

**VISVESVARAYATECHNOLOGICAL UNIVERSITY**  
**“JNANA SANGAMA”BELAGAVI-590018**  
**KARNATAKA**



An Internship report on  
***“INDUSTRIAL TRAINING”***  
*Submitted in Partial fulfillment for the Award of Degree of*  
**BACHELOR OF CIVIL ENGINEERING**

SUBMITTED BY

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*Internship carried out at*  
**SKILL DEVELOPMENT & INNOVATION CENTRE,**  
**DEPARTMENT OF CIVIL ENGINEERING,**  
**RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE**  
**BALLARI – 583104**

UNDER THE GUIDANCE OF

**Mr. Ganesh H.**  
**Asst-Professor**  
**Dept. of Civil Engineering RYMEC, Ballari**



**DEPARTMENT OF CIVIL ENGINEERING**  
**RAO BAHADUR.Y.MAHABALESWARAPPA ENGINEERING COLLEGE**  
**[Formerly VIJAYANAGAR ENGINEERING COLLEGE]**  
**BALLARI-583104**

2020-2021



VISVESVARAYA TECHNOLOGICAL UNIVERSITY  
"JNANA SANGAMA" BELAGAVI-590018



V.V. SANGHA'S  
RAO BAHADUR.Y.MAHABALESWARAPPA ENGINEERING COLLEGE

[Formerly VIJAYANAGAR ENGINEERING COLLEGE.]

BALLARI-585104, KARNATAKA.

(Affiliated to Visvesvaraya Technological University, Belagavi and approved by AICTE, New Delhi.)



**DEPARTMENT OF CIVIL ENGINEERING**  
**CERTIFICATE**

This is to certify that Internship work entitled "**INDUSTRIAL TRAINING**" has been successfully carried out by the internship group in the partial fulfillment for the award of Bachelor degree in **Civil Engineering** from Visvesvaraya Technological University, Belagavi, during the academic year 2020-2021. It is certified that all corrections / suggestions indicated for internal assessment have been incorporated in the report.

**INTERNSHIP GROUP:**

1. M PRASAD

USN:3VC16CV040

2. K AKSHAY KUMAR

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4. KARISHMA M

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Signature of the Internship guide

Signature of the HOD

  
Ganesh H  
Asst. Professor

  
Signature of the Principal

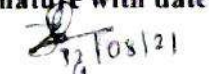

  
Dr. Hanumantha Reddy  
Professor & HOD 09/08/2021

Dr. T Hanumantha Reddy  
Principal

**Name of the External Examiners**

**Signature with date**

1. Zameer. H.
2. Balavapraksh. M. S.

  
12/08/21  
  
12/08/21



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**COURSE NAME** : INTERNSHIP PROFESSIONAL PRACTICE

**COURSE CODE:** C412

**SUBJECT CODE** : 17CV84

**NAME OF THE STUDENT:** - Poornima

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**GUIDED BY** : Mr. Ganesh H.

Assistant Professor

**PREREQUISITITES:** 1.Strength of materials and Basic surveying.

2. Building Materials and Construction Technology and Concrete Technology.

3. Building Planning and Drawing, Analysis and Design of RCC and Steel structural Elements.

<b>Subject Code</b> <b>15CV84</b>	<b>Internship Objectives</b>
<b>CO412.1</b>	To study and research about construction process.
<b>CO412.2</b>	To analyze and design the various buildings.



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<b>CO412.3</b>	To carry out laboratory and filed tests.
<b>CO412.4</b>	To provide effective report and presentation of the information collected in Internship.

<b>CO's</b>	<b>Internship Outcomes</b>	<b>Bloom's level</b>
<b>CO412.1</b>	<b><u>Identify</u></b> and <b><u>Explain</u></b> planning, spacing of columns as per codal provisions.	<b>Understand (L2)</b>
<b>CO412.2</b>	<b><u>Describe</u></b> and <b><u>Explain</u></b> about analyze and design of buildings.	<b>Understand, Analyze (L2,L4)</b>
<b>CO412.3</b>	<b><u>Investigate</u></b> and <b><u>Explain</u></b> the laboratory and filed tests.	<b>Understand, Create (L2,L6)</b>
<b>CO412.4</b>	<b><u>Developed</u></b> communication, Presentation and Writing skills.	<b>Create (L6)</b>



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**Correlation between program outcomes (Po's) and course outcomes (Co's)**

Course outcomes (Co's)	Program outcomes (Po's)
	Mapping of Course outcomes with Program outcomes
<b>CO1:Identify</b> and <b>Explain</b> planning, spacing of columns as per codal provisions.	<ul style="list-style-type: none"><li>a) The course outcome requires/apply the knowledge of basic science basic mathematics (arithmetic's) and Engineering specialization to solve engineering problems, hence the CO maps with PO1 at moderate level (PO1-2)</li><li>b) The course outcome requires/apply the knowledge, formulate and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences are made, hence the CO maps with PO2 at moderate level(PO2-2)</li><li>c) The course outcomes requires/ applying Design solutions of complex engineering problems and design system components or processes that meet the specified needs with appropriate considerations for the public health, safety and the cultural, societal and environmental considerations ,hence the CO maps with PO3 at moderate level (PO3-2)</li><li>d) The course outcome requires/applies the knowledge of ethical principles (IS codes) and commits to professional ethics the norms of engineering practice and responsibilities as a civil engineer, hence the CO maps with PO9 at moderate level(PO8-2)</li><li>e) The course outcome requires/applies the knowledge of communication on planning stage with the engineering community and society at large and design the documentation, hence the CO</li></ul>





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	<p>maps the PO10 at moderate level (PO10-2)</p> <p>f) The course outcome requires/applies the knowledge of project management and finance to manage projects in multidisciplinary environment, hence the CO maps with PO11 at moderate level (PO11-2)</p> <p>g) The course outcomes requires/applies the knowledge of working effective as an individual /team in the progress of project execution, hence the CO maps with PO9 at moderate level (PO9-2)</p> <p>h) The course outcomes requires/applies the knowledge of need and ability to engage in independent and lifelong learning in context of technological change, hence the CO maps with PO12 at moderate level (PO12-2)</p>
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**CO2:Describe** and **Explain** analysis and manual design calculations based on required criteria using relevant codes.

- a) The course outcome requires/applies the knowledge of basic science higher mathematics (arithmetic's) and Engineering fundamentals of analysis and design. Here we observe that maps at very high level with math's, science and engineering fundamentals, hence the CO maps with PO1 at moderate level (PO1-2)
- b) The course outcome requires/applies the knowledge of designing solutions for complex engineering problems considering the environmental safety, hence the CO maps with PO3 at moderate level (PO3-2)
- c) The course outcome requires/applies the knowledge, formulate and analyse complex engineering problems reaching substantiated conclusions using first principle of mathematics, natural sciences and engineering sciences are made, hence the CO maps with PO2 at moderate level (PO2-2)
- d) The course outcome requires/applies the knowledge of ethical principles (IS codes) and commits to professional ethics and norms of engineering practice and responsibilities as a civil engineer, hence the CO maps with PO8 at very moderate level (PO8-2)
- e) The course outcome requires/applies the knowledge of working effectively as an individual / team in the progress of project execution. Hence the CO maps with PO9 at high level (PO9-3)
- f) f) The course outcome requires/applies the knowledge of need and ability to engage in independent and lifelong learning in context of technological change, hence the CO maps with PO12 at moderate level (PO12-2)



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**CO3: Investigate and Compare** the analysis, design and prepare drawings using relevant computer software.

- a) The course outcome requires/applies the knowledge of basic science higher mathematics (arithmetic's) and Engineering fundamentals of analysis and design. Here we observe that maps at very high level with maths, science and engineering fundamentals, hence the CO maps with PO1 at high level (PO1-3)
- b) The course outcome requires/applies the knowledge of designing solutions for complex engineering problems considering the environmental safety, hence the CO maps with PO3 at moderate level (PO3-2)
- c) The course outcome requires/applies the knowledge, formulate and analyse complex engineering problems reaching substantiated conclusions using first principle of mathematics, natural sciences and engineering sciences are made, hence the CO maps with PO2at moderate level (PO2-2)
- d) The course outcome requires/applies the knowledge of ethical principles (IS codes) and commits to professional ethics and norms of engineering practice and responsibilities as a civil engineer, hence the CO maps with PO8 at moderate level (PO8-2)
- e) The course outcome requires/applies the knowledge of working effectively as an individual /team in the progress of project execution. Hence the CO maps with PO9 at moderate level (PO9-2)
- f) The course outcome requires/applies the knowledge of need and ability to engage in independent and lifelong learning in context of technological change, hence the CO maps with PO12 at moderate level (PO12-2)





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**CO4: Justify and Validate a presentable report.**

- a) The course outcomes requires/applies the knowledge of working effective as a individual/ team in the progress of project execution, hence the CO maps with PO9 at high level (PO9-3)
- b) The course outcome requires/applies the knowledge of communication on planning stage with the engineering community and society at large and design the documentation, hence the CO maps the PO10 at moderate level (PO10-3)



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## PROGRAM OUTCOMES (PO'S)

Engineering graduates will be able to:

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an Engineering specialization to the solution of complex engineering problems.
- 2.Problem analyze:** Identify, formulate, review, research, literature and analyze complex engineering problem reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- 3.Design / development of solutions:** Design solutions of complex engineering problems and design system components or processes that meet the specified needs with appropriate considerations for the public health, safety and the cultural, societal and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern tool usage:** create, select and apply appropriate techniques, resources and modern engineering and IT tools including predict. Apply reasoning informed by the contextual knowledge to asses societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice ones and modelling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and the society:** Apply reasoning informed by the contextual knowledge to asses societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7.Environmental and sustainability:** understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of need for sustainable development.



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- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and society at large such as, being able to comprehend and write effective reports and design documentation, make effective presentation and give and receive clear instructions.
- 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and in multidisciplinary environments.
- 12. Lifelong learning:** Recognise the need for, and have the presentation and ability to engage in independent and lifelong learning in the broadest context of technological change.



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**CO –PO Matrix**

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO412.1	2	2	2					2	2	2	2	2			
CO412.2	2	2	2					2	3			2	1		1
CO412.3	3	2	2					2	2			2		1	
CO412.4									3	2					
Average	2.33	2	2					2	2.5	2	2	2	1	1	1

**Note:** Correlation levels: 1: Low 2: Moderate 3: High

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## 1. INTRODUCTION

For a career oriented applied education RYMEC has introduced a new skill development & innovation centre in campus for students, this internship bridge the gap between theory & practical's, & also provides student's knowledge about field based real world experiences during this internship.

An internship is a period of work experience offered by an employer to give students and graduates exposure to the working environment, often within a specific industry, which relates to their field of study.

An internship can give you a real insight into the world of work, allowing you to build on the theory you learned at university and helping you to gain practical skills that will help strengthen your CV and make you more employable. Internships offer you the chance to test your skills in real-life situations, explore your career options and gain an insight into an organization or career path.

**Topics covered in this internship are as follows:-**

- Building planning
- Column marking by total station
- Masonry
- Bar bending schedule
- Plumbing & UGD
- Painting work
- Electrical work

**We have learnt following topics from building planning:-**

- Building planning as per vastu.
- NBC (national building codes) for residential buildings.
- Types of buildings.
- Plan of building drawing.

**We have learnt following topics from column marking by total station:-**

- Setting up total station.
- How to use total station.
- Stake outs.

- Column marking.

**We have learnt following from construction of masonry:-**

- Types of masonry.
- Tools & materials.
- Different types of bonds & how to construct it.

**We have learnt following from bar bending schedule:-**

- Importance of bar bending schedule.
- Tools & materials required.
- Different types & sizes of bars available.
- Calculation of length of rebar's for different structural elements.
- How to bend the bars.

**We have learnt following from plumbing & UGD:-**

- Tools & materials required.
- How the connections are made.
- Water supply & sanitary connection drawings.

**We have learnt following from painting work:-**

- Painting & its requirements.
- Types of paints.
- Surface preparations.
- How to Paint on different surfaces.

**We have learnt following from electrical work:-**

- Different types of power supply.
- Different types of wirings.
- Supply connections for buildings.

### **1.1. BUILDING PLANNING AS PER VAASTU & BYE-LAWS (as per NBC)**

A building to be a structure constructed using any type of materials and for whatever purpose, be it for residential, commercial, industrial or other. The structures that fall under the definition of a building are as follows:-

- Foundations, plinths or pedestals, walls, floors, roofs, chimneys, plumbing/drainage structures, fixed structures, etc.
- All the various components that comprise the building or any structure attached to it
- Fences or boundary walls enclosing an area, land or building, signboards or display structures outside the boundary walls or above the structure, etc.
- Tanks constructed for the purpose of storing fluids or other materials such as chemicals, water, effluents and swimming pools, ponds, etc.
- Temporary structures such as tents, Shamianas and tarpaulin shelters which are built to serve a particular purpose for a short duration of time have been exempted and are not to be considered buildings.

### **1.1.1. TYPES OF BUILDING**

#### **BUILDINGS CLASSIFIED ON THE BASIS OF DEPENDING ON THEIR USAGE:-**

**Residential Buildings:-** These are buildings which are used for normal residential purposes and should facilitate activities such as sleeping, living and cooking. The building must include one or more family residencies, apartments, flats and private garages.

**Educational Buildings:-** These are buildings housing educational institutions such as schools or colleges which are affiliated and recognized by an appropriate board, university or any similar affiliation authority. The building should promote the aggregation of instructional, educational and recreational activities pertaining to educational purposes. Further, it is mandatory for the building to have proper residential facilities for essential staff that need to reside within the campus. Apart from this, the institution should also have a hostel exclusive to the institute either within its premises or outside.

**Institutional Buildings:-** These types of buildings consist of buildings that are constructed by the government, semi-government organizations or registered trusts for specific purposes. Those specific purposes include medical treatment purposes such as treatment of physical or mental illness, children's hospitals, old age homes, centers for the care of orphans or abandoned women, auditoriums or complexes meant to be used for cultural or allied activities, religious accommodation.

**Assembly Buildings:-** These are defined as buildings or parts of them which houses public gatherings congregated with the intent of amusement, recreation, social, religious, patriotic, civil, travel or other similar purposes. Buildings such as movie houses, drama theatres, drive-in theatres, assembly halls, clubhouses, town halls, auditoriums, exhibition halls, museums, mangal karyalayas, gymnasiums, sports complexes, restaurants, boarding houses, dance clubs, gymkhanas, places.

**Business Buildings:-** If a building or a part of it is primarily used for keeping records of business transactions, maintaining accounts, bookkeeping purposes or managing other types of records then it can be classified as a business building. Buildings under this category include offices, banks, courthouses and other professional establishments serving the aforementioned purposes.

**Mercantile Buildings:-** In these types of buildings, either the entire building or a part of it is used for housing shops, stores or showrooms where display and sale of wholesale goods, retail goods or merchandise is carried out. Such buildings should also accommodate office, storage and service facilities essential for the business which should be located in the same building.

**Industrial Buildings:-** Buildings used to manufacture, assemble or process products or materials are termed as industrial buildings. They include manufacturing units, assembly plants, factories, mills, powerplants, oil refineries, gas plants, dairy plants, laboratories, etc.

**Storage Buildings:-** If a building or a part of it is used for the storage of commodities, goods, merchandise, etc. then it is categorized as a storage building. They comprise buildings such as warehouses, cold storages, grain storage units, barns, stables, freight depot, transit shed, hangars, truck terminals, public garages, etc.

**Wholesale Establishments: -** Buildings under this category include establishments being fully or partially utilized for wholesale trade and manufacture, wholesale shops having required storage facilities or warehouses and establishments providing truck transportation services and/or truck transportation booking services.

**Mixed Land Use Buildings:-** These are buildings which are used for both residential purposes as well as for carrying out non-residential activities.

**Hazardous Buildings:-** These types of buildings have been further divided into two sub-categories by the government. They are:

- Buildings used for the manufacture, processing, handling or storage of substances which are radioactive, highly combustible/explosive or capable of burning rapidly with/without the potential to produce poisonous fumes or emissions that are explosive in nature.
- Buildings used for the manufacture, processing, handling or storage of substances which are highly corrosive, toxic or noxious alkalis, acids or other chemicals producing explosive or poisonous fumes, explosive mixtures or substances capable of disintegrating matter into fine particles causing spontaneous ignition.

#### **BUILDINGS CATEGORIZED WITH RESPECT TO THEIR DESIGN AND HEIGHT:-**

**Detached Buildings:-** A building comprising roofs and walls which is detached from any other building and has openspaces within its boundaries is termed as a detached building.

**Semi-Detached Buildings:-** These are buildings which are detached from any other building on three sides and have open spaces on all those sides. Open spaces have been defined as integral parts of the site which are left open to the sky.

**Multi-Storey or High Rise Buildings:-** All buildings comprising more than 4 stories and/or buildings with height more than 15 meters (without stilt) or 17.5 meters (with stilt) above the average level of the front road have been categorized as high rise buildings.

#### **BUILDINGS CATEGORIZED IN TERMS OF SAFETY STANDARDS RESULTING DUE TO THEIR USE AND MAINTENANCE LEVEL:-**

**Slums:-** Buildings under this category have a low level of maintenance and bad habitability conditions which are caused due to inadequate sanitation, ventilation and other detrimental factors. Slums are tagged according to the concerned legislation by a competent authority.

**Unsafe Buildings:-** Buildings that are structurally weak and thus unsafe, unsanitary or contaminated, do not have proper entry and/or exit facilities, prone to fire hazards, poses dangers to human life or according to its existing use, may pose a danger to safety, health or public welfare are deemed to be unsafe. As per government regulations, these buildings must undergo restoration, demolition or undertake necessary measures as per the instructions of the concerned



authority.

## **BUILDINGS CATEGORIZED ON THE BASIS OF OTHER MISCELLANEOUS FEATURES:-**

**Special Buildings:-** this is an all-encompassing category which includes assembly buildings, industrial buildings, wholesale establishments, hazardous buildings, hotels, hostels and buildings with central air conditioning which are more than 15 meters in height and have a built-up area of more than 600 square meters.

**Multi-Level Car Parking:-** these are buildings which are either partially below ground level and have two or more basements or above ground level with two or more floors that are principally used for parking cars, bikes, scooters and other light motorized vehicles.

### **1.1.2. BYE-LAWS AS PER NBC FOR RESIDENTIAL BUILDING**

- The national code NBC is a standardized set of rules to be followed by authorities and constrictions forms, to provide a healthy and safe living experience for all residence.
- The National Building Code (NBC) is a document that provides guidelines for construction of structures – residential, mercantile, institutional, educational, commercial, assembly, storage spaces or even hazardous buildings.
- It is important to follow these guidelines that are meant to protect the overall health of the construction and ensure the health and safety of the public and the residents.
- These standardized codes were first published in 1970 and revised later in 1983. The latest revision was in 2005.

#### **Building bye laws:-**

- The rules and regulation framed by town planning authorities by covering the requirements of building, ensuring safety of the public through open spaces, minimum size of rooms and height and area limitation, are known as **building bye-laws**.
- Rules and regulations which largely regulate the building activity should be formulated to get disciplined growth of building and the better planned development of towns and cities.

#### **Objective of building bye-laws:-**

- Pre-planning of building activity.

- Allow orderly growth and prevent haphazard development.
- Provisions of by-laws usually afford safety against fire, noise, health hazard and structure failure.
- Provide proper utilization of space to achieved maximum efficiency in planning.
- They provide health, safety and comfort to the people who live in building.
- Due to these bye-laws, each building will have proper approaches, light, air and ventilation.

**Scope of building bye-laws:-**

Aspects of different type of building in building bye laws:

- Building frontage line
- Minimum plot size
- Built up area of building
- Height of building
- Provision of safety, water supply, drainage, proper light and ventilation
- Requirement for off street parking space

**Applicability of building bye-laws:-**

- New construction
- Additional and alternations to a building
- Changing of occupancy of building (residential □ education etc.)
- Development of land is undertaken
- In demolition

Table 1:- Exterior setbacks up to 11.5m height

**Exterior minimum Setbacks for buildings ( except Industrial ) upto 11.50 m in height.**

**a. For Residential /Commercial use**

Sl. No.	Width/Depth of site (m)	Width of site		Depth of site	
		Right Set Back	Left Set back	Front Set Back	Rear Set Back
1	Up to 6	0.50m	0	1.00m	0
2	Over 6 up to 9	0.50m	0.50m	1.00m	0.75m
3	Above 9	8%	8%	12%	8%

Table 2:- Exterior setbacks above 11.5m

**Exterior Setbacks for buildings ( except Industrial ) above 11.50 meters in height.**

Sl. No.	Height of building in meters	Exterior Setbacks to be left on all sides (Front, rear and sides in meters)
1	Above 11.5 upto 15.0	5.0
	Above 15.0 upto 18.0	6.0
2	Above 18.0 upto 21.0	7.0
3	Above 21.0 upto 24.0	8.0
4	Above 24.0 upto 27.0	9.0
5	Above 27.0 upto 30.0	10.0
6	Above 30.0 upto 35.0	11.0
7	Above 35.0 upto 40.0	12.0
8	Above 40.0 upto 45.0	13.0
9	Above 45.0 upto 50.0	15.0
10	Above 50.0	16.0

**'Floor Area Ratio' (FAR) means the quotient obtained by dividing the total covered area on all floors by the area of the plot .**

<b>FAR</b>	<b><math display="block">\frac{\text{Total covered area of the floors}}{\text{Plot Area}}</math></b>
------------	--

Table 3:- Floor area ratio, plot coverage & road width for residential buildings.

**b. Maximum Plot Coverage, Floor Area Ratio and Road Widths for Different Sital Areas for Commercial buildings.**

Plot area in Sq. m.	Maximum Plot Coverage	Permissible FAR	Minimum Road Width in m.
Upto 240	65%	1.50	Upto 6
240 to 500	65%	1.60	6 to 9
500 to 750	60%	1.70	9 to 12
750 to 1000	55%	1.80	Over 12
1000 to 4000	55%	2.00	Over 12
4000 to 6000	50%	2.25	Over 18
Over 6000			

Table 4:- Floor area ratio, plot coverage & road width for commercial buildings.

**a. Maximum Plot Coverage, Floor Area Ratio and Road Widths for Different Sital Areas for Residential buildings.**

Plot area in Sq.m	Maximum Plot Coverage	Permissible FAR	Minimum Road Width in m.
Upto 240	70%	1.50	Upto 6
240 to 500	65%	1.60	6 to 9
500 to 750	60%	1.70	9 to 12
750 to 1000	55%	1.80	Over 12
1000 to 4000	55%	1.90	Over 12
4000 to 10000	50%	2.00	Over 18
Over 10000			

Table 5:- Width of corridors for different buildings

Sl. No	Building use or type	Minimum width of the corridor in meters
1	Residential building	1.0
2	Assembly buildings such as auditorium, Kalyana Mantapas, Religious building, Temple, Mosque or Church and other buildings of Public assembly or Conference.	2.0
3	Institutional buildings such as:	
	a. Government office	2.0
	b. Government Hospitals	2.4
	c. Educational Buildings such as Schools, Colleges, Research Institutions	2.0
	d. Commercial buildings such as private office, Nursing homes, Lodges, etc.	2.0
	e. All other buildings	1.5

### 1.1.3. VAASTU

- Vastu Shastra is an ancient guide for a positive home, right from the entrance of a house to the bedroom, kitchen, bathroom, outdoors, and courtyard.
- Vaastu shastra (literally "science of architecture") is a traditional Indian system of architecture originating in India. Texts from the Indian subcontinent describe principles of design, layout, measurements, ground preparation, space arrangement, and spatial geometry. Vaastu Shastras incorporate traditional Hindu and (in some cases) Buddhist beliefs. The designs aim to integrate architecture with nature, the relative functions of various parts of the structure, and ancient beliefs utilizing geometric patterns (yantra), symmetry, and directional alignments.



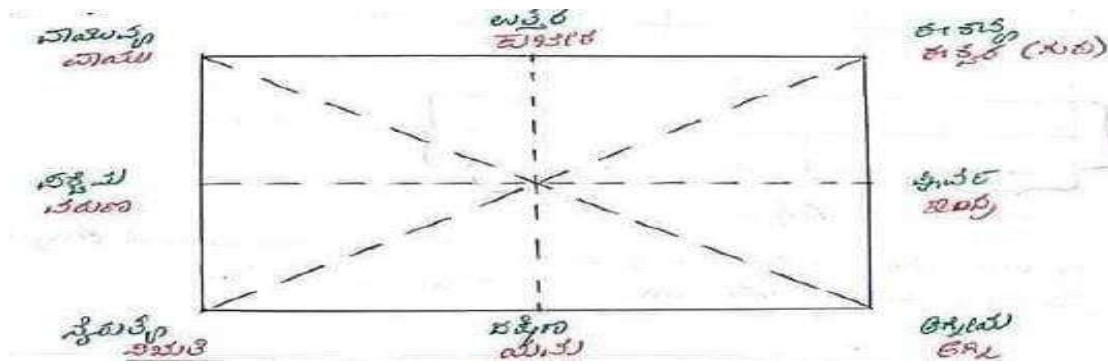


Fig 1:- Directions as per vastu

Vastu Shastra are the textual part of Vastu Vidya - the broader knowledge about architecture and design theories from ancient India. Vastu Vidya knowledge is a collection of ideas and concepts, with or without the support of layout diagrams that are not rigid. Rather, these ideas and concepts are models for the organization of space and form within a building or collection of buildings, based on their functions in relation to each other, their usage and the overall fabric of the Vastu. Ancient Vastu Shastra principles include those for the design of Mandir (Hindu temples) and the principles for the design and layout of houses, towns, cities, gardens, roads, water works, shops and other public areas. The Sanskrit word vastu means a dwelling or house with a corresponding plot of land. The vrddhi, vastu, takes the meaning of "the site or foundation of a house, site, ground, building or dwelling-place, habitation, homestead, house".



Fig 2:- Directions with room provisions as per vastu



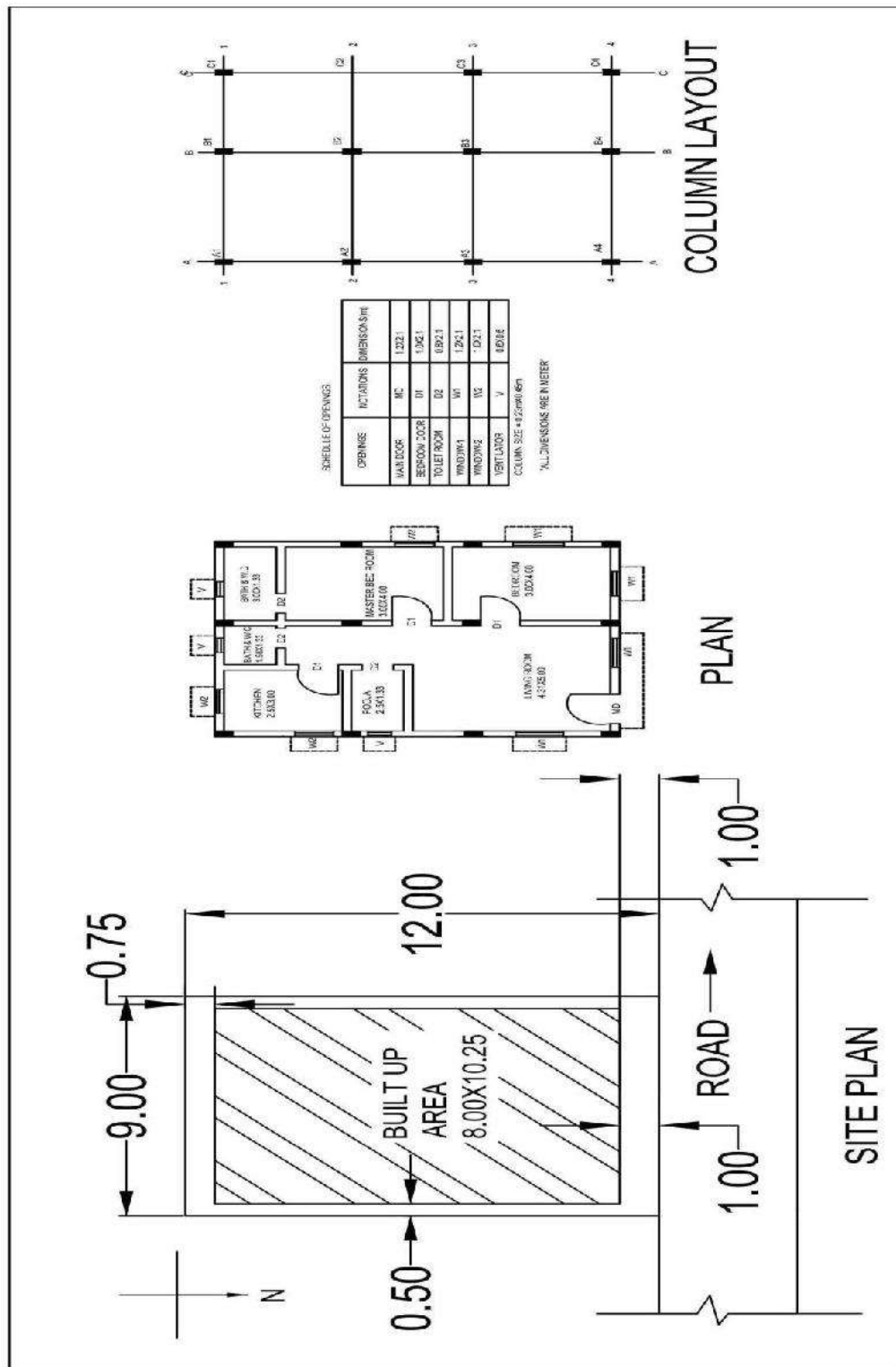


Fig 3 :- Site plan, building plan & column layout

## 1.2. COLUMN MARKING BY USING TOTAL STATION.

A **total station** is an optical instrument commonly used in construction, surveying and civil engineering. It is useful for measuring horizontal angles, vertical angles and distance it does this by analyzing the slope between itself and a specific point. Electronic distance meter (EDM).

A total station is an optical instrument commonly used in construction, surveying and civil engineering. It is useful for measuring horizontal angles, vertical angles and distance it does this by analyzing the slope between itself and a specific point.

A high-quality total station camera combines surveying, imaging and high-speed 3D scanning into one precise and reliable instrument. It blends the latest field technologies with advanced technical features to create a tool that is trusty and dependable in demanding field situations while producing accurate results for analysis and engineering.

Total stations often contain a few different components:

- Electronic transit theodolite
- Electronic distance meter (EDM)
- Microprocessor
- Electronic data collector and storage system
- Operators often use total stations with additional equipment as well, including tripods, tribrachs, reflector poles and prisms

**Using total stations for measurements provides several unique advantages:-**

- **Accuracy:** Total stations are highly accurate to a fraction of an arc second as well as measure distances to hundredths of a foot over thousands of feet.
- **Ease of use:** Total stations are easy and intuitive to use. They can take simultaneous distance and horizontal measurements, and they make it easy to calculate coordinates. So, operators can spend more of their time and energy on critical engineering and analytical problems that demand their attention.
- **Speed:** Total stations collect information quickly, so operators can get in and out of the field efficiently.
- **Convenience:** Total stations offer quick and convenient setup. With a total station, an operator can take multiple surveys from one location.
- **Effortless CAD interface:** It's easy to download survey data to a computer-assisted drawing

(CAD) program to avoid time-consuming data manipulation.

#### **Features of total station:-**

- **Mechanical total stations:** Mechanical total stations are reliable and accurate, and they make surveying quick and easy. They do not offer remote control operation or automated features, however, and operation typically requires two people.
- **Robotic total stations:** These total stations allow for more technological convenience. They offer extended remote control abilities, they need only one operator, and they allow for increased safety in challenging terrain because of their unique ability to operate at a distance.
- **Prism total stations:** Both mechanical and robotic total stations come in prism models. Prism models are more traditional than reflector-less models, and they are still more commonly used. They use prisms to reflect infrared waves and then determine angles and distance by measuring the prism's location.
- **Reflector-less total stations:** Both mechanical and robotic total stations come in reflector-less versions, as well. These newer models of total stations are useful for taking measurements in challenging circumstances. They can work in difficult terrain or in places you can't reach on foot, and they don't require the use of a prism.

#### **Applications of total station:-**

- Superior EDM for high accuracy and long-range prism measurements.
- High-accuracy scanning and scanning range technology.
- High-resolution site imagery technology.
- Imaging solutions like video robotic control and photogrammetric measurements.
- Integrated surveying with global navigation satellite system (GNSS) receivers.
- Seamless field-to-office integration with software for data processing, analysis and use.
- Optional solutions for locating lost or stolen equipment.

#### **1.2.1. SETTING UP FOR A TOTAL STATION:-**

The process for setting up the device is fairly simple. Just follow these ten steps and you will be ready for your **total station survey**:

**Gather Your Equipment:** First, you will need to have your equipment ready. In addition to the

device, this should include a tripod, tri-Brach, controller, cables, survey stake or nail and a mallet.

**Establish and Mark a Point of Reference:** Establish a point of reference for your project. This often needs to be measured using conventional means. Mark this point with a stake or nail.

**Set up the Tripod at the Reference Point:** Open the tripod and set it over the point of reference. Try to position the center of the tripod roughly over the stake.

**Attach the Tri-Brach and Course Level:** Attach the tri-Brach to the tripod and course level to the tripod.

**Adjust as Necessary:** Using these initial, course instrument, get the tripod as close as possible to be totally level and directly over the point of reference.

**Place the Total Station on the Tripod:** Attach the device to the tripod being careful not to move it off-center.

**Connect Cables:** Connect the battery pack and controller to the **total station** using the appropriate cables.

**Power On and Start Controller:** Turn the device on and open the fine-level functionality using the controller.

**Make Fine Adjustments:** Adjust the device using the fine level to get to directly over the survey marker on the stake. Also, ensure that it is perfectly level.

**You're Ready:** You are now ready to begin taking sightings. Using a **total station**, you can easily capture important measurements for land surveying, construction and many other projects.

### 1.2.2. STAKEOUT

The Stakeout function is used to find a specific point in the field. There are four ways to define the target point for stakeout.

- The first method is to specify a point number from the current coordinate file. To do this, click on the Point Number button and type in the point number in the dialog.
- The second method is to give a station and an offset from a centerline. The program will prompt for a centerline file (.CL) and then the station and offset. You can also specify the

station interval for automatically incrementing to the next stakeout point. See the Roads section of this manual for how to create centerline files.

- The third method is to graphically pick the point from the drawing. Select Pick Point and a dialog box allow you to pick different snaps: endpoint, midpoint, center, node (point), or intersection. This will help you pick your desired point more accurately. For example, you can select endpoint and then pick on a poly line corner to stakeout that the poly line endpoint. See the Object Snap command in this manual for more on snaps.
- The fourth method is to simply type in the target point coordinates in the Northing, Easting and Elevation fields.

## **Stake Out Points:-**

Before starting the stakeout, be sure that the instrument is setup with correct occupied point, back sight and instrument height. This setup data is displayed in the third line of the dialog. You can pick the Setup button to change the instrument setup.

After you click Start to begin staking the point the dialog shows the angle to turn the gun and the horizontal distance to the target. Turn the instrument to this angle and position the prism man at this angle and distance. Then pick the Read button to take a measurement. Then report the horizontal distance and cut/fill from the current position to the target. This distance is also reported as how far north/south and how far east/west to go and as how far in/out and left/right to go. To in/out and left/right distances are relative to the prism man facing the instrument. Keep moving the man and picking the Read button until you reach the point. Then pick the Store button.

- Staking out points is one of the most common uses for a **total station**. The process for staking out points begins by setting up the device at known coordinates, as described above.
- Enter the coordinates of the stake point into the device. It will calculate the correct direction for this point (which will become zero degrees).
- Turn the **total station** to zero degrees on the horizontal axis. Position a reflection in the line of sight of the device.
- Using the EDM functionality, move the reflector until it is the correct distance away from the instrument.
- This is the point of the coordinates entered into the system.

- Mark the point with a stake.
- With many devices, points can be uploaded from a computer beforehand.
- This helps to make targeting the point even easier because the user only needs to select the relevant point number on the controller.



**Plate 1 & 2:- Staking out points by using total station**



## 2. CONSTRUCTION OF MASONRY

**Masonry** is the building of structures from individual units, which are often laid in and bound together by mortar; the term masonry can also refer to the units themselves. The common materials of masonry construction are brick, building stone such as marble, granite, and limestone, cast stone, concrete block, glass block, and adobe. Masonry is generally a highly durable form of construction. However, the materials used, the quality of the mortar and workmanship, and the pattern in which the units are assembled can substantially affect the durability of the overall masonry construction. A person who constructs masonry is called a mason or bricklayer.

### Advantages

- The use of materials such as bricks and stones can increase the thermal mass of a building.
- Masonry is a non-combustible product and can protect the building from fire.
- Masonry walls are more resistant to projectiles, such as debris from hurricanes or tornadoes.

### Disadvantages

- Extreme weather, under certain circumstances, can cause degradation of masonry due to expansion and contraction forces associated with freeze-thaw cycles.
- Masonry tends to be heavy and must be built upon a strong foundation, such as reinforced concrete, to avoid settling and cracking.
- Other than concrete, masonry construction does not lend itself well to mechanization, and requires more skilled labor than stick-framing.
- Masonry consists of loose components and has a low tolerance to oscillation as compared to other materials such as reinforced concrete, plastics, wood, or metals.



**Plate 3:- Collecting bricks for construction**

### Tools required:-

- Trowel
- Pan/tray
- Materials

## 2.1. MATERIALS USED FOR CONSTRUCTION OF MASONRY

- **Cement:-** Cement is a finely milled mineral powder, usually grey in color. The most important raw materials for the production of **cement** are limestone, clay, and marl. Mixed with water, **cement** serves as an adhesive to bind sand, gravel, and hard rock in concrete.

- **Sand:-** Sand is a granular material composed of finely divided rock and mineral particles. Sand has various compositions but is defined by its grain size. Sand grains are smaller than gravel and coarser than silt. Sand can also refer to a textural class of soil or soil type; i.e., a soil containing more than 85 percent sand-sized particles by mass.

The composition of sand varies, depending on the local rock sources and conditions, but the most common constituent of sand in inland continental settings and non-tropical coastal settings is silica (silicon dioxide, or SiO<sub>2</sub>), usually in the form of quartz.

- **Masonry units Like:-**

**Bricks:-** A brick is a type of block used to build walls, pavements and other elements in masonry construction. Properly, the term brick denotes a block composed of dried clay, but is now also used informally to denote other chemically cured construction blocks. Bricks can be joined together using mortar, adhesives or by interlocking them.

**Cement Concrete blocks:-** It is a standard size rectangular block used in building construction. CMUs are some of the most versatile building products available because of the wide variety of appearances that can be achieved using them.

**Stone:-** The construction of stones bonded together with mortar is termed as stone masonry. Where the stones can be found in abundance in nature, on cutting and dressing to the proper shape, they provide an economical material for the construction of various building components such as walls, columns, footings, arches, beams, etc..

## 2.2. TYPES OF MASONRY

### 1. Brick Masonry Construction

Brick masonry construction makes use of first-class burnt clay bricks. For less important

construction, third class bricks are used in masonry. Second class bricks are best for masonry construction that is plastered as it lacks finish compared with first class bricks.

The overall tensile strength offered by the brick masonry is less and is irrespective of the class of brick chosen. Overall performance depends on the size, position, and number of openings provided to the masonry structure.

**Bond:-** A systematic arrangement of a course of bricks in brick masonry, by which the continuous vertical joints are formed, is called a Bond.

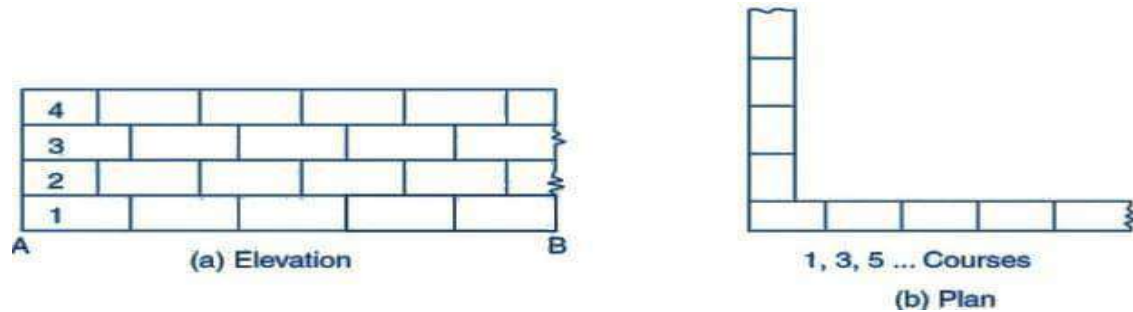
#### **Types of Bonds in Brick Masonry Wall Construction:-**

1. Stretcher bond
2. Header bond
3. English bond and
4. Flemish bond
5. Facing bond
6. Dutch bond
7. English cross bond
8. Brick on edge bond
9. Raking bond

**Stretcher bond:-** Longer narrow face of the brick is called as stretcher as shown in the elevation of figure below. Stretcher bond, also called as running bond, is created when bricks are laid with only their stretchers showing, overlapping midway with the courses of bricks below and above.

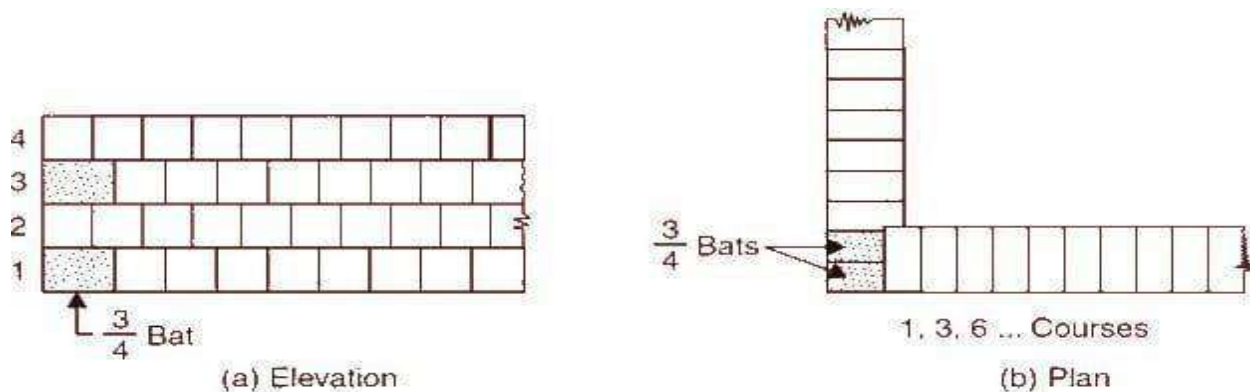
Stretcher bond in the brick is the simplest repeating pattern. But the limitation of stretcher bond is that it cannot make effective bonding with adjacent bricks in full width thick brick walls. They are suitably used only for one-half brick thick walls such as for the construction half brick thick partition wall.

Walls constructed with stretcher bonds are not stable enough to stand alone in case of longer span and height. Thus they then need supporting structure such as brick masonry columns at regular intervals. Stretcher bonds are commonly used in the steel or reinforced concrete framed structures as the outer facing. These are also used as the outer facing of cavity walls. Other common applications of such walls are the boundary walls, gardens etc.



**Fig 4:- Plan & elevation of stretcher bond**

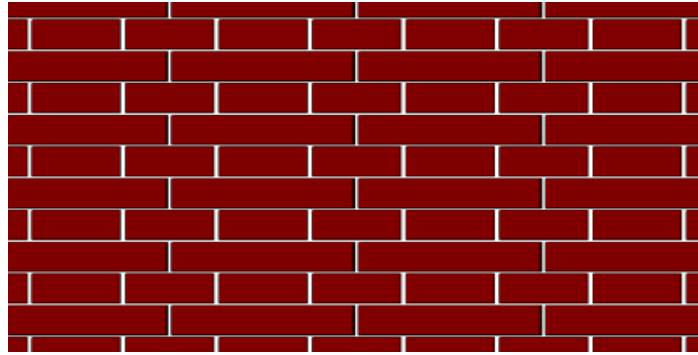
**Header bond:-** Header is the shorter square face of the brick which measures 9cm x 9cm. Header bond is also known as heading bond. In header bonds, all bricks in each course are placed as headers on the faces of the walls. While Stretcher bond is used for the construction of walls of half brick thickness whereas header bond is used for the construction of walls with full brick thickness which measures 18cm. In header bonds, the overlap is kept equal to half width of the brick. To achieve this, three quarter brick bats are used in alternate courses as quoins.



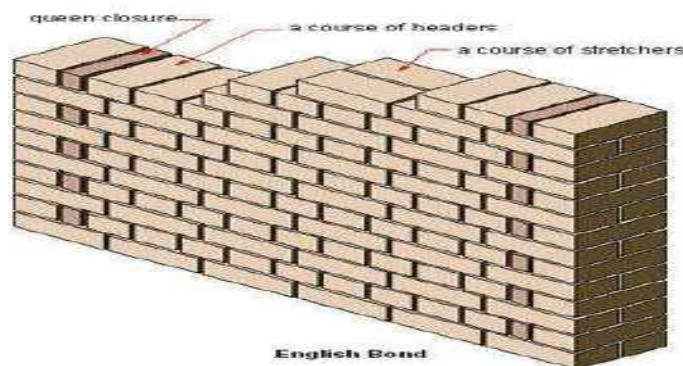
**Fig 5:- Plan & elevation of header bond**

**English Bond:-** English bond in brick masonry has one course of stretchers only and a course of header above it, i.e. it has two alternating courses of stretchers and headers. Headers are laid centered on the stretchers in course below and each alternate row is vertically aligned.

To break the continuity of vertical joints, quoin closer is used in the beginning and end of a wall after first header. A quoin close is a brick cut lengthwise into two halves and used at corners in brick walls.



**Fig 6:- English Bond**

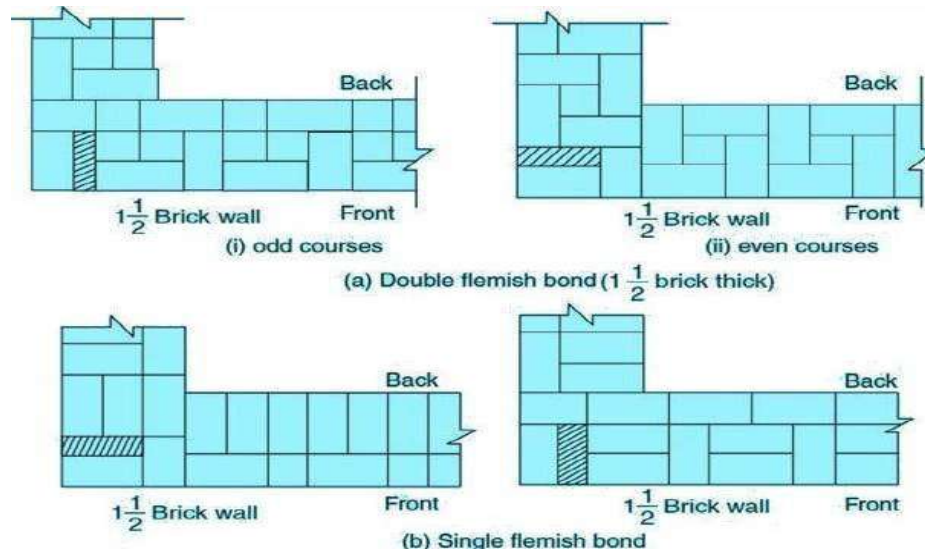


**Fig 7:- English Bond – Isometric View**

**Flemish Bond:-** For the breaking of vertical joints in the successive courses, closers are inserted in alternate courses next to the quoin header. In walls having their thickness equal to odd number of half bricks, bats are essentially used to achieve the bond. Flemish bond, also known as Dutch bond, is created by laying alternate headers and stretchers in a single course. The next course of brick is laid such that header lies in the middle of the stretcher in the course below, i.e. the alternate headers of each course are centered on the stretcher of course below. Every alternate course of Flemish bond starts with header at the corner.

The thickness of Flemish bond is minimum one full brick. The disadvantage of using Flemish bond is that construction of Flemish bond is difficult and requires greater skill to lay it properly as all vertical mortar joints need to be aligned vertically for best effects. For the breaking of vertical joints in the successive courses, closers are inserted in alternate courses next to the quoin header. In walls having their thickness equal to odd number of half bricks, bats are used to achieve the bond.

Flemish bonds have better appearance but are weaker than English bonds for load bearing wall construction. Thus, if the pointing has to be done for brick masonry walls, then Flemish bond may be used for better aesthetic view. If the walls have to be plastered, then it is better to use English bond.



**Fig-8:- Flemish Bond**

**Flemish bonds are classified as:**

- Single Flemish Bond
- Double Flemish Bond

Single Flemish bond is a combination of English bond and Flemish bond. In this type of construction, the front exposed surface of wall consists of Flemish bond and the back surface of the wall consists of English bond in each course. Minimum thickness required for single Flemish bond is one and a half brick thickness. The main purpose of using single Flemish bond is to provide greater aesthetic appearance on the front surface with required strength in the brickwork with English bond.

Double Flemish Bond has the same appearance both in the front and back elevations, i.e. each course consists of alternate header and stretcher. This type of bonding is comparatively weaker than English bond.

## 2. Stone Masonry Construction

Stone is the most durable, strong and weather-resistant construction material compared with any others. These are less affected by daily wear and tear. Masonry structures made out of stone



hence last for a longer period. It has a life period of 300 to 1000 plus years. Due to it's numerous advantageous, it is widely used in masonry construction.

**Stone masonry has two main classifications:**

1. Rubble Masonry
2. Ashlar Masonry

**Rubble Masonry is again classified into:**

- Uncoursed or Coursed Random Rubble Masonry
- Uncoursed or Coursed Square Masonry
- Polygonal Rubble Masonry
- Dry Rubble Masonry

**Ashlar masonry is again classified into:**

- Ashlar Fine Masonry
- Ashlar Block in Course
- Ashlar Chamfered Masonry
- Ashlar Rough Tooled Masonry
- Rock or quarry faced masonry



**Fig 9:- Stone masonry**

### **3. Concrete Masonry Construction**

In concrete masonry construction, the concrete blocks are pressed on the top of other similar to brick masonry construction. This creates a staggered formation. The dimension of concrete blocks is larger compared to bricks, so less time is required to lay concrete blocks.

Concrete block construction hence is popular as it is affordable and gain high fire resistance. The concrete masonry blocks come in various sizes, shapes, and special forms thus making it a

versatile construction material. It is highly used in the construction of factories, schools and residential buildings.



**Fig10:- Concrete block masonry**

#### **4. Veneer Masonry Construction**

This masonry construction is a type mainly used for remodeling and to provide interior finish. It gives the appearance of a stone or brick wall with a better economy and insulation. Veneer masonry units can be placed on the existing concrete wall giving a better appearance.



**Fig 11:- Veneer masonry**

#### **5. Gabion Masonry Construction**

Gabions are baskets made out of zinc protected steel or so-called galvanized steel that is filled with medium-sized fractured stones. These gabions act as a single unit. It behaves like a revetment or retaining walls.





**Fig 12:- Gabion masonry**

These masonry units are well-drained and flexible in nature. Hence have high resistance to horizontal pressure like water flows, soil flow, frost damage and floods. Commonly used gabions are rectangular in nature. The durability of gabions depends on the corrosion resistance property of the steel used for gabion baskets.

#### **6. Composite Masonry Construction**

A composite masonry construction makes use of two or more types of building materials for the construction. These masonry constructions are employed to increase the appearance of the building and to use available material resources with the utmost economy.



**Plate 4&5:- Construction of masonry wall**

### 3. BAR BENDING SCHEDULE

Bar Bending Schedule, commonly referred to as “BBS” is a comprehensive list that describes the location, mark, type, size, length and number, and bending details of each bar or fabric in a Reinforcement Drawing of a Structure.

This process of listing the location, type and size, number of and all other details is called “Scheduling”. In context of Reinforcement bars, it is called bar scheduling. In short, Bar Bending Schedule is a way of organizing re-bars for each structural unit, giving detailed reinforcement requirements.

#### Tools required:-

- Bar cutter
- Re-bars
- Bar bending key

#### 3.1. DESIGN STEPS

Most of the information in a BBS can be found in reinforcement drawings of the structural unit. Bar shape, diameter, length and spacing is directly entered in the schedule just by looking at the drawings, which will have detailed dimensioning.

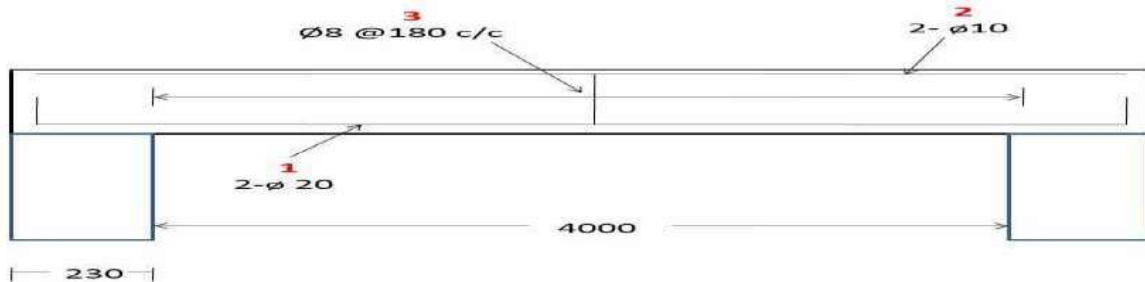


Fig 13:- Longitudinal section of beam

#### Beam reinforcement bar marking for BBS

##### Number of bars:

Suppose the spacing of stirrups is 150 c/c and the length along which they are placed is 6800mm, we can find the number of bars by the formula below

$$[\text{Length} / \text{Spacing}] + 1 = \text{number of bars} \text{ FOR EX: } [6800 / 150] + 1 = 46.33$$

In this case, we always round up. Hence, we require 47 stirrups.

### Cutting Length:

We must remember that steel is ductile in nature and is subject to elongation. Hence, the length of a bar is increased when bends or hooks are introduced. Hence, certain deductions are needed to offset this increase in length.

Cutting Length = True Length of a bar – Deductions

For 45 degree

Cutting length = Total length – 1 x Dia of bar x No. of bends

Cutting length = Total length – 2 x Dia of bar x No. of bends

### For stirrups:

90 degree hook:

Length of stirrup =  $(2A + 2B) + 20 \times \text{dia}$

Length of stirrup =  $(2A + 2B) + 24 \times \text{dia}$

### 1. Hook Length or Cutting length of Stirrups:-

The hook length is commonly provided for stirrups in beams and ties in columns. In general, Hooks are added at the two ends of the rebar in stirrups or ties.

Hook Length =  $9d$  ( $d$  is dia of the bar)

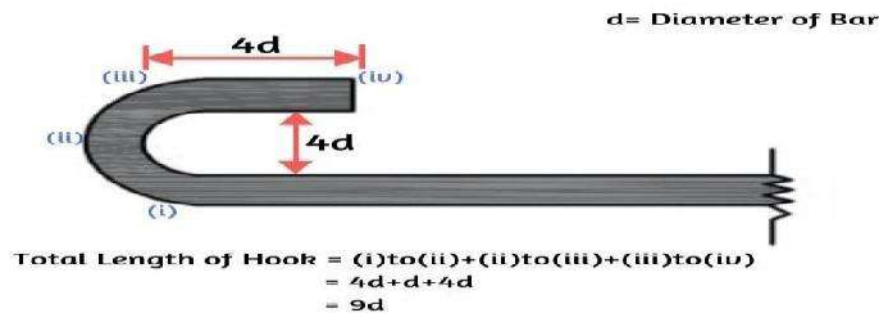


Fig 14:- Hook length

From above fig, length of hook = [(Curved Portion) +  $4d$ ] =  $[(4d + d) + 4d] = 9d$

**Hook Length =  $9d$  [ $d$  is Diameter of the Bar]**



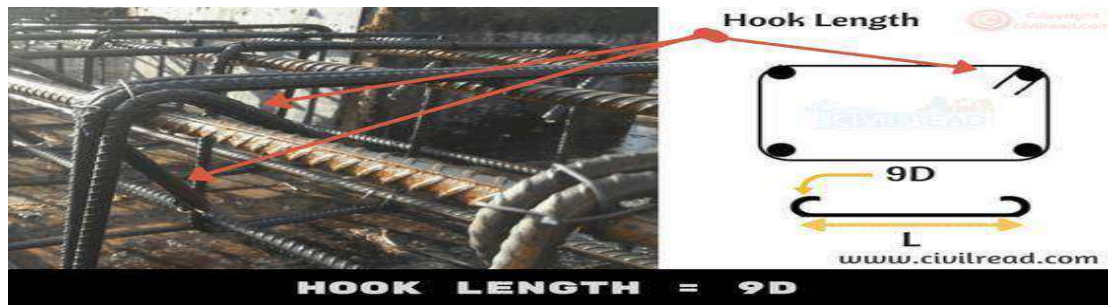


Fig 15:- Hook length of stirrups

### Example Calculation considering stirrup with the hooks at ends:

For clear understanding, look at the below image for calculation of the total length of stirrup with the two hooks at ends.

Total Cutting Length of stirrup or tie = Total length of Bar + 2 x Hook Length (Two hooks)  
Total Cutting Length =  $L + 2(9d)$

Therefore Total Cutting length =  $L + 18d$  ( $d$  is the Diameter of a bar) Hope, now you are clear with the Hook length calculation.

## 2. Bend Length:-

The Bend length calculation is different for Cranked bars (bent up bars) and bends at corners. The bars are usually cranked in Slabs and bars are bent at corners in Stirrups or ties.

### (i) Bend Length calculation in Cranked Bars:-

As shear stress is maximum at supports in slab. To resist these stresses we usually crank the bars at the ends of supports in the slab. The below figure depicts the bent up bar in Slab. To calculate the bend length the below procedure is followed.

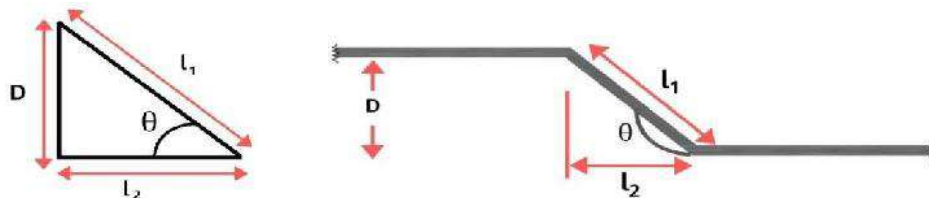


Fig 16:- Bend length for slabs

From the above figure as the bar is bent at an angle  $\theta^\circ$  the additional length ( $l_a$ ) is introduced. Where,  $l_a = l_1 - l_2$ —(i)

$$\tan \theta = D/l_2 ;$$

$$\sin \theta = D/l_1$$

Hence  $l_1 = D/\sin\theta$  and  $l_2 = D/\tan\theta$

Therefore from (i) :-  $l_a = D/\sin\theta - D/\tan\theta$

### Example Calculation considering Bent up bar in Slab (Cranked bar):-

To keep the crank bar in position, an extra bar of length (L/4) is provided below the crank bar as shown in the below figure.

Therefore, the total length of bar =  $L + 0.42D + 0.42D + (L/4) + (L/4) = 1.5L + 0.84D$

Remember D = Depth of Slab-Top Cover-Bottom cover

### (ii) Bend Length calculation when bars are bent at corners:-

The important standards used while calculating the bend length at corners

45° Bend length = 1d

90° Bend length = 2d

135° Bend length = 3d

Here, 'd' = Diameter of bar

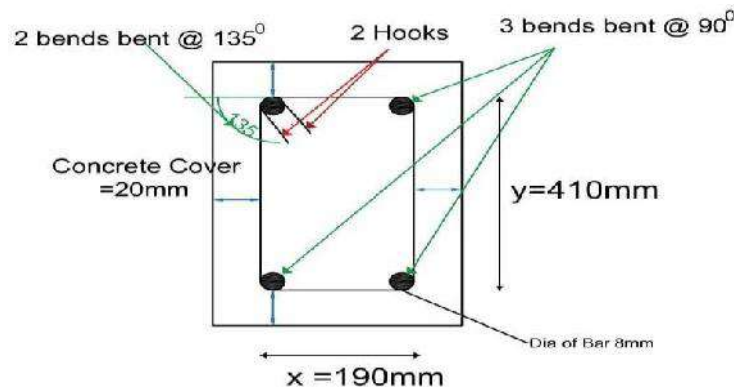


Fig 17:- Bend length for stirrups

From above fig, there are 3 bends which are bent at an angle of  $90^\circ$  and two bends are bent at an angle of  $135^\circ$

Total bend length =  $3 \times 90^\circ \text{ Bend length} + 2 \times 135^\circ \text{ Bend length} = 3 \times 2d + 2 \times 3d = 12d = 12 \times 8 = 96\text{mm}$

### 3. Overlap Length / Lap Length in Reinforcement:-

The standard length of Rebar is 12m. Suppose the height of the column is 20 m. To purvey this requirement, two bars of length 12m and 8m are overlapped (joined) with overlap length.

Overlap Length for compression members (columns) =  $50d$

The Overlap Length for tension members (beams) =  $40d$

[ $d$  is the Diameter of the bar]

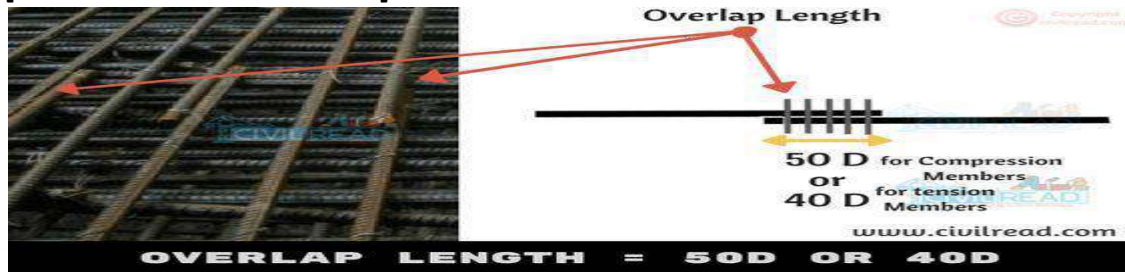


Fig 18:- overlap length for slabs

### How to Prepare Bar Bending Schedule:

To understand clear, Here I am considering the below structural member RCC Column and preparing a BBS for it.

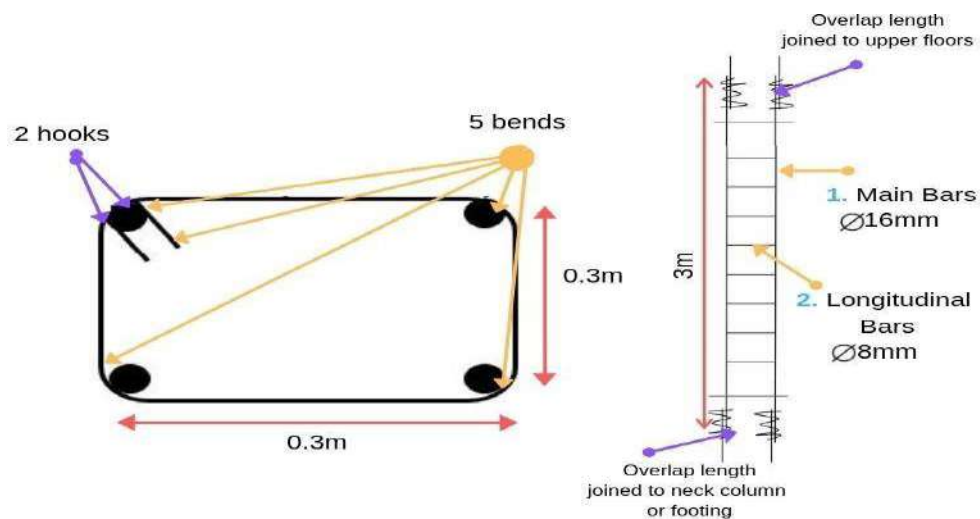


Fig 19:- overlap length for column



**Table 6:- Bar bending schedule for column**

BBS of Column	
Structural Member	Column (3mx0.3mx0.3m)
Bar Marking	<ol style="list-style-type: none"> <li>1. Main Bars</li> <li>2. Stirrups (Longitudinal bars)</li> </ol>
Dia of Bar	<ol style="list-style-type: none"> <li>1. Main Bars = 16mm ;</li> <li>2. Stirrups (Longitudinal bars) = 8mm</li> </ol>
No. of Bars used	<ol style="list-style-type: none"> <li>1. Main bars = 4</li> <li>2. Stirrups = 30</li> </ol>
Cutting length	<ol style="list-style-type: none"> <li>1. Main bars = 3.16m</li> <li>2. Stirrups = 2.64m</li> </ol>
Total Length of bar	<ol style="list-style-type: none"> <li>1. Main bars = 18.4m</li> <li>2. Stirrups = 43.2m</li> </ol>
Weight of Steel bar	<ol style="list-style-type: none"> <li>1. Main bars = 29Kgs</li> <li>2. Stirrups = 17Kgs</li> </ol>

**Calculation part of above table:**

**No. of Bars calculation:**

Main bars = 4

To calculate the No. of longitudinal bars adopt spacing between bars

is 0.1m No. of Longitudinal bars = Length of column / Spacing =

$3/0.1 = 30$  bars Longitudinal bars = 30

**Cutting length calculation:**

$$\text{Main bars} = 3\text{m} + 50d + 50d = 3 + 50 \times 0.016 + 50 \times 0.016 = 4.6\text{m}$$

Stirrups:

$$\text{Hook length} = 9d + 9d = 18d = 18 \times 0.08 = 1.44\text{m}$$

$$\text{Bend length} = 3 \times 90^\circ \text{ Bend length} + 2 \times 135^\circ$$

$$\text{Bend length} = 3 \times 2d + 2 \times 3d = 12d = 12 \times 8 = 0.096\text{m}$$

$$= 1 + \text{hook length} + \text{bend length} = 0.3 + 0.3 + 0.3 + 0.3 + 0.144 + 0.096 = 1.44\text{m}$$

Hence for Main Bars = 4.6m; Longitudinal bars = 1.44m

**Total Length of Bars:**

Total length of Main bars = No. of Main bars x length of one bar

$$= 4 \times 4.6 = 18.4\text{m}$$

Total length of Longitudinal bars = No. of longitudinal bars x length of one bar

$$= 30 \times 1.44 = 43.2\text{m}$$

**Weight of steel bar:**

$$\text{Weight of steel bar for 1m} = 1\text{m} \times D^2/162$$

$$\text{Total weight of Main bars} = 18.4 \times 16^2/162 =$$

$$29\text{Kgs}$$

$$\text{Total weight of longitudinal bars} = 43.2 \times$$

$$8^2/162 = 17\text{Kgs}$$

Total weight of steel bar required to do BBS of above column = 46Kgs.

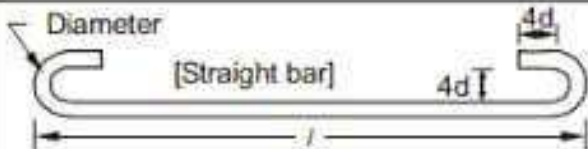
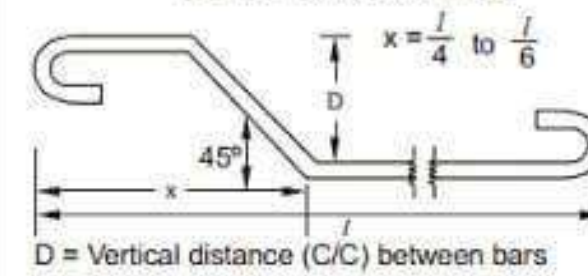
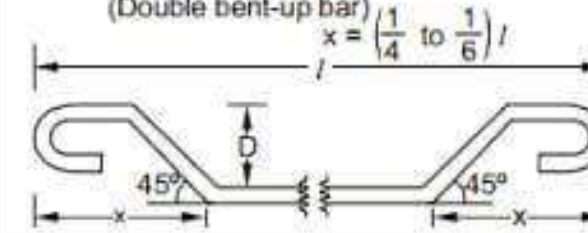
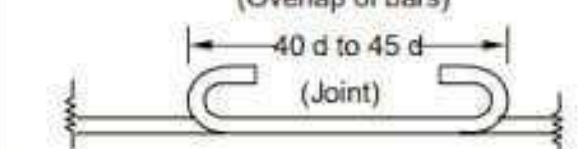
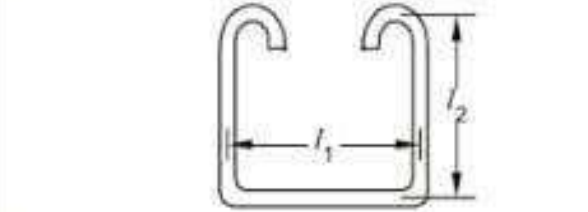

Sl. No.	Details of Bar Shape	Length of Hooks	Total Length of Bar
1.	 <p>[Straight bar]</p>	$2[9d] = 18d$ (both hooks together)	$[l + 18d]$
2.	 <p>[Bent-up at one end only]</p> <p><math>x = \frac{l}{4}</math> to <math>\frac{l}{6}</math></p> <p><math>D</math> = Vertical distance (C/C) between bars</p>	$2[9d] = 18d$ (both hooks together)	$[l + 18d + 0.42D]$
3.	 <p>(Double bent-up bar)</p> <p><math>x = \left(\frac{1}{4} \text{ to } \frac{1}{6}\right)l</math></p>	$2[9d] = 18d$ (as for above cases)	$[l + 18d + 2 \times 0.42D]$
4.	 <p>(Overlap of bars)</p> <p>40 d to 45 d</p> <p>(Joint)</p>	$2[9d] = 18d$	Overlap length at joint $= [(40d \text{ to } 45d) + 18d]$
5.		[Here, one hooks height = 14d] $2 \times (14d) = 28d$	$[l_1 + 2l_2 + 28d]$
6.		$2(12d) = 24d$	$[2(l_1 + l_2) + 24d]$

Table 7:- Length of hook & total length of bar



**Plate 6&7:- Bar bending**

**Important rules while preparing Bar Bending Schedule:-**

- The bars used in building should be grouped together for each structural unit and listed separately for each floor.
- Bars are listed in numerical order.
- To identify the bar in the bundle of bars, each bar is uniquely labeled with reference details (Length of the bar, size of the bar, Shape of the bar).
- The type of bar and shape of the bar should be in accordance with B8666. It is essential that the bar mark reference on the label attached to a bundle of bars refers uniquely to a particular group or set of bars of defined length, size, shape and type used on the job. The cutting length and bending length calculations are separately calculated and not included in the detailed list. Like I have listed the Bar Bending details in a table and calculations are done separately.

### **Use of Bar Bending Schedule:**

- BBS helps to estimate the total quantity of steel required for the construction of building or structure. It helps to quote for tender the cost incurred by steel.
- Finding the cutting length and bending length in reinforcement detailing improves the quality of construction and minimize the wastage of steel, makes an economic construction
- With the help of reinforcement drawings, cutting and bending can be done at the factory and transported to the site. This increases faster construction and reduces the total construction cost. For site engineers, it becomes easy to verify the cutting length and bending length of the reinforcement before placing the concrete.

## **3.2. DIFFERENT TYPES OF REBAR MATERIALS & SIZES**

### **Types of Steel Reinforced Bars are used in Cement Concrete:-**

- Hot Rolled Deformed Bars
- Cold Rolled Steel Bars
- Mild Steel Bars
- Twisted Steel Bars
- Welded Steel Wire

### **DIFFERENT REBAR SIZES**

#### **Bars in slab**

Like in slab we generally use 8mm, 10mm, 12mm because load is less as compared to beam, column, footing.

Note: - 8mm bar generally used in one way slab as distribution bar (secondary steel)

#### **Bars in beam**

In beam we use bars having diameter Greater than 12mm (depends upon load)

#### **Bars in column**

In column we use Greater than 12 mm (depends upon load)

#### **Bars in footing/foundation**

Similarly for footing we use 10 mm or more than that (depends upon loading)

Bars which are available in the market are 8 mm, 10 mm, 12 mm, 16 mm, 20 mm, 25 mm, 28mm, 32 mm, 36 mm and 42 mm

Greater diameter like 64 mm and 128 mm has to be ordered specially from steel plant for



manufacturing.



**Plate 8&9:- Bar bending tools & different types of bars**

## 4. PLUMBING WORK & UGD

**Plumbing** is any system that conveys fluids for a wide range of applications. Plumbing uses pipes, valves, plumbing fixtures, tanks, and other apparatuses to convey fluids.

- Heating and cooling (HVAC), waste removal, and potable water delivery are among the most common uses for plumbing, but it is not limited to these applications.
- The word derives from the Latin for lead, plum bum, as the first effective pipes used in the Roman era were lead pipes.
- In the developed world, plumbing infrastructure is critical to public health and sanitation.
- Boilermakers and pipefitters are not plumbers although they work with piping as part of their trade and their work can include some plumbing.

The major categories of plumbing systems or subsystems are:-

- potable cold and hot tap water supply
- plumbing drainage venting
- sewage systems and septic systems with or without hot water heat recycling and graywater recovery and treatment systems
- Rainwater, surface, and subsurface water drainage
- fuel gas piping
- Hydronics, i.e. heating and cooling systems using water to transport thermal energy, as in district heating systems, like for example the New York City steam system.

### 4.1. MATERIALS

- **PVC pipes:-** Polyvinyl chloride is one of the world's most widely produced synthetic polymers. It is a plastic material. In the manufacturing of PVC, plasticizers are added in order to make it easy to bend and to increase flexibility. But sometimes PVC is made without adding plasticizers in order to get a hard, rigid material. This material is known as UPVC. Sometimes PVC is chlorinated using free radical chlorination in order to obtain CPVC. It has more improved properties than both PVC and UPVC. The main difference between UPVC and CPVC is that UPVC is made without adding plasticizers whereas CPVC is made by adding plasticizers and it is chlorinated as well.

- **UPVC pipes:-** UPVC is the term that stands for unplasticized polyvinyl chloride. PVC or polyvinyl chloride is a polymer material that can be heated and molded to get desired products



such as pipes. PVC pipes are strong and very hard. Therefore, manufacturers tend to add plasticizers to PVC in order to reduce rigidity. However, UPVC is the unplasticized PVC in which no plasticizer is included. Hence it is very rigid.

UPVC pipes are less bendable and are hard to work with due to their rigidity. A UPVC pipe is nearly rigid as an iron pipe. However, it is easy to cut with power tools. UPVC pipes are durable and fire-resistant. They are also recyclable.

- **CPVC pipes:-** CPVC or chlorinated polyvinyl chloride is a thermoplastic polymer. It is produced by the chlorination of PVC polymer. This chlorination is done to get the properties such as more flexibility and ability to withstand high temperatures.

The production process includes the chlorination of PVC via free radical chlorination. This reaction is initiated by using UV energy, which can decompose chlorine gas into radicals. These radicals then react with PVC and replace a portion of hydrogen atoms with chlorine atoms. Various additives are also introduced to the polymer material in order to make it easy to process.

#### **Types of pipes based on pipe materials:-**

- Cast iron Pipe.
- G.I Pipe.
- Wrought Iron Pipe.
- Steel Pipe.
- Copper Pipe.
- Plastic Pipe.
- Asbestos Cement Pipe
- Concrete Pipe.
- Vitrified Clay Pipe.

## **4.2. PLUMBING FITTINGS OR TOOLS**

- |            |                |                     |
|------------|----------------|---------------------|
| • Adapter  | • Diverted tee | • Trap primer       |
| • Elbow    | • Plug         | • Combo tee         |
| • Coupling | • Barb         | • Sanitary tee      |
| • Reducer  | • Valve        | • Drain & vent pipe |

- Union
- Slip-joint fitting
- Baffle tee
- Nipple
- Sweep elbow
- Clean out
- Double-tapped bushing
- Closet flange
- Double sanitary tee

**Plate 10&11:- Plumbing tools & plumbing connections**



## 4.2. UNDER GROUND DRAINAGE SYSTEM

### General Rules in designing sanitary system:

- The pipes should take the shortest possible route to the house sewer or the terminating point of the Sanitary system
- Control components such as clean-outs, traps, and vents, should be located strategically so as to ensure efficient circulation.

### Sub-systems of Sanitary System:-

- Waste Collection System
- Ventilation System

### Definition of Terms:-

- **Sullage:** The Wastewater coming from bathrooms and kitchens which does not contain fecal matter is known as sullage.
- **Plumbing System:** It is entire system of pipe line for providing water supply to the building or it is a system of pipes for disposal of wastewater from the building.
- **Sewer:** A pipe carrying sewage/ wastewater is called sewer.
- **Soil Pipe:** It is pipe carrying sewage from W.C.
- **Waste Pipe:** It is a pipe carrying sullage from bathrooms, kitchens, sinks, wash basins, etc.
- **Sewerage System:** A system of sewers of different types and sizes in a town collecting wastewater from the town and carrying it to the wastewater treatment plant.

### House Drainage Plan:-

- Drainage layout plan should be as simple as possible. Pipes should be laid in straight line.
- Both vertical and horizontal pipes shall be laid in straight lines as far as possible.
- Where there is change in the direction of pipe, inspection chamber or manhole should be provided.
- Sewers should not be laid under a building to avoid the risk of decrease in bearing capacity in case of continuous leakage of sewage from joints. The leaked sewage percolates in the soil and increase moisture content of soil below the foundation. Increased moisture content decreases bearing capacity which is not desirable.

- Pipes should be laid at proper gradient and proper size. The usual size of house sewer is 100 mm, 150 mm, 230 mm, and 300 mm. They should be laid with such a gradient that there is no deposit of solid matter.

#### **Traps and Pipes and other components of house Drainage System:-**

- Traps
- Pipes
- Sanitary Fittings

#### **Different types of traps:-**

- Floor Trap or Nahni Trap
- Gully Trap
- P, Q and S-Trap
- Intercepting Trap
- Grease Trap

### **4.3. DISPOSAL METHODS (MANHOLE & SEPTIC TANK)**

**1.Manhole:-** A manhole or an inspection chamber is a unit constructed underground to provide access to the utilities like a sewer system, drainage system, etc. Hence, with the help of a manhole, underground utilities are inspected, modified, cleaned and maintained.



**Fig 20:- Manhole**

#### **Purpose of Manhole**

- To perform inspection, cleaning, and removal of any obstruction present in the sewage line.
- The joining of sewers, the change of direction or the alignment of sewers can be performed with the help of manhole.
- These have a perforated cover which helps the foul gases to escape. Hence it is a good means

of ventilation for the underground sewage system.

- Manholes help to lay the sewer line in the conventional lengths.

### **Features of Manhole**

The main parts of a manhole are the chamber or ring and the Vertical Circular Pipe. The vertical circular pipe is available in varying depth and sizes. These pipes are used to access the inspection joints in the system. Manholes are mainly positioned 0.5m away from the curb lines of the road. The cover of a manhole is a plug that protects the manhole from any unauthorized access. The covers used for manholes can be rectangular, square or circular in shape. The material of cover can be precast concrete, composite material or any glass-reinforced plastic material. The provision for access through the manhole is performed through steps. If the depth of the manhole is less than 1 m, a step ladder is constructed. If the depth of the manhole is greater than 2.5m, a regular ladder is fitted. Now modern manholes do not demand physical entry.

The three main types of manhole depending on the depth are:

- **Shallow Manhole:-** A shallow manhole has a depth ranging from 75 to 90 cm. These are constructed at the start of a branch sewer or in an area where there is not much traffic. The shallow manhole is provided with a light cover called as the inspection chamber.
- **Normal Manhole:-** These are provided at the sewer line with a heavy cover on its top. It has a depth of 150cm. Normal manhole takes a square shape.
- **Deep Manhole:-** Deep manhole is provided at a depth greater than 150cm with a very heavy cover at its top. The size can be increased and the facility for going down is also increased.

### **Location of the Manhole**

The manhole construction is performed under the following circumstances:

- Where a change of sewer line is necessary
- There is a change in sewer size and alignment.
- A junction is formed by two or more sewer lines.

## **2. Septic tank**

- A septic tank can be defined as primary sedimentation tank with large detention time (12 to 36hrs against a period of 2hrs in an ordinary sedimentation tank).
- In un-sketched rural and urban areas septic tanks are suitable for disposal of night soil. But sufficient water should be available as water is required for flow of the night soil from latrine



to the septic tank and for proper functioning of the septic tank.

- The effluent from the septic tank is usually disposed by absorption in the soil through soak pit, if no municipal drainage system is prevailing in the area. If municipal drainage line exists in the area, the effluent is discharged to the drain.

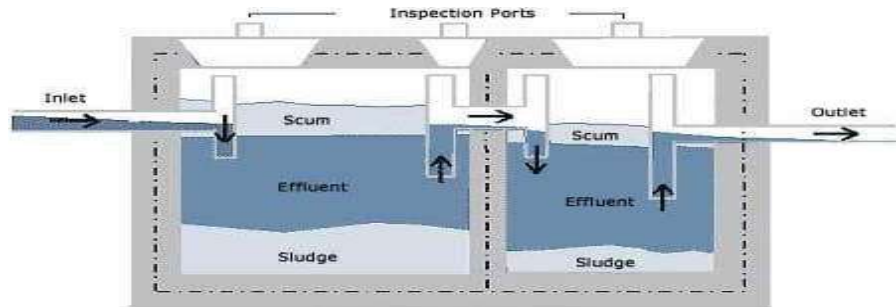


Fig 21:- Septic tank

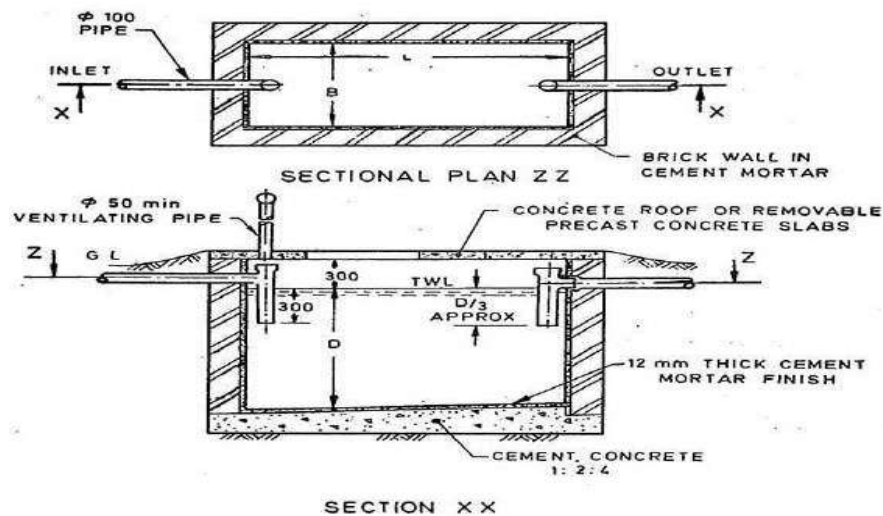


Fig 22:- Plan & cross-section of Septic tank

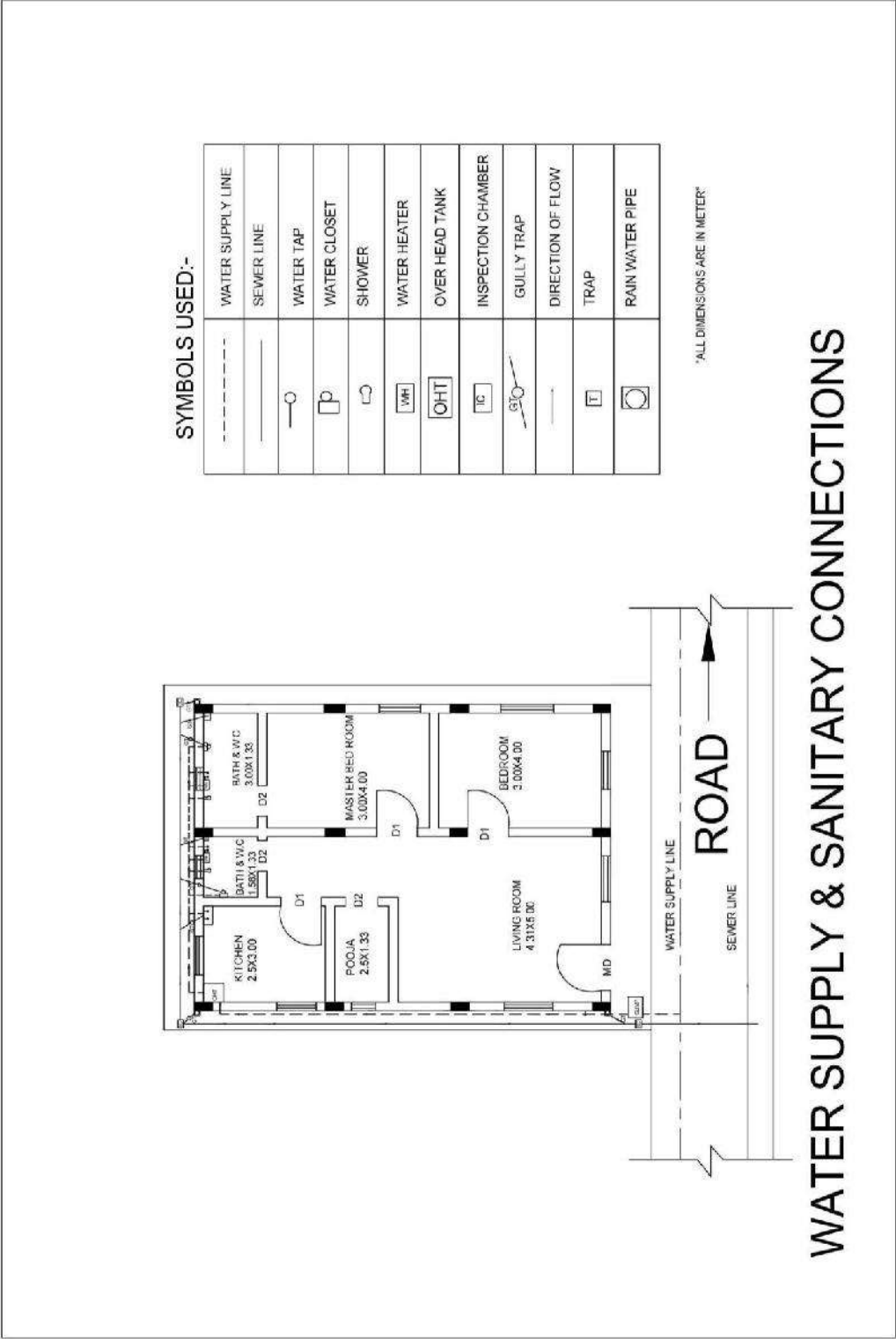


Fig 23:- Water supply & sanitary connections for a building



## 5. PAINTING WORK

Paint is a liquid or mastic material that can be applied to surfaces to color, protect and provide texture. They are usually stored as a liquid and dry into a thin film after application. Paints be categorized decorative, are applied on site, or industrial, applied in factories as part of the manufacturing process.

**Some of the attributes normally required from paint include:**

- Capable of easy application.
- Good flow out of application marks (e.g. brush-marking).
- Capable of forming a continuous protective film.
- High opacity.
- Quick drying.
- Corrosion resistance.
- Water and heat resistance, Color stability against visible and ultraviolet radiation, Abrasion and scratch resistance, Durability, Flexibility, Easily cleaned.

Paints can be applied with a brush or roller, or by dipping, flow coating, spraying, hot spraying, electrostatic spraying, airless spraying, electrode position, powder coating, vacuum impregnation, immersion, and so on.

### 5.1. TYPES OF PAINTS

- Water-based paint, also described as ‘latex paint’ or ‘acrylic’ if the binding ingredient is a form of acrylic, takes less time to dry than oil-based, however, they are less glossy and are often less durable.
- Although not strictly paint, primer is often required as a component when working with paint. Oil-based paint will require an oil-based primer, and water-based paint will require a water-based primer.
- Very generally, oil-based paints can be applied onto water-based paints, but water-based paints cannot be applied onto oil-based paints.

**Different types of paints are:-****1. Enamel Paint**

This particular type of paint is commonly produced by adding zinc or lead straight to varnish. In order to achieve a vast array of colors, pigments are going to be added onto it. Enamel paints are proven to form hard and glossier coatings that are absolutely easy to clean. Additionally, the paint is characterized by being chemically resistant and waterproof, offering excellent color retention and good coverage. Subcontractors must be supervised properly during the application process of this paint. A subcontractor scheduling software is an excellent project and crew management tool that ultimately helps the entire project cycle and all crew members involved.

Below are some of the most common uses of enamel paint:

- Windows
- Interior and exterior walls
- Stairs
- Wood trims, flooring and doors
- Surface areas like masonry, metals, wicker, glass and plasters

The major limitations when it comes to enamel paint are the requirement of titanium coating and slow drying before application.

**2. Oil Paint**

Oil paints usually use white lead as its base and are usually applied in 3 coatings – primer, undercoat, and lastly finish coat. This type of paint can greatly achieve glossy and mat finishes and at the same time while being durable and affordable. The painted surfaces after using oil paint are very easy to clean and it is also characterized by ease of application. Oil paint is typically used indoors, metal structures, walls and windows. It is important to take note that oil paint isn't suitable most particularly for humid conditions and it also take so much time to dry out completely. For its application, linseed oil and pigments should be added beforehand.

**3. Emulsion Paint**

Emulsion paints often use polystyrene and polyvinyl acetate as its binding materials, and at the same time, it contains driers such as manganese and cobalt. Furthermore, this paint can either be oil-based or water and its pigments are often used in order to achieve all desired colors. Emulsion paints are typically characterized by its hardening and fast-drying capabilities. For the

surfaces, it can be easily cleaned using water. After the application, the paint itself definitely offers good color retention, durability and lastly alkali resistance.

#### **4. Cement Paint**

This type of paint is neither water nor oil-based but usually available in powder form, mixed using water to achieve paint consistency. The very base material for this is either colored cement or white and it might also contain pigments, other additives, and even accelerators. Cement paint is commonly used in both rough external and internal surfaces since its characteristics are proven to be very durable and waterproof. Take into consideration that cement has longer drying time, usually for about 24 hrs. The application for it should be done in two coatings in order to prevent dampness issues.

#### **5. Bituminous Paint**

This specific type of paint is usually made from tar or dissolved asphalt that ultimately gives it a common characterized black color. It is also waterproof and at the same time alkali-resistant. However, it is not suitable for any applications wherein it will be fully exposed to the sun because it gradually deteriorates. Bituminous paint is typically used for concrete foundations, underwater ironworks, iron pipes, and wooden surfaces. For metal application, it helps in providing rust resistance.

#### **6. Plastic Paint**

This type of paint often uses water as the thinner, and this is very much available in a wide-ranging set of colors. The way it dries is quick and it certainly offers very high coverage. Below are the common applications of plastic paint:

- Slabs
- Ceilings, walls of display rooms, auditoriums, showrooms, etc.
- Decks

#### **7. Anti-Corrosive Paint**

This paint is often characterized by its own chemical resistance as being implied with its name. Linseed oil, fine sand and zinc chrome are where it has been made of. This paint has a normal black color and often applies for pipes or any metallic surfaces. This paint is capable of obstructing the corrosion by minimizing the direct access of water and air to the metal. The coatings act as a barrier in order to inhibit the main contact between corrosive materials and chemical compounds.

## 8. Cellulose Paint

This paint is commonly produced from amyl acetate, celluloid sheets and photographic films. Adhesion could be improved through the addition of castor oil and the surfaces could be cleaned easily. Once the paint has dried, it can be washed too. This particular kind of paint is usually characterized by its faster drying, hardness and smoother finish while it offers resistance against water, acids, and smoke. Cars and airplanes are where cellulose paint is best applied. It is absolutely the cost that turned out to be the greatest disadvantage of this paint. Nevertheless, still, it is worth investing.

## 9. Varnishes

Varnish, liquid coating material containing a resin that dries to a hard transparent film. Most varnishes are a blend of resin, drying oil, drier, and volatile solvent. When varnish dries, its solvent portion evaporates, and the remaining constituents oxidize or polymerize to form a durable transparent film. Varnishes provide protective coatings for wooden surfaces, paintings, and various decorative objects. Varnish protects and enhances the appearance of wooden floors, interior wood paneling and trim, and furn.

## 10. Distempers

Distempers are the cheaper variety of paints in which chalk is used as base and water is used as a carrier. The emulsifying agent which is commonly used is glue or casein. Distempers are available in powder they are to be mixed with hot water before use. The surface to be distempered should be thoroughly rubbed and cleaned. The cracks, if any should be filled by lime putty. The surface should be kept dry for about two months before applying distemper. Thus a primary coat is applied and is allowed to dry. Distemper is usually applied in two coats.

Properties of Distemper:-

- They are generally light in color.
- The coatings are generally thick.
- They give reflective coating.
- They are less durable than oil paints but are cheaper.

## 5.2. PAINTING TOOLS

- Step ladders and extension ladders – to help you reach elevated areas
- Paint scraper – to remove loose or peeling paint from wood, plaster, and other surfaces
- Triangular-load scraper – to remove paint in small or tight areas
- Steel wool – to remove corrosion from metal surfaces
- Bristle brush – to clear loose material from masonry
- Wire brush – to remove efflorescence and loose material from masonry, or to remove loose, flaking paint
- Putty knife – to scrape away loose paint, or to apply filler
- Broad putty knife – to fill in and smooth patching compounds in plaster and wallboard
- Glazing compound – to replace cracked, broken, or missing panes of glass
- Spackling paste – to fill nail holes and small imperfections in walls Long-handled brush – to clean large exterior surfaces
- Scrub brush – to remove mildew and dirt
- Sandpaper (various grits) – to smooth and feather previously painted surfaces, or to roughen glossy surfaces so paint will adhere better
- Drop cloths – to protect furniture, floors, and shrubbery from paint
- Sanding block – to hold sandpaper and help you sand surfaces to an even finish
- Caulking gun – to apply caulk to cracks in walls, gaps, and seams in woodwork, and the junction of different surfaces (e.g., wood siding and stone)
- Tubes of caulk – same as above (note that all-acrylic and siliconized acrylic caulks are paintable; silicone caulk is not)
- Masking tape – to protect window panes and trim from paint
- Paint guide – to protect carpets and walls when painting baseboards and other trim
- Roller tray and grid – to load rollers with paint
- Brush comb – to clean paint brushes
- Paint pail – to mix paint and carry it to the worksite



**Plate 12:- Painting tools**

### 5.3. PAINTING ON DIFFERENT SURFACES

#### 1. Painting on new wood work

The painting on new wood work is done on the following steps. For good work, 4 coats of paints are required, while for inferior work, only 2 to 3 coats are applied.

**Preparation of surface:** For good results, wood work should be well-seasoned, and should not contain more than 15% moisture. The surface is dusted off thoroughly to remove dust, shavings, foreign matter etc. Heads of nails are punched to a depth 3 mm below the surface to be painted. Greasy spots, if any, should be removed by rubbing with piece of clean white muslin soaked in benzene or turpentine, allowed to dry, and glass papered if necessary.

**Knotting:** Knotting is the process of covering or killing all knots in the wood work with a substance through which the resin cannot come out or exude. Otherwise, the resin coming out of knots would damage the paint. Knotting can be done by three methods. In the first method, called ordinary or sized knotting two coats are applied. The first coat consists of grounding 15 g of red lead in 2 liters of water, adding 225 g of glue and heating the solution. This coat dries in 10 minutes, and then the second coat is applied. The second coat consists of red lead ground in boiled linseed oil and thinned with turpentine oil. The second method is known as *patent* which consists of applying a coat of hot lime, leaving it for 24 hours, scrapping off the surface and then carrying out ordinary or size knotting.



**Priming:** After knotting, the surface is rubbed smooth with a abrasive paper. Priming consists of applying first coat of paint to fill all the pores. Priming coat creates a layer or film which provides adhesion of the paint with the surface. Usually, the ingredients of the paint are kept the same as in subsequent coats though in varying proportion. The composition of primer for ordinary work may be composed of 3 kg red lead, 3 kg white lead 3 liter of linseed oil or turpentine. For superior work, the following composition is recommended:

For interior work			For exterior work		
Red lead	= 0.25 kg	(base)	Red lead	= 0.04 kg	(base)
White lead	= 3.5 kg		White lead	= 4.5 kg	
Boil Linseed oil	= 0.5 litre	(vehicle)	Raw Linseed oil	= 2.25 kg	(vehicle)
Raw Linseed oil	= 0.5 litre				
Litharge	= 0.05 kg	(drier)	Litharge	= 0.09 kg	(drier)

**Table 8:- Paint quantity required for interior & exterior wall**

**Stopping:-** It is the process of rubbing down the wood surface by means of pumice stone or glass paper after prime coat is applied, and then filling up all cracks, all nail holes, dents, open joints etc., with putty. After putty dries up, the surface is rubbed again with pumice stone or glass paper. The putty is made by mixing powdered chalk in linseed oil to the consistency of a thick paste. For superior work, hard stopping is restored to by using one-third white lead and two-thirds ordinary putty in place of ordinary putty.

**Under-coatings:-** After stopping, second and successive coatings (known as under-coatings) are applied. The first coat is the prime coat. The under-coatings should be of the same shade as that of the finishing coat. The under-coatings may be necessary, depending upon the quality of work desired. Sufficient time should be allowed for each coat to dry before next coat is applied. For superior work, each coat is allowed to dry, rubbed down with pumice stone or glass paper then cleaned before next coat is applied.

**Finishing coat:-** Finishing coat is applied after the under-coat is perfectly dry. This coat is applied very carefully, by a skilled painter, so that finished surface is smooth, uniform and

free from patches and bush marks.

## **2. Repainting old work**

- Before repainting old work, the old paint having cracks and blisters should be removed, by applying any one of the following solvents or paint removers:
- Applying solution containing 1 kg of caustic soda in 5 litres of water. The paint gets dissolved.
- Applying mixture containing one part of soft soap, two parts of potash and one part of quicklime, while in hot state. After 24 hours of application, the surface is washed with hot water.
- Applying mixture of equal parts of washing soda and quicklime to the required consistency. After 1 hour of application, the surface is washed with water.
- After removing the old paint, the surface is properly cleaned and then rubbed with Pumice stone or glass paper. The cleaned surface is given two or three coats of paint to obtain the desired finish.

## **3. Painting new iron and steel work**

Iron and steel surfaces are painted so that rusting is prevented. Hence surface should be prepared very carefully.

- The surface is cleaned off scale and rust etc. by scrapping or brushing with steel wire brushes, oil, grease, etc. is removed by washing the surface with petrol, benzene or lime water.
- The cleaned surface is treated with a film of phosphoric acid. This film protects the surface from rusting and provides better adhesive surface for the paint.
- The prime coat or first coat is then applied with a brush. The coat consists of dissolving 3 kg of red lead in 1 litre of boiled linseed oil.
- After the prime coat has dried, two or more under-coats are applied either with a brush or with spray gun. Care should be taken to see that each successive coat is applied only after the previous coat has dried completely. The under-coat may consist of 3 kg of red oxide, dissolved in 5 litres of boiled linseed oil.
- After the under-coat has dried, the final coat of the desired type of paint is applied. The finishing coat should present smooth finish.

#### 4. Repainting old iron and steel work

Before repainting, the old surface is thoroughly cleaned by application of soap water. The grease, if any, may be removed by washing the surface with lime and water. However, if the old paint has cracked, it has to be removed by flame-cleaning. A flat oxy-acetylene flame is passed over the metal, burning off the old paint and loosening rust and scale. The surface is then scrapped with wire brush and washed with solution of caustic soda and fresh slacked lime, after the surface is thus prepared, painting is carried out as for the new surface.

#### 5. Interior Wall Painting

- **Surface Preparation:-** If you are planning on painting a new wall, give it 28 days to cure and make sure it does not have any waterproofing issues. Use sandpaper or other scraping tools to remove any particles that may affect your paint finish such as loose flaking paint, dirt, grease, and dust.
- **Primer:-** Apply Shalimar Water Neutralizing Cement, Universal White, or Thinnable cement primer depending on the area you wish to paint. Give it about 6 to 8 hours to dry then spot prime the nailholes and cracks.
- **Putty:-** When the primer has dried, apply putty to get rid of all uneven wall surface areas. Use Shalimar Magic Acrylic Wall or and allow it 6 hours to dry. Sand the pasted area to make it even with the rest of the wall using a 180/320 emery paper then wipe off the putty dust.
- **Top Coat:-** If you want your walls to have a shiny appeal; thin out interior emulsion paint at a ratio of 3:5 or 7:10 with water. For a softer and more depth sheen, mix water and emulsion paint at a ratio of 1:5 or 3:10. Mix and apply 2 to 3 coats of interior emulsion paint within a period of 6 hours.

#### 6. Exterior Wall Painting

- **Surface Preparation:-** Allow the surface to cure for 28 days and make sure that there are no waterproofing issues. Sand the surface with sandpaper or scraping tools to remove dirt and grease then wipe off any remaining dust.
- **Primer:-** Use Shalimar Exterior Primer and allow it 6 hours to dry. Use a 180 or 320 sand paper to smoothen the surface then wipe with a dry and clean cloth.
- **Putty:-** If there are any marks on the walls, apply Shalimar Magic Acrylic Wall Putty or Wall Guard to even out the areas. Allow the putty 6 hours to dry, level the pasted surface with

sandpaper, and wipe off any remaining dust.

- **Top Coat:-** Now for the final part of exterior paint application, thin professional exterior emulsion with cleanwater at a ratio of 2:5 or 1:2 by volume. Apply 2 to 3 coats of professional exterior emulsion paint and allow it 6 hours to dry for four. If you want a darker shade, apply more coats of paint.



**Plate 13:- Different wall paintings**

## 6. ELECTRIC WORK

An electric power system is a network of electrical components deployed to supply, transfer, and use electric power. An example of a power system is the electrical grid that provides power to homes and industry within an extended area. The electrical grid can be broadly divided into the generators that supply the power, the transmission system that carries the power from the generating centers to the load centers, and the distribution system that feeds the power to nearby homes and industries. Smaller power systems are also found in industry, hospitals, commercial buildings and homes. The majority of these systems rely upon three-phase AC power the standard for large-scale power transmission and distribution across the modern world.

Specialized power systems that do not always rely upon three-phase AC power are found in aircraft, electric rail systems, ocean liners, submarines and automobiles.

### 6.1. TOOLS & MATERIALS

#### Tools

- Pliers
- Screwdrivers and nut drivers
- Wire strippers
- Fishing tools
- Measuring devices
- Power drills and drivers, hammer/drills
- Power saws

#### Wiring materials

Electrical wire is made of materials like copper, aluminum and silver. As silver is expensive, mostly copper and aluminum are used in wiring.

Materials are classified into three types according to their properties:

#### Conducting Material

- **Copper:-** It is a good conductor of electricity. It is used in wiring materials in cables. It has low resistance and is used for conduction of electricity at high, medium and low voltage. It is used in wiring and cable making.
- **Aluminum:-** It is light weight and cheaper in comparison to copper. Therefore, this type of conducting material is mostly used in electrical wiring. It is silvery-white in colour and it has

a soft texture. It is often used in wiring and making cable.

**Insulating Materials:-** Insulating materials are used for insulating purpose. These types of materials are bad conductors of current. For example rubber, paper, mica, wood, glass and cotton.

### **Wiring Accessories**

Wiring accessories are used for connecting appliances:-

- **Switch:-** A switch is used to make or break an electrical circuit. It is used to switch ‘on’ or ‘off’ the supply of electricity to an appliance.

**One-way switch:** It is used to control single circuits and lamp.

**Two-way switch:** It is used to divert the flow of current to either of two directions. The two-way switch can also be used to control one lamp from two different places as in the case of staircase wiring.

**Intermediate switch:** It is used to control a lamp from more than two locations.

- **Holders**

A holder is of two types.

1. Pendant holder
  2. Batten holder
- **Ceiling rose:-** It is used to provide a tapping to the pendant lamp– holder through the flexible wire or a connection to a fluorescent tube.
  - **Socket outlet/plug:-** The socket outlet has an insulated base with the moulded or socket base having three terminalsleeves.
  - **Main switch:-** To control the electrical circuit a main switch is used. Through the main switch, the power in a building is controlled completely.

## **6.2. DIFFERENT TYPES OF ELECTRICAL HOUSE WIRING SYSTEMS**

### **1. Cleat Wiring**

This wiring comprises of PVC insulated wires or ordinary VIR that are braided and compounded. They are held on walls and ceilings using porcelain cleats with grooves, wood or plastic. It is a temporary wiring system, therefore making it unsuitable for domestic premises. Moreover, cleat wiring system is rarely being used these days.



## **2. Casing and Capping Wiring**

It was quite popular in the past but it is considered obsolete these days due to the popularity of the conduit and sheathed wiring system. The cables used in this electric wiring were PVC, VIR or any other approved insulated cables. The cables were carried through the wooden casing enclosures, where the casing was made of a strip of wood with parallel grooves cut lengthwise for accommodating the cables.

## **3. Batten Wiring**

This is when a single electrical wire or a group of wires are laid over a wooden batten. The wires are held to the batten using a brass clip and spaced at an interval of 10 cm for horizontal runs and 15 cm for vertical runs.

## **4. Lead Sheathed Wiring**

Lead sheathed wiring uses conductors which are insulated with VIR and are covered with an outer sheath of lead aluminum alloy which contains about 95% lead. The metal sheath gives protection to cables from mechanical damage, moisture and atmospheric corrosion.

## **5. Conduit Wiring**

- **Surface Conduit Wiring** When GI or PVC conduits are installed on walls or roof, it is known as surface conduit wiring. The conduits are attached to the walls with a 2-hole strap and base clip at regular distances. Electrical wires are laid inside the conduits.
- **Concealed Conduit Wiring** When the conduits are hidden inside the wall slots or chiseled brick wall, it is called concealed conduit wiring. Electrical wires are laid inside the conduits. This is popular since it is stronger and more aesthetically appealing.

### **Advantages**

- It is a safe wiring system
- Safe from chemical effects, humidity and other external factors
- No risk of shock
- It is aesthetically appealing
- No risk of wear and tear, fire or damaged cable insulation
- Quite reliable
- Renovations can be easily performed as you can replace old wires easily

## Disadvantages

- Expensive as compared to surface conduit wiring
- Changing the location of switches or appliances is difficult
- Installation is complex
- Hard to find defects in the wiring
- Adding additional conduit in future is a tedious task.



**Plate 14:- Electrical tools**



**Plate 14 & 15:- Electrical connections by students**

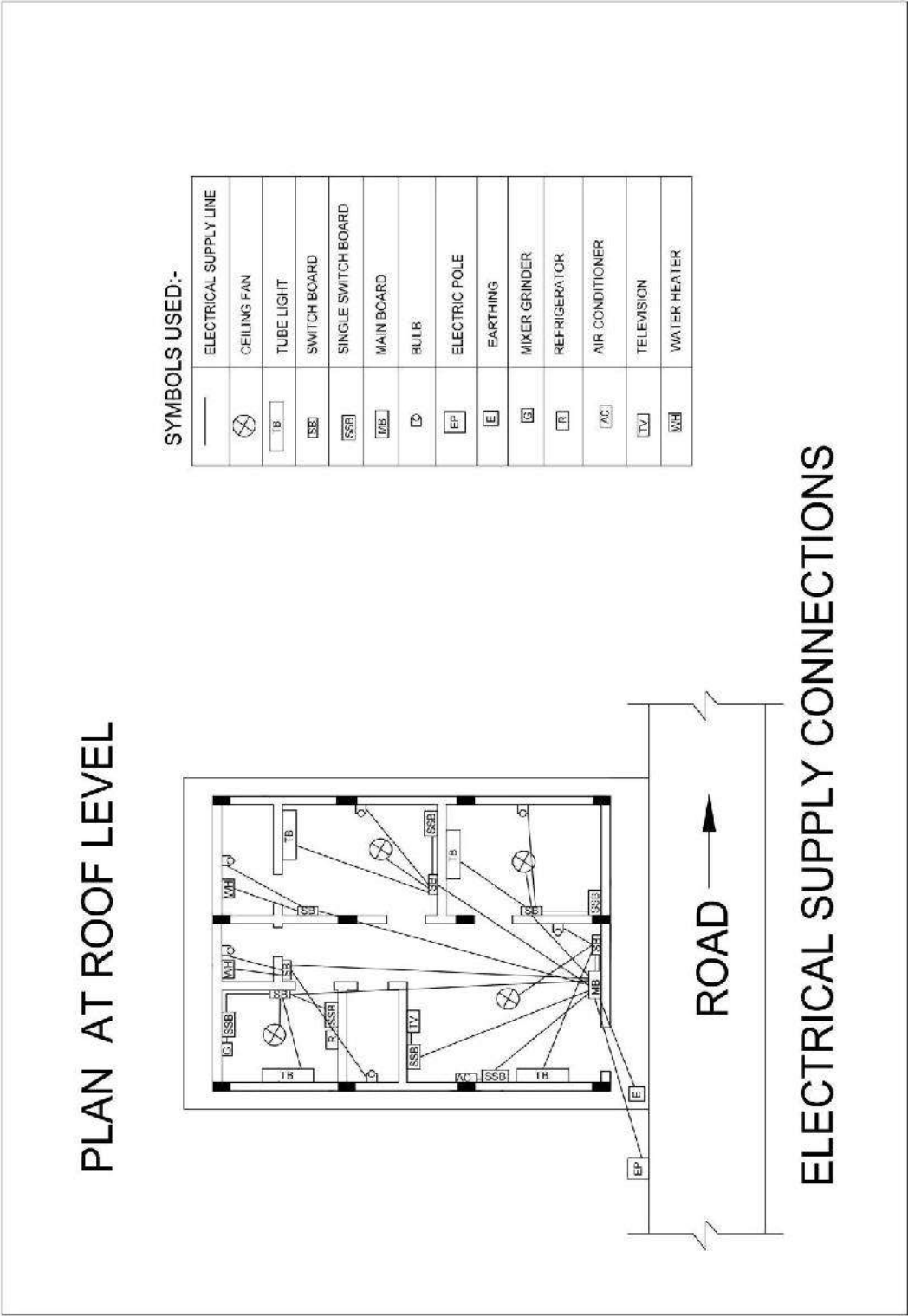


Fig 24:- Electrical supply connections (Diagonally)

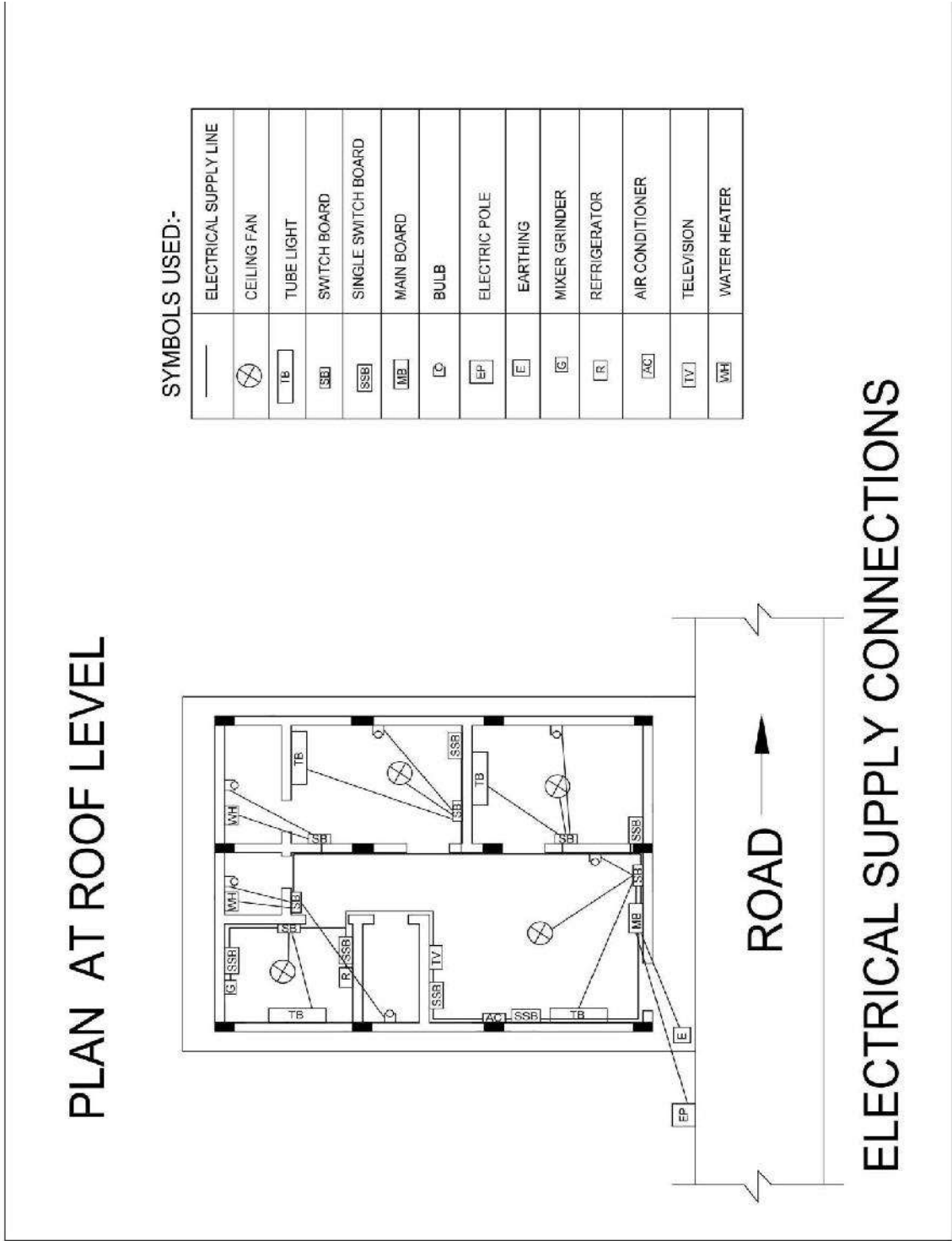


Fig 25:- Electrical supply connections (along the sides of wall)

## 7. CONCLUSION

We had a wonderful experience in site. We got technical & practical knowledge, real field experience during this internship. Our lecturers explained & made us to work in site so that we can relate to field experiences & practical knowledge. We worked out our own plan & its drawings as per building bye-laws & executed in the field. We got to know the requirements, details, drawings required for construction.

We are really thankful to our Principal, HOD sir & internship co-coordinator for giving the great opportunity to conduct internship program in the college itself. It was great experience to work in field & improving our skills. This training will help us a lot in future & to face real problems in field.



**VISVESVARAYA TECHNOLOGICAL UNIVERSITY**  
**"JNANA SANGAMA" BELAGAVI-590018**  
**KARNATAKA**



An Internship report on  
**"INDUSTRIAL TRAINING"**  
*Submitted in Partial fulfillment for the Award of Degree of*  
**BACHELOR OF CIVIL ENGINEERING**

**SUBMITTED BY**

- |                    |                 |
|--------------------|-----------------|
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*Internship carried out at*  
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**BALLARI - 583104**

**UNDER THE GUIDANCE OF**  
**Mr. H.M MALLIKARJUNA**  
**Professor**  
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**DEPARTMENT OF CIVIL ENGINEERING**  
**RAO BAHADUR.Y.MAHABALESWARAPPA ENGINEERING COLLEGE**  
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**2020-2021**



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BALLARI-583104, KARNATAKA.

(Affiliated to Visvesvaraya Technological University, Belagavi and approved by AICTE, New Delhi.)



**DEPARTMENT OF CIVIL ENGINEERING  
CERTIFICATE**

This is to certify that Internship work entitled "**INDUSTRIAL TRAINING**" has been successfully carried out by the internship group in the partial fulfillment for the award of Bachelor degree in **Civil Engineering** from Visvesvaraya Technological University, Belagavi, during the academic year 2020-2021. It is certified that all corrections / suggestions indicated for internal assessment have been incorporated in the report.

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2. M.MANIPAL REDDY
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Signature of the Internship guide

Signature of the HOD

Dr. H.M. Mallikarjuna  
Professor

Dr. H.M. Mallikarjuna  
Professor & HOD

Signature of the Principal

Dr. T Hanumantha Reddy  
Principal

Name of the External Examiners

1. ZAMEER. K
2. Gurupada Swamy. D.M.

Signature with date

16/08/21  
16/8/21



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I take this opportunity to express my deep sense of gratitude to my Internship Guide **Dr. H.M MALLIKARJUNA Prof**, Department of Civil Engineering, RYMEC, Ballari for his/her keen interest and invaluable help throughout the training of this work and also in shaping my profession.

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## ABSTRACT

Construction plays a very significant role in economic growth of the country. It will have multiple effects on the other sectors of the country's economy. The main goal of this matter is to evaluate Civil Engineering Internship Programs for Educational Improvement by doing statistical analyses on comprehensive survey data gathered from enquiry sheets. Finally, binary logistics regression was conducted to identify factors that predict the students' satisfaction level. A positive, statistically significant relationship was identifies between internship satisfaction level, future carrier planning multidisciplinary team working, learning theoretical and practical applications. This study proved that the civil engineering students are keen to participate in practical training programs during their period of education and also that civil engineering departments should update the theoretical courses taking into consideration, the practical application. The contents all chapters is briefly explained in this report.

The purpose of this course is to apply the theoretical knowledge into practical work. There was a two main part in our training the first part was practical part and the second part is office work. the student can be trained as a site enginner.it give you the opportunity to supervise the construction work closely, or as a design engineer using software programme such as, AUTOCAD and REVIT.

The training started at 15/03/2021 and last till 10/04/2021, during this you can see the subsequent of the construction work such as;

Planning of the building as per basic Vastu and By-Laws using AUTOCAD software, column marking using TOTAL STATION, Construction of Masonry, Bar bending drawings and scheduling, Plumbing work, Painting work, Electrical work and Software training.



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**COURSE NAME** : INTERNSHIP PROFESSIONAL PRACTICE  
**SUBJECT CODE** : 17CV84

**COURSE CODE:** C412

**NAME OF THE STUDENT**

1. D.Manikanta - 3VC17CV022
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4. Megha sri. P - 3VC17CV047

**GUIDED BY** : Mr. MALLIKARJUNA H.M  
Professor

**PRE REQUISITITES:** 1. Strength of materials and Basic surveying.

2. Building Materials and Construction Technology and Concrete Technology.
3. Building Planning and Drawing, Analysis and Design of RCC and Steel structural Elements.



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Subject Code 15CV84	Internship Objectives
CO412.1	To study and research about construction process.
CO412.2	To analyze and design the various buildings.
CO412.3	To carry out laboratory and filed tests.
CO412.4	To provide effective report and presentation of the information collected in Internship.





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CO's	Internship Outcomes	Bloom's level
CO412.1	<u>Identify</u> and <u>Explain</u> planning, spacing of columns as per codal provisions.	Understand (L2)
CO412.2	<u>Describe</u> and <u>Explain</u> about analyze and design of buildings.	Understand, Analyse (L2,L4)
CO412.3	<u>Investigate</u> and <u>Explain</u> the laboratory and filed tests.	Understand, Create (L2,L6)
CO412.4	<u>Developed</u> communication, Presentation and Writing skills.	Create (L6)



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**CO1: Identify and Explain** planning, spacing of columns as per codal provisions.

- a) The course outcome requires/apply the knowledge of basic science basic mathematics (arithmetic's) and Engineering specialization to solve engineering problems, hence the CO maps with PO1 at moderate level (PO1-2)
- b) The course outcome requires/apply the knowledge, formulate and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences are made, hence the CO maps with PO2 at moderate level (PO2-2)
- c) The course outcomes requires/ applying Design solutions of complex engineering problems and design system components or processes that meet the specified needs with appropriate considerations for the public health, safety and the cultural, societal and environmental considerations ,hence the CO maps with PO3 at moderate level (PO3-2)
- d) The course outcome requires/applies the knowledge of ethical principles (IS codes) and commits to professional ethics the norms of engineering practice and responsibilities as a civil engineer, hence the CO maps with PO9 at moderate level (PO8-2)
- e) The course outcome requires/applies the knowledge of communication on planning stage with the engineering community and society at large and design the documentation, hence the CO maps the PO10 at moderate level (PO10-2)
- f) The course outcome requires/applies the knowledge of project management and finance to manage projects in multidisciplinary environment, hence the CO maps with PO11 at moderate level (PO11-2)
- g) The course outcomes requires/applies the knowledge of working



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	<p>effective as an individual /team in the progress of project execution, hence the CO maps with PO9 at moderate level (PO9-2)</p> <p>h) The course outcomes requires/applies the knowledge of need and ability to engage in independent and lifelong learning in context of technological change, hence the CO maps with PO12 at moderate level (PO12-2)</p>
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**CO2: Describe and Explain** analysis and manual design calculations based on required criteria using relevant codes.

- a) The course outcome requires/applies the knowledge of basic science higher mathematics (arithmetic's) and Engineering fundamentals of analysis and design. Here we observe that maps at very high level with math's, science and engineering fundamentals, hence the CO maps with PO1 at moderate level (PO1-2)
- b) The course outcome requires/applies the knowledge of designing solutions for complex engineering problems considering the environmental safety, hence the CO maps with PO3 at moderate level (PO3-2)
- c) The course outcome requires/applies the knowledge, formulate and analyse complex engineering problems reaching substantiated conclusions using first principle of mathematics, natural sciences and engineering sciences are made, hence the CO maps with PO2 at moderate level (PO2-2)
- d) The course outcome requires/applies the knowledge of ethical principles (IS codes) and commits to professional ethics and norms of engineering practice and responsibilities as a civil engineer, hence the CO maps with PO8 at very moderate level (PO8-2)
- e) The course outcome requires/applies the knowledge of working effectively as an individual / team in the progress of project execution. Hence the CO maps with PO9 at high level (PO9-3)
- f) The course outcome requires/applies the knowledge of need and ability to engage in independent and lifelong learning in context of technological change, hence the CO maps with PO12 at moderate level (PO12-2)



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**CO3: Investigate and Compare** the analysis, design and prepare drawings using relevant computer software.

- a) The course outcome requires/applies the knowledge of basic science higher mathematics (arithmetic's) and Engineering fundamentals of analysis and design. Here we observe that maps at very high level with maths, science and engineering fundamentals, hence the CO maps with PO1 at high level (PO1-3)
- b) The course outcome requires/applies the knowledge of designing solutions for complex engineering problems considering the environmental safety, hence the CO maps with PO3 at moderate level (PO3-2)
- c) The course outcome requires/applies the knowledge, formulate and analyse complex engineering problems reaching substantiated conclusions using first principle of mathematics, natural sciences and engineering sciences are made, hence the CO maps with PO2 at moderate level (PO2-2)
- d) The course outcome requires/applies the knowledge of ethical principles (IS codes) and commits to professional ethics and norms of engineering practice and responsibilities as a civil engineer, hence the CO maps with PO8 at moderate level (PO8-2)
- e) The course outcome requires/applies the knowledge of working effectively as an individual /team in the progress of project execution. Hence the CO maps with PO9 at moderate level (PO9-2)
- f) The course outcome requires/applies the knowledge of need and ability to engage in independent and lifelong learning in context of technological change, hence the CO maps with PO12 at moderate level (PO12-2)



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CO4: Justify and Validate a presentable report.

- The course outcomes requires/applies the knowledge of working effective as a individual/ team in the progress of project execution, hence the CO maps with PO9 at high level (PO9-3)
- The course outcome requires/applies the knowledge of communication on planning stage with the engineering community and society at large and design the documentation, hence the CO maps the PO10 at moderate level (PO10-3)





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### PROGRAM OUTCOMES (PO'S)

Engineering graduates will be able to:

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an Engineering specialization to the solution of complex engineering problems.
- 2. Problem analyze:** Identify, formulate, review, research, literature and analyze complex engineering problem reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- 3. Design / development of solutions:** Design solutions of complex engineering problems and design system components or processes that meet the specified needs with appropriate considerations for the public health, safety and the cultural, societal and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern tool usage:** create, select and apply appropriate techniques, resources and modern engineering and IT tools including predict. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice ones and modelling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and the society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environmental and sustainability:** understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of need for sustainable development.



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Cantonment, Ballari – 583104  
**Department of Civil Engineering**



- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and society at large such as, being able to comprehend and write effective reports and design documentation, make effective presentation and give and receive clear instructions.
- 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and in multidisciplinary environments.
- 12. Lifelong learning:** Recognise the need for, and have the presentation and ability to engage in independent and lifelong learning in the broadest context of technological change.



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**CO –PO Matrix**

CO \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO412.1	2	2	2					2	2	2	2	2			
CO412.2	2	2	2					2	3			2	1		1
CO412.3	3	2	2					2	2			2		1	
CO412.4									3	2					
Average	2.33	2	2					2	2.5	2	2	2	1	1	1

Note: Correlation levels: 1: Low 2: Moderate 3: High

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## CHAPTER 1

### INTRODUCTION:

For a career – oriented applied education, **RYMEC** has introduced a **New skill development and Innovation centre** in campus. This internship bridges the gap between theory and practice and provides students with practical, field-based, real world experiences during their years of study.

The students can be trained as site engineers, it gives them the opportunity to supervise the construction work closely or as a design engineer using software programs such as AutoCAD, ETABS, Google SketchUp etc.

There were two main parts in our training, the first part was **practical** and second was **office work**. During this training period we the students learn how to relate our theoretical knowledge with practical fields, we get to know the difficulties faced by an engineer and how to manage everything and what are the duties of an engineer for these practical and technical skills we participated in the **Skill development and innovation centre**.

### OBJECTIVES:

1. Assessing the theoretical knowledge of planning, masonry, bar-bending, plumbing, electrical work in practical.
2. To implement new technical ideas in civil engineering project.
3. To plan according to Vaastu and Bye-Laws

### OUTCOMES:

1. The students are capable of implementing the knowledge of planning, masonry, bar-bending, plumbing, electrical work in practical.
2. Should demonstrate peer-recognized expertise together with the ability to articulate that expertise and use it for contemporary problem solving in the analysis, design, and evolution of civil engineering project.
3. The students will be able to understand the professional and ethical responsibility.

### INTERNSHIP PROGRAMM'S:

1. Planning by Vaastu and Bye-laws
2. Column marking using total station
3. Construction of masonry
4. Bar bending schedule
5. Plumbing work and UGD
6. Painting work
7. Electrical work
8. Software.

## CHAPTER 2

### NATIONAL BUILDING CODE:

1. National building code (NBC) is a standardised set of rules to be followed by authorities and construction firms, to provide a healthy and safe living experience for all residents.
2. NBC is document that provides guidelines for construction of structures -residential, educational etc.
3. It is important to follow these guidelines that are meant to protect the overall health of construction and ensure the health and safety of the public and the residents.
4. The code was first published in 1970 at the instance of planning commission and then first revised in 1983. Second version of the code was in 2005. According to NBC buildings are classified according to use of the following.

<b>GROUP A</b>	<b>RESIDENTIAL</b>
<b>GROUP B</b>	<b>EDUCATIONAL</b>
<b>GROUP C</b>	<b>INSTITUTIONAL</b>
<b>GROUP D</b>	<b>ASSEMBLY</b>
<b>GROUP E</b>	<b>BUSINESS</b>
<b>GROUP F</b>	<b>MERCANTILE</b>
<b>GROUP G</b>	<b>INDUSTRIAL</b>
<b>GROUP H</b>	<b>STORAGE</b>
<b>GROUP J</b>	<b>HAZARDOUS</b>



## **BYE -LAWS:**

Bye-laws are the legal tools used to regulate coverage, height, building bulk, and architectural design and construction aspect of buildings so as to achieve orderly development of an area.

## **PRINCIPLES OF BYE-LAWS :**

Classifying the building with unit as a family and mentioning the requirement. Classify room according to use and then specifying minimum standard of each room with respect to size, height, floor area, ventilation and light.

## **OBJECTIVES OF BUILDING BYE-LAWS:**

1. Preplanning of building activity.
2. Allow orderly growth and prevent haphazard development.
3. Provisions of bye-laws usually afford safety against fire, noise, health hazard and structure failure.
4. Provide proper utilization of space to achieved maximum efficiency in planning.
5. They provide health, safety and comfort to the people who live in building.
6. Due to these bye-laws, each building will have proper approaches, light, air and ventilation

## **SCOPE OF BUILDING BYE-LAWS:**

Aspects of different type of building bye-laws are :

1. Building frontage line
2. Minimum plot size
3. Built up area of building
4. Height of building
5. Provision of safety, water supply, drainage, proper light and ventilation
6. Requirement for off street parking space
7. Size of structural element

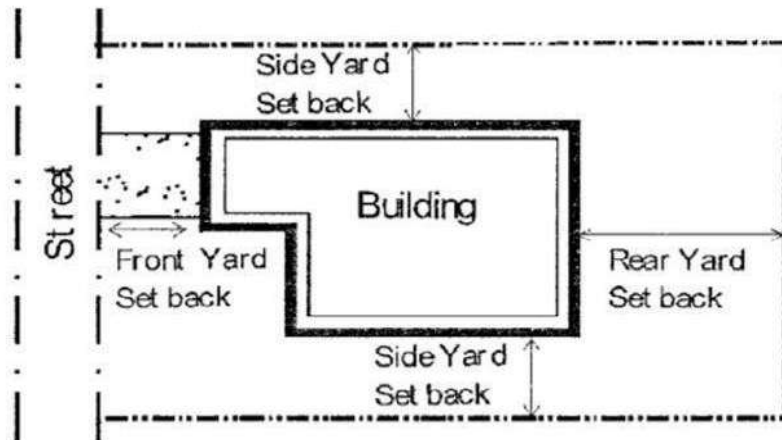
## **APPLICABILITY OF BUILDING BYE-LAWS:**

1. New construction
2. Additional and alternations to a building
3. Changing of occupancy of building
4. Development of land is undertaken
5. Indemolition

## BUILDING SET BACKS:

Setback can be explained as the minimum open space required around any building or structure. Municipal regulations provide that a specific distance should be maintained between a building and the boundary of the plot on which the building is being constructed.

### Set back distance



**TABLE -2**

**Exterior minimum Setbacks for buildings ( except Industrial ) upto 11.50 m in height.**

**a. For Residential /Commercial use**

Sl. No.	Width/Depth of site (m)	Width of site		Depth of site	
		Right Set Back	Left Set back	Front Set Back	Rear Set Back
1	Up to 6	0.50m	0	1.00m	0
2	Over 6 up to 9	0.50m	0.50m	1.00m	0.75m
3	Above 9	8%	8%	12%	8%

**b. For Transportation & Communication / Public Utilities / Public & Semipublic use**

Sl. No.	Width/Depth of site (m)	Width of site		Depth of site	
		Right Set Back	Left Set back	Front Set Back	Rear Set Back
1	Up to 9	1.00m	0	1.25m	1.0m
2	Above 9	12%	12%	15%	12%

## Distance of buildings from electrical lines

Sl. No.	Electrical lines	Vertical clearance in m	Horizontal clearance in m
1	Low and medium voltage lines up to 11 KV	2.5	1.2
2	High voltage lines up to and including 11 KV	3.7	1.2
3	High voltage line above 11 and up to and including 33 KV	3.7	2.0
4	Above 33 KV	No Objection Certificate from concerned electricity department is to be obtained	

TABLE – 3

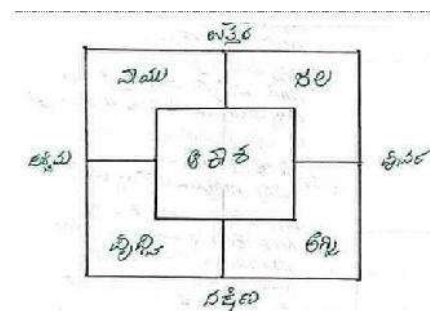
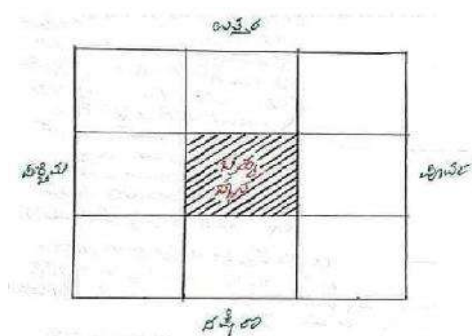
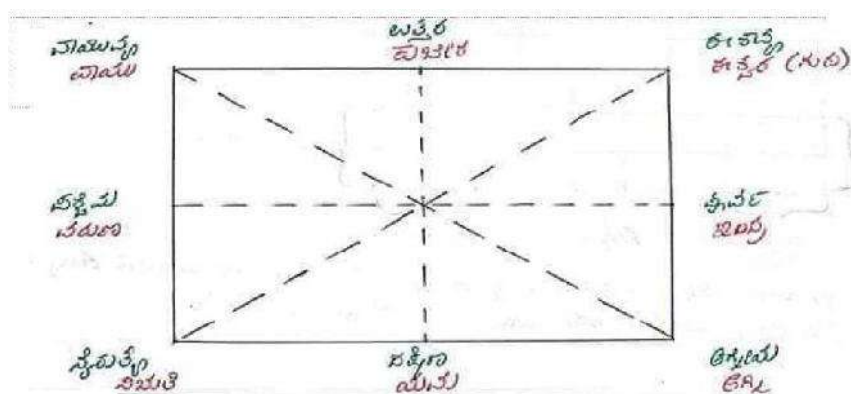
Exterior Setbacks for buildings ( except Industrial ) above 11.50 meters in height.

Sl. No.	Height of building in meters	Exterior Setbacks to be left on all sides (Front, rear and sides in meters)
1	Above 11.5 upto 15.0	5.0
	Above 15.0 upto 18.0	6.0
2	Above 18.0 upto 21.0	7.0
3	Above 21.0 upto 24.0	8.0
4	Above 24.0 upto 27.0	9.0
5	Above 27.0 upto 30.0	10.0
6	Above 30.0 upto 35.0	11.0
7	Above 35.0 upto 40.0	12.0
8	Above 40.0 upto 45.0	13.0
9	Above 45.0 upto 50.0	15.0
10	Above 50.0	16.0

Sl. No	Building use or type	Minimum width of the corridor in meters
1	Residential building	1.0
2	Assembly buildings such as auditorium, Kalyana Mantapas, Religious building, Temple, Mosque or Church and other buildings of Public assembly or Conference.	2.0
3	Institutional buildings such as:	
	a. Government office	2.0
	b. Government Hospitals	2.4
	c. Educational Buildings such as Schools, Colleges, Research Institutions	2.0
	d. Commercial buildings such as private office, Nursing homes, Lodges, etc.	2.0
	e. All other buildings	1.5

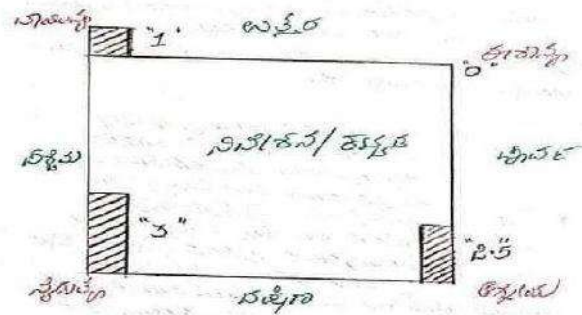
## BUILDING HOME AS PER VAASTU:

Vaastu shastra is a traditional Indian system of architecture originating in India. Texts from the Indian subcontinent describe principles of design, layout, measurements, ground preparation, space arrangement, and spatial geometry. Vaastu shastras incorporate traditional Hindu and Buddhist beliefs.

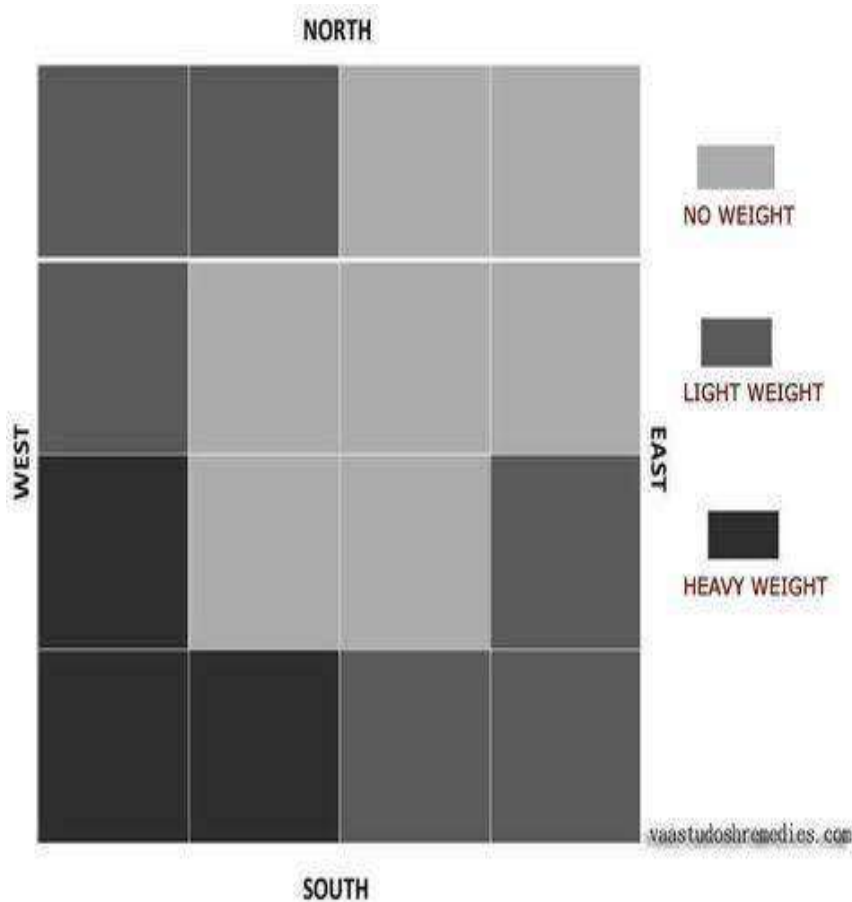




## ELEVATION OF BUILDING



## WEIGHT ON DIFFERENT DIRECTION



We are dealing with the construction of a residential building. Following are the images of the plan and details of the plan are as follows,

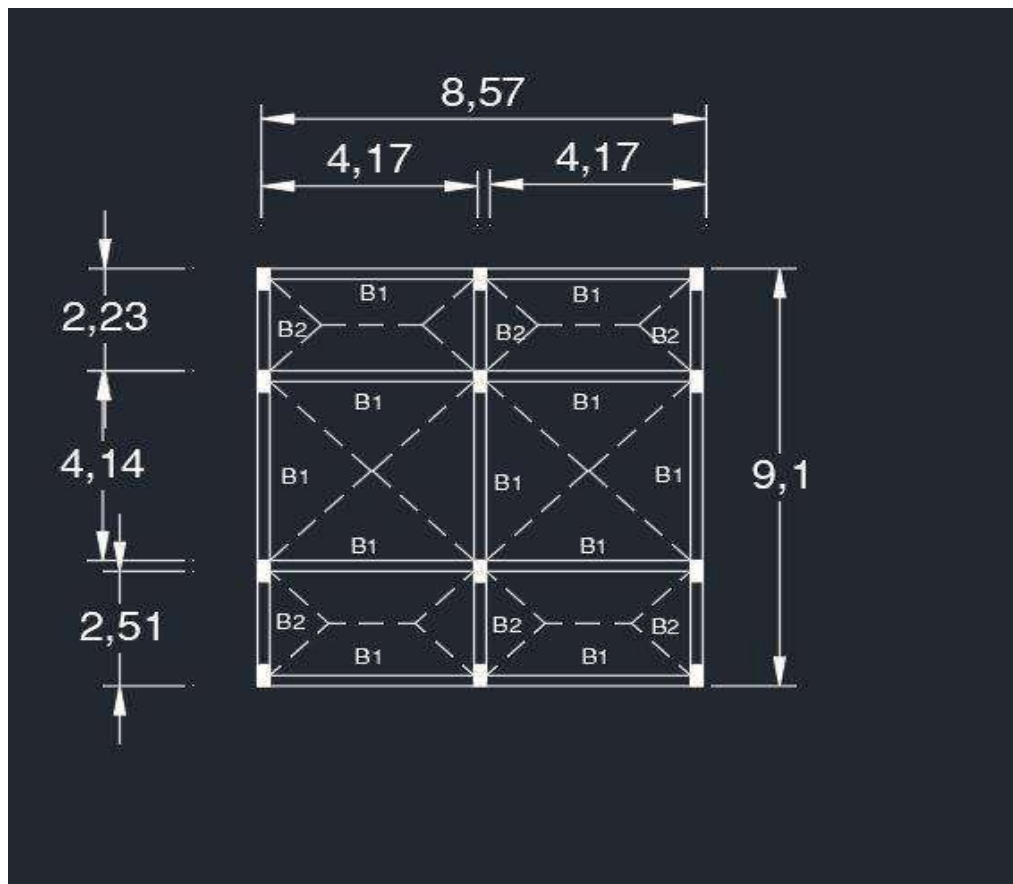
Site size: 30ft \*40ft (9m\*12m)

No of rooms: 2 bedrooms, 1 kitchen, 1 living area, common bathroom, store room etc

No of floors: ground floor

## CHAPTER 3:

### BEAM LAYOUT:







## **PROCEDURE FOLLOWED FOR COLUMN MARKING USING TOTAL STATION:**

### **Site visit and survey:**

1. Visiting the proposed site and taking the actual measurement of plot.
2. Marking the site boundary.
3. Make the plan according to the measured site size in AUTOCAD as per vastu and setbacks .(our planning of plot is westfacing)
4. Make beam and column layout in the AUTOCAD.
5. Calculate the number of columns required for building construction.

### **Total station set-up:**

1. Levelling the total station must be accomplished to sufficient accuracy otherwise the instrument will not report results.
2. Levelling the instrument takes 30-45 min's make sure that you can see all the targets.

### **Tripod setup:**

1. Tripod legs should be equally spaced.
2. Tripod head should be approximately level.
3. Head should be directly over survey point.

### **Mount instrument on tripod:**

1. Place instrument on tripod.
2. Insert battery in the instrument before levelling.

### **Levelling the instrument:**

1. Adjust the levelling foot screws to centre the survey point in the optical reticle.
2. Centre the bubble in the circular level by adjusting the tripod.
3. Loosen the clamp and turn instrument until plate level is parallel to two of the levelling foot screws.
4. Centre the bubble using the levelling screws, the bubble moves towards the screw that is turned clockwise.
5. Rotate the instrument 90 degrees and level using 3<sup>rd</sup> levelling screw.
6. Observe the survey point in the optical plummet and centre the point by losing the centre instrument.

### Measuring the boundary from total station:

1. Verifying the centre of the instrument by electronic centring.
2. Creating file in the total station which follows
  - Sfunction
  - File
  - Create
  - Give name to file > entre
  - Press Escapetwice
  - Sfunction
  - Measure
  - Rectangular coordinate
  - Edit
  - Name point code and pointnumber
  - Entre prismheight
  - Save
  - Set horizontal angle to north using compass
3. Measure station point and two reference points (one front sight and another on back of station) and measure 4 boundaries from total station and mount all 7 points to SDcard.
4. Transfer all the points to excel sheet and copy them to the topocon software where we should align the site boundary to the measured boundary and set column into it.
5. Mark all the column points on to the ground and mark the column and footing size using marking powder.



## CHAPTER 4:

### CONSTRUCTION OF MASONRY

**Types of tools used for masonry construction:**

#### 1. Trowel:



#### 2. Setting outsquare:



#### 3. PLUMBBOB



#### 4. PLUMBRULE



#### 5. Brickhammer:



#### 6. Brushes:

BRUSH	SIZE	SURFACES
	3" to 4"	Exterior siding, decks, fences, masonry, walls, ceilings, doors
	2" to 2 1/2"	Baseboards, cabinets, furniture, stairs, railings, shutters, gutters
	2" to 2 1/2" angle sash	Window frames, casings, moldings, cutting-in edges of walls & ceilings
	1" to 1 1/2" angle or flat	Hobbies & crafts, window moldings, light corners, very detailed areas



**7.Mansonwire:****8.Mortar pan :****9.SPADES****10.waterlevel:****Materials used for various masonry construction:****Cement:**

Cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel together. Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete.

Cement is manufactured through a closely controlled chemical combination of calcium, silicon, aluminium, iron and other ingredients. Common materials used to manufacture cement include limestone, shells, and chalk or marl combined with shale, clay, slate, blast furnace slag, silica sand, and iron ore.



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## **Physical Properties of Cement**

Different blends of cement used in construction are characterized by their physical properties. Some key parameters control the quality of cement. The physical properties of good cement are based on:

- 1) Fineness of cement
- 2) Soundness
- 3) Consistency
- 4) Strength
- 5) Setting time
- 6) Heat of hydration
- 7) Loss of ignition
- 8) Bulk density
- 9) Specific gravity (Relative density)

### **1) Fineness of Cement**

The size of the particles of the cement is its fineness. The required fineness of good cement is achieved through grinding the clinker in the last step of cement production process. As hydration rate of cement is directly related to the cement particle size, fineness of cement is very important.

### **2) Soundness of Cement**

Soundness refers to the ability of cement to not shrink upon hardening. Good quality cement retains its volume after setting without delayed expansion, which is caused by excessive free lime and magnesia.

### **3) Consistency of Cement**

The ability of cement paste to flow is consistency.

It is measured by Vicat Test.

In Vicat Test Cement paste of normal consistency is taken in the Vicat Apparatus.

The plunger of the apparatus is brought down to touch the top surface of the cement.

The plunger will penetrate the cement up to a certain depth depending on the consistency. Cement is said to have a normal consistency when the plunger penetrates 10 to 11 mm.

### **4) Strength of Cement**



Three types of strength of cement are measured compressive, tensile and flexural. Various factors affect the strength such as water-cement ratio, cement-fine aggregate ratio, curing conditions, size and shape of a specimen, the manner of moulding and mixing, loading conditions and age.

**Compressive Strength:** It is the most common strength test. A test specimen (50mm) is taken and subjected to a compressive load until failure. The loading sequence must be within 20 seconds and 80 seconds.

**Tensile strength:** Though this test used to be common during the early years of cement production, now it does not offer any useful information about the properties of cement.

**Flexural strength:** This is actually a measure of tensile strength in bending. The test is performed in a 40 x 40 x 160 mm cement mortar beam, which is loaded at its centre point until failure.

## **5) Setting Time of Cement**

Cement sets and hardens when water is added. This setting time can vary depending on multiple factors, such as fineness of cement, cement-water ratio, chemical content, and admixtures. Cement used in construction should have an initial setting time that is not too low and a final setting time not too high. Hence, two setting times are measured:

*Initial set:* When the paste begins to stiffen noticeably (typically occurs within 30-45 minutes)

*Final set:* When the cement hardens, being able to sustain some load (occurs below 10 hours)

.

**SAND:**

Sand is a granular material composed of finely divided rock and mineral particles. Sand has various compositions but is defined by its grain size. Sand grains are smaller than gravel and coarser than silt.

**Properties of sand****1. Porosity:**

Porosity also known as permeability is the most important property of the moulding sand. It is the ability of the moulding sand to allow gasses to pass through gasses and steam are generated during the pouring of molten metal into the sand cavity.

**2. Cohesiveness:**

Cohesiveness is the property of sand to hold its particles together. It may be defined as the strength of the moulding sand. This property plays a vital role in retaining intricate shapes of the mould. Insufficient strength may lead to a collapse in the mould particles during handling, turning over, or closing. Clay and bentonite improves the cohesiveness.

**3. Adhesiveness:**

Adhesiveness is the property of sand due to which the sand particles sticks to the sides of the moulding box. Adhesiveness of sand enables the proper lifting of cope along with the sand.

**4. Plasticity:**

Plasticity is the property of the moulding sand by virtue of which it flows to all corners around the mould when rammed, thus not providing any possibility of left out spaces, and acquires a predetermined shape under ramming pressure.

**5. Flow-Ability:**

Flow-ability is the ability of moulding sand to free flow and fill the recesses and the fine details in the pattern. It varies with moisture content.

## M-SAND



Manufactured sand (M-Sand) is artificial sand produced from crushing hard stones into small sand sized angular shaped particles, washed and finely graded to be used as construction aggregate. It is a superior alternative to River Sand for construction purpose.

Manufactured sand (M-Sand) is an additional of river sand for concrete structures.

Manufactured sand is created as rigid granite stone by crushing.

The crushed sand is of cubical form with grounded boundaries, washed and classified as a building material. The extent of manufactured sand (M-Sand) is a reduced amount of 4.75 mm.

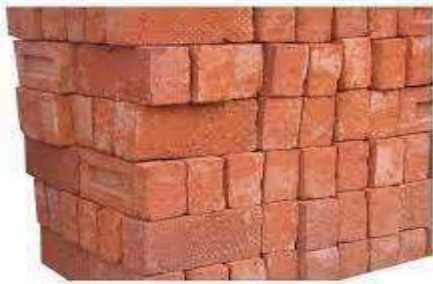
M-Sand has a silt content of about 0.2% and water absorption of 1.6%.

Bulk density as well as specific gravity of together are as well as the chemical features and strength of M-Sand are comparable to that of the river Sand as per IS-383.

### PROPERTIES OF M-SAND:

1. The manufactured sand has an essential gradation of fines, physical properties such as shape, even exterior touches, and constancy which kinds it the greatest sand appropriate for construction. These physical properties of sand provide greater strength to the concrete by decreasing separation, bleeding, honeycombing, voids, and capillary.
2. This feature of M-Sand allows the concrete structures to experience very environmentally sustainable conditions and prevents the weathering of reinforced steel by reducing permeability, moisture ingress, freezing-thaw effects of improving the longevity of concrete structures.
3. The controller of these physical properties of the manufacture of sand marks the concrete that requires less water and delivers advanced workable concrete. Less use of water also helps from improving the consistency of concrete, less time to blend and settle the concrete, and thus improves the productivity of on-site building operations.
4. Construction defects in the placement and post-concretion, such as separation, bleeding, honeycombing, voids, and capillarity in concrete, are minimized with the use of M-Sand, as it has the highest original and final set time as well as excellent fineness.
5. Use of M-Sand has enhanced reliability, increased resilience, decreased isolation, permeability, improved workability, reduced post-concrete defects, and has seen to be cost-effective as a building material that replaces riversand.
6. The outline of Crushed sand is cubicle and angular and has a rugged feel and is thus better for concrete.

## BRICKS:



A brick is a type of block used to build walls, pavements and other elements in masonry construction. Properly, the term brick denotes a block composed of dried clay, but is now also used informally to denote other chemically cured construction blocks. Bricks can be joined together using mortar, adhesives or by interlocking them.[1][2] Bricks are produced in numerous classes, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities.

## PROPERTIES OF BRICKS

1. It should have a rectangular shape, regular surface and red colour appearance.
2. It should conform in size to the specified dimensions (19 x 9 x 9cm).
3. It should be properly burnt. This can be ascertained by holding two bricks freely, one in each hand, and striking them.
4. A sharp metallic sound indicates good burning whereas a dull thud would indicate incomplete burning.
5. A good building brick should not absorb water more than 20 percent of its dry weight. Absorption should not exceed 25 percent in any case.
6. A good building brick should possess requisite compressive strength, which in no case should be less than 35 kg/cm<sup>2</sup>.
7. A rough test for the strength of the brick is to let it fall freely from a height of about one meter on to a hard floor. It should not break.
8. Brick should be hard enough so that it is not scratched by a fingernail.
9. A good brick has a uniform colour and structure through its body. This can be checked by taking a brick from the lot and breaking it into two parts.

The broken surface in both the halves should have same appearance and structure.

## DIFFERENT TYPES OF MASONRY CONSTRUCTION

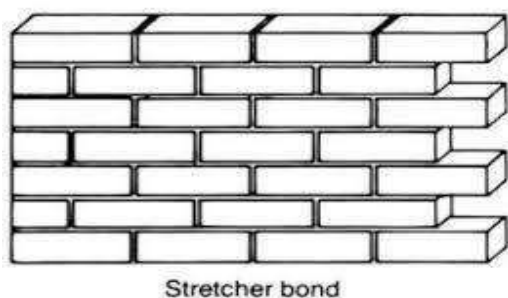
1. StoneMasonry
2. BrickMasonry
3. BlockMasonry
4. VeneerMasonry
5. GabionMasonry
6. CompositeMasonry
7. ReinforcedMasonry

## DIFFERENT TYPES OF BONDS

- 1 Stretcherbond
- 2 English bond
- 3 English garden wall
- 4 English cross bond
- 5 Flemishbond
- 6 Flemish garden wall (also called Sussex bond)
- 7 Monk bond
- 8 Header bond

### Stretcher bond:

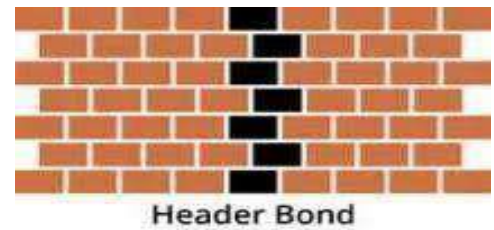
1. Bricks are laid in stretchers, as in the figurebelow.
2. Used in the walls of half brick inthickness.
3. Due to its constant occurrence in last position it is also called as chimneybond.





### Header bond:

1. Header is the shorter square face of the brick which measures 9cm\*9cm.
2. Header bond is also known as heading bond.
3. In header bond, all bricks in each course are placed as headers on the faces of the walls.



### English bond :

1. The facing bricks are laid in alternate courses of headers and stretchers.
2. Queen closer inserted next to quoin-headers to produce overlap
3. English bond is the strongest as it avoids vertical joints.

### Flemish bond:

1. it is highly economical.
2. walls one brick in thickness are easier to produce a fair face on both sides in Flemish than in English bond.

S.N.	English bond	S.N.	Flemish bond
1	Headers and stretchers are laid in alternate courses.	1	Headers and stretchers are laid alternately in each course.
2	Strongest of the types of bonds.	2	Comparatively less strong for walls more than 30cm thick.
3	Provides rough appearance.	3	Provide good appearance.
4	Absence of vertical joints in the structure.	4	Partly continuous vertical joints appear in the structure.
5	Special attention is not required for this bond.	5	Special attention is required for this bond.
6	Progress of work is more.	6	Progress of work is less.
7	Costly, no brick bats are used.	7	Economical, as brick bats are used.
8	Skilled labor is not required for its construction	8	Skilled labor required for its construction.
9	Less mortar is used.	9	More mortar is used due to use of bats.





## CHAPTER 5:

### BAR BENDING

Types of tools used for bar bending:

1. Hammer:



2. Chisel:



3. Bindinghook:



4. Lever:



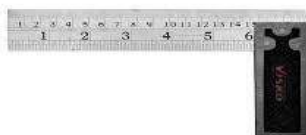
5. Plumbbob:



6. measuring tape :



7. Tri-square:



8. Chalkbox



**9.Bindingwire****10.Bar cuttingmachine:****11.Safetyhelmet:****12. Safetyglasses:****13.safetyshoes:****14.Woodenplank:**

## Steel:

It is an alloy made up of iron with typically a few tenths of a percent of carbon to improve its strength and fracture resistance compared to iron. Many other elements may be present or added. Stainless steels that are corrosion- and oxidation-resistant need typically an additional 11% chromium. Because of its high tensile strength and low cost, steel is used in buildings, infrastructure, tools, ships, trains, cars, machines, electrical appliances, and weapons. Iron is the base metal of steel.

## PROPERTIES OF STEEL

### 1. Yield strength

It is the point at which a material begins to undergo a significant increase in the rate of strain in relation to stress. Once a material goes beyond the yield point, its fatigue life becomes dramatically reduced.

### 2. Tensile strength

As steel has high tensile strength and low cost, it is a major component used in various fields like buildings, ships, automobiles, machines, tools, appliances and weapons.

### 3. Elongation

1. It measures how much a material will stretch compared to its initial state prior to fracturing/failure.
2. More brittle a material is the less it will elongate.
3. Concrete, glass are extremely brittle.
4. Metals vary significantly in elongation i.e. alloy and low carbon steels will typically elongate for more high carbon steels.

### 4. Hardness

1. The hardness of a material measures by how much it will resist local plastic deformation due to mechanical abrasion.
2. It is especially important during manufacturing.
3. One of the most considered non destructive hardness test is "Rockwell test".
4. This test measures the depth of penetration of an index under a large load and compares it to the penetration by a pre-load.



## BAR BENDING

The Bar bending is a process of cutting and bending reinforcement steel bar into Desire shape as per structural drawing was given by structural engineer for various structural elements like footing, column, beam, slab, etc.

It is the manufacture and bending of the steel reinforcing bars and beams, also known as rebar, used as reinforcement in concrete construction.

### BAR BENDING SCHEDULE

Bar Bending Schedule is a detailed list of bent reinforcement bars given in any structural concrete element. Bar Bending Schedule Contains bar mark, Diameter, length, shape, and weight.

A Bar Bending Schedule helps site engineer to estimate required quantities of the various diameter of bars used in construction. It helps the engineer to check the reinforcement work done by the contractor.

### TYPES OF BAR BENDING

There are five typical methods of bending in the industry: rolling, incremental bending, hot bending, rotary-draw bending, and induction bending. Each method has its advantages. Some methods are more commonly used in the steel construction industry, while others are more common in the automobile or manufacturing industries:

→**Rolling (cold bending)** is the typical method of curving steel for construction and is usually the most economical for rolling members with tighter radii. A steel member is placed in a machine and curved between three rolls. Cold bending may also be called “pyramid rolling” because of the three rolls’ pyramid arrangement. Bending occurs when the distance between these rolls is manipulated before each successive pass.

→**Incremental bending or gag pressing** is usually used for cambering and curving to very large radii. Bending is achieved by applying point loads with a hydraulic ram or press at the member’s third point.

→**Hot bending** is where a structural member is heated directly and then bent. The heat source could be a direct flame or furnace. This application is used extensively in repair.

→**Rotary-draw bending** is where the structural member is bent by rotating it around a die. The member is clamped into a form and then is drawn through the machine until the bend is formed. This method produces tight radii and is mainly used for complicated bends in the machine and parts industry.

→**Induction bending** uses an electric coil to heat a short section of a structural member, and then that member is drawn through a process similar to rotary-draw and cooled with water directly after. In some cases, this process can produce a smaller, tighter radius.

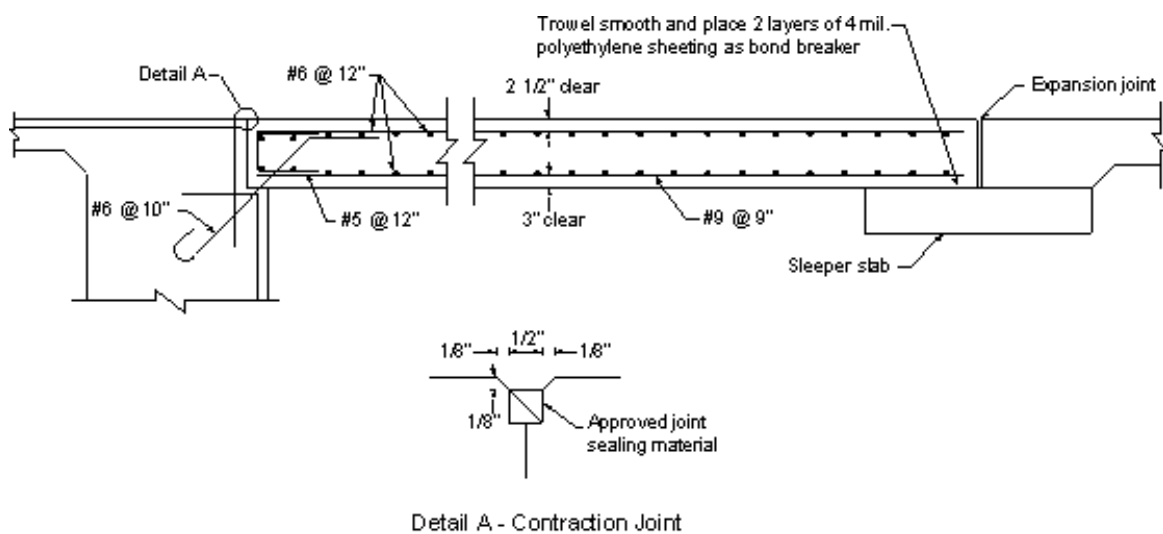
### Advantages of Bar Bending Schedule in Construction

1. Provides better estimation of reinforcement used in each structural concrete member. You can also calculate the overall reinforcement required for the construction project.
2. It helps engineer in the procurement of reinforcement steel and better stock management.
3. Bar Bending Schedule Provides exact estimated quantity required. So, at a construction site, wastage can be controlled by careful supervising of the contractor with the help of Bar Bending Schedule.
4. Bar Bending Schedule makes cutting, bending of reinforcement easy at a factory and can be directly transported to the Construction site. This will not only reduce the wastage of reinforcement steel but also help us reduce labor cost. Though, it helping in reducing the overall cost of the construction project.
5. This helps site engineer or quality inspector to check and approve reinforcement work with better quality control.
6. Billing can be done really fast and easy using Bar Bending Schedule. It also makes easy for clients to approve bills for Payment.

### Step by Step Preparation of Bar Bending Schedule

#### Step 1. Identification of Members (Steel Bars)

Each different type of Steel bar or Member is usually tagged with a number or bar mark in the structural drawing. Now, open a structural drawing and list down all the shapes of bar you see in the structural drawing. Now mark the diameter of Member in the table.



The above image shows the number of bars like #5, #6, #9, etc, along with Dia of the Bar.

#### Step 2. Count the Number of bars

Now, Count the number of each different shapes of the bar and note down in bar bending schedule



To calculate a number of bars in big slab structure, you need to check the specific spacing between bars (centre to centre or c/c, its show in above fig) and the length of the concrete slab in which the bars are distributed.

**Number of Bars** = (Concrete slab length in which bar is Distributed – 2 X Cover) / (c/c spacing between bars)

For Example: Suppose, 10 MM bars are distributed in the 10-meter-long slab at 150 mm c/c spacing, Considering the side cover of 50 mm. Then calculate the number of bars

$$\text{Number of Bars} = (10000 - 2 \times 50) / (150) = 66 \text{ Bars of } 10 \text{ mm DÍA}$$

### Step 3: Calculate the length of Reinforcement bars

The formula to calculate the length of those bars

**Length of Bar** = Length of Concrete member (direction in which bar is placed) – (2 X Cover) + Development length

## ELEVATION OF DEVELOPMENT LENGTH

### DEVELOPMENT LENGTH CHART

Development Length for fully stressed bars deformed bars conforming to IS 1786 For Bars in Tension (Limit State Design) $\sigma_s = 415 \text{ N/mm}^2$					
Dia	M20	M25	M30	M35	M40 & Above
8	435	375	350	310	275
10	545	465	435	385	345
12	650	560	520	460	410
16	865	745	695	615	550
20	1085	930	865	765	685
25	1355	1160	1085	955	855
32	1730	1485	1385	1225	1095
<b>**Note:</b> All above values are in mm All above values are rounded up to nearest multiple of 5					

Development Length for fully stressed bars deformed bars conforming to IS 1786 For Bars in Compression (Limit State Design) $\sigma_s = 415 \text{ N/mm}^2$					
Dia	M20	M25	M30	M35	M40 & Above
8	350	300	280	245	220
10	435	375	350	310	275
12	520	445	415	370	330
16	695	595	555	490	440
20	865	745	695	615	550
25	1085	930	865	765	685
32	1385	1190	1110	980	875
<b>**Note:</b> All above values are in mm All above values are rounded up to nearest multiple of 5					



#### Step 4: Calculate the unit weight of Reinforcement Bar

The formula for Calculating Unit weight of Bar

Unit weight of Bar = Volume of Bar X Density of Bar (7850 kg/m<sup>3</sup>)

Unit Weight of Reinforcement Bar with D<sub>ia</sub> (D) =  $D^2 / 162$

**Example, 10 mm D<sub>ia</sub> reinforcement bar Weight =  $10^2 / 162 = 0.617$  kg/m.**

However, you can use the below table to check the Unit weight of different D<sub>ia</sub> Bars

Diameter of Bar (mm)	Unit weight in kg/m
8	0.395
10	0.617
12	0.889
16	1.580
20	2.469
25	3.858
32	6.321
40	9.877

#### Step 5: Calculate the Weight of particular Shape of Bar

Weight of Reinforcement Bar (Shape of Bar) = No of Bars X Length of Bars X Unit weight of Bar

This Formula gives the total Weight of specific shape Bar in Kilogram.

#### Bar Bending Schedule Shape Code

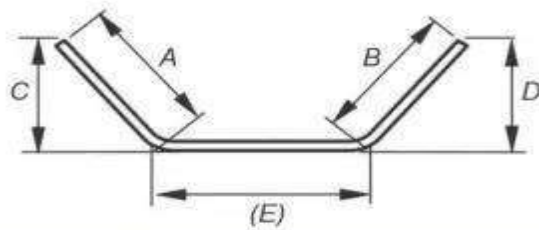
For Small Construction Project, we generally use thumb rules for Reinforcement bar Calculation, but for large scale construction project BBS is prepared using Bar Bending Shape Code.

Which helps to avoid unnecessary wastage. Bar bending shape code makes easier for Engineer to cut steel bar for the reinforcement as per the design.

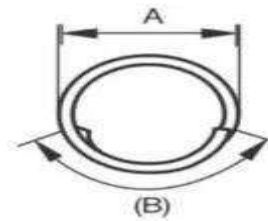
Bar Bending Shape Code as per BS 8666:2005

#### Different types of Bar Bending Shape Code listed below

Where **L** stands for Total Length of the reinforcement bar

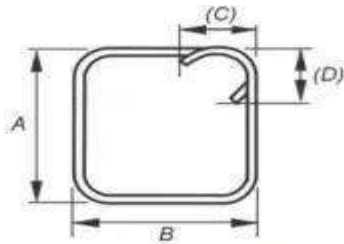


$$L = A + B + (E)$$



B is the overlap

$$L = \pi (A - d) + B$$



$$L = 2(A + B + (C)) - 2.5r - 5d$$

The volume of Steel Reinforcement for Different RRC member

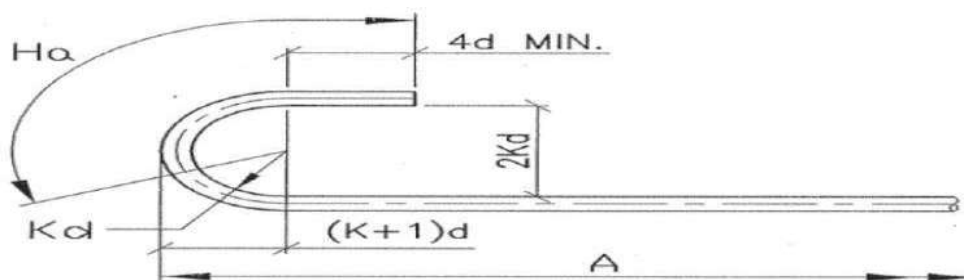
RCC Member	Volume of Steel by volume of Concrete
Slab	1.5% – 2%
Column	2.5% – 3%
Beam	2.5% – 3%

For Example, for 10 M3 concrete in Column, considering 2.5% of steel Volume, the column has a 0.25 M3 of steel. Calculate the total weight of steel and steel weight per M3.

Volume of Steel for 10m<sup>3</sup> Concrete = 0.25 m<sup>3</sup>

Wight of Steel Per M3 Concrete = total Volume of steel X Density of Steel (i.e. 7850 Kg/M<sup>3</sup>)

Weight of steel for 10 M<sup>3</sup> concrete = 0.25 X 7850 = 1962.5 Kg. For 10 m<sup>3</sup> Concrete, the total steel required is 1962.5 Kg. i.e. For 1 m<sup>3</sup> Concrete, the total Steel required is 196.25 Kg.



**Minimum Scheduling Radius, Diameter, and Bend Allowance**

Nominal Size of Bar, dia in MM	Minimum Radius for scheduling r	The minimum diameter of Bending former	General (5d straight), including links, where bend is $\geq 150^\circ$ mm	Links where bend $\leq 150^\circ$ (Min 10d straight) mm
6	12	24	110*	110*
8	16	32	115*	115*
10	20	40	120*	130
12	24	48	125*	160
16	32	64	130	210
20	70	140	190	290
25	87	175	240	365
32	112	224	305	465
40	140	280	380	580
50	175	350	475	725

**BAR BENDING TOOLS:**

## CHAPTER 6:

### PLUMBING WORK

The system of pipes, tanks, fittings, and other apparatus required for the water supply, heating, and sanitation in a building called a **Plumbing**. Plumbing system comprise the entire system of piping -fixtures and appliances etc. use for water supply and drainages.

Plumbing water supply system comprises of:

- Watersupply
- Distribution pipes
- Taps
- Valves
- Storage tanks

Plumbing drainage system consists of::

- Washbasins
- Waterclosets
- Urinals
- Traps
- Soil wastepipes
- Vent pipes and
- Septic Tanks

#### WATER DISTRIBUTION SYSTEM:

Water is first collected in underground tank (known as Suction tanks) and then it is pumped to the elevated storage tanks, usually situated at the top of the buildings.

**1. While laying out the pipe lines ,the following considerations should be kept in mind to prevent the Contamination of water:**

- No cross section between pipes
- No backflow from any appliance towards source of supply.
- Water supply pipes or drainage pipes should not be very close to each other.
- Underground pipe lines should be enclosed in cement mortar, so that it's rusting by soil bacteria is prevented.

- Pipes should have earth cover of at least 60cm.
- When pipe laid above ground, it should run cleanwater.
- Pipes should carry water under adequate waterpressure.
- Layout of the pipe should be simple and direct as far aspossible.

## 2. Estimation of water requirements:

It is very difficult to precisely assess the quantity of water demanded by the public, since there are many variable factors affecting water consumption. The various types of water demands, which a city may have, may be broken into following classes:

TYPESOFCONSUMPTION	-	NORMAL RANGE
		(lit/capita/day)

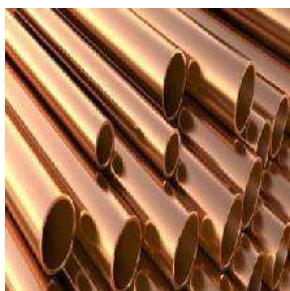
DomesticConsumption	-	65 – 300
Industrial andCommercialDemand	-	45 – 450
Public UsesIncludingFire	-	20 – 90
Lossesand Waste	-	45 -150

### Service pipes:

The pipe leading from the distribution main of the municipal water supply to the plumbing system of house is known as **service pipes**

**The following materials are commonly used for service pipes:**

- Copper pipe or brasspipe
- Galvanisediron
- Leadpipe
- Polythenepipe



## Valves:

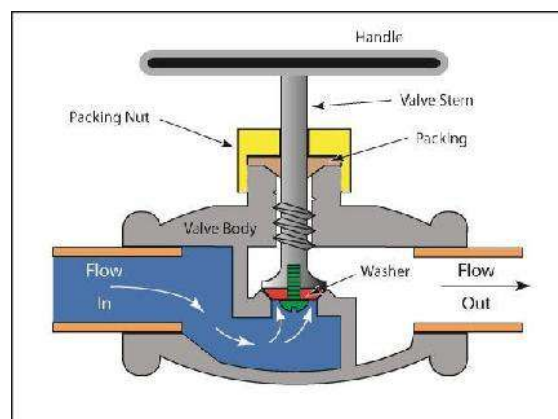
Valves are used in pipe lines for convenience in manually closing the pipes to control the flow of water.

For domestic water supply there are two types of valves commonly used:

- Globe valve
- Gate valve

## Comparison between globe valves and gate valves:

- Gate valves are used for On-Off control whereas Globe valves in addition can also be used for the flow regulation.
- Gate valves offer very little resistance to fluid flow in
- fully open position and also have small pressure drop across the valve. Globe valves on the other hand have a high pressure drop even in fully open conditions and offer substantial resistance to fluid flow.
- Gate valves of the same size are cheaper than globe valves.
- Gate valves because of their design have very little fluid trapping in the line but the globe valves have a larger amount due to the direction of flow.
- Gate valves are unidirectional and can be put around in anyway.
- The globe valves are not.





### Storage tanks:

When supplying of water to a building the pressure of water may not sufficient to rise all the floors of the building . Then storage tanks are required to supply water to all floors of a building. A storage tanks may be situated at ground level or roof level or at both levels.

A storage tank is made of the following materials:

- Mild steelplates
- Reinforcedconcrete
- Stone or brickmasonry



A Storage tank consists of ;

- **Top cover** :It is made of steel or aluminium or other suitable material ,light in weight and tight fitting , so that any insects does not enter.
- **Ball Valve with float** :It is provided near the inlet of the tank , so as to control the inflow of water.
- **Over flow pipe** : If the floating assembly fails ,the inflow is not cut-off and the water entering the tank overflows through this pipe
- **Inlet pipe or Supply pipe**: Admitting water into the tank.
- **Outlet pipe**: It is set about 2.5 to 5cm above the bottom of the tank ,for cutting the supply to house
- **Drain pipe** : For cleaning of the tank periodically

### Water supply and distribution System:

Water is provided by the city water companies using normal pressure from public water main and there are different types of water distribution system such as;

**DIRECT** :Water is provided by the city water companies using normal pressure from public water main.

**INDIRECT:**

1. GravitySystem
2. Air PressureSystem

**Materials:****Types of pipes, materials and fittings:**

## 1. PVC Pipe (Poly Vinyl Chloride):

- Most commonly used pipe for plumbing.
- Common replacement for metal piping.
- Most widely used plastics in the world.
- Used for unheated water as well as vent and drainage system.
- PVC pipe and fittings usually come in white or dark gray

## 2. PE Pipe (Polyethylene plastic material):

- Intended for long span water system installation.
- Allows cost savings in installation.
- Lengths of pipe are joined together and to other pipe materials.
- Including distribution of pressurized natural gas, pipelines carrying petroleum and petroleum products and chemicals, underground loops for geothermal heating and cooling systems, distribution of compressed gases and air, potable water mains and service lines, and sanitary and storm sewer systems.

## 3. CI Pipe (Cast iron pipes):

- These type of pipes are used in sewage networks for the purpose of conveying sewage from homes and offices.
- They are one of the oldest piping systems present today and are being largely replaced by high-density polyethylene (HDPE) pipes and polyvinyl chloride (PVC) pipes.

## 4. GI Pipe (Galvanized Iron):

- It is steel, which has been galvanized by the application of a protective coating of zinc, which reduces rust and corrosion.
- GI pipes are preferred due to their strength and durability.

**Plumbing Materials:**

1. Solvent weld or solvent welding : It is a way of joining two pieces of plastic waste pipes using a glue which is called solvent weld cement. The cement is liberally applied to both parts of the connection and the solvent literally welds the parts together.
2. Teflon tape : It is specifically used for attachment threaded pipe on fittings.
3. ABS Cleaner and Cement: It is an adhesive material used by a plumber when working with ABS pipes.

**Fittings:**

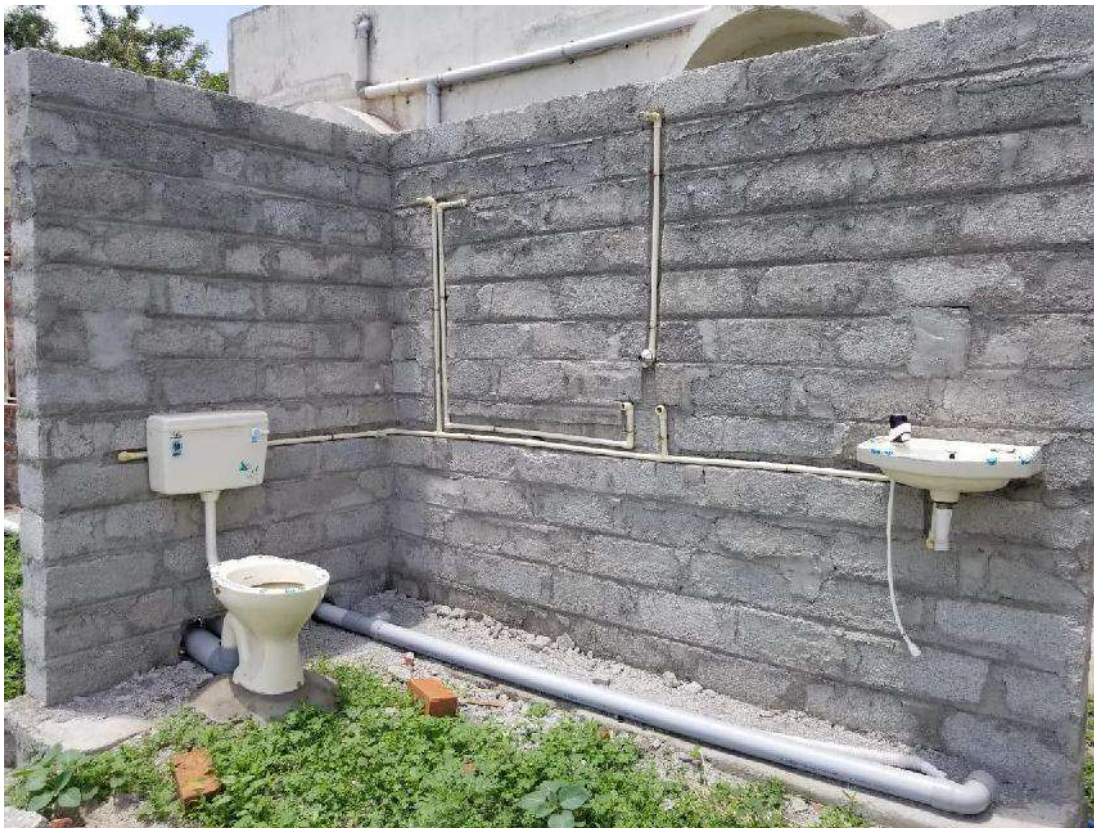
Fittings are any pipe part used to join two sections of pipes.

Detachable piece of pipe or tubing that either connects to another piece of pipe or tubing or connects two such pieces.

**Types of pipe Fittings are ;**

- Coupling
- Reducer
- Valves
- Elbow
- Unions
- Tee
- Cross
- Cap and
- Barb







## CHAPTER7:

### Paintingwork

#### Types of tools used for painting work:

1. Roller:



2. Tray:



3. Brush:



4. Tape:



5. Drop cloth:



6. Sprayer



7. Extensionpole:



8. Painterstool:



## 9. Paint remover:



## 10. Paint bucket:





## DIFFERENT TYPES OF PAINTS

The brief descriptions of different types of paints are given below:

### 1. Aluminium Paint:

The very finely ground aluminium is suspended in either quick-drying spirit varnish or slow-drying oil varnish as per requirement. The spirit or oil evaporates and a thin metallic film of aluminium is formed on the surface.

The advantages of aluminium paint are as follows:

- (i) It is visible in darkness.
- (ii) It resists heat to a certain degree.
- (iii) The surfaces of iron and steel are better protected from corrosion by this paint than any other paint.
- (iv) It possesses a high covering capacity. A litre of paint can cover an area of about 200m<sup>2</sup>.
- (v) It gives good appearance to the surface.
- (vi) It is impervious to moisture.
- (vii) It possesses high electrical resistance.

The aluminium paint is widely used for painting gas tanks, hot water pipes, marine piers, oil storage tanks, radiators, etc.

### 2. Anticorrosive Paint:

This paint essentially consists of oil and a strong drier. A pigment such as chromium oxide or lead or red lead or zinc chrome is taken and after mixing it with some quantity of very fine sand, it is added to the paint.

The advantages of an anticorrosive paint are as follows:

- (i) It is cheap.
- (ii) It lasts for a long duration.
- (iii) The appearance of the paint is black.

### 3. Asbestos Paint:

This is a peculiar type of paint and it is applied on the surfaces which are exposed to the acidic gases and steam.

### 4. Bituminous Paint:

This paint is prepared by dissolving asphalt or mineral pitches or vegetable bitumen in any type of oil or petroleum. A variety of bituminous paints is available. The paint presents a black appearance and it is used for painting ironwork under water.

## 5. Cellulose Paint:

This paint is prepared from nitro-cotton, celluloid sheets, photographic films, etc. An ordinary paint hardens by oxidation. A cellulose paint hardens by evaporation of thinning agent. It thus hardens quickly. It is a little more costly, but it presents a flexible, hard and smooth surface. Also, the surface painted with cellulose paint can be washed and easily cleaned. The cellulose paint is not affected by contact with hot water and the surface can stand extreme degrees of cold and heat.

## 6. Cement Paint:

This paint consists of white cement, pigment, accelerator and other additives. It is available in dry powder form. The cement paint is available in variety of shades and it exhibits excellent decorative appearance. It is waterproof and durable. It proves to be useful for surfaces which are damp at the time of painting or are likely to become damp after painting.

For external finish, on cement-plastered walls, it is mixed with water immediately before its application. It is desirable to provide cement paint on rough surface rather than on smooth surface because its adhesion power is poor on smoothly finished surface.

For painting surfaces like corrugated iron sheets, etc., the cement paint is mixed with boiled linseed oil. The mixture is constantly stirred during use.

The cement paint is applied in two coats. Before the first coat is applied, the surfaces are wetted to even and control suction and to assist the hardening process of the cement paint. The application of paint over a surface exposed directly to hot sunlight should be avoided. Otherwise the coating will dry before it is cured and will become chalky.

The second coat is applied not less than 24 hours after the first coat and it considerably helps in improving the appearance of the surface..

### **Following are the advantages of cement paints:**

- (i) It requires less skill and time for applying cement water paints and the applying implements can be cleaned with water only.
- (ii) The preparation of surfaces is easier in a cement paint system as it is not necessary to remove the previous coats of cement paints.
- (iii) They are suitable for painting fresh plasters having high alkalinity because cement paints are not likely to be attacked by the alkalinity of masonry surfaces.
- (iv) They become an integral part of the substrata and add to its strength.
- (v) They can be applied over new and damp walls which cannot be painted over with oil paints until they are sufficiently dried.
- (vi) They prove to be economical as compared to the oil paints and they dry more rapidly than the oil paints.

Following **precautions** should be taken to avoid defects or complaints of the cement paints:

(i) The defect of cracking occurs when the film of paint has not adequate flexibility to move with thermal or moisture movements in the surface.

The cement paints however become integral part of the surface, if they are suitably cured and hence they do not move independently of the surface.

(ii) The efflorescence or crystalline deposits are sometimes seen on the finished surfaces. Such defects are mainly due to the nature of surface before application of paint or due to some external factor like highly saline atmosphere.

(iii) The flaking or lifting of the paint film due to loss of adhesion can be prevented by properly curing the surface after the application of paint.

(iv) The most common fungi or micro-organisms found in paints and coatings are moulds and they are attached to paint coatings by mycelial hairs which extend into and under the coatings. Such defects can be removed by scrubbing the surface with brush or by applying suitable fungicides or by adding the fungicides to the paint itself. A fungicidal wash may also be used effectively to retard fresh growth.

(v) The paint should be cured sufficiently after application. It will avoid the phenomena of chalking of surfaces which indicates the paint film losing adhesion with the surface and becoming powdery.

## **7. Colloidal Paint:**

No inert material is mixed in this type of paint. It requires more time to settle and in the process of settlement, it penetrates through the surface. It may be used for interior as well as exterior walls.

## **8. Emulsion Paint:**

A variety of emulsion paints is available. It contains binding materials such as polyvinyl acetate, synthetic resins, etc. This paint is easy to apply and it dries quickly in about 1½ to 2 hours. The colour of the paint is retained for a long period and the surface of paint is tough and it can be cleaned by washing with water. There is absence of odour and the paint possesses excellent alkali resistance.

The application of emulsion paint can be carried out either by brush or spray gun. For long service life, it is recommended to apply two coats of emulsion paint. For rough cement plastered surface, a thin coat of cement paint may first be applied to smoothen the surface. It is necessary to have a sound surface to receive the emulsion paint.

## **9. Enamel Paint:**

This paint is available in different colours. It contains white lead or zinc white, oil, petroleum spirit and resinous matter. It dries slowly and forms a hard and durable surface. The surface provided with this paint is not affected by acids, alkalies, fumes of gas, hot and cold water, steam, etc. It can be used for both internal and external walls. In order to improve the appearance, it is desirable to apply a coat of titanium white in pale linseed oil before the coat of enamel paint.

## **10. Graphite Paint:**

The paint presents a black colour and it is applied on iron surfaces which come in contact with ammonia, chlorine, sulphur gases, etc. It is also used in mines and underground railways.

## **11. Inodorous Paint:**

No turpentine is used in this paint, but white lead or zinc white is mixed with methylated spirit. The white lead or zinc white is well ground in oil. The shellac with some quantity of linseed oil and castor oil is dissolved in methylated spirit. The paint is not durable, but it dries quickly. The methylated spirit evaporates and a film of shellac remains on the surface.

## **12. Luminous Paint:**

This paint contains calcium sulphide with varnish. The surface on which luminous paint is applied shines like radium dials of watches after the source of light has been cut off. The paint should be applied on surfaces which are free from corrosion or any other lead paint.

## **13. Oil Paint:**

This is the ordinary paint and it is generally applied in three coats of varying composition. They are respectively termed as primes, undercoats and finishing coats. This paint is cheap and easy to apply and it possesses good opacity and low gloss.

It should be remembered that the oil paint should not be applied during humid and damp weather. The presence of dampness on wall surface also considerably affects the life of oil paint coating. It is advisable to redecorate the surfaces finished with oil paint with a coating of fresh oil paint only. The layer of old oil paint serves as a foundation for the fresh paint.

## **14. Plastic Paint:**

This paint contains the necessary variety of plastics and it is available in the market under different trade names. The application of plastic paint can be done either by brush painting or spray painting. This paint possesses pleasing appearance and it is attractive in colour. This paint is widely used for show rooms, auditoriums, etc.

The plastic emulsion paints were introduced in our country in 1955 or so and they are becoming more and more popular day by day. An emulsion is a liquid having fine suspended particles of a substance. For plastic emulsion paints, the emulsion is composed of plastic compounds such as vinyl acetate and acrylate which are held in water.

The typical composition of one litre of plastic emulsion paint is as follows:

When the paint dries, the water evaporates and a film of binders, pigments and other solids is left behind. One litre of plastic emulsion paint covers about 15 m<sup>2</sup> of wall surface per coat. For interior jobs, the two coats of paint are sufficient, each coat having a thickness of about 0.04 mm.

Following are the important guidelines for the use of plastic emulsion paints:

**(i) Application:**

It is observed that the plastic emulsion paints are widely used for interior jobs in our country because they cannot resist effectively the attack of enemies of paints such as salts, dust and gases carried by air, sunlight, fog, rain, rise and fall of temperature, etc.

**(ii) BaseSurface:**

The success of paint will depend on the quality of plaster and characteristics of base surface. The surface to be painted should be cleaned of all dust particles and rubbed with sandpaper, if necessary. The levelling putty should be applied, if required.

**(iii) Brushes:**

The application of these paints should be done with clean brushes or sponge rollers. These paints possess good flow properties and hence the brush marks are automatically levelled off giving beautiful, uniform and washable surface in a short time.

**(iv) Colour of Paints:**

If dark colour plastic emulsion paints are required, they should be used as made by the manufacturers. For light colour paints, a white emulsion with certain other colours known as the tinters (available in tubes), may be added to the paints made by the manufacturers.

**(v) Diluting the Paint:**

These paints are usually supplied with thick consistency and for diluting the paints, the instructions given by the manufacturer should be strictly followed. In a general way, it can be stated that half litre extra water will be required for first coat and quarter litre extra water will be required for second coat.

**(vi) Metallic Surfaces:**

These paints are water based and hence, they are not suitable for metallic surfaces. These paints are not water-repellent and it is likely that some fungus growth may develop in unfavourable circumstances.

**(vii) Moisture Resistance:**

These paints allow moisture to evaporate through minute pores. But even then, it is desirable to allow 4 months, preferably one year, for moisture to escape from fresh masonry and fresh plaster.

**(viii) Nature of Surface:**

The plastic binders need not require a rough surface for adhesion and they even stick to a smooth surface. However the initial roughening of surface before the application of first coat is necessary to remove dust, salts, etc. A good plastic emulsion paint would not colour a moist cloth when rubbed on the painted surface.

**(ix) Thickness of Coat:**

The thickness of coat should neither be too thin nor too thick. In fact, it must possess elasticity to match the stresses in the plaster and should not separate out from the surface. However the film of paint can be made durable by thickening in successive coats and not in one coat at a time.

**(x) Washing:**

It is desirable to wash the painted surfaces with wet cloth lightly at least once in a month. If this precaution is not taken, the dust particles would adhere to the surface and the paint may lose its good appearance.

**15. Silicate Paint:**

This paint is prepared by mixing calcined and finely ground silica with resinous substances. The paint when dried forms a hard surface and it is durable. It can stand extreme heat and it adheres firmly to brickwork also. It is not affected by alkalies. No chemical action takes place on metals by this paint. The drier used with this paint should be of a special silicate drier type.

The silicate paint can directly be applied on brick, plaster or concrete surfaces. These surfaces should be made wet before the paint is applied.

The two or three coats of silicate paint are recommended and it is not necessary to have a priming coat. The tool which is used to apply silicate paint should be immediately cleaned with water after use. The surfaces should not be painted with silicate paint in hot weather.

**16. Synthetic Rubber Paint:**

This paint is prepared from resins.

It has the following advantages:

- (i) It offers good resistance to the water and is not affected by heavy rains.
- (ii) It dries quickly.
- (iii) A uniform colour is maintained when this paint is applied on the surface.
- (iv) It is little affected by weather and sunlight.
- (v) It can be applied on surfaces which may not be completely dry e.g. fresh concrete.
- (vi) It is moderate in cost and covers a sizeable area.



## **PROCESS OF BUILDING PAINTING.**

Inside house painting process:

Painting is a five step process for new house (**inside house**).

First painters will clean building walls and ceiling

1. Apply primer.
2. Apply wall putty.
3. Apply wall putty — second coat.
4. Apply selected paint coat.
5. Apply selected paint coat — final one.

### **Applying Primer:**

This is the first step in painting process.

### **Applying Putty:**

This process will bring smooth surface to the walls. To identify/test smoothness you can take a tube light and wall under that lighting, you will come to know smoothness of wall.

If plastering was not done properly then you will end up spending more amount on wall putty.

### **Applying paint:**

Once putty was applied then paint quote will start. Once you finish one quote of painting electrical people will fix switches. Carpenters can start working on wardrobes and kitchen wood work. Once you finish all the works in house you can go for second quote.

You can paint second quote once after GruhaPravesham because of home paint color may change.

### **Outside house painting process:**

Painting is a three step process for new house. First painters will clean building walls.

1. Apply primer.
2. Apply selected paint coat.
3. Apply selected paint coat — final one.

## CHAPTER 8:

### ELECTRICAL WORK

#### TYPES OF TOOLS USED FOR ELECTRICAL WORK:

1. PLIERS:



2. MULTIMETER:



3. WIRESTRIPPER:



4. SCREWDRIVER



5. TAPE:



6. FLASHLIGHT



## 7.NEEDLE-NOSEPLIERS:



## 8.HAMMERS:



## 9.LEVEL:



## 10. UTILITYKNIFE:



## 11.SOLDERINGIRON:



## 12. LINEMANSPLIER:



## 13.FISHTAPE:



## 14. DRILLINGMACHINE:



## TYPES OF MATERIALS USED FOR ELECTRICAL WORK:

### SESSION 1: IDENTIFYING AND SELECTING THE WIRING MATERIALS AND COMPONENTS

#### Wiring materials

Electrical wire is made of materials like copper, aluminium and silver. As silver is expensive, mostly copper and aluminium are used in wiring.

Materials are classified into three types according to their properties:

1. Conducting materials
2. Insulating materials
3. Semiconducting materials

### Conducting Material

#### (a) Copper

It is a good conductor of electricity. It is used in wiring materials in cables. It has low resistance and is used for conduction of electricity at high, medium and low voltage (Fig. 3.2).

It is used in wiring and cable making.



#### (b) Aluminium

It is light weight and cheaper in comparison to copper. Therefore, this type of conducting material is mostly used in electrical wiring. It is silvery-white in colour and it has a soft texture. It is often used in wiring and making cable (Fig. 3.3).



### Insulating Materials

Insulating materials are used for insulating purpose.

These types of materials are bad conductors of current. Eg. rubber, paper, mica, glass, cotton.

## Wiring Accessories

Wiring accessories are used for connecting appliances

### (a) Switch

A switch is used to make or break an electrical circuit. It is used to switch 'on' or 'off' the supply of electricity to an appliance.

There are various switches such as

1. surface switch
2. flush switch
3. ceiling switch
4. pull switch
5. push button switch
6. bed switch



**(i) Surface switch:** It is mounted on wooden boards fixed on the surface of a wall. It is of three types

1. One-way switch
2. Two-way switch
3. Intermediate switch

**1. One-way switch:** It is used to control single circuits and lamp

**2. Two-way switch:** It is used to divert the flow of current to either of two directions. The two-way switch can also be used to control one lamp from two different places as in the case of staircase wiring

**3. Intermediate switch:** It is used to control a lamp from more than two locations

(i) Flush switch: It is used for decorative purpose

(ii) Bed switch: As the name indicates, it is used to

switch 'on' the light from any place, other than switch board or from near the bed.



### (b) Holders

A holder is of two types.

1. Pendantholder
2. Battenholder



### (c) Ceiling rose

It is used to provide a tapping to the pendant lamp-holder through the flexible wire or a connection to a fluorescent tube



### (d) Socketoutlet/plug

The socket outlet has an insulated base with the moulded or socket base having three terminal sleeves



### (e) Mainswitch

To control the electrical circuit a main switch is used. Through the main switch, the power in a building is controlled completely



### Miniature Circuit Breaker (MCB)

A MCB is used in new constructions instead of the older types of fuses. Circuit breakers are small devices used to control and protect the electrical panel and the other devices from overflowing of electrical power.



### Uses of MCB

Home electrical panels

As with all breakers, the MCB is designed to protect the house from circuit overload. An MCB is much safer than the typical fuse, because it can be reset manually and can handle larger amounts of power. The breaker can manage the flow of energy, distributing the voltage even when many devices run off the same power circuit.



## Lights

MCBs are used in the lighting system of the house, because they can deal with the amount of power needed to lightening a house, especially if specific types of lamps, such as fluorescent lights are used. MCBs overcome the need of additional power required when switching on the lights, especially when lights are used extensively in the entire house.

## Industrial applications

There are many small scale industrial buildings where MCBs are used instead of the old fuses. Miniature circuit breakers are largely used in restaurants, bakeries and commercial food stores.

## Heaters

When heaters are used at home or in the office, the MCB can be beneficial. It is known in general that heaters can be problematic sometimes, especially with distribution of electrical power. The MCB prevents possible problems, cutting off electricity in the case of overload or fault. In this case, though, you need to choose a miniature circuit breaker of the proper capacity, enabling it to handle the load of power when needed.

## Conduit Wiring

Electrical conduits are used to protect and provide the route of electrical wiring in an electrical system. Electrical conduits are made of metal, plastic, or fibre and can be rigid or flexible. Conduits must be installed by electricians as per standard regulations. For workshops and public buildings, conduit wiring is the best and most desirable system of wiring. It provides protection and safety against fire.

## Materials used in Conduit Wiring

- \* GI (Galvanised Iron) wire
- \* Elbow
- \* Coupling
- \* VIR (Vulcanized Indian Rubber) or PVC (Poly Vinyl Chloride) insulated cables
- \* Locknut
- \* Clip
- \* Junction Box



### Advantages of conduit wiring

- \* Safe
- \* Better appearance
- \* No risk offire
- \* No risk of damage of cableinsulation
- \* Safe from humidity, smoke, steam,etc.
- \* No risk of shock
- \* Long lasting



### Disadvantages of conduit wiring

- \* Expensive
- \* Installation is noteasy
- \* Not easily customisable for futureuse
- \* Hard to detect faults

### Colour Code

Wiring for AC and DC circuit are colour coded for identification of individual wires .

Function	Label	New colour	Old colour
Protective ground	P G	Green or green-yellow	Green
Neutral	N	White	Gray
Line, single phase	L	Black or red	—
Line, three phase	L1	Black	Brown
Line, three phase	L2	Red	Orange
Line, three phase	L3	Blue	Yellow

## SESSION 2: ICTP SWITCH AND DISTRIBUTIONBOARD

### ICTP (Iron Clad Triple Pole)

Switch It is used alongwith the energy meter to isolate the supply of electricity automatically or manually



## Distribution Board

A distribution board is a component of an electricity supply system that divides an electrical power feed into subsidiary circuits, while providing a protective fuse or circuit breaker for each circuit in a common enclosure. A distribution board is also known as panel board, breaker panel, or electric panel.

## Electrical Circuit

In an electric circuit the positive side of wire is connected to the negative side of a load, for example, bulb, TV, etc. and power supply is started by using a switch. The circuit is like an electrical house

## Types of Circuit

1. Open
3. Closed
4. Series
5. Parallel

**\*Series circuit:** It is like a stair-case. In this type of circuit  $r_1$ ,  $r_2$ ,  $r_3$  are resistances connected in series. In this,  $R = r_1 + r_2 + r_3$  where  $R$  is equivalent to resistance.

**\* Parallel circuit:** When various resistances are connected in parallel, then it is called a parallel circuit. Like if  $r_1$ ,  $r_2$  and  $r_3$  are connected in parallel, then  $1/R = 1/r_1 + 1/r_2 + 1/r_3$

In this, all resistances having positive sides are connected on one end and all negative sides are connected on another end. In this, voltages are same in all the branches.

## Fixing Wiring Accessories on Board

You should know the tools required for fixing the accessories on the board. You should also know the purpose of fixing the accessories. In-house wiring of the switches, holders and socket should be fixed on wooden/ sun mica boards and blocks. Therefore, it is necessary to learn how to fix the accessories. The ways to fix these accessories have been discussed in the following practical activity.

## SESSION 3: WORKPLACE HEALTH AND

## SAFETY MEASURES

**Electrical Hazard** An electrical hazard defines a dangerous condition. This dangerous condition is related to energised equipment or a conductor at workplace. If a technician comes in contact with the energised equipment, then the equipment may cause injury to the technician. There is a possibility of being electrocuted or getting an arc flash burn, thermal burn or blast injury while assembling the components in a unit. Many of the hazards can be avoided by being aware and taking appropriate precautions. This will ensure safety at workplace.

Points that need to be remembered for working safely around electrical panel and cabinet are as follows.

1. Watch out for loose cords and wires. Loose cords and wires can cause physical hazards and even electrical hazards. Hazard Tape should be placed if a cord or wire is placed on a pathway.
2. Wear proper personal protective equipment. The kind of personal protective equipment (PPE) required around a machine will depend upon the type of machine and task the employee is performing. Nevertheless gloves, hardhats, safety glasses, earplugs and other gears are important to use where necessary. For safety, signs can be posted near panels reminding employees to wear PPE.
3. Use caution around heat sources. Some panel and equipment get hot while operating. Everyone should be aware of these areas and use caution when nearby. PPE like gloves or flame-resistant clothing may be required in these areas.
4. Be careful when cleaning: When cleaning around a panel or equipment, one should note other possible hazards too.
5. Be cautious while testing, replacing the components in the panel. All levels of voltage should be considered equally dangerous. Even the voltage levels which cannot produce electrical shock should also not be ignored. We should check and confirm that the circuit is dead before touching it for repairing maintenance or any other work.
6. Never use equipment with damaged insulation or broken plugs. If you are repairing an electrical device always turn off the main supply.
7. Avoid water while working with electricity



### **Fire Extinguisher**

A fire extinguisher is a protection device used to cease fire. It is the basic first aid equipment which can be effectively used for controlling fire. A fire extinguisher is a cylindrical pressure vessel containing an agent which can be discharged to cease a fire. A fire extinguisher should always be available in areas where persons work with electrical equipment.

Different parts of a fire extinguisher are shown



The following steps demonstrate the operation of a fire extinguisher in case of a fire emergency.

**Step 1:** Identify the safety pin of the fire extinguisher which is generally present in its handle

**Step 2:** Break the seal and pull the safety pin from the handle

**Step 3:** Use the fire extinguisher by squeezing the lever

**Step 4:** Sweep it from side to side

## Electrical Rescue Techniques

### (a) Approaching the accident

- \* Never rush into an accident situation
- \* Call 108 as soon as possible
- \* Approach the accident place cautiously

### (b) Examining the scene

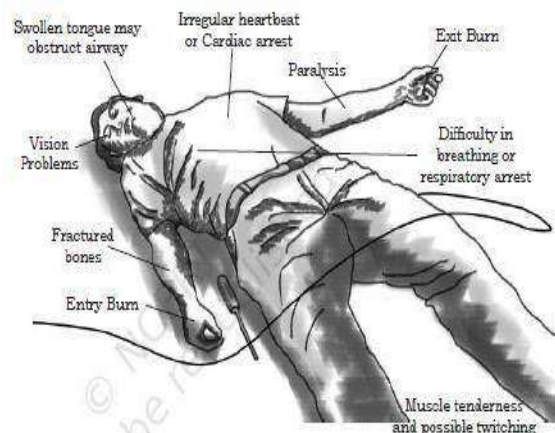
- \* Visually examine victims to determine if they are in contact with energised conductors.
- \* Metal surfaces, objects near the victim may also be energised.

You may become a victim if you touch an energised victim or conductive surface.

- \* Do not touch the victim or conductive surfaces while they are energised.
- \* Switch off the electrical circuits if possible.

## First aid

- \* A victim may require Cardio-Pulmonary Resuscitation (CPR). Steps to perform in CPR
- \* If the victim is breathing and has a heartbeat, give first aid for injuries and treat for shock.



\* Ensure the victim gets medical care as soon as possible.

### **Earthing System:**

In electricity supply systems, an earthing system or grounding system is circuitry which connects parts of the electric circuit with the ground, thus defining the electric potential of the conductors relative to the Earth's conductive surface.

Regulations for earthing system vary considerably among countries and among different parts of electric systems. Most low voltage systems connect one supply conductor to the earth.

### **Applications Of Earthing:**

- Protect human against lightning and earth fault condition
- Protect the premises against lightning and earth fault condition
- Provide low resistance and safe path for lightning and fault current
- All metallic enclosure and extraneous conductive parts are at equipotential
- LV System Earth

### **Functions of Earthing:**

- **Equipment Earth** : Path for fault current, lower touch voltage, protection against electric shock.
- **Lighting Earth** : Low resistance path to divert the current under lightning attack.
- **Telecom Earth** : Signal Earth, reduce noise and interference, stabilize DC supply voltage and prevent electric shock.
- **Computer Earth** : reduce interference, maintain supply voltages.

### **Types of Earthing:**

- Supply System – Neutral Earth
- System Earth
- Electrical Safety Earth
- Lightning Earth
- Generator Earth



- Protection Earth (i.e. surgearrestor)
- Telecom / ComputerEarth
- Shielding Earth
- Integrated Earthling System(Advocated)
- Electrostatic Earth (Clean Room /Hospital)

### **Electric Installations:**

Electric Installations require necessary design, planning taking into consideration

- Planning &Designing
- Layout of workingdrawing.
- Application to electric supply company for granting estimated low supply and requirement of sub-stations/transformer.
- Laying conduit for underground supply lines before concreting and completing plinth work.
- Laying conduits in slabs and beam reinforcement, fixing of fan hooks/ boxes in slabs reinforcement for main supply to consumer units/rooms
- Physical marking of layout of wiring in all units/rooms.
- Providing & laying completewiring
- Fixing all fittings and fixtures and complete electricalinstallations
- Testing of Installations
- Providing consumermeters.
- Submission of test reports to electric supply company for supply connection after obtaining NOC from PWD in cases of building exceeds 15mheight.
- Checking of electrical installation by authorized officer of electrical supply company before passing & sealing ofmeters.
- Permanent electric supply connection to buildings Alternate Source of Electric Supply.
- A stand-by electric generator should be installed to supply power to staircase and corridor lighting circuits, fire lifts, the standby fire pumps, smoke extraction & damper systems in case of failure of normal electricssupply.

## CHAPTER 9:

### SOFTWARE TRAINING

#### **Autodesk Revit:**

**Autodesk Revit** is a building information modelling software for architects, landscape architects, structural engineers, mechanical, electrical, and plumbing (MEP) engineers, designers and contractors.

The original software was developed by Charles River Software, founded in 1997, renamed Revit Technology Corporation in 2000, and acquired by Autodesk in 2002. The software allows users to design a building and structure and its components in 3D, annotate the model with 2D drafting elements, and access building information from the building model's database. Revit is 4D building information modeling capable with tools to plan and track various stages in the building's lifecycle, from concept to construction and later maintenance and/or demolition.

#### **History:**

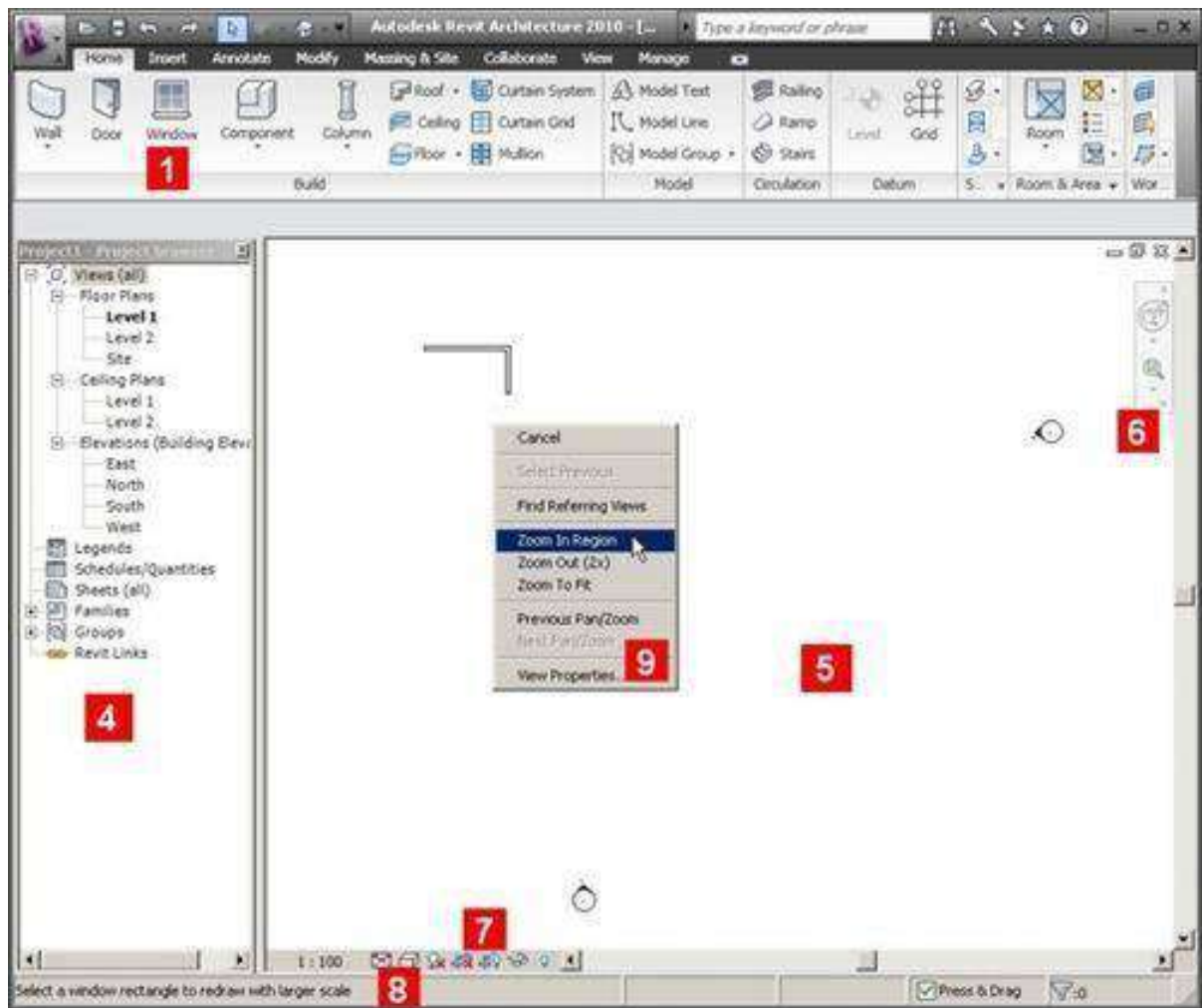
**Charles River Software** was founded in Newton, Massachusetts, on October 31, 1997, by Leonid Raiz and Irwin Jungreis, key developers of PTC's Pro/Engineer software for mechanical design, with the intent of bringing the power of parametric modeling to the building industry.

From the outset, Revit was intended to allow architects and other building professionals to design and document a building by creating a parametric three-dimensional model that included both the geometry and non-geometric design and construction information, which is also known as Building Information Modeling (BIM).

#### **BIM (Building Information Modeling):**

**BIM** is used for creating and managing data during the design, construction, and operations process. **BIM** integrates multi-disciplinary data to create detailed digital representations that are managed in an open cloud platform for real-time collaboration. Building information modeling is a process supported by various tools, technologies and contracts involving the generation and management of digital representations of physical and functional characteristics of place.

Here is how the Revit Interface looks like:



## 1. Ribbon Bar

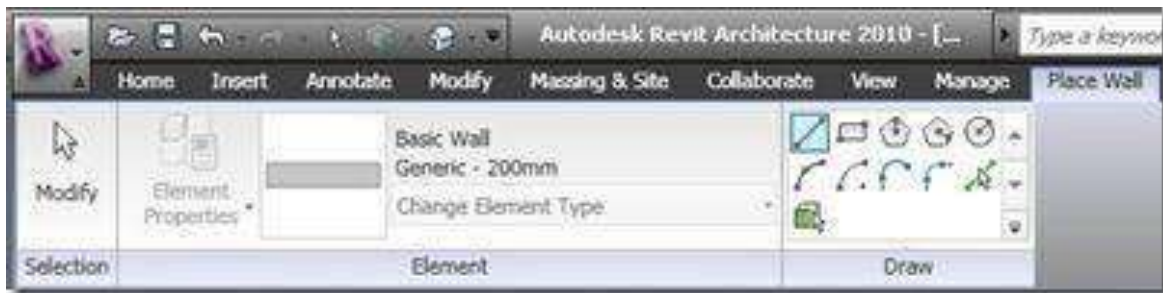
You might already be familiar with ribbon interface. Microsoft Office 2007 uses it. AutoCAD uses it since AutoCAD 2009. And now, it looks like all Autodesk 2010 products use it.



Ribbon has several tabs. Each tab contains specific tools. Home tab contains most used tools in RAC. So if you want to place a wall, find wall tool in ribbon.

## 2. ContextualBar

This is also something new. Each time you activate a tool or select an object, ribbon will show contextual tab. This tab contains options related to that object. Like this example, you can change the wall type in element section, or you can draw an arc wall by defining it in draw section



## 3. Option Bar

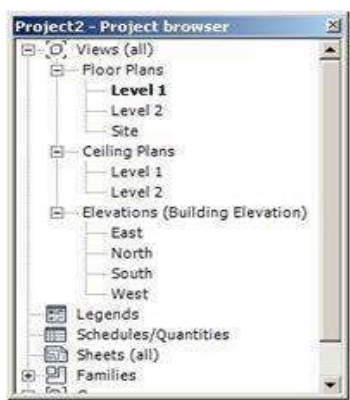
Option bar only appear when you activate a tool. Option bar allows you to define how you want an object to be placed. In this example, the wall height, wall location line, wall offset, and radius (for archwalls).



I feel a little bit annoyed wondering why does this bar still exist. I wonder why don't Autodesk just put it all together in contextual bar?

## 4. ProjectBrowser

Project browser is the most important feature to access your project. You can access all of the views, families, groups, and Revit links using this browser. If you want to see or modify floor plan for level 2, just double click it in the browser. The current view will be highlighted in the browser.



## 5. DrawingArea

Drawing area is where you can interact with your model. You can add, view, and select then modify your model here.

## 6. NavigationBar

Navigation bar is also become a standard in all Autodesk products' interface. Navigation bar contains navigation tools such as zoom, steering wheel, and view cube.

## 7. ViewControl

View control provides you tools for changing the drawing scale, detail level, and model graphic style (hidden, shaded, etc)



## 8. StatusBar

Status bar is where Revit will tell you what to do. If you activate door tool, the status bar will display: **“Click on Wall to place Door (Space bar to flip the instance left/right)”**

Pay attention to status bar, especially if you new to Revit. And also when you are playing with a new tool. It will guide you so you won't get lost!

## 9. Contextual Menu/ShortcutMenu

I prefer to use 'contextual menu', but in the help file, they name it shortcut menu. So let's just use it. You can access this menu by click your right mouse button.

Get familiar with the interface. You don't have to remember all of the now. But when you need to access your view or access a tool, you should know which part of the interface you should looking for.

## **CHAPTER 10:**

### **OUTCOME OF INTERNSHIP**

After the completion of my Internship, I had been exposed to a site engineer working life. Throughout my internship, I could understand the works involved in the construction and the practical problems. Along my training period, I realized that observation is a main element to find out the root cause of a problem. Not only for my project but daily activities too. During my internship, I cooperate with my colleagues and teachers to determine/discuss about the problem. Moreover, the project indirectly helps me to learn independently, discipline myself, be considerate /patient, self-trust, take initiative and the ability to solve problems. Besides, my communication skill is strengthening as well when communicating with others. I have received criticism and advice from engineers and technicians when mistakes were made. However, those advices are useful guidance for me to change myself and avoids me from committing the same mistakes again. The activities that I had learned during internship are useful for me in future to face challenges in a working environment.

Throughout the internship, I found that several things are important.

#### **Critical and Analytical Thinking**

To organize our tasks and assignment, we need to analyze our problems and assignment, and to formulate a good solution to the problem. We should have to set contingency plan for the solution, so that we are well prepared for the enforceable situation.

#### **Time Management**

A proper time management allows us to do our tasks efficiently and meet our schedules. Scheduling avoids time wastage and allows us to plan ahead and gaining more as a result.

#### **Goal Management**

Opposing to a Herculean goal seemed to be reached at first sight, it is better to sub divide the goals to a few achievable tasks, so that we will be gaining more confidence by accomplishing those tasks.



**Colleagues Interactions**

In working environment, teamwork is vital in contributing to a strong organization. Teamwork is also essential in reaching the goals of the organization as a entity. Thus, communicating and sharing is much needed in the working environment. Therefore, we should be respecting each other in work, and working together as a team, instead of working alone. This is because working together as team is easier in reaching our targets, rather than operating individually.

SI No	Name_of_student	Enrollment_No.
1	P GOUDAPPA	3VC14CV068
2	VIKAS M C	3VC15CV119
3	SANJANA B	3VC15CV127
4	ASHWATHKUMAR B K	3VC16CV007
5	B RAM MOHAN	3VC16CV009
6	HARSHAVARDHAN. K	3VC16CV024
7	M.PRASAD	3VC16CV040
8	N MANIKANTA	3VC16CV045
9	MONIKA G M	3VC16CV053
10	MURALI KRISHNA B S	3VC16CV054
11	NIKHIL M REVANKAR	3VC16CV060
12	RAMAKRISHNA CHAVAN	3VC16CV079
13	Trimurthi Pujari	3VC16CV109
14	VIJAYA KALLANAGOUDRA	3VC16CV116
15	VINODKUMAR REDDY D	3VC16CV120
16	LAVANYA.H.B	3VC16CV417
17	PRATHIBHA.R	3VC16CV427
18	A AKSHATA	3VC17CV001
19	A V MEGHANA	3VC17CV002
20	ABDUL TEGGINAMANI	3VC17CV003
21	AKARSH K V	3VC17CV006
22	AKESH AGARWAL	3VC17CV007
23	AMOOL K	3VC17CV008
24	AMRUTHA A	3VC17CV009
25	ANUSHA M K	3VC17CV011
26	APOORVA T	3VC17CV012
27	ARPITHA D B	3VC17CV013
28	AYESHA SADIYA P	3VC17CV014
29	B SHIVA SAI REDDY	3VC17CV015
30	B UMME ZAIBA NUSRATH	3VC17CV016
31	BASAVARAJ S ASKI	3VC17CV017
32	C G GANESH GOUDA	3VC17CV019
33	CHETAN NAGAGOUDA KANDRI	3VC17CV021
34	D MANIKANTA	3VC17CV022
35	G SOUNDARYA	3VC17CV026
36	HANUMESH MINAJGI	3VC17CV028
37	HARISH KUMAR K M	3VC17CV029
38	K AKSHAY KUMAR	3VC17CV031
39	K SWETHA	3VC17CV032
40	KAMPANA	3VC17CV033
41	KANNARI VENKATESHAREDDY	3VC17CV034
42	KAVITA MUTTAL	3VC17CV035
43	LAKSHMI T	3VC17CV037
44	M MANIPAL REDDY	3VC17CV038

45	M PRABHAKAR	3VC17CV039
46	M SUSHMA	3VC17CV040
47	MADHU CHUNGADI	3VC17CV041
48	MAHADEVI R	3VC17CV042
49	MALIGE KEERTHANA	3VC17CV044
50	MANJUNATH KAMBAR	3VC17CV045
51	MANOJ KUMAR A E	3VC17CV046
52	MEGHASRI P	3VC17CV047
53	N G KISHORE KUMAR	3VC17CV049
54	NAGARAJ	3VC17CV050
55	NAVEEN Y R	3VC17CV051
56	NEELUFAR H S	3VC17CV052
57	NIVEDITHA BEVIN K	3VC17CV053
58	P THIMMA REDDY	3VC17CV055
59	PARAPPAGOUDA PATIL	3VC17CV056
60	PAVANKUMAR DANI	3VC17CV058
61	POOJA RATHOD	3VC17CV059
62	R S SAHANA	3VC17CV061
63	RAGHAVENDRA	3VC17CV062
64	RAISON BEE P	3VC17CV064
65	RAJUNAIK	3VC17CV067
66	RAMYA K A	3VC17CV070
67	ROHINI RAJASHEKHAR PATIL	3VC17CV071
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69	SANDESH	3VC17CV074
70	SARDHAR SHASHIKUMAR	3VC17CV075
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72	SHASHIDHAR	3VC17CV077
73	SHREYASHREE Y	3VC17CV079
74	SUDARSHANA A K	3VC17CV083
75	SUMUK M S	3VC17CV086
76	USHA	3VC17CV089
77	VEENA M S	3VC17CV091
78	VEERESH K	3VC17CV092
79	VIJAYALAKSHMI A H	3VC17CV093
80	VEERESH MOOLIMANI	3VC17CV094
81	VISHWANATH	3VC17CV095
82	YASHODHA	3VC17CV096
83	ABHISHEK K	3VC17CV099
84	B SAMEERA JEENATH	3VC17CV100
85	C M SHREYA	3VC17CV101
86	M VINAYASHASTRI	3VC17CV102
87	SHARANA BASAVA K	3VC17CV103
88	ARATHI	3VC18CV402
89	B MAHESH REDDY	3VC18CV403
90	BANADA SAMPATH KUMAR	3VC18CV404
91	BHEEMA RAO	3VC18CV405

92	GURU BASAVA	3VC18CV408
93	H AKSHAYA KUMAR GOUDA	3VC18CV409
94	H M VISHWESHWARAI AH	3VC18CV410
95	H S SAGAR	3VC18CV411
96	HALLI ASHWINI	3VC18CV412
97	HARISH K	3VC18CV413
98	IMRAN S	3VC18CV414
99	JAYALAXMI	3VC18CV415
100	KARISHMA M	3VC18CV416
101	KOTRESH S	3VC18CV417
102	MANIKANTA T	3VC18CV418
103	MOHAMMED AMEER SUHAIL	3VC18CV421
104	MOHAN MADLI	3VC18CV422
105	MUBARAK M	3VC18CV423
106	MUZEED UR RAHAMAN	3VC18CV424
107	NAGARAJA C M	3VC18CV425
108	NAGARAJA SHETTI	3VC18CV426
109	NIRUPADESWSARA K S	3VC18CV427
110	PARIKSHITARAJ	3VC18CV428
111	POORNIMA	3VC18CV429
112	PRASHANTH VARMA K	3VC18CV430
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114	RAVI KUMAR B	3VC18CV432
115	S AMRUTHA	3VC18CV433
116	SAGAR K M	3VC18CV434
117	SAMAEERBANU L	3VC18CV435
118	SHAKUNTALA K	3VC18CV436
119	SHILPA K	3VC18CV437
120	SHIVAKUMAR GOUDA K J	3VC18CV438
121	SIDDESHA H	3VC18CV439
122	SUNIL G	3VC18CV440
123	TANVER NAIK L	3VC18CV441
124	UMA K	3VC18CV442
125	VEERAI AH K	3VC18CV443
126	VIJAYA KUMAR A	3VC18CV444



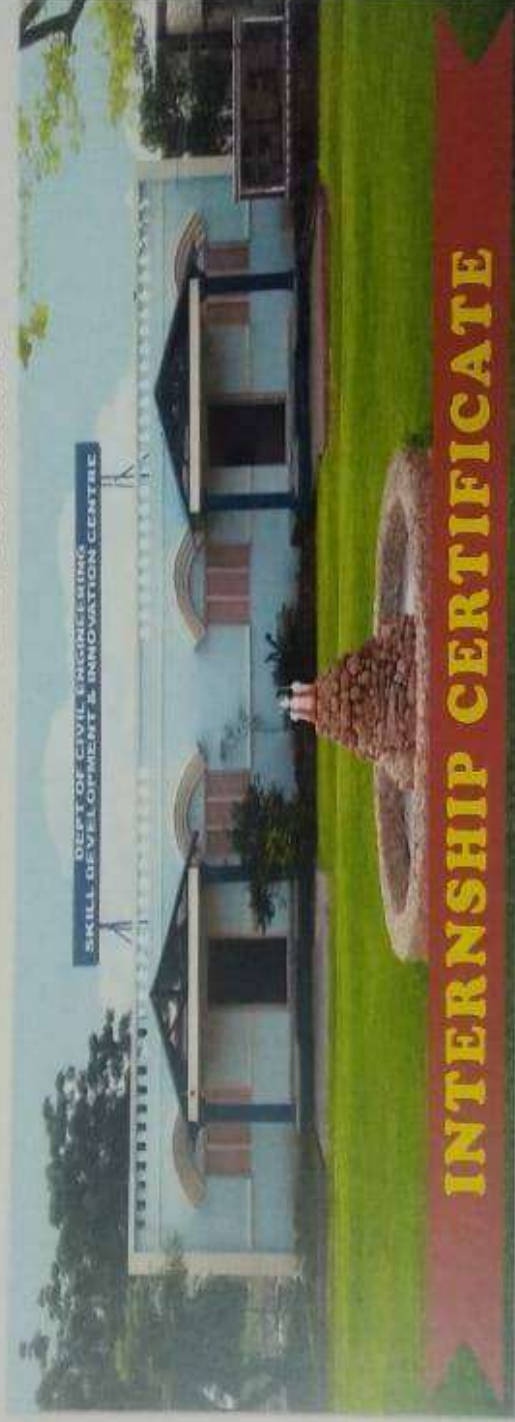
V.V.Sangha's

**RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE**

CANTONMENT, BALLARI-583104, KARNATAKA

(Affiliated to VTU, Belagavi and Approved by AICTE, New Delhi)

**DEPARTMENT OF CIVIL ENGINEERING**



## INTERNSHIP CERTIFICATE

This is to Certify that Mr./Miss. VIJAYA KALLANAGOUDRA USN 3VC16CV116 of VIII Semester. He /She has successfully completed Internship Training Programme from 15/03/21 to 10/04/21 in **SKILL DEVELOPMENT & INNOVATION CENTRE**, Dept. of Civil Engineering, RYMEC, Ballari, for the academic year 2020-21. We found his/her sincere, hardworking and worked well during the training period. We wish him/her good future.

*T. Hanumantha Reddy*  
Dr. T Hanumantha Reddy  
Principal, RYMEC

*Dr. H M Mahakarjuna*  
Dr. H M Mahakarjuna  
Head of the Department

*J. M. S. S. L. WBBP*  
Dr. J M Srishaila/Basava Prabhu M S  
Skill Development & Innovation Centre Coordinators





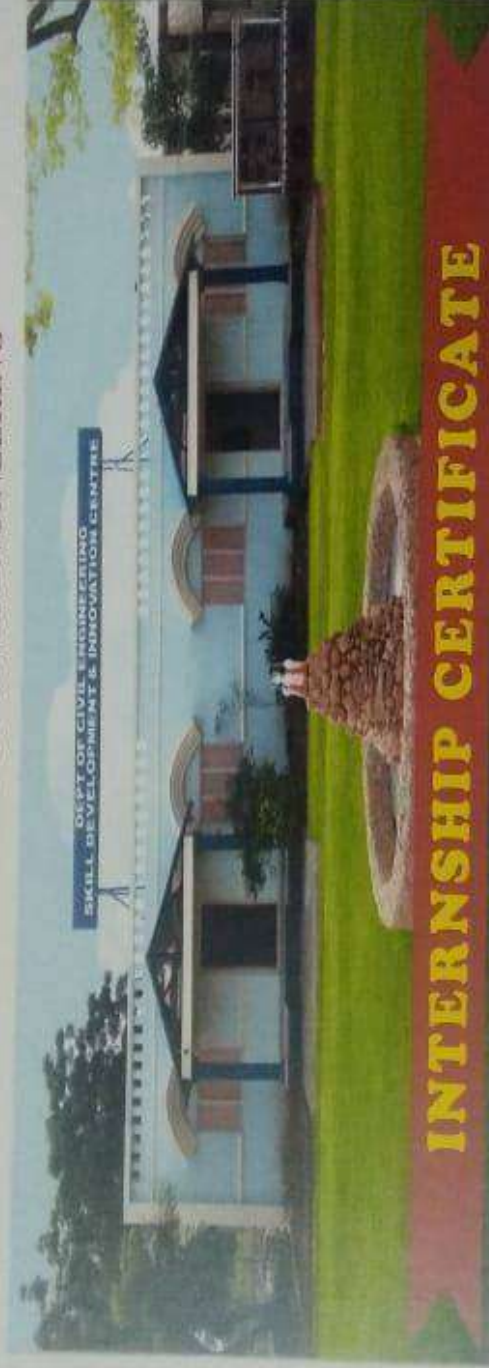
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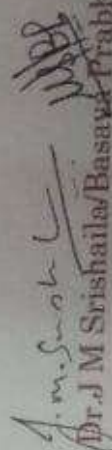
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This is to Certify that Mr./Miss. M SUSHMA USN 3VCI7CV040 of VIII Semester. He / She has successfully completed Internship Training Programme from 15/03/21 to 10/04/21 in **SKILL DEVELOPMENT & INNOVATION CENTRE**, Dept. of Civil Engineering, RYMEC, Ballari, for the academic year 2020-21. We found his/her sincere, hardworking and worked well during the training period. We wish him/her good future.

  
Dr. T Hanumantha Reddy  
Principal, RYMEC

  
Dr. H.M. Mailikarjuna  
Head of the Department

  
Dr. J. M. Srishaila/Basava Prabhhu M S  
Skill Development & Innovation Centre Coordinators





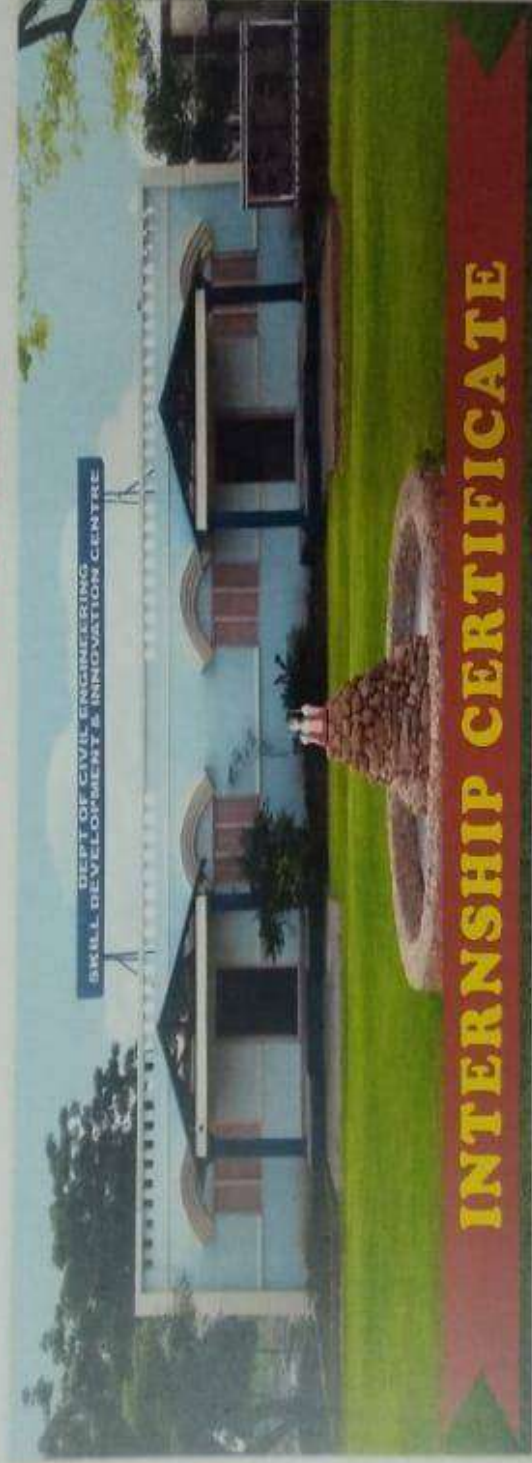
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## INTERNSHIP CERTIFICATE

This is to Certify that Mr./Miss. **K AKSHAY KUMAR** USN **3VCI7CV031** of **VIII Semester**. He /She has successfully completed Internship Training Programme from **15/03/21 to 10/04/21** in **SKILL DEVELOPMENT & INNOVATION CENTRE**, Dept. of Civil Engineering, RYMEC, Ballari, for the academic year 2020-21. We found his/her sincere, hardworking and worked well during the training period. We wish him/her good future.

**Dr. T Hanumantha Reddy**

Principal, RYMEC

**Dr. H M Madhikarjuna**

Head of the Department

**Dr. J M Srishaila/Basava Prabhu M S**

Skill Development & Innovation Centre Coordinators





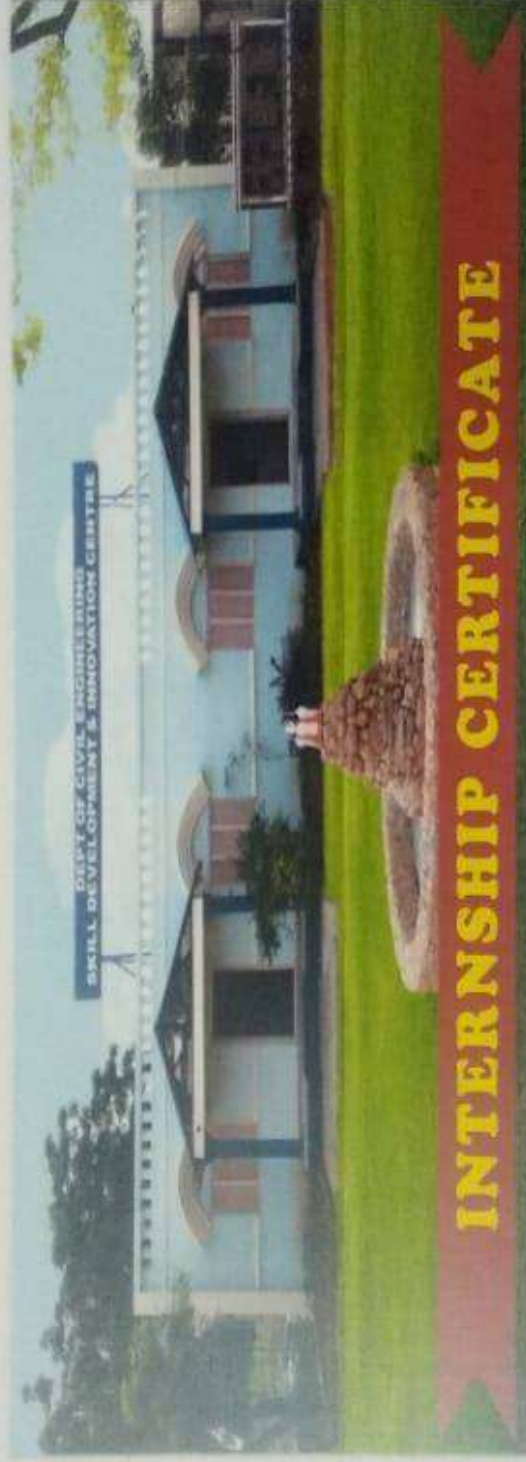
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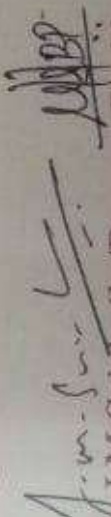
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This is to Certify that Mr./Miss. AKARSH K V USN 3VC17CV006 of VIII Semester. He /She has successfully completed Internship Training Programme from 15/03/21 to 10/04/21 in **SKILL DEVELOPMENT & INNOVATION CENTRE**, Dept. of Civil Engineering, RYMEC, Ballari, for the academic year 2020-21. We found his/her sincere, hardworking and worked well during the training period. We wish him/her good future.

  
Dr. T Hanumantha Reddy  
Principal, RYMEC

  
Dr. H M Manikarjuna  
Head of the Department

  
Dr. J M Srishaila/Basava Prabhu M S  
Skill Development & Innovation Centre Coordinators