OFFICE OF THE ADDL. CHIEF ENGINEER (DESIGN)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

DESIGN CIRCULAR No. 1.

No. ACE(D)(C)/TC(7)/83/591 Dated: the September 22, 1983.

Subject:- Soil Investigation.

Soil investigations are being got carried out by various Executive Engineers for engineering purposes including determination of safe bearing capacity. Reports received in C.D.O. from various Executive Engineers indicate that observations relating to depth, at which tests are carried out are made with reference to ground level at the location of the bore hole or test. Generally there is considerable variation in ground level in the same area from place to place and it is very difficult to co-relate the results at a particular depth in one bore hole with the observations in the other bore holes.

All Executive Engineers are, therefore, requested that in future wherever soil investigations are carried out, the reduced level of the ground at the point of test should also be indicated with reference to a common datum level.

(S.C. Gupta)
A.C.E.(D)

All Executive Engineers (Civil) in D.D.A.
(Executive Engineer _____ Division _____, D.D.A.)

Copy forwarded to:-

1. The Engineer Member for favour of information.
2. The Chief Engineer, DDA and Chief Engineer(Q.C.)
   for information.
3. All Superintending Engineers in D.D.A. for
   information and necessary action.
4. The S.S.W.-I & S.S.W.-II, D.D.A.

(S.C. Gupta)
A.C.E.(D)

OFFICE OF THE ADDL. CHIEF ENGINEER (DESIGN)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

DESIGN CIRCULAR NO. 2.

No. ACE(D)(C)/TC(6)/83/3910 Dated the 21 September, 1983.

Subject:- Building Statistics.

Delhi Development Authority has constructed large number of housing schemes and many of them have been completed. Central Design Organisation has taken up compilation of statistical technical information on building constructed by D.D.A. This information when available can be used for various purposes, like forecasting requirement of building materials, deciding future construction programme with reference to availability of building materials, comparing efficiencies of building design and various other purposes.

All Executive Engineers in D.D.A. are requested to please supply the information for the housing schemes completed for their Division in the enclosed proforma. One separate sheet may be used for each work. Rest of the information in the proforma can be filled up with reference to information available in final bills and technically sanctioned estimates. In case of information regarding quantities of different diameters of steel bars used in the work, these details may have to be worked out in those cases where accounts of steel consumption have not been maintained diameter wise. If Executive Engineer's find it difficult to supply this information, this information may be left out but other information sent as early as possible. Sufficient copies of this circular are enclosed for distribution to various A.Es in each Division.

Early action in sending this information will be highly appreciated.

Encl:- As Above.

(S.C. Gupta)
A.C.E.(D)

All Executive Engineers(Civil), in DDA with four spare copies.

Copy for information forwarded to:-

1. The Engineer Member, DDA.
2. The Chief Engineer, DDA & C.G.(O.C.).
3. The all A.C.E.s, D.D.A.
4. The all S.Es (Civil), D.D.A.

(S.C. Gupta)
A.C.E.(D)

/dhr.

(13)

PROFORMA

BUILDING STATISTICS

Sl. No.	Items	
1.	Name of Work	
2.	Architectural Scheme No.	
3.	Number of Units constructed and total plinth area	
4.	Total quantity of cement concrete work in the building	
	Cement concrete	
	a) 1:2:4	
	b) 1:1½:3	
	Lean cement concrete	
	c) 1:5:10	
5.	Total quantity of steel used in the work	Tor Steel / Mild steel / Other reinforcement
	a) 6 mm dia.	
	b) 8 mm dia.	
	c) 10 mm dia.	
	d) 12 mm dia.	
	e) 16 mm dia.	
6.	Total quantity of cement consumed in the building.	
7.	Total quantity of brick work in the building	
	a) Cement mortar	
	b) Cement lime mortar	

...../-

Sl. No.	Items	
8.	Total quantity of door window and shutters in Sq. M.	
	a) Shutters	
	b) Frames	
9.	Total quantity of flooring	
	a) Cement concrete flooring	
	b) Mosaic flooring	
10.	Total quantity of plaster	
	a) Cement plaster	
	b) Cement lime plaster	
11.	Specifications of building	
	a) Type of foundation	spread footings/raft/ under-reamed piles
	b) Load bearing/framed structure	
	c) Doors and window	Steel/Wooden
	i) Frames	Steel/Wooden
	ii) Shutters	
	d) Plaster	Cement/Lime
	i) External	Cement/Lime
	ii) Internal	

Exec. Engineer

CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

(5)

NO.ACE(D) (C)/TC(6)/83/38

DATED : 7-1-84

SUB: BUILDING STATISTICS.

A reference is invited to this office letter NO.ACE(D) (C)/TC (6)/83/390 dt. 22.9.83 (Design Circular NO. 2) vide which statistical information about housing schemes completed in their divisions was requested from various Executive Engineers in DDA. Information has not been received from any Executive Engineer except a nil report from EE/HDXXIV, RPDVI, CPDVI, RPDV, CPDIII & EA to SE-C-X/DDA.

All Executive Engineers are once again requested to furnish the necessary information as early as possible.

(S.C. GUPTA)
A.C.E. (D)

ALL EXECUTIVE ENGINEERS IN DDA.

Copy forwarded to :

1. Engineer Member, DDA.
2. CE & CE(QC)/DDA
3. All Addl. Chief Engineers in DDA.
4. All Superintending Engineers (Civil) in DDA.

ADDL. CHIEF ENGINEER (D)

ssm/7.1

Circular. 3

CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

NO. ADE(D)TC(9)83/ 436 DATED : 30/9/83

Design of an overhead tank had been referred to CDO for checking. During the review of this design, it was noticed that :

a) No provision had been made for testing of bored compaction under-reamed piles used in foundation of this overhead tank.

b) The tank design had not been checked for wind load under empty condition.

c) The drawings submitted by the contractor and approved by DDA did not show full details of railing as contemplated in the tendered documents.

d) While approving the design in DDA, bulb diameter has been increased to 90 cm. from 75 cm. without changing the stem diametre of the under-remaed pile or the spacing between the piles.

Testing of piles for verifying the load carrying capacity of under-reamed piles is necessary. Provision made in Indian Standard Code in this respect should be strictly adhered to & testing of under-reamed piles got done before allowing further construction of the super-structure.

Checking of structural design of water tank & its stability under wind load with tank being empty is necessary as this can be critical position in some specific cases. Drawings approved for execution should include complete details as required under the agreement to avoid the possibility of field execution not being done as per the agreement.

All Engineers in DDA are requested to keep these observations in view in future works.

(S.C. GUPTA)
A.C.E. (D)

CE/CE(QC), DDA.
All ACEs.
All SEs i/c SSWs & SE(Arb.) with four spare copies for their Executive Engineers.

Copy forwarded for favour of information to :

1. VC/DDA.
2. EM/DDA.

Copy to : Guard File.

(S.C. GUPTA)

CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

NO. ACE(D)TC(3)83/1246 DESIGN CIRCULAR NO. 4 DATED : 16.12.83

SUB: FOUR-STOREYED MASONRY CONSTRUCTION - STRENGTHENING ARRANGEMENTS REQUIRED FOR RESISTENCE IN [illegible]

1. Four -storeyed masonry buildings are being constructed by DDA in Delhi in connection with various housing schemes under execution. Strengthening arrangements in such houses are required to be provided in accordance with Indian Standard 4326 1976 i.e. code of practice for earthquake resistant design and construction of buildings & IS 1893-1975 i.e. Indian Standard criteria for earthquake resistant design of structures. The present circular has been prepared to remove any doubts if their exist all among the engineers in DDA & an effort has been made to consolidate the the provisions required to be made in such structures.

2. Table 2 detailing the strengthening arrangements required to be made per Indian standard 4326-1967 are given in annex. I. According to this table, provisions required to be made in a particular building depend upon the design seismic co.-efficient.

2.1 Design seismic coefficient is a product of basic horizontal Seismic coefficient (0.05 for Delhi), importance factor for the structure and a coefficient depending upon soil foundation system. Importance factor having ing.1 for all residential buildings, design seismic coefficient would exceed 0.06 only when soil foundation system coefficient exceeds 1.2. Such situation arises only in case of buildings having isolated RCC footings footings without tie beams or unreinforced spread strip foundations or well foundation in type III soils. In case of piles, raft foundation combined or isolated RCC footings with tie beams, this factor continues to be 1.2 or less. Type III soft soils for this purpose are loose soils which have standard penetration value 'N' less than 10 or are poorly graded sand or gravely sand with a little or no fine with 'N' value less than 15. Such soils in general will have very poor bearing capacity is less than 10T/Sqm. In such a situation, provision of vertical steel at corners & junctions of walls in masonry buildigs would also become necessary.

2.2. Lintel bands will have to be provided in all four-storeyed building. Reinforced cement concrete slabs shall have full bearing on wall. While providing lintel band, care shall be taken to ensure that reinforcement is continuous throughout the lintel band and full bond length is provided wherever there is need to overlap the reinforcement. The band shetild be provided in reinforced cement concrete mix 1:2:4. This bandshould have a thickness of 7.5 Cm. & shall be of full width ofthe wall. It shall be reinforced with 2 Nos. 10mm dia high strength deformed bars [illegible] face of the wall with suitable cover having links of 6mm dia [illegible]

...P/2....

Careful consideration has to be given to location of opening in bearing walls. For this purpose, provisions of para 8.3 in IS Code 4326-1976 are enclosed as Annex.II. All efforts should be made to comply with these requirements to the extent practicable.

3. All Engineers of DDA are requested to examine each case carefully in the light of codal requirements & provide suitable strengthening arrangements as necessary. In case of doubt, the matter should be taken up by concerned engineers with their next higher authority.

Encl:- 2 Nos.

(S.C. GUPTA)
A.C.E.(D)

CE/CE(QC), DDA.
ALL ADDL. CHIEF ENGINEERS.
ALL SEs/SSWs with five spare copies each for their EEs/SWs.

Copy forwarded for favour of information to:

1. The Vice Chairman DDA
2. The Engineer Member DDA
3. The Chief Architect DDA

Copy to guard file.

TABLE 2 STRENGTHENING ARRANGEMENTS
(Clauses 4.4.2.2, 8.3.6 and 8.4.1)

No.	Design Seismic Coefficient	No. of Storeys	Strengthening Methods to be Provided
(1)	(2)	(3)	(4)
i)	$\alpha_h < 0.05$	1 to 4	a) Masonry mortar (sec 8.1.2)
ii)	$0.05 \leq \alpha_h < 0.06$	1 to 4	a) Masonry mortar (sec 8.1.2) b) Lintel band (sec 8.4.2)
iii)	$0.06 \leq \alpha_h < 0.08$	a) Single and double storeyed with reinforced concrete or reinforced brick slab roof	a) Masonry mortar (sec 8.1.2) b) Lintel band (sec 8.4.2)
		b) Single and double storeyed with pitched or other types of roof	a) Masonry mortar (sec 8.1.2) b) Lintel band (sec 8.4.2) c) Roof band (sec 8.4.3) d) Bracing in plan at tie level (sec 4.4.2.2)
		c) 3 or 4	a) Masonry mortar (sec 8.1.2 b) Lintel band (sec 8.4.2) c) Roof band and gable band where necessary (sec 8.4.3 and 8.4.4) d) Vertical steel at corners and junctions of walls (sec 8.4.6) e) Vertical steel at jambs of openings (sec 8.4.7) f) Bracing in plan at tie level for pitched roof (sec 4.4.2.2)
iv)	$\alpha_h \geq 0.08$	1 to 4	a) Masonry mortar (sec 8.1.2) b) Lintel band (sec 8.4.2) c) Roof band and gable band, where necessary sec 8.4.3 and 8.4.4) d) Vertical steel at corners and junctions of walls (sec 8.4.6) e) Vertical steel at jambs of openings (sec 8.4.7) f) Bracing in plan at tie level for pitched roof (sec 4.4.2.2)

XTRACT OF I.S. CODE 4326-1576 ANNEXURE II

8.3 Openings in Bearing Walls

8.3.1 Openings in any storey shall preferably have their top at the same level so that a continuous band could be provided over them including the lintels throughout the building.

8.3.2 The total width of the openings shall not be more than half of the length of the wall between the adjacent cross walls except as provided in 8.3.6

8.3.3 The opening shall preferably be located away from the corner by a clear distance equal to at least 1/8 of the height of the opening where seismic coefficient is less than 0.08 and 1/4 of the height where seismic coefficient is 0.08 or more.

8.3.4 The horizontal distance between two openings shall not be less than 1/4 of the height of the shorter opening where seismic coefficient is less than 0.08 and 1/2 of the height where seismic coefficient is 0.08 or more.

8.3.5 The vertical distance from an opening to an opening directly above shall not be less than 60 cm.

8.3.6 Where openings do not comply with the requirements of 8.3.1 to 8.3.5 they shall be strengthened in accordance with 8.4.7. The requirements of Table 2 are however to be met with even if openings comply with 8.3.2 to 8.3.5 to safeguards the integrity of the structure as a whole.

8.3.7 If a window or ventilator is to be projected out, the projection shall be in reinforced masonry or concrete and well anchored.

8.3.8 If an opening is tall from bottom to almost top of a story dividing the wall into two portions, these portions shall be reinforced with horizontal reinforcement of 6 mm diameter bars at not more than 60 cm intervals one on inner and one on outer face, properly tied to vertical steel at jambs and corner or junction of walls where used.

8.3.9 The use of arches to span over the openings is a source of weakness and shall be avoided unless steel ties are provided.

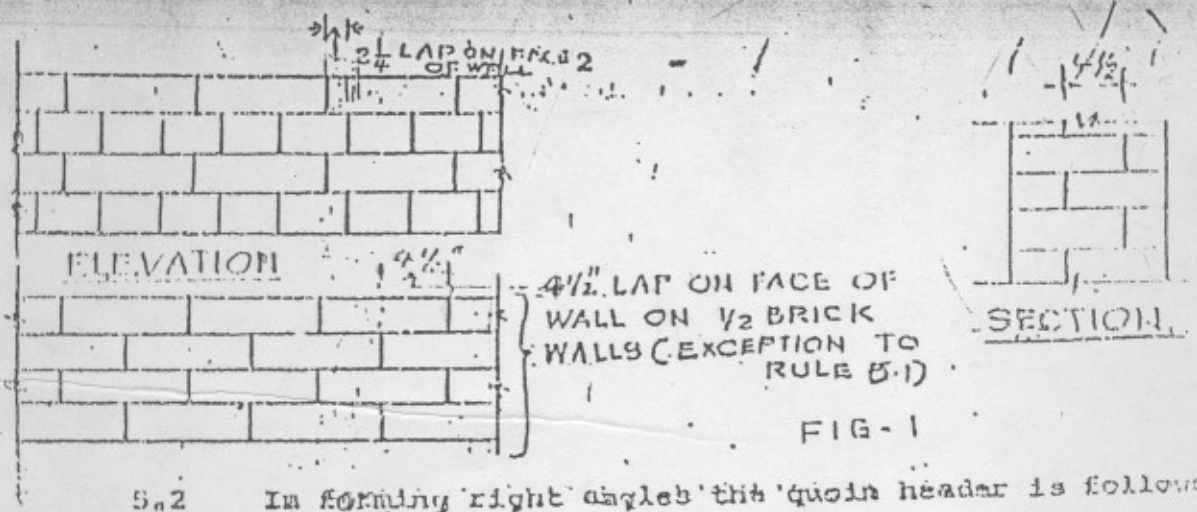
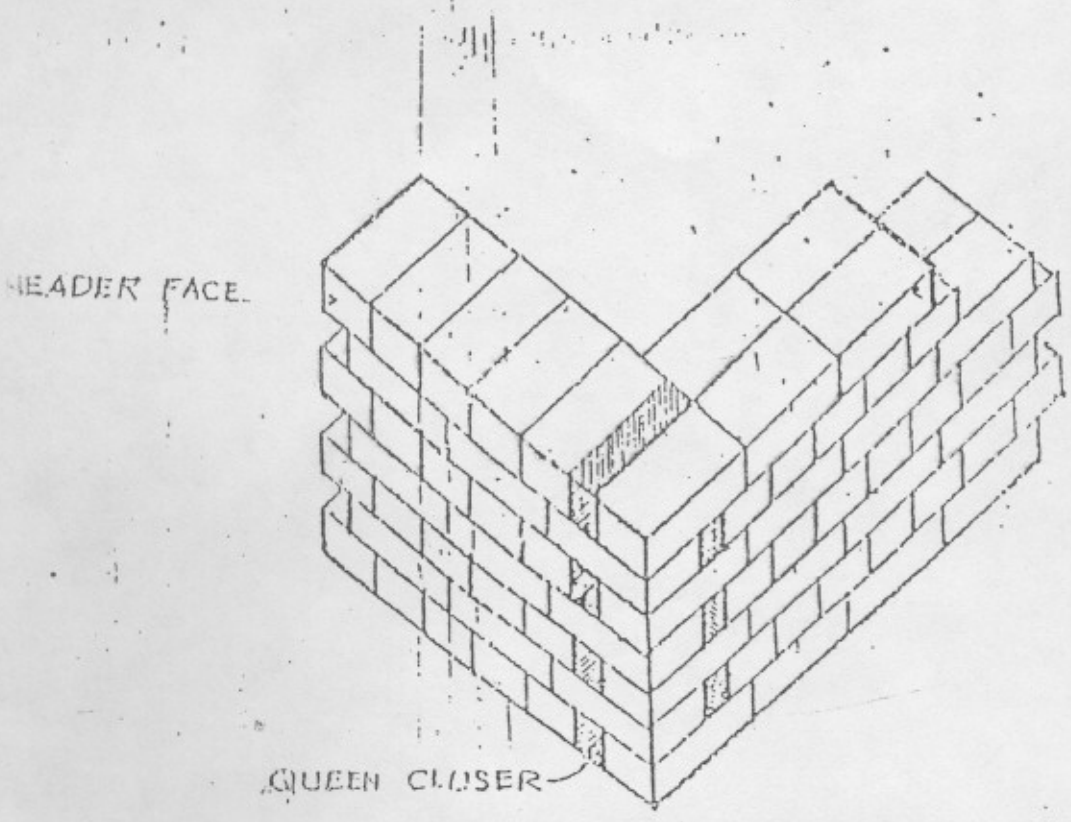


FIG-1

5.2 In forming right angled this quoin header is followed by a queen closer and is taken throughout the width of the wall. Fig.2 illustrates this, for various wall thicknesses.



PERSPECTIVE OF ONE BRICK CORNER

FIG-2

(12)

71

CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

NO. ACE(D)TC(12)83/DDA/41 Dt : 9-1-84

DESIGN CIRCULAR NO. 5 :

BOND IN BRICK MASONRY

1. The Fact Finding Committee appointed by the L.G. under the chairmanship of Sh. V.B. Vaish and also the CAG(Audit) have pointed out the deficiencies in respect of bond in brick masonry constructed by the DDA. Hence it is important for every engineer in DDA to understand the significance of bond in brick masonry and execute accordingly. Details of bonds are available in various text books and CPWD specifications. The aim of this circular is to compile these informations and pass on to all engineers of DDA with the hope that this will result in improvement of the workmanship in brick masonry construction.

2. The manner in which bricks are arranged in a wall is of great importance to its appearance and strength. In order to distribute the super-imposed load throughout the length of the wall, the bricks must be arranged to make bond with one another longitudinally as well as across the width of the wall.

3. The over lapping arrangement of bricks in order to tie them together into one solid mass of brick work is known as bond. The normal brick is a rectangular solid whose longest dimension is known as stretcher face and the next longest as header face and its smallest dimension as depth. To obtain bond some brick shapes are required which can be obtained by actual cutting of the standard size bricks. Queen closer, 3/4 bat and 1/2 bat are some such special shapes. Queen closer is obtained by cutting the normal brick into half longitudinally (size 9"x2¾"x3"), ¼ bat is obtained by cutting off ¼ length of brick (size 4½"x4"x3") and ½ bat by cutting off ½ length of bricks (Size 4½"x4"x3").

4. There are many types of bonds. The English bond is the most common in India. In this system the facing bricks are laid in alternate courses of headers and stretchers. This is undoubtedly the strongest bond with no continuous straight joints occur in any part of the wall. A queen closer is introduced next to the quoin header and is continuous thereby out the thickness of the walls thus giving headers to lap over the course below (Quoin header is the first brick on the header course laid in the corner).

5. Rules of Bond: General.

5.1 The lap of brick work on the face of a wall should be 2½" and across the wall 4½" (except in the case of 4½ brick wall in stretcher bond) Fig.1. illustrates this rule.

5.3 The vertical joints on the face of wall would not coinc. but form a plumb line in alternate courses.

5.4 Set out the bond on the face and then all transverse cross joints must continue unbroken across the width of the wall unless stopped by the centre of stretcher. See Fig. 3.

5.5 Bricks in the interior of a wall should be laid as headers. See Fig. 3.

5.6 If a wall is even number of half bricks in thickness the bond on the opposite face is the same and if the wall is an odd number of half bricks in thickness the bond of the opposite face is different. See Fig. 3.

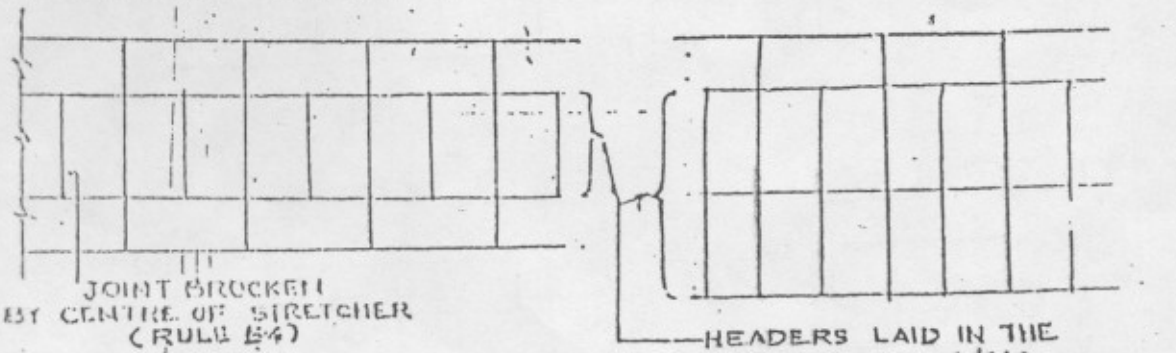


FIG-3

5.7 When a wall changes direction the face bond in the same course changes (see Fig. 2) except where two walls of different thicknesses join into each other (Detail Fig. 4(a) and Straight joints a curved wall (Detail Fig. 4(b)).

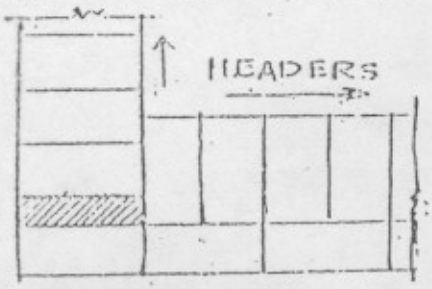


FIG 4(A)

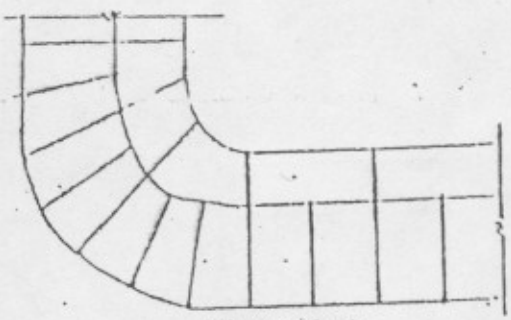


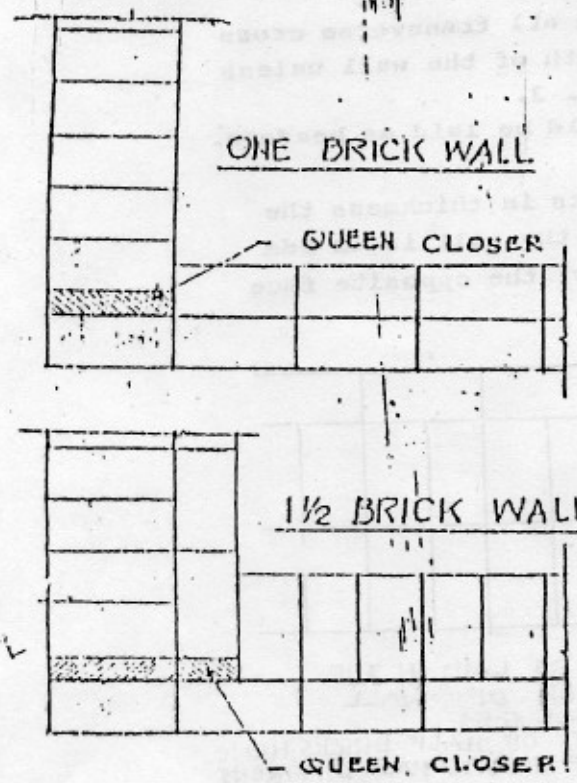
FIG 4(B)

5.8 In the bonding of corners the tie-brick in the internal angle of walls having an even number of half bricks in thickness is parallel to the quoin header. Walls having a odd number of half bricks in thickness, the tie brick is placed in the opposite direction. The queen closer joint on plan should continue right across the thickness of the wall on which the queen closer appears on the face. Fig. 5

.....P/4.....

CORNERS

ODD COURSE



EVEN COURSE

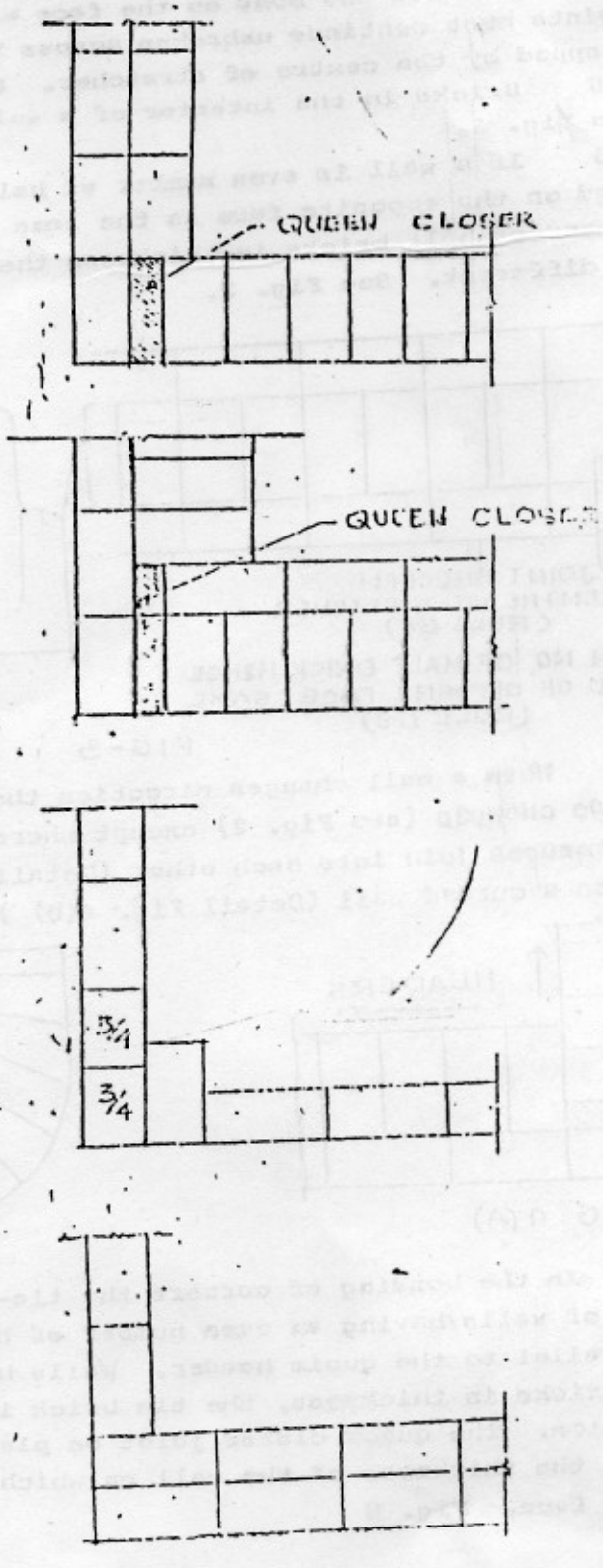
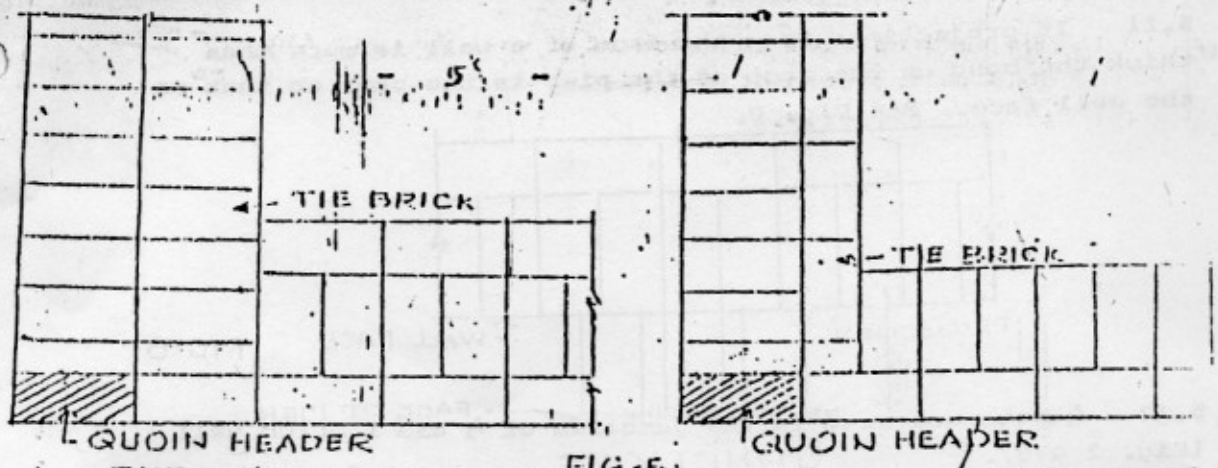


FIG. 2



EVEN Nos. OF HALF BRICKS FIG-5. ODD Nos. OF HALF BRICKS

5.9 In bonding to junctions provide tie bricks along the header course of the cross wall into the stretcher course of main wall (Detail Fig.6(a) & (b)) unless stopped by the centre of a stretcher (Detail Fig.6(c)).

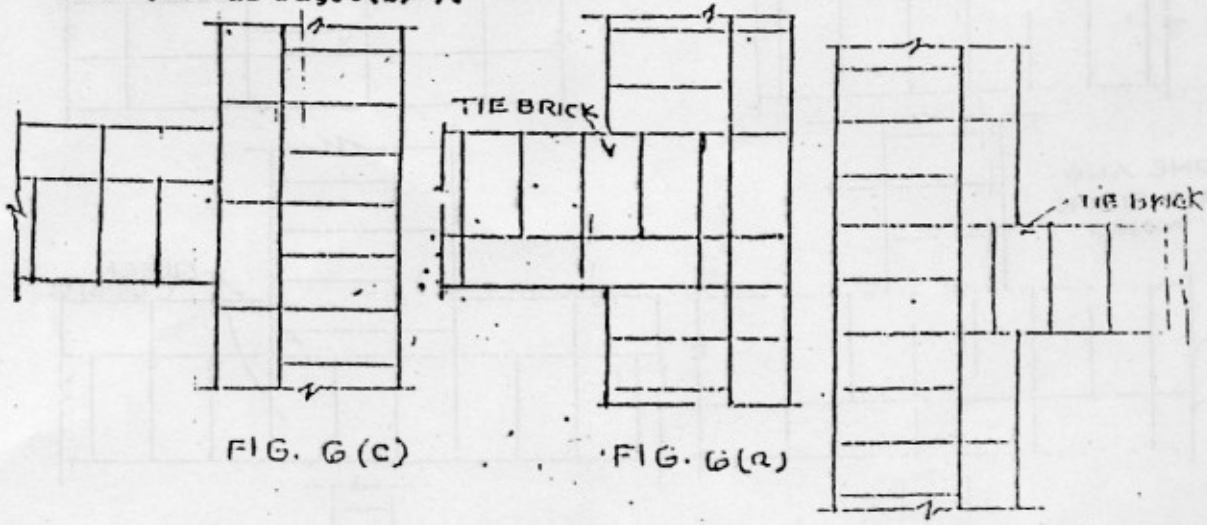


FIG. 6(c) FIG. 6(a) FIG 6(b)

5.10 At intersections take the bonding of each wall across the bonding of the other alternately. Fig. 7.

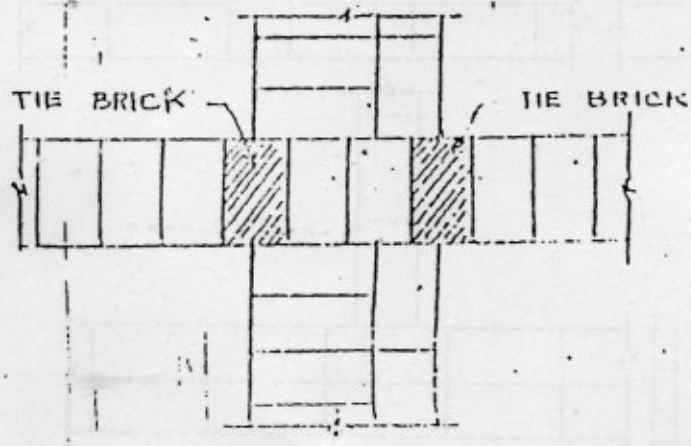


FIG.7

....P/5.....

5.11 If projections from the face of a wall is more than ½ brick thick the bond on the face of the pier is the same as that on the wall face. See Fig. 8.

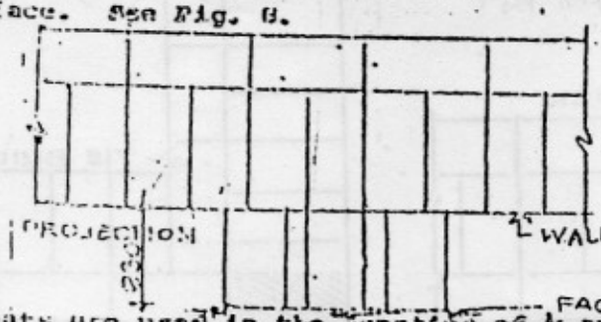


FIG-8

5.12 ¾ bats are used in the junction of ½ and 1 brick wall (Fig. 2 & 9).

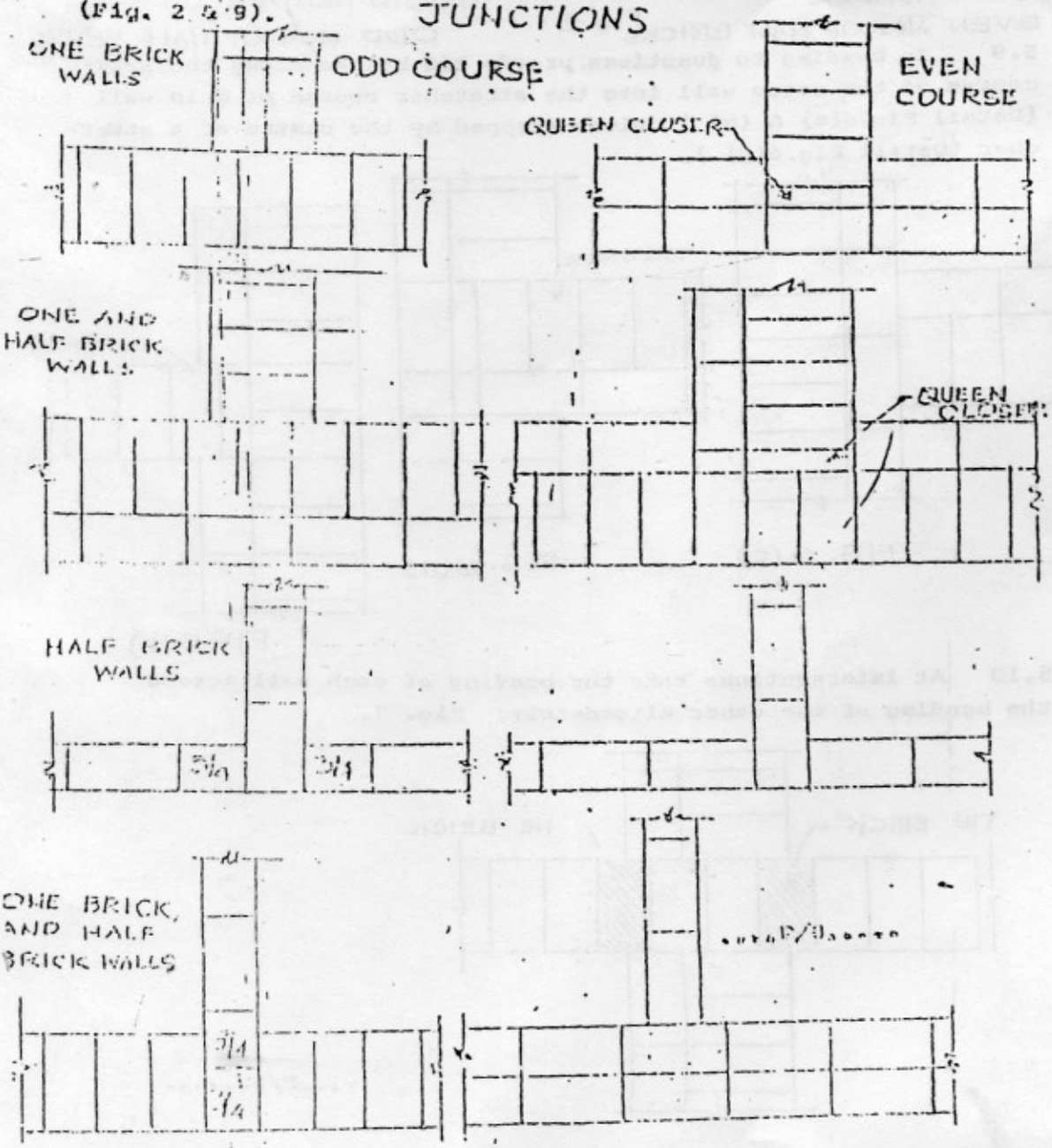


FIG-9

6. SPECIAL RULES FOR FOOTING :

6.1 All brickwork in footings as far as possible shall be laid as headers. Odd half bricks in the width of the footing should be laid in mean the centre of the course as possible except (a) when a double course of one width is required. (Fig.10(a))

(b) The top course of footing of one brick wall. In this case, stretcher can be placed alternately on the inner and outer face of the course. (Fig.10(b)).

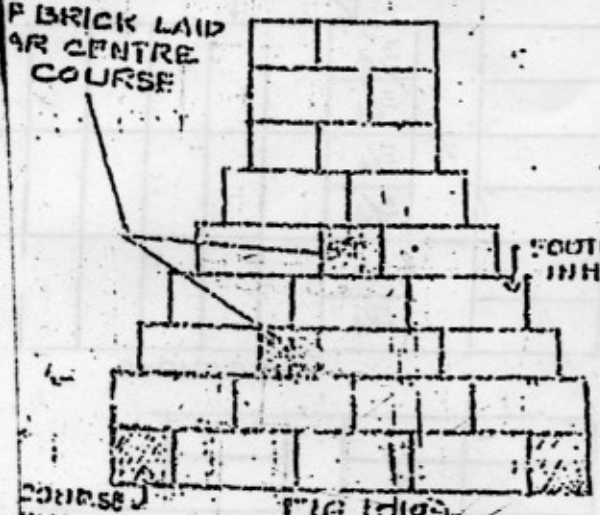


FIG 10(a)

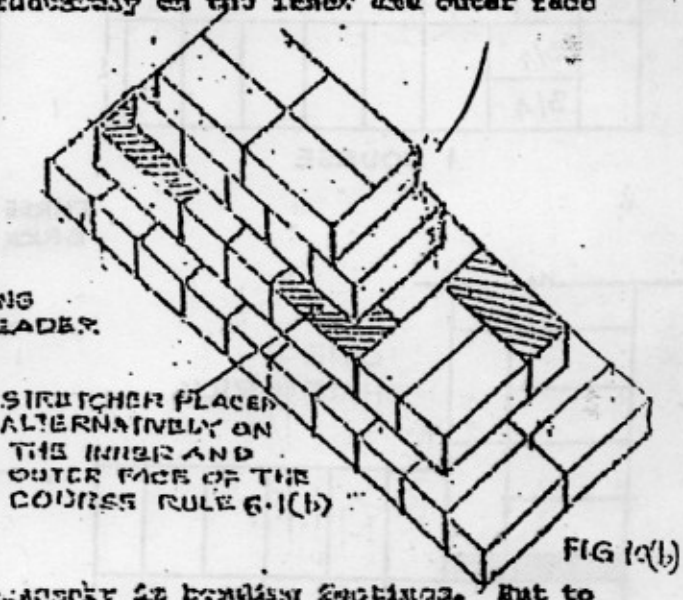


FIG 10(b)

6.2 No queen closers in brickwork in bonding footings. But to avoid a straight joint between the top course of footing and the first course of walling a bat to be introduced into the footing. Details of some courses of footing are illustrated in Fig. 11.

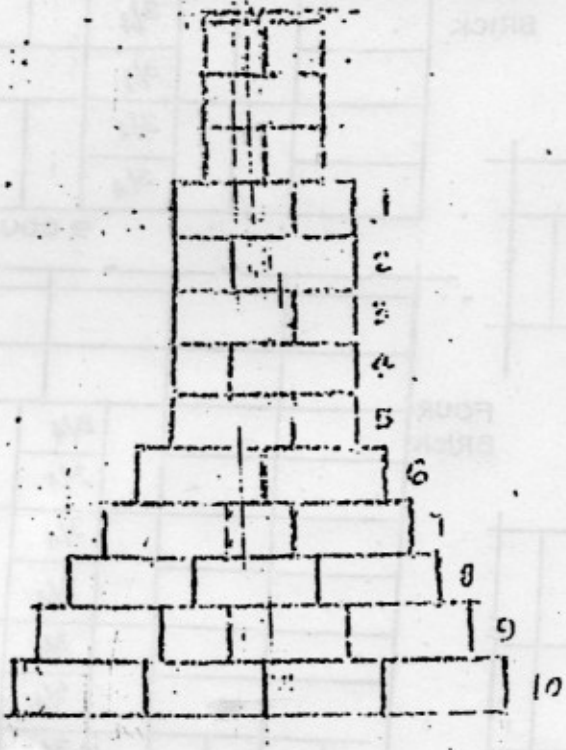


FIG. 11

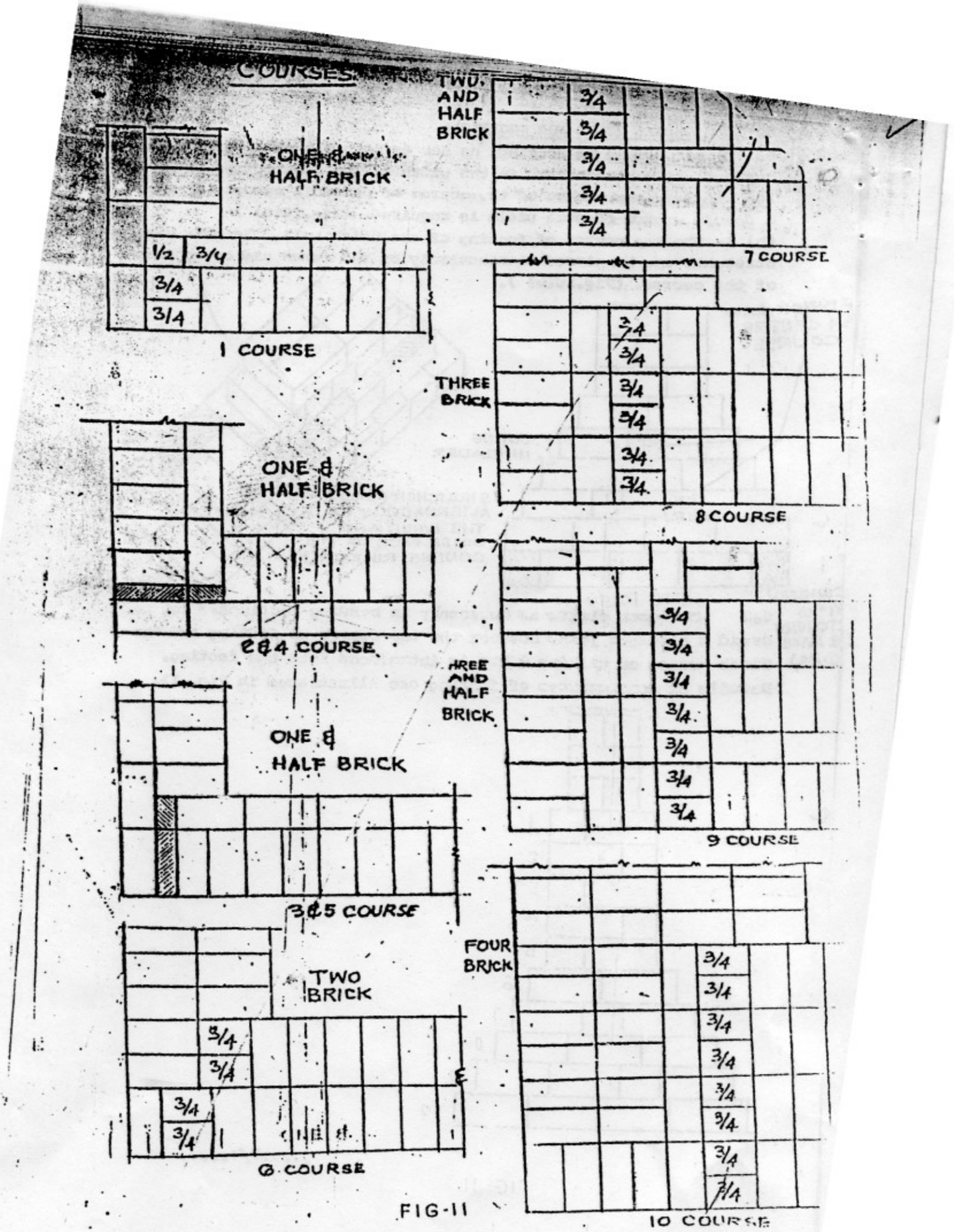

COURSES
ONE & HALF BRICK
1/2
3/4
3/4
3/4
1 COURSE
ONE & HALF BRICK
2 & 4 COURSE
ONE & HALF BRICK
3 & 5 COURSE
TWO BRICK
3/4
3/4
3/4
3/4
6 COURSE
TWO AND HALF BRICK
3/4
3/4
3/4
3/4
3/4
7 COURSE
THREE BRICK
3/4
3/4
3/4
3/4
3/4
3/4
8 COURSE
THREE AND HALF BRICK
3/4
3/4
3/4
3/4
3/4
3/4
3/4
3/4
9 COURSE
FOUR BRICK
3/4
3/4
3/4
3/4
3/4
3/4
3/4
3/4
10 COURSE

FIG-11

The above rules explain the details regarding bond in brick walls. For further reading reference may be made to 'BRICK WORK'-CUTTER (CASSEL, LONDON) BUILDING CONSTRUCTION BY MITCHEL (BATSFORD, LONDON) or CPWD Specification.

7. All connected brickwork shall be carried up simultaneously and no portion of the work shall be left more than one metre below the rest of the work. Where this is not possible the work shall be raked back (i and not toothed) according to bond at an angle not steeper than 45°; the work done per day shall not be more than one metre height. Toothing should not be done because when the brickwork settles down, the brick layer will experience great difficulty in tying in to these toothing ends at a later date.

All iron fixtures, pipes, outlets of water, hold fasts of doors and windows which are required to be built into the wall shall be embedded in mortar or cement concrete as the case may be in their correct position as the work proceeds. Pipe outlets shall be embedded in during construction. In case this is not possible 'dry bricks' shall be provided exactly where the pipes cross the masonry and removed while laying the pipes. Constructed masonry shall normally not be punctured on any account.

(S.C. GUPTA)
A.C.E. (D)

1. CE & CE(QC)/DDA
2. ACEs in DDA.
3. SEs & SSHs with 5 copies for their SEs.

Copy for favour of information to :

1. Vice-Chairman, DDA.
2. Engineer Member, DDA.
3. Chief Architect, DDA.

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(S.C. GUPTA)
A.C.E. (D)

OFFICE OF THE ADDL. CHIEF ENGINEER (DESIGN)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

No. ACE(D)TC(7)83/1395 Dated: 23.12.83.

(DESIGN CIRCULAR NO.6)

Subject:- Soil Investigations.

Soil investigations are being got carried out by various Executive Engineers for engineering purposes including determination of safe bearing capacity. Reports received in C.D.O. from some Executive Engineers have indicated the :

1. Reports give sub-soil water table levels as met with during site investigation but fail to indicate the likely levels to which it may rise or fall during the year and the life time of the building.
2. Dates on which tests have been conducted.
3. Reduced Levels at the location where various tests have been carried out.
4. Calculations for determination of safe bearing capacity wherever required.
5. Likelihood of the site being flooded or otherwise.
6. Information about deletrious effect if any of soil or sub-soil water on concrete and masonry foundations.
7. Separate reports are given for small pockets in a big site without correlating the recommendation with overall soil characteristics of the entire area.

Instructions have already been issued vide Design Circular No. 1 issued vide No.ACE(D)TC(7)83/391 dated 22.9.83 regarding correlating soil investigation with reduced levels of the ground at the point of test. All Executive Engineers are requested to ensure that the reports supplied by soil investigating agencies are complete and do not have the deficiencies as mentioned above.

(S.C. Gupta)
A.C.E. (D)

1. Chief Engineer & Chief Engineer (C.C.).
2. All Addl. Chief Engineers.
3. All S.Es and S.S.Os with ten spare copies for their E.Es/S.Os.

Copy forwarded for favour of information to:

1. Vice-Chairman, D.D.A.
2. Engineer Member, D.D.A.

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(S.C. Gupta)
A.C.E. (D)

CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

(20)

No: ACE(D):TC(13)/84/ / Dated:- 16.

Design Circular No.7

Sub: Structural Drawings issued by various offices.

It is seen, that the structural drawing issued by various officers in DDA do not indicate the names of the officers who signed /approved these drawings & the date on which the drawings were issued.

The structural drawing shall always clearly show the name of officers and the date. Reference to architectural drawings should also be given.

All Engineers in DDA are requested to follow these guide lines.

(S.C. GUPTA)
Addl. Chief Engineer(D)

1. CE and CE(Q.C.)DDA.
2. ACEs in DDA.
3. SEs and SSWs in DDA with 5 spare copies for their SEs.

Copy for favour of information to Engineer Member., DDA.

(S.C. GUPTA)
Addl. Chief Engineer(D)

(21)

OFFICE OF THE CHIEF ENGINEER (DESIGN)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

No. CE(D)TC(7)83/ 917 Dated:- 5/1/84

DESIGN CIRCULAR NO. 8

Sub: Soil Investigation

Design circular no. 6 circulated vide T.O.No. ACE(D)TC(7) 83/1295 dated:-23-12-83 pointed out that separate soil investigation reports are being given for small pockets in a big site without correlating the recommendation with overall soil characteristic of the entire area.

Inspite of clearly indicating this deficiency, we are still receiving soil investigation reports for individual pockets of big areas without any reference to the adjoining areas.

In order to have clear under standing of the site, the soil investigation report should discuss the nature and bearing capacities of the soil of the adjoining area. The bearing capacity of any individual pocket shall be recommended only after giving due consideration to the site as a whole.

If any building has been constructed in the adjoining areas, the consultant/EE should supply information regarding the bearing capacity adopted for this building, type of foundation and the present performance of the same.

EEs shall ensure that the soil investigation reports contain these informations and also other informations laid down in our design circular no. 6. Soil investigation reports received by C.D.O. which are deficient in these matters are liable to be returned to EEs without any further action in CDO.

(S.C. GUPTA)
CHIEF ENGINEER (DESIGN)

All Executive Engineers (Civil) in D.D.A.

(Executive Engineer_____Division_____D.D.A.)

Copy forwarded to:-

1. The Engineer Member, DDA for favour of information.
2. All CEs of DDA.
3. C.E.(Q.C.) D.D.A.
4. All SEs of DDA. They are requested to kindly ensure compliance of these instructions by their EE's.
5. SSW I & SSW II/ D.D.A.
6. Guard file in C.D.O.

(S.C. GUPTA)
CHIEF ENGINEER (DESIGN)

OFFICE OF THE CHIEF ENGINEER (DESIGN)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

Design Circular No: 9

No: CE(D) (I)/TC(14)/84/3292 Dt: 15-11-84

SUB: Joints in Buildings.

1. Movement of Building Components All building materials expand or contract with change in temperature and variation of moisture content. The magnitude of these changes vary with the type of materials used. Most building materials expand when wetted & shrink while drying. Some materials which contain considerable moisture at the time of construction dry out subsequently. Such materials are stone, brick & concrete and major dimensional changes are caused by their contraction.

2) If the resulting expansion & contraction movements are restricted partly of wholly by any means; for example, by restraining effect of cross & end walls in large buildings, internal stesses like tension during contraction & compression during expansion occur in the structure and their magnitude depends on:

a) The extent to which such free movement has been prevented due to connection of the element to other structural elements.

b) The extent to which the movement would have taken place if there was no restraint.

c) The extent to which the material creeps & flows under stress.

d) The extent to which the elastic deformation taken place.

These four factors are interdependent & the movement which actually occurs, depends on the restraint to these movements, as well as creep.

1.3) In a tropical countr-y like India, occurance of large variations in the atmospheric temperature and humidity are to be expected and the problem of crack prevention assumes greater importance. The larger the structure or the number of storeys it has, the greater the extent to which such movements take place stress caused by these changes are superimposed on stresses in the structure due to other loads and when even material is stressed beyond its tensile or shear strength, it cracks.

1.4) There are two ways of dealing with expansion & contraction of structures. The structures may be monolithic and heavy reinforcement may link each section so that all stresses formed may be accomodated without fracture. Alternatively, the structure may be provided with a number of joints which relieve the stress by allowing predetermined sections of the structure to move. In the first method, accurate assesment shall be made of all conditions which are likely to introduce stesses in the structure. This is not always possible, but this method is followed in cases like shell structures & certain rigid frames where provision of joints will interfere with the rigidity of the structure. In the second method where joints are provided, reasonable care has to be exercised for the design, location and detailing of joints and selecting materials such as joint fillers & waterbars, so that large movements may be accomodated without structural failure, disfiguring cracks or penetration of moisture.

1.5) Deformation may also be caused as a result of loading. Allowance for the movement in the joint shall be made for this deformation particular to allow for the following factors:

a) Difference in the compressibility of various materials used in the individual sections of the building.

b) The unequal loading of the individual parts of building (eg) as a result of the difference in hight when constructing sections in parts or in the final stage.

2/-

Differential settlement due to unequal loading, variable load bearing capacity of the soil and on account of constructing a building partly on old foundation; due to the over lapping of the load distribution with that of adjacent foundation or due to variation in moisture conditions in sub-soil.

1.6) The joints are specifically designed and provided to permit relative movement of adjacent parts of member/ structure without imparing the functional integrity of the member/structure. Their general function is to prevent the build up of harmful stresses. They may also be the connection joint between the several parts of a member/structure or they may be provided solely to permit translation or rotationor both.

2. Various Types of Movement Joints.

2.1 Contraction joint: It is deliberate discontinuity with no initial gap between the sides of the joint. It is intended to permit contraction of member/structure. The joint is called partial contraction joint if the concrete along is interupted and the reinforcement is allowed to pass through the joint.

2.2 Expansion joint It is a complete discontinuity in both reinforcement and concrete. It is designed to allow both exransion and contraction and essentially provide a space between the parts.

2.3 Sliding joint It is a complete discontinuation in concrete as well as reinforcement. Special provision is made to fecilitate relative movement in the plane of the joint.

2.4 Hinged joint: This is provided to permit relative rotation of the member of the joint.

2.5 Settlement joint: This is provided to permit the adjacent member/ structure to settle or deflect relative to each other.

2.6 Separation Joint: This is provided to separate adjoining parts of structure and in general is similar to expansion joints.

3. Evaluation of Dimensional changes:

3.1 Temperature variation : Spacing and gap of the expansion joints is determined with reference to the movement which occur due to temprature changes. The following table gives the coefficient of thermal exransion of various building material.

Coefficients of thermal expansion of various building materials with in range of 1-100-C	
Brick and brickwork	5-7x10^{-6} per ^{0} C)
Cement mortars and concrete ...	10-14x10^{-6} per ^{0} C
Stones	
1) Igneous rocks ...	8-10x10^{-6} per ^{0} C
2) Lime stones ...	2.4-9x10^{-6} per ^{0} C
3) Marbles ...	1.4-11x10^{-6} per ^{0}C
4) Sand stones ...	7-16x10^{-6} per ^{0} C
5) Slates ...	6-10x10^{-6} per ^{0} C
Metals	
1) Aluminium ...	25x10^{-6} per ^{0} C
2 Bronze ...	17.6x10^{-6} per ^{0}C
3) Copper ...	17.3x10^{-6} per ^{0} C
4) Lead ...	29x10^{-6} per ^{0}C
5) Steel and iron ...	7-13x10^{-6} per ^{0}C

:/-

3.1.2 The effect of the temperature stresses can be under-stood with the following example. Taking the coefficient of expansion of concrete as 10×10^{-6}/C, for 30 m long concrete member subjected to 33°C change in temperature, the expansion will be approximately 10mm. If this is prevented the stress induced in unreinforced area is 7N/mm² with E= 20KN/mm². If such a stress is superimposed on the existing stress cracks would occur. If reinforced, distribution of cracking would be controlled by the amount, form and distance of the reinforcement which might even reduce the crack width and spacing to the extent as to cause no harmful consequence.

3.2 Contraction due to Drying shrinkage:

3.2.1 Brickwork and cement concrete contract on drying out and expand when wetted again. The process of contraction may continue even for a longtime after construction, depending upon the external humidity conditions. Contraction due to drying shrinkage for different materials may be taken as follows:-

i)	Dense concrete	0.2-0.5mm per m
ii)	Light weight concrete	0.5-0.8 mm per m
iii)	Non-autoclaved aerated concrete.	3 mm per m

3.2.2 To appreciate the effect of drying shrinkage the following example may be considered. Taking the drying shrinkage as 0.5mm/m, for a member of 3m long, the shrinkage is 1.5mm and the stresses induced in the unreinforced section is 10N/mm² for concrete of E= 20KN/mm². if the shrinkage is restrained. This stress can cause cracking in unreinforced portion of concrete.

The stresses developed in various grades of concrete when shrinkage is restrained are givenbelow:

Grade of concrete	Modulus of Elasgity for concrete. (Approx.) KN/mm²	Stresses developed N/mm²
1:5:10	13	6.5
1:4:8	16	8
1:3:6	18	9
1:2:4	22	11

These values which are independent of length of the members show that the effect of drying shrinkage is lower in case of lean mixes and higher for richer mixes, therefore it is necessary to lightly or nominally reinforce the plain converete where over provided.

4/-

Recommendation for spacing of expansion joints

4.1 Spacing of expansion joints and their width depends on the local experience gained from observations of structures earlier constructed. The precise determination of the amount of movement occuring in building to ascertain the spacing and width of joint is very complicated owing to numerous factors involved and may not be necessary in normal circumstances

4.2 The following table gives the recommended spacing of expansion joints for various cases.

Description	Spacing of joints
1) Walls	
a) Load bearing walls with crosswalls at intervals. Traditional type of one brick or more	30m intervals
(b) Wall of ware house type construction (without cross walls)	Expansion joints in walls at 30m maximum intervals.
(2) Chijjas, balconies & parapets	6-12m intervals
(3) Roofs	
(a) ordinary roof slabs of R.C.C protected by mud phuska or other insulating media in unframed construction.	20-30m intervals and at changes in direction as in L,T,H and Y shaped structures.
(b) Thin unprotected slabs	15m intervals
(4) Frames: Joint in structures through slabs, beams, columns etc. dividing the building into two independent structural units	Corners of L,H,T and I shaped structures and at 45m intervals in long uniform structures.
(5) Coping	Corresponding to joints in roof slab.
(6) Compound walls	30 m intervals

4.3 The gap width of expansion joint shall preferably be 25 mm. Width of expansion joint is to be increased at places where it also functions as a separation joint. Width of separations joint is 10mm per storey without upper limit, but subject to a minimum of 25 mm.

4.4.1 In case of masonry walls, the vertical control joints shall be provided from the top of the wall to the top of the foundations. The vertical control joints shall not be taken through the foundation Reinforcement shall not pass through the joint. In case of masonry walls resting on pile foundation the vertical control joint shall be taken upto the top of the grade beam over the piles. Reinforcement shall not pass through the joint In this connection please see para 4.6 where joint should extend into the foundation also.

4.4.2 In case of RCC framed strecutre, the vertical contral joint between two columns shall extend from top of the column to the top of the pedestal provided over the RCC footing exceptin in case covered by 4.6)

5/-

Circular No.1	Regarding Soil Investigation
Circular No.2	Regarding Building Statistics.
Circular No.3	Regarding Over head Tank.
Circular No.4	Circular Regarding Four Storeyed Mansonry construction Strengthening arrangement reduired for resistance in Seismic Zone.
Circular No.5	Bond in brick Masonary.
Circular No.6	Soil Investigation.
Circular No.7	Structural drawings issued by various office.
Circular No.8	Soil Investigation..
Circular No.9	Joints in Buildings.
Circular No.10	Structural designs in Central Design Organisation
Circular No.11	Preparation of detalled Estimates.
Circular No.12	Initial load testing of under-reamed piles.
Circular No.13	Preparation of site plan-instructions.
Circular No.14	Structural design in Central Design Organisation.
Circular No.15	Requisition of structural design work in C.D.O.-Proforma-Cum-Check List.

4.5 The subgrade below the entire area of the building shall preferably be of the same type of soil. Whatever this is not possible a suitably located seperation joint shall be provided. In such cases the joint shall seperate the foundations also.

4.6 In addition to the above situation the seperation joint shall extend to the foundation as well, in the following special cases also when,

(a) Parts of the structure are likely to be subjected to different types of earthquake signals-cases of very long buildings.

(b) Parts of the structure which are likely to have different earthquake response-when mass and rigidity distribution of two parts are different.

5. Control of cracking

5.1 In addition to provision of joints measures may be taken to reduce damage due to thermal effects as indicated below.

(i) Choosing texture and colour for the exposed surface such that max. of the solar radiation is reflected and the minimum is absorbed. White wash finish for roofing would be advantageous.

(ii) Providing insulating surface on the top of sutuctural slabs to reduce and delay the penetration of heat into the structure.

5.2 Control of shrinkage cracking

When bricks having drying shrinkage of not more than 0.02% are used fine haircracks appear in joints. These may usually be ignored. With bricks of higher strinkage values, major cracks may appear through the brick work. To confine cracks to the joints and to dessipate them into a large number of fine cracks it is desirable that the mortar used shall be weaker than the bricks.

6. Location of joints:

6.1 In many cases expansion joint will have to be incorporated as architectural feature. The choise of joint filler, the pattern of joint and further finishes to mask the joint if any, would depend on architectural considerations. Expansion joints may be advantageously located in corners where they will be hidden from view. The joints in floors may be located at or near the junction between the wall and the floor.

6.2 Buildings having plans with shapes like L,T,E and I shall be seperated into rectangular parts by providing seperation sections as whown in fig-1. In addition seperation joint extending to foundation may be provided at 60m to 100m centres in case of very long straight portions in view of para 4.6. (Fig-1)

7. Defects may arise in expansion joints due to inadequate joints spacing, incorrect location and size of joint or due to incorrect construction procedure such as discontinuous joints, badly formed sealing cavities, poor compaction and misalignment of waterbars. Also defective choice of jointing material will result in defects like loss of adhesion of sealing compound, fracture of the sealing compound, flow of the sealing compound, cavitations, building, spalling, oxidation of joint filler etc.

8. Installation of Expn. joints in walls.

8.1 In case of walls above ground level where the width of joint is less than 15mm, use of sealing compound will suffice, but for wider joints a joint filler shall be used (Fig-2) for walls below GL or for walls subject to water presure use of an efficient waterbar is essential (Fig-3.)

6/-

8.2 Installation of Expn. joints in roofs & floors:

8.2.1 Expn. jts. in roofs shall be finished to obtain an effective seal against penetration of water. A waterbar shall be installed in the expn joint. Joint and the cover slabs shall be suitably treated for water proofing. (Fig-4)

8.2.2 In the case of expn. joints in floors provision of water bars may not be necessary. Where the lower part of the joint is left open chamfering shall be provided on either side of the joint to improve apperence. If and open joint is not acceptable, a cover plate fixed on one side and free to slide over the surface on the other side may be provided. (Fig-6)

8.2.3 In case of long chjjas and parapets, the joints shall be at intervals of 6m. The expn. joint shall not extend into the portion where the sun shade is embedded into the masonry but shall stop short of face by 5cm and the distributor reinforcement in the embedded portion and in the 5cm portion of the chjjas slab, where there is no expansion joint shall be increased to 0.3% of the gross cross-sectional area to take up the tempronture stresses. (Fig-5)

In case of covered verandah and balcony slabs the spacing of the joints may be increased to 12m-14m. The joint gap may be 12mm.

8.2.4 Fig-7 shows the tupical details of expansion joint at roof between R.C.C beam and masonry wall.

Fig-8 shows the typical details of expansion joint at locations where there is roof one one side and floor on the other side. This detail may be followed with suitable modification in case of roofs at different level.

8.2.5 Fig-9 shows alternate arrangements of providing expansion joints in load bearing structures. Expansion joints may have walls on either side or R.C.C beams on either side or R.C.C beam on one side and wall on the other side.

8.3 Installation of Expn. joints in framed bldgs. In the case of continuous expn. jts. between two parts of building twin columns shall be provided and the details of expn. joint shall be as in Fig-10,11,12.

8.4 Method of construction of expansion joints: Expansion joints shall be so constructed that the joints are clean and free from any foreign material. In case of expansion joints at twin column or beams, one beam/column is cast first and the other beam/column is cast after the setting of the first beam/column. While casting the second beam/column shuttering with proper wedges etc may be used when the joint gap is sufficiently large,. In case of narrow gaps, shalitexboards may be fixed on the first beam/column and the second member is cast.

In order to prevent the appreearance of cracks grooves may be provided at.

(a) Juncion of slab and wall (b) top of lintel (c) junction R.C.C member and wall.

(S.C. GUPTA)
Chief Engineer (Design)
C.D.O/D.D.A/ NEW DELHI.

7/-

All SEs (Civil) in DDA. with
5 spare copies for their EEs.

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1. The EM for favour of information.
2. All CEs of DDA and CE (N.C)
3. SSW I & SSW II/DDA.

19/11/84

(S.C. GUPTA)
CHIEF ENGINEER (DESIGN)
C.D.O/ D.D.A/ NEW DELHI.

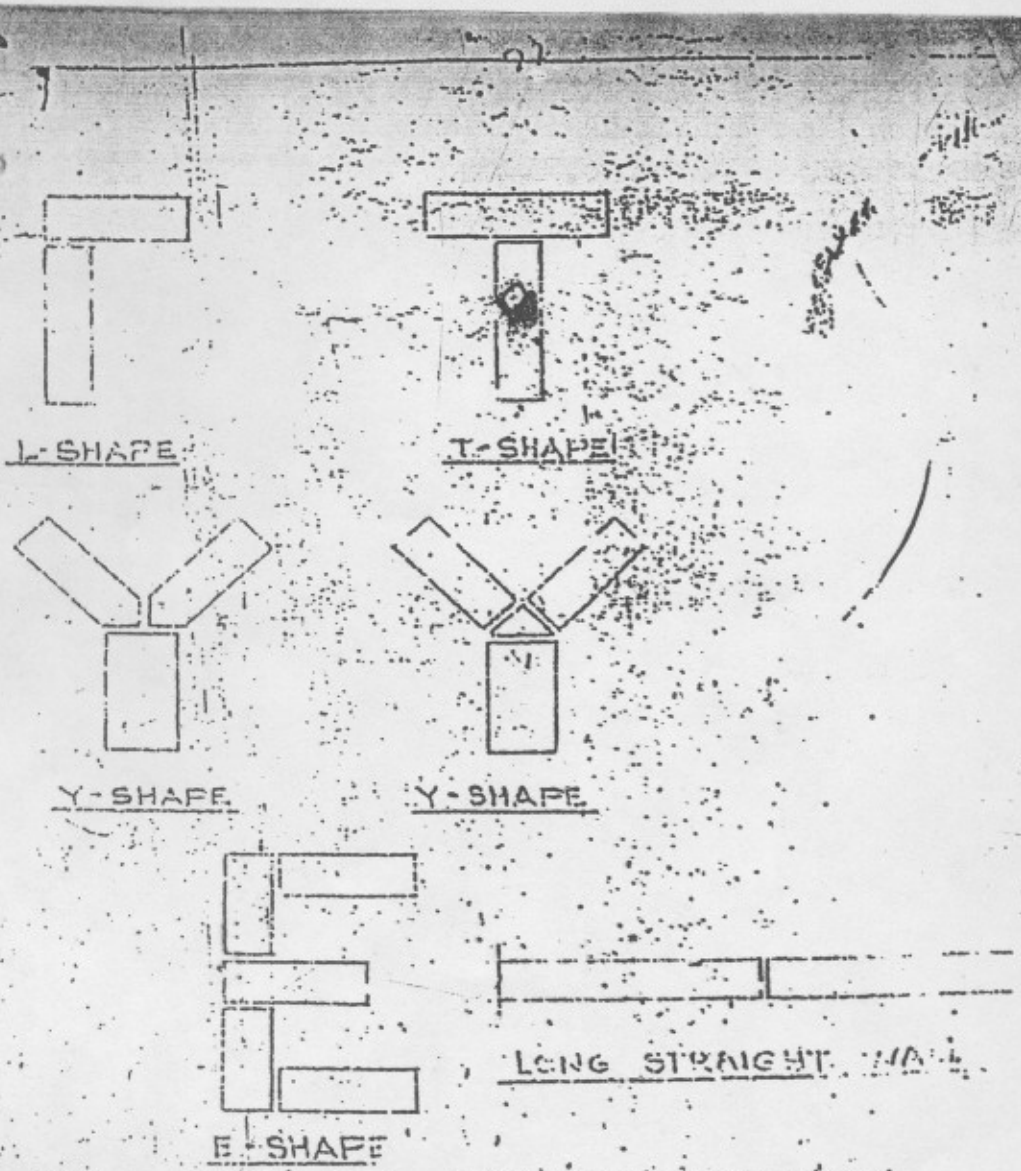
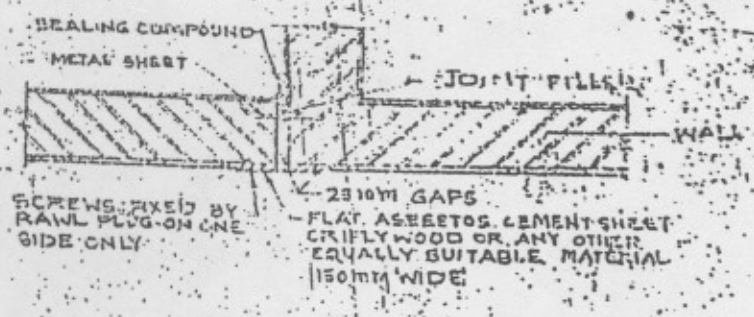


FIG. 2 LOCATIONS OF SEPERATION JOINTS

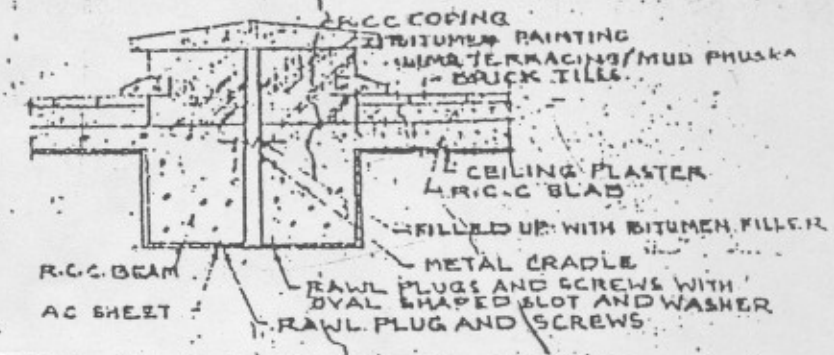


EXPANSION JOINT USING JOINT FILLER AND SEALING COMPOUND

FIG.

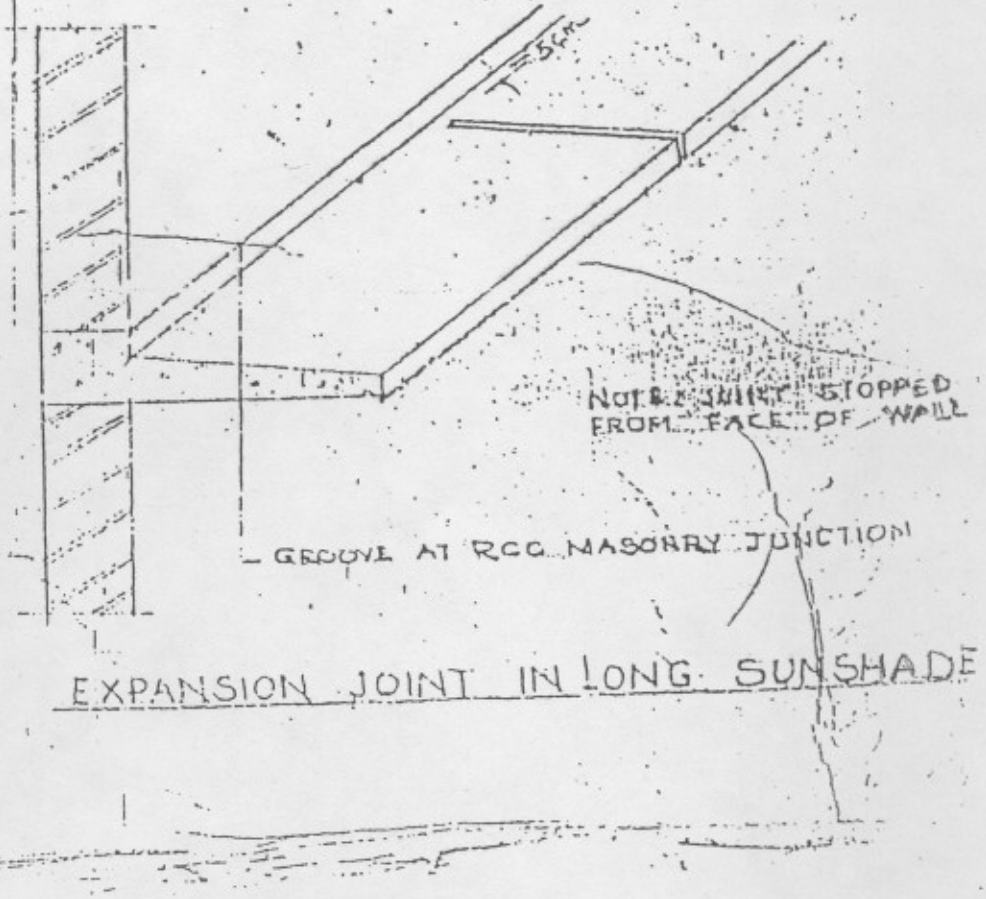
EXPANSION JOINT SURFACE MOUNTED WATER BAR

FIG-4



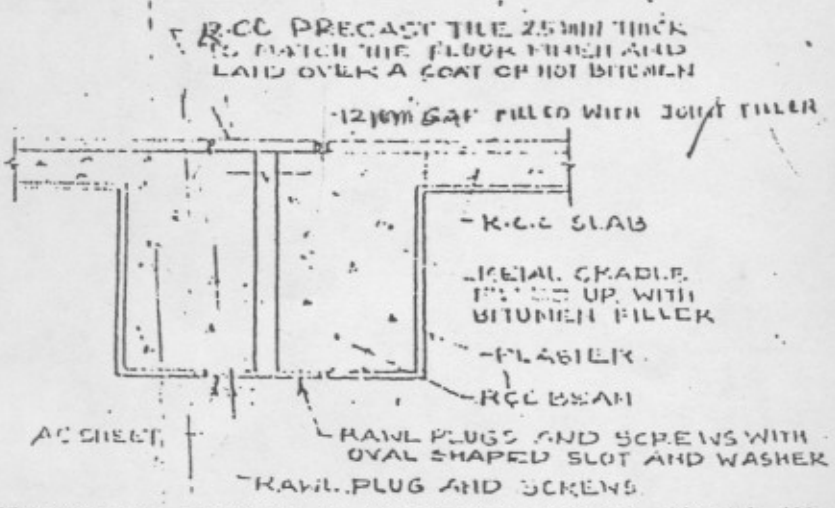
EXPANSION JOINT DETAILS AT ROOF

FIG-5



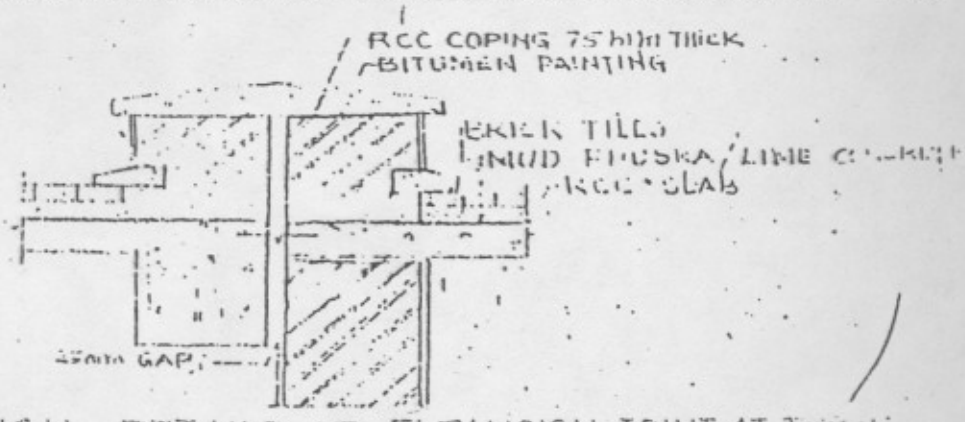
EXPANSION JOINT IN LONG SUNSHADE

FIG.6 -



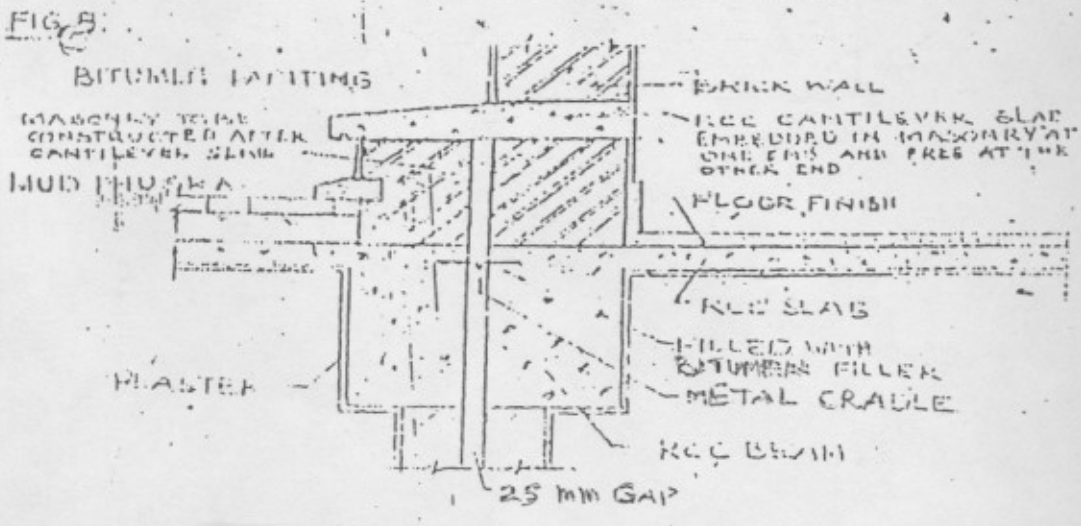
TYPICAL DETAILS OF EXPANSION JOINT AT FLOOR

FIG.7 -



TYPICAL DETAILS OF EXPANSION JOINT AT ROOF
WALL AND BEAM JUNCTION

FIG.8 -

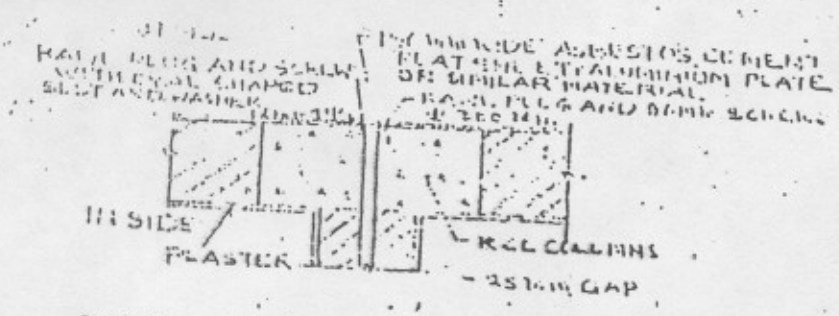


TYPICAL DETAIL OF EXPANSION JOINT AT ROOF
AND FLOOR JUNCTION

FIG·9

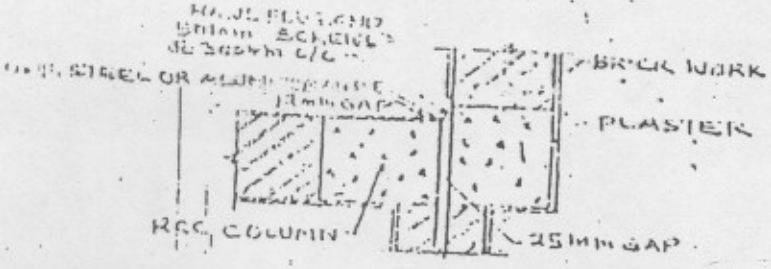
PLAN OF ALTERNATE ARRANGEMENTS OF JOINTS

FIG·10



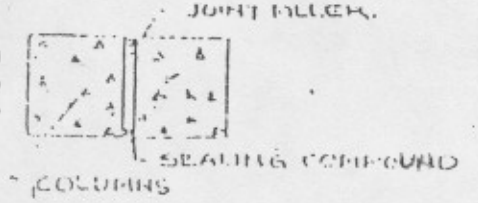
TYPICAL DETAILS OF EXPANSION JOINT ON OUTER FACE OF COLUMNS

FIG·11



TYPICAL DETAILS OF EXPANSION JOINT AT CORNER COLUMNS

FIG·12



TYPICAL DETAILS OF EXPANSION JOINT AT ISOLATED T-SHAPED COLUMNS

(34)

OFFICE OF THE CHIEF ENGINEER (DESIGNS)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

DESIGN CIRCULAR NO. 10

No. CE(D)/TC(13)84/DDA/ 1065 Dated the 18 July, 1985.

Subject:- STRUCTURAL DESIGNS IN CENTRAL DESIGN ORGANISATION.

It has been experienced that requests for undertaking and supplying structural design for new schemes are being made to C.D.O. by officers at various levels. Quite often necessary details are not furnished when making such a request. These leads to delay in processing of case in C.D.O.

To avoid these short-comings, a proforma has been devised and is enclosed. All future requests to C.D.O. for undertaking structural drawings should be accompanied with this proforma duly filled in.

C.D.O. at the moment is undertaking structural designs of works which have a building component costing more than one crore, and thus falls outside the purview of structural designs being done by Chief Engineers. Requests for undertaking structural design works by C.D.O. should, therefore, invariably be routed through the Chief Engineer of the Zone concerned.

All Engineers in D.D.A. are requested to follow these instructions.

Encl: A proforma

(S.C. Gupta)
Chief Engineer (Designs)

All Chief Engineers in D.D.A.

All Superintending Engineers and S.S.Os in D.D.A. with 5 spare copies for their Executive Engineers.

Copy also forwarded for favour of information to Engineer Member, D.D.A. and Chief Engineer(Quality Control), D.D.A.

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(S. C. Gupta)
Chief Engineer (Designs)

REQUISITION FOR THE DESIGN WORK TO C.D.O.

PROFORMA-CUM-CHECK LIST

Name of the work

1. Name of Circle
3. Name of Division
4. Reference to Administrative Approval and Expenditure sanction (Copy of preliminary estimate to be attached):
5. Present position regarding:-
   a) Technical sanction (if technical sanction is already accorded indicate special provision relating to structure made therein, if any).
   b) Approval of N.I.T.
   c) Receipt of Tender.
   d) Availability of land
6. Whether soil investigation has been carried out, if so attach the soil consultants report.

   Check List

   a) Whether sub-soil water level likely to rise during the life of the building has been indicated.
   b) Whether ground levels at the location of bore holes have been indicated.
   c) If raft foundation has been recommended - has he given value for modulus of subgrade reaction.
   d) Whether calculations in support of recommended bearing capacity are included in soil report.
   e) In case soil consultant has recommended under reamed pile foundation has he given the type and load carrying capacities of different piles.
7. Recommended bearing capacity of soil and depth of foundation.

   Check List

   a) Whether safe bearing capacity of adjoining pockets and position of works in these pockets has been indicated.
8. Formation level of ground for proposed construction. Attach a layout plan indicating contours for existing ground.
9. Attach three sets of architectural drawings.
10. Attach layout plan of the proposed construction.
11. Attach layout plan of the zone indicating the proposed pocket and adjoining pockets.
12. Indicate any special feature in site.

Chief Engineer

Zone

(36)

OFFICE OF THE CHIEF ENGINEER (DESIGNS)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

No.CE(D)11/SP(37)84/DDA/1677 Dated: the 25 October, 1985.

DESIGN CIRCULAR NO. 11.

Subject:- PREPARATION OF DETAILED ESTIMATES.

It has been noticed that detailed estimates are being prepared by some Engineers in D.D.A. without obtaining details about foundations and other structural elements from those who are to provide structural designs for the work. Tenders are called on the basis of these detailed estimates and even works are awarded.

When structural designs are taken up, the type of foundation provided in the detailed estimate may not be same as required by structural considerations and available bearing capacity. There can be changes even in the sizes of structural members and mortar/concrete mixes. This leads to contractural complications and delay in start of work.

It is, therefore, necessary that all officers should obtain necessary details about structural requirements from concerned structural designers before preparing detailed estimates, calling tenders and awarding work. All Engineers in D.D.A., are requested to follow this practice.

(S.C. Gupta)
Chief Engineer (Designs)

All Superintending Engineers including SSWs with 5 spare copies for their Executive Engineers.

Copy for information to all Chief Engineers in D.D.A.

Copy also forwarded for information to Engineer Member, D.D.A. and Chief Engineer(Q.C.), D.D.A.

Copy to Guard Circular File.

Copy to all Executive Engineers in C.D.O.

(S.C. Gupta)
Chief Engineer (Designs)

OFFICE OF THE CHIEF ENGINEER(DESIGN)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

No.CE(D)TC(15)86/ 56 Dated: 10 January, 1986.

(DESIGN CIRCULAR NO. 12)

Sub:- Initial load testing of under-reamed piles.

These days under-reamed pile foundation is being provided in several works in D.D.A. To assess load carrying capacity of the piles, initial load testing as per IS 2911 (Pt. 4) - 1985 is carried out. The Code provides that piles shall be tested either to the ultimate bearing capacity or to twice the estimated safe load. It is observed that piles are generally tested up to twice the estimated safe load. With a view to have an idea of the reserve capacity of the piles, it is desirable that the piles are testpd up to ultimate load carrying capacity.

All Engineers in D.D.A. are requested to follow these guidelines in future works and ensure that at least half the piles of each size are tested to ultimate load.

(S. C. GUPTA)
Chief Engineer(Design).

All Chief Engineers in D.D.A.

All Superintending Engineers and SSWs in D.D.A. with 5 spare copies for thdir Executive Engineers.

Copy also forwarded for favour of information to Engineer Member, D.D.A. and Chief Engineer(D.C.), D.D.A.

Copy to Guard file of circulars in C.D.O.

Copy to All Executive Engineers in C.D.O.

Chief Engineers(Design).

CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

No: CE(D)/TC(13)84/DDA/ 1151 Dt: 21-8-86

Circular no: 13

Sometimes Executive Engineers are approaching this office with the problem that open wells have come in the layout of the building and they ask for seperate foundation design for these portions. It is observed that in most of the cases these open wells could have been avoided had the EEs been more careful at the time of submitting site plan to the architects or at the time of giving layout. Because with slight adjustment in the layout of some blocks, the wells could be saved.

Similarly, the Executive Engineers have been reporting that some blocks come in low lying area, thus, requesting fresh foundation drawing. Here also, in most of the cases the problem could be solved by suitably fixing the plinth level of various blocks. Sometimes this is not done for one reason or the other. As such in some cases the type of foundation has to be changed which may lead to contractual complications.

These types of problems not only contribute to the delay in execution but also add to the cost besides increasing the design work. All engineers in DDA are, therefore, requested to avoid such cases by paying more attention while preparing site plans and/or giving layouts.

(S.C. GUPTA)
CHIEF ENGINEER (DESIGN)

COPY TO :

1. All Chief Engineers in DDA.
2. All Supdt. Engineers and SSWs in DDA with 5 spare copies for their Executive Engineers.
3. Copy also forwarded for favour of information to Engineer Member, DDA and CE(QC), DDA.
4. Copy to Guard file on circulars in CDO.
5. Copy to ALL E.E. in CDO.

(S.C. GUPTA)
CHIEF ENGINEER (DESIGN)

(40)

OFFICE OF THE CHIEF ENGINEER (DESIGNS)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

Design Circular no...14.....

No: CE(D)TC(13)84/DDA/1126 dt :- 15-2-88

Sub: Structural Designs in Central Design Organisation

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Design Circular No. 10 was issued vide this office letter no: CE(D)TC(13)84/DDA/1065 dated 18.7.05. The purpose of issuing the circular was to streamline the procedure for receiving the requisitions for structural design for any specified work, and also the data required for carrying out the structural design work, so that time consuming correspondence is avoided. It was specifically requested to route the proforma through the Chief Engineers so that the office of the Chief Engineers could ensure the informations being correct and complete and that all salient informations were given.

It has, however, been found that, in practice, this proforma is not given the due importance and incomplete and inadequate data are forwarded, as received from the field units, without any apparent contribution or verification at any level. It is seen that, even the presence of such predominent features like open well, pond etc. within the layout, have not been intimated. Similarly, even earth filling, as huge as 3 M, is not conveyed. This results in difficulties at a later stage.

Hence, it has become necessary to re-circulate the proforma with a view to bring the same to the notice of the CEs so that they may give due attention to submission of data contained in the proforma.

The proforma has been slightly modified so as to bring out the specific information required more clearly.

It may be mentioned that it will not be possible to take up design work of a project for which the data

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required in the prescribed proforma, which is necessary for carrying out structural designs, is not made available in complete shape.

(H.D. SHARMA)
CHIEF ENGINEER (DESIGN)

1. All Chief Engineers in DDA
2. All SEs in DDA with 5 spare copies for their Executive Engineers.

Copies to :-

1. E.M. for favour of information.
2. Chief Engineer (QC), DDA
3. All Executive Engineers in C.D.O.
4. Guard file on circulars in CDO.

CHIEF ENGINEER (DESIGNS)

REQUISITION FOR THE DESIGN WORK TO CDO
PROFORMA – CUM – CHECK LIST

1. Name of work :

2. Name of circle :

3. Name of Division :

4. Present position of work.

   i) AA & ES
   (copy of PE to be attached)

   ii) Technical sanction
   (Indicate special structural provision made in the detailed estimate).

   iii) Approval of NIT

   iv) Receipt of tenders

   v) Availability of land.

5. Attach Soil Investigation Report

Check List

i) Whether recommended bearing capacity of soil and depth of foundation given.

ii) Whether sub-soil water level indicated ? Also, whether the water table likely to rise during the life of the building has been indicated.

iii) Whether the ground level at each bore hole location is given ? A soil profile in one sheet with one datum level showing water table and different soil strata in different bore holes may be given for comparbtive study.

iv) Has the recommended bearing capacity of the soil been supported by calculations ?

v) Has the consultant recommended any special type of foundation ?

   a) If raft foundation is recommended, has the modulus of subgrade reaction been worked out ?

   b) If pile foundation is recommended, has he given the type and load carrying capacity of different piles & indicated the length and diameter of piles ?

vi) Indicate the safe bearing capacity of the adjoining pockets and the nature of structures there.

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(43)

6. Formation level of the proposed construction. Attach a layout plan showing the contours of existing ground(If it is not possible to give contour plan, mark the depth of filling required in various areas in the layout plan).

7. Three sets of architectural working drawings and the layout plans.

8. Attach layout plan of the zone showing the proposed pocket & the adjoining pockets.

9. Indicate special feature of the site such as open wells, pond ditches, abandoned sewers etc.

CHIEF ENGINEER
ZONE :

OFFICE OF THE CHIEF ENGINEER(DESIGNS)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

Design Circular No. 15.

No.CE(D)TC(13)84/DDA/281 March 8, 1989

REQUISITION OF STRUCTURAL DESIGN WORK
IN C.D.O. - PROFORMA-CUM-CHECK LIST

The proforma-cum-check list for requisition of structural design work in C.D.O. was slightly modified and issued with Design Circular No.14 vide this office No.CE(D)TC(13)84/DDA/126 dated 15th February, 1988.

But, it is seen that inspite of this Circular, the proforma-cum-check list is not being received from the CEs at the first instance itself. This causes avoidable delay in taking-up design work. Even where the proforma is received, it is not being filled with due care. For example, in one case, the fact that as much as 3 meters of filling was to be done, had not even been indicated. In another, the layout did not show that some blocks were only 2-storeyed and other 3-storeyed. It will be appreciated that such informations are essential for structural design. This proforma is a primary document for the purpose of structural design and the CEs are requested to give due importance to the same.

The proforma is recirculated herewith after making minor modifications to make it more clear. The attention of CEs is specially drawn to item No.7 of the enclosed proforma. It is seen that the data regarding the earth filling that will be done at site, is invariably not given by the field staff. This is an important data for structural design and should be supplied at the first instance itself.

It is mentioned again that it will not be possible to take up design work of a project for which the data in the prescribed proforma is not made available in complete shape.

(H.D. Sharma)
Chief Engineer(Designs)

Encl: As above

1. All Chief Engineers in D.D.A.
2. All SEs in DDA with 5 spare copies for their EEs.

Copies to:

1. Engineer Member, DDA, for favour of information.
2. Chief Engineer(DC), DDA, for favour of information.
3. All EEs in C.D.O., DDA.
4. Guard file on Circulars in C.D.O., DDA.

Chief Engineer(Designs)

/sunil/

REQUISITION FOR DESIGN WORK

PROFORMA - CUM - CHECK LIST

1. Name of work:
2. Name of Circle:
3. Name of Division:
4. Present position of work:

i) AA & ES
(copy of PE to be attached)

ii) Technical sanction
(Indicate special structural provisions made in the TS)

iii) NIT

iv) Receipt of tenders

v) Availability of land

5. Soil Investigation Report
(Attach a copy)

i) Whether sub-soil water level indicated?

ii) Whether water table likely to rise during the life of the building? If so indicate the level.

iii) Whether the bore holes are connected to a common bench mark? If not, this may be done.

iv) All bore holes data to be represented in one sheet with reference to a common datum
(Attach such a representation with soil report)

v) Has the recommended bearing capacity of the soil been supported by calculations?

vi) Has the consultant recommended any special type of fundation?

a) If the pile foundation is recommended the modulus of subgrade reaction is to be given.

b) If the pile foundation is recommended the type of pile and the load carrying capacities for different pile lengths and diameters are to be given.
Calculations on the basis of the table of I.S.-2911 (PartIII) and also on the basis of soil parameter should be submitted.

Contd..P/2..

6. i) Indicate the safe bearing capacity adopted in the adjoining pockets.

ii) Type of buildings constructed in the adjoining pockets.

7. Attach a layout plan clearly indicating the depth of earth filling that would ultimately be done at the location of each and every block.

8. These shall be architectural working drawings and the layout.

9. Attach a layout plan of the total area showing the location of the pocket under consideration.

10. Indicate any special feature of the site such as open wells, ponds, ditches, abandoned sewers, septic tanks, natural water courses, etc.

Chief Engineer

Zone

sunil

PROFORMA - CUM - CHECK - LIST

1. Name of work :

2. Name of Circle :

3. Name of Division :

4. Present position of work :

   i) AA & ES
   ---(copy of PE to be attached)

   ii). Technical sanction
   (Indicate special structural provisions made in the TS)

   iii) NIT

   iv) Receipt of tenders

   v) Availability of land,

5. Soil Investigation Report
   (Attach a copy) —

   i) Whether sub-soil, water level indicated? —

   ii) Whether water table likely to rise during the life of the building? If yes indicate the level.

   iii) Whether the bore holes are connected to a common bench mark? If not, this may be done. —

   iv) All bore holes data to be represented in one sheet with reference to a common datum w.r.t. Soil Strata & C & N Values etc. (Attach such a representation with Soil report)

   v) Has the recommended bearing capacity of

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the soil been supported by calculations?

Whether recommended bearing capacity is available for foundation widths 0.8m to 2.4m.

5.a) Has the consultant recommended any special type of foundation?

a) If the raft foundation is recommended the modulus of subgrade reaction is to be given.

b) If the pile foundation is recommended the type of pile and the load carrying capacities for different pile lengths and diameters are to be given.

Calculations on the basis of the table of I.S.-2911 (Part-III) and also on the basis of soil parameter should be submitted.

Whether contents of the soil investigation report authenticated by the Engineer-incharge.

6.0 i) Indicate the safe bearing capacity adopted in the adjoining pockets.

ii) Type of buildings constructed in the adjoining pockets.

7.0 i) Attach a layout plan clearly indicating the depth of earth filling that would ultimately be done at the location of each and every block with respect of finished/formed ground levels.

ii) Minimum & Maximum depths from FL. to foundation bed likely during execution.

8. Three sets of Architectural working drawings and the layout.

9. Attach a layout plan of the total area showing the location of the pocket under consideration.

10. Indicate any special feature of the site such as open wells, ponds, ditches, abandoned sewers, septic tanks, natural water courses etc.

11. Comments on the recommendations made by the soil consultants.

Chief Engineer

Encl

CE(D)-TC(13)84/Circ/2674 Dt. 19.11. (49)

DELHI DEVELOPMENT AUTHORITY
OFFICE OF THE S.E.(DESIGN)

NO:

CIRCULAR NO: 17

SUB: ARCHITECTURAL SCHEMES AND STRUCTURAL FEASIBILITY

Delhi has been identified in seismic zone No. IV as per IS Code No. 1893. This is medium to high intensity zone as per relevant provisions of IS Code.

It is mandatory as per IS Code to provide structural arrangements according to the provisions of IS 4326 before it can be deemed structurally safe in seismic zone No IV. In view of the same some of the essential recommendations of the relevant seismic codes are given below for information and guidance of all concerned. Some of the important mandatory recommendations given in the above codes have been summed up below.

The seismic codes recognises the following type of construction safe for seismic zones.

1. TYPE CONSTRUCTION:

i) Framed structure
ii) Load Bearing structure.

2. FRAMED CONSTRUCTION:

i) RCC framed construction can be with or without shear walls.
ii) Where shear walls are deemed necessary it is desirable that shear walls are distributed preferably evenly over the whole building plan.
iii) Shear walls should extend from foundation upwards.
iv) The architectural schemes/drawing should be planned so as to maintain regular grids in both directions.
v) The framed structure shall be provided in case-
a) box type construction is not feasible for load bearing walls.
b) height of building is more than 15 mtrs or more than 4 storeyes when measured from the mean ground level to the roof slab.
c) wherever cost is not a constrain.

3. BOX TYPE CONSTRUCTION:

a) Traditional masonry construction with load bearing walls fall under this category. This type of

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construction is deemed to be most economical and is recommended to be adopted generally unless structurally not desirable.

b) IS Code 4326 essentially specifies as under for such type of construction:-

i) The bearing walls in both direction shall be straight and symetrical in plan.

ii) Walls shall extend from foundation level.

iii) The length of the wall shall not exceed more than 6mtrs to restrict the slenderness ratio.

iv) The total width of the openings shall not be more than half of the length of the wall.

v) The opening shall preferably be located away from the corner by a clear distance equal to atleast 1/8 of the height of the opening.

vi) The horizontal distance between two openings shall not be less than 1/4 of the height of the shorter openings.

vii) The vertical distance from an opening to an opening directly above shall not be less than 60cm.

3. PROJECTED MEMBERS:

i) Projected parts shall be avoided as far as possible. If the projected parts cannot be avoided, they shall be properly reinforced and firmly tied to the main structure.

ii) The projected parts shall be as light as possible. It is desirable that the projections should be used for creating terraces instead of extension of rooms on cantilevers.

iii) In case of incremental housing schemes the projected parts should be eliminated at all costs to avoid undesirable and unauthorised construction activity by individual allottee at a later date which may risk the safety of the projected member.

4. EXPANSION JOINT/SEPARATION JOINT:

i) Expansion joints shall be spaced to restrict the continuity in the structure to less than 30 mtrs. particularly in case of continuous row houses.

ii) L,T,Y or C shapes of building shall be invariably separated by separation joint so as to form rectangular shape in plan.

iii) The gap width shall be @ 10mm per storey subject to minimum of 25mm.

(ANIL TIKU)
S.E. (DESIGN)

Copy to:

1. Engineer Member
2. All Chief Engineers
3 Chief Architect
4. Addl. Chief Architect.
5. All Senior Architects

OFFICE OF THE CHIEF ENGINEER (DESIGN)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY

No.ACE(D)TC(13)/92/DDA/674 Dated : 31-1-92

Circular No.18

SUBJECT : COMPUTER AIDED DESIGN CELL

C.D.O. has started Computer Aided Design Cell w.e.f. January, 1992. At present, there is only one Computer and Printer available. We have formulated programmes for structural designs which includes facilities for Static and Dyamic analysis as well.

C.D.O. has prepared programme for design of sewerage and drainage network system for development works. The CAD programme available are being operated and Computer Aided Design is being encouraged by CDO. It will take some time before Engineers of CDO are fully conversant with CAD and render services to all concerned.

CDO invites names of Engineers if any, who are interested for training in CAD system of designs who shall be imparted working knowledge of CAD according to the schedule which will be formulated after the names are received.

This circular be brought to the notice of all concerned Engineers so that, options are given by individual engineers for Computer Programme.Training. The name should be reach the undersigned by 17.2.91.

29/1/92
(M.L. TIKU)
SUPERINTENDING ENGINEER (D)

Copy to :

1. Engineer Member, DDA for information.
2. All Chief Engineers, DDA.
3. All S.Es., Director (Works), DDA.
4. All Executive Engineers, DDA.

(Electrical)

29/1/92
SUPERINTENDING ENGINEER (D)

(52)

OFFICE OF THE CHIEF ENGINEER (DESIGN)
CENTRAL DESIGN ORGANISATION
DELHI DEVELOPMENT AUTHORITY
14TH FLOOR : VIKAS MINAR
NEW DELHI

.....

No. CE(D) TC(13)/84/DDA/436 Dated:- 7.5.1992

C I R C U L A R -19

Subject: GENERAL INSTRUCTIONS FOR STRUCTURAL DESIGNS.

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Certain general instructions which are relevant to every structural design prepared for housing projects have been consolidated and are enclosed herewith. These instructions would be applicable to all the specific structural designs and drawings issued by the Central Design Organisation for the various housing schemes. It is requested that these instructions may be circulated to all the Superintending Engineers and Executive Engineers under your control.

Encl:-
As Above
Notes No 1 To 38

(R.S. JINDAL)
CHIEF ENGINEER (DESIGN)

All Chief Engineers

Place it on site
Smt Bindiya 15/6

1. All dimensions are in mm.
2. If any difference is found between drawings and site conditions the same shall be brought to the notice of Central Design Organisation for reconci-liation before execution.
3. No dimension shall be scaled out, only written dimensions shall be followed.
4. All centre line dimensions shall be extracted from the Architectural Drawings.
5. 75 designation bricks are to be used for the foundation work.
6. Cement mortar for foundation shall be 1:6 (1 cement : 6 fine sand) from Ist off set below plinth level to foundation level upto top of foundation lean concrete bed.
7. Load bearing masonry walls are shown in hatching in the plan.
8. If the area requires any filling such filling would be kept to the minimum and plinth level would be decided accordingly.
9. Filling of earth wherever required shall be done simultaneously for equal depths on both sides of the wall.
10. If it is a filled up area it should be ensured that the foundation rests on the original/virgin soil.
11. It must be ensured that there existed no natural water course under the foundation, which might have been later on filled up and which may get activated during heavy rains. Effective drainage arrangement shall be made for life time of the structure.
19. It may be ensured by the Executive Engineer In-charge that houses under construction are situated sufficiently away from a retaining wall, nallah, ditch or low lying area, to ensure stability of soil considering depth of structure, nallah ditch etc. If necessary Soil consult-

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nts/Central Design Organisation should be consulted.

13. Electric Distribution Board nitch shall be provided with Reinforced Cement Concrete Box of suitable shape while doing brick work.

14. Thickness of walls shall not be reduced for fixing wash basin. In case such recession in masonry is necessary, reinforced cement concrete box of suitable shape shall be provided while doing brick work.

15. 115mm thick walls are to be treated as non-load-bearing.

16. Projections provided for ornamental effects in elevation shall be in reinforced cement concrete and shall be suitably anchored back to the main structure.

17. Masonry where supported on cantilevers shall be firmly tied to the main structure in accordance with IS-1326.

18. Foundation design for compound wall and partition walls shall be finalised by the Executive Engineer In-charge.

19. Expansion joints are to be provided as per codal requirements.

20. The work shall be taken up only for the approved scheme.

21. No shuttering shall be provided for the column faces flushing 230mm thick masonry walls. Walls shall be constructed prior to the casting of the columns.

22. High yeild strength deformed bars confirming to IS-1786-1985 (Grade Fe 415) shall be used except otherwise specified.

23. Not more than 1/3rd of the steel reinforcement shall be lapped at one location.

24. The minimum lap length for reinforcement shall be 69 times diameter of the reinforcement bar.

25. Lintel bands shall be provided for all floors.

26. Lintel band reinforcement shall be continuous through columns, lintels for openings and at junctions of walls.

27. Unless noted otherwise, all reinforced cement concrete work shall be done in 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate - 20 mm nominal size) attaining 210 kg/cm^2 strength in 28 days.

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28. Clear cover for main reinforcement shall be as follows :

i)	Slab	15mm
ii)	Beams	25mm
iii)	Column	40mm
iv)	Footings	75mm

29. Bearing for the slab shall be for full brick width of the wall.

30. Suitable bed blocks shall be provided under the beams.

31. All slabs except otherwise specified are 100mm thick. Reinforcement detailing shall be done as per bar bending schedule.

32. Distribution reinforcement for slabs not shown in the drawing shall be provided as 8 ϕ @ 300 c/c. Wherever required.

33. Suitable camber shall be provided for the large spanned members or projected members while casting. Centering for the cantilevers shall be removed only after adequate counter weight is available.

34. For all beams proper bearing shall be provided.

35. 230mm load bearing brick work in cup board provided in the rooms, will be stopped at lintel level for casting loft slab over it. Further brick work shall be raised over the loft slab for supporting floor slab.

36. Depressions in slabs where indicated are the maximum permissible. However these may be reduced as per site requirements and conditions.

37. Plinth protection shall be provided as per agreement.

38. Between adjoining footings at different levels, a clear horizontal distance shall be maintained so that slope of the joining line of footing beds is not steeper than 1 vertical : 2 horizontal. Where required suitable longitudnal drop in steps shall be provided in the foundation bed, maintaining a slope not steeper than 1 vertical : 2 horizontal for the cross walls also.

(52)

DELHI DEVELOPMENT AUTHORITY
ENGINEERS
CENTRAL DESIGN ORGANISATION

File No.CE(D)TC(13)/84/DDA/ Dated /3/1994

Sub: AMENDMENT NO.1 TO CIRCULAR NO.19

Vide Circular No.19 regarding general instructions for structural designs issued by this office vide letter No.CE(D)TC(13)/84/DDA/436 dated 7.5.1992 enclosing Design Notes may be corrected as under:

(i) The Note No.24 is substituted as below:

"The development(lap) length for reinforcement in tension, unless otherwise specified, shall be 57 times the bar diameter (57d) for the concrete mix 1:2:4 and (47d) for the concrete mix 1:1.5:3."

(ii) The Note No.25 is substituted as below:

"Lintel bands shall be provided for all floors in load bearing brick masonry walls and composite structures. The lintel bands are not to be provided in case of RCC framed structures"

This shall be expressed as 'Amendment No.1' to the said Design Notes applicable to all the structural designs and drawings to be issued by the Central Design Organisation.

(Er.Y.L.BANKA)
Chief Engineer(Design)

To

1. Chief Engineers(EZ,WZ,NZ,SEZ,SWZ & Rohini)
2. All Supdtg.Engineers(Civil),DDA..
3. All Ex.Engineers(Civil),DDA.

Copy to:
1. S.E.(D),CDO for information and necessary action.
2. Ex.Engineers(D)-I,II,III,IV&V for information and necessary action.

Executive
Chief Engineer(Design)
C.D.O. (DDA)