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Yaha Hoga Jugaad

India's First
Complete Guide to

Bar Bending Schedule

Bar Bending Schedule

❑ Introduction:

Welcome to the comprehensive guide on Bar Bending Schedule (BBS) – an indispensable aspect of modern construction practices. This eBook is designed to unravel the intricacies of BBS, a fundamental process that bridges architectural designs with structural reality. Whether you're a budding engineer, a seasoned construction professional, or simply curious about the inner workings of building projects, this eBook will provide valuable insights into the world of reinforcement detailing and scheduling. Let’s Start !!

❑ What You'll Learn:

1. **What You Will Learn:** In the following chapters, you will delve into the core principles of Bar Bending Schedule.

2. **Understanding BBS:** Gain a clear grasp of what Bar Bending Schedule entails, its significance, and how it influences the overall construction process.

3. **Essential Components:** Explore the crucial elements of BBS, including bar identification, types, sizes, cutting lengths, bending details, and accurate quantity calculations.

4. **Creating BBS:** Learn the step-by-step process of creating a meticulous BBS, from interpreting structural drawings to employing industry-standard practices.

5. **BBS Formats:** Discover various formats and templates used for organizing BBS data, enabling seamless communication between project stakeholders.

6. **Optimizing Efficiency:** Uncover strategies to optimize BBS to enhance project efficiency, minimize wastage, and ensure precise implementation.

❑ Conclusion:

As you conclude your journey through this eBook, you'll emerge equipped with a deep understanding of Bar Bending Schedule. Whether you're tasked with generating BBS documents, overseeing construction projects, or simply seeking to expand your knowledge, the insights gained from this eBook will undoubtedly serve you well. Let this eBook be your guiding light as you navigate the intricate realm of Bar Bending Schedule.

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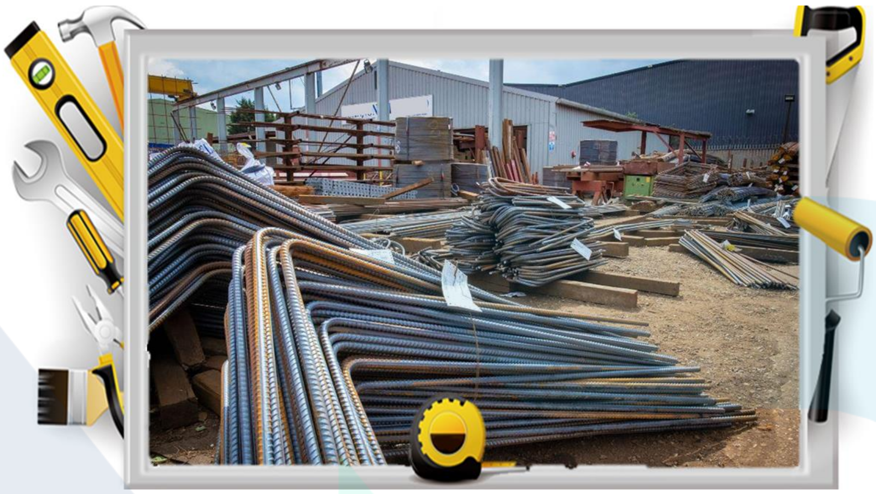
Introduction to BBS

Introducing Bar Bending Schedule

Bar bending, an essential aspect of building construction, involves the precise cutting and shaping of reinforcement bars. The process comprises several key steps that culminate in what is known as scheduling. In this book, we will cover the fundamental to advanced techniques of bar bending.



The first step in bar bending is the structural drawing reading which further includes:

- **Location and Marking:** Identifying the specific locations where bars are to be placed and marking them accordingly.

- **Type of Bar:** Specifying the type or grade of reinforcement bar to be used for different structural elements.

- **Size of Bar:** Determining the dimensions and diameter of each reinforcement bar.

- **Cutting Length:** Calculating the length to which each bar needs to be cut before bending and placing it.

- **Number of Bars:** Mentioning the quantity of bars required for each particular section of the structure.

- **Bending Details:** Providing precise instructions on how the bars should be bent to achieve the desired shape.

- **Total Quantity:** Summing up the total quantity of each type of reinforcement bar required as per the structural drawing.

All these detailed listings together form the essential process known as "Scheduling" in the context of Bar Bending.

Bar Bending Schedule Sample Format

Schedule Sheet Prepared In Excel

S.No.	Description	Shape of Bar	No. of Items	Dia of bar	No. of Bars	CL_1(m)	CL_2(m)	CL_3(m)	Cutting Length (m)	Total Length	Unit Wt.	Total Wt.	8mm (KG)	10mm (KG)	12mm (KG)	16 mm (kg)
FOOTING																
1	F1															
	X-dir	200 200	15	12 #	14				2.25	472.92	0.889	420.37	-	-	420.37	-
	Y-dir	200 200		12 #	10				1.75	262.80	0.889	233.60	-	-	233.60	-
2	F2															
	X-dir	200 200	8	12 #	12				1.75	168.19	0.889	149.50	-	-	149.50	-
	Y-dir	200 200		12 #	8				1.28	81.92	0.889	72.82	-	-	72.82	-

Please note that the format of the Bar Bending Schedule provided earlier is just one example among various formats utilized in construction companies. Each company may have its own specific processes and systems for creating Bar Bending Schedules. However, in the absence of a predefined company format, the mentioned format can serve as a suitable starting point for initiating the work.

It's essential to understand that Bar Bending Schedules are customized documents tailored to suit the unique requirements of each construction project. Companies may have specific templates and guidelines to follow, ensuring consistency and accuracy in the documentation process.

Before creating a Bar Bending Schedule, project teams should carefully analyze the structural drawings and specifications to determine the optimal reinforcement bar arrangement for each element.

Moreover, companies often maintain a library of standard bar shapes and bending templates, which can streamline the process and ensure adherence to quality standards.

Advantages of Bar Bending Schedule

- **Accuracy:** The schedule ensures precise cutting lengths and bending details for each reinforcement bar, reducing errors and wastage of materials.

- **Efficiency:** By having a detailed plan in advance, construction teams can work efficiently, saving time during the actual bar bending process.

- **Cost-Effectiveness:** The schedule helps in optimizing the use of reinforcement bars, leading to cost savings and better budget management.

- **Quality Control:** With a scheduled approach, the quality of bar bending work improves, leading to a stronger and more durable structure.

- **Coordination:** The schedule acts as a clear guideline for all involved parties, facilitating better coordination between engineers, contractors, and laborers.

- **Avoids On-Site Conflicts:** Having a pre-planned schedule reduces conflicts and confusions on-site, leading to a smoother construction process.

- **Structural Integrity:** Properly bent and positioned bars result in a structurally sound building that can withstand design loads and stresses.

- **Safety:** Accurate bar bending reduces the chances of accidents and mishaps during construction.

- **Documentation:** The schedule serves as a crucial piece of documentation for future reference, inspections, and maintenance.

Uses of Bar Bending Schedule in Construction Project

- **Initial Planning:** During the initial planning stage, a preliminary BBS is not typically prepared. Instead, rough estimates of reinforcement quantities may be made based on high-level structural layouts. The BBS is not fully calculated at this stage, as it is more of a cost estimation exercise rather than a detailed engineering analysis. No specific drawing is associated with the BBS at this point.

- **Detailed Design:** In this stage, the BBS is calculated based on detailed structural drawings, such as the reinforcement layout plans, sections, and elevations. These drawings provide specific information about the structural elements' size, shape, and positioning. Engineers use this information to calculate the exact quantities, types, sizes, cutting lengths, and bending details of reinforcement bars required for each structural element.

- **Procurement:** The BBS calculated during the detailed design stage is used for procurement. The list of required reinforcement bars, along with their specifications, is used to order the materials from suppliers. The procurement team uses this information to ensure the right materials are purchased and delivered to the construction site.

- **Construction Execution:** During the construction phase, the BBS serves as a reference for the actual bar bending work. The site workers use the BBS to accurately cut, bend, and position the reinforcement bars. They follow the bending details provided in the BBS to ensure proper installation.

- **Revisions and Changes:** If design changes or unforeseen circumstances occur during construction that affect the reinforcement requirements, a revised BBS is prepared. This revised BBS incorporates the updated quantities, sizes, and bending details based on the changes made. The revised BBS is then used for further construction work.

- **Quality Assurance and Inspections:** Inspectors may refer to the BBS during quality assurance and inspections to ensure that the reinforcement bars are installed as per the design and construction specifications. They cross-check the actual work on-site against the details provided in the BBS.

- **As-Built Documentation:** After construction is complete, the actual positions and details of reinforcement bars are recorded as-built. This information is then updated in the BBS to create a final version that reflects the constructed reality. The as-built BBS serves as a valuable reference for future maintenance and renovations.

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Why Steel Reinforcement is used in RCC work

- **Strength:** Steel reinforcement provides tensile strength to the concrete, making the composite material (RCC) capable of withstanding both compressive and tensile forces.

- **Coefficient of Thermal Expansion:** Coefficient of Thermal Expansion characteristics of reinforcement is almost similar to concrete.

- **Flexibility:** The use of steel reinforcement allows for flexibility in design, enabling construction of structures with various shapes, sizes, and spans.

- **Crack Control:** Steel bars help control and minimize cracks that may occur in concrete due to temperature changes, shrinkage, or loading.

- **Durability:** Steel reinforcement enhances the durability and longevity of RCC structures, as it mitigates the impact of environmental factors and loadings.

- **Load-Bearing Capacity:** The addition of steel bars significantly increases the load-bearing capacity of the RCC elements, allowing for the construction of taller and larger structures.

- **Ductility:** Steel is a ductile material, which means it can deform without breaking. This property allows RCC structures to absorb energy during earthquakes or other dynamic loads, making them more resistant to damage.

- **Fire Resistance:** Steel reinforcement provides some fire resistance to the concrete, as it acts as a heat sink, protecting the inner core from rapid temperature rise.

- **Construction Speed:** Using steel reinforcement speeds up construction since pre-cut bars can be easily placed and secured in the desired positions.

- **Cost-Effectiveness:** The use of steel reinforcement optimizes the use of materials, reducing overall construction costs while maintaining structural integrity.

- **Code Compliance:** Steel reinforcement in RCC work is essential for complying with building codes and design standards that require adequate reinforcement for safety and stability.

Different Grades of Steel Reinforcement

In construction, various grades of steel reinforcement are manufactured to meet specific engineering requirements. The most commonly used grades are:

- **Mild Steel (Grade I):** This is the most basic and commonly used grade of steel reinforcement, suitable for general construction purposes. It has a yield strength of 250 N/mm².

- **Medium Tensile Steel (Grade II):** This grade offers higher strength than mild steel, with a yield strength of 415 N/mm². It is used for structures that require increased load-bearing capacity.

- **High Strength Deformed Bars (HYSD) (Grade III and IV):** These bars have higher yield strength (500 N/mm² and 550 N/mm², respectively) due to the presence of carbon, manganese, and other alloys. They are used in heavy and critical structures like bridges and high-rise buildings.

- **TMT Bars (Thermo-Mechanically Treated) (Fe 415, Fe 500, Fe 550, Fe 600):** TMT bars are manufactured with a special process that imparts superior strength and ductility. They are categorized based on their minimum yield strength, with Fe 415 having a yield strength of 415 N/mm², Fe 500 having 500 N/mm², Fe 550 having 550 N/mm², and Fe 600 having 600 N/mm². TMT bars are widely used in modern construction due to their excellent properties and cost-effectiveness.

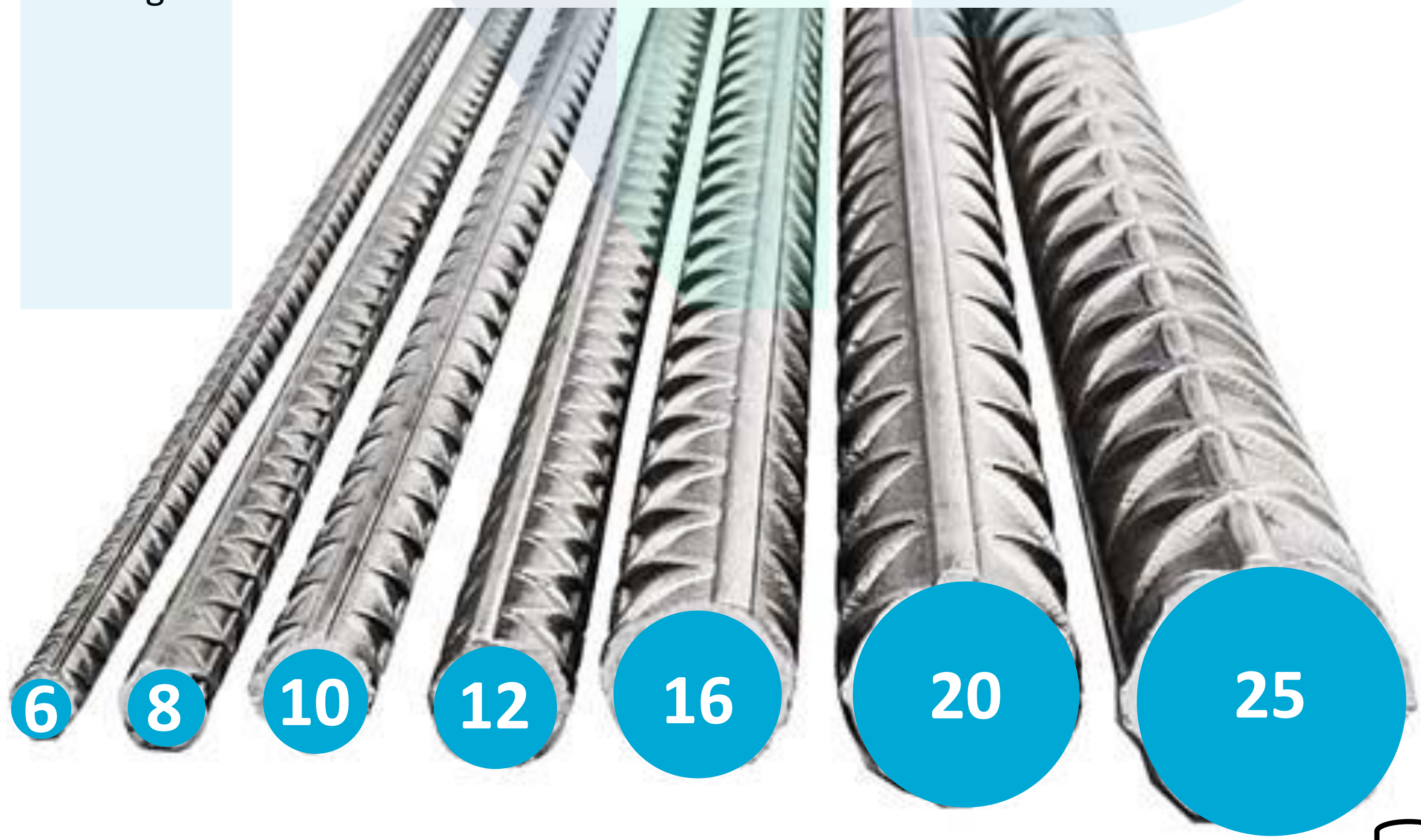
Each grade of steel reinforcement has its distinct advantages, and the selection of the appropriate grade depends on the structural requirements and design considerations of the specific construction project.

Different Diameter of Steel Reinforcement

In the construction industry, there are various standard diameters of bars used for reinforcement purposes. The most commonly used diameters of bars are:

- 6 mm
- 8 mm
- 10 mm
- 12 mm
- 16 mm
- 20 mm
- 25 mm
- 32 mm
- 40 mm
- 50 mm

These diameters represent the cross-sectional size of the bars and are available in different lengths, typically ranging from 6 meters to 12 meters or more but generally 12 meters is used, depending on the supplier and project requirements. The selection of the appropriate bar diameter is based on the structural design, the load-carrying capacity required, and the specific construction needs. Larger diameter bars are generally used in heavy and critical structures, while smaller diameter bars are used in lighter and less critical elements.



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Unit Weight of Steel Reinforcement

Standard formula used for calculating unit weight of steel reinforcement:

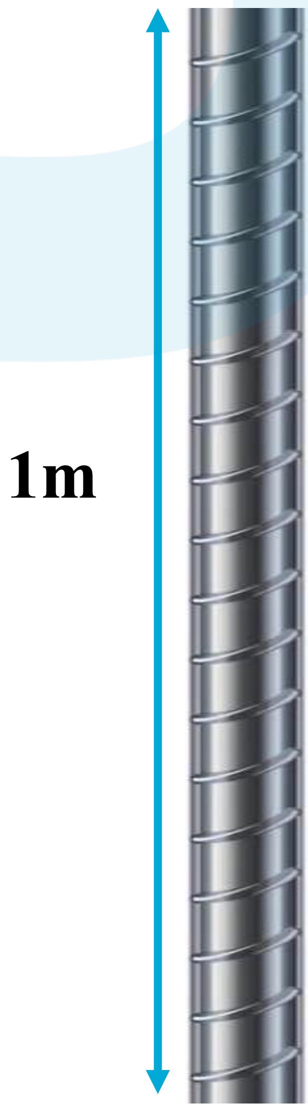
$$\frac{D^2}{162}$$

Let's derive this standard formula of unit weight.

- = Unit Weight of Bar : Volume x Density
- = (Area x Length) x Density

Unit Conversion 'm' to 'mm & mm^3'
(1m = 1000 mm
1m^3 = 1000mm x 1000mm x 1000mm)

- $= [(\pi/4) \times D^2 \times 1\text{ m}] \times 7850\text{ kg/m}^3$
- $= [(\pi/4) \times D^2 \times 1000] \times \dfrac{7850\text{ kg/mm}^3}{1000\text{mm} \times 1000\text{mm} \times 1000\text{mm}}$
- $= D^2 \times 0.00616225$
- $= \dfrac{D^2}{1 / 0.00616225}$
- $= (D^2/162)$



Unit weight of different diameter of Bar.

- 08mm = (8x8)/162 = 0.395 kg/m
- 10mm = (10x10)/162 = 0.617 kg/m
- 12mm = (12x12)/162 = 0.889 kg/m
- 16mm = (16x16)/162 = 1.580 kg/m
- 20mm = (20x20)/162 = 2.470 kg/m
- 25mm = (25x25)/162 = 3.858 kg/m
- 32mm = (32x32)/162 = 6.320 kg/m

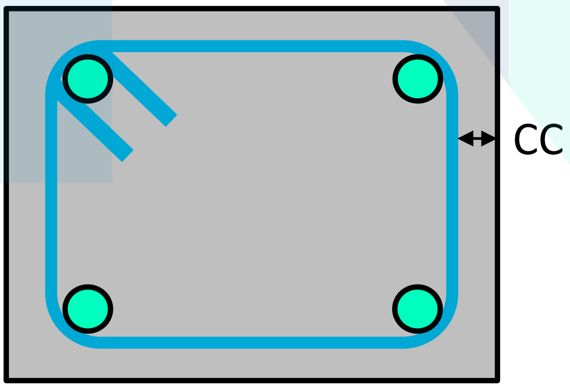
Details about Clear & Effective Cover

Clear Cover:

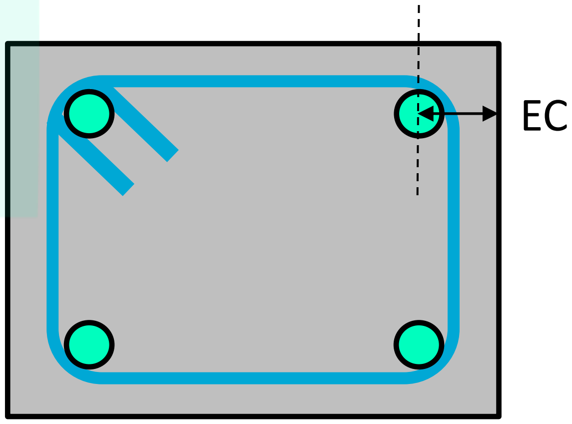
- Clear cover refers to the distance between the outer surface of the concrete and the nearest surface of the reinforcement bar.
- It is designed to provide protection to the reinforcement from environmental factors like moisture, chemicals, and carbonation, as well as to prevent corrosion.
- Clear cover also helps in maintaining the fire resistance of the concrete element.
- It is specified in building codes and standards to ensure the durability and safety of the structure.

Effective Cover:

- Effective cover refers to the distance between the center of the reinforcement bar and the nearest outer surface of the concrete.
- It takes into account the bar diameter and the concrete cover to determine the actual distance from the bar center to the concrete surface.
- Effective cover is crucial in structural design calculations as it affects the development length and anchorage of reinforcement.



CLEAR COVER



EFFECTIVE COVER

In Bar Bending Schedule (BBS), the clear cover is considered for detailing and scheduling purposes. The clear cover is essential in determining the bending and cutting length of the bars and ensuring they are placed at the correct position within the concrete element.

Value of Clear Cover

The values of clear cover used in different structural members can vary depending on factors like environmental conditions, structural design requirements, and building codes. Here are some general guidelines for clear cover values typically used in different structural elements:

1. Beams and Slabs:

- ❖ For normal environmental exposure and non-aggressive conditions: 20 mm to 25 mm.
- ❖ For moderate environmental exposure and mildly aggressive conditions: 30 mm to 40 mm.
- ❖ For severe environmental exposure and highly aggressive conditions: 50 mm or more.

2. Columns:

- ❖ For normal environmental exposure and non-aggressive conditions: 40 mm.
- ❖ For moderate environmental exposure and mildly aggressive conditions: 50 mm to 60 mm.
- ❖ For severe environmental exposure and highly aggressive conditions: 75 mm or more.

3. Footings and Pile Caps:

- ❖ For normal environmental exposure and non-aggressive conditions: 40 mm to 50 mm.
- ❖ For moderate environmental exposure and mildly aggressive conditions: 50 mm to 75 mm.
- ❖ For severe environmental exposure and highly aggressive conditions: 75 mm or more.

4. Walls:

- For normal environmental exposure and non-aggressive conditions: 25 mm to 30 mm.
- For moderate environmental exposure and mildly aggressive conditions: 30 mm to 40 mm.
- For severe environmental exposure and highly aggressive conditions: 40 mm to 50 mm.

5. Retaining Walls:

- For normal environmental exposure and non-aggressive conditions: 30 mm to 40 mm.
- For moderate environmental exposure and mildly aggressive conditions: 40 mm to 50 mm.
- For severe environmental exposure and highly aggressive conditions: 50 mm to 75 mm.

6. Staircases:

- For normal environmental exposure and non-aggressive conditions: 15 mm to 20 mm.
- For moderate environmental exposure and mildly aggressive conditions: 20 mm to 25 mm.
- For severe environmental exposure and highly aggressive conditions: 25 mm to 30 mm.

7. Slab-on-Grade (Ground Slabs):

- For normal environmental exposure and non-aggressive conditions: 20 mm to 25 mm.
- For moderate environmental exposure and mildly aggressive conditions: 30 mm to 40 mm.
- For severe environmental exposure and highly aggressive conditions: 50 mm or more.

8. Water Tanks (Reinforced Concrete):

- For normal environmental exposure and non-aggressive conditions: 25 mm to 30 mm.
- For moderate environmental exposure and mildly aggressive conditions: 30 mm to 40 mm.
- For severe environmental exposure and highly aggressive conditions: 40 mm to 50 mm.

- Please note that these values are approximate and may differ based on specific project requirements and local building codes. Designers and engineers should always refer to the applicable building standards and consult with structural consultants to determine the appropriate clear cover values for each project. Additionally, seismic considerations and fire resistance requirements may also influence the selection of clear cover values for specific structural elements.

Standard Codes Used in Bar Bending Schedule

Here are the names of some standard codes commonly used in Bar Bending Schedule (BBS) in :

India:

- IS 2502: Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement (BBS-related guidelines).
- IS 1786: Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement (specifies the properties and grades of reinforcement bars).

United States:

- ACI 318: Building Code Requirements for Structural Concrete (provides guidelines for concrete design and reinforcement detailing).
- CRSI Manual of Standard Practice: Published by the Concrete Reinforcing Steel Institute, it covers standard practices for the industry.

United Kingdom (British):

- BS 8666: Scheduling, Dimensioning, Bending, and Cutting of Steel Reinforcement for Concrete (covers BBS-related guidelines).
- BS 4466: Specification for Higher Strength Cold Worked Steel Bars for the Reinforcement of Concrete (specifies properties and grades of reinforcement bars).

Saudi Arabia:

- SASO 42: Saudi Building Code (provides guidelines for structural design and reinforcement detailing in Saudi Arabia).

These standard codes play a crucial role in ensuring consistency, safety, and quality in the construction industry. They provide essential guidelines and specifications for the design, detailing, and construction of reinforced concrete structures, including the preparation of Bar Bending Schedules. Engineers, architects, and construction professionals refer to these codes to ensure that their designs and construction practices adhere to recognized industry standards.

❖ Bend Deduction in Bar Bending Schedule (BBS):

Bend Deduction refers to the length deducted from the total length of a reinforcement bar due to bending, so that the resulting bar length after bending corresponds to the required design length.

It is essential to account for bend deduction accurately in the BBS to ensure the reinforcement bars fit perfectly within the structural elements without affecting their strength and performance.

Why Bend Deduction is Done:

Bend Deduction is done to account for the elongation of the reinforcement bar during bending. When a bar is bent to form hooks, bends, or other shapes, its length increases due to bending radii and curvatures. To maintain the required design length, the bend deduction compensates for this elongation.

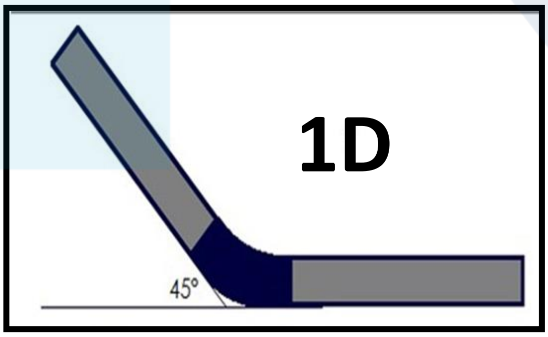
Types of Bend Deduction:

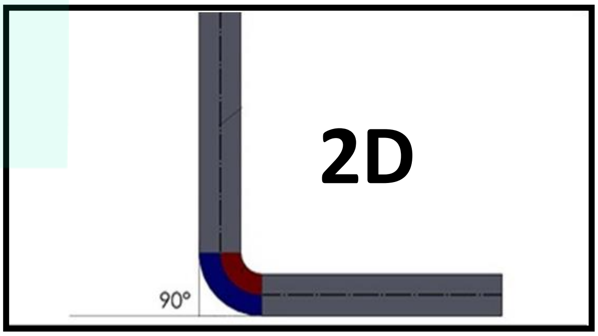
❖ Values of Bend Deduction:

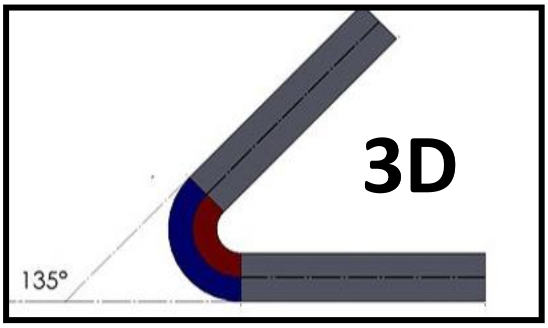
The values of bend deduction vary depending on the specific bending angles, bending radii, and bar diameters used in the construction project.

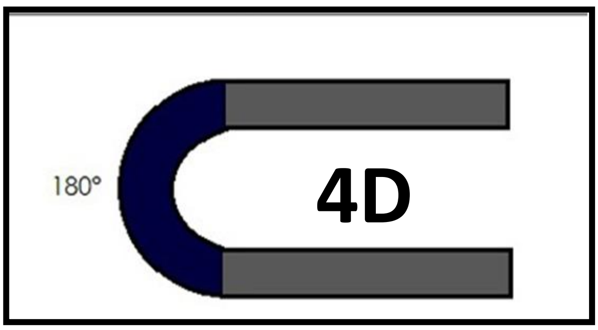
They can be obtained from relevant design codes, industry standards, or bending machines' manufacturer's recommendations.

For example, 45-degree: 1D, 90-degree: 2D, 135-degree: 3D and 180-degree: 4D.









Symbols & Representation

Symbols & Representation in BBS

In a Bar Bending Schedule (BBS), various symbols and representations are used to communicate essential information about the reinforcement bars and their arrangement in a clear and concise manner. These symbols help to identify different types of bars, bending details, and other relevant data. Here are some common symbols and representations used in BBS:

Bar Shape Symbols:

- Straight Bar: A straight line represents a straight bar without any bends.
- Bent Bar: A zigzag line or series of angles represent bent bars with specific bending details.

Bar Diameter and Spacing:

- The diameter of the bar is mentioned alongside the bar shape symbol, e.g., 12Φ (12mm diameter bar).
- The spacing between parallel bars is indicated, e.g., @150 c/c (150mm center-to-center spacing).

Bend Detail Symbols:

- Right Angle Bend: A square or L-shaped symbol denotes a right-angle bend.
- U-shaped Bend: A rounded U-shaped symbol represents a U-bend.
- Hook Bend: A small semicircular symbol denotes a standard hook bend.
- Crank Bend: A symbol with a series of angles indicates a crank bend.
- Stirrup or Ring: A closed circular symbol represents a stirrup or ring.

BBS Header and Title:

The BBS contains a header with details like project name, drawing number, scale, date, and other project-specific information.
A clear title describes the purpose of the BBS and the specific structural element it covers.

Dimensional Units:

- ❖ The units of measurement used for bar dimensions, such as millimeters (mm) or centimeters (cm), are mentioned.

The BBS refers to the relevant reinforcement drawings or sections for further details and clarification.
These symbols and representations, when used consistently and correctly, make the Bar Bending Schedule a valuable document that facilitates efficient communication, accurate reinforcement fabrication, and precise construction of the reinforced concrete structure.

❑ Some Basic Symbol given Indian Standard 5525:1969

Symbols Relating to Cross Sectional Shape and Size of Reinforcement Bars

∅	Plain round bar or Diameter of plain round bar
□	Plain square bar or Side of plain square bar
#	Deformed bar (including square twisted bar) or Nominal size (equivalent diameter or side) of the deformed bar (*see* Note)

Img.1.

Symbols Relating to Various Structural Members

Bm	Beam(s)
Col	Column(s)
FG	Footing(s)
GR	Girder(s)
JT	Joist(s)
LL	Lintel(s)
LB	Lintel Beam(s)
Sb	Slab(s)
WL	Longitudinal Wall
WX	Cross Wall

Img.2.

Symbols Relating to Position and Direction

EW	Each way
@	Spacing centre to centre
⟷	Limit of area covered by bars
⟶	Direction in which bars extend

Img.3.

Symbols Relating to Shape of the Bar Along Its Length

Bt	Bent bar
St	Straight bar
Stp	Stirrup
Sp	Spiral
Ct	Column tie

Img.4.

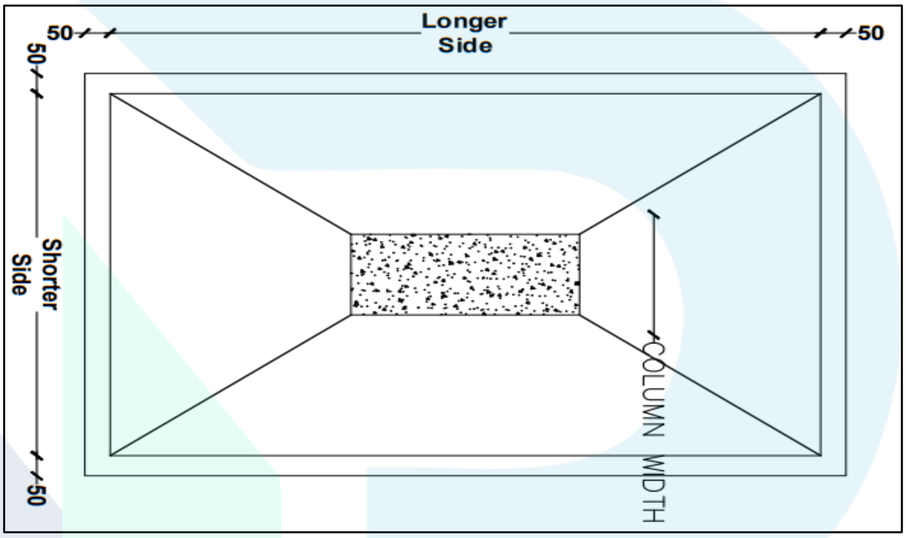
Drawing Reading

❖ Footing Drawing:

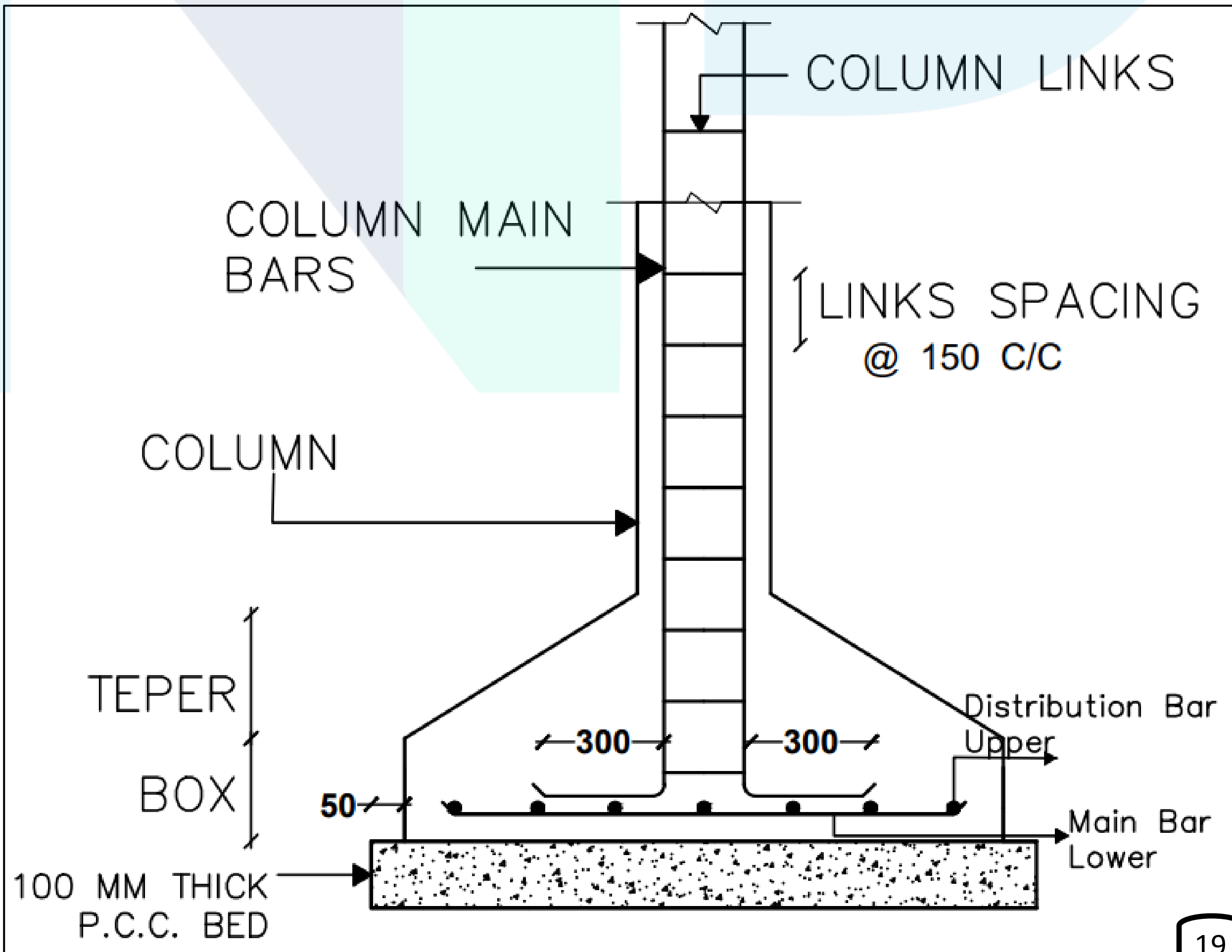
➢ Footing & Reinforcement Details

Dis.	EXCAVATION SIZE (m)	P.C.C THICK (m)	FOOTING SIZE (m)	FOOTING DEPTH		REINFORCEMENT ALONG	
				AT COLUMN FACE (m)	AT FOOTING END (m)	LONG LOWER TIER	SHORT UPPER TIER
F1	1x1.2	0.1	0.9x1.1	0.38	0.15	12 Φ	12 Φ

➢ Footing Plan

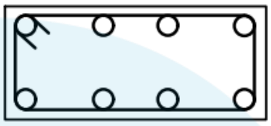


➢ Footing Section

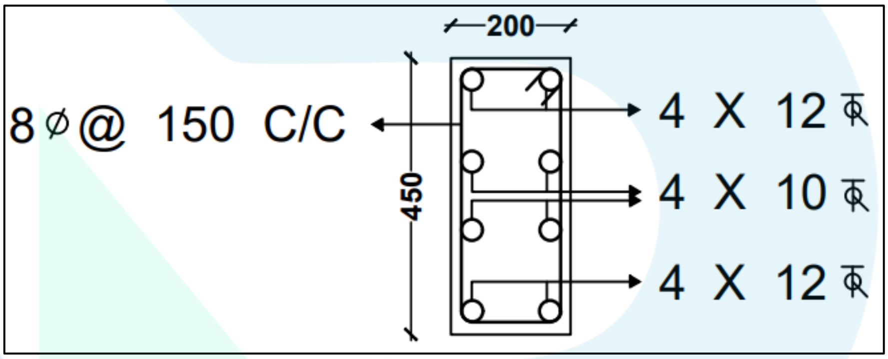


❖ Column Drawing:

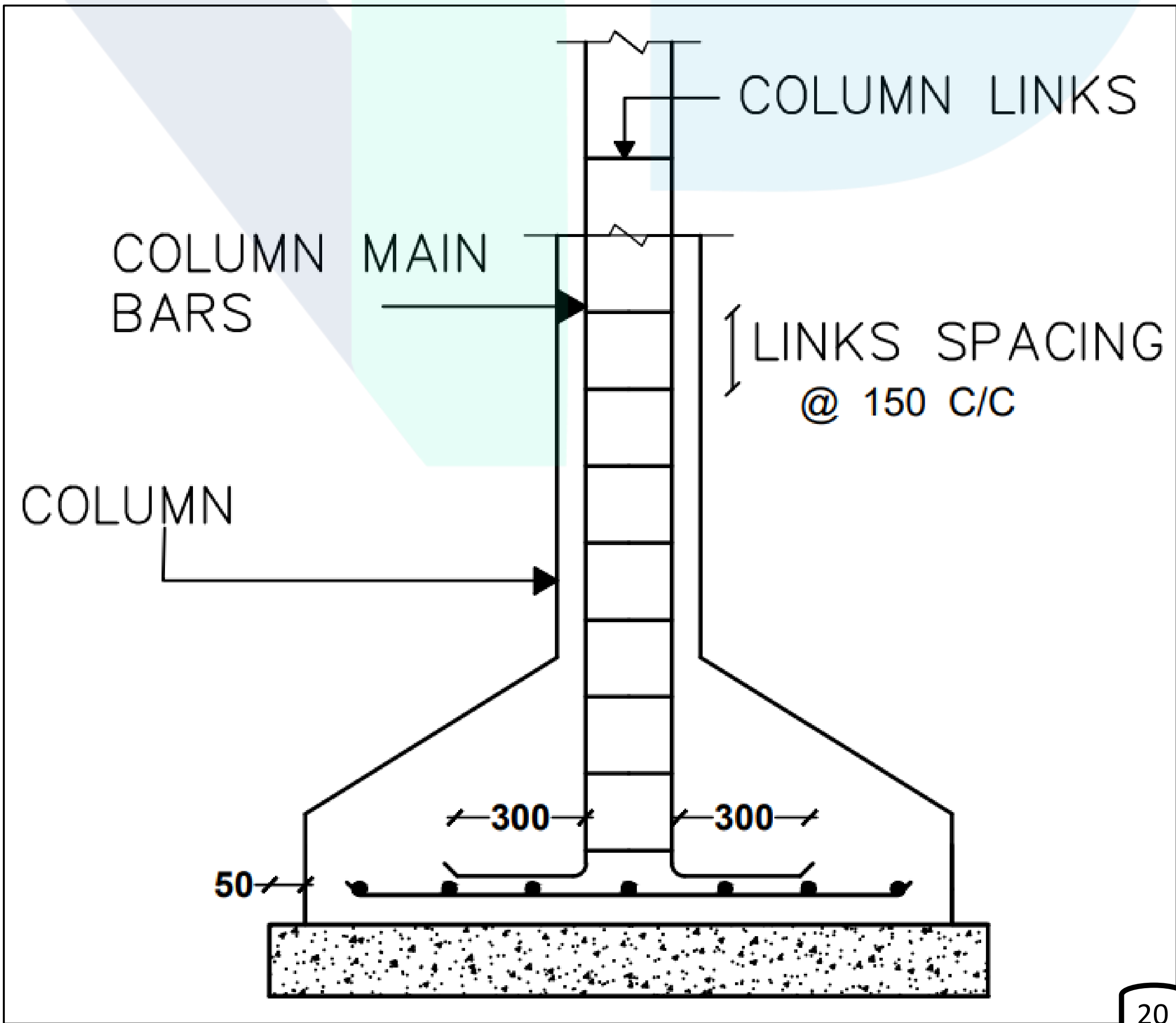
➢ Column & Reinforcement Details

COLUMN SIZE (m)	VERTICAL BARS	RINGS C/C	COLUMN SECTION AT G. FLOOR
0.2x0.45	4 X 12 4 X 10	8 ⌀@ 150 C/C	

➢ Column Layout Plan

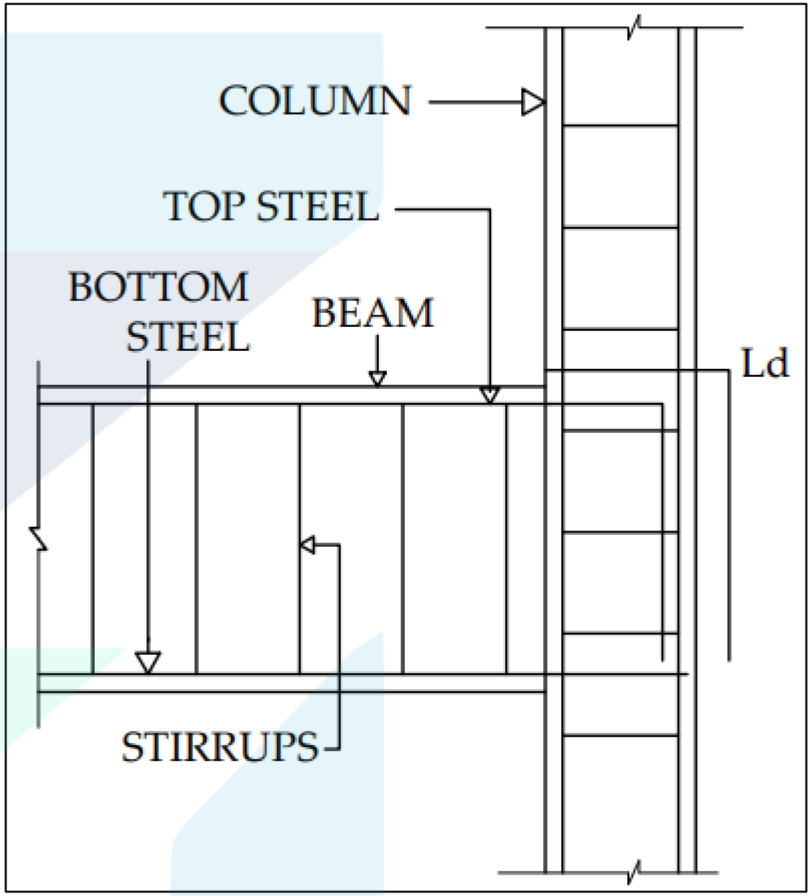


➢ Column Section



❖ Beam Drawing:

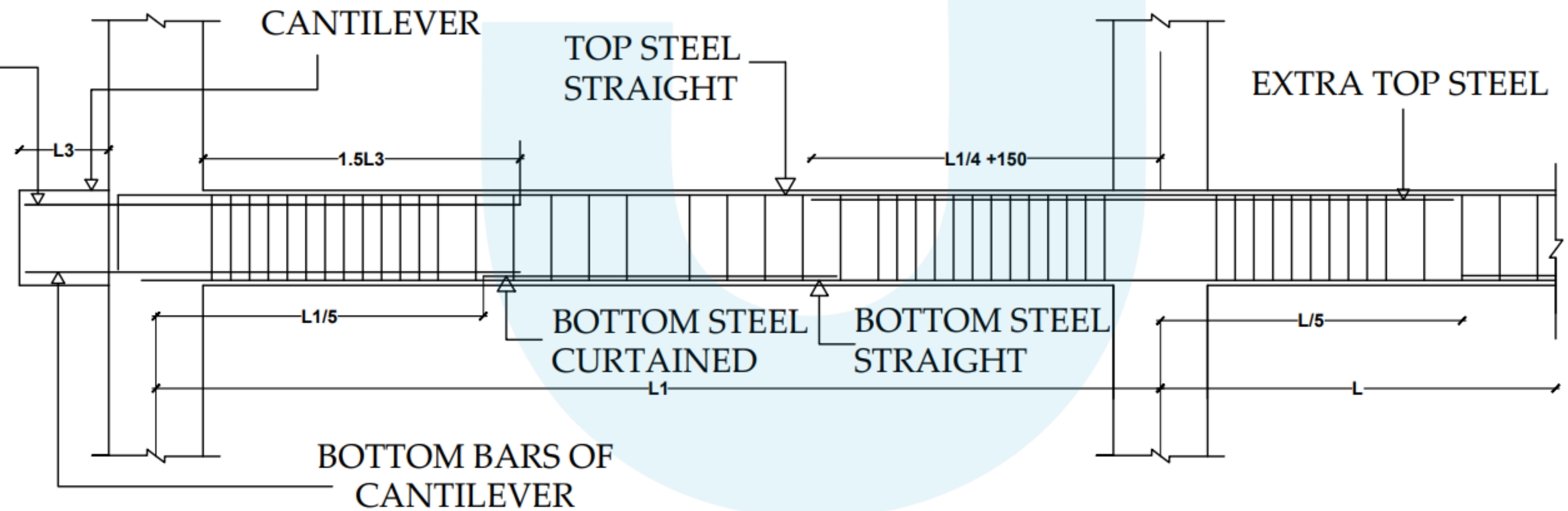
➢ Typical End Span Details of Beam



➢ Beam & Reinforcement Details

BEAM NO.	SIZE/ THICKNESS BXD (OVERALL) M	MID SPAN MAIN BAR (MM)		TOP BARS (MM)	RINGS / DISTRIBUTION C/C (MM)
		BOTTOM STRAIGHT BARS	BOTTOM B/UP AT 2D FROM FACE		
B1	2 X 3	2 X 12 ϕ	1 X 10 ϕ	2 X 10	8 @ 150 C/C

➢ Details of Typical Continuous Beam



Development Length
&
Lap Length

Development Length/Anchorage Length (Ld):

- Development length refers to the length of reinforcement required to transfer the stresses between the concrete and the steel reinforcement bars to ensure adequate bond strength.

- It is essential because concrete has low tensile strength compared to steel, so the reinforcement bars need to be adequately anchored into the concrete to effectively resist tension and prevent slippage or pullout.

- The development length is critical in ensuring the stability and load-carrying capacity of reinforced concrete elements like beams, columns, and slabs.

Why Development Length is Used:

- When a load is applied to a reinforced concrete member, tensile stresses develop in the reinforcement bars. To prevent premature failure or debonding, the development length ensures that these stresses are safely transferred into the concrete.

- Proper development length is necessary to prevent bond failure, which could lead to structural instability and safety concerns.

Industry Value for Development Length:

- The value of development length depends on various factors, such as the type of bar, concrete strength, cover depth, and environmental conditions.
- Development length is specified in relevant design codes, such as ACI 318 (USA), BS 8110 (UK), IS 456 (India), and AS 3600 (Australia).

It is usually expressed in terms of the bar diameter (d) or as a multiple of the bar diameter (typically 40 times the bar diameter for straight bars in tension and 50 times the bar diameter for bent or hooked bars).

Development/Anchorage Length

❖ Here are some useful details related to development length taken from Indian standard 456:200.

26.2.1 *Development Length of Bars*

The development length L_d is given by

$$L_d = \frac{\phi \sigma_s}{4\tau_{bd}}$$

where

ϕ = nominal diameter of the bar,

σ_s = stress in bar at the section considered at design load, and

τ_{bd} = design bond stress given in **26.2.1.1**.

Img.1.

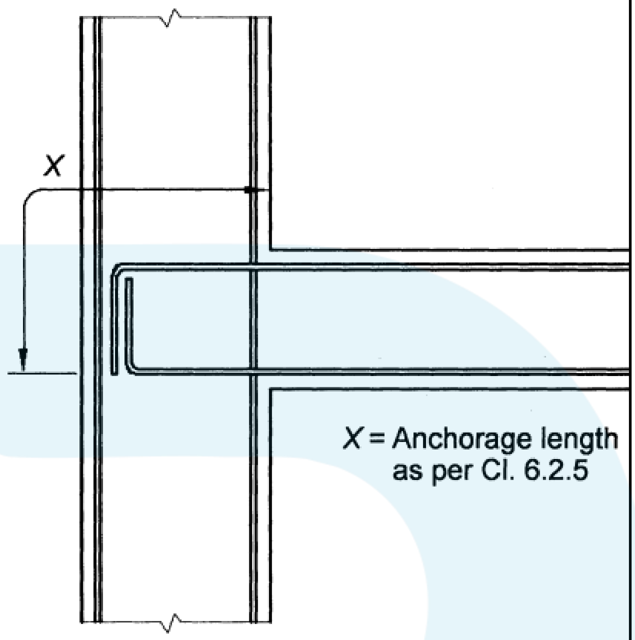


FIG. 2 ANCHORAGE OF LONGITUDINAL BEAM BARS
EXTERIOR BEAM-COLUMN JOINT

Img.2.

26.2.1.1 Design bond stress in limit state method for plain bars in tension shall be as below:

Grade of concrete	M 20	M 25	M 30	M 35	M 40 and above
Design bond stress, τ_{bd}, N/mm²	1.2	1.4	1.5	1.7	1.9

For deformed bars conforming to IS 1786 these values shall be increased by 60 percent.

For bars in compression, the values of bond stress for bars in tension shall be increased by 25 percent.

Img.3.

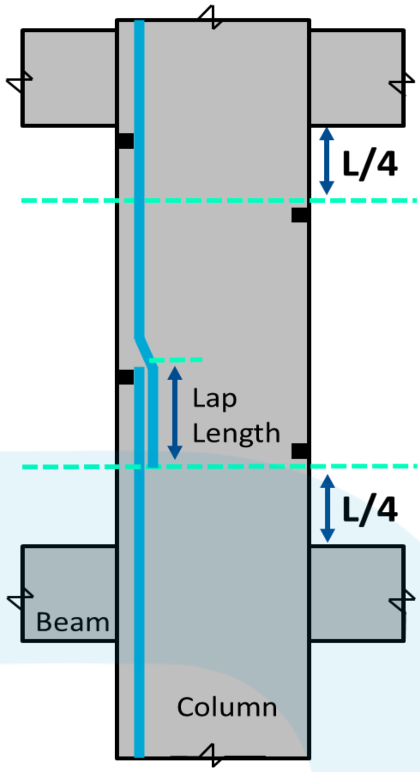
DEFORM BARS IN TENSION

Grade of concrete	M 20	M 25	M 30	M 35	M 40 and above
Design bond stress, τ_{bd}, N/mm²	1.92	2.24	2.40	2.72	3.04

Img.4.

Lap Length:

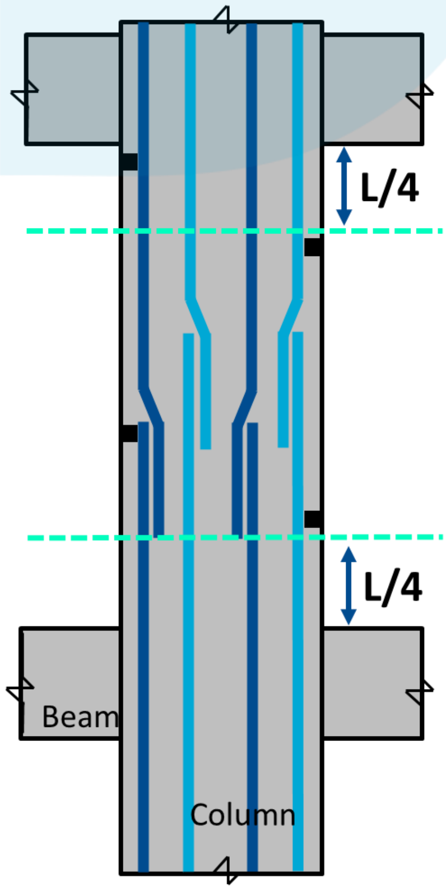
- Lap length is the amount of overlap or splice required for two reinforcement bars to develop adequate bond strength when they are joined together.
- It is essential to ensure the continuity of reinforcement along the length of the structure and to resist the tensile forces effectively.
- Lap length is used in locations where two reinforcement bars of the same diameter are joined together, like in beams, columns, and slabs.



Lap Joint

Why Lap Length is Used:

- Lap length ensures the continuity of reinforcement, preventing any structural weakness or discontinuity in the concrete member.
- The lap length is crucial for distributing stresses uniformly across the splice, allowing the reinforcement to work as a single continuous element.



Lap Joint with staggered pattern

Industry Value for Lap Length:

- Similar to development length, the lap length value depends on factors such as the bar diameter, concrete strength, cover depth, and design codes.

- The lap length is specified in design codes, such as ACI 318 (USA), BS 8110 (UK), IS 456 (India), and AS 3600 (Australia).

- It is typically expressed as a multiple of the bar diameter or as an absolute length. Lap length should not be less then the development length.

- Please note that the specific values for development length and lap length can vary depending on the structural design requirements and the code used in a particular country. Engineers and designers should refer to the relevant design codes for accurate and appropriate values of development length and lap length in their projects.

6.2.6 *Splicing of Longitudinal Bars*

6.2.6.1 *Lap splices*

When adopted, closed links shall be provided over the entire length over which the longitudinal bars are spliced. Further,

a) the spacing of these links shall not exceed 150 mm (*see* Fig. 3).

b) the lap length shall not be less than the development length of the largest longitudinal reinforcement bar in tension.

c) lap splices shall not be provided,

   1) within a joint ;

   2) within a distance of 2*d* from face of the column; and

Data taken from: IS 13920:2016

Cutting Length Formula in BBS

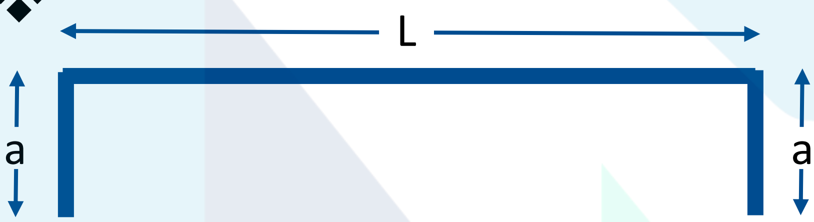
Cutting Length Formula

❖ **Shape**

Cutting Length

CL = L

❖ **Shape**



Cutting Length

CL = a + L + a – Bend Deduction

Bend Deduction : 2 x 2D (90°)

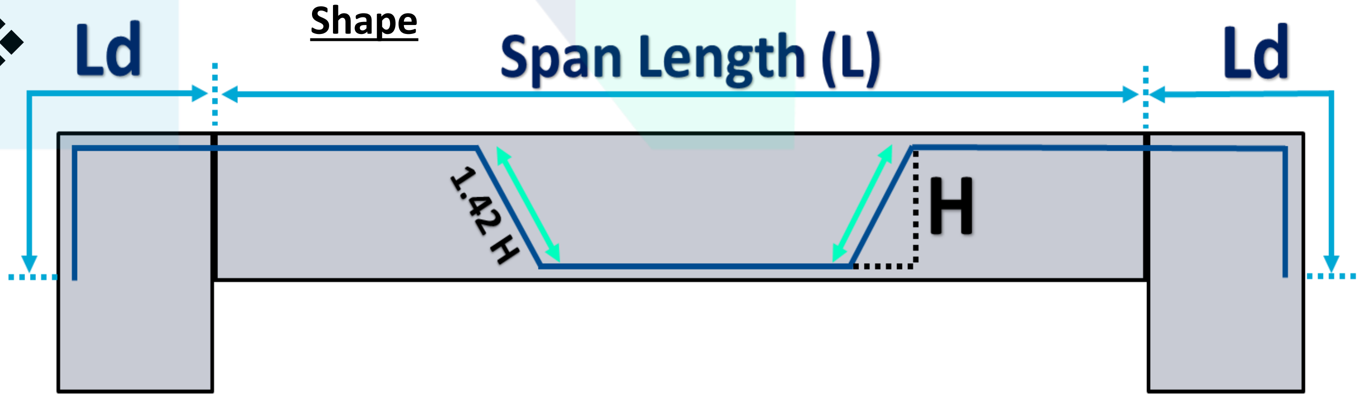
❖ **Shape**

Cutting Length

CL = a + L – Bend Deduction

Bend Deduction : 1 x 2D (90°)

❖ **Shape**

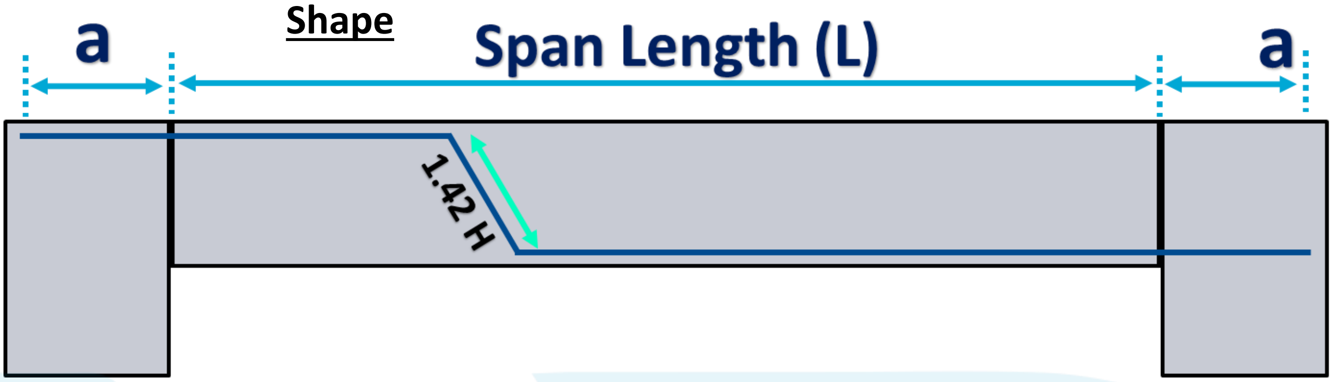


CL = Ld + Span Length(L) + (0.42H x 2) + Ld – Bend Deduction (2x90 + 4x45)

❑ Note: This formula is for curtail/crank bar in beam. As you can see in diagram the actual value of crank part is '1.42H', but in the time of calculation we derive the standard value to calculate CL without complication which is '0.42H'. Derivation is in next part.

Cutting Length Formula

Shape

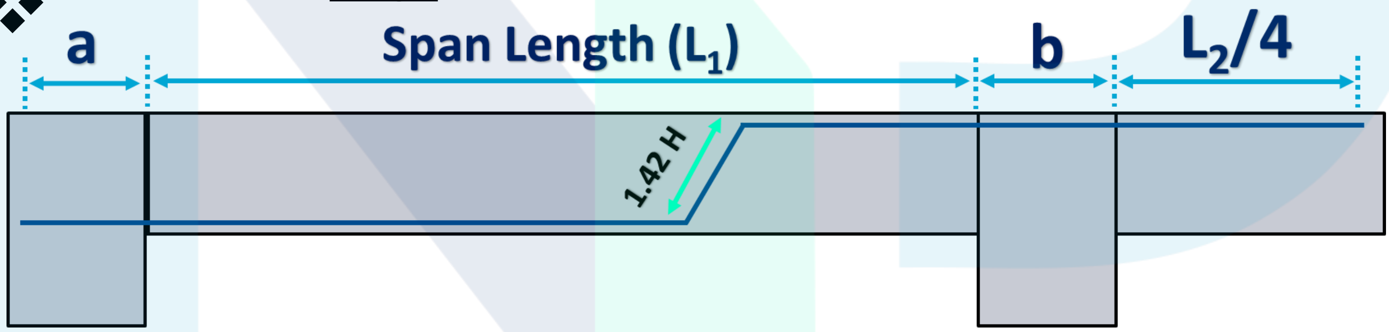


CL = a + Span Length(L) + (0.42H) + a – Bend Deduction (2x45)

(Where, a = Beam width – Cover)

- Note: This formula is for curtail/crank bar in Slab. As you can see in diagram the actual value of crank part is ‘1.42H’, but in the time of calculation we derive the standard value to calculate CL without complication which is ‘0.42H’. Derivation is in next part.

Shape



CL = a + Span Length(L_1) + (0.42H) + b + $L_2/4$ – Bend Deduction (2x45)

(Where, a = Beam width – Cover)

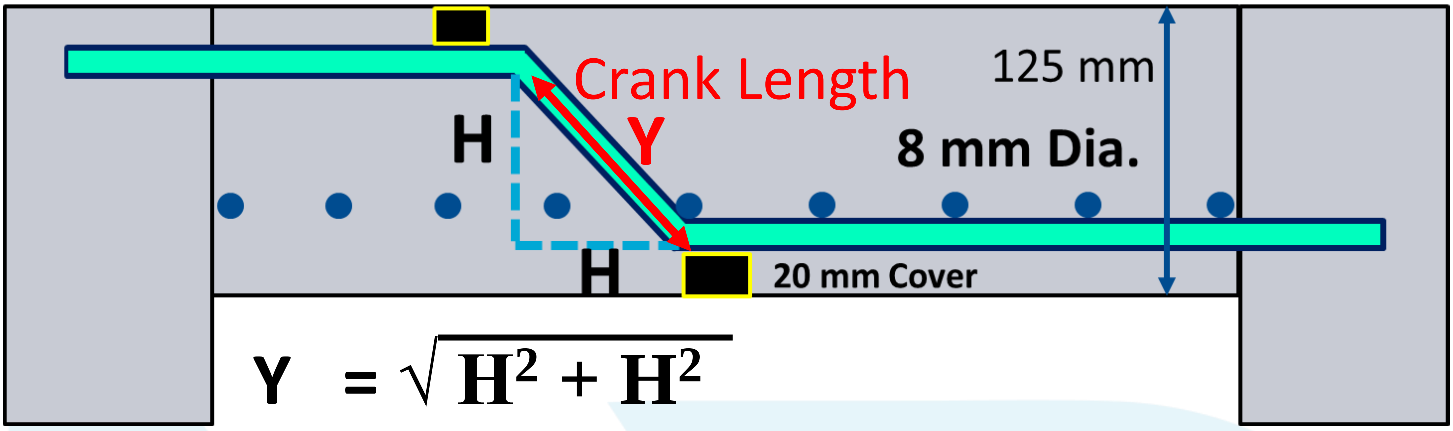
- Note: This formula is for curtail/crank bar in Continuous Slab. As you can see in diagram the actual value of crank part is ‘1.42H’, but in the time of calculation we derive the standard value to calculate CL without complication which is ‘0.42H’. Derivation is in next part.

Formula To Calculate Number of Bars:

1) When bar is calculated from start to end point = $\dfrac{\text{Distance}}{\text{Spacing}} + 1$

2) When bar is calculated from start but not till end point = $\dfrac{\text{Distance}}{\text{Spacing}}$

3) When bar is calculated excluding start and end point = $\dfrac{\text{Distance}}{\text{Spacing}} - 1$



$$Y = \sqrt{H^2 + H^2}$$

$$Y = \sqrt{2H^2}$$

$$Y = \sqrt{2}\,H$$

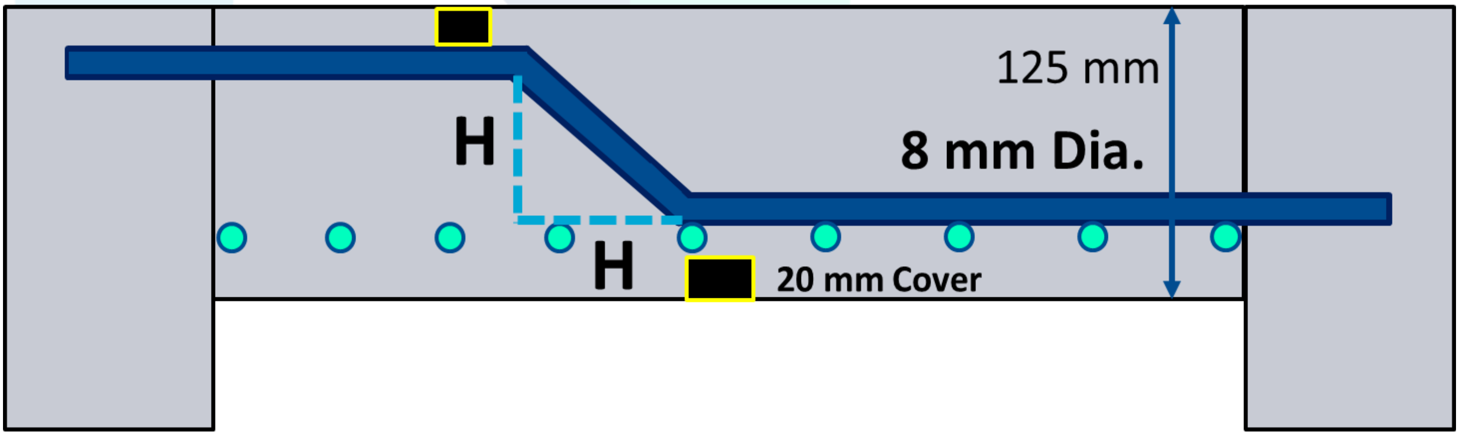
$$Y = 1.42\,H$$

- Note: This formula is for curtail/crank bar in slab/beam. As you can see in diagram the actual value of crank part is '1.42H', but in the time of calculation we calculate it as standard value of '0.42H', because it is easier to calculate this way.

Formula to calculate value of 'H' when bar is placed at bottom

H = Slab Depth – (2xCover) – Dia. of bar

H = 125 – (2x20) – 8 = 77 mm



Formula to calculate value of 'H' when bar is placed just above bottom bar

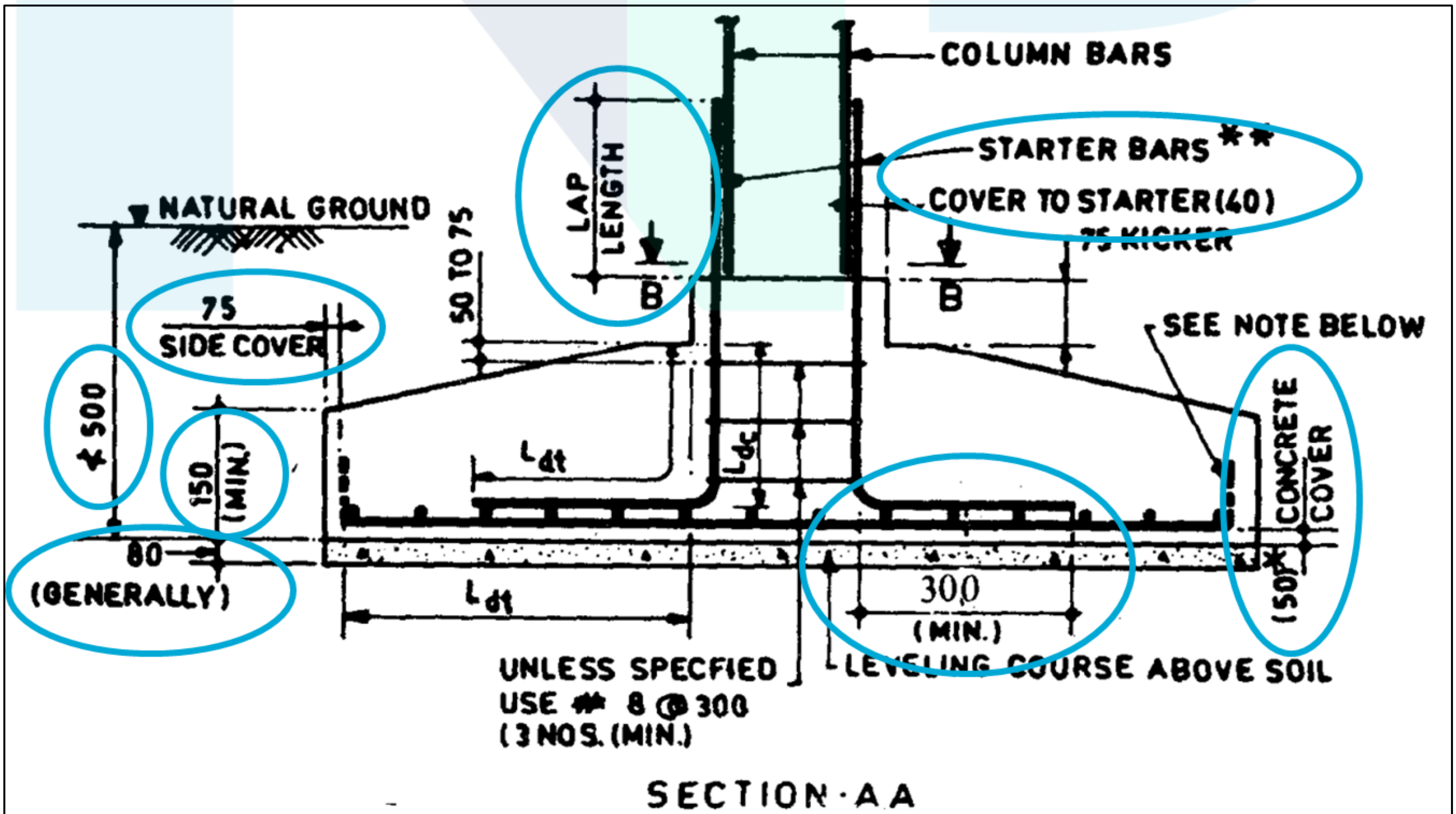
H = Slab Depth – (2xCover) – Dia. of bar – Dia. Of bottom bar

H = 125 – (2x20) – 8 – 8 = 69 mm

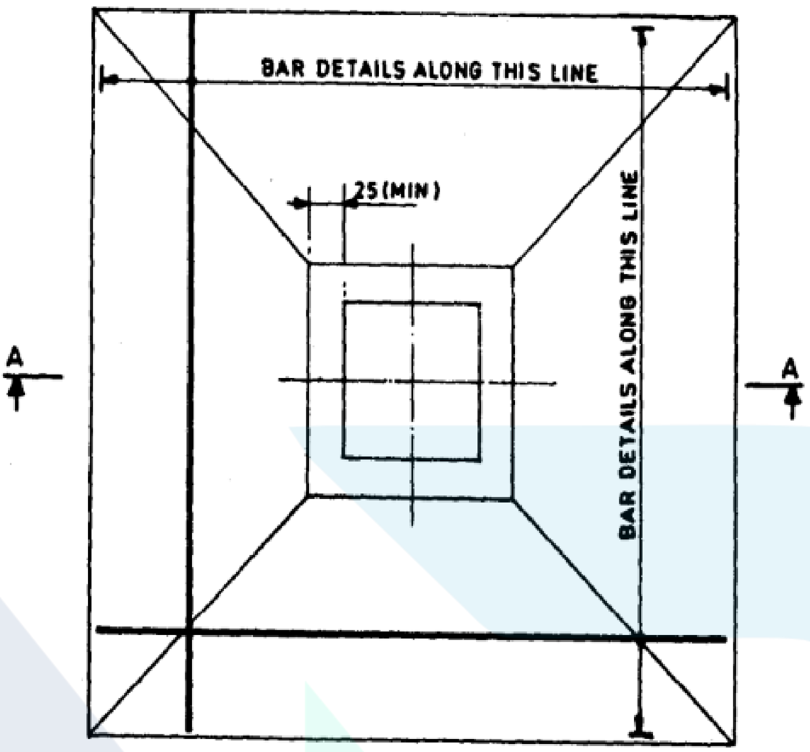
IS Codes Used in BBS

IS Code Reference for Footing

Concrete Reinforcement & Detailing SP-34:1987



IS Code Reference for Footing



PLAN

6.2 Cover — The minimum thickness of cover to main reinforcement shall not be less than 50 mm for surfaces in contact with earth face and not less than 40 mm for external exposed face. However, where the concrete is in direct contact with the soil, for example, when a levelling course of lean concrete is not used at the bottom of footing, it is usual to specify a cover of 75 mm. This allows for the uneven surface of the excavation. In case of raft foundation, whether resting directly on soil or on lean concrete, the cover for the reinforcement shall not be less than 75 mm.

6.3 Minimum Reinforcement and Bar Diameter — The minimum reinforcement according to slab and beam elements as appropriate should be followed, unless otherwise specified. The diameter of main reinforcing bars should be not less than 10 mm.

IS Code Reference for Column

Plain & Reinforced Concrete Code of Practice IS 456:2000

26.4.1 *Nominal Cover*

26.4.2.1 However for a longitudinal reinforcing bar in a column nominal cover shall in any case not be less than 40 mm, or less than the diameter of such bar. In the case of columns of minimum dimension of 200 mm or under, whose reinforcing bars do not exceed 12 mm, a nominal cover of 25 mm may be used.

26.5.3 *Columns*

26.5.3.1 *Longitudinal reinforcement*

c) The minimum number of longitudinal bars provided in a column shall be four in rectangular columns and six in circular columns.

d) The bars shall not be less than 12 mm in diameter.

e) A reinforced concrete column having helical reinforcement shall have at least six bars of longitudinal reinforcement within the helical reinforcement.

26.2.5.1 *Lap splices*

a) Lap splices shall not be used for bars larger than 36 mm; for larger diameters, bars may be welded (*see* 12.4); in cases where welding is not practicable, lapping of bars larger than 36 mm may be permitted, in which case additional spirals should be provided around the lapped bars.

b) Lap splices shall be considered as staggered if the centre to centre distance of the splices is not less than 1.3 times the lap length calculated as described in (c).

d) The lap length in compression shall be equal to the development length in compression, calculated as described in **26.2.1**, but not less than 24 ϕ.

e) When bars of two different diameters are to be spliced, the lap length shall be calculated on the basis of diameter of the smaller bar.

Ductile Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces -Code Of Practice IS 13920:1993

7 COLUMNS AND FRAME MEMBERS SUBJECTED TO BENDING AND AXIAL LOAD

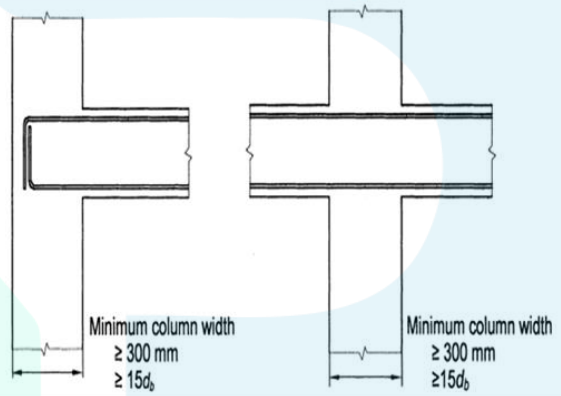
7.1.2 The minimum dimension of the member shall not be less than 200 mm. However, in frames which have beams with centre to centre span exceeding 5 m or columns of unsupported length exceeding 4 m, the shortest dimension of the column shall not be less than 300 mm.

7.1.3 The ratio of the shortest cross sectional dimension to the perpendicular dimension shall preferably not be less than 0·4.

7.1.1 The minimum dimension of a column shall not be less than,

a) 20 d_b, where d_b is diameter of the largest diameter longitudinal reinforcement bar in the beam passing through or anchoring into the column at the joint, or

b) 300 mm (*see* Fig. 7).



Fi

7.3 Longitudinal Reinforcement

7.3.1 Circular columns shall have minimum of 6 bars.

7.3.2 *Splicing of Longitudinal Bars*

7.3.2.1 *Lap splices*

When adopted, closed links shall be provided over the entire length over which the longitudinal bars are spliced. Further,

a) the spacing of these links shall not exceed 100 mm.

b) the lap length shall not be less than the development length of the largest longitudinal reinforcement bar in tension.

c) lap splices shall be provided only in the central half of clear column height, and not
   1) within a joint, or
   2) within a distance of 2*d* from face of the beam.

d) not more than 50 percent of area of steel bars shall be spliced at any one section.

e) lap splices shall not be used for bars of diameter larger than 32 mm for which mechanical splicing shall be adopted.

7.4 Transverse Reinforcement

7.4.1 Transverse reinforcement shall consist of closed loop,

a) spiral or circular links in circular columns, and

b) rectangular links in rectangular columns.

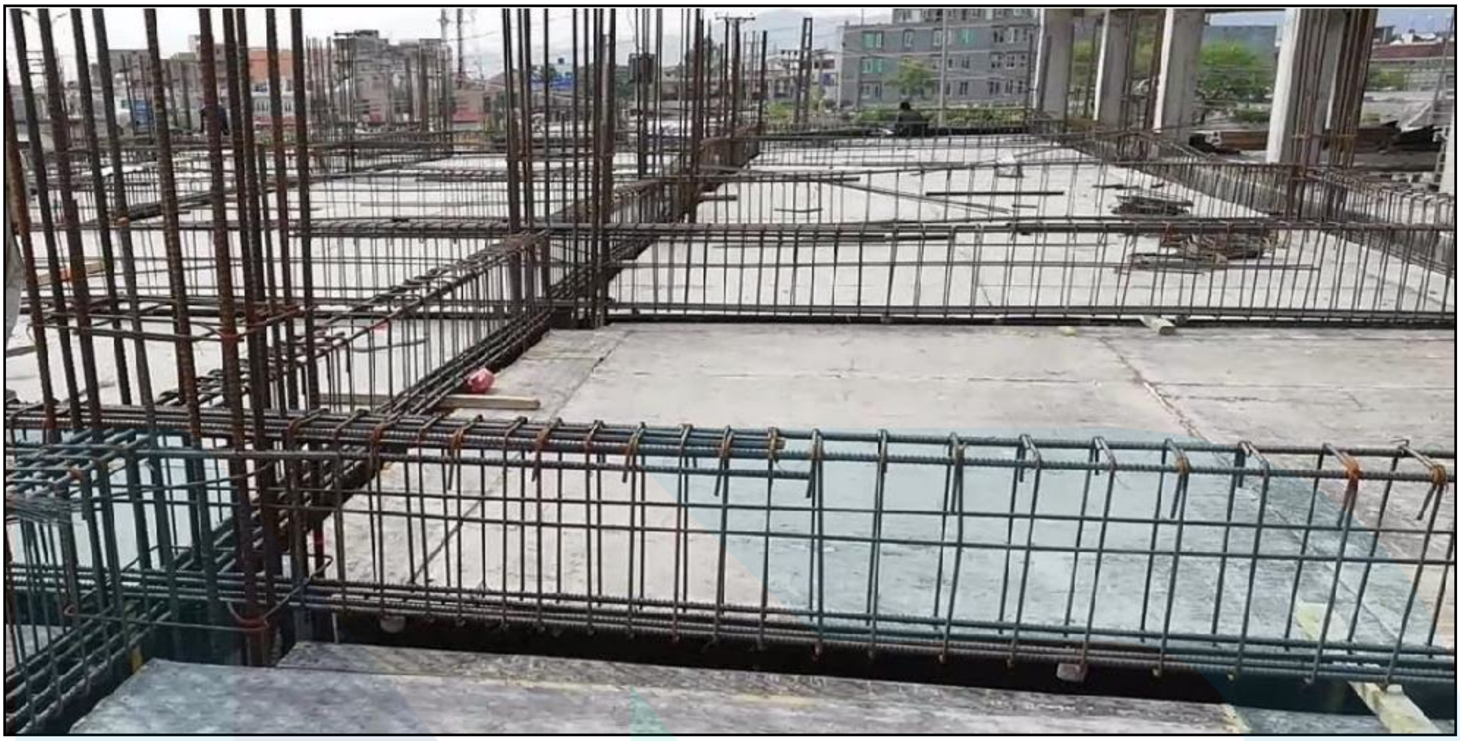
In either case, the closed link shall have 135° hook ends with an extension of 6 times its diameter (but not < 65 mm) at each end, which are embedded in the confined core of the column (*see* Fig. 10A).

7.4.2 When rectangular links are used,

a) the minimum diameter permitted of transverse reinforcement bars is 8 mm, when diameter of longitudinal bar is less than or equal to 32 mm, and 10 mm, when diameter of longitudinal bar is more than 32 mm;

b) the maximum spacing of parallel legs of links shall be 300 mm centre to centre;

IS Code Reference for Beam



Ductile Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces -Code Of Practice IS 13920:1993

6 BEAMS

6.1 General

Requirements of this section shall apply to beams resisting earthquake-induced effects, in which the factored axial compressive stress does not exceed 0.08 f_{ck}. Beams, in which the factored axial compressive stress exceeds 0.08 f_{ck}, shall be designed as per requirements of 7.

6.1.1 Beams shall preferably have width-to-depth ratio of more than 0.3.

6.1.2 Beams shall not have width less than 200 mm.

6.1.3 Beams shall not have depth D more than 1/4th of clear span. This may not apply to the floor beam of frame staging of elevated RC water tanks.

6.2 Longitudinal Reinforcement

6.2.1 The longitudinal reinforcement in beams shall be as given below:

a) Beams shall have at least two 12 mm diameter bars each at the top and bottom faces.

6.2.5 At an exterior joint, top and bottom bars of beams shall be provided with anchorage length beyond the inner face of the column, equal to development length of the bar in tension plus 10 times bar diameter minus the allowance for 90° bends (*see* Fig. 2).

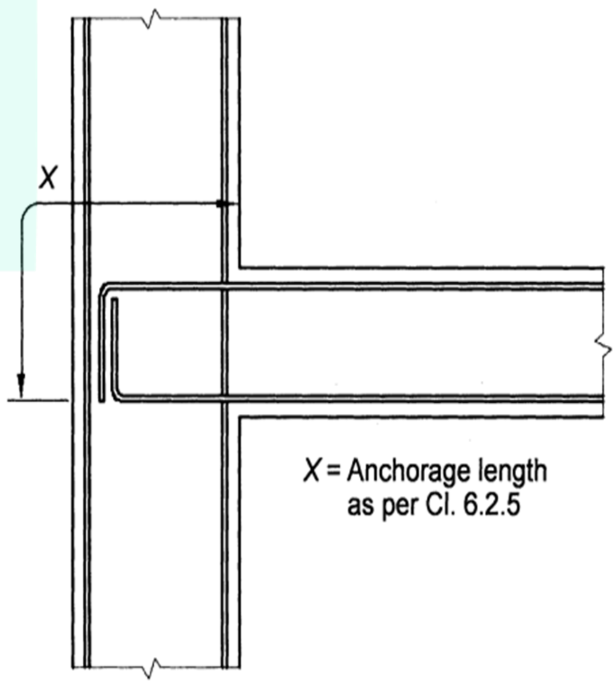


FIG. 2 ANCHORAGE OF LONGITUDINAL BEAM BARS AT EXTERIOR BEAM-COLUMN JOINT

6.2.6 *Splicing of Longitudinal Bars*

6.2.6.1 *Lap splices*

When adopted, closed links shall be provided over the entire length over which the longitudinal bars are spliced. Further,

a) the spacing of these links shall not exceed 150 mm (*see* Fig. 3).

b) the lap length shall not be less than the development length of the largest longitudinal reinforcement bar in tension.

c) lap splices shall not be provided,

1) within a joint ;

2) within a distance of $2d$ from face of the column; and

3) within a quarter length of the beam adjoining the location where flexural yielding may occur under earthquake effects.

d) not more than 50 percent of area of steel bars on either top or bottom face shall be spliced at any one section.

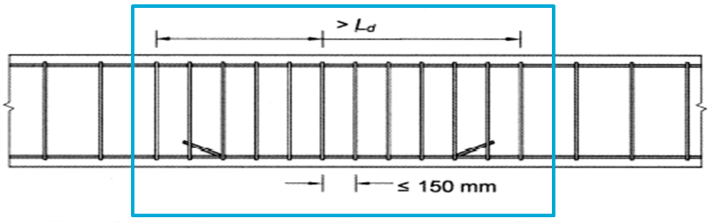


FIG. 3 LAP LENGTH AT LOCATION OF SPLICING OF LONGITUDINAL BARS IN BEAM

6.3.2 The minimum diameter of a link shall be 8 mm.

6.3.5 *Close Spacing of Links*

Spacing of links over a length of $2d$ at either end of a beam shall not exceed,

a) $d/4$;

b) 8 times the diameter of the smallest longitudinal bar; and

c) 100 mm (*see* Fig. 6).

6.3.5.1 The first link shall be at a distance not exceeding 50 mm from the joint face.

6.3.5.2 Closely spaced links shall be provided over a length equal to $2d$ on either side of a section where flexural yielding may occur under earthquake effects. Over the remaining length of the beam, vertical links shall be provided at a spacing not exceeding $d/2$.

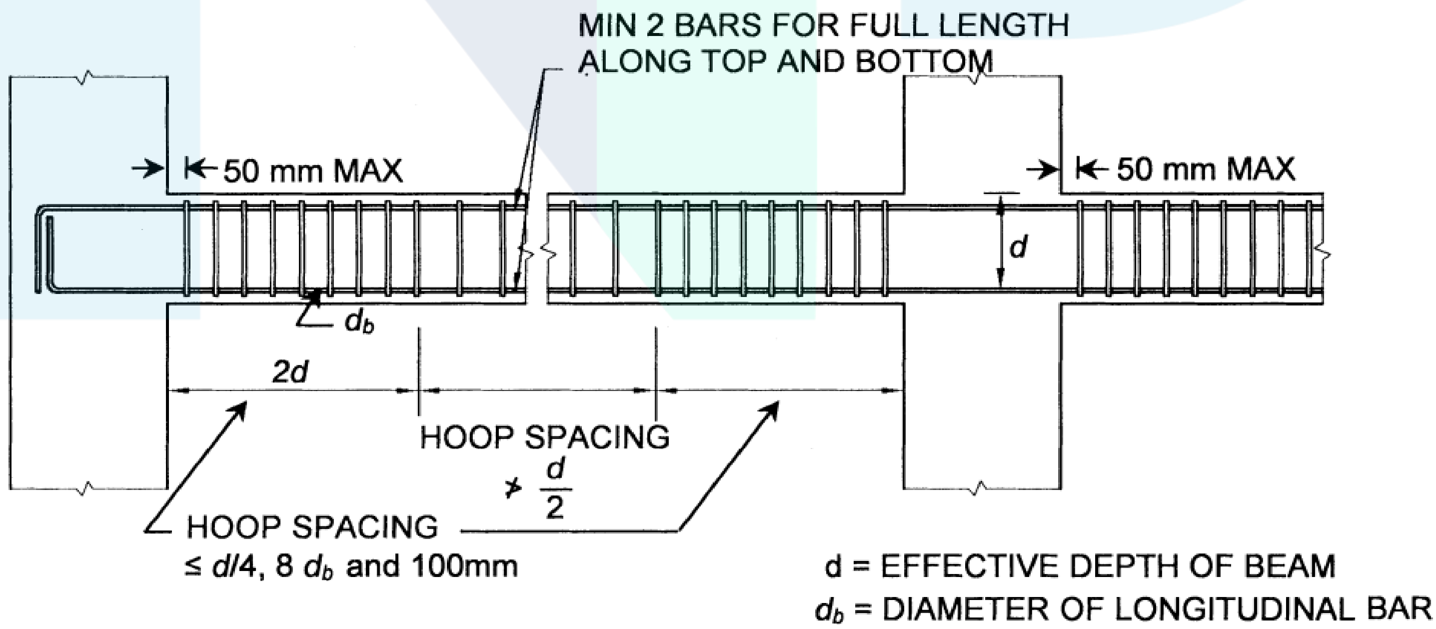


FIG. 6 DETAILS OF TRANSVERSE REINFORCEMENT IN BEAMS

IS Code Reference for Slab

Concrete Reinforcement & Detailing SP-34:1987

9.2 Spacing, Cover and Diameter

9.2.1 *Spacing*

a) The pitch of the bars for main tensile reinforcement in solid slab shall be not more than thrice the effective depth of such slab or 450 mm, whichever is smaller.

b) The pitch of the distribution bars or the pitch of the bars provided against shrinkage and temperature shall not be more than 5 times the effective depth of such slab or 450 mm, whichever is smaller. Table C-6 (*see* Appendix C) give area of bars for different spacing and diameter of bars.

9.2.2 *Cover*

a) The cover at each end of reinforcing bar shall be neither less than 25 mm nor less than twice the diameter of such bar.

b) The minimum cover to reinforcement (tension, compression, shear) shall be not less than 15 mm, nor less than the diameter of bar.

9.2.3 *Bar Diameters* — The main bars in the slab shall not be less than 8 mm (high yield strength bars) or 10 mm (plain bars) and distribution steel shall not be less than 6 mm diameter bars. The diameter of the bar shall not also be more than one-eighth of the slab thickness.

Plain & Reinforced Concrete Code of Practice IS 456:2000

D-1.4 Tension reinforcement provided at mid-span in the middle strip shall extend in the lower part of the slab to within 0.25 *l* of a continuous edge, or 0.15 *l* of a discontinuous edge.

D-1.5 Over the continuous edges of a middle strip, the tension reinforcement shall extend in the upper part of the slab a distance of 0.15 *l* from the support, and at least 50 perccent shall extend a distance of 0.3 *l*.

BBS of RCC Component

Stirrups

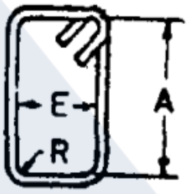
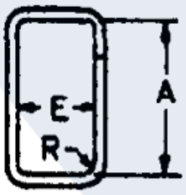
Bar Bending Schedule of Stirrup

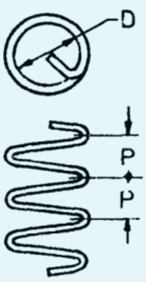
IS Code Reference of Stirrup IS: 2502 - 19631

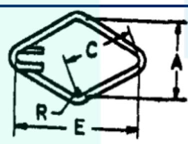
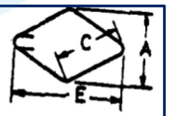
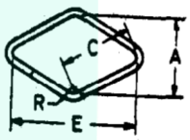
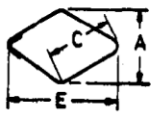
IS : 2502 - 1963

TABLE VIII MEASUREMENT OF BENDING DIMENSIONS FOR BINDERS, STIRRUPS, LINKS AND THE LIKE FOR REINFORCED CONCRETE

(*Clauses* 3.1 *and* 3.1.2)

Ref No.	Method of Measurement of Bending Dimension	Approx Total Length of Bar (*L*) Measured Along Centre Line	Sketch and Dimensions to be Given in Schedule
A		$2(A+E)+24d$	 (*See* Notes 1 and 3)
B		$2(A+E)+20d$	 (*See* Notes 1 and 3)

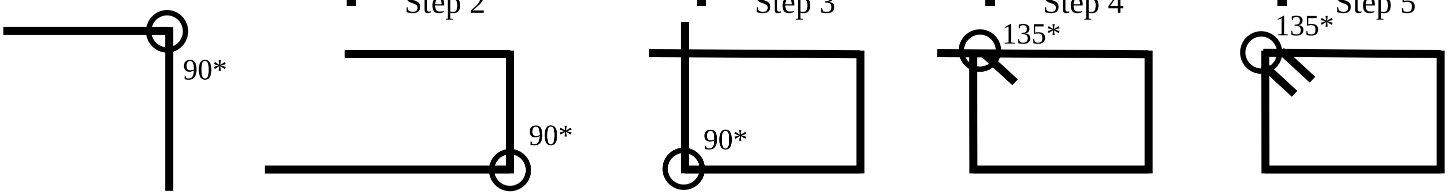
C		Where *P* is not greater than *D*/5 $N\pi(D+d)+8d$ *N* = number of complete and fractional turns *D* = internal dia *P* = pitch of helix *d* = size of bar

F		$4C+24d$	 (*See* Notes 1 and 3)
G		$4C+20d$	 (*See* Notes 1 and 3)

- Note: Bend deduction while calculating cutting length depends upon the company pattern. So, follow as per company requirement. These calculation is for understanding purpose with bend deduction.

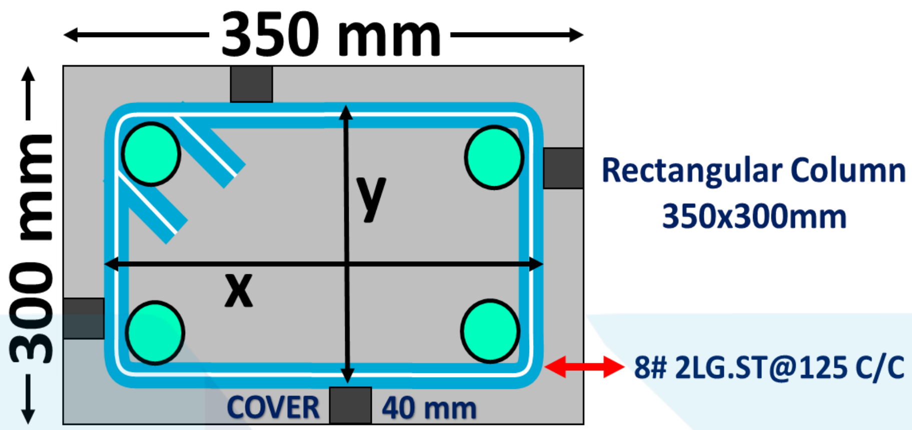
❖ Steps Involved in making a stirrup

- Step 1
- Step 2
- Step 3
- Step 4
- Step 5



Bar Bending Schedule of Stirrup

Rectangular Stirrup

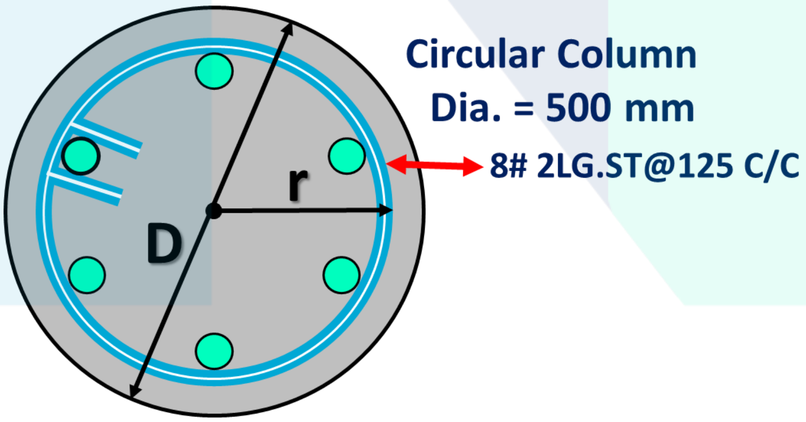


- Follow these value
- Hook Length
  - 90* Hook = 10D
  - 135* Hook = 12D
- Bend Deduction
  - 90* Bend = 2D
  - 135* Bend = 3D

- Cutting Length Formula = 2 (x + y) + Hook Length – Bend Deduction
- Cutting Length Formula = 2 (x + y) + (2x 135*hook) – (3x90*bend) – (2x135*bend)
- Where, x = 350 – 40 – 40 = 270 mm , y = 300 – 40 – 40 = 220 mm
- Cutting Length = 2 (270 + 220) + 2 (12 x 8) – (3x2x8) – (2x3x8)

= Answer solve yourself

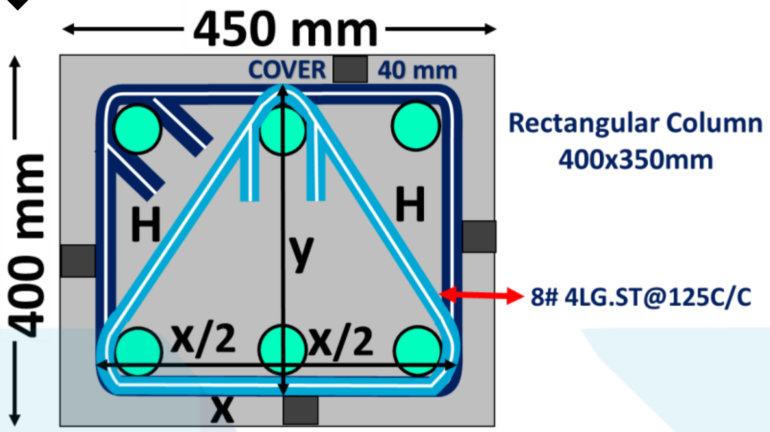
Circular Stirrup



- Cutting Length Formula : 2πr + Hook Length – Bend Deduction
- Cutting Length Formula : 2πr + (2x90*hook) – (2x90*bend)
- r = D/2 – Cover
- r = 500/2 – 40 = 210 mm
- Cutting Length: 2 x π x 210 + (2x10x8) – (2x2x8)

= Answer solve yourself

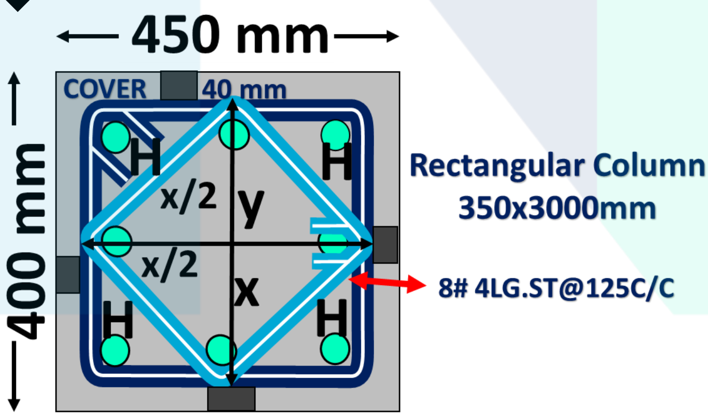
Triangular Stirrup

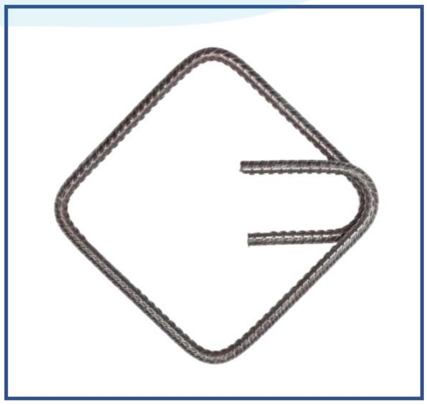


- Cutting Length Formula : (2H + X) + Hook Length – Bend Deduction
- Cutting Length Formula : (2H + X) + (2x135*hook) – (4x135*bend)
- $H = \sqrt{(X/2)^2 + (Y)^2}$, X = 450 – 40 – 40 = 370 mm , Y = 400 – 40 – 40 = 320 mm
- $H = \sqrt{(370/2)^2 + (320)^2}$ H = 370 mm
- Cutting Length Formula : (2x370 + 370) + (2x12x8) – (4x3x8)

= Answer solve yourself

Diamond Stirrup



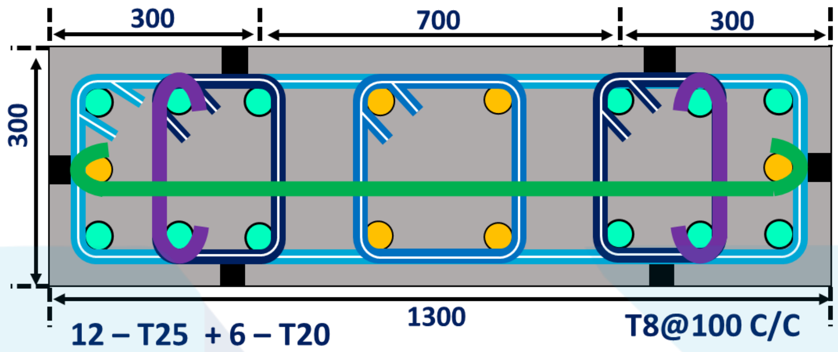


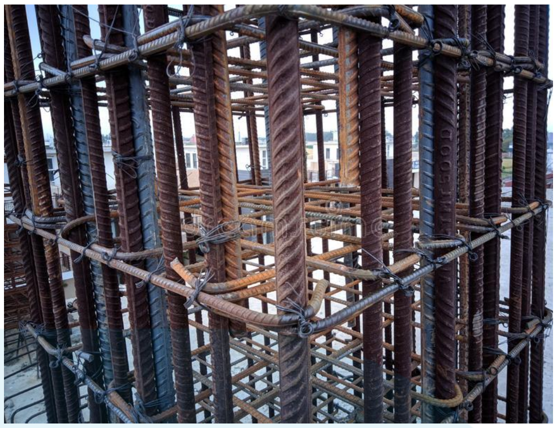
- Cutting Length Formula : (4H) + Hook Length – Bend Deduction
- Cutting Length Formula : (4H) + (2x135*hook) – (3x90*bend)-(2X135*bend)
- $H = \sqrt{(X/2)^2 + (Y/2)^2}$, X = 450 – 40 – 40 = 370 mm , Y = 400 – 40 – 40 = 320 mm
- $H = \sqrt{(370/2)^2 + (320/2)^2}$ H = 245 mm
- Cutting Length Formula : (4 x 245) + (2x12x8) – (3x2x8) – (2x3x8)

= Answer solve yourself

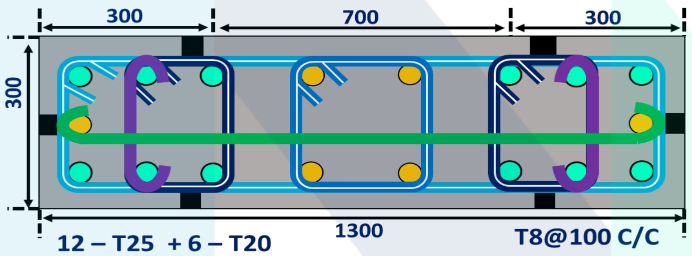
Bar Bending Schedule of Stirrup

Multiple Binders

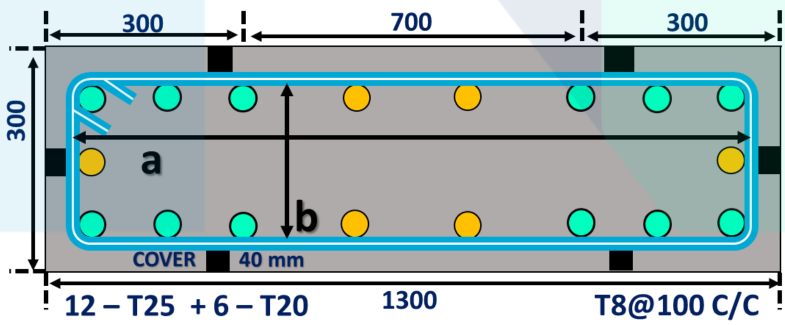




How Multiple Binders are placed in column



Calculating Cutting Length: STEP - 1



Where,

a= 1300-40-40 = 1220 mm

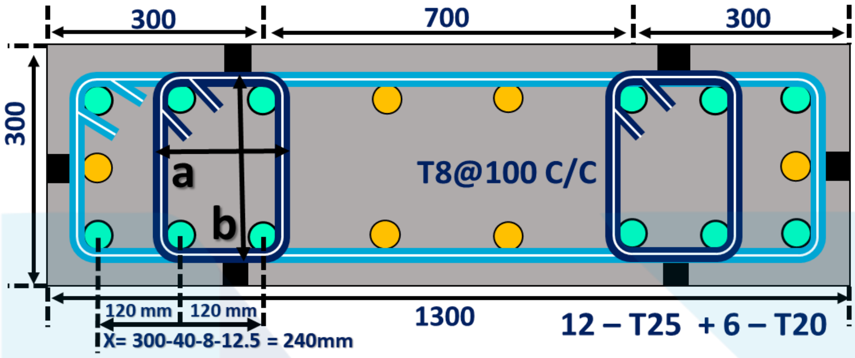
b= 300-40-40 = 220 mm

- Cutting Length (CL) : 2(a+b) + Hook Length – Bend Deduction
- Cutting Length (CL) : 2(a+b) + (2x135*hook) – (3x90*bend) – (2x135*bend)
- Cutting Length (CL) : 2 (1220 + 220) + (2x12x8) – (3x2x8) – (2x3x8)

= Answer solve yourself

Multiple Binders

Calculating Cutting Length: STEP - 2



Where,

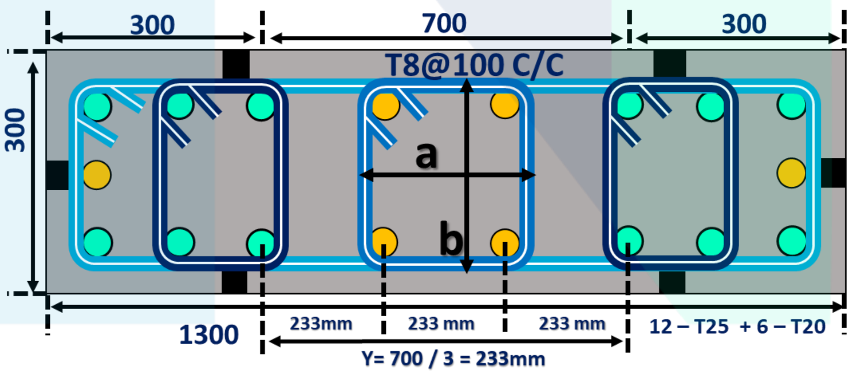
a= 120 + 12.5 + 12.5 + 8 + 8 = 161

b= 300-40-40 = 220 mm

- Cutting Length (CL) : 2(a+b) + Hook Length – Bend Deduction
- Cutting Length (CL) : 2(a+b) + (2x135*hook) – (3x90*bend) – (2x135*bend)
- Cutting Length (CL) : 2 (161 + 220) + (2x12x8) – (3x2x8) – (2x3x8)

= Answer solve yourself

Calculating Cutting Length: STEP - 3



Where,

a= 233 +10 + 10 + 8 + 8 = 269 mm

b= 300-40-40 = 220 mm

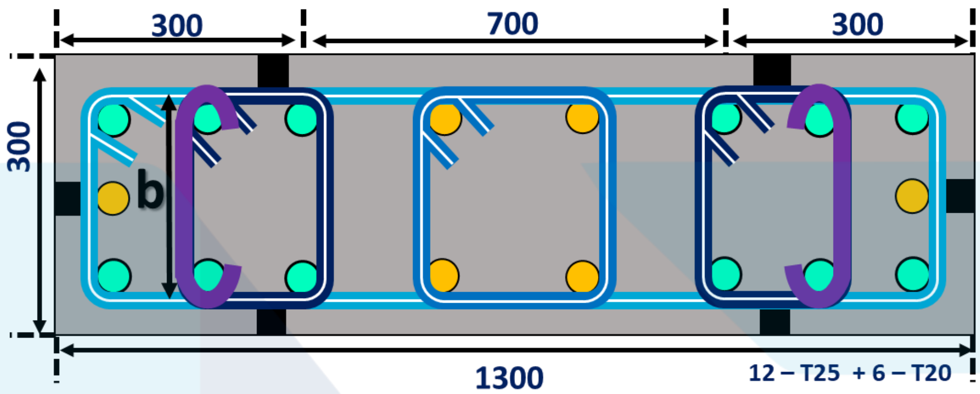
- Cutting Length (CL) : 2(a+b) + Hook Length – Bend Deduction
- Cutting Length (CL) : 2(a+b) + (2x135*hook) – (3x90*bend) – (2x135*bend)
- Cutting Length (CL) : 2 (269 + 220) + (2x12x8) – (3x2x8) – (2x3x8)

= Answer solve yourself

Bar Bending Schedule of Stirrup

Multiple Binders

Calculating Cutting Length: STEP - 4



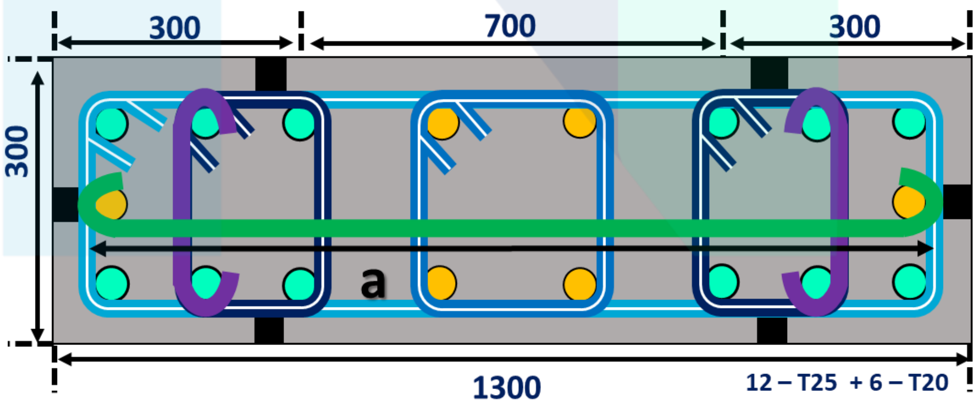
Where,

b= 300-40-40 = 220 mm

- Cutting Length (CL) : b + Hook Length
- Cutting Length (CL) : b + (2x180*hook)
- Cutting Length (CL) : 220 + (2x12x8)

<u>= Answer solve yourself</u>

Calculating Cutting Length: STEP - 5



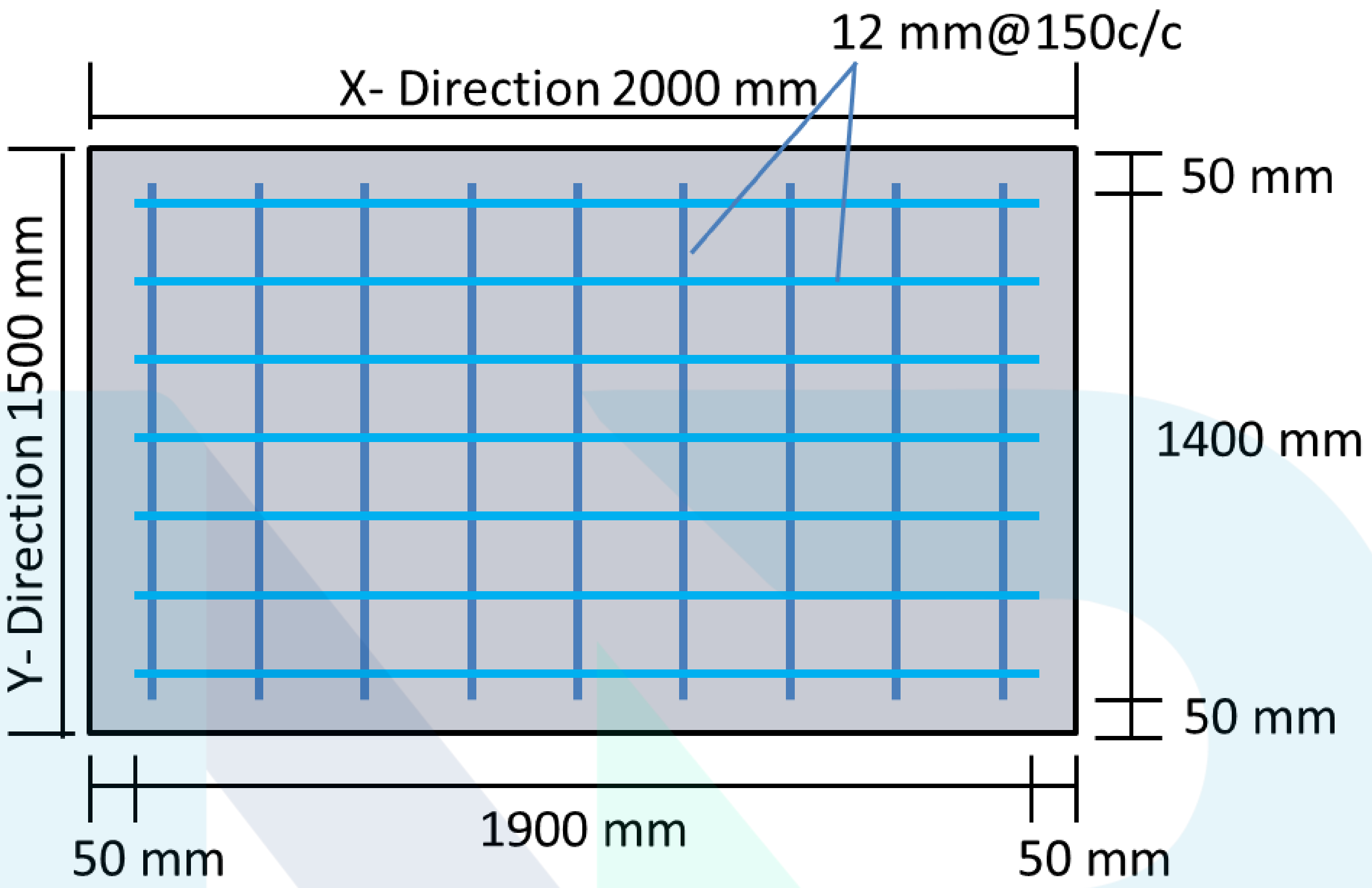
Where,

a= 1300-40-40 = 1220 mm

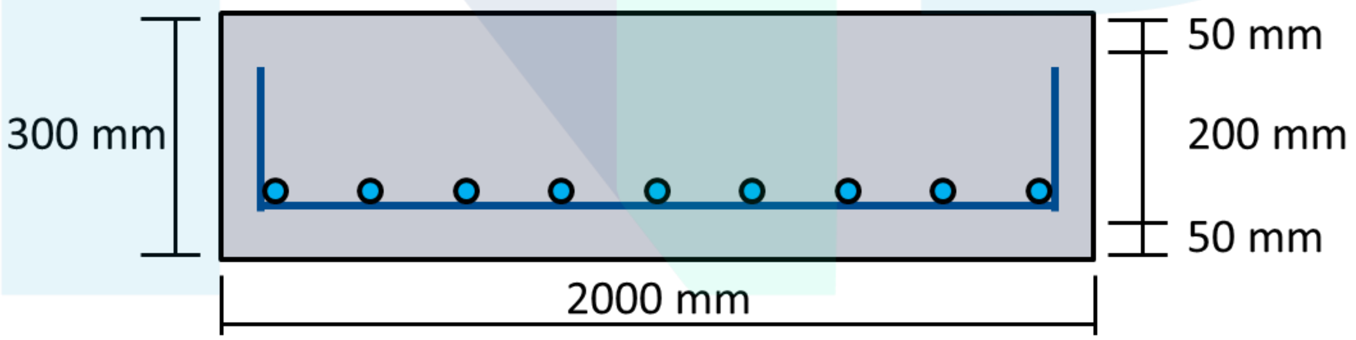
- Cutting Length (CL) : a + Hook Length
- Cutting Length (CL) : a + (2x180*hook)
- Cutting Length (CL) : 1220 + (2x12x8)

<u>= Answer solve yourself</u>

Footing



❑ Footing Plan



❑ Footing Section

❑ Given data:

- Footing length = 2000 mm, width = 1500 mm, depth = 300 mm
- Rebar diameter = 12 mm
- Spacing=150 mm
- Cover = 50 mm on all the sides

Bar Bending Schedule of Footing

- No. of bars along x-direction
  - = [{(footing length) - (2 × cover)} ÷ spacing] + 1
  - = [{(2000 mm) - (2 × 50 mm.)} ÷ 150 mm] +1
  - = [{1900 mm} ÷ 150 mm] +1
  - = 12.67 + 1
  - = 13.67 = 14 nos.
  - (By rounding off)

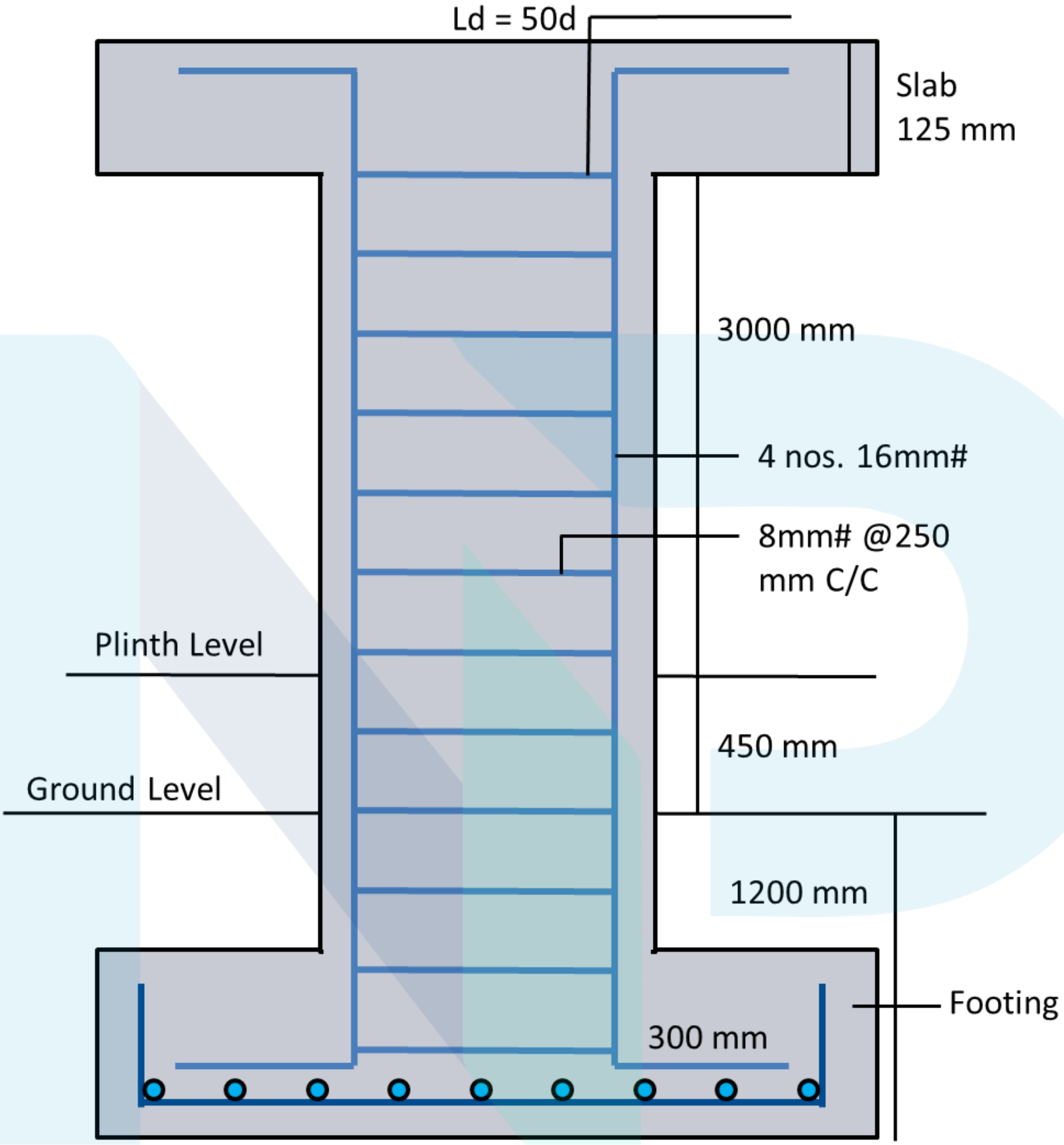
- No. of bars along y-direction
  - = [{(footing width) - (2 × cover)} ÷ spacing] +1
  - = [{(1500 mm) - (2 × 50 mm)} ÷ 150 mm.] +1
  - = [{1400 mm} ÷ 150 mm] +1
  - = 9.33 +1
  - = 10 nos.

- Cutting length of the bar along the x-direction
  - = [{bar length in x-axis} + {2 nos. × (L- bend length)}] – 2nos.× (2 times bar dia. for 90° bend.)
  - = [{footing length - 2 × cover} + 2nos. x {footing height - 2 × cover}] – 2× (2 × bar dia.)
  - = [{2000 mm - 2 × 50 mm} + 2 × {300 mm - 2 × 50 mm}] – 2 × (2 × 12 mm)
  - = [1900 mm + 400 mm] - 48 mm
  - = 2300 mm - 48 mm
  - = 2252 mm. i.e., 2.252 m

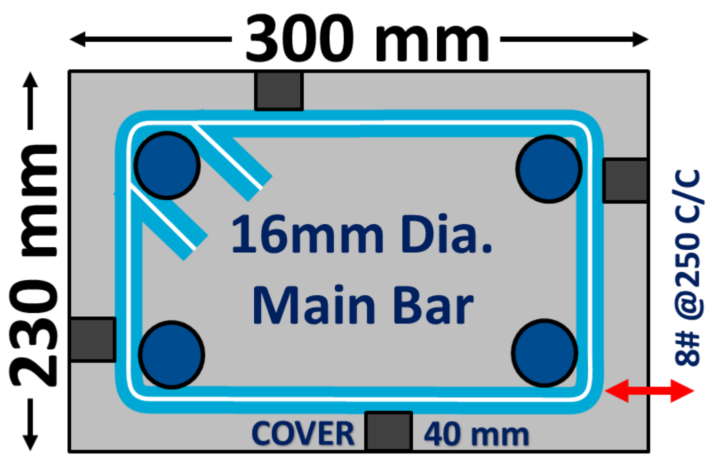
- Cutting length of the bar along the y-direction
  - = [{bar length in y-axis} + {2 nos. × (L- bend length)}] – 2nos.× (2 times bar dia. for 90° bend.)
  - = [{footing width - 2 × cover} + 2nos. x {footing height - 2 × cover}] – 2× (2 × bar dia.)
  - = [{ 1500 mm - 2 × 50 mm } + 2 × {300 mm - 2 × 50 mm }] - 2 × (2 × 12 mm)
  - = [1400 mm + 400 mm] - 48 mm
  - = 1800 mm - 48 mm
  - = 1752 mm. i.e. 1.752 m.

Column

Bar Bending Schedule of Column



- Given data :
- ➢ Longitudinal bar dia. d = 16 mm
- ➢ no. of bars = 4 no.
- ➢ Lateral ties bar dia. d1= 8 mm
- ➢ spacing = 250 mm
- ➢ cover = 40 mm.
- ➢ Column size x = 300 mm & y = 230 mm.
- ➢ Development length Ld = 50d



- Length of the longitudinal bar

➢ = up to ground level + GL to plinth level + plinth level to slab bottom + slab cover + Ld + L-bend in footing - distance from footing bottom.

➢ = {1200 mm + 450 mm + 3000 mm + 20 mm + 50d + 300 mm} - 70 mm.

➢ = {4670 + (50 × 16mm) + 300 mm } - 70 mm

➢ = 5770 mm - 70 mm

➢ = 5700 mm i.e., 5.70 m

- Length of the lateral ties

➢ = perimeter of lateral ties + total hook length - no. of bends

➢ = 2sides × (x – 2 × cover) + 2 sides x (y – 2 × cover) + (2nos x hook length) - (3 nos. × bend)

(Here, we have taken hook length = 12d1 for 135° & bend = 2d1 for 90°L)

➢ = {[2x (300mm - 2× 40mm)] + [2 × (230 mm - 2 × 40 mm)]} + { 2 × 12 × 8mm } - {3×2 x 8mm }

➢ = {[2 x 220 mm] + [2 x 150 mm]} + 192 mm - 48 mm

➢ = {440 mm + 300 mm} + 144 mm

➢ = 884 mm i.e., 0.884 m.

- Total number of lateral ties (stirrups)

➢ = {[length of the longitudinal bar - (Ld + L bend over footing)] ÷ stirrup spacing} +1

➢ = {[5700 mm - (50 x 16 mm + 300 mm)] = 250 mm} +1

➢ = {[5700mm – 1100mm] ÷ 250 mm} +1

➢ = {4600 mm ÷ 250 mm} + 1

➢ = 18.4 + 1

➢ = 19.4 nos.

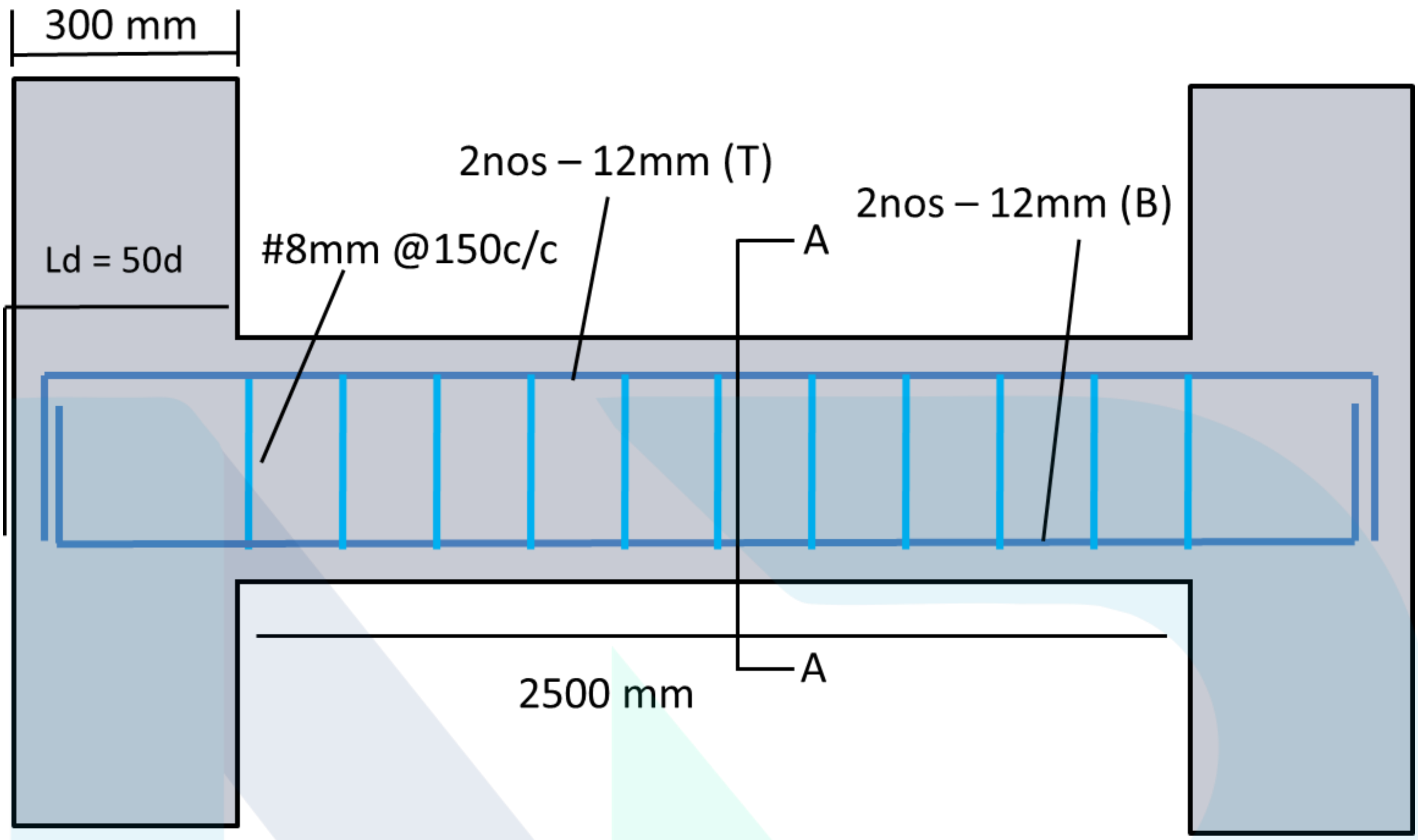
➢ Rounding off, the number of stirrups required = 20 nos.

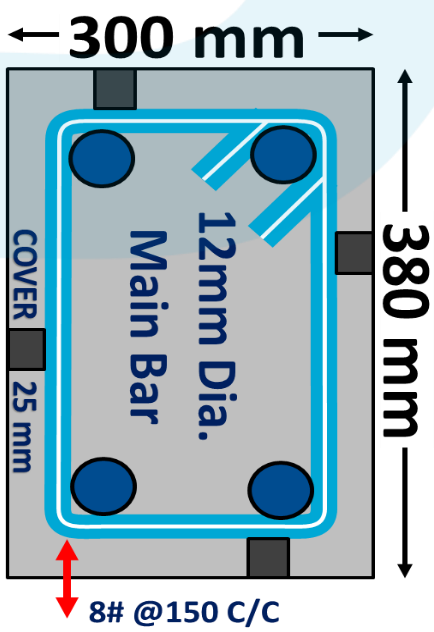
Note: Ld + L bend is deducted from the length as no stirrups are provided over that length.

Beam

NOTES PADHO
Yaha Hoga Jugaad

Bar Bending Schedule of Beam





8# @150 C/C

Section: A - A

❑ Given data:

- Clear span of the beam = 2500 mm,
- Beam size = 300mm x 380 mm
- Top & bottom rebar dia. = 12 mm,
- Number of bars = 4 nos.
- Stirrups #8 mm @ 150 mm c/c
- Clear cover =25 mm on all the sides.

❑ The cutting length of the main bar

- = [(2 times × Ld) + inner distance between columns – (2nos. × 2d)]
- (Let us take development length Ld as 50d, and we have taken 2d for the 90° bend deductions)
- = [(2 × 50 × 12 mm) + 2500 mm - (2 nos. × 2 × 12 mm)]
- = [1200 mm + 2500 mm - 48 mm]
- = 3652 mm i.e., 3.652 m

- Length of Lateral Ties
- = [2nos. x {(a +b)} + (hook length) – (90° bend) – (135° bend)]

Where,
- a = beam width – 2 × cover
- b = beam depth - 2 × cover

- = [2 nos. x {(300 mm – 2 × 25mm) + (380 mm – 2 × 25mm)} + (2nos ×12d) – (3 nos. × 2d) – (2 nos. × 3d)]

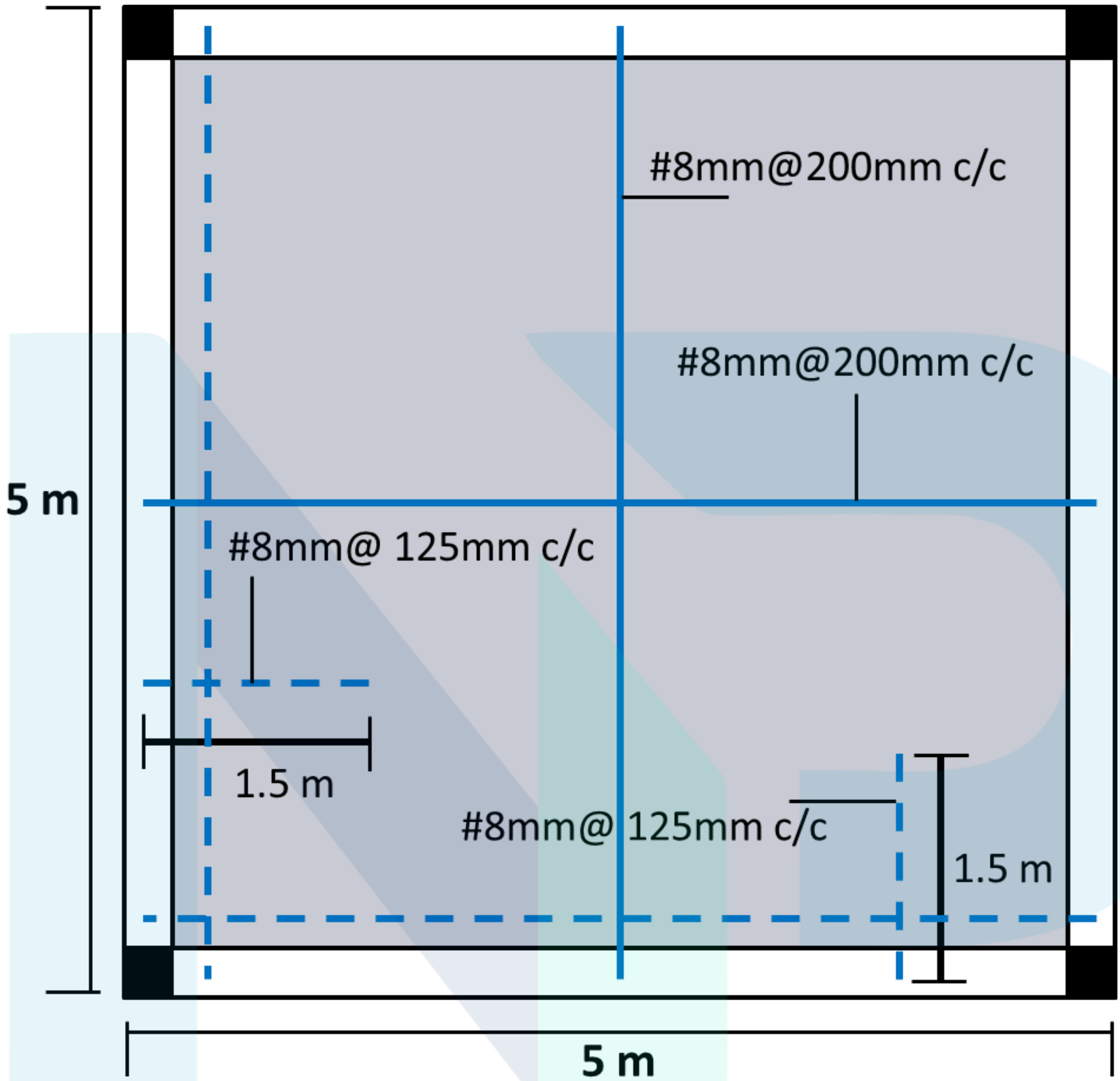
(Here, 12d is taken for hook length.
We have deducted 2d for 90° bend -3nos., & 3d for 135° bend -2nos. as shown in the above drawing.)

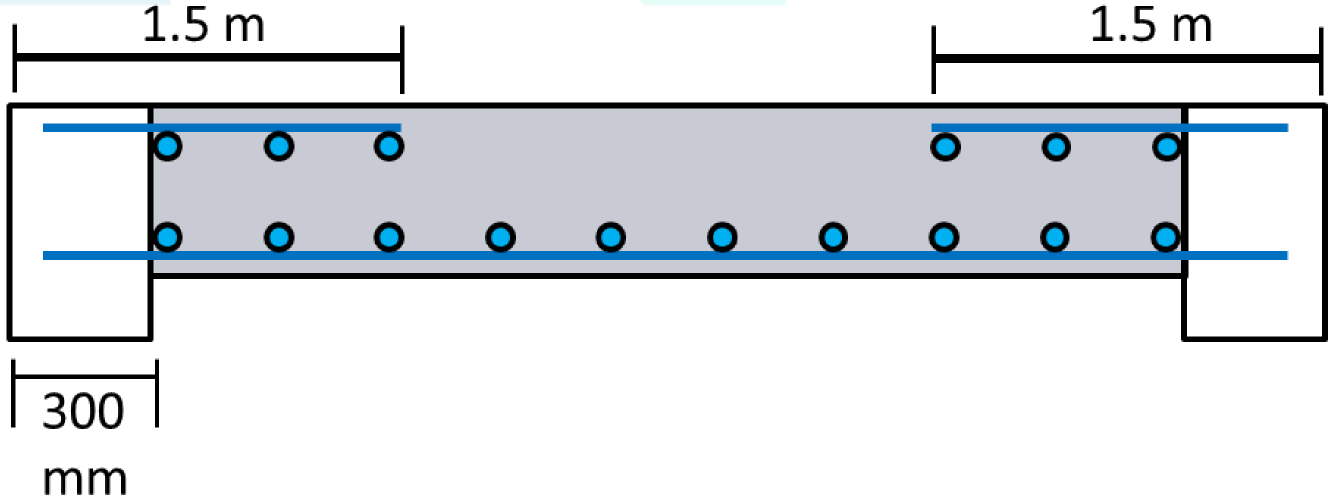
- = [2 nos. x {(250 mm) + (330 mm) } + (2nos. ×12 × 8mm) – (3 nos. × 2 × 8mm) – (2 nos. × 3 × 8 mm)]
- = [2 nos. x { 580 mm } + 192 mm - 48mm - 48mm]
- = [1160 mm + 192 mm - 96 mm]
- = 1256 mm i.e. 1.256 m

- Number of stirrups
- = (plinth beam length ÷ stirrup spacing) + 1
- = (2500 mm ÷ 150 mm) +1
- = 16.66 + 1
- = 17.66 nos.
- = By rounding off, the no. of stirrups required = 18 nos.

Slab

Bar Bending Schedule of Slab





Bar Bending Schedule of Slab

- Details from the diagram:
- Thickness of slab is 150 mm.
- Bottom bar of slab will be provided 8 mm dia of steel is at 200 mm center to center spacing.
- Top bar of slab will be provided 8 mm dia of steel is at 200 mm center to center spacing.
- Extra bar of slab at x-axis will be provided 8 mm dia of steel is at 125 mm center to center spacing.
- Extra bar of slab at y-axis will be provided 8 mm dia of steel is at 125 mm center to center spacing.
- Top Distribution bar of slab at x-axis will be provided 8 mm dia of steel is at 125 mm center to center spacing.
- Top Distribution bar of slab at y-axis will be provided 8 mm dia of steel is at 125 mm center to center spacing.
- Concrete Cover of slab is 20 mm

- Steps for BBS of Slab:
- Numbers of steel in Main bar:
- Number of steel bar = ((Total length of slab – Beam Width) ÷ spacing of bar) +1
- Number of steel bar = (5000 – 300) ÷ 200 + 1
- Number of steel bar = 25 numbers

- Numbers of steel in Distribution bar:
- Number of steel bar = ((Total length of slab – Beam Width) ÷ spacing of bar) +1
- Number of steel bar = (5000 – 300) ÷ 200 + 1
- Number of steel bar = 25 numbers

- Numbers of Extra bar at x-axis:
- Number of steels = ((Total length of slab – Beam Width) ÷ spacing of bar) +1
- Number of steel bar = (5000 – 300) ÷ 125 + 1
- Number of steel bar = 39 numbers
- As the Extra bars on both the X-axis side = 39 x 2 = 78

- Numbers of Extra bar at y-axis:
  - Number of steels = (Total length of slab ÷ spacing of bar) +1
  - Number of steel bar = (5000 – 300) ÷ 125 + 1
  - Number of steel bar = 39 numbers
  - As the Extra bars on both the Y-axis side = 39 x 2 = 78

- Numbers of Top Distribution bar at x-axis:
  - Number of steels = ((1500 – Beam Width) ÷ spacing of bar) +1
  - Number of steel bar = (1500 – 300) ÷ 125 + 1
  - Number of steel bar = 11 numbers
  - As the Extra bars on both the X-axis side = 11 x 2 = 22

- Numbers of Top Distribution bar at y-axis:
  - Number of steels = ((1500 – Beam Width) ÷ spacing of bar) +1
  - Number of steel bar = (1500 – 300) ÷ 125 + 1
  - Number of steel bar = 11 numbers
  - As the Extra bars on both the Y-axis side = 11 x 2 = 22

- Cut Length of Main Bar:
  - Length of Main bar = slab length - 2(concrete cover)
  - = 5000 -2(20)
  - = 4960 mm or 4.96 m
  - Now we find the length of bar.
  - The total length of Main bar = 4960 x number of steels in slab
  - The total length of bar = 4960 x 25
  - The total length of bar = 1,24,000 mm

- Cut Length of Distribution Bar:
  - Length of Distribution bar = slab length - 2(concrete cover)
  - = 5000 -2(20)
  - = 4960 mm or 4.96 m
  - Now we find the length of bar.
  - The total length of Distribution Bar = 4960 x number of steels in slab
  - The total length of Distribution Bar = 4960 x 25
  - The total length of bar = 1,24,000 mm

- Cut Length of Extra Bar at x-axis:
  - Total Length of extra bar = Length of extra bar - concrete cover
  - = 1500 - 20
  - = 1480 mm or 1.48 meter
  - Now we find the length of bar.
  - The total length of extra bar at x-axis = 1480 x number of extra bar in slab
  - The total length of bar = 1480 x 78
  - The total length of bar = 1,15,440 mm

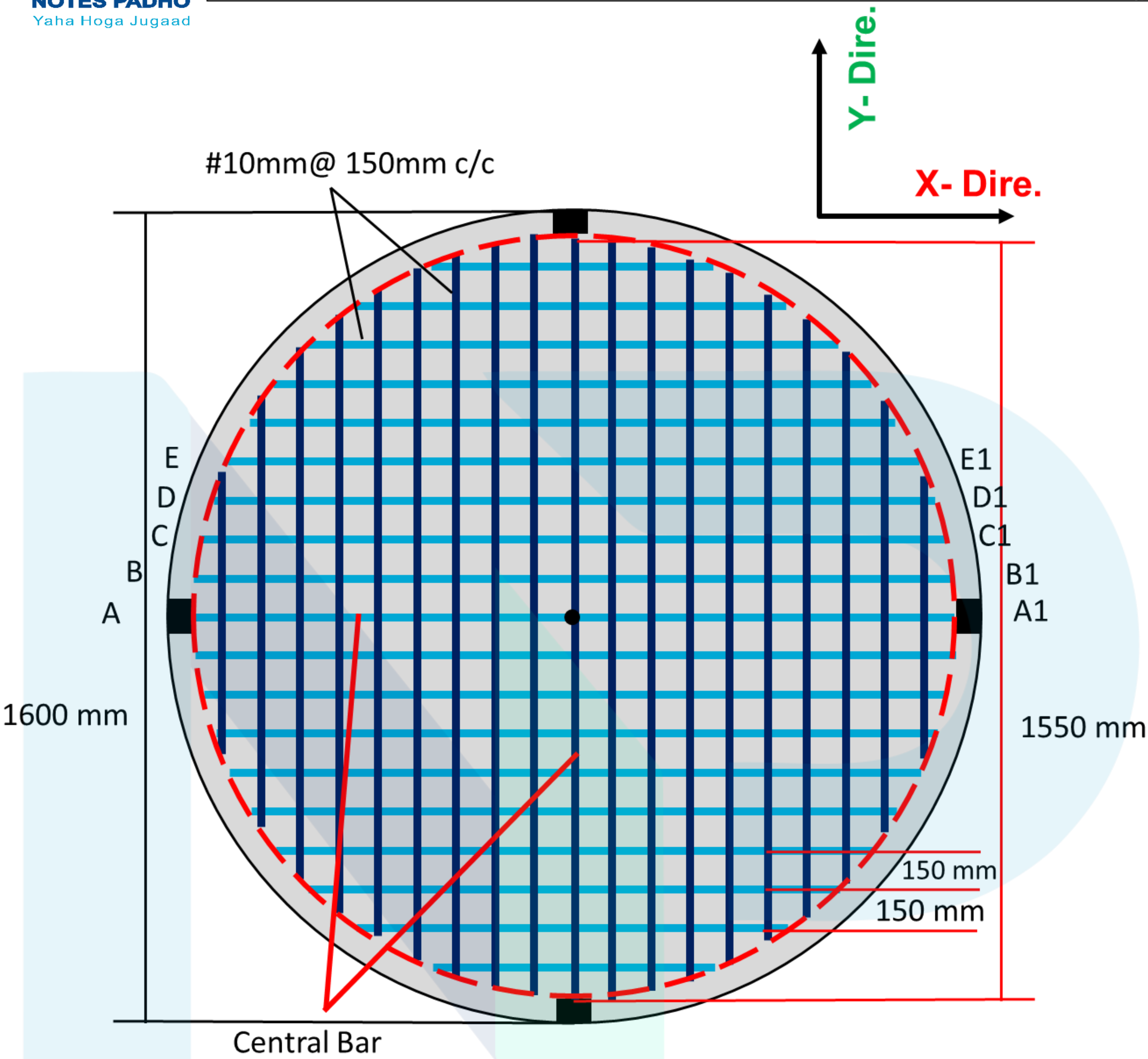
- Cut Length of Extra Bar at y-axis:
  - Length of Extra Bar at y-axis = slab length - concrete cover
  - = 1500 – 20
  - = 1480 mm or 1.48 m
  - Now we find the length of bar.
  - The total length of Extra bar = 1480 x number of extra bar in slab
  - The total length of bar = 1480 x 78
  - The total length of bar = 1,15,440 mm

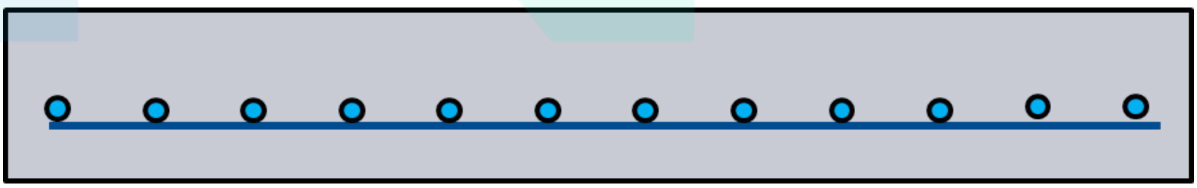
- Cut Length of Top Distribution Bar at x-axis:
  - Length of Top Distribution bar = slab length - 2(concrete cover)
  - = 5000 -2(20)
  - = 4960 mm or 4.96 m
  - Now we find the length of bar.
  - The total length of Top Distribution Bar = 4960 x number of steels in slab
  - The total length of Top Distribution Bar = 4960 x 25
  - The total length of bar = 1,24,000 mm

- Cut Length of Top Distribution Bar at y-axis:
  - Length of Top Distribution bar = slab length - 2(concrete cover)
  - = 5000 -2(20)
  - = 4960 mm or 4.96 m
  - Now we find the length of bar.
  - The total length of Top Distribution Bar = 4960 x number of steels in slab
  - The total length of Top Distribution Bar = 4960 x 25
  - The total length of bar = 1,24,000 mm

Circular Slab

Bar Bending Schedule of Circular Slab





- Given data:
  - Diameter of the circular slab = 1600mm = 1.6m.
  - Clear cover for the reinforcement = 25mm.
  - Rebar diameter = 10mm.
  - Rebar spacing = 150mm c/c

- The formula for finding the length of the bar
- =2√r2 - d2

Where,

- r = [diameter of the slab - (2nos.x clear cover)] ÷ 2
- d = c/c distance of the individual bars from the central bar of the circle.

- As you can observe in the above-given drawing, I have drawn a red-coloured circle by deducting the clear cover. Radius r in the above formula will be the radius of this red circle.

- r = [1600mm - (2nos. x 25mm)] ÷ 2
- = [1550mm] ÷ 2
- = 775mm.

- The value of r will be the same for the cutting length calculation of every individual bar of the slab.
- Note: All the rebars of the circular slab act as a chord of the red circle. To gain a basic understanding of this theory, you must go through the article,
- "The length of the individual bars in the upper half part of the circular slab will be different.
- The cutting length of the bars in the lower half portion will be equal to the upper half part bars.
- I have named the bars for the half portion of the Circular slab and let us find out the cutting length of each of these bars."

- 1. Cutting length of bar AA1
- = diameter of red circle = 1550mm

- 2. Cutting length of bar BB1
- =2√r2 – d2
- Here, d = 150mm.
- = 2 × √7752 – 1502
- = 2 × √600625-22500
- = 2 × √578125
- = 2 × 760.345
- = 1520.69mm = 1.521m

- 3. Cutting length of the bar CC1
  - Here, d = 300mm.
  - =2√r2 - d2
  - = 2 × √7752 - 3002
  - = 2 × √ 600625 - 90000
  - = 2 × √ 510625
  - = 2 × 714.58
  - = 1429.16mm = 1.429m

- 4. Cutting length of the bar DD1
  - Here, d = 450mm.
  - =2√r2 - d2
  - = 2 × √7752 - 4502
  - = 2 × √600625-202500
  - = 2 × √398125
  - = 2 × 630.971
  - = 1261.94mm = 1.261m

- 5.Cutting length of the bar EE1
  - Here, d = 600mm.
  - =2√r2 - d2
  - = 2 × √7752 - 6002
  - = 2 × √600625 - 360000
  - = 2 × √ 240625
  - = 2 × 490.535
  - = 981.07mm = 0.981m

- 6. Cutting length of the bar FF1
  - Here, d = 750mm.
  - =2√r2 - d2
  - = 2 × √√7752 - 7502
  - = 2 × √ 600625-562500
  - = 2 × √38125
  - = 2 × 195.256
  - = 390.51mm = 0.39 m

- No. of bars in a circular slab
  - The no. of top bars in the circular slab
  - = [(diameter of the slab) ÷ c/c bar spacing] +1
  - = [(1600mm) ÷ 150mm] + 1
  - = 11 nos.

- That means 5 bars on either side of the central bar AA1
  - Total no. of bars
  - = Top bars + Bottom bars
  - = 11nos + 11nos.=22nos.

- As the upper half part of the circle is identical to the bottom half part, you will have 2nos of central common bars and 4 nos. of the chord bars having the same cutting length.

1. Cutting length of central bar AA1 = 1.55m = 2nos.
2. Cutting length of bar BB1 = 1.521m = 4nos.
3. Cutting length of bar CC1 = 1.429m = 4nos.
4. Cutting length of bar DD1 = 1.261m = 4nos.
5. Cutting length of bar EE1 = 0.981m = 4nos.

BBS Excel Format

Bar Bending Schedule Format

Serial No.

Details of element you are solving

Number of element you are solving

No. Of Bar

Cut Length of Element

Total length of bar in element

Total Wt. of Bar

S.No.	Description	Shape of Bar	No. of Items	Dia of bar	No. of Bars	CL_1 (m)	CL_2 (m)	CL_3 (m)	Cutting Length (m)	Total Length	Unit Wt.	Total Wt.	8mm (KG)	10mm (KG)	12mm (KG)	16 mm (kg)
FOOTING																
1	F1															
	X- dir	200 200	15	12 #	14				2.25	472.92	0.889	420.37	-	-	420.37	-
	Y- dir	200 200		12 #	10				1.75	262.80	0.889	233.60	-	-	233.60	-
2	F2															
	X- dir	200 200	8	12 #	12				1.75	168.19	0.889	149.50	-	-	149.50	-
	Y- dir	200 200		12 #	8				1.28	81.92	0.889	72.82	-	-	72.82	-

Bar shape req. for bar bender

Dia. Of Bar

Diff. Cut Length value in one element ex. 1 column but different cut length after lap.

Unit Wt. of Bar directly put formula

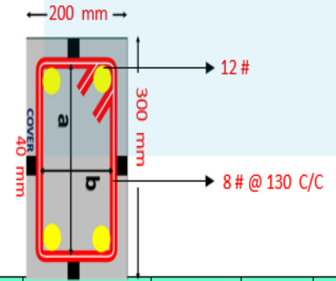
Put value of Total wt. under same dia. of bar. Helps to calculate quantity at end.

Visit : www.NotesPadho.com to Download This Excel Format

Bar Bending Schedule Automatic Format for Stirrup

BBS of Rectangular Stirrup

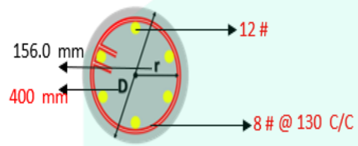
General Data			
Section	200 mm	300 mm
Main Dia at conner	12 #	
Dia of tie/ Stirrups	8 #	@ 130 C/C
Clear Cover	40 mm	



S.No.	Description	Shape of Bar	No. of Items	Dia of bar	No. of bars	Cutting lenngth (m)	Total Length	Unit Wt	Total Wt.	8mm (KG)	10mm (KG)	12mm (KG)	16 mm(kg)
	2LG.ST		1	8 #	1	0.84 m	0.84 m	0.40 kg	0.33 kg	0.33 kg	-	-	-

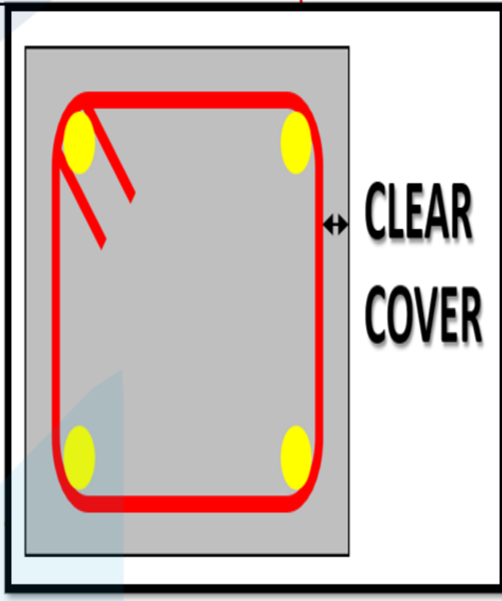
BBS of Circular Stirrup

General Data			
Circular Column Dia	400 mm	
Main Dia at conner	12 #	
Dia of tie/ Stirrps	8 #	@ 130 C/C
Clear Cover	40 mm	
r (= D/2 – Cover – Half dia. of	156.0 mm	



S.No.	Description	Shape of Bar	No. of Items	Dia of bar	No. of bars	Cutting lenngth (m)	Total Length	Unit Wt	Total Wt.	8mm (KG)	10mm (KG)	12mm (KG)	16 mm(kg)
	2LG.ST		1	8 #	1	1.14 m	1.14 m	0.40 kg	0.45 kg	0.45 kg	-	-	-

Section	Size of the Column or Beam
Main Dia.	Diameter of Column or Beam reinforcement.
Dia. of Tie	Diameter Of Stirrups along with c/c spacing between them.
Clear Cover	The clear cover is the distance between the exposed concrete surface to



In general / min
Beam - 25 mm
Column -40 mm

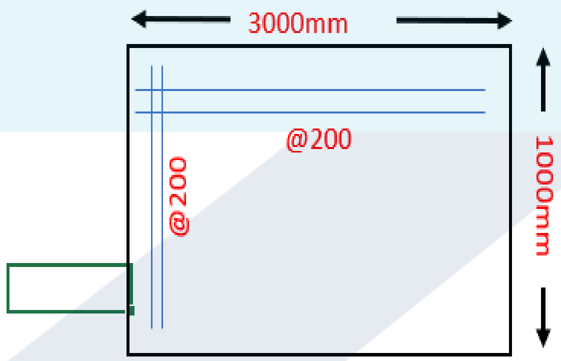
Note: This automatic excel format will help you calculate BBS of different components. But you should learn manual calculation first because automatic calculation is not always 100% accurate. Value changes as per different conditions.

Visit : www.NotesPadho.com to Download This Excel Format

BBS of Double mesh Footing

General Data

Footing ID	F2	
Footing Size	1000mm	3000mm
Height (H)	800mm	
	200mm	
Y -dir Top Reinforcement	16#	@200C/C
X -dir Top Reinforcement	16#	@200C/C
Y -dir Bottom Reinforcement	16#	@150C/C
X -dir Bottom Reinforcement	16#	@150C/C
Clear Cover	50mm	
No. of Items	1	



S.No.	Description	Shape of Bar	No. of Items	Dia of bar	No. of bars	Cutting lenngth (m)	Total Length	Unit Wt	Total Wt.	8mm (KG)	10mm (KG)	12mm (KG)	16 mm(kg)
	Footing F2												
	X -dir Top Reinforcement		1	16#	16	1.94	30.98 m	1.58 kg	48.95 kg	-	-	-	48.95 kg
	Y -dir Top Reinforcement		1	16#	6	3.90	23.42 m	1.58 kg	37.02 kg	-	-	-	37.02 kg
	X -dir Bottom Reinforcement		1	16#	21	1.94	40.66 m	1.58 kg	64.25 kg	-	-	-	64.25 kg
	Y -dir Bottom Reinforcement		1	16#	7	3.90	27.33 m	1.58 kg	43.18 kg	-	-	-	43.18 kg

Note: This automatic excel format will help you calculate BBS of different components. But you should learn manual calculation first because automatic calculation is not always 100% accurate. Value changes as per different conditions.

Visit : www.NotesPadho.com to Download This Excel Format

Bar Bending Schedule Automatic Format for Column

Column BBS

Description	value
UG Pedestal Depth	1700
Footing Depth	300
Plinth Beam Depth	300
Floor Beam Depth	300
No of Floor Beam	1
Floor Height	3000
Parapet Wall Height	500
Footing Development Length	300
Dia Of Bar	12
Cover	40
Footing Main Bar	12
Footing Distribution Bar	12
No of Bar in Column	6

Description	Value
Cutting Length Of One Bar	6336
Weight Of One Bar	5.632
Steel Required for 1 Column	38.016
Steel Weight for 1 Column	33.792

Note: This automatic excel format will help you calculate BBS of different components. But you should learn manual calculation first because automatic calculation is not always 100% accurate. Value changes as per different conditions.

Bar Bending Schedule of Beam

General Data

Beam ID	B2		
First Support	Beam	250 mm	350 mm
Last Support	Beam	250 mm	350 mm

Clear Cover	25 mm	
No of Items	2	
Stirrups	8#	@120C/C
Beam Section	250 mm	300 mm
Development Length	50 d	
Lap Length	50 d	

Support & members

Members (C/C)

Member 1	2395 mm
Member 2	3050 mm
Member 3	3255 mm
Member 4	2375 mm
Member 5	2510 mm
Member 6	2375 mm
Member 7	3255 mm
Member 8	3050 mm
Member 9	2395 mm
Member 10	

Support

Intermidiate Support 1	250 mm
Intermidiate Support 2	250 mm
Intermidiate Support 3	250 mm
Intermidiate Support 4	400 mm
Intermidiate Support 5	400 mm
Intermidiate Support 6	250 mm
Intermidiate Support 7	250 mm
Intermidiate Support 8	250 mm
Intermidiate Support 9	

2771

3650

Main Reinforcement

Top	2	12
Bottom	2	12

Note: This automatic excel format will help you calculate BBS of different components. But you should learn manual calculation first because automatic calculation is not always 100% accurate. Value changes as per different conditions.

BBS of Slab

	SIZE OF SLAB	LONGER SPAN (LY)	SHORTER SPAN (LX)	COVER	THICKNESS OF SLAB	VOLUE OF H	
						MAIN BAR	DISTRIBUTION BAR
		6000	4000	20	125	77	77

S.NO.	TYPE OF BAR	DIA OF BAR	SPACING
1	MAIN BAR	8	130
2	DISTRIBUTION BAR	8	130
3	TOP EXTRA BAR IN LEFT & RIGHT	8	260
4	TOP EXTRA BAR IN TOP & BOTTOM SIDE	8	260
5	TOP EXTRA DISTRIBUTION BAR IN LEFT & RIGHT SIDE	8	130
6	TOP EXTRA DISTRIBUTION BAR IN TOP & BOTTOM SIDE	8	130

S.NO.	TYPES OF BAR	NO. OF BAR	DIA. OF BAR(IN MM)	CUTTING LENGTH(IN M)	TOTAL LENGTH(IN M)	UNIT WT.	TOTAL WT(IN KG)	Unit
1	MAIN BAR	48	8	4.784	229.64832	0.395	90.73	
2	DISTRIBUTION BAR	32	8	6.784	217.09888	0.395	85.77	
3	TOP EXTRA BAR IN LEFT & RIGHT	18	8	1.717	30.912	0.395	12.21	
4	TOP EXTRA BAR IN TOP & BOTTOM SIDE	14	8	2.384	33.376	0.395	13.19	
5	TOP EXTRA DISTRIBUTION BAR IN LEFT & RIGHT SIDE	24	8	6.768	162.432	0.395	64.17	
6	TOP EXTRA DISTRIBUTION BAR IN TOP & BOTTOM SIDE	34	8	4.768	162.112	0.395	64.04	
TOTAL WT. OF STEEL TO BE USED IN TWO-WAY SLAB							**330.11**	Kg
ADD 5% WASTAGE							16.51	
GRAND TOTAL WT. OF TWO-WAY SLAB							346.61	Kg

Note: This automatic excel format will help you calculate BBS of different components. But you should learn manual calculation first because automatic calculation is not always 100% accurate. Value changes as per different conditions.

Visit : www.NotesPadho.com to Download This Excel Format

Bar Bending Schedule Automatic Format for Circular Slab

Size (outer to outer)	4000mm	
Reinforcement	12#	#######
Clear cover	20mm	
No of items	1	

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S.No.	DESCRIPTION	SHAPE OF BARS	NO. OF ITEMS	DIA.OF BARS	NO. OF BARS	CUTTING LENGTH	TOTAL LENGTH	UNIT WEIGHT	TOTAL WEIGHT	8mm(Kg)	10mm(Kg)	12mm(Kg)	16mm(Kg)
	L1		1	12 #	2	3.96 m	7.92 m	0.89 kg	7.04 kg	-	-	7.04 kg	-
	L2		1	12 #	4	3.95 m	15.79 m	0.89 kg	14.04 kg	-	-	14.04 kg	-
	L3		1	12 #	4	3.91 m	15.66 m	0.89 kg	13.92 kg	-	-	13.92 kg	-
	L4		1	12 #	4	3.86 m	15.43 m	0.89 kg	13.71 kg	-	-	13.71 kg	-
	L5		1	12 #	4	3.77 m	15.10 m	0.89 kg	13.42 kg	-	-	13.42 kg	-
	L6		1	12 #	4	3.66 m	14.66 m	0.89 kg	13.03 kg	-	-	13.03 kg	-
	L7		1	12 #	4	3.53 m	14.11 m	0.89 kg	12.54 kg	-	-	12.54 kg	-
	L8		1	12 #	4	3.36 m	13.43 m	0.89 kg	11.94 kg	-	-	11.94 kg	-
	L9		1	12 #	4	3.15 m	12.60 m	0.89 kg	11.20 kg	-	-	11.20 kg	-
	L10		1	12 #	4	2.90 m	11.59 m	0.89 kg	10.30 kg	-	-	10.30 kg	-
	L11		1	12 #	4	2.58 m	10.34 m	0.89 kg	9.19 kg	-	-	9.19 kg	-
	L12		1	12 #	4	2.19 m	8.76 m	0.89 kg	7.78 kg	-	-	7.78 kg	-
	L13		1	12 #	4	1.65 m	6.60 m	0.89 kg	5.87 kg	-	-	5.87 kg	-
	L14		1	12 #	4	0.69 m	2.75 m	0.89 kg	2.44 kg	-	-	2.44 kg	-

Note: This automatic excel format will help you calculate BBS of different components. But you should learn manual calculation first because automatic calculation is not always 100% accurate. Value changes as per different conditions.

Bar Bending Schedule Automatic Format for Sunken Slab

Bar Bending Schedule of Sunken Slab

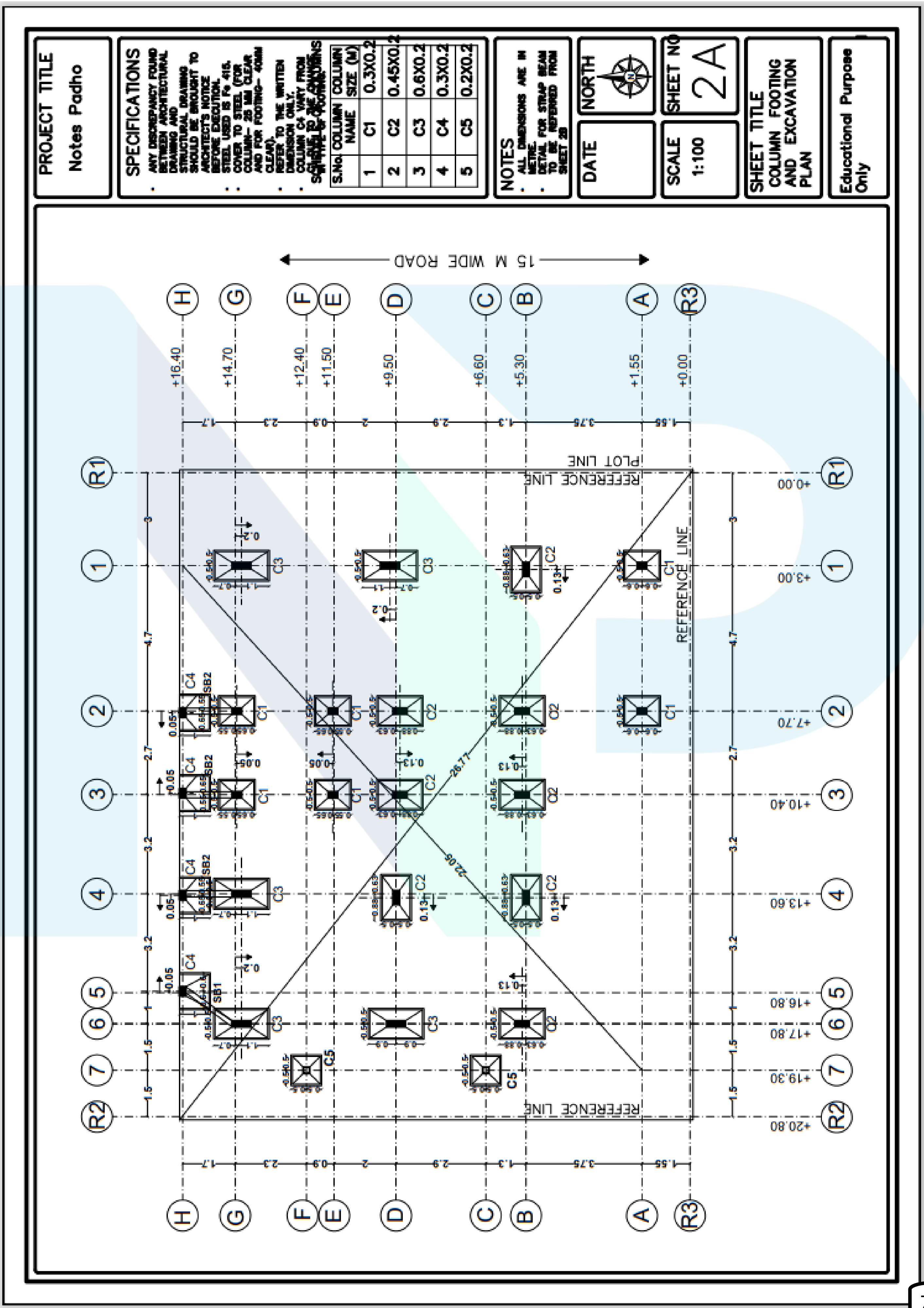
General Data					
Sunken Slab	S4				
Longer Span	2625 mm	Beam Section	250 mm	300 mm	
Shorter Span	1025 mm	Clear Cover of Beam	25 mm		
		Top Dis at			
Clear Cover of Slab	20 mm	Dia. Of Main Bar	8	125	
No. of Items	4	Dia. Of Dis. Bar	8	125	

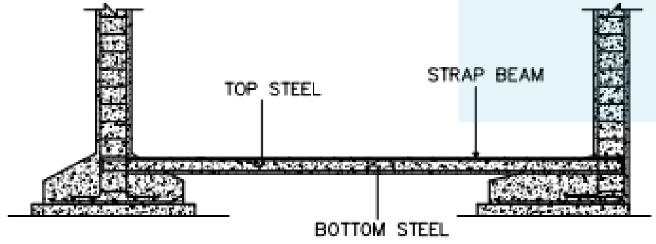
S.No.	Description	Shape of Bar	No. of Items	Dia of bar	No. of bars	Cutting lenngth (m)	Total Length	Unit Wt	Total Wt.	8mm (KG)	10mm (KG)	12mm (KG)	16 mm(KG)
	Sunken Slab S4												
	Bottom Main Bar		4	8 #	22	1.48	129.80 m	0.40 kg	51.28 kg	51.28 kg	-	-	-
	Bottom Distribution Bar		4	8 #	10	3.08	123.00 m	0.40 kg	48.59 kg	48.59 kg	-	-	-
	Top Main Bar		4	8 #	22	1.48	129.80 m	0.40 kg	51.28 kg	51.28 kg	-	-	-
	Top Distribution Bar		4	8 #	10	3.08	123.00 m	0.40 kg	48.59 kg	48.59 kg	-	-	-

Note: This automatic excel format will help you calculate BBS of different components. But you should learn manual calculation first because automatic calculation is not always 100% accurate. Value changes as per different conditions.

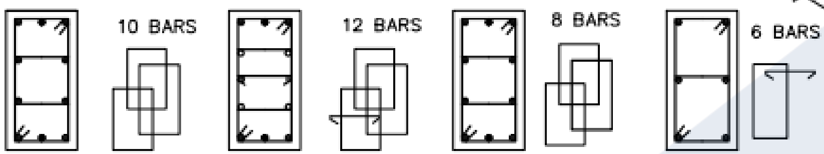
BBS Sample Drawings

Sample Drawing



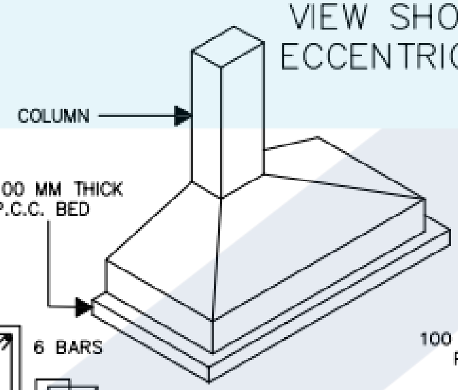


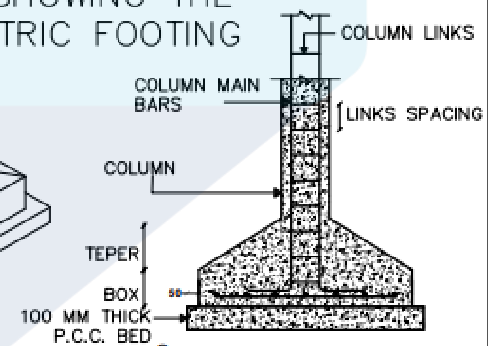
DETAIL OF STRAP BEAM

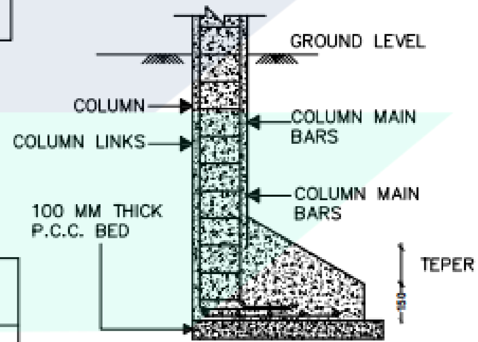


TYPICAL STIRRUP DETAIL (PROVIDE 135° HOOK WITH 0.075 EXTENSION)

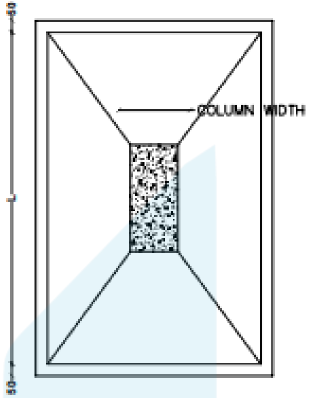
VIEW SHOWING THE ECCENTRIC FOOTING







TYPICAL DETAIL OF ECCENTRIC FOOTING



TYPICAL DETAIL OF COLUMN FOOTING

SCHEDULE OF STRAP BEAM

BEAM NO.	SIZE	BOTTOM STEEL		TOP BARS	STIRRUPS
		STRAIGHT	BENT		
SB	0.2x0.45	2 X 16 T	2 X 16 T	2 X 16 T	8 Ø @ 150 C/C

SCHEDULE OF COLUMN AND COLUMN FOOTING

COL. NO.	EXCAVATION SIZE (m)	P.C.C THICK (m)	FOOTING SIZE (m)	FOOTING DEPTH		REINFORCEMENT ALONG		COLUMN SIZE (m)	VERTICAL BARS	RINGS C/C	COLUMN SECTION AT G. FLOOR
				AT COLUMN FACE (m)	AT FOOTING END (m)	LONG LOWER TIER	SHORT UPPER TIER				
C1	1x1.2	0.1	0.9x1.1	0.38	0.15	7 X 10 T	8 X 10 T	0.2x0.3	4 X 12 T 2 X 10	8 ø @ 150 C/C	
C2	1x1.5	0.1	0.9x1.4	0.45	0.15	7 X 12 T	8 X 12 T	0.2x0.45	4 X 12 T 4 X 10	8 ø @ 150 C/C	
C3	1x1.8	0.1	0.9x1.7	0.6	0.15	7 X 12 T	9 X 12 T	0.2x0.6	10 X 12 T	8 ø @ 150 C/C	
C4	0.6x1.2	0.1	0.9x1.1	0.4	0.15	7 X 10 T	8 X 10 T	0.2x0.3	6 X 12 T	8 ø @ 150 C/C	
C5	1x1	0.1	0.9x0.9	0.4	0.15	6 X 10 T	8 X 10 T	0.2x0.2	4 X 12 T	8 ø @ 150 C/C	

PROJECT TITLE
Notes Padho

SPECIFICATIONS
- ANY DISCREPANCY FOUND BETWEEN ARCHITECTURAL DRAWING AND STRUCTURAL DRAWING SHOULD BE BROUGHT TO ARCHITECT'S NOTICE BEFORE EXECUTION.
- STEEL USED IS Fe 415.
- COVER TO STEEL (FOR COLUMN- 25 MM CLEAR AND FOR FOOTING- 40MM CLEAR).
- REFER TO THE WRITTEN DIMENSION ONLY.
- COLUMN C4 VARY FROM C1 DUE TO THE CHANGE IN TYPE OF FOOTING.

SCHEDULE OF COLUMNS

S.No.	COLUMN NAME	COLUMN SIZE (M)
1	C1	0.3X0.2
2	C2	0.45X0.2
3	C3	0.6X0.2
4	C4	0.3X0.2
5	C5	0.2X0.2

NOTES
- ALL DIMENSIONS ARE IN METRE.
- DETAIL FOR STRAP BEAM TO BE REFERRED FROM SHEET 2B

DATE

NORTH

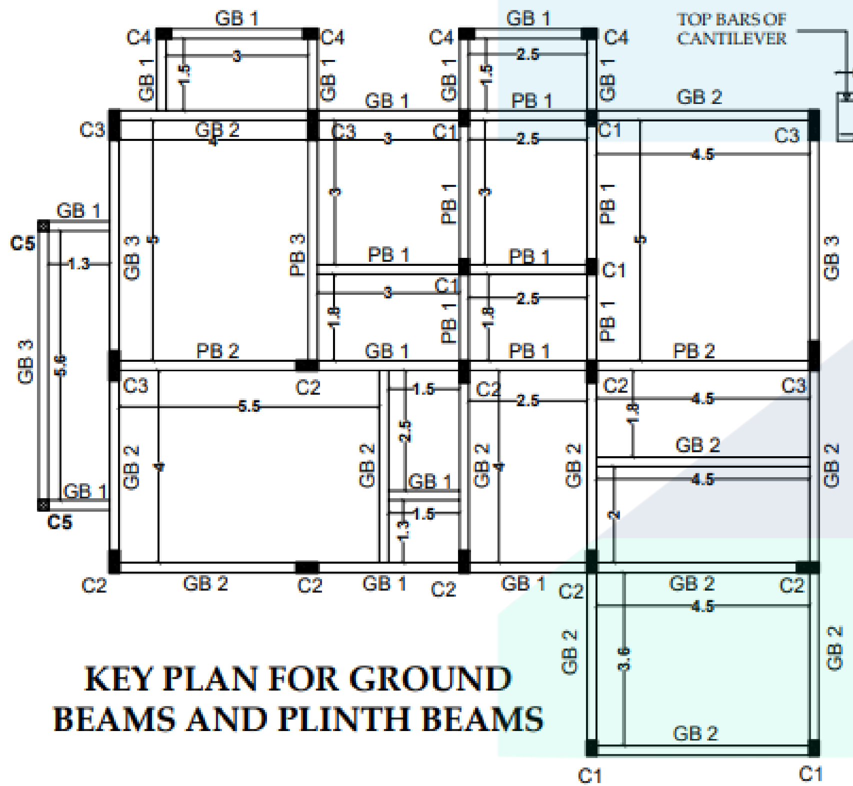
SCALE
1:100

SHEET NO
2B

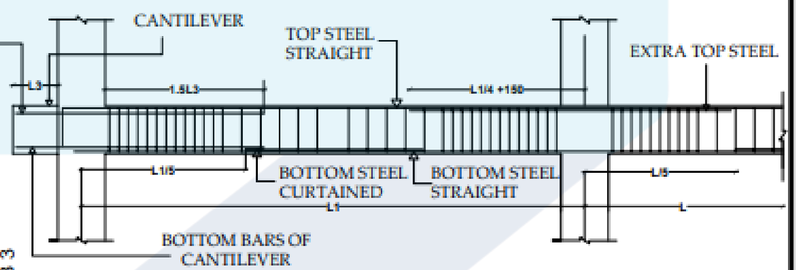
SHEET TITLE
COLUMN FOOTING DETAILS

Educational Purpose Only

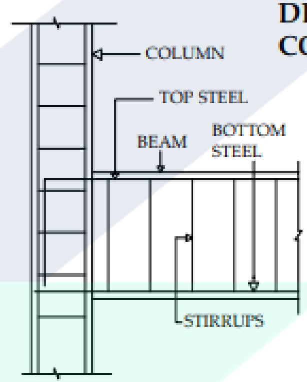
NOTES PADHO
Yaha Hoga Jugaad



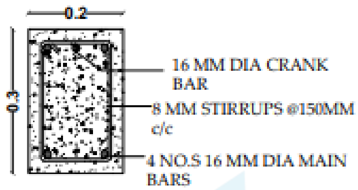
KEY PLAN FOR GROUND BEAMS AND PLINTH BEAMS



DETAILS OF TYPICAL CONTINOUS BEAM



TYPICAL END SPAN DETAILS OF BEAM



SECTION OF B1 SCALE - 1:10

NOTE: PB = PLINTH BEAM @ PLINTH LEVEL
GB = GROUND BEAM @ GROUND LEVEL

SCHEDULE OF BEAMS AT PLINTH LEVEL

BEAM NO.	SIZE/ THICKNESS BXD (OVERALL) M	MID SPAN MAIN BAR (MM)		TOP BARS (MM)	RINGS / DISTRIBUTION C/C (MM)
		BOTTOM STRAIGHT BARS	BOTTOM B/UP AT 2D FROM FACE		
B1	2 X 3	2 X 12 ⏀	1 X 10 ⏀	2 X 10 ⏀	8 ø @ 150 C/C
B2	2 X 4.5	2 X 12 ⏀	2 X 10 ⏀	2 X 10 ⏀	8 ø @ 150 C/C
B3	2 X 6	2 X 12 ⏀	2 X 12 ⏀	2 X 10 ⏀	8 ø @ 150 C/C

NOTE:

- TENSION OVERLAP 60 X DIA. AND COMPRESSION OVERLAP 30 X DIA OF BARS.
- MINIMUM CLEAR COVER FOR
  (a) SLAB = 15 MM
  (b) BEAM = 25 MM
- PROVIDE 8 ⏀ @ 300 C/C 1200 LONG BARS AS EXTRA TOP OVER THOSE BEAMS WHICH ARE PARALLEL TO MAIN REINFORCEMENT OF SLAB.
- BENT UP BARS SHALL BE EXTENDED UPTO 0.3 L IN ADJACENT SPAN OVER CONTINUOUS SUPPORT IF EXTRA TOPNOT PROVIDED AND ANCHOR DOWN IN END SUPPORT.
- NOT MORE THAN HALF THE COLUMN BARS SHALL BE LAPPED AT THE SECTION.
- USE OF NEEDLE VIBRATOR AND PLASTICIZERS RECOMMENDED FOR R.C.C. WORK.
- USE DENSIFIED COATED PLYWOOD FOR SHUTTERING AND FORMWORK.
- USE STEEL PROPS AND STEEL SUPPORT FOR FORMWORK.
- BURNT OIL NOT PERMITTED FOR DE-SHUTTERING.
- CURING - EXPOSED SURFACE OF CONCRETE SHALL BE KEPT CONTINUOUSLY IN WET CONDITION FOR MINIMUM 14 DAYS.
- GHODI OR CHAIR HEIGHT = SLAB THICKNESS - (15MM + DIA OF SLAB MAIN BAR).

PROJECT TITLE
Notes Padho

SPECIFICATIONS

- ANY DISCREPANCY FOUND BETWEEN ARCHITECTURAL DRAWING AND STRUCTURAL DRAWING SHOULD BE BROUGHT TO ARCHITECT'S NOTICE BEFORE EXECUTION.
- ALL CONCRETE MIX M-20 AND STEEL Fe-250 EXCEPT 6MM DIA. OF BARS.
- PLEASE READ THIS DRAWING WITH RELEVANT ARCHITECTURAL DRAWING FOR BEAM, SLAB POSITION AND CANTILEVER POSITIONS.
- CONTRACTOR IS RESPONSIBLE FOR

SCHEDULE OF COLUMNS

S.No.	COLUMN NAME	COLUMN SIZE (M)
1	C1	0.3X0.2
2	C2	0.45X0.2
3	C3	0.6X0.2
4	C4	0.3X0.2
5	C5	0.2X0.2

NOTES
ALL DIMENSIONS ARE IN METRE.

DATE

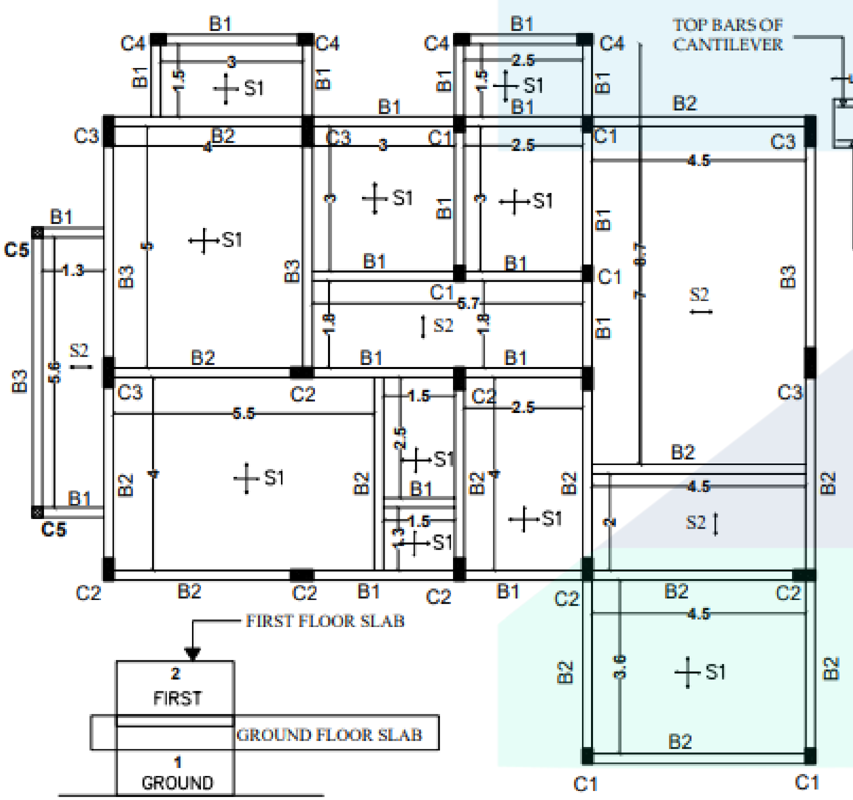
NORTH

SCALE
1:100

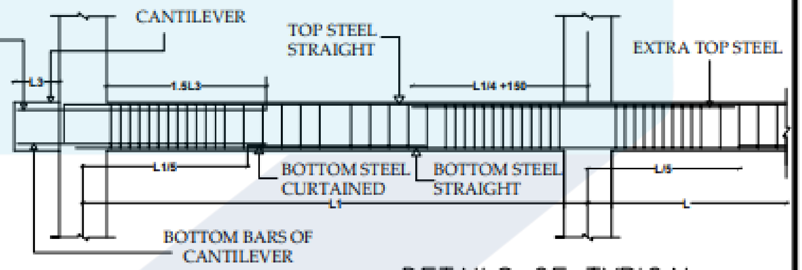
SHEET NO
3

SHEET TITLE
GROUND BEAM AND PLINTH BEAM LAYOUT PLAN

Educational Purpose Only



KEY PLAN FOR GROUND SLAB AND BEAMS



DETAILS OF TYPICAL CONTINOUS BEAM

KEY ELEVATION SHOWING NO. OF FLOORS CONSIDERED FOR STRUCTURAL DESIGN

SLAB NO.	TH. MM	TYPE	MID SPAN STEEL	OTHER SPAN STEEL	REMARKS
S1	100	TWO WAY	# 8 @ 180 c/c ALT. BENT @L/4	# 8 @ 200 c/c ALT. BENT @L/4	----------
S2	100	ONE WAY	# 8 @ 180 c/c ALT. BENT @L/4	# 6 @ 150 c/c	----------
S3	150	ONE WAY	# 8 @ 180 c/c ALT. BENT @L/4	# 8 @ 180 c/c	SLAB FROM BEAM BOTTOM

DETAIL OF SLAB

SCHEDULE OF BEAMS AT SLAB LEVEL

BEAM NO.	SIZE/ THICKNESS BXD (OVERALL) M	MID SPAN MAIN BAR (MM)		TOP BARS (MM)	RINGS / DISTRIBUTION C/C (MM)
		BOTTOM STRAIGHT BARS	BOTTOM B/UP AT 2D FROM FACE		
B1	2 X 3	2 X 12 ф	1 X 10 ф	2 X 10 ф	8 ø @ 150 C/C
B2	2 X 4.5	2 X 12 ф	2 X 10 ф	2 X 10 ф	8 ø @ 150 C/C
B3	2 X 6	2 X 12 ф	2 X 12 ф	2 X 10 ф	8 ø @ 150 C/C

NOTE:

- TENSION OVERLAP 60 X DIA. AND COMPRESSION OVERLAP 30 X DIA OF BARS.
- MINIMUM CLEAR COVER FOR
  (a) SLAB = 15 MM
  (b) BEAM = 25 MM
- PROVIDE 8 ф @ 300 C/C 1200 LONG BARS AS EXTRA TOP OVER THOSE BEAMS WHICH ARE PARALLEL TO MAIN REINFORCEMENT OF SLAB.
- BENT UP BARS SHALL BE EXTENDED UPTO 0.3 L IN ADJACENT SPAN OVER CONTINUOUS SUPPORT IF EXTRA TOPNOT PROVIDED AND ANCHOR DOWN IN END SUPPORT.
- NOT MORE THAN HALF THE COLUMN BARS SHALL BE LAPPED AT THE SECTION.
- USE OF NEEDLE VIBRATOR AND PLASTICIZERS RECOMMENDED FOR R.C.C. WORK.
- USE DENSIFIED COATED PLYWOOD FOR SHUTTERING AND FORMWORK.
- USE STEEL PROPS AND STEEL SUPPORT FOR FORMWORK.
- BURNT OIL NOT PERMITTED FOR DE-SHUTTERING.
- CURING - EXPOSED SURFACE OF CONCRETE SHALL BE KEPT CONTINUOUSLY IN WET CONDITION FOR MINIMUM 14 DAYS.
- GHODI OR CHAIR HEIGHT = SLAB THICKNESS - (15MM + DIA OF SLAB MAIN BAR).

PROJECT TITLE
Notes Padho

SPECIFICATIONS

- ANY DISCREPANCY FOUND BETWEEN ARCHITECTURAL DRAWING AND STRUCTURAL DRAWING SHOULD BE BROUGHT TO ARCHITECT'S NOTICE BEFORE EXECUTION.
- ALL CONCRETE MIX M-20 AND STEEL Fe-250 EXCEPT 6MM DIA. OF BARS.
- PLEASE READ THIS DRAWING WITH RELEVANT ARCHITECTURAL DRAWING FOR BEAM, SLAB POSITION AND CANTILEVER POSITIONS.
- CONTRACTOR IS RESPONSIBLE FOR GRADING.

SCHEDULE OF COLUMNS

S.No	COLUMN NAME	COLUMN SIZE (M)
1	C1	0.3X0.2
2	C2	0.45X0.2
3	C3	0.6X0.2
4	C4	0.3X0.2
5	C5	0.2X0.2

NOTES
ALL DIMENSIONS ARE IN METRE.

DATE

NORTH

SCALE
1:100

SHEET NO
06

SHEET TITLE
GROUND FLOOR SLAB DETAILS

Educational Purpose Only

NOTES PADHO

Yaha Hoga Jugaad

Thank you!