

INTERNSHIP REPORT
ON
BUILDING CONSTRUCTION

SUBMITTED BY :

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE GWALIOR

A GOVT. AIDED AUTONOMOUS INSTITUTE UNDER PGPV , BHOPAL ESTABLISHED IN 1957

IN PARTIAL FULFILLMENT FOR REQUIREMENT FOR THE AWARD OF THE DEGREE

OF

BACHLOR OF TECHNOLOGY

IN

CIVIL ENGINEERING



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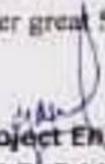
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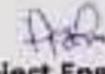


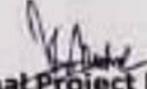
CERTIFICATE

This is to certify that **ASTHA GANDHARV** Enrollment No. **0901CE193D04** student of **B.Tech 5th Semester, CIVIL BRANCH** of **MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.)** has undergone training from **10/01/2022 to 10/05/2022** with full devotion at site of Construction of **MAHILA POLYTECHNIC COLLEGE, BHOPAL (M.P.)**

I wish her great Success in her life.

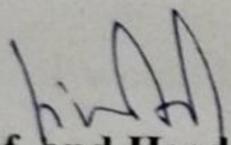

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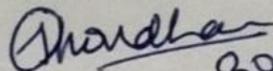

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RECOMMENDATION

It is here by recommended that the internship report entitled. "CONSTRUCTION BUILDING" Which is being submitted by ASTHA GANDHARV completed under the guidance of PROF. JAYVANT CHAUDHARY may be accepted In the partial fulfillment of the award of the Degree of Bachelor of Engineering of Civil Engineering


for Prof. and Head
Civil Engineering Department
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GUIDED BY


30/05/22

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I would like to express my deepest appreciation to all those who provided me the possibility to complete this report. A special gratitude I give to project manager JPD Surendra Rao Gaurkhede (P D P I U) whose contribution in stimulating suggestions & encouragement, helped me to coordinate my project especially in writing this report. Furthermore I would also like to acknowledge with much appreciation the crucial role of EE Shireen Khan , AE Palak Jain , Project engineer A K Sharma NIRMAN BHAWAN PWD.. best possible guidance regarding the Project. Lastly,

I would like to appreciate the efforts made by PDPIU,BHOPAL for providing the professional experience to the us

Date: 10/01/2022 TO 10/05/2022

Place: BHOPAL

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ABSTRACT

The problem and the solution. One of the challenges of theory-building research in applied disciplines is making the logic used to build the theory explicit and accessible to the user of the developed theory. Although different methods of theory building advocate different theory-building research processes, there is an inherently generic nature to theory building. This chapter acts as a foundation for the journal by highlighting strategies commonly used in building theory and offers a generic, five-phase method of theory-building research.

सार

समस्या और समाधान। अनुप्रयुक्त विषयों में सिद्धांत-निर्माण अनुसंधान की चुनौतियों में से एक है सिद्धांत के निर्माण के लिए प्रयुक्त तर्क को स्पष्ट और विकसित सिद्धांत के उपयोगकर्ता के लिए सुलभ बनाना। यद्यपि सिद्धांत निर्माण के विभिन्न तरीके विभिन्न सिद्धांत-निर्माण अनुसंधान प्रक्रियाओं की वकालत करते हैं, सिद्धांत निर्माण के लिए एक स्वाभाविक रूप से सामान्य प्रकृति है। यह अध्याय सिद्धांत के निर्माण में आमतौर पर उपयोग की जाने वाली रणनीतियों को उजागर करके पत्रिका के लिए एक नींव के रूप में कार्य करता है और सिद्धांत-निर्माण अनुसंधान की एक सामान्य, पांच-चरण विधि प्रदान करता है।

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INTRODUCTION

Engineering is a professional art of applying science to the efficient conversion of natural resources for the benefit of man. Engineering therefore requires above all creative imagination to innovative useful application for natural phenomenon.

THE DESIGN PROCESS

The design process of structural planning and design requires not only imagination and conceptual thinking but also sound knowledge of science of structural engineering besides the knowledge of practical aspects, such as recent design codes, bye laws, backed up by ample experience, intuition and judgement. The purpose of standards is to ensure and enhance the safety, keeping careful balance between economy and safety.

The process of design commences with planning of the structure , primarily to meet its functional requirements. Initially, the requirements proposed by the client are taken into consideration. They may be vague, ambiguous or even unacceptable from engineering point of view because he is not aware of the various implications involved in the process of planning and design , and about the limitations and intricacies of structural science. It is emphasized that any structure to be constructed must satisfy the need efficiently for which it is intended and shall be durable for its desired life span. Thus, the design of any structure is categorized into the following two main types :-

- 1) functional design
- 2) structural design.

FUNCTIONAL DESIGN

The structure to be constructed should be primarily serve the basic purpose for which it is to be used and must have a pleasing look r".• The building should provide happy environment inside as well as outside. Therefore, the functional planning of a building must take into account the proper arrangements of rooms / halls to satisfy the need of the client, good ventilation, lighting, acoustics, unobstructed view in the case of community halls, cinema halls, etc. sufficient head room, proper water supply and drainage arrangements, planting of trees etc. bearing all these aspects in mind the architect/engineer has to decide whether it should be a load bearing structure or R.C.0 framed structure or a steel structure etc..

STRUCTURAL DESIGN

The structural design is an art and science of understanding the behaviour of structural members subjected to loads and designing them with economy and elegance to give a safe

The principle elements of a R.O building frame consists of :

- 1) slabs to cover large area
- 2) beams to support slabs and walls
- 3) columns to support beams
- 4) footings to distribute concentrated column loads over a large of the supporting soil such that the bearing capacity of soil is not exceeded.

In a framed structure the load is transferred from slab to beam, from beam to column and then to the foundation and soil below it.

STAGES IN STRUCTURAL DESIGN

The process of structural design involves the following stages :

- 1) structural planning
- 2) action of forces and computation of loads
- 3) methods of analysis
- 4) member design
- 5) detailing, drawing and preparation of schedules.

STRUCTURAL PLANNING

After getting an architectural plan of the buildings, the structural planning of the building frame is done. This involves determination of the following :

- a) positioning and orientation of column of columns
- b) position of beams
- c) spanning of slabs
- d) layout of stairs
- e) selecting proper type of footing

the basic principle in deciding the layout of component members is that the loads should be transferred to the foundation along the shortest path.

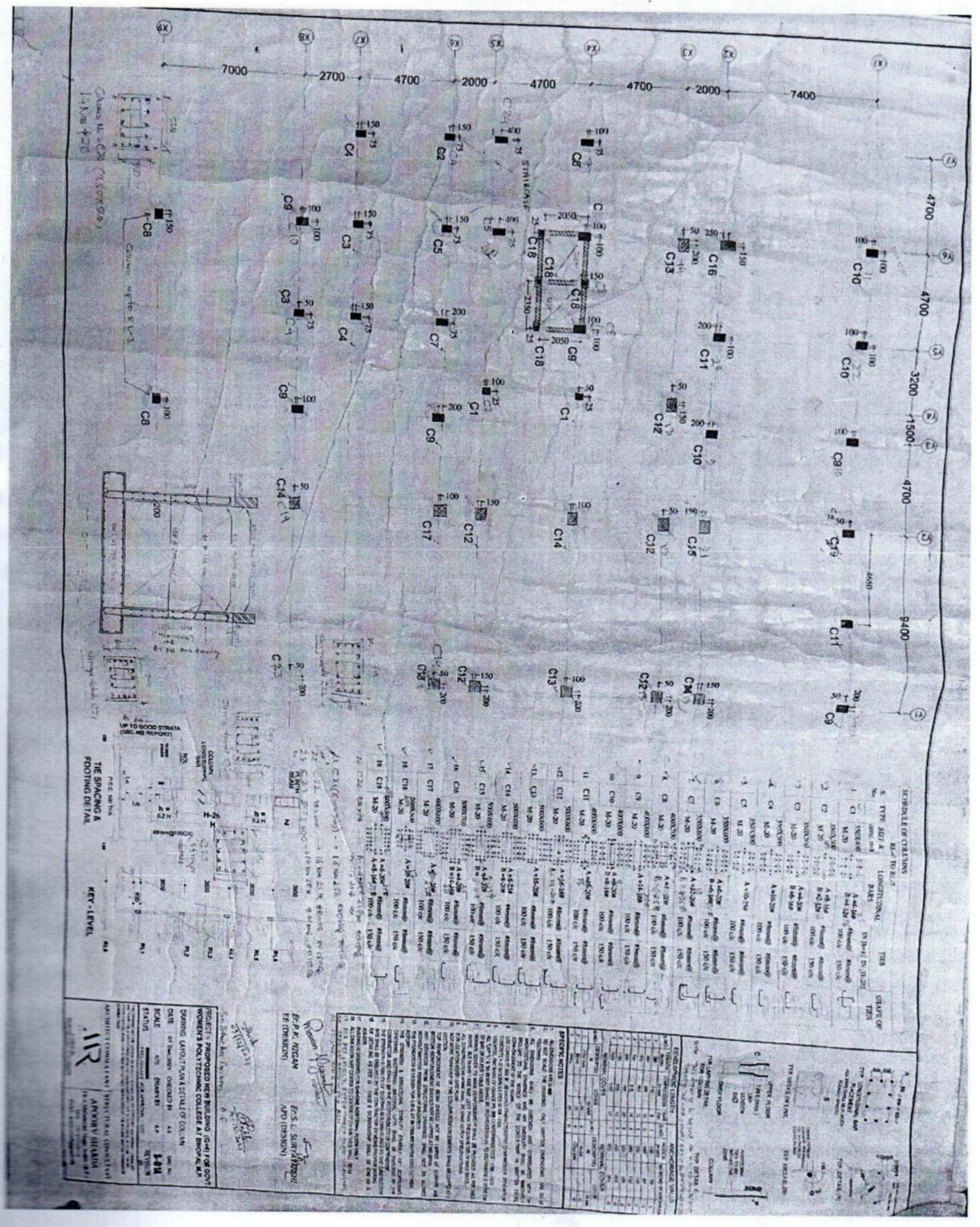
POSITION OF COLUMNS

- 1) Columns should be preferably located at or near the corners of a building and at the intersections of beams/walls. Since the basic function of the columns is to support beams which are normally placed under the walls to support them, their position automatically gets fixed as shown in the figure below.

Column position for rectangular pattern building.

- 2) Select the position of columns so as to reduce bending moments in beams. When the locations of two columns are very near, then one column should be provided instead of two at such a position so as to reduce the beam moment.
- 3) Avoid larger spans of beams. When the centre to centre distance between the intersection of walls is large or when there are no cross walls, the spacing between two columns is governed by limitations of spans of supported beams because spacing of columns decides the span of beam. As the span of the beam increases, the required depth of the beam, and hence its self weight, and the total load on beam increases.

It is well known that the moment governing the beam design varies with the square of the span and directly with the load. Hence with the increase in the span, there is considerable increase in the size of the beam. On the other hand, in the case of column, the increase in total load due to increase in length is negligible as long as the column is short. Therefore the cost of the beam per unit length increases rapidly with the



COLUMN PLAN FIG. 1

span as compared to beams on the basis of unit cost. Therefore the larger span of the beams should, be preferably avoided for economy reasons.

In general, the maximum spans of beams carrying live loads upto 4 kN/m^2 may be limited to the following values.

Beam type Cantilevers simply supported Fixed/continuous rectangular 3meters
6meters 8meters flanged 5meters 10meters 12meters

- 4) Avoid larger centre to centre distance between columns. Larger spacing of columns not only increases the load on the column at each floor posing problem of stocky columns in lower storeys of a multi storeyed building. Heavy sections of column lead to offsets from walls and obstruct the floor area.
- 5) The columns on property line need special treatment. Since column footing requires certain area beyond the column, difficulties are encountered in providing footing for such columns. In such cases, the column may be shifted inside along a cross wall to make room for accommodating the footing within the property line.

ORIENTATION OF COLUMNS

- 1) Avoid projection of column outside wall. According requirements of aesthetics and utility, projections of columns outside the wall in the room should be avoided as they not only give bad also obstruct the use of floor space and create problems in furniture flush with the wall. Provide depth of the column in the plane of the wall to avoid such offsets.
- 2) Orient the column so that the depth of the column is contained in the major plane of bending or is perpendicular to the major axis of bending. When the column is rigidly connected to right angles, it subjected to moments of addition

to the axial load. In such cases, the column should be so oriented that the depth of the column is perpendicular to major axis of bending so as to get larger moment of inertia and hence greater moment resisting capacity. It will also reduce L_{eff}/D ratio resulting in increase in the load carrying capacity of the column.

- 3) It should be borne in mind that increasing the depth in the plane of bending not only increases the moment carrying capacity but also increases its stiffness, thereby more moment is transferred to the column at the beam column junction.
- 4) However, if the difference in bending moment in two mutually perpendicular directions is not large the depth of the column may be taken along the wall provided column has sufficient strength in the plane of large moment. This will avoid offsets in the rooms.

POSITION OF BEAMS

- 1) Beams shall normally be provided under the walls or below a heavy concentrated load to avoid these loads directly coming on slabs. Since beams are primarily provided to support slabs, its spacing shall be decided by the maximum spans of slabs.
- 2) Slab requires the maximum volume of concrete to carry a given load. Therefore the thickness of slab is required to be kept minimum. The maximum practical thickness for residential/office/public buildings is 200mm while the minimum is 100mm.
- 3) The maximum and minimum spans of slabs which decide the spacing of beams are governed by loading and limiting thickness given above. In the case of

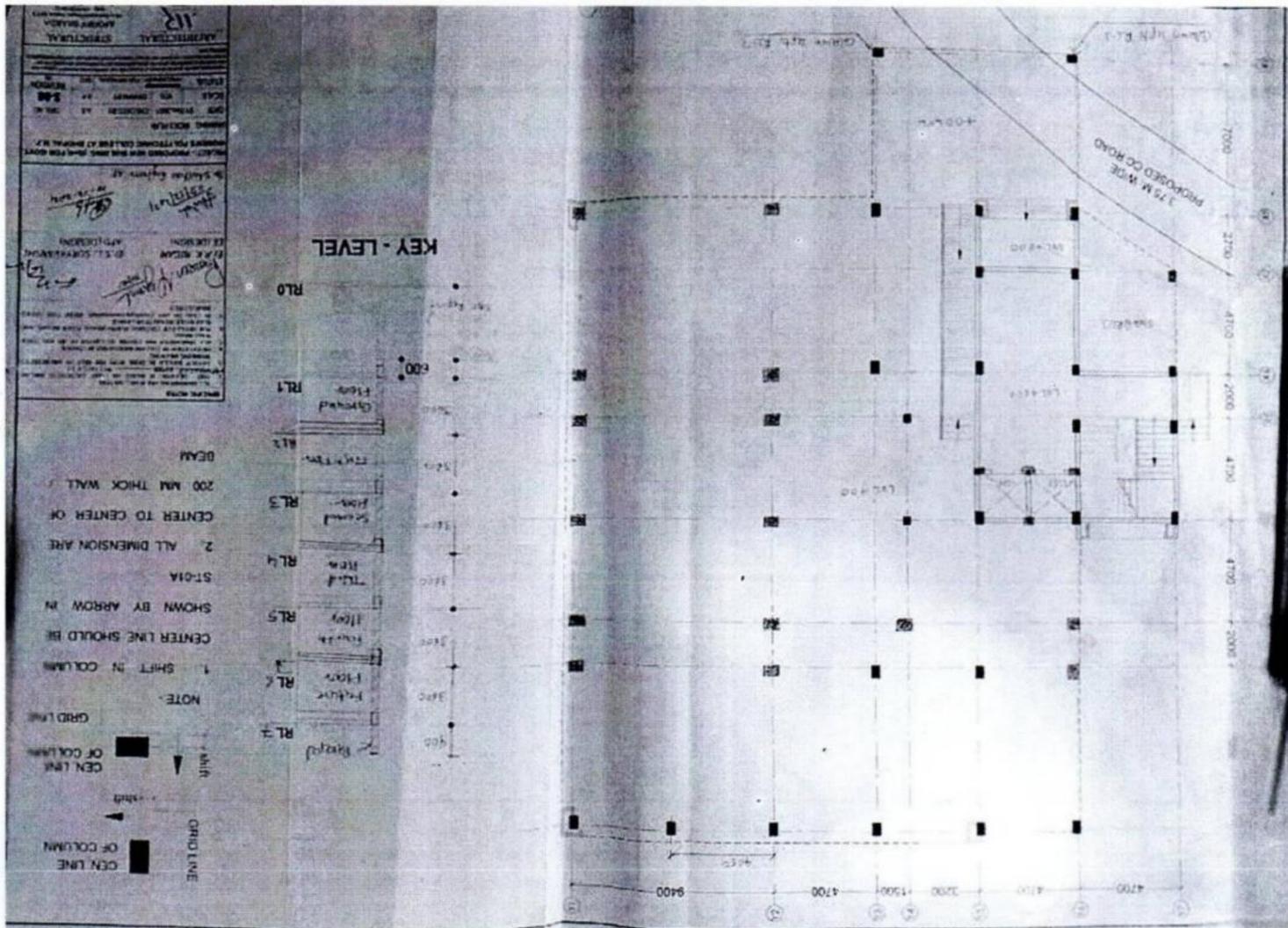
buildings, with live load less than 5kN/m^2 the maximum spacing of beams may be limited to the values of maximum spans of slabs given below.

Support condition	cantilevers	Simply supported	Fixed/continuous	One-way	Two-way	One-way	Two-way	One-way	Two-way
Maximum Recommended span of slabs	1.5m	2.0m	3.5m	4.5m	4.5m	6.0m			

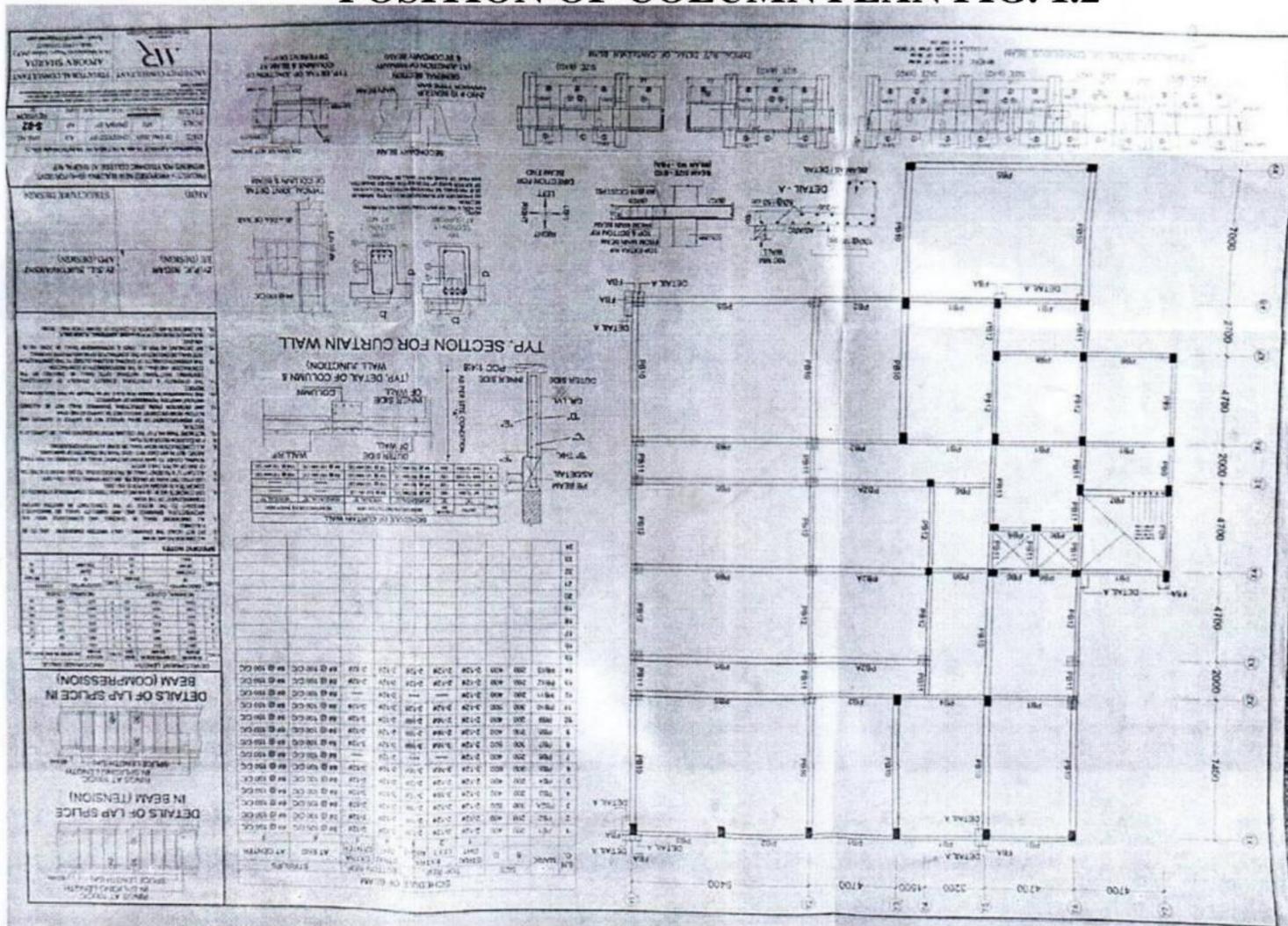
- 4) Avoid larger spacing of beams from deflection and cracking criteria. Larger spans of beams shall also be avoided from the considerations of controlling the deflection and cracking. This is because it is well known that deflection varies directly with the cube of span and inversely with the cube of depth i.e. L^3/D^3 . Consequently, increase in D is less than increase in span L which results in greater deflection for larger span.
- 5) However, for large span, normally higher L/D ratio is taken to restrict the depth from considerations of head room, aesthetics and psychological effect. Therefore spans of beams which require the depth of beam greater than one meter should be avoided.

SPANNING OF SLABS

This is decided by supporting arrangements. When the supports are only on opposite edges or only in one direction, the slab acts as a one way supported slab. When rectangular slab is supported along its four edges it acts as one way slab when $L_y/L_x > 2$ and as two way slab for $L_y/L_x < 2$. However two way action of the slab not only depends on the aspect ratio L_y/L_x and but also on the ratio of reinforcement in the two directions. Therefore, designer is free to decide as to whether the slab should be designed as one way or two way.



POSITION OF COLUMN PLAN FIG. 1.2



BEAM PLAN FIG. 1.3

- 1) A slab normally acts as a one way slab when the aspect ratio $L_y/L_x > 2$, since in this case one way action is predominant. In one way slab, main steel is provided along the short span only and the load transferred to two opposite supports only. The steel along the long span just acts as distribution steel and is not designed for transferring the load but to distribute the load and to resist shrinkage and temperature stresses.
- 2) A two way slab having aspect ratio $L_y / L_x < 2$ is generally economical compared to one way slab because steel along the spans acts as main steel and transfers the load to all its four supports. The two way action is advantageous essentially for large spans and for live loads greater than 3kN/m^2 . For short spans and light loads, steel required for two way slab does not differ appreciably as compared to steel for one way slab because of the requirement of minimum steel.
- 3) Spanning of the slab is also decided by the continuity of the slab.
- 4) Decide the type of the slab. While deciding the type of the slab whether a cantilever or a simply supported slab or a continuous slab loaded by UDL it should be borne in mind that the maximum bending moment in cantilever ($M = wL^2 / 2$) is four times that of a simply supported slab ($M = wL^2/8$), while it is five to six times that of a continuous slab or a fixed slab ($M = wL^2/10$ or $wL^2/12$) for the same span length.
- 5) Similarly deflection of a cantilever loaded by a uniformly distributed load is given by : $\delta = wL^4 / 8EI = 48/5 * (5wL^4 / 384EI)$ which is 9.6 times that of a simply supported slab = $(5wL^4 / 384 EI)$.

While designing any slab as a cantilever slab, it is of utmost importance to see whether adequate anchorage to the same is available or not.

- 1) The type of footing depends upon the load carried by the column and bearing capacity of the supporting soil. It may be noted that the earth under the foundation is susceptible to large variations. Even under one small building the soil may vary from a soft clay to hard murum.
- 2) It is necessary to conduct the survey in the area where the proposed structure is to be constructed to determine the soil properties. Drill holes and trial pits should be taken and in situ plate load test may be performed and samples of soil tested in the laboratory to determine the bearing capacity of soil and other properties.
- 3) For framed structure under study, isolated column footings are normally preferred except in case of soils with very low bearing capacities. If such soil or black cotton soil exists for great depths, pile foundation.- can be appropriate choice.
- 4) If columns are very closely spaced and bearing capacity of the soil is low, raft foundation can be an alternative solution. For column on the boundary line, a combined footing or a strap footing may be provided.

ACTIONS OF FORCES AND COMPUTATION OF LOADS

BASIC STRUCTURAL ACTIONS

The various structural actions which a structural engineer is required to know are as follows :-

TYPES OF STRUCTURAL ACTIONS

Axial force action :- This occurs in the case of one dimensional (discrete) members like columns, arches, cables and members of trusses, and it is caused by forces passing through the centroidal axis and inducing axial (tensile or compressive) stresses only.

Membrane action :-

This occurs in the case of two dimensional (continuum) structures like plates and shells. This induces forces along the axial surface only.

Bending action :-

The force either parallel or transverse, to the membrane axis and contained in the plane of bending induces bending (tensile and compressive) stresses. The bending may be about one or both axes which are perpendicular to the member axis.

The bending action is essentially by transverse forces or by moments about axes lying in the plane of the slab.

Shear action :-

The shear action is caused by in-plane parallel forces inducing shear stresses.

Twisting action :-

This action is caused by out of plane parallel forces i.e., forces not contained in the plane of axis of the member but in a plane perpendicular to axis of the member inducing torsional moment and hence shear stresses in the member

Combined action :-

It is a combination of one or more of above actions. It produces a complex complex stress condition in the member.

ANALYSIS OF A STRUCTURE

The different approaches to structural analysis are :-

- 1) Elastic analysis
- 2) Limit analysis

Elastic analysis is used in working stress method of design.

Limit analysis is further bifurcated as plastic theory applied to steel structures and ultimate load method of design, and its modified version namely Limit State Method for R.C.Structures, which includes design for ultimate limit state at which ultimate load theory applies and in service state elastic theory applies and in service elastic theory applies and in services state elastic theory is used.

MEMBER DESIGN :- The member design consists of design of slab, beam, column, and footing.

DETAILING, DRAWING, AND PREPARATION OF SCHEDULE

Detailing is a process of evolution based on an understanding of structural behavior and material properties. The good detailing ensures that the structure will

behave as designed and should not mar the appearance of the exposed surface due to excessive cracking. The skillful detailing will assure satisfactory behaviour and adequate strength of structural members.

MARKING OF FRAME COMPONENTS

Before starting the structural design of R.C. frame components, it is always necessary to mark or designate them first to facilitate identification, listing and scheduling. The different schemes adopted for marking or identification are given below.

- a. Column reference scheme
- b. Scheme as recommended by IS : 55251.5: "Recommendations for detailing of reinforcement in reinforced concrete work". This scheme of marking is called as a grid reference scheme.
- c. Scheme followed by the private sector.

DESIGN PHILOSOPHIES

Reinforced concrete structures can be designed by using one of the following design philosophies.

- 1) Working Stress Method (WSM)
- 2) Ultimate Load Method (ULM)
- 3) Limit State Method (LSM)

Working stress method used over decades is now practically out dated. It is not used at all in many advanced countries of the world because of its inherent drawbacks. The latest I.S. Code gives emphasis on Limit State method which is the modified version of Ultimate load method. It is a judicious amalgamation of WSM and ULM removing all drawbacks of both methods but maintaining their good points. It is also based on sound scientific principles backed up by 25 years of research. The limit state method has proved to have an edge over the working stress design from the view point of economy.

LOADS AND MATERIALS

Loads and properties of materials constitute the basic parameters affecting the design of a R.C. structure. Both of them are basically of varying nature. The correct assessment of loads/forces on a structure is a very important step and serviceable design of structure.

TYPES OF LOADS

The loads are broadly classified as vertical loads, horizontal loads, and longitudinal loads. The vertical loads consists of dead load, live load, impact load. The horizontal loads comprises of wind load and earth quake load. The longitudinal loads (viz,

tractive and braking forces are considered in special cases of design of bridges, design of gantry girders etc.)

Dead load :-

Dead loads are permanent or stationary loads which are transferred to the structure throughout their life span. Dead load is primarily due to self weight of structural members, permanent partition walls, fixed permanent equipment and weights of different materials.

Imposed loads or Live loads :-

Live loads or movable loads with out any acceleration or impact. These are assumed to be produced by the intended use or occupancy of the building including weights of movable partition or furniture etc. The imposed loads to be assumed in buildings

Impact load :-

Impact load is caused by vibration or impact or acceleration. A person walking produces a live load but soldiers marching or frames supporting lifts and hoists produce impact loads. Thus impact load is equal to imposed incremented by some percentage depending on the intensity of impact.

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Wind load :-

Wind load is primary horizontal load caused by movement of air relative to earth. The details of design wind load are given is IS : 875 (part - 3)2.2 Wind load is required to be considered in design especially when the height of the building

exceeds two times dimensions transverse to the exposed wind surface. For low rise building say up to 4 to 5 storeys the wind load is not critical because the moment of resistance provided by the continuity of floor system to column connection and walls provided between column connection and walls provided between columns are sufficient to accommodate the effect of these forces. Further in limit state method the factor for design load is reduced to $1.2(DL + LL + WL)$ when the wind is considered as against the factor of $1.5 (DL + LL)$ when wind is not considered.

Earth quake load :-

Earth quake loads are horizontal loads caused by earth quake and shall be computed in accordance with IS : 189322 . For monolithic reinforced concrete structures located in seismic zone II and III with out more than 5 storey high, and importance factor less than 1, the seismic forces are not critical.

CHARACTERISTIC LOAD

Since the loads are variable in nature they are determined based on statistical approach. But it is impossible to give a guarantee that the loads can not exceed during the life span of the structure. Thus, the characteristic value of the load is obtained based on statistical probabilistic principles from mean value and standard deviation.

The characteristic load is defined as that value of load which has 95% probability of not being exceeded during the service span of the structure. However, this requires large amount of statistical data. Code recommends to take the working loads or service loads based on past experience and judgement and are taken as per IS : 87521 and IS : 18932.3 codes.

DESIGN LOADS

The variation in loads due to unforeseen increase in the loads, constructional inaccuracies, type of limit state etc., are taken into account to define the design load. The design load is given by : Design load = γ_f x characteristic load Where γ_f = partial safety of loads.

Notes : (1) DL = dead load IL = imposed load WL = windload (2) while considering earth quake effects. Substitute EL for WL. (3) since the serviceability relates to the behavior of structure at working load the partial safety factors for limit state of serviceability are unity. (4) for limit state of serviceability, the values given in this table are applicable for short term effects. While .assessing the long term effects due to creep, the dead load and that part of the dead load and live load likely to be permanent may only be considered.

CRITICAL LOAD COMBINATIONS

While designing a structure, all load combinations, in general are required to be considered and the structure is designed for the most critical of all. For building upto 4 storeys, wind load is not considered, the elements are required to be designed for critical combination of dead load and live load only:

For deciding critical load arrangements, we are required to use maximum and minimum loads. For this code prescribes different load factors as given below :

$$\text{Maximum load} = w_{nw} = 1.5(DL + LL)$$

$$\text{Minimum load} = w_{m,,,} = DL$$

The maximum positive moments producing tension at the bottom will occur when the deflection is maximum or curvature producing concavity upwards is maximum. This condition will occur when maximum load (i.e. both DL and LL) covers the whole span while minimum load (i.e. only DL) is on adjacent spans.

(a) consideration may be limited to combination of :

- 1) Design dead load on all spans will full design live loads on two adjacent spans (for obtaining maximum hogging moment.)
- 2) Design dead load on all spans with full design imposed load on alternate spans (to get maximum span moment.)

- 3) When design imposed load does not exceed three-fourths of the design dead load, the load arrangement may be design dead load and design imposed load on all the spans.

The loading arrangement giving maximum span moment, say span AB is shown in below figure 1.a and figure 1.b gives the loading arrangements for maximum negative moment at support B

PROPERTIES OF CONCRETE

Grade of concrete :

Concrete is known by its grade which is designated as M15, M20, M25 etc, in which letter M refers to concrete mix and the number 15, 20, 25 etc. denotes the specified compressive strength (f_{ck}) of 150 mm size cube at 25 days, expressed in N/mm^2 . Thus, concrete is known by its compressive strength. In R.C. work M20, M25 grades of concrete are common, but higher grades of concrete should be used for severe and very severe and extreme environment.

Compressive strength :-

Like load the strength of concrete is also a quantity which varies considerably for the same concrete mix. Therefore a single representative value known as characteristic strength, is arrived at using statistical probabilistic principals.

Characteristic strength :-

It is defined as that value of the strength below which not more than 5% of the test results are suspected to fall, (i.e., there is 95% probability of achieving this value, or only 5% probability of not achieving the same).

Characteristic strength of concrete in flexural member :-

It may be noted that the strength of concrete cube does not truly represent the strength of concrete in flexural member because factors namely, the size effect, the prism effect, state of stress in a member and casting and curing conditions for concrete in the member. Taking this into consideration the characteristic strength of concrete in a flexural member is taken as 0.67 times^{2.6} the strength of concrete cube.

Design strength (f_d) and partial safety factor (γ_d) for material strength :-

The strength to be taken for the purpose of design is known as design strength and is given by

$$\text{Design strength (} f_d \text{)} = \text{characteristic strength (} f_{ck} \text{)}$$

Partial safety factors for material

Strength (γ_m)

The value of γ_m depends upon the type of material and upon the type of limit state.

According to I.S. code,

$$\gamma_m = 1.5 \text{ for concrete and } \gamma_m = 1.15 \text{ for steel.}$$

$$\text{Design strength of concrete in member} = 0.67 f_{ck} / 1.5 = 0.446 f_{ck} = 0.45 f_{ck}$$

Tensile strength (f_{cr}) :-

The estimate of flexural tensile strength or the modulus of rupture of the cracking strength of concrete from cube compressive strength is obtained from the relation :

Effect of the reduction in E_c with time is to increase deflections and cracking with time. It plays a very important role in limit of serviceability and in calculations of deflection and cracking.

It is further notified that as E_c changes modular ratio E_s/E_c

Where

$$E_s = \text{modulus elasticity of steel} = 2 \times 10^5 \text{ N/mm}^2.$$

$$E_c = 5000 \text{ N/mm}^2.$$

As the modulus of elasticity of concrete changes with time, age at loading etc, the modular ratio also changes accordingly. IS : Code gives the following expression for the long term modular ratio also changes accordingly. I.S. Code gives the following expression for the long term modular ratio taking into account the effects of creep and shrinkage partially.

$$\text{Long terms modular ratio} = m = \frac{280}{3 \text{ abc}}$$

Where abc = permissible compressive stress due to bending in concrete in N/mm^2

This modular ratio is useful only in the working stress design. It is also required for calculating the properties of a transformed section of a R.C. member for the serviceability calculations.

CONVENTIONAL METHOD :-

This involves determination of positions of columns, position of beams, spanning of slabs, and type of footing.

The structural plan will be drawn showing therein :

- 1) Position of columns, beams, and spanning of slabs,
- 2) Centre to centre dimensions between beams, columns to decide the span lengths of slabs and beams,
- 3) Marking of slabs, beams, and columns using one of the marking scheme.

After the preparation of structural plan, the calculations will be done for unit loads as:-

- 1) unit loads on slabs of roof, floor, balconies, stairs, w.c and bath rooms, lofts etc, (kN/m)
- 2) unit loads on walls (external, internal) per metre height, (in kN/m)
- 3) unit loads on parapet walls, grills, weather sheds etc. (in kN/m).

In such a case, the design will first be done of footings and columns by estimation of approximate equivalent axial load on columns, giving sufficient allowance for effect of continuity of slabs and beams, uniaxial / biaxial bending in columns due to fixity with beam; slenderness of column etc. where ever necessary.

DESIGN OF SLABS

This procedure involves the design of slab. Primarily to design a slab we have to confirm if it is a one way slab or two way slab

a) ONE WAY SLAB :-

It supports on opposite edges or when $L_y/L_x > 2$, Predominantly bends in one direction across the span and acts like a wide beam of unit width. If a continuous slab/beam loaded by using UDL has equal spans or if spans do not differ by more than 15% of the longest they are designed using IS:code. For accurate analysis a continuous slab carrying ultimate load is analysed using elastic method with redistribution of moments.

b) TWO WAY SLAB :-

A rectangular slab supported on four edges with ratio of long span to short span less than 2 ($L_y/L_x < 2$) deflects in the form of a dish. It transfers the transverse load to its supporting edges by bending in both directions.

DESIGN OF ONE-WAY SLAB:

STEPS :-

- 1) SLAB MARK— write the slab mark or designation such as S 1, S2 etc...
- 2) END CONDITION — for approximate analysis write the end condition No. according to the category of the slab.

SPAN LENGTH (L)- depending upon end conditions determine the effective span of the slab. In fact, since the depth of slab is not known in advance and the width of support is normally greater than the effective depth of slab, in practice the effective

depth of slab is taken equal center to center distance between till supports to be on safer side.

3) TRIAL SECTION :-

Effective depth = effective span L /

required(d) basic (L/d) ratio * x

where. basic l/d ratio

= 7 (for cantilever)

= 20 (for simply supported)

= 26(for continuous).

x = depends upon $P_t\%$ and steel stress (f_s)

Initially assume $P_t = 0.5\% - 0.9\%$ for steel

of steel grade Fe-250 = $0.25\% - 0.45\%$ for steel

of steel grade Fe-415

= $0.2\% - 0.35\%$ for steel

of Fe-500

Obtain the nominal cover from IS: code , and add half the diameter of main steel, to get effective cover.

Therefore,

Effective cover= d' =nominal cover + half dia.

Total depth of slab = effective depth + effective cover

= $d + d'$.

4) LOADS

Calculate load in kN/m on one metre wide strip of slab

Dead load :-Self weight = $W_s = 25D$ Where, D shall be in metre. Floor Finish = FF = 1.5 kN/m
Total dead load =DL = $W_d = W_s + FF$
Imposed load = LL
Total working load $W = DL + LL$
Total ultimate load $W_u = 1.5W$

5) DESIGN MOMENTS :-

Design moment $M_u = WL*L/2$ (for cantilever) = $WL*L/8$ (for simply supported) = according to the code (for continuous).

6) CHECK FOR CONCRETE DEPTH :-

$$M_{u,lim} = 0.36 * f_{ck} * X_{u,lim} * (d - 0.42x_{u,lim}) * b$$

Where,

$M_{u,lim}$ = maximum ultimate moment
 f_{ck} = strength of concrete
 d = effective depth
 b = breadth (1 meter).

If $M_u < M_{u,lim}$ then we will find area of steel (A_{st}) from the following formula :-

$$M_u = 0.87 * F_y * A_{st} * (d - 0.42x_u)$$

If $M_u > M_{u,lim}$ redesign depth. Minimum area of steel (A_{st}) = $0.15% * b * D$ (for $F_y=250$) = $0.12% * b * D$ (for $F_y=415$ or 500)

Assume bar diameter (8mm or 10mm for steel grade Fe415, and 10mm or 12mm for Fe250).

Required spacing (S)

= $1000 * a_m / A_{st}$ where, a_m is area of one bar. Maximum spacing (S.) < (3d or 300mm) whichever is less.

From practical consideration minimum spacing is $75 < s < 100$.

8) CHECK FOR DEFLECTION:-

Calculate required $P_t\%$ (maximum value at mid-span of continuous slab or simply supported slab). $(P_t)_{\text{assumed}} < (P_t)_{\text{required}}$ Then the check may be considered to be satisfied else detailed check should be carried out as given in the code as under:-

Calculate steel stress of service load (f_s)

$f_s = 0.58 W * (A_{st})_{\text{reqd}} / (A_{st})_{\text{prov}}$. Obtain modification factor (α) corresponding to $(P_t)_{\text{prov}}$ and f_s . Required depth (d) = $L / (\text{basic } L/d \text{ ratio} * \alpha) < \text{effective depth provided}$.

9) DISTRIBUTION STEEL :-

Required $A_{st \text{ min}} = 1.2D$ for HYSD bars, = $1.5D$ for Fe250 where D in mm Assume bar diameter (6mm for steel grade Fe 250 and 8mm for Fe 415). Required spacing, $s = 1000 * a_{st} / A_{st \text{ min}}$, to be rounded off on lower side in multiple of 10mm or 25mm as desired. Maximum spacing, $s = < (5d \text{ or } 450\text{mm})$ whichever is less. In practice spacing is kept between 150mm to 300mm.

10) CHECK FOR SHEAR :-

a) calculate design (maximum) shear.

In case of slabs, design shear may be taken equal to maximum shear $V_{u.\text{max}}$ at support and is given by:- $V_{u.\text{max}} = W_u * L * \text{shear coefficient} = W_u * L / 2$ for simply supported slab. Where, W_u = ultimate UDL on slab/ unit width. In other cases, the maximum shear may be calculated from principles of mechanics.

b) calculate shear resistance (V_{uc}) of slab: This may be obtained from the relation $(V_{uc}) = t_b d * k$ ($b = 1000\text{mm}$ in case of slabs). depends upon $P_t = 100 A_{st} / b d$.

Where A_{st} = area of tension steel. It is the bottom steel at simply supported end and top steel at Continuous end. $A_{st} = A_{st} / 2$ if alternate bars from mid span are bent to top at simple support. Check that $V_{uc} > V_{u,max}$. If not increase the depth.

This check for shear is mostly satisfied in all case of slabs subjected to uniformly distributed load an therefore many times omitted in design calculations.

It may be noted that when the check of shear is obtained, it is not necessary to provide minimum stirrups a they are required in the case of beams.

II) CHECK FOR DEVELOPMENT LENGTH :-

Required $L_d < 1.3 M_N + L_o$

For slabs alternate bars are bent at support $M = M_{u,max} / 2$ And $L_o = b/2 - x + 3(p$ for HYSD bars using 90 degrees bend. = $b/2 - x + 139$ for mild steel using 180 degrees bend.

Where x = end clearance.

DESIGN OF TWO WAY SLABS:

STEPS :-

1. SLAB MARK :-

Write slab designation eg — S I, S2 etc...

2. END CONDITIONS :-

Write end boundary condition No.

3. SPANS :-

Determine short span L_x , long span L_y , check that $L_y / L_x < 2$

4. TRIAL DEPTH (D):-

It Will be decided by deflection criteria based on short span L_x and total depth D . The allowable L/D ratio for two way slab with short span up to 3.5m and for loading class up to 3kN/m^2

Allowable L/D ratio for span > 3.5 m and loading class $> 3\text{kN/m}^2$ End condition L/D ratio Grade of steel Fe 250 Fe 415 Or 500 Simp., supported slabs 35 28 Con tin ous slabs 40 32

Assuming $P_t\%$ between 0.2% to 0.3% and proceeding, 5. LOADS :-Calculate load for one meter width strip of slab. $W_u = 1.5(25D + FF + LL)\text{kN/m}$ 6. DESIGN MOMENTS :-

Obtain the bending moments by using the relation $M_u = a W L_x * L_x$. Using IS CODE. 7. CHECK FOR CONCRETE DEPTH FROM BENDING MOMENT CRITERIA :-

In the case of a two way slab, effective depths for reinforcement in short span steel and effective depths fo reinforcement in short span and long span is placed above short span steel. The effective depth d_o is for outer layer of short span steel and effective depth d_i is for inner layer of Ion span steel at mid span. As far as support section is concerned, the effective depth is d_o only for both spans.

$d_o = D - (\text{nomimal cover} + 00/2)$ where $(i) = \text{diameter of the bar}$. $d_i = d_o - p$ for mid span long span steel.

8. MAIN STEEL :-

Calculate the area of steel required at four different locations. Main steel calculated is provided only in the middle strips of width equal to $3/4$ th the slab width. there will b

no main steel parallel to the support in edge strip of width equal to 1/8th of slab width. In this edge strip, only distribution steel will be provided. Distribution steel will be provided for middle strip bars at top of supports.

9. CHECK FOR DEFLECTION :-

If $l < 3.5\text{m}$ and $L.L < 31(\text{N/m}^2)$, check that $(L/D)_{\text{prov}} > (L/D)_{\text{req}}$ then,

Design moment coefficients 'be approximate analysis End condition No. EC=1 EC=2 EC=3 Design moment coefficient $a = 1/8$ $a = 1/10$ $a = 1/12$

For $L_x > 3.5\text{m}$ or $L.L > 3\text{kN/m}^2$, the deflection check should be similar to that explained in one way slab.

10. TORSION STEEL :-

At corners where slab is discontinuous over both edges, $A_t = (3/4)A_{st}$. At corners where slab is discontinuous over only one edge, $A_t = (3/8)A_{st}$. At corners where slab is discontinuous over both the edges, $A_t = 0$.

11. CHECK FOR SHEAR :-

a) Design maximum shear in two way slab may be obtained using the following relation. At middle of short edge, $V_{u,\text{max}} = W L_x / 3$ per unit width. At middle of long edge, $V_{u,\text{max}} = W L_x \left(\frac{l_y}{2l_x + 1} \right)$ where, $l_y = L_y / L_x$.

Increase above value by 20% for shear at continuous edge and decrease the same by 10% at simply supported discontinuous edge and continuous over the other.

b) Shear resistance and hence shear check is obtained in the same way as it is obtained for one way slab.

c) load carried by supporting beams of two way slab.

Long edge : Trapezoidal load with ordinate $W \cdot Lx / 2$ Equivalent UD load for bending
 $W_{eqs} = W \cdot Lx [1 - (1/3 f_{fill}) / 2]$.

Equivalent UD load for shear $W_{eqs} = W [1 - (1/2 f_i)] / 2$

Short edge : Equivalent UD loading for bending $W_{eqs} = W Lx / 3$ Equivalent UD
loading for shear $W_{eqs} = W l_x / 4$.

DESIGN OF BEAMS:

A beam is a structural member that is capable of withstanding load by primarily resisting bending.

The designing of the beam mainly consists of fixing the breadth and depth of the beam and arriving at the area of steel and the diameter of bars to be used. The breadth of the beam is generally kept equal to the thickness of the wall to avoid offset inside the room. It shall also not exceed the width of the column for effective transfer of load from beam to column. The depth of the beam is taken between $L/10$ to $L/16$.

The dimensions of the beam that we have chosen are : breadth=230mm and depth=450mm.

Procedure to design beams :

1) Analysis : The beam is analyzed first in order to calculate the internal actions such as Bending Moment and Shear Force. A simplified substitute frame analysis can be used for determining the bending moments and shearing forces at any floor or roof level due to gravity loads. The Moment distribution method is used for this purpose.

2) Loads: In order to analyze the frame, it is needed to calculate the loads to which the beams are subjected to. The different loadings are as follows:

i) Uniformly Distributed Load : (w) in kN/m

The load transferred from the slab per metre length will be either rectangular from one way slab or trapezoidal/triangular from two-way slab. Depending on the position of the slab, the loading may be decided. In the case of two way slabs, trapezoidal load comes from the longer side while the triangular load comes from the shorter side.

a) Slab on the Right side : The load transferred from the slab on the right side is denoted as w_2 and the slab from the left side is denoted as w_1 .

The equivalent U.D.L to evaluate shear force from a slab = $wl \left(1 - \frac{1}{3} \left(\frac{y}{l}\right)^2\right)$ (1) 3
The equivalent U.D.L to evaluate bending moment from a slab = $wl \left(1 - \frac{1}{2} \left(\frac{y}{l}\right)\right)$ (2) 4
Where $\frac{y}{l} = 1$ for triangular loads & $\frac{y}{l} = 1$ for trapezoidal loads.

b) Masonry wall : $W_w = \gamma \times t(w) \times H(w)$ where $t(w)$ = thickness in m, $H(w)$ = height in m and γ = unit weight of masonry = 19.2 kN/m³

c) Self weight : $W_s = 25 \times b \times D$ d) Total working load = $(W_{s1} + W_{s2}) + W_w + W_s$ for calculation of B.M and S.F.

Design (ultimate) load : $w_u = 1.5w$ kN/m.

ii) Point Loads: Given total No. of point loads = Number of secondary beams supported.

iii) Design Moment : While designing it should first be noted if it is a flanged section or a rectangular section. Most of the intermediate beams are designed as rectangular sections. The main beams may be designed as flanged sections. For rectangular beams, the maximum depth of N.A lies at the centre. For flanged sections, check if the N.A lies within the flange or not and then proceed to calculate the moment. The dimensions of flanged section as designed as per the code IS: 456-2000 as per Cl 23.1. Either way, for a singly reinforced section,

$$M_u = 0.367 f_{ck} \cdot b_f \cdot x_u (d - 0.42 x_u)$$

(3) If design moment M_d calculated through frame analysis is less than M_u , then N.A is known to lie within the flange. This is the case that usually governs the slab-beam construction.

iv) Main steel : $A_{st} = \frac{M_d}{0.87 f_y (d - 0.42 x_u)}$ If it is a flanged section, replace d by D The continuous beams at supports are generally required to be designed as a doubly reinforced section. Steps to design a doubly reinforced section :

1. Calculate $M_{u_{max}} = 0.367 f_{ck} b d (d - 0.42 x_{u_{max}})$ 2. If $M > M_{u_{max}}$, then the design should be as a doubly reinforced. 3. $A_{st1} = \frac{M_{u_{max}}}{0.87 f_y (d - 0.42 x_{u_{max}})}$

4. $A_{st2} = \frac{(M_u - M_{u_{max}})}{0.87 f_y (d - d_c)}$ 5. Total area of tension = $A_{st1} + A_{st2}$. 6. Calculate $A_{sc} = \frac{A_{st2}}{f_{sc}}$

fsc can be obtained as $E_s \times 0.0035 \times (x_{\max} - d) / x_{\max}$ v) Detailing of Reinforcement: Select number and diameter of bars. Required spacing may be calculated as per the code. vi) Check for shear & shear reinforcement:

1. Find the shear force(acting), F from the frame analysis. 2. Find the shear strength of the beam given by $F' = k.z.b.d$, where the parameters are as designated in the code.

If $F < F''$, then provide minimum reinforcement, the spacing of the bars given by $0.87f_y A_{st} / (0.4b)$ 4. If $F > F''$, then shear reinforcement need to be provided given for $F - F''$, with the spacing $s = 0.87f_y A_{st} d / (F - F'')$ 5. In case bars are bent up for provision of shear reinforcement, then the additional force coming in due to the bent up must also be considered. $V_{usb} = 0.87f_y A_{sb} \sin \alpha < 0.5r''''$, where $F'''' = F - F''$ vi) Check for deflection: In the case of beam, deflection criteria is normally satisfied, because $L/d < 16$ and hence computations are skipped.

STRUCTURAL ANALYSIS:

A brief introduction: We come across various structures in our day to day life ranging from simple ones like the curtain rods and electric poles to more complex ones like multistoried buildings, shell roofs, bridges, dams, heavy machineries, automobiles, aeroplanes and ships. These structures are subjected to various loads like concentrated loads, uniformly distributed loads, uniformly varying loads, random loads, internal or external pressures and dynamic forces. The structure transfers its load to the supports and ultimately to the ground.

Treating an entire structure as a single rigid body and finding the reactions from supports is the first step in analyzing a structure. While transferring the loads acting on the structure, the members of the structure are subjected to internal forces like axial forces, shearing forces, bending and torsional moments. Structural analysis deals with analyzing these internal forces in the members of the structures.

It is easier to analyze a multistory building with the help of 'frame analysis' than the analysis of individual beams. The frame analysis of roof, ground floor and an internal frame is done. The results of the internal frame analysis are applied to other internal frames as well and hence the internal forces (namely 'shear forces and bending moments) are obtained.

The procedure of 'Moment Distribution Method' is used in this case to analyze the multi storey frame. The following steps may be taken:

- 1) Assuming all ends are fixed, find the fixed end moments developed.
- 2) Calculate distribution factors for all the members meeting at a joint.

3) Balance a joint by distributing balancing moment(negative of unbalanced moment at the joint) to various members meeting at the joint proportional to their distribution factors. Do similar excursive for all joints.

4) Carry over half the distributed moment to the far ends of the members. This upsets the balance of the joint.

5) Repeat the steps 3 and 4 till distributed moments are negligible.

6) Sum up all the moments at a particular end of the member to get final moment.

If sway is there in the frame, then the following procedure may be adopted.

- (a) Assume the sway is prevented by giving external support at beam level. Carry out analysis as explained above. This is called non-sway analysis. Considering the free body diagrams of column, find horizontal forces developed at supports. Then consider the horizontal equilibrium of the entire system to get force 'S' developed at additional support assumed at beam level.
- (b) Actually, there is no support at beam level and hence 'S' is the sway force moving the beam laterally. For the given sway force, it is difficult to find the end moments developed. Hence, an arbitrary sway is assumed, say A. Then, fixed end moments developed in column, AB and CD are :

Now, arbitrary proportionate values may be assumed for MF1 and MF2. Then $MF1/MF2 = H_A = (M_{pg} + M_{BA})/L1$ and $H_D = (M_{CD} + M_{DC})/L2$. Moment Distribution is carried out to get final moments. Let M_{AB} , M_{BA} , M_{CD} and M_{DC} be the final values. Hence, sway force 'S' acting in this case is obtained by considering horizontal equilibrium of the frame as shown, we have to multiply by the sway correction factor $k = S/S'$. Final Moments = Non Sway Moments + $k \times$ sway moments.

DESIGN OF COLUMNS:

The design of column necessitates determination of loads transferred from beam at different floor levels. Loads are transferred from slabs to beams and then to columns. Hence, slabs and beams are normally designed prior to the design of columns. This method called as 'exact method' which enables one to assess the loads on columns more accurately and thereby the design of column becomes realistic and economical.

However, in practice, many times situations arise which require the design of columns and footings to be given prior to the design of slabs and beams. In such a case, loads on columns and footings are required to be assessed using judgement based on past experience and using approximate methods. The loads can be determined approximately on the basis of floor area shared by each column. These loads are normally calculated on the higher side so that they are not less than the actual loads transferred from slabs/beams. In such cases, the design of column is likely to be uneconomical.

Categorization of columns: This is the first step in designing of the columns because the procedure for design of columns in each of the three categories is different.

(I) **Internal columns or Axially loaded columns:** Internal columns carrying beams either in all four directions or only in opposite directions are predominantly subjected to axial compression because moments due to loads on beams on opposite sides balance each other. Judgement should be used to place a column under this category because if spans and/or loads on beams on opposite sides vary appreciably the beam moments on opposite sides may not balance each other and the column will be subjected to bending moment and it will be required to place under the second category.

(H) Side columns or columns subjected to axial compression and uniaxial bending: Columns along the sides of a building which carry beams either in three orthogonal directions or a single beam in one direction are subjected predominantly to axial load and uniaxial bending due to unbalanced moment transferred from a single beam on one side, while the moments from the other two beams in opposite directions- balance each other provided their spans and loads on them are nearly equal. If such columns are to be designed as axially loaded columns using approximate method, the axial load is required to be increased to account for the effect of uniaxial bending in column. The load thus arrived is called equivalent axial load for the purpose of design of column section.

(III) Corner columns or columns subjected to axial compression and biaxial bending : Corner columns or the columns which carry beams in two perpendicular directions are subjected to biaxial bending due to beams in orthogonal directions. They require large increase in axial load to account for the effect of biaxial bending for obtaining an equivalent axial load.

Computation of loads on columns: There are two methods namely for this purpose. They are: 1) Exact Method: This method is used to compute loads if the beam end shears are known prior to the column design. These have been calculated while analyzing the loads on beams and designing them. For columns with axial compression and uniaxial/biaxial bending, the moments on the columns have been obtained from the frame analysis by moment distribution method. Total load (L.C)= $V_1 + V_2 + V_3 + V_4 + P_a + P_{self}$ Where V_1, V_2, V_3, V_4 = end shears of beams meeting at the column at the floor under consideration from all the four directions. P_a =axial load coming from above P_{self} = self weight of the column at the floor under consideration.

2) Approximate Method: This method is used when the design of footing is required to be given prior to design of slab and beam and approximate sizes of column are required to be assumed. This is done by knowing the influence area and the load in the area that is borne by that particular column.

$P_{u'floor} = P_{us} + P_{uw} + P_a$
 P_{us} = load transferred from slab to column at each floor level = $w_{us} \times A_{col}$
 P_{uw} = wall load transferred to column at each floor level = $w_{uw} \times L_w$
 P_a = load on column from above
However, above procedure of column loads does not work well when there are number of secondary beams. In such cases, approximate loads are required to be calculated on beams first and column load are obtained from beam shears.

Calculation of Moments in Columns:

The moments in the columns are obtained directly and exactly if the entire structural frame is analysed using Moment Distribution method. However, if the building cannot be divided into a number of frames due to peculiar positions of columns, as in some cases of residential buildings or in building frames in which the connections are assumed to be simple, the moments in columns at any floor level can be obtained by considering substitute column frame which consists of only the relevant column together with connected beams fixed at their far end. The moment in the column can be calculated using the equation $M_{col} = (k_c/E_k) \times M_e$ Where k_c = stiffness of column under consideration = I_c/L_c = sum of stiffnesses of members meeting at the joint = $\sum k_b/2$ Stiffness of the beams k_b shall be reduced to half to account for the effect of members beyond the adjacent spans being ignored. M_e = unbalanced fixed end moment at the joint.

side. spans are

$= w_u \cdot L^2 / 12$, if a single beam is rigidly connected to the column on one

$= w_{u1} L_1^2 / 12 - w_{u2} L_2^2 / 12$, if two beams with unequal loads or unequal

rigidly connected on opposite sides of the column. $M_e = W_u L^2 / 24$, if a single beam is simply connected to column. $M_e = W_{u1} L_1^2 / 24 - W_{u2} L_2^2 / 24$, if two beams with unequal loads or unequal spans are simply connected in opposite sides of the column, in which W_{u1} and W_{u2} are the loads and L_1 , L_2 are lengths of the beams on two sides.

The calculated moment in column shall not be less than $M_{min} = P_u \times e_{min}$

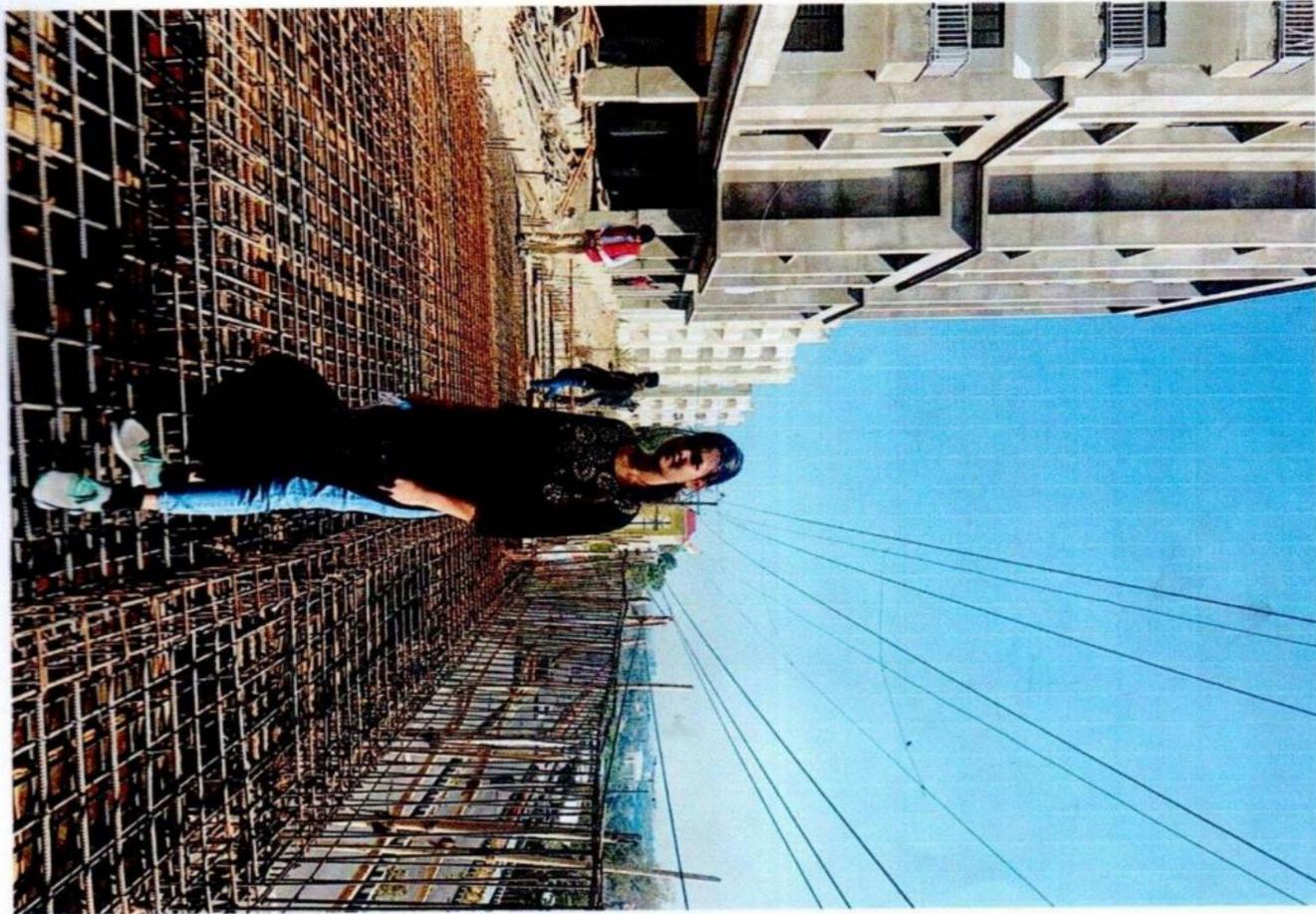
When column above and below the floor level are of different sizes with their outer faces flush, the load from upper column becomes eccentric with respect to the lower column. However, it may be noted that the moment due to this eccentricity is opposite to the moment transferred by the beam to the column at that level. This, in fact results in reduction of the effective moment and hence the moment due to this eccentricity need not be considered. It needs consideration only when there is no floor beam in the plane of the offset.

Grouping of Columns: Once the load on each column and effective lengths are determined, the columns in the same category which have total loads on them not varying by more than 10 to 20% and having the same effective lengths may be grouped together. In such a case, column carrying maximum load may only be designed in that group and the same section be adopted for all the columns in that group. This saves the computational efforts and labour, considerably during the execution of work. This is of prime importance in practical design.

Design of column section: The design of column section may be done by any of the two methods:

(A) Approximate Equivalent axial load Method: In this approach, total equivalent axial load is obtained by adding calculated approximate axial loads. Preliminary section is designed for this total equivalent axial load using the procedure for design of axially loaded columns. The section so obtained is later on checked by exact method for actual compression and bending moment.

(B) Exact Method: This method of designing column depends upon the type of column (short or slender) and the type of loading and whether the column is subjected to axial load only or subjected to combined axial load and uniaxial bending or combined axial load and biaxial bending. The columns are easy to design using the design aids given in SP-16.



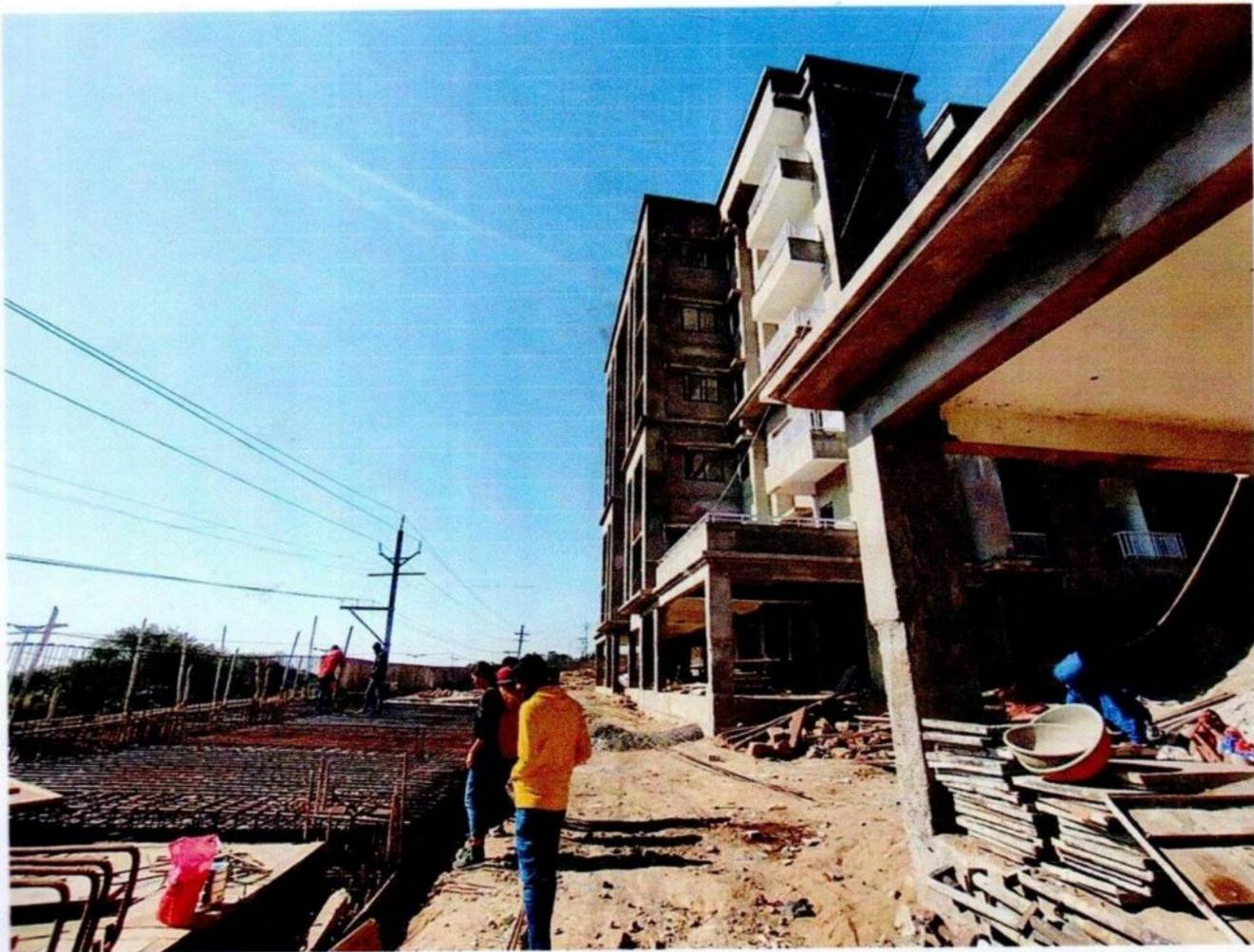
SLAB FIGURE 1



COMBINED FOOTING



SLAB FIGURE 2



SITE VISIT



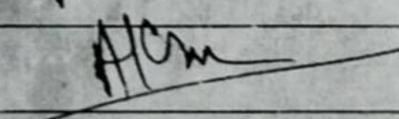
ISOLATED FOOTING

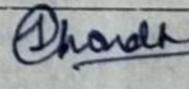
CONCLUSION

This training helped me to gain knowledge by experiencing various works taking place in the site. By this In plant training I had an opportunity to witness various situations in the site and practically and innovatively overcoming them. In brief I learned about various new Construction Technologies and more importantly I experienced the whole Construction of laying out a span of a Segmental building. This helped me in clearing various theoretical and practical doubts and made me somewhat realize the future scope of Civil Engineering.

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Abha Grandhwar		Department	civil	
Industry/Organization	PDPIU		Date/Duration	DD/MM/YR -DD/MM/YR 10/01/22 - 25/01/22	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality/Timely completion of assigned work					✓
Learning capacity/Knowledge up gradation				✓	
Performance/Quality of work				✓	
Behaviour/Discipline/Team work					✓
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic					
<u>OVERALL GRADE (Any one)</u>	✓ <u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u>				
<u>Name of Industry Mentor</u>	A. K. Sharma, Project Engineer				
<u>Signature of Industry Mentor</u>					

Receiving Date	Name of Faculty Mentor	Dr. Jayvant Chaudhary	Sign	
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FORMAT

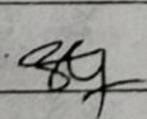
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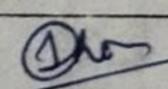
Name of student	Asitha Gyandhara		Department	civil	
Industry/Organization	PDPIU		Date/Duration	DD/MM/YR - DD/MM/YR 26/01/22 - 10/02/22	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation				✓	
Performance/Quality of work				✓	
Behaviour/Discipline/Team work					✓
Sincerity/Hard work					✓
Comment on nature of work done/Area/Topic	✓				
<u>OVERALL GRADE (Any one)</u>	<u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u>				
<u>Name of Industry Mentor</u>	A.K. Sharma, Project Engineer				
<u>Signature of Industry Mentor</u>	AKM				

Receiving Date	Name of Faculty Mentor	Dr. Jayvark Chandhary	Sign	Chandhary
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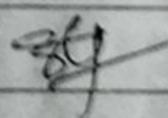
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Industry/Organization	PD-PIU		Date/Duration	DD/MM/YR - DD/MM/YR 11/02/22 - 25/02/22	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation				✓	
Performance/Quality of work				✓	
Behaviour/Discipline/Team work					✓
Sincerity/Hard work					
Comment on nature of work done/Area/Topic					
<u>OVERALL GRADE (Any one)</u>	✓ <u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u>				
<u>Name of Industry Mentor</u>	Shireen Khan AEP/UPWD.				
<u>Signature of Industry Mentor</u>					

Receiving Date		Name of Faculty Mentor	Dr. Jyoti Chaudhary	Sign	
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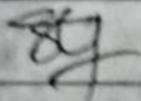
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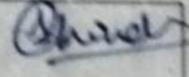
Name of student	Astha Ojandhar		Department	Civil	
Industry/Organization	FD - PIU		Date/Duration	DD/MM/YR - DD/MM/YR 26/02/22 - 10/03/22	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation				✓	
Performance/Quality of work			✓		
Behaviour/ Discipline/Team work					✓
Sincerity/Hard work					
Comment on nature of work done Area/Topic					
<u>OVERALL GRADE (Any one)</u>	<u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u>				
<u>Name of Industry Mentor</u>	Shireen Khan AE PIU PWID				
<u>Signature of Industry Mentor</u>					

Receiving Date		Name of Faculty Mentor	Dr. Jyoti Chaudhary	Sign	
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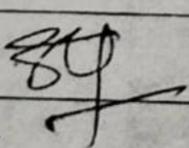
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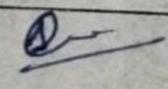
Name of student	Astha Grandhauv		Department	civil	
Industry/Organization	PD-PIU		Date/Duration	DD/MM/YR - DD/MM/YR 11/03/22 - 25/04/22	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation				✓	
Performance/Quality of work					✓
Behaviour/Discipline/Team work					✓
Sincerity/Hard work					
Comment on nature of work done/ Area/ Topic	✓				
<u>OVERALL GRADE (Any one)</u>	<u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u>				
<u>Name of Industry Mentor</u>	Shireen Khan AEPIU PWD				
<u>Signature of Industry Mentor</u>					

Receiving Date	Name of Faculty Mentor	Dr. Jayant Chaudhary	Sign	
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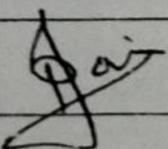
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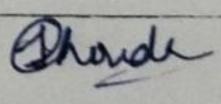
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Industry/Organization	PD - PIU		Date/Duration	DD/MM/YR - DD/MM/YR 26/03/22 - 10/04/22	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality/Timely completion of assigned work					✓
Learning capacity/Knowledge up gradation					✓
Performance/Quality of work				✓	
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic					
<u>OVERALL GRADE (Any one)</u>	<u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u>				
<u>Name of Industry Mentor</u>	Shireen Khan AE PIU/PWD				
<u>Signature of Industry Mentor</u>					

Receiving Date		Name of Faculty Mentor	Dr. Jayant Chaudhary	Sign	
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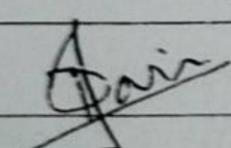
FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Aishta Grandhewu		Department	Civil	
Industry/Organization	PD - PIU		Date/Duration	DD/MM/YR - DD/MM/YR 11/04/22 - 25/04/22	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation				✓	
Performance/Quality of work					✓
Behaviour/Discipline/Team work					✓
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic					
<u>OVERALL GRADE (Any one)</u>	<u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u>				
<u>Name of Industry Mentor</u>	PALAK JAIN , ASSISTANT ENGINEER MPPWD PIU				
<u>Signature of Industry Mentor</u>					

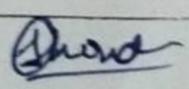
Receiving Date		Name of Faculty Mentor	Dr. Jayvant Chondhary	Sign	
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FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Astha Goyalhava		Department	Civil	
Industry/Organization	PD - PIU		Date/Duration	DD/MM/YR - DD/MM/YR 26/04/22 - 10/05/22	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation				✓	
Performance/Quality of work					✓
Behaviour/Discipline/Team work					✓
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic					
<u>OVERALL GRADE (Any one)</u>	<u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u>				
<u>Name of Industry Mentor</u>	PALAK JAIN , ASSISTANT ENGINEER				
<u>Signature of Industry Mentor</u>					

MPPW
PIU

Receiving Date	Name of Faculty Mentor	Dr. Jayant Chavhan	Sign	
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MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR - 474005

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Civil Engineering Department

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