there is any trace of earth in it. The coarse aggregate should be properly graded as required and should be clean and free from impurities such as earth, coal, dustand other organic materials. Unclean coarse aggregate should be screened and washed before use.

In concrete mix proportions should be as per specification of the work. Necessary allowance are to be made for the bulking of sand. The reinforcement should be placed as per design by the engineer and it should be free from rust, oil, dirt etc. Steel to be used as reinforcement should comply with the standard requirements. Extreme care should be taken to see that the reinforcements is not disturbed during placing of the concrete. The centering or form work should be sufficiently strong and rigid and in good condition so as to turn out a good smooth finished surface. It should be removed only after getting written permission of the engineer in charge of the work. Hand mixing shall be always avoided. As a rule, mixer machine must be used for mixing. The coarse aggregates, sand and cement should be loaded in the mixer machine in proper sequence. A good sequence is to place half the required coarse aggregates and sand into the hopper of the mixer machine, add cement over it and then put on the remaining half of the aggregates. The dry mix is then transfered to rotating drum using the mechanical device attachment. Dry mixing may be continued for about 30 seconds. The requisite amount of water to be added gradually and the mixing should continue untill the desired con - sistency is attained. However, wet mixing should proceed at least for 2 minutes to ensure overall uniformity of the mix.

7.4 REPAIRING OF DAMAGED CONCRETE

Before any repair work is put in hand, the cause of damage must be identified as clearly as possible. Sometimes the cause is obvious as for example, cause of accidental damage but more often than not, careful investigation is required. Normally cracked concrete and spalled out concrete need quick repair which are detailed below.

7.4.1 REPAIR OF CRACKS IN CONCRETE

The simple reason for repairing cracked concrete is in order to prevent corrosion of reinforcement. Cracks may provide a path for ingress of carbon dioxide or moisture through the concrete cover, providing ambient condition for corrosion to take place. Thus, at first sight it appears that formation of crack is a corrosion hazard. It has been shown that cracking at right angles to a reinforcing bar is often relatively unimportant. In this case the cracking will have an effect localized to a very small spot. Cracking along the length of a bar is far more serions because a larger portion of the bar is exposed. Cracks may be classified broadly as either live i.e. those where the width varies with time or dead cracks where no further movement is likely. The following procedure may be adopted for repairing a cracked concrete according to its nature and type of crack.

Dead cracks are generally the result of an event that has passed, such as accidental overload, and they may usually be locked in such a way as to restore the structure as nearly as possible to its original uncracked state. Cracks wider than about 1 mm in horizontal surfaces can usually

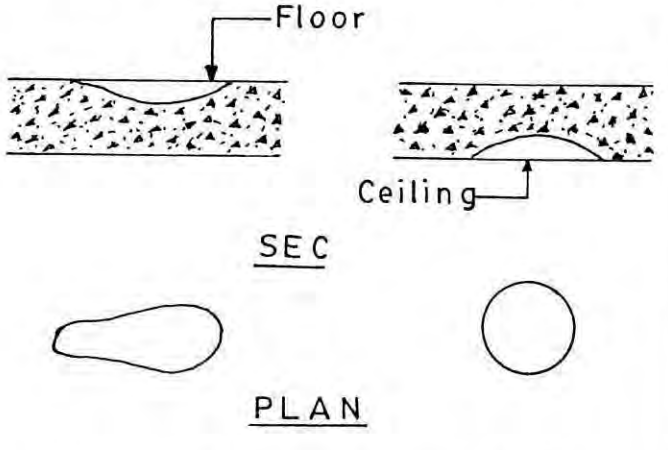
be sealed by filling them with cement grout. Finer cracks and those in soffits or vertical surfaces may be sealed by injecting a polymer. Epoxy resins may be used when pressure injection is necessary or when the repair is being carried out in order to restore structural integrity, but cheaper polymers can often be used when the purpose of the repair is to protect reinforcement from corrosion and the polymer grout can be run into the crack under gravity. Use of epoxy resins is very much limited in Bangladesh as this is very costly and not found everywhere. It is, however being used by some established agencies like M/S. Concord Engineers Ltd. as observed at the time of survey.

Cracks wider than about 1 mm in the upper surface of slabs can be sealed by brushing in dry cement followed, by light spraying with water if necessary. This treatment will seal the upper part of a crack against ingress of moisture and carbon dioxide but the depth of penetration of the cement will be variable. For cracks wider than about 2 mm it may be preferable to use a cement and water grout but this is far more likely to leave marks on the surrounding concrete. Alternatively, cracks can be chiseled out to a width of 5-10 mm and pointed up with cement and sand mortar.

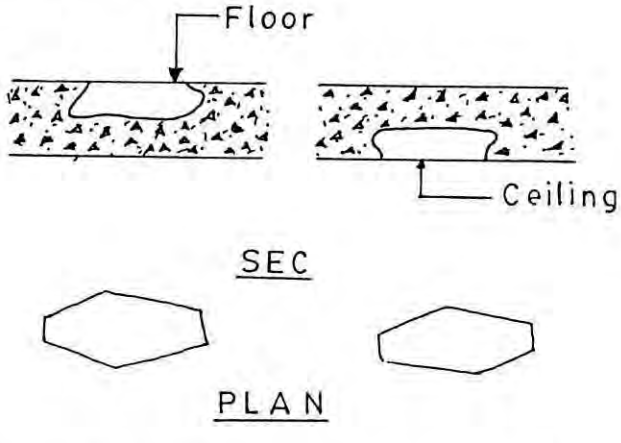
Stitching, external stressing etc. are some of the major crack repairing procedures used in developed nations. These methods are not in wide use in Bangladesh.

7.4.2 REPAIR OF SPALLED CONCRETE

Whatever be the cause of spalling damage, preparation of the damage area for repair is very important. Application of a sound patch to an unsound surface is useless because the patch will eventually come away, taking some of the unsound material with it. The first step must be to remove unsound concrete. The area to be cut out should be delineated with a saw cut to a depth of about 5 mm in order to provide a neat edge but the remainder of the cutting out operation can be done with percussive tools. Feather edges should be avoided if at all possible. Edges should be cut normal to the surface or slightly inclined inward for a depth of at least 10 mm as shown below. The periphery of the cut should preferably have sharp angnlar edges and not smooth round corners.



INCORRECT METHOD OF CUTTING OUT



CORRECT METHOD OF CUTTING OUT

If any corroded reinforcement is present the concrete should be cut back far enough to ensure that all corroded areas are exposed so that they can be cleaned and with bars of small diameter this will usually involve exposing the full perimeter. In case of doubt it is better to remove more concrete than strictly necessary rather than too little. Dust should be removed, as far as possible, from the surface of the concrete

before patching material is applied. After the steel bar has been prepared as described, a bonding coat should be applied to all exposed surfaces. This should be done with a minimum of delay but if necessary the surfaces should be cleaned again immediately before the bonding coat is applied. The first layer of patching material should be applied immediately after the bonding coat, while the latter is still wet. If there has been an unavoidable delay it may be necessary to repeat the final stage of preparation in order to expose a fresh surface. Hand applied repairs usually consist of cement sand mortar in proportions of about 1:4 using a sharp concreting sand. Repairs should be built up in layers, and each layer should normally be applied as soon as the preceeding one is strong enough to support it. The thickness of each layer should not normally exceed 20 mm.

CHAPTER 8

PROBLEMS ASSOCIATED WITH MASONRY WORK.

8.1 INTRODUCTION

One can not think of building construction without brick work in Bangladesh. This is the most vital item of the building construction industries here. The masonry brick work consists of the construction of brick foundation, wall (both load bearing & partition) and columns of any thickness and dimensions, with 1st class bricks in cement mortar in the proportion of 1:6 unless otherwise specified. The standard of the building depends on the quality and durability of the brick work. So it is necessary to find out the defects of brick work commonly seen in Bangladesh and the possible causes of failure of brick masonry. In the light of the causes of failure and defects found in brick work, proper method of construction should develop for betterment of the building construction industries in Bangladesh.

8.2 CAUSES OF FAILURE OF BRICK MASONRY

The correct approach to the understanding of the basic requirements in any construction is the criterion of failure. Brick masonry may fail due to the following causes.

1) By crushing, if it is overloaded with vertical loads.
2) By shearing along any horizontal plane due to lateral over loading.
3) By rupture along a vertical joint under vertical loads.

Care against crushing can be taken by providing adequate dimensions. Shearing along any horizontal plane is prevented by providing stronger mortar. Rupture along a vertical plane is avoided by staggering the vertical joints in brick work. Good bonding ensure good brick masonry. Bonding is the process of arranging bricks in courses in order to develop longitudinal and transverse interlocking for individual bricks. The purpose is to achieve a united mass as strong as practicable, to suit the length, height and thickness of brick work and the loads and stresses to whick it is subjected. The method is to ensure that vertical joints do not come one over the other.

However, if a wall is built so that there is no continuous vertical joint, the load will get distributed. This type of construction will be more durable and strong. As bricks are small units whick have equal dimensions, the process of bonding is easily performed. To ensure good bonding, the following rules should be observed.

1) The amount by whick the bricks in one course overlap the bricks in the course below should be minimum ¼ brick along the length of the wall and ½ brick across the thickness of the wall.

2) The vertical joints in the alternate courses should fall in plumb (vertical)line from the top of the wall to its base, whether on the face or in the interior of the wall.

3) The bricks should be uniform in size and the proportion of length to breadth be such that the length equals twice the width plus one joint. Good bond is impossible to achicve if the size of the bricks is not uniform.

8.3 DEFECTS IN BRICK WORK

Common defects occuring in brickwork are (1) Sulphate attack on mortars. (2) Use of unsound materials in const. (3) Corrosion of iron and steel. (4) Crystallisation of salts. (5) Linear changes resulting from variation in moisture content.

Defects on account of sulphate attack lead to expansion of mortar, thereby causing cracking of brickwork, spalling of brick edges, deterioration of mortar, wide horizontal and vertical cracks in the plaster and the falling off of the plaster. The cause of this attack is the chemical action between the sulphate salts present in bricks and the aluminimum constituents of portland cement . This action is rapid in presence of water and hence wherever moisture penetrates or excessive dampness occurs, this type of defects crop up. Prevention of moisture penetration will reduce the chances of this defect to a large extent. Use of bricks of low sulphate content and sulphate resistant cement in mortar eliminates the risk of sulphate attack.

Unsound materials cause the formation of small pits with nodules of friable materials at the mortar joints. General expansion and cracking of brickwork is visible. Unsoundness in lime is caused by the presence of unslaked particles, which may be present in the mortar unless care is taken to effect complete slaking. Defect due to frost action would cause cracking in the brickwork. Prevention of water accumulation would go a long way in preventing this defect. Crystallization of salts or efflorescence is a prominent defect in brick masonry. Cause of efflorescence & the preventive measure to be taken has been elaborately described in chapter-5.

8.4 PROPER METHOD OF CONSTRUCTION

The bricks to be used should confirm with the requirements of the specification of the work. Bricks shall be perfectly clean and free from moss or dirt of any kind. If necessary, the bricks shall be cleaned by scrubbing. The bricks should be saturated with water so as to prevent absorption of moisture from the mortar. Bricks should be immersed in water for at least 12 hours prior to their use in masonry work. Soaking of bricks in water is very important, as otherwise, they would absorb water from the mortar making it dry and weak and causing the bond between the bricks to be lost. Soaking of bricks to saturation frees them to a great extent from salt, which otherwise would cause the plaster, white wash and colour wash, to disintegrate and fall off in scales.

Preparation of mortar as per specified proportion of sand, cement and water must be ensured to obtain right working consistency. If it needs to be changed the engineer at sight must be consulted and the change noted down. Mixing of mortar in huge quantity must be avoided. Only the quantity that can be consumed in half an hour time should be mixed. Sand and cement should be thoroughly mixed before water is added to prepare the wet mix. The mason should not be allowed to pour water in mortar while it is being used to fill in the vertical joints. The joints should always be filled completely with trowels. The bricks should be properly laid on their beds. The mortar should completely cover the bed as well as the sides of bricks. The bricks should be properly laid with the frog mark up. The joints of brick work that will remain below ground level should be made flush with trowels and the portion of the plinth to remain exposed should have the joints racked well so as to help better plaster

bondage. The plastered area should extend 6 inch below ground level. As far as possible, the brick work should be raised uniformly. But when this is not possible or when a cross wall is intended to be inserted after sometime, steps or recesses should be provided as shown in Fig-8.3

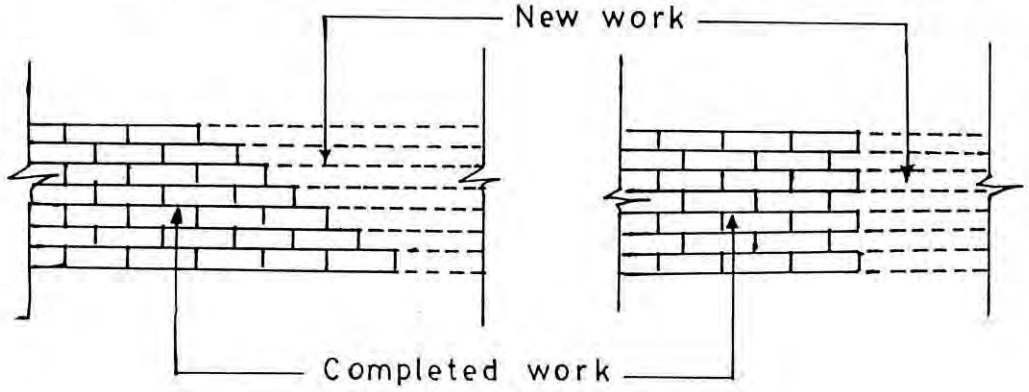


FIG:- 8-3

In the brick work, brick bats (broken piece of bricks) should not be used except as closers. All the brick bats of size less than half brick should be rejected and not allowed to be used in the construction. Proper curing of brick work mustbe ensured.

When new and old work have to be joined together, the old work must be well cleaned and thoroughly watered before the new work commences. No mortar joint shall exceed 3/8 inch in thickness. Thicker joints seriously weaken the structure. The maximum height that will be permitted to be done in a day should not exceed 3 feet for 10 inch wall and 2 feet for 5 inch wall. At the end of the days work the vertical and horizontal joints must be racked to a depth of ½ inch with a bent iron rod, so as to ensure good adhesion to the plaster to be done subsequently. It also help to fill up the joint between the bricks if any leaving no gap.

Face bricks for facing work should be specially selected with regard to their colour, shape, size and edges, Brick shall be laid so as

to give a perfectly straight face or the shape specified and the surface should be tested properly with suitable tools. Care must be taken to see that face bricks are laid on full mortar beds and have the vertical joints completely filled with mortar.

8.5 REPAIR OF MASONRY STRUCTURES

The objective of the repair which will generally be to restore or enhance one or more of the following

a) Durability

b) Structural strength

c) Function

d) Appearance

Of these four requirements, restoration of durability is by far the most common in repair work. One must also consider wheather the repair is to be permanent or temporary.

Cracks in masonry work due to unequal settlement and impact should be repaired immediately to prevent their aggrevation and consequent failure of the structure. If the bricks bordering the cracks can be removed without affecting the structure, then it should be done and portion should be rebuilt by proper cleaning and moistening the area . On many occations, cracks in masonry work may be repaired by grouting as used in concrete repair work (chapter-7).

The failure of brick abutments or masonry walls in contact with water often starts by disintegration and consequent erosion of mortar along the pointing in the portion that is subjected to alternate wetting and drying due to fluctuation of water level. The disintegrated and loose mortar including scales and growth of algae must be removed and thoroughly cleaned with wire brush.Pointing work shall then be carried out with rich mortarand cured for 14 days. Growth of vegetation or trees should be removed before roots penetrate deep in the masonry works.

CHAPTER 9

FOUNDATION PROBLEMS

9.1 INTRODUCTION

One can not think of building construction without foundation. It is very important part of the building. Wrong type of foundations may lead to various construction problems. Unwanted problems arises at the time of laying out the building. Sometimes construction may be hampered to a great extent due to want of required equipment for the selected type of foundation. On the otherhand, future possibility of vertical extension of the low rise buildigs may not be possible if foundations were not properly designed considering such possibility. The decision to select right type of foundation is important. But type of foundation depend on the soil condition and type of structure. Again, the soil condition widely vary from place to place which calls for exploratory soil investigation. The possible objectives and procedures for soil investigation are briefly described in this chapter. On many occations, deep excavation for foundation creats various types of problems in Bangladesh. On the otherhand post construction problems i,e, failure of foundation is also seen to occur all over Bangladesh. The reasons behind these post construction failures of foundation and possible remedial measures are also included here.

9.2 SOIL INVESTIGATION

The object of soil investigation is to get information regarding i) the nature, thickness and variation of soil strata at a place, ii) physical properties of the soil strata encountered, and iii) the seasonal variations in ground water table and its effect on the soil strata met.

The first step in soil investigation is to carry out a preliminary survey of the site. Information can be collected from the residents of the area regarding the type of soils available at different levels and also the location of water table of different seasons. A study of any existing building nearby will give a fair idea of the behaviour of the soil at the site. In case, if preliminary information and survey lead to conclude good soil condition, further investigation may not be necessary. However, for high rise buildings and where the character of soil is doubtful, it is essential to carry out a thorough investigation of the soil at site. The methods used for further study are

1) Open test pit method.
2) Borings.
3) Sub-surface soundings.
4) Geo-physical methods etc.

The preliminary and the detailed investigations mentioned above will furnish the following data about the site.

1) The depth of bed rock, if any
2) Character of soil, i.e. gravel, sand, silt or clay
3) Presence of boulders or other obstructions, if any
4) Evaluation of the ground water table

The next thing to determine is the type of foundation to be used, the depth to which it should be taken and its dimensions so that it can safely transmit the load from the building to the soil without any failure or significant settlement. For their determination, a knowledge of the safe allowable pressure on the soil is necessary.

This is called the bearing capacity of the soil. The maximum load which a soil can carry just prior to failure is termed the ultimate bearing capacity of soil. A fraction (usually 1/3 rd) of the ultimate value is considered to be safe or allowable bearing capacity of soil.

Sometimes, it may be necessary to increase the bearing capacity of the existing site. Some of the methods commonly adopted are as follows.

i) Compaction

ii) Consolidation

iii) Confining the soil

iv) Grouting

V) Chemical treatment etc.

The most suitable method to be followed shall depend on the soil investigation report, the financial capabilities of the client and the personal judgement of the foundation consultant.

9.3 PROBLEMS OF DEEP EXCAVATION

Where the soil is soft and loose, deep excavation is required for the foundation. All most all types of deep excavation for the building foundation are done manually in Bangladesh. Accidental deaths during deep excavation due to side collapsing have been reported. The main problems associated with excavations are

1. Collapsing of sides of the trench
2. Water collected at the bottom of the trench due to seepage through the sides and the bottom

The collapsing of the sides of the trench may be protected by adopting a suitable method of shoring . During the process of shoring

it is absolutely necessary to take extreme care for the safety of persons working as well as the adjacent properties. Careful watch should be kept on the amount of slip of earth from the sides of the trench. It is necessary to appoint at least one supervisor on ground to look after the workers in the trench.

The water collected at the bottom of the trench may be removed by adopting one of the following methods

1. Pumping
2. Providing sumps and side drains
3. Well point system etc.

9.4 POST CONSTRUCTION PROBLEMS

Post consturuction problems of foundation may occur due to various reasons. These problems are faced in various buildings all over Bangladesh. Causes of these post construction along with preventive measures to reduce their recurences are discussed below.

9.4.1 UNEQUAL SETTLEMENT OF SUB SOIL

Unequal settlement may occur due to various reasons such as unequal distribution of laad on the foundations, varying bearing power of the sub-soil, eccentricity of the load etc. Due to unequal settlement of the sub-soil, cracks may develop in the building which in future leads to serious defects. Following are the measures to be adopted to prevent such failure:

a) Foundation should preferably rest on rock or hard soil.

b) Design of foundations should be appropriate to the nature of sub soil.

c) It should be seen that the allowable bearing pressure on the soil is not exceeded, even under the worst conditions.

d) Designer should check that proper attention has been given to the eccentricity of the load on the foundations.

9·4·2 UNEQUAL SETTLEMENT OF THE MASONRY

Mortar joints may shrink and compress which may lead to unequal settlement of the masonry. Measures to avoid such situation are as follows

a) Mortar to be used in the masonry should be stiff and in line with the workability desired.

b) The masonry work should be raised evenly.

c) The height of wall to be raised per day should be limited to 3 feet maximum.

d) Watering to ensure proper curing should be done to the masonry work.

9·4·3 WITHDRAWAL OF MOISTURE FROM THE SUB-SOIL

This occurs at places where there is considerable variation in the height of water table. When water table falls, the soil particles lose cohesion and hence, there is shrinkage of soil resulting in the cracks to the building. The precaution to be taken to avoid such failure would be to drive piles upto the required depth.

9·4·4 LATERAL PRESSURE ON THE SUPER STRUCTURE

The thrust of a piched roof or arch action or wind action on the super structure or an earth quake causes wall to overturn. Remedial measures to prevent this failure would be to provide a sufficient wide base and to design the foundations for the worst condition of expected lateral load.

9.4.5 HORIZONTAL MOVEMENT OF THE EARTH

Very soft soil is liable to give way under the action of load, especially at places such as sloping ground, river banks etc. Hence in such cases, it is desirable to construct retaining walls or to drive sheet piles to prevent the escape of the earth.

9.4.6 TRANSPIRATION OF TREES AND SHRUBS

The roots of trees planted near a building may extend upto the foundation level and may absorb the moisture. This effect is seen in the form of a depression on the ground and it may lead to cracks in the building .Remedial measures are

a) Foundations should be taken sufficiently deep. A minimum depth of three feet is required for this purpose.

b) Fast growing and water-seeking trees should not be planted near the building with a minimum distance of 25 ft.

9.4.7 ATMOSPHERIC ACTION

Rain and sun are the main atmospheric agents which seriously affect the foundations of a building . Heavy rains or considerable variation in temperature or frost action may damage the foundations. Rain water may create pockets mear the walls and while percolating through the top soil, it may carry certain chemicals and salts obtained from sewage, and other waste left over ground. These chemicals and salts may react with the mortar or concrete used in foundation and may start the disintegration of the foundation work. Remedial measures should include the following steps.

a) The depth of foundation to be increased so that rain water can not reach it easily.

b) Provision of suitable under ground drains should be kept in order to maintain the water table at a definite level.

c) Careful and compacted filling of the sides of the foundation trenches should be ensured with the earth and or sand.

d) A gentle slope should be provided on the ground sloping away from the walls so as to keep rain water away from penetrating through soil adjacent to the foundation.

CHAPTER 10

MISCELLANEOUS PROBLEMS

10.1 INTRODUCTION

There are widely varying catagories of works involved in Building construction. The associated problems are also widely varied and unlimited. The major problems observed at the time of survey has been discussed in the previous chapters. (from chapter-2 to 9). The problems related to construction materials, equipments, foundation, concrete works, masonry etc has been dealt with at length and probable remedial measures suitable and proven satisfactory by practice has been outlined. Besides, there are other varieties of problems like those associated with doors and windows, shuttering, termite attack, workers etc. which needs consideration and are described in this chapter.

10.2 PROBLEMS WITH DOORS AND WINDOWS

Doors and windows are useful building elements. The main function of doors in a building is to serve as a connecting link between the various internal parts. Window are generally provided to give light and ventilation to the interior parts of a building. Usual materials for doors and windows are wood, glass, plywood and metals. But the supply of quality wood is in-sufficient. Those available are not seasoned, although the price is rising up fast. The door and window frames and shutters made of these unseasoned wood soon fail to work properly due to change in their dimensions with weathering effect. The present practice of various types of doors & shutters along with their usefullness and commondefects are described below.

Flush doors are suitable espacially for interior work in place of solid or wooden panel doors. These are prepared by specialist firms and available in standard sizes. Flush doors are economical, easy to clean, better in appearance, little affected by moisture, termite-proof and crack-proof. The following points should be kept in mind in order to ensure good quality of flush doors.

a) The life of flush doors depends to a large extent on the glue bonds, Hence, glue used for the manufacture of flush doors should be of very high standard. The glue usually used are phenol formaldehyde (PF type) and urea formaldehyde (UF type). Phenol formaldehyde can join wooden pieces under high pressure and heat. It is the best for water proofing qualities but it is costly. Urea formaldehyde can join wooden pieces under pressure at room temperature.

b) Timber to be used in the preparation of flush doors should be properly seasoned and its moisture content should be reduced to the desired level.

c) Flush door should be suitably heated and pressed in hot-press.

d) Termite-proof treatment should be given to all timber work before applying glue.

Now a days metal windows are being used especially for public building. Metal used in the construction may be mild steel, bronze, aluminim or other alloys. The metal frame may be fixed direct to the wall or it may be fixed on a wooden or R.C.C. frame. The precautions to be taken in case of metal windows are as follows :

a) The members of the frame and sash should be properly welded at the corners.

b) The metal frame should be embedded in cement mortar or bituminons mastic to prevent the entry of moisture or rain water.

c) The window units should be carefully stacked at site. As window frames are not designed to carry external loads. They should be carefully carried while placing in position. It is advisable to check and slightly adjust the movements of shutters before erecting the window in the opening. The hinges should always remain clear of the plaster. As a precautionary measure, they should be wrapped in plastic bags while plastering.

d) Precautions should be taken to prevent corrosion of the metal windows

The advantages of metal windows over wooden windows are as follows:-

a) Metal windows are not subject to contraction or expansion due to weather effects as in the case of wooden windows. Metal windows exhibit elegant appearance.

b) The members of metal windows are narrow and hence steel windows admit more light & ventilation for the same area as compared to wooden windows .

c) Metal windows are factory made products and so they possess greater precisions as compared to wooden windows.

Now a days pre-cast concrete door and window frames locally known as chowkats are being used in place of wooden frames(chowkats) which are in short supply and have become increasingly costlier. Concrete chowkats are cheaper than those made of wood and more suitable

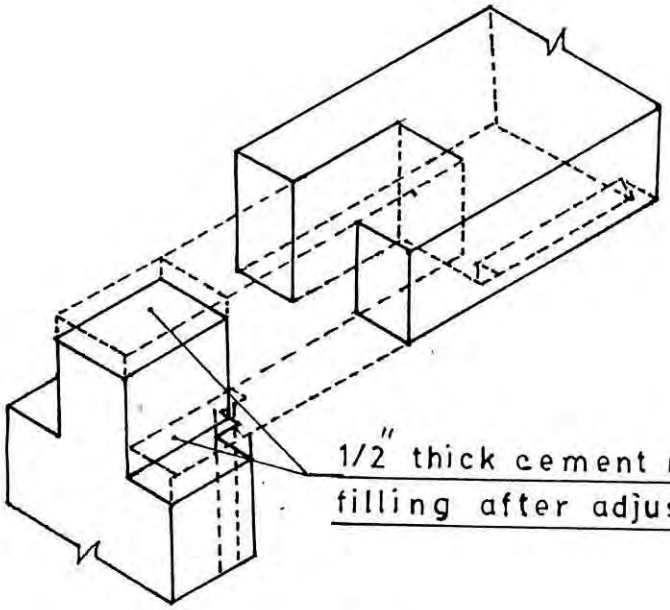
in damp areas like bath rooms, kitchen, out side door frame exposed to wheather. These are also resistant to termite attack and fire.

Innumerable sized and types of doors and windows are used in building which consume large volume of timber. In order to minimise the wastage of timber, it is essential and important to standardise and optimise the dimensions of doors and windows. This will help to economise the cost of pre-fabricated door and window frames in buildings replacing relatively costlier timber frames.

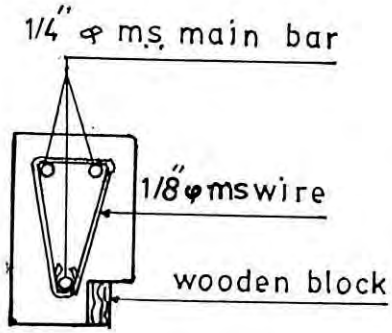
Pre-fabricated reinforced concrete door and window frames are being produced on small scale by the House Building Research Institute at Mirpur, Dhaka. ¼" dia M.S. rods are used as main reinforcement while 1/8" M.S. wires are used as ties. A typical R.C. door frame detail is shown in Fig. 10.1. It is learnt that these R.C. frame chowkats are gredually gaining acclaimation from the people.

10.3 FORMWORK AND SHUTTERING

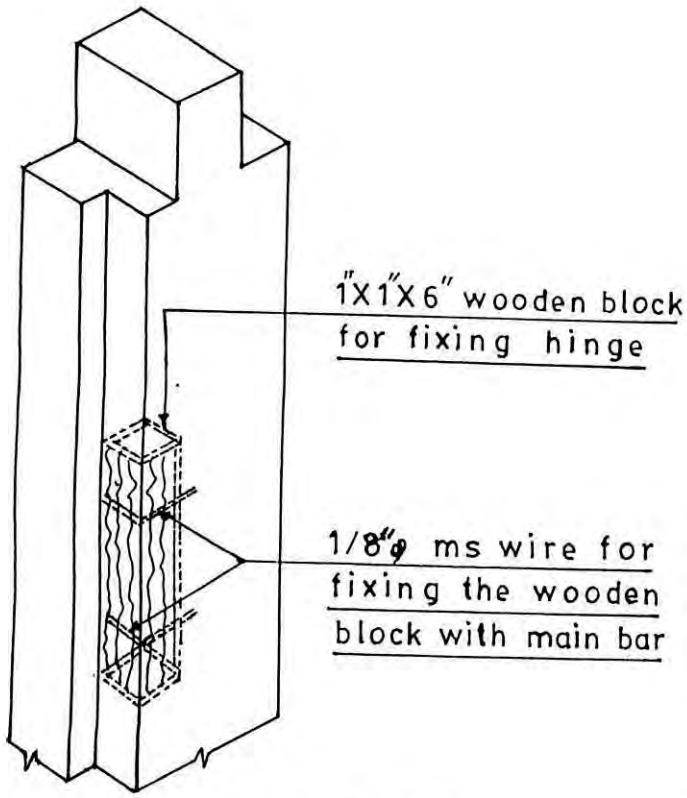
When concrete is placed, it is in a plastic state. It needs to be supported by temporary supports and casings of the desired shape till it becomes sufficiently strong to support its own weight. This temporary casing is known as formwork or shuttering. The requirements of formwork are a) Easy removal b) Economy c) Less leakage d) Rigidity, e) Smooth surface and f) Strength.



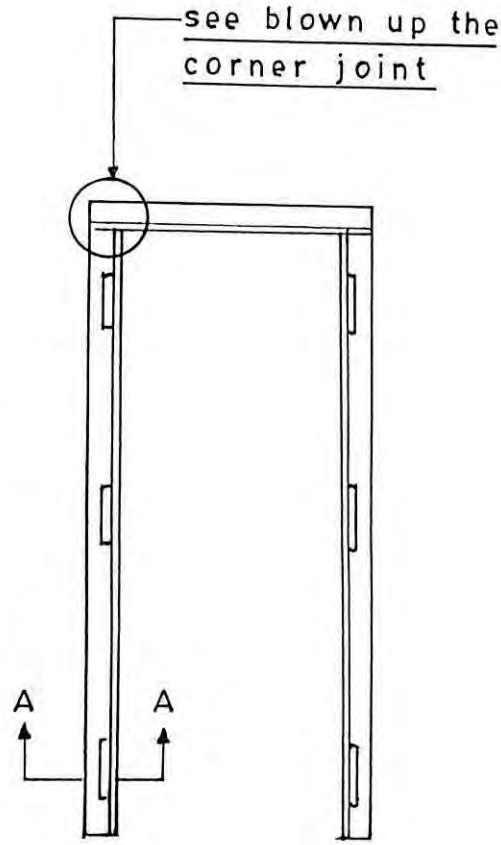
blown up corner joint
by isometric view



section-AA



isometric view of r.c.c. chowkat



elevation of door frame

Fig. 10·1 Reinforced Concrete Door Frame[9]

Steel & timbers are the commonly used materials for the formwork. Steel is used for formwork when it is desired to reuse the formwork several times. The initial cost of steel formwork is very high. But it proves to be economical for large works requiring many repetitions of the formwork. The erection and removal of steel formwork are simple and it presents a smooth surface on removal. When formwork is required for small works requiring less repetitions, timber is preferred to steel. The timber formwork is cheap in initial cost and it can be easily adopted or altered for a new use. Following facts in connection with timber formwork should be remembered.

1) The timber is to receive wet concrete. Hence timber formwork should be neither too dry nor too wet. If it is too dry, the timber will swell and get distorted when wet concrete is placed on it, This will affect workability of concrete and honeycomb surface will appear on removal of the formwork. On the otherhand, if it is too wet, the timber will shrink in hot weather resulting in gaps in the formwork through which concrete will flow out. Hence ridges will be formed on the concrete surface. It is found that a moisture content of about 20% is appropriate for the timber formwork .

2) The dimensions of components of timber formwork will depend upon the loads to be carried and the availability of timber sections. But generally the latter is the governing factor as the former can be adjusted by suitable spacing of the supports.

3) Minimum nails should be used in timber formwork and the nail heads should be kept projecting so as to facilitate easy removal.

4) The formwork should be designed to resist the high pressure resulting from the quick filling of the concrete.

5) The inside of the formwork should be washed with water just before the start of pouring concrete in to it.

Good exposed surface of concrete members can be achieved if the above mentioned hints are taken into consideration during preparation of form works and shutterings with timber. But, here in Bangladesh, the inherent mentality of the workers to get the job done quickly without assigning any importance to the quality, is responsible for bad, unpleasing concrete surfaces so common all over the country.

10.4 IMPROPER CURING

Inadequate curing causes innumerable cracks to develop at the concrete surface. The quick surface drying of concrete results in the swift movement of moisture from the interior to the surface. This steep moisture gradient cause high internal stresses which are responsible for internal micro cracks in the semi plastic concrete. Desireable strength can not be achieved without proper curing.

By proper curing, durability and impermeability of concrete are increased and shrinkage is reduced. Resistance of concrete to abrasion is considerably increased by proper curing. Curing can be considered as creation of a favourable environment during the early period for uninterrupted hydration. The desirable conditions are, suitable temperature and presence of ample moisture. The methods of curing are largely dependent on the nature of work, weather conditions and economy considerations. To ensure proper curing, the following steps may be followed.

1. For vertical surfaces, curing is difficult. It is generally done by spraying water at intervals after formwork is removed. Wooden formwork

should be coated with oil from inside and during hot season, water should be sprayed to the outside of formwork. Alternatively, the exposed surface of concrete may be covered with hanging canvass or gunny bags which should be kept wet.

2. For horizontal surface such as slabs, floors etc.curing can be done by spraying, ponding or covering the concrete with moist earth, sand or wet gunny bags. For flat horizontal surface, ponding is an effective method and it consists of little earthen dams built all over the surface to be cured and filling in the enclosures with water.

3. Curing of plaster is also essential. For want of curing the plaster become weak even though right proportion may have been used. Curing of plaster shall continue for at least 7 days.

Improper curing has frequently been observed in Bangladesh and this has certainly adversely affected the quality of works. So,due attention must be paid immediately in this regard to improve on the quality.

10.5 TERMITE ATTACK

The termites are popularly known as white ants and they are found in everywhere in Bangladesh. These insects live in a colony and they are very fast in eating wood and other cellulose materials as food. They also damage other materials like plastics,leather etc. The term termite proofing is used to indicate the treatment which is given to a building so as to prevent or control the growth of termite in a building.

There are two types of termites which damages the buildings. They are known as drywood termites and subterranean termites. The drywood termites live in drywood in small colonies without maintaining any connection with the soil. These termites are lessin number and they are generally found in the humid coastal regions of Bangladesh. On the other-hand subterranian termites can not servive or live without maintaining connection with the soil. The primary colonies of these termites are established in the ground and in search of food, which is mostly wood, they develop earthen shelter tubes or tunnels in other materials. They require adequate moisture and it is supplied either from soil through tunnels or through wet spots in building or through any other available source. The entry of the termites into buildings takes place through cracks or fissures in concrete and masonry, pipes, conduits, floor joints etc.

The removal of termites from a building is not an easy task. The termites get rich supplies of food in a building such as textile, wood work, paper products, vegetable products, plastic insulation of wiring etc. All these items are easily attacked by termites reducing their strength and values considerably. Once the termites establish their colony in a particular building, it becomes difficult and costly to remove them completely. It is therefore, better to give suitable treatment of termite proofing during the construction of building. Great care should be taken in inspecting the filling material or debris used for reclamation of soil. If it contains termite colonies, the building construction on the reclaimed land become victim of the termite attack. It is not possible for termites to enter through dense concrete foundations or other solid foundations. The construction of foundations should therefore be carried out with superior quality materials and better work-

manship. Suitable joint fillers or metal strips may be used to make floor joints termite proof. The site of building should be carefully inspected and cleared of all dead wood, old tree stumps, etc. If mounds of subterranean termites are found, they should be destroyed by forcing insecticides at a number of points along them after making openings or holes in the earthen tunnels. The materials of superstructure which are easily susceptible to termite attack should be treated with suitable preservative. Also wooden members such as door frame, stair cases etc. should be set on flooring and not through flooring.

Termite proofing can be achieved by soil treatment with chemicals. Soil insecticides are throughly mixed and well spread in soil so as to provide an effective chemical barrier for termites. Various patented chemical insecticides such as DDT, BHC, PCP etc may be used. But the following chemicals in oil solution or preferably water emulsion have proved to be successful. The chemicals are Aldrin- 0·5 % Chlordane 1.0% , Dieldrin 0.5 % and Heptachlor 0.5%. The above concentrations are by weight. They are insoluble in water and hence, they are not leached out by the sub soil water. The applications of these chemicals serve as a chemical barrier between the building and the ground and this method has proved to be the most effective method of termite proofing.

The post construction treatments after termite attack consist of opening earth around the building(2'-0"x1'-6") and treating it with chemicals; drilling holes in damaged portions of masonry and wood work and injecting chemicals under pressure. After injecting the chemicals the room should be closed about 24 hours. Then it should be opened. These treatments are costly & complicated & should be carried out through experts in this field.

10-6 CONCLUDING REMARKS

Building construction problems are unlimited. The problems so far discussed are not all. There may be many more problems omitted due to the limitation of time or simply the because the persons surveyed forgot to mention. It is not possible for one to out-line all the problems of building construction. Co-ordinated efforts to collect data in this regard by more individuals will be required. The main problem in Bangladesh is the poor economic condition of the country. Many of the problems are related with economy. For example, the deterioration of law and order situation, adoption of unfaremeans during construction, adulteration of construction materials, incapability of collection of good quality materials etc. are very much related with the poor financial condition of the country. The mentality of the persons involved in the building construction industry are not satisfactory and must be improved for healthy development of the building construction practice. It is anticipated that the situation will improve in future as the demand for good building construction grow stronger.

CHAPTER 11

CONCLUSION AND SUGGESTION

11.1 CONCLUSION

From the survey carried out during this study, numerous problems associated with the present day building construction practices in Bangladesh have been reported. The problems are varied in nature and in magnitude. Some of these problems are related to the constructional materials while some others related to the construction equipments. Some are faced prior to and or during construction phase while many crop up after construction. All the similar varities have been grouped together and discussed elaborately under different chapter heads. Here in this chapter, the conclusions of the previously discussed problems are outlined briefly. The conclusions are

1) The quality of construction materials like bricks, reinforcing steel, cement, sand etc. vary widely and were found to be far below standard in many places.
2) Most contractors do not possess the common construction equipments like concrete bucket, mixure machine, earth rammer, mixing plant, stone crushers etc. Although some big contractors possess them but even then skilled technicians are absent.
3) Buildings are being designed and constructed without carrying out any soil investigation for the site of construction. This brings about unnecessary problems during construction and some post constructional defects which could have been avoided if soil investigation were done prior to construction.

4) Salinity problems i,e, the efflorescence of bricks and mortar were observed almost every where in Bangladesh.

5) Visible cracks in concrete structure and brick masonry were observed. Most of these cracks were due to negligence and improper methods of construction followed

6) Soaking of roof slabs and dampness of walls and floors are quite common problems which could have been avoided in most cases.

7) Improper fitting of the various building accessories like door and window frames, sanitary fixtures etc.were observed in almost all public buildings.

8) Most of the contractor in Bangladesh are technically unsound and lack skilled work force.

9) Overall socio-economic condition of the country is poor and the moral standard is even lower. Quality of construction seriously suffer on many occations due to ill motives of the contractors and the supervising staffs.

10) Lack of co-ordination between different teams (e.g.civil,sanitary, electrical etc) involved in building construction causes unnecessary delay and creats problems which should not have happened at all.

11) Inadequate and improper maintenance work are responsible for many post constructional problems.

12) Market price of constructional materials is very unstable. The rise in price is sudden and sharp. But the contractor seldom gets the price enhancements because of clumsy procedure. The effect is low quality construction with multiple defects.

13) Many buildings in the private sector, specially out side Dhaka have been constructed without being designed by an architect andor professional engineer. These improperly designed buildings creats environmental problems as well as functional problems of the building it self.

14) The unabated growth of the musclemen over the last decade and their extortion of money from the contractors in the name of club subscriptions is a serious threat to healthy development of building construction industry.

11.2 SUGGESTION

Most of the constructional problems are in a way related with the financial condition of the owner and to some extent the contractor. A positive step then would be to economise the cost of construction. So the process called economy construction should be found out. A brief outline of the various parameters influencing the process of economy construction is given below

The cost of construction is governed by the following five parameters. a) Material, b) Labour c) Equipment d) Overhead and supervision e) Profit.

a) Material: The cost of material can be economised by incorporating in the design locally available materials and thereby saving the cost of transportation which in many cases may be more than the cost of the material Economy may sometimes be achieved by slightly relaxing the rigid inspection of the material provided the safety and durability of the structures is

not sacrificed and the requirements of the purpose for which material is used are fully satisfied.

b) Labour: In Bangladesh unskilled labour is available at comparatively cheap rates. As far as possible, advantage should be taken of the locally available semi-skilled labour without resorting to outside skilled labour. If a high class building is required to be constructed a high grade concrete finish may be necessary, especially if the concrete surface is exposed to weathering action. On the otherhand if a ware-house or a godown is required, the standard of concrete finish and the type of mix can be lowered. Workmanship specified should therefore be in conformity to the requirement of the project and accordingly skilled or semi-skilled labour should be engaged.

c) Equipment: A problem which frequently confronts a contractor as he plans to construct a project is the selection of the most suitable equipment. He should consider the money spent for equipment as an investment which he can expect to recover, with a profit, during the useful life of the equipment . Contractors and other users of construction equipment frequently are concerned with a decision as to whether to purchase or rent equipment. Under certain conditions it is financially advantageous to purchase, whereas under other conditions it is more economical and satisfactory to rent it. The purchase of equipment, as compared with renting it, has several advantages including the following:

i) It is more economical if the equipment is used sufficiently.

ii) It is more likely to be available for use when needed.

iii) Because ownership should assure better maintenance and care, purchased equipment are kept in better mechanical condition. Among the disadvantages of owning equipments the following may be mentioned :-

i) It may be more expensive than renting.

ii) The purchase of equipment may require a substantial investment of money or credit that could be spent else where if needed.

iii) The ownership of equipment might influence a contractor to continue using the equipment beyond its economical life, thereby increasing the cost of production unnecessarily.

d) Overhead and supervision:- Overheads and supervising staff, though themselves do not produce any physical out put, yet they are very important parties and they indirectly make substantial contribution to the achievement of the targets. However their number should be kept to minimum in order to get the job done under optimum conditions.

e) Profit: This factor can not be directly controlled by the engineer. However the amount of profits is the difference between cost of the first four parameters described above and the output achieved in terms of its valuation. The Engineer therefore can increase profit by getting maximum work from men and machines and by reducing the expenditure on the various items of expenditure. The list given below indicates some of the ways in which the cost of construction can be reduced and as a corollary to this, the profit can be increased.

1) Standardising the members of the concrete structure so that the same forms can be used a number of times.

2) By avoiding complicated construction procedures as far as possible so that unskilled or semi-skilled workers can manage the affairs.

3) By avoiding unnecessary special construction features.

4) Using cost saving equipments.

5) Using local materials as far as possible.

6) Making specifications clear and unambiguous.

7) As far as possible follow standards already framed by the local standard institutes.

8) The supervisory staff should have adequate experience in similar constructional fields in order to deliver their duties efficiently.

Along with the vital step of economy construction the following sugessions may be considered to overcome the building construction problems in Bangladesh.

1) Collection of proper construction materials must be ensured. Effective measures should be taken by the government for production of quality materials through Bangladesh Standard Testing Institution or similar organisation.

2) Modern construction equipment may be collected centrally by the government and to be rented to the builders.

3) Arrangement for training of the workers and technicians to be ensured by the government as well as by the agencies concerned and certificate to be issued after complition of the training. Only the certificate holders should be employed in the respective field works.

4) Good co-operation among the related persons of building construction industries should be motivated.

5) Stable price in the market should be ensured by the government otherwise standard provisions for price escalation should be laid down.

6) Proper method of construction should be followed and strict supervision in this regard should be guaranteed.

7) Law and order situation of the country must improve for healthy growth of building construction industry. Stable political situation is a precondition.

APPENDIX - A

A.1. Builders

1. Engr. Mohammad Nasim Hasan, Proprietor, M/s Hasan Engineering and Construction, 479 Malibagh, Dhaka 1217
2. Engr. Mohammad Luqman, Economic Design Consultants, 213 Lalmatia Block-A, Mirpur Road, Dhaka 1207.
3. Engr. A.H.M. Shahiduzzaman, Asstt. Project Manager, Eastern Housing Limited, 125/A Motijheel C/A, Dhaka.
4. K.A. Mokarram, Contractor, Iqbalnagar Mosque Road, Khulna.
5. Mr. Ruhol Amin, Proprietor,M/s R.R. Enterprise, 86 B.K. Roy Road, Khulna.
6. Mr. Tamizuddin, Proprietor,M/s Shabuz Kalabid, Sugar Mill Road, Joypurhat.
7. Mr. Molla Shamsul Alam, Proprietor, M/s Molla Construction, Marwaripatty, Joypurhat.
8. Mr. Shafiul Islam, Contractor, Bogra.
9. Mr. Sayed Motiur Rahman. Contractor, Puraton Koshba, Jessore.

A.2 Engineers.

1. Engr. A.F.M. Sharfuddin, Chief Engineer, Public Works Department, Dhaka.
2. Engr. Ayet Ali Bhuiyan, Executive Engineer, PWD Division Jessore.
3. Engr. Dewan Shah Alam, Sub-Divisional Engineer, PWD, Khulna.
4. Engr. Shafiul Alam Khan, Research Engineer, Housing and Building Research Institute, Mirpur, Dhaka.

5. Engr. Nazmul Haque, Asstt. Engineer, Municipal Corporation, Khulna.
6. Engr. Abu Sadeque, Asstt. Engineer, PWD Design Division, Dhaka.
7. Engr. Ainul Farhad, Asstt. Engineer, PWD Design Division, Dhaka.
8. Engr. Abdul Mazid Sikder, Sub-Divisional Engineer, PWD, Dhaka.

A.3 House Owners and Dwellers

1. Mr. Md. Safiqul Islam, Chief Matropoliton Magistrate, Khulna.
2. Mr. Nizamuddin, Information Officer, PID, Rajshahi.
3. K.B.M. Abdul Latif, Basepara, Jessore.
4. Mr. A.K. Azad, District Controller of Food, Joypurhat.
5. Dr. Abdun Noor, Civil Surgeon, Joypurhat.
6. Mr. S. Zaman, Supt.of Police, Joypurhat.
7. Molla Atiar Rahman, 23/2 Share-e- Bangla Road, Dhaka.

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