# DRAUGHTSMAN CIVIL

## NSQF LEVEL - 4

## 2nd Year

## TRADE PRACTICAL

**SECTOR :** CONSTRUCTION

**(As per revised syllabus July 2022 - 1200 Hrs)**



Directorate General of Training

DIRECTORATE GENERAL OF TRAINING
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
GOVERNMENT OF INDIA

NATIONAL INSTRUCTIONAL MEDIA INSTITUTE, CHENNAI

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**Sector** : **CONSTRUCTION**

**Duration** : **2 - Years**

**Trade** : **Draughtsman Civil - 2nd Year - Trade Practical - NSQF Level - 4 (Revised 2022)**

## Developed & Published by


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# FOREWORD

The Government of India has set an ambitious target of imparting skills to 30 crores people, one out of every four Indians, by 2020 to help them secure jobs as part of the National Skills Development Policy. Industrial Training Institutes (ITIs) play a vital role in this process especially in terms of providing skilled manpower. Keeping this in mind, and for providing the current industry relevant skill training to Trainees, ITI syllabus has been recently updated with the help of Media Development Committee members of various stakeholders viz. Industries, Entrepreneurs, Academicians and representatives from ITIs.

The National Instructional Media Institute (NIMI), Chennai, has now come up with instructional material to suit the revised curriculum for **Draughtsman Civil - 2nd year Trade Practical** NSQF Level - 4 (Revised 2022) in **Construction Sector** under **Yearly Pattern.** The NSQF Level - 4 (Revised 2022) Trade Practical will help the trainees to get an international equivalency standard where their skill proficiency and competency will be duly recognized across the globe and this will also increase the scope of recognition of prior learning. NSQF Level - 4 (Revised 2022) trainees will also get the opportunities to promote life long learning and skill development. I have no doubt that with NSQF Level - 4 (Revised 2022) the trainers and trainees of ITIs, and all stakeholders will derive maximum benefits from these Instructional Media Packages IMPs and that NIMI's effort will go a long way in improving the quality of Vocational training in the country.

The Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

Addl. Secretary/Director General (Training)
Ministry of Skill Development & Entrepreneurship
Government of India.

New Delhi - 110 001

# PREFACE

The National Instructional Media Institute (NIMI) was established in 1986 at Chennai by then Directorate General of Employment and Training (D.G.E & T), Ministry of Labour and Employment, (now under Directorate General of Training, Ministry of Skill Development and Entrepreneurship) Government of India, with technical assistance from the Govt. of Federal Republic of Germany. The prime objective of this Institute is to develop and provide instructional materials for various trades as per the prescribed syllabus under the Craftsman and Apprenticeship Training Schemes.

The instructional materials are created keeping in mind, the main objective of Vocational Training under NCVT/NAC in India, which is to help an individual to master skills to do a job. The instructional materials are generated in the form of Instructional Media Packages (IMPs). An IMP consists of Theory book, Practical book, Test and Assignment book, Instructor Guide, Audio Visual Aid (Wall charts and Transparencies) and other support materials.

The trade practical book consists of series of exercises to be completed by the trainees in the workshop. These exercises are designed to ensure that all the skills in the prescribed syllabus are covered. The trade theory book provides related theoretical knowledge required to enable the trainee to do a job. The test and assignments will enable the instructor to give assignments for the evaluation of the performance of a trainee. The wall charts and transparencies are unique, as they not only help the instructor to effectively present a topic but also help him to assess the trainee's understanding. The instructor guide enables the instructor to plan his schedule of instruction, plan the raw material requirements, day to day lessons and demonstrations.

IMPs also deals with the complex skills required to be developed for effective team work. Necessary care has also been taken to include important skill areas of allied trades as prescribed in the syllabus.

The availability of a complete Instructional Media Package in an institute helps both the trainer and management to impart effective training.

The IMPs are the outcome of collective efforts of the staff members of NIMI and the members of the Media Development Committees specially drawn from Public and Private sector industries, various training institutes under the Directorate General of Training (DGT), Government and Private ITIs.

NIMI would like to take this opportunity to convey sincere thanks to the Directors of Employment & Training of various State Governments, Training Departments of Industries both in the Public and Private sectors, Officers of DGT and DGT field institutes, proof readers, individual media developers and coordinators, but for whose active support NIMI would not have been able to bring out this materials.

**Chennai - 600 032** **EXECUTIVE DIRECTOR**

ACKNOWLEDGEMENT

National Instructional Media Institute (NIMI) sincerely acknowledges with thanks for the co-operation and contribution extended by the following Media Developers and their sponsoring organisation to bring out this IMP **(Trade Practical)** for the trade of **Draughtsman Civil - NSQF Level - 4 (Revised 2022)** under the **Construction** Sector for ITIs.

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NIMI records its appreciation of the Data Entry, CAD, DTP Operators for their excellent and devoted services in the process of development of this Instructional Material.

NIMI also acknowledges with thanks, the invaluable efforts rendered by all other staff who have contributed for the development of this Instructional Material.

NIMI is grateful to all others who have directly or indirectly helped in developing this IMP.

# INTRODUCTION

**TRADE PRACTICAL**

The trade practical manual is intented to be used in practical workshop. It consists of a series of practical exercises to be completed by the trainees during the course of the **Draughtsman Civil** trade supplemented and supported by instructions/ informations to assist in performing the exercises. These exercises are designed to ensure that all the skills in compliance with NSQF Level - 4 (Revised 2022) syllabus are covered.

This manual is divided into Fourteen modules. The Fourteen modules are given below.

| | | |
|---|---|---|
| **Module 1** | - | **Building Drawing** |
| **Module 2** | - | **Computer Practice** |
| **Module 3** | - | **3D Modeling in CAD** |
| **Module 4** | - | **Building Drawing (Public)** |
| **Module 5** | - | **Reinforced Cement Concrete Structure** |
| **Module 6** | - | **Steel Structures** |
| **Module 7** | - | **Public Health and Sanitation** |
| **Module 8** | - | **Road Engineering** |
| **Module 9** | - | **Bridge Engineering** |
| **Module 10** | - | **Railway Engineering** |
| **Module 11** | - | **Irrigation engineering** |
| **Module 12** | - | **Estimating and costing** |
| **Module 13** | - | **Total station** |
| **Module 14** | - | **Global positioning system** |

The skill training in the shop floor is planned through a series of practical exercises centred around some practical project. However, there are few instances where the individual exercise does not form a part of project.

While developing the practical manual a sincere effort was made to prepare each exercise which will be easy to understand and carry out even by below average trainee. However the development team accept that there is a scope for further improvement. NIMI looks forward to the suggestions from the experienced training faculty for improving the manual.

**TRADE THEORY**

The manual of trade theory consists of theoretical information for the Course of the **Draughtsman Civil -** Trade Practical - NSQF Level - 4 (Revised 2022) in Construction. The contents are sequenced according to the practical exercise contained in NSQF Level - 4 (Revised 2022) syllabus on Trade Theory attempt has been made to relate the theoretical aspects with the skill covered in each exercise to the extent possible. This correlation is maintained to help the trainees to develop the perceptional capabilities for performing the skills.

The trade theory has to be taught and learnt along with the corresponding exercise contained in the manual on trade practical. The indications about the corresponding practical exercises are given in every sheet of this manual.

It will be preferable to teach/learn the trade theory connected to each exercise at least one class before performing the related skills in the shop floor. The trade theory is to be treated as an integrated part of each exercise.

The material is not for the purpose of self learning and should be considered as supplementary to class room instruction.

## CONTENTS

# LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

| S.No | Learning Outcome | Lesson No |
|---|---|---|
| 1 | Draw single storied building site plan layout. **(NOS: CON/N1302)** | 2.1.91 - 2.1.95 |
| 2 | Create objects on CAD workspace using Toolbars, Commands, Menus, formatting layer and style. **(NOS: CON/N1302)** | 2.2.96 - 2.2.101 |
| 3 | Draw a sanction plan of double storied flat roof residential building by using CAD. **(NOS: CON/N1302)** | 2.2.102 - 2.2.107 |
| 4 | Create objects on 3D modeling concept in CAD. **(NOS: IES/N9424)** | 2.3.108 - 2.3.114 |
| 5 | Prepare a drawing of public building detailing with roof and coloumns by frame structures using CAD. **(NOS: CON/N1302)** | 2.4.115 - 2.4.120 |
| 6 | Prepare detailed drawing of RCC structures using CAD and prepare bar bending schedule. **(NOS: IES/N9425)** | 2.5.121 - 2.5.123 |
| 7 | Prepare detailed drawing of RCC structures using CAD and prepare bar bending schedule. **(NOS: IES/N9425)** Draw the details of a framed structure and portal frame of a residential building Using CAD. **(NOS: IES/N9426)** | 2.5.124 - 2.5.129 |
| 8 | Draw the different types of steel sections, rivets and bolts using CAD. **(NOS: CON/N1302)** Draw the details of girders, roof trusses and steel stanchions using CAD. **(NOS: CON/N1302)** | 2.6.130 - 2.6.133 |
| 9 | Prepare the detailed drawing showing the different types of sanitary fittings, arrangements of manholes, details of septic tank using CAD. **(NOS: IES/N9427)** Draw the details flow diagram of water treatment plant (WTP) and Swerage Treatment plant (STP). **(NOS: IES/N9428)** | 2.7.134 - 2.7.141 |
| 10 | Draw the cross sectional view of different types of roads showing component parts using CAD. **(NOS: IES/N9429)** | 2.8.142 - 2.8.144 |
| 11 | Draw the details of different types of culverts using CAD. **(NOS: IES/N9430)** Prepare detailed drawing a bridge using CAD. **(NOS: IES/N9431)** | 2.9.145 - 2.9.149 |
| 12 | Draw the typical cross section of rail sections, railway tracks in cutting and embankment usingCAD. **(NOS: IES/N9432)** | 2.10.150 - 2.10.153 |
| 13 | Prepare detailed drawing of typical cross sections of Dam, barrages, weir and Cross drainageworks using CAD. **(NOS: IES/N9433)** Draw the schematic diagram of different structures of Hydro electric project using CAD. **(NOS: IES/N9434)** | 2.11.154 - 2.11.159 |
| 14 | Prepare detailed estimate and cost analysis of different types of building and other structures using application software. **(NOS: IES/N9435)** Prepare rate analysis of different items of work. **(NOS: IES/N9436)** Problems on preparing preliminary/Approximate estimates for building project. **(NOS: IES/N9437)** | 2.12.160 - 2.12.165 |
| 15 | Prepare a map using Total station. **(NOS: IES/N9438)** | 2.13.166 -2.13.175 |
| 16 | Locate the station point using GPS and obtain a set of co-ordinates. **(NOS: IES/N9439)** | 2.13.176 -2.13.179 |

## SYLLABUS

| Duration | Reference Learning Outcome | Professional Skills (Trade Practical) with Indicative hours | Professional Knowledge (Trade Theory) |
|---|---|---|---|
| Professional Skill 28Hrs; Professional Knowledge 08Hrs | Draw single storied Building site plan layout. (Mapped NOS: CON/ N1302) | Drawing details of:-<br>91. Single storied residential house with attached bath of both pitched and flat roof. (09hrs)<br>92. Making plan, elevation, and section with aid of line diagrams of the building. (10hrs)<br>93. Layout and detailing of residential building. (03hrs)<br>94. Create a drawing of building showing set backs. (03hrs)<br>95. Showing layout plan and key plan. (03hrs) | Building:-<br>• Principle of planning<br>• Objectives & importance.<br>• Function& responsibility.<br>• Orientation.<br>• Local building Bye-Laws as per ISI code.<br>• Lay out plan & key plan.<br>• Submitted in composition of drawing.<br>• Provisions for safety.<br>• Requirement of green belt and land. (08 hrs.) |
| Professional Skill 28Hrs; Professional Knowledge 10 Hrs | Create objects on CAD workspace using Toolbars, Commands, Menus, formatting layer and style. (Mapped NOS: CON/N1302) | Computer practice:-<br>96. Function of keys and practice of basic commands. (03hrs)<br>97. Use of elementary commands by CAD toolbar. (03hrs)<br>98. Creation of objects in different layers on CAD workspace. (5 hrs)<br>99. Plotting of drawing from CAD. (01hr)<br>100. 2D drafting of flash door, panel door, window, hand railing, wash basin, sewerage pipe joints, etc. (10hrs)<br>101. Preparing Library folder by creating blocks of the above items. (6hrs) | Computer aided drafting:-<br>• Operating system ,Hardware& software.<br>• Introduction of CAD.<br>• Its Graphical User Interface.<br>• Method of Installation.<br>• Basic commands of CAD.<br>• Knowledge of Tool icons and set of Toolbars.<br>• Knowledge of shortcut keyboard commands. (10hrs.) |
| Professional Skill 112 Hrs; Professional Knowledge 32 Hrs | Draw a sanction plan of double storied flat roof residential building by using CAD. (Mapped NOS: CON/N1302) | Building Drawing (Residential)<br>Prepare:-<br>102. Plan, section and elevation of buildings with specifications for the given line drawing to suitable Scale. (32hrs)<br>103. A House single storeyed residential building with single bed room and attached bathroom with R.C.C. flat roof slab. (18hrs) | Building Planning:-<br>• Economy & orientation.<br>• Provision for lighting and ventilation.<br>• Provision for drainage and sanitation.<br>• Types of building.<br>• Planning & designing of residential , public and commercial building. (16 hrs.) |

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| | | 104. A residential building with double beded rooms with R.C.C. flat roof slab. (18 hrs.)<br>105. Two roomed house with RCC slope roof with gable ends. (12 hrs.)<br>106. A House with fully tiled roof with hips and valleys. (10 hrs.)<br>107. Design and create a double storied residential building (3BHK) with Positioning layout of Furniture, Electrical appliances and plumbing / sanitary fittings. (22 hrs.) | Prefabricated Structure:-<br>• Preparation.<br>• Method of construction, assembling.<br>• Advantages & disadvantages.(16 hrs.) |
| Professional Skill 28Hrs; Professional Knowledge 08Hrs | Create objects on 3D modeling concept in CAD. (Mapped NOS: IES /N9424) | 3D modeling in CAD :- (28hrs)<br>108. Create and use model space viewports. (04hrs)<br>109. Create a standard engineering layout. (04hrs)<br>110. Create and edit wireframe model. (04hrs)<br>111. Create and edit solid mesh and surface modeling. (04hrs)<br>112. Create and edit simple 2D regions and 3D solid models. (04hrs)<br>113. Generate 3D text and dimensions using a variety of 3D display techniques. (04hrs)<br>114. Render a 3D model with a variety of lights and materials. (04hrs) | 3D modeling concept in CAD<br>• 3D coordinate systems to aid in the construction of 3D objects<br>• Knowledge of shortcut keyboard commands. (08 hrs.) |
| Professional Skill 56Hrs; Professional Knowledge 16Hrs | Prepare a drawing of public building detailing with roof and coloumns by frame structures using CAD. (Mapped NOS: CON/N1302) | Building Drawing (Public)<br>Prepare:-<br>115. A Primary health center for rural area with R.C.C roof. (10 hrs.)<br>116. A Village Library building with R.C.C flat roof. (12 hrs.)<br>117. A small Restaurant building with R.C.C flat roof. (06 hrs.)<br>118. A Single storeyed School building with R.C.C flat roof. (10 hrs.)<br>119. A Small workshop with north light steel roof truss (6 to 10m Span) over R.C.C. Columns. (12 hrs.)<br>120. Service plans. (06hrs) | • Parks &play ground-Types of recreation, landscaping. etc<br>• Concepts of design of earthquake resisting buildings- requirements resistance , safety, flexible building elements, special requirements, base isolation techniques. (16 hrs.) |

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| Professional Skill 28Hrs; Professional Knowledge 08Hrs | Prepare detailed drawing of RCC structures using CAD and prepare bar bending schedule. (Mapped NOS: IES / N9425) | Drawing details of RCC members with reinforcement:-<br>121. Rectangular beams(Single reinforced &Double reinforced). (10hrs)<br>122. Lintel, chajjas&slabs.(10hrs)<br>123. Stair - details of step. (08hrs) | Reinforced cement concrete structure:-<br>• Introduction to RCC uses.<br>• Materials - proportions<br>• Form work<br>• Bar bending details as per IS Code.<br>• Reinforced brick work. (8 hrs.) |
| Professional Skill 56Hrs; Professional Knowledge 18Hrs | Prepare detailed drawing of RCC structures using CAD and prepare bar bending schedule. (Mapped NOS: IES / N9425)<br>Draw the details of a framed structure and portal frame of a residential building using CAD. (Mapped NOS: IES /N9426) | Draw Reinforced details of RCC members:-<br>124. Preparing bar-bending schedule. (08hrs)<br>125. Details of one-way slab & two-way slab. (18 hrs)<br>126. T-beam, Inverted beam, cantilever, retaining wall, Lift well. (08 hrs)<br>127. Column with footing. (07hrs)<br>128. Continuous columns showing disposition of reinforcement. (08hrs)<br>129. RCC framed structure, portal frame, B.I.S. Code 456-2000, SP - 34 and its application. (07hrs) | Materials used for RCC:-<br>• Construction.<br>• Selection of materials ¡V coarse aggregate, fine aggregate, cement water and reinforcement.<br>• Characteristics.<br>• Method of mixing concrete ¡V machine mixing and hand mixing.<br>• Slump test.<br>• Structure ¡V columns, beams, slabs - one-way slab & two-way slab.<br>• Innovative construction.<br>• Safety against earthquake.<br>• Grade of cement, steel-behaviour and test.<br>• Bar-bending schedule.<br>• Retaining wall.<br>• R.C.C. Framed structure. (18 hrs.) |
| Professional Skill 56Hrs; Professional Knowledge 16Hrs | Draw the different types of steel sections, rivets and bolts using CAD. (Mapped NOS: CON/ N1302) Draw the details of girders, roof trusses and steel stanchions using CAD. (Mapped NOS: CON/N1302) | Drawing of different types of:-<br>130. Steel sections, rivet,bolts,etc. (16 hrs)<br>131. Section and elevation of girders. (12hrs)<br>132. Structural Joints. (12hrs)<br>133. Plate girders roof trusses, stanchion etc. (16hrs) | Steel structures:-<br>• Conmen forms of steel sections.<br>• Structural fasteners , Joints.<br>• Tension & compression member.<br>• Classification, fabrication.<br>• Construction details.(16 hrs.) |
| Professional Skill 56Hrs; Professional Knowledge 24Hrs | Prepare the detailed drawing showing the different types of sanitary fittings, arrangements of manholes, details of septic tank using CAD. (Mapped NOS: IES / N9427) Draw the details flow diagram of water treatment plant (WTP) and Swerage Treatment plant (STP). (Mapped NOS: IES /N9428) | Public Health & Sanitation.<br>134. Drawings of showing various pipe joints for underground drainage. (9hrs)<br>135. Types of sanitary fittings in multi-storeyed building. (9hrs)<br>136. Manholes and septic tank. (9hrs)<br>137. Water supply system. (6hrs)<br>138. R.C.C square overhead tank supported by four columns. (9hrs) | |

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| | | 139.Preparation of service plan(drainage plan)for isolated building & in sewer system. (6 hrs)<br>140. Drawings of toilet fixtures. (04hrs)<br>141. Flow diagram of water treatment plant (WTP) and Swerage Treatment plant (STP). (04hrs) | House drainage of building:-<br>• Introduction.<br>• Terms used in PHE.<br>• Systems of sanitation.<br>• System of house drainage.<br>• Plumbing, sanitary fittings, etc.<br>• Types of sewer appurtenance.<br>• Systems of plumbing.<br>• Manholes & Septic tank.<br>• Water treatment plant<br>• Swerage treatment plant (24 hrs.) |
| Professional Skill 56Hrs; Professional Knowledge 16Hrs | Draw the cross sectional view of different types of roads showing component parts using CAD. (Mapped NOS: IES / N9429) | Roads:-<br>142. Draw showing road structure and component parts. (18hrs)<br>143. Prepare a drawing of Cross-sections showing the different types of roads-accordingto location materials. (20hrs)<br>144. Prepare a drawing of road curves & gradient. (18hrs) | Roads:-<br>• Introduction.<br>• History of highway development.<br>• General principles of alignment.<br>• Classification and construction of different types of roads,<br>• Component parts.<br>• Road curves, gradient.<br>• Curves-types, designation of curves.<br>• Setting out simple curve by successive bisection from long chords.<br>• Simple curve by offsets from long chords.<br>• Road drainage system.(16 hrs.) |
| Professional Skill 56Hrs; Professional Knowledge 16Hrs | Draw the details of different types of culverts using CAD. (Mapped NOS: IES /N9430) Prepare detailed drawing a bridge using CAD. (Mapped NOS: IES / N9431) | Bridge &Culvert :-<br>Prepare drawing of -<br>145. Different types of culvert. (10hrs)<br>146. Preparing drawing of an arched bridge. (10 hrs)<br>Draw plan and sectional views of the following:-<br>147. R.C.C Slab Culvert with splayed wing walls. (12hrs)<br>148. Steel Foot over bridge across a highway. (12hrs)<br>149. Two span Tee Beam Bridge with square returns. (12hrs) | Bridges &Culvert:-<br>• Introduction to bridges.<br>• Component parts of bridge.<br>• Classification of culverts.<br>• IRC loading.<br>• Selection of type and location.<br>• Factors governing the ideal site.<br>• Alignment of bridge.<br>• Foundation -selection-caisson.<br>• Coffer dam- types.<br>• Types of super structure.<br>• Substructure-piers,abutments, wing walls.<br>• Classification of bridge.<br>• Tunnels- rules used for the sizes of different members.(16 hrs.) |

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|---|---|---|---|
| Professional Skill 56Hrs; Professional Knowledge 16Hrs | Draw the typical cross section of rail sections, railway tracks in cutting and embankment using CAD. (Mapped NOS: IES /N9432) | Railway:-<br>150. Draw typical cross section of rail track. (06hrs)<br>151. Draw Railway tracks – embankment layout plans of railway platform. (22 hrs)<br>152. Draw typical cross-section of railway tracks cutting & embankment (single lane & double lane). (22hrs)<br>153. Draw layout of signalling points & croossing.(6hrs) | Railways :-<br>• Permanent way<br>• Rail gauges, Functions, Requirements, Types, Sections, Length of rail.<br>• Welding of rail, wear of rail.<br>• Coning of wheels, hogged rail, bending of rail, creep of rail.<br>• Causes and prevention of creep.<br>• Sleeper and ballast-function, types, requirement, materials, rail.<br>• Fixtures, Fastenings and plate laying in rail.<br>• Joints-types, fish plate, fish bolt-spikes, chairs and keys-bearing plate, block elastic, base plate.<br>• Anchors and anti-creepers.<br>• Construction of permanent ways.<br>• Railway station and yard.(16 hrs.) |
| Professional Skill 56Hrs; Professional Knowledge 16Hrs | Prepare detailed drawing of typical cross sections of Dam, barrages, weir and Cross drainage works using CAD. (Mapped NOS: IES /N9433) Draw the schematic diagram of different structures of Hydro electric project using CAD. (Mapped NOS: IES /N9434) | 154. Dams, barrages, weir etc. (9hrs)<br>155. Longitudinal section of distributaries with the help of given sketch & data. (9hrs)<br>156. Head regulators. (8hrs)<br>157. Types of cross drainage work. (9 hrs.)<br>158. Hydro electric project. (9hrs)<br>Drawing of canal<br>159. Alignment including ongitudinal and cross sections of canals with the given data. (12 hrs) | Irrigation Engineering:-<br>• Terms used in irrigation.<br>• Hydrology like duty, delta, base period, intensity of irrigation.<br>• Hydrograph, peak flow, run off, catchment area, CCA, corps like, rabi, kharifetc.<br>• Storage, diversion head work - characteristics and types.<br>• Reservoir ¡Vtypes of reservoirs, i.e., single purpose and multi-purpose, area, capacity and curves of reservoir.<br>• Dams, weir & barrages- types purposes.<br>• Hydro electric project like Forebay, Penstock, Turbines, Power house, etc.<br>• Canals- classification and distribution system, canal structures.<br>• Types of cross drainage works like Aquaduct, Super passage, Syphon, Level crossing, inlet and outlet, etc.(16 hrs.) |
| Professional Skill 84Hrs; Professional Knowledge 32Hrs | Prepare detailed estimate and cost analysis of different types of building and other structures using application software. (Mapped NOS: IES / N9435) Prepare rate analysis of different items of work. (Mapped NOS: IES /N9436) Problems on preparing preliminary/ Approximate estimates for building project. (Mapped NOS: IES / N9437) | Estimating and Costing:-<br>(visualizing the plotted drawing)<br>160. Prepare detailed Estimate :- Calculate quantities of items of single storied and double storied building. (12 hrs.)<br>161. Prepare abstract of estimate by prevailing rates. (10 hrs.)<br>162. Prepare rate analysis of major items - RCC, PCC, Wood works, Stone & Brick masonry & Plastering. (16hrs) | |

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|---|---|---|---|
| | | 163. Solve problems on preparation ofpreliminary / approximate estimates for building projects by Excel worksheet as per Govt. schedule. (16hrs)<br>164. Familiarisationwith and making estimation with software. (18 hrs)<br>165. Estimate earthwork of irregular boundaries. (12 hrs)<br>Total Station:-<br>166. Application of survey using TS. (06hrs) | Estimating and Costing :-<br>• Introduction.<br>• Purpose and common techniques.<br>• Drawing of construction.<br>• Measurement techniques.<br>• Estimate-necessity, importance, types-approximate and detailed estimate-main and sub estimates, revised, supplementary, maintenance / repair estimate-taking off quantities- method<br>• Rate analysis of typical items and their specifications.<br>• Labour and materials.<br>• Govt. Schedule of rate.<br>• Estimating of irregular boundaries by trapezoidal and Simpsons formula.(32 hrs.)<br>Total Station:- ¡V |
| Professional Skill 56Hrs; Professional Knowledge 16Hrs | Prepare a map using Total station. (Mapped NOS: IES /N9438) | 167. Field procedure for co-ordinate measurement. (06hrs)<br>168. Field procedure to run open traverse and closed traverse. (04hrs)<br>169. Transfer or establish Bench Mark. (03hrs)<br>170. Perform stakeout / demarcation of building layout /plot layout/ roads/ alignment. (08 hrs.)<br>171. Measure remote distance and elevation. (10 hrs)<br>172. Calculate surface area on field/ site. (03hrs)<br>173. Calculate volume of field/site. (03hrs)<br>174. Procedure for down load and up load data. (06 hrs)<br>175. Simple survey map using Auto CAD. (07hrs) | • Introduction.<br>• Components parts, accessories used.<br>• characteristics, features.<br>• advantages and disadvantages.<br>• principle of EMD.<br>• Working and need.<br>• Setting and measurement.<br>• Electronic, display & Data reading.<br>• Rectangular and polar co-ordinate system.<br>• Terminology of open and closed traverse.<br>(16 hrs.) |
| Professional Skill 28Hrs; Professional Knowledge 08Hrs | Locate the station point using GPS and obtain a set of co-ordinates. (Mapped NOS: IES / N9439) | GPS Awareness:-<br>176. Practical application of GPSComponents of GPS data processing.GPS signal. 9hrs<br>177. Code and biasesTechniques of GPS observing. 4hrs<br>178. Set up and use GPS equipment. – (9 hrs)<br>179. Compare with GPS, GIS,GNSS& CAD. (06hrs) | GPS (Global Positioning System):-<br>• Introduction of GPS system.<br>• Co- ordinate and time system.<br>• Satellite and conversional geodetic system.<br>• GPS. Signal, code, and biases<br>• Role of TRANSIT in GPS development.<br>• GPS segment organisation.<br>• GPS survey methods. Basic geodetic co-ordinate.<br>• Ground support equipment, signals.<br>• Tracking devises& system.<br>• Time measurement and GPS timing. 8hrs |

# Single storied residential building with attached bath (flat roof)

**Objectives:** At the end of this exercise you shall be able to
- **identify the thickness of wall**
- **draw the plan of building**
- **draw the section of the building**
- **draw the elevation of residence.**

## PROCEDURE

TASK 1 : **Draw the plan of the building, section on AA and front elevation of the residence (Fig 1)**

1 Select a scale of 1:50
2 Layout the drawing sheet for plan, section and Elevation.
3 Prepare the plan starting from the corner of Living room.
4 Draw wall thickness as per the scale.
5 Create the rooms as per the Figure.
6 Erase the unnecessary construction lines.
7 Mark the position of door, windows etc.
8 Furnish the dimensions and notes where ever needed.
9 Complete the plan.

— — — — — — — —

TASK 2 : **Draw the section (Fig 2)**

1 Draw a horizontal lines shows the ground level
2 Identify the position of cutting plane
3 Create projection lines for walls. as per the room size.
4 Draw the basement line, roof line, parapet- line etc.
5 Furnish the foundation details as shown.
6 Hatch the section as per the materials used.
7 Furnish the dimensions.
8 Complete the section.

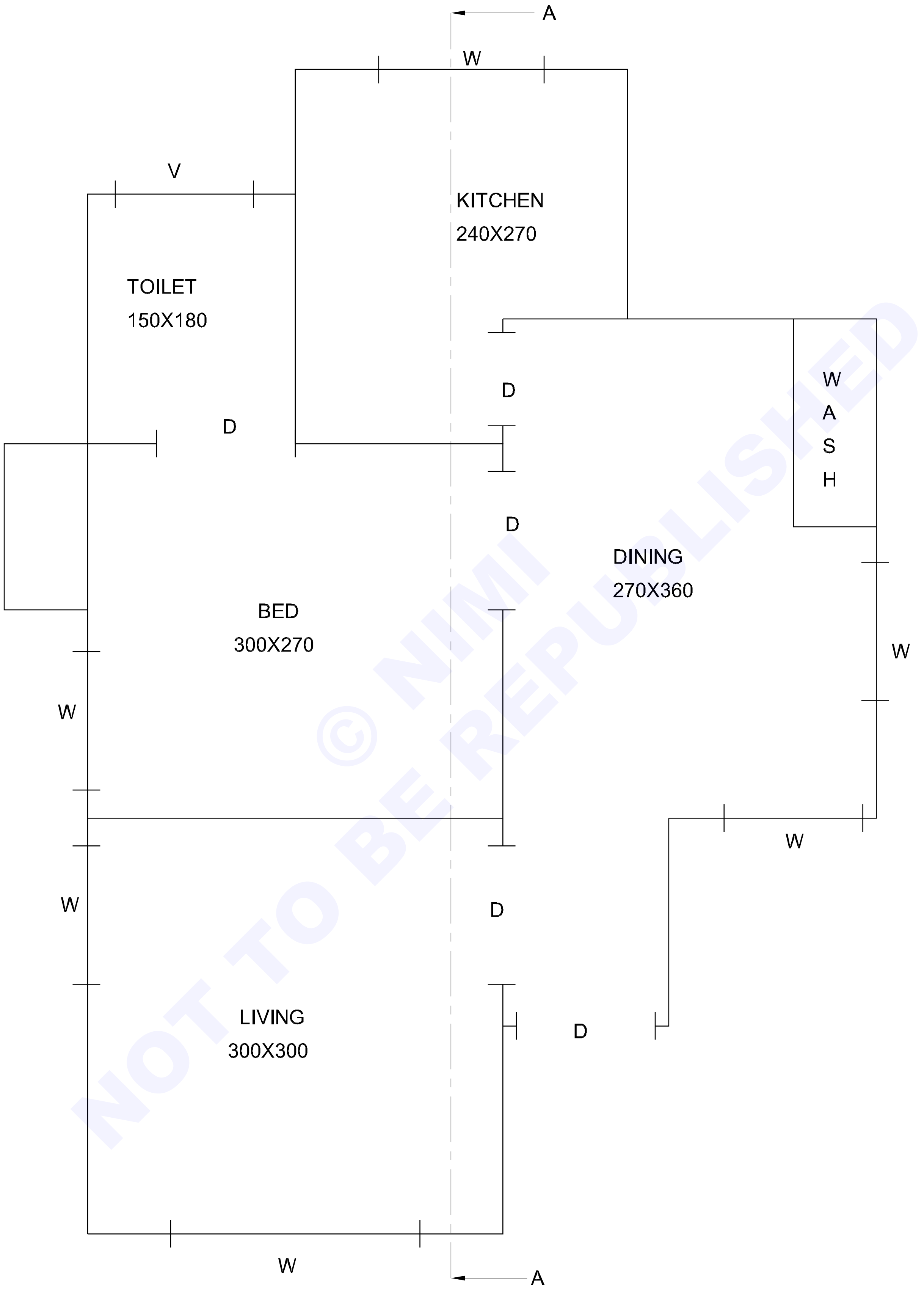
— — — — — — — —

TASK 3 : **Draw the elevation**

1 Draw projection lines from plan and section.
2 Remove the unwanted projection lines and develop the elevation.
3 Furnish the door, window, sunshade details etc.
4 Finish the required elevation by outlines.
5 Complete the working drawing with specification schedule of joinery and other details

— — — — — — — —

Fig 1

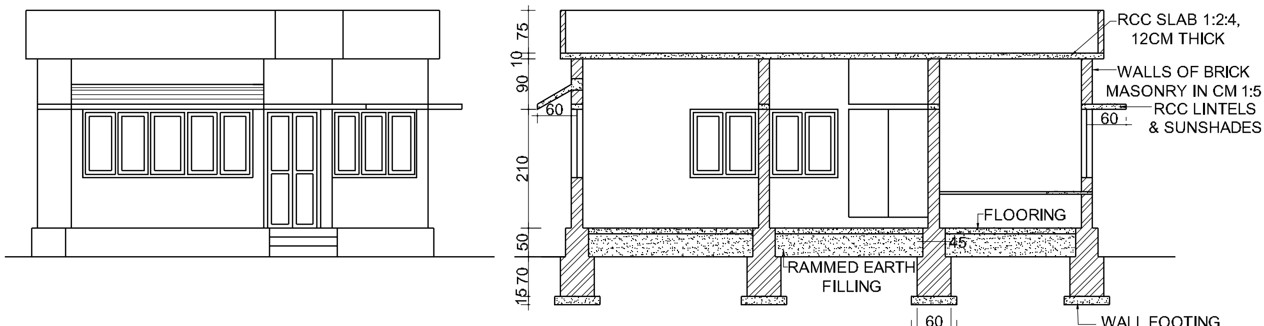





**LINE DIAGRAM FOR A RESIDENCE**

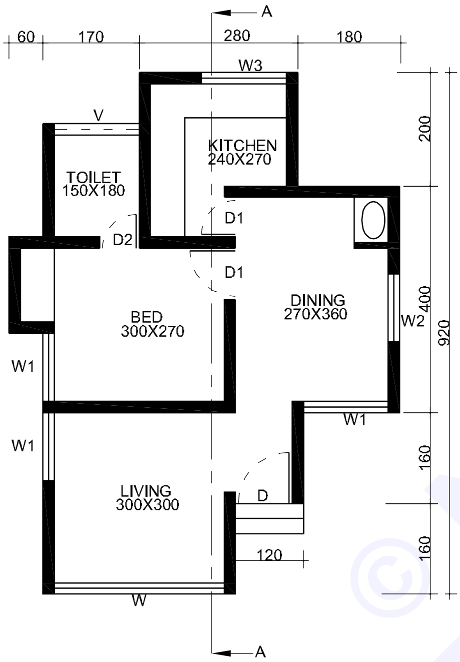
DC20N2191H1

Fig 2




ELEVATION

SECTION ON AA




PLAN

SCHEDULE OF JOINERY

| MARK | ITEM | SIZE | TYPE | NOS. |
|---|---|---|---|---|
| D | DOOR | 110X210 | PANELLED | 1 |
| D1 | DOOR | 100X200 | PANELLED | 2 |
| D2 | DOOR | 90X200 | PANELLED | 1 |
| W1 | WINDOW | 300X150 | GLAZED | 1 |
| W2 | WINDOW | 120X150 | GLAZED | 1 |
| W3 | WINDOW | 150X120 | GLAZED | 1 |
| V | VENTILATOR | 150X60 | GLAZED | 1 |

SPECIFICATIONS

1) FOUNDATION:-
2) WALLS:-
3) LINTELS:-
4) ROOF SLAB:-
5) PLASTERING:-
6) FLOORING:-
7) PAINTING:-

Note:- Provide Foundation according to the condition of soil

PLAN AND SECTION OF A BUILDING

DC20N2191H2



## Single storied residential building with attached bath (pitched roof)

**Objectives :** At the end of this exercise you shall be able to
- **draw the plan, section and elevation of single storied residential building with attached bath**
- **prepare the working drawing of a building with pitched roof.**

## PROCEDURE

TASK 1 : **Prepare the working of a single bed room residence with pitched roof**

1 Draw the plan. (Fig 1a)

2 Draw the rooms as per sizes given in the plan, with a wall thickness of 300mm for walls and 100mm for partition walls.

3 Draw th-e plinth line and the pillar.

4 Provide doors, windows, ventilators, and steps.

5 Draw the roof line (pitched roof) in dashed lines as shown in (Fig 1a)

6 Dimension the plan.

7 Draw the section “AA”. (Fig 1b)

8 Draw the foundation basement and flooring as per given specification.

9 Above that draw the outer wall first. Draw the section of next wall (height 3600mm) 2500mm from that wall.

10 Draw the section of other walls, doors and steps as per Figure.

11 Draw the roof in 30°. Draw the wall plates on the wall.

12 Draw the common rafters battens and ridge piece.

13 Draw the side view of roof by drawing lines closely at top and spacely at bottom.

14 Draw the proper symbols.

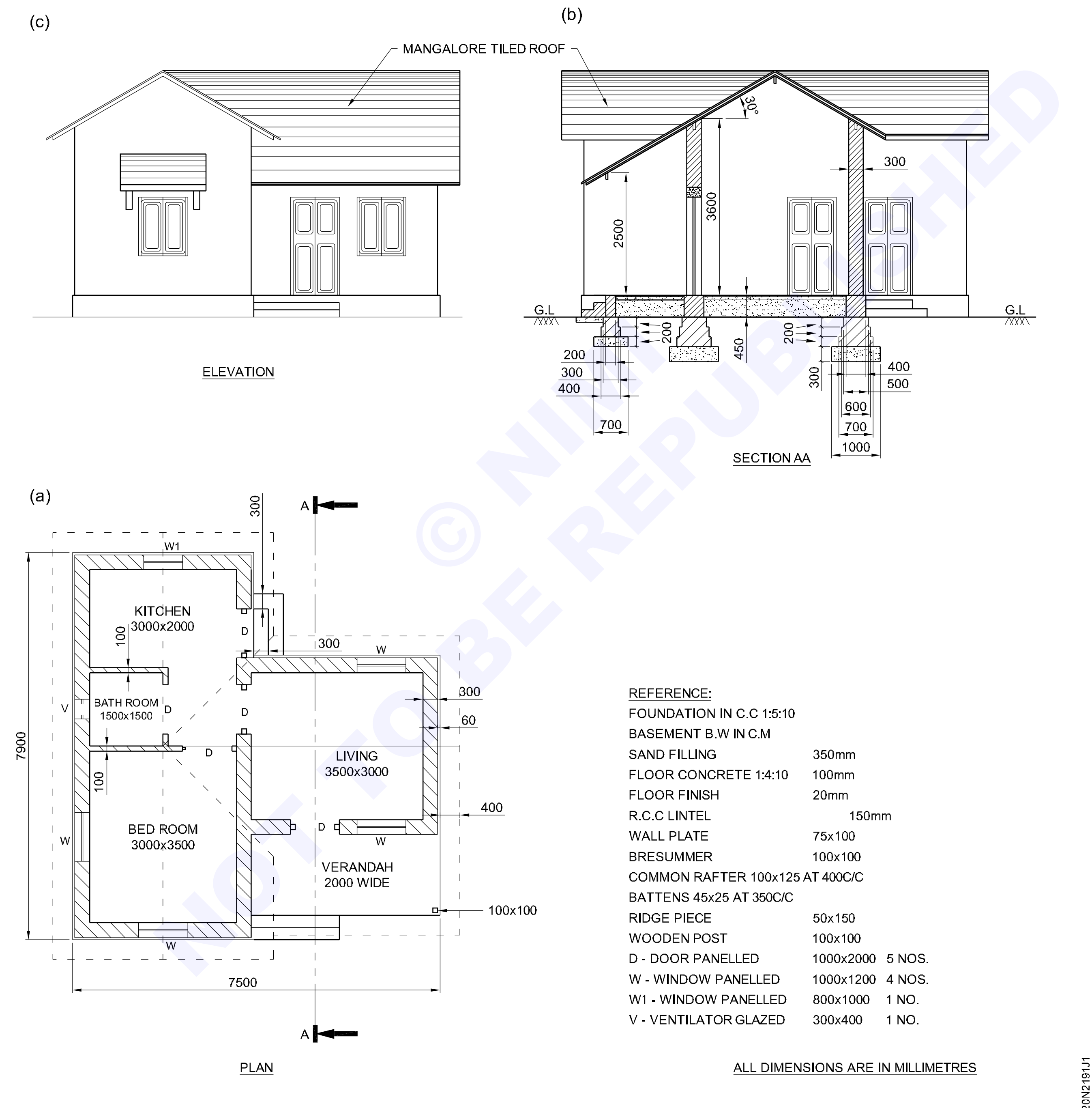
15 Dimension the section fully.

16 Print the specifications.

**Draw elevation (Fig 1c)**

1 Project plan and section and develop the elevation as shown in Fig 1c.

Fig 1




A MANGALORE TILED RESIDENCE

# Making plan, Elevation and section with aid of line diagrams of the building

**Objectives :** At the end of this exercise you shall be able to
- **identify the size of rooms wall thickness**
- **identify the number and positions of wall opening**
- **draw the line diagram of the residential building.**

## PROCEDURE

TASK 1 : **Prepare the given line sketch of the pitched roof residence in a scale of 1:50 (Fig 1)**

1 Select a scale of 1:50.

2 Draw a right angled corner indicating the verandah.

3 Draw parallel and perpendicular lines as per the room arrangements, size of room etc.

4 By using outlines finish the positions of rooms.

5 Erase the unwanted construction lines, if any.

6 Furnish the details of rooms, positions of door, windows etc.

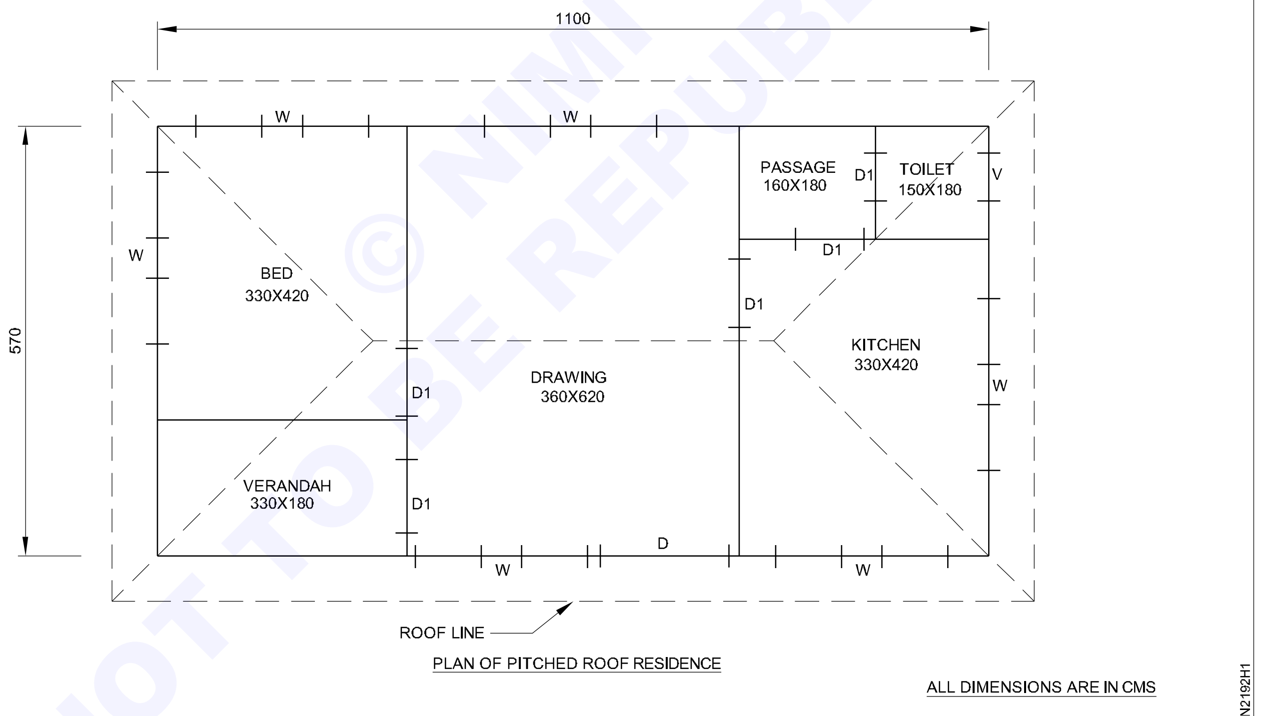
7 Draw the roof lines in dashed lines as shown.

8 Dimension the figure as per the datas given.

9 Specify the scale and related notes.

10 Complete the required line sketch.

Fig 1




BUILDING DRAWING

## Layout and detailing of residential building

**Objectives :** At the end of this exercise you shall be able to
- **identify the various interior and exterior furnishings details of a residence**
- **practice the template for apt interior furnishings**
- **draw the layout and detailing a building.**

PROCEDURE

TASK 1 : **Prepare the given sketch using templates (Fig 1)**

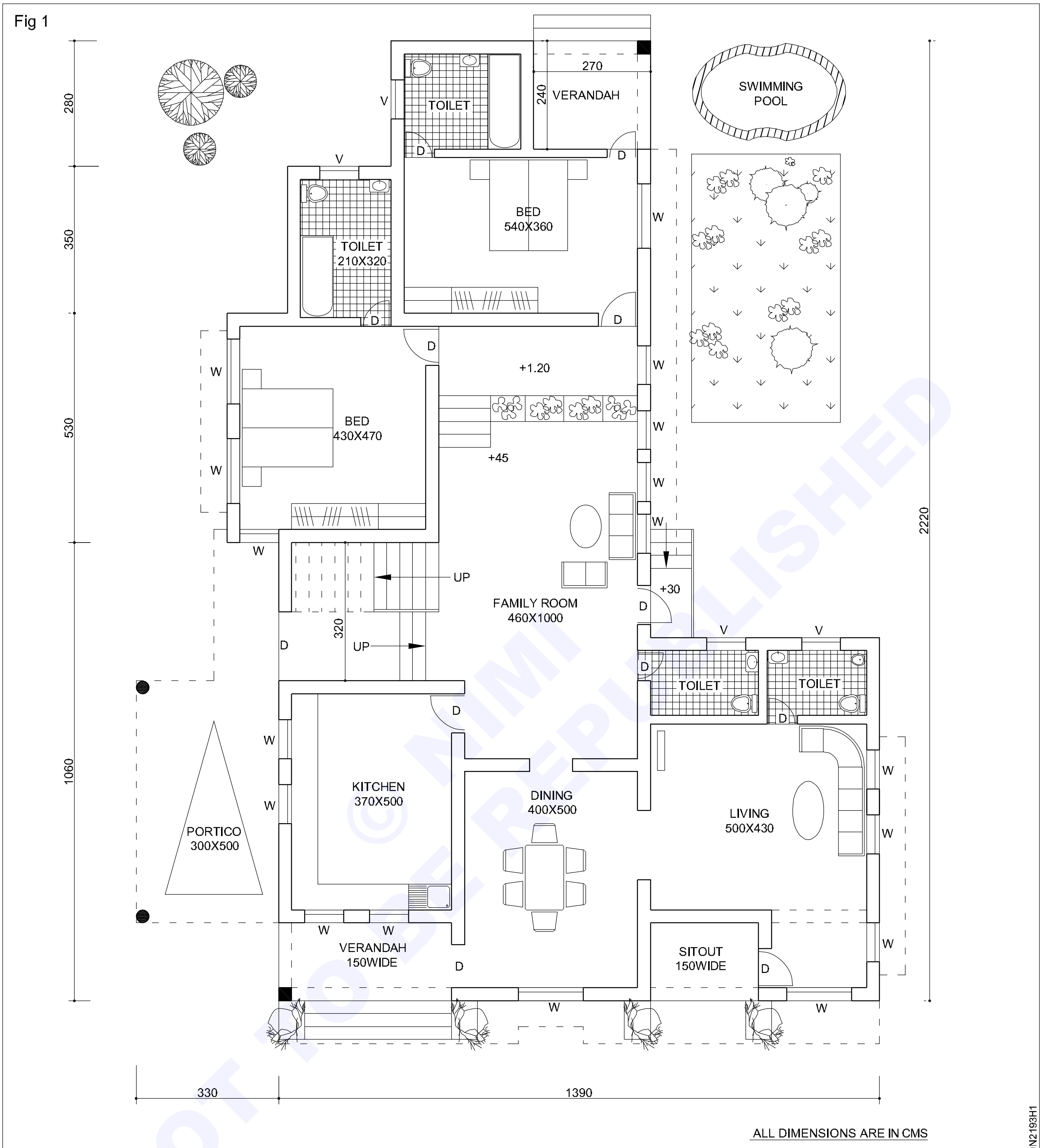
1 Draw the plan to a scale of 1:50.

2 Select the template and create the furniture.

3 Furnish the surrounding details as shown, for lawn. swimming pool, garden etc.

4 Complete the drawing.

Fig 1




**LAYOUT AND DETAILING A RESIDENCE**

## Create a drawing of building showing set back

**Objectives :** At the end of this excercise you shall be
- **draw a plan of able to single bed room residential building**
- **draw a set back layout of the building.**

PROCEDURE

TASK 1 : **Draw a plan of single bed room residential building**

**DATA**

- Bed Room = 3.73m × 3.63m
- Living Room = 3.6m x 5.36m
- Verandah = 3.83m x 2.27m
- Kitchen = 3.6m x 2.7m
- Bath = 2.3m x 1.5m
- WC = 1.2m x 1.5m

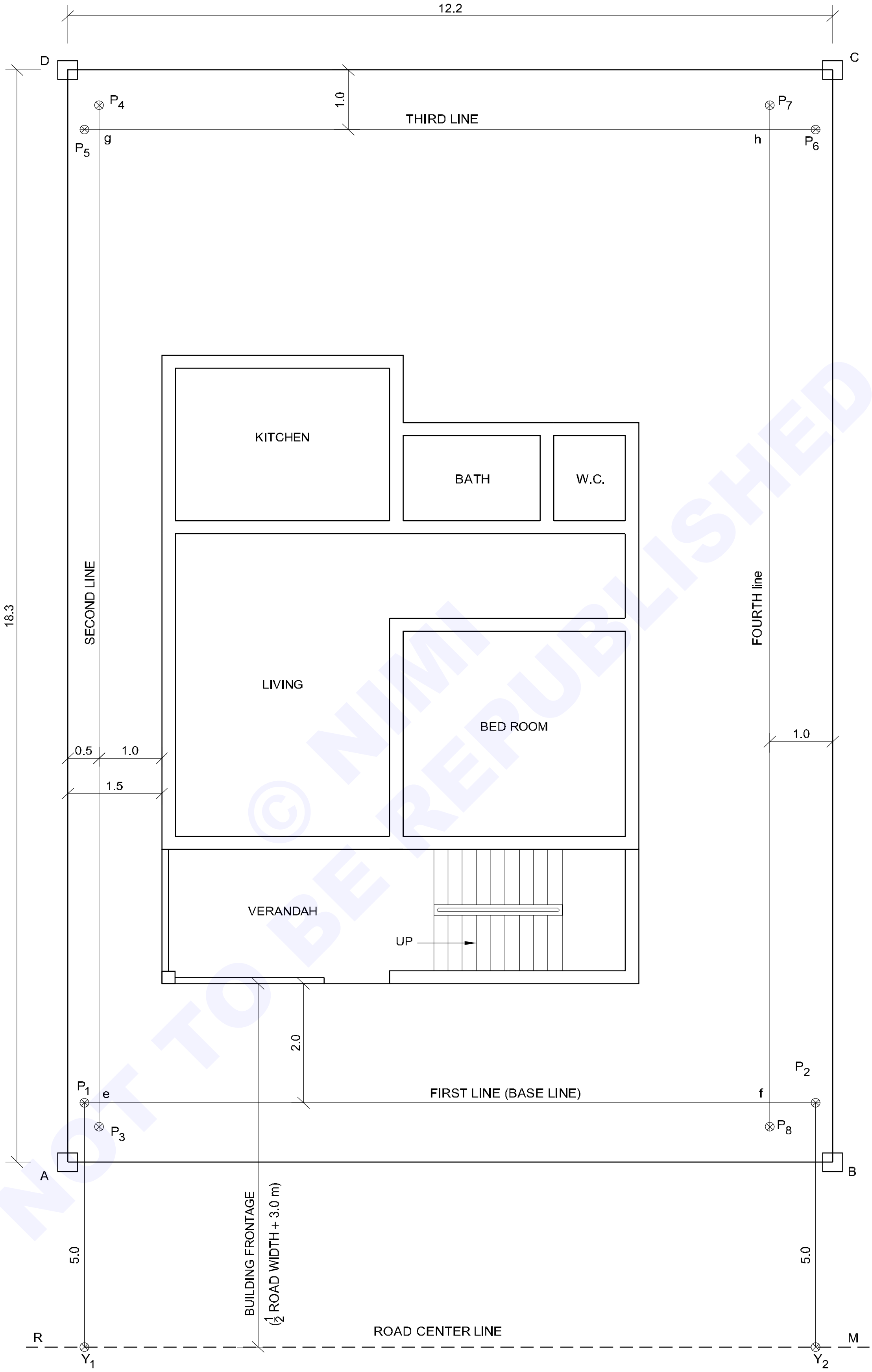
— — — — — — — —

TASK 2 : **Draw a setback layout of the building (Fig 1)**

**DATA**

- Size of plot : 18.3m x 12.2m
- Building frontage : 1/2 Road width + 3m.
- Frontage (minimum 3m).
- Set Back (minimum 1 1/2 m).
- Left side back 1 1/2 m.
- Draw and complete set back layout.

Fig 1




NOTE:
1. WIDTH OF ROAD INCLUDING WIDENING = 8.0 m
2. ALL DIMENSUINS ARE IN METRE

**SET BACK LAYOUT**

## Showing layout plan and key plan

**Objective :** At the end of this exercise you shall be able to
- **preparing a key plan to your I.T.I from the nearest railway station/bus terminal.**

PROCEDURE

TASK 1 : **Draw a plan of single bed room residential building (Fig 1)**

1 Prepare a key plan to your I.T.I to display at the entrance.

2 The key plan should be prepared from the nearest railway station.

3 Bus terminal to your I.T.I Campus.

4 Indicate the details of the surrounding of your I.T.I.

5 To draw the key plan for you I.T.I refer the key plan.

Fig 1




— — — — — — — —

# Function of keys and practice of base commands

**Objectives : At the end of this exercise you shall be able to**
- **identify basic computer terms**
- **start auto CAD four ways.**

## Hardware

### Microprocessor

The complex procedure that transforms raw input data into useful information for output is called “processing”. The Processor is the “brain” of the computer. The processor interprets and carries out instruction. In personal computers the processor is a single chip plugged into a circuit board. This chip is called a microprocessor.

### Central processing Unit (CPU)

The CPU is the term used for the computer’s processor unit. The CPU contains the intelligence of the machine. It is where the calculations and decisions are made.

### Memory (RAM)

Your CPU needs memory to hold pieces of information while it works. While this information in memory, the CPU access it directly. This memory is called random access memory (RAM). RAM holds information only while the power is on. When you turn off or reset the computer, the information disappears.

The more RAM a computer has, the quicker it works and the more it can do.

The most common of measurement for computer memory is the byte. A byte can be described as the amount of memory it takes to store a single character. A kilobyte(KB) equals 1,024 bytes. A Megabyte (MB) equals 1,024 kilobytes, or 1,048,576 bytes. So a computer with 64 MB of memory actually has (64 $\times$ 1,048,576) 67,108,864 bytes. This is equal to approximately 1024 pages of information,

### Input/output devices

Input devices accept date and instructions from the user. The most common input devices are the keyboard, mouse and scanner. Output devices return processed data back to the user. The most common output devices are the monitor, printer, speaker and plotter.

### Storage

The purposes of storage is to hold data that the computer isn’t using. When you need to work with a set of data, the computer retrieves the data from storage and puts it into memory. When it no longer needs the data, it puts it back into storage. There are 2 advantages to storage. First, there is more room in storage and second, storage retains its contents when the computer is turned off, Storage devices include: Hard disks (inside your computer), per drives, zip disks, CDR//w, pocket harddiscs, etc.

## Software

### Operating systems

When you turn on the computer, it goes through several steps to prepare itself for use.

The first step is a self-test. This involves:

a Identifying the devices attached to it ( such as the monitor, mouse and printer).

b Counts the amount of memory available.

c Checks to see if the memory is functioning properly.

The second step is searching for a special program called the operating system. When the computer finds the operating system, it loads it into memory (remember RAM), The operating system enables the computer to:

a Communicate with you.

b Use devices such as the disk drives, keyboard and monitor.

The operating system is now ready to accept commands form you. The operating system continues to run until the computer is turned off. Examples of operating systems are: Windows 7,8 windows NT, ME, 2000, XP,OS/2, Unix and more.

Note: 1. Apple/Macintosh computers have their own operating system.

2 AutoCAD new version will not work with windows 98 or Apple/Macintosh.

### Application software

The operating system is basically for the computer. The application Software is for the user. Application Software is designed to do a specific task.

There are basically four major categories:

Business. Utility, Personal, and Entertainment.

Business application software would be desktop publishing, spreadsheet programs, database software and graphics, AutoCAD is a ‘graphics’ business application software.

Utility application software helps you maintain your computer. You would use a utility program to recover an accidentally deleted file, improve the efficiency of your computer and help you move, copy or delete files. Norton Utilities is an example of a ‘utility application” software.

Personal application software is basically what is sounds like. This software is designed for your personal needs, such as: balancing your checkbook, making an address book, creating a calendar and many more tasks.

Entertainment application software are video games, puzzles, flight simulators and even educational programs.

### Starting AutoCAD

To Start AutoCAD, select the START button/programs/ AutoCAD. If one of the dialog boxes shown be low does not appear automatically. Select the system take to change your settings.

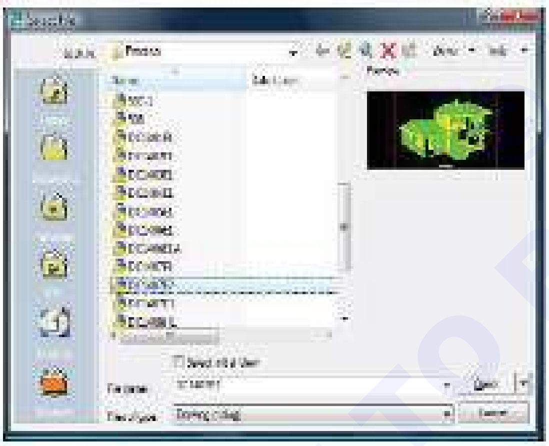
Prefer these dialog boxes for trainee new to AutoCAD. But after you become an "expert" you may disable this option.

Notice the four buttons located in the upper left corner of this dialog box. Each button provides a different way to start a drawing. A brief description of each is listed below.

### Open a drawing (Fig 1)

Allows you to select a drawing from a list of the most recently opened drawings or select the "Browse" button to search for more drawing files. After you select the file desired, select the OK button. The file selected will appear on your screen. (This option is only active when you first enter AutoCAD. Normally you will use **file/open.**

Fig 1



### Start from scratch (Fig 2)

Allows you to begin a new drawing from scratch. Starting from scratch means all settings are preset by AutoCAD.

You must select the measurement system on which to base your new drawing; Imperial or Metric.

### Use a template (Fig 3)

Allows you to choose a previously created template. You can choose one of the templates supplied with AutoCAD or create your own.

Fig 2

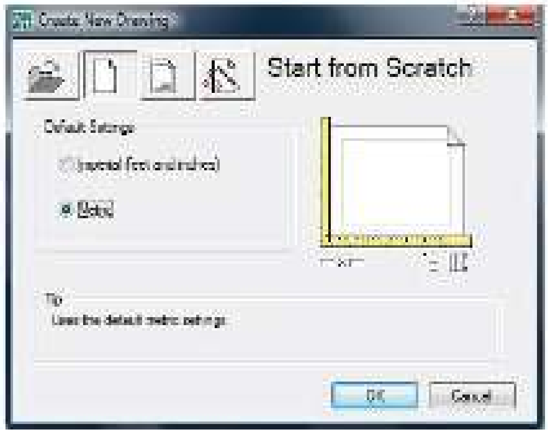
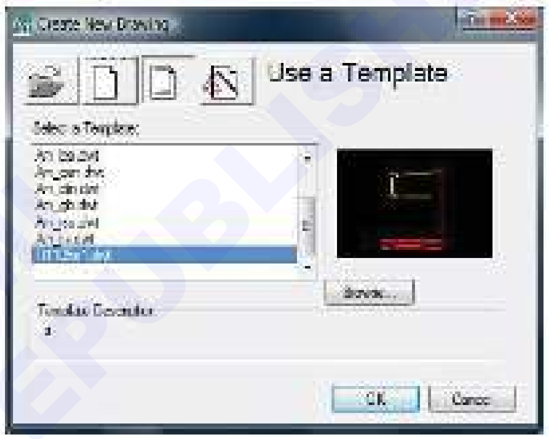



Fig 3




**We will be creating a template in exercise 6.03**

### Use of a wizard (Fig 4)

Allows you to start new drawing using either the "Quick" or "Advanced" setup wizard sets the units, angle, angle measurement, angle direction and area for your new drawing.

Fig 4

### Opening AutoCAD

For starting Auto CAD, double click the Auto CAD icon on the desk top or CAD from start menu, if startup dialog box not shown in GUI, follow the following.

**Procedure: right click on the screen (Fig 5)**

Select option.

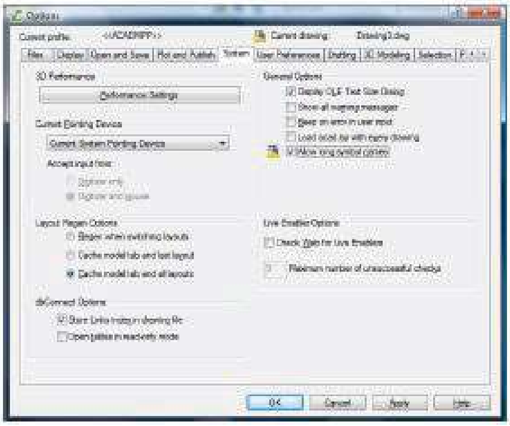
Option dialogue box.

Select system tab.

Click on the startup.

Select show startup dialogue box.

Fig 5



Startup dialogue box shown below. In the startup dialogue box, four options are available such as, open drawing, start from scratch, use a template and use a wizard. (Fig 6)

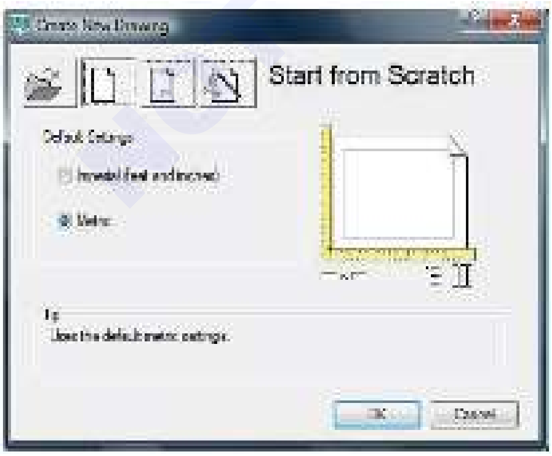
1 Opening a drawing.

2 Start from scratch.

3 Use template.

4 Use a wizard.

Fig 6




1 **Open a drawing:** To open an already saved drawings.

2 Starts an empty drawing using default imperial or metric settings. Auto CAD stores this setting in the measurement system variable. You can change measurement system for a given drawing by using the measurement system variable.

**Imperial:** Starts a new drawing based on the Imperial measurement system. The default drawing boundary (The drawing limits) is 12 x 9 inches.

**Metric:** Starts new drawing based on the metric measurement system. The default drawing boundary (the drawing limits) is 420 x 297 millimeters.

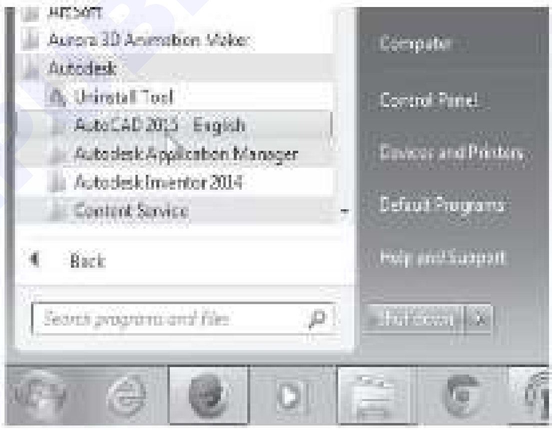
3 **Use a template:** Starts a drawing based on a drawing template file.

4 **Use a Wizard:** Sets up a drawing using a step-by-step guide. You can choose from two wizards: Quick set up and Advanced Set up.

### Starting up AutoCAD

Select AutoCAD option on the program menu or select the AutoCAD icon on the desktop. (Fig 7)

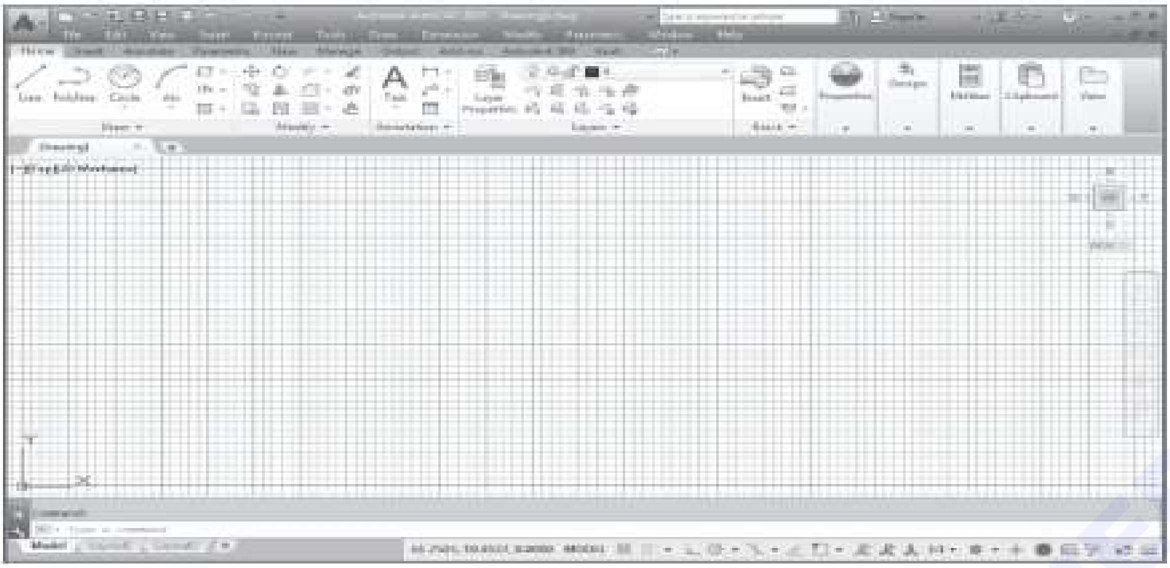
Fig 7




Once one program is loaded into memory, the AutoCAD drawing screen will appear on the screen.

Note that AutoCAD automatically assigns generic name, Drawing X, as new drawings are created. In our example, AutoCAD opened the graphics window using the default system units and assigned the drawing name Drawing 1. (Fig 8)

Fig 8



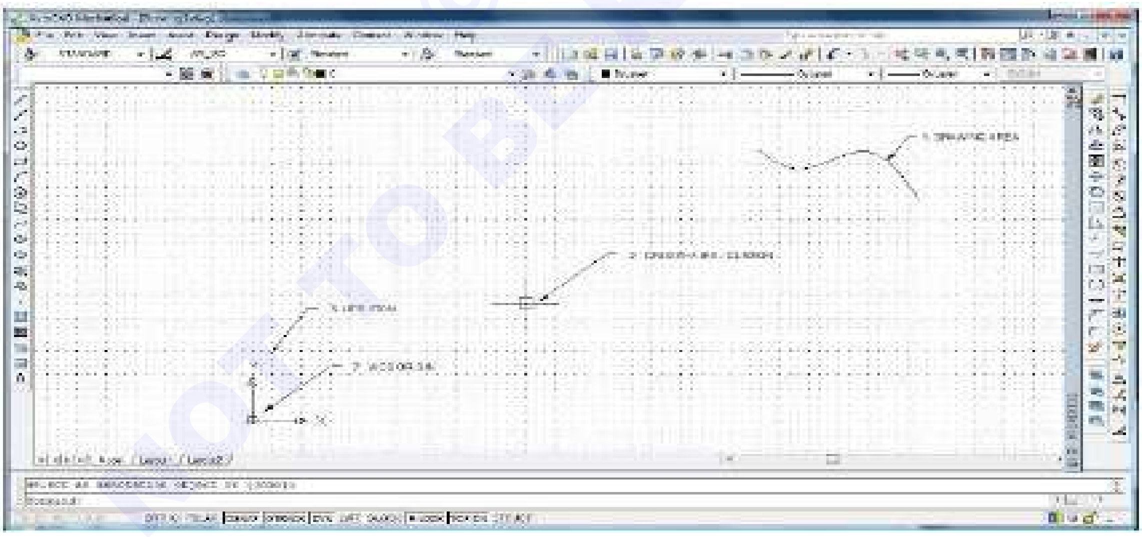
## Getting familiar with the autocad window

**Objectives : At the end of this exercise you shall be able to**
- **identify basic computer terms**
- **identify function keys**
- **start auto CAD four way.**

### Getting familiar with the autocad window

Before you can start drawing you need to get familiar with the AutoCAD window. In the following lessons, will be you referring to all of the areas described below. (Fig 1)

Fig 1



So it is important for you to understand each of them. But remember, this page will always be here for you.

**Drawing area**

Location: The large area in the center of the screen.

This is where you will draw. This area represents a piece of paper.

The color of this area can be changed using Tools/Option/ Display Color.

**2 Crosshairs/cursor**

**Location:** Can be anywhere in the drawing area. The movement of the cursor is controlled by the movement of the pointing device such as a mouse. You will use the cursor to locate points, make selections and draw objects.

The size can be changed using Tools/Options/Display. Crosshair size.

### 3 Command line

**Location:** The three lines at the bottom of the screen. This is where you enter commands and Autocad will prompt you enter commands and Autocad will prompt you to input information.

### 4 Coordinate display (F6)

**Location:** Lower left corner.

In the Absolute mode (coords = 1) displays the location of the crosshairs / cursor in reference to the origin. The first number represents the horizontal movement (X asix), the second number represents the vertical movement (Y axis) and the third number is the Z axis which is used for 3D.

In the relative polar mode (coords = 2) displays the distance and angle of the cursor from the last point entered. (Distance < Angle)

### 5 Status bar

**Location:** Below the command line.

Display your current settings. These settings can be turned on the and off by clicking on the word (snap, grid, ortho, etc.) or by pressing the function keys, F1, F2 etc. See button description below.

[ Snap ] (F9)

Increment snap controls the movement of the cursor. If it is off, the cursor will move smoothly. If it is ON, the cursor will jump in an incremental movement.

The increment spacing can be changed at any time using tools / Drafting Setting / Snap and Grid.

[ Ortho ] (F8)

When Ortho is ON, cursor movement is restricted to horizontal or vertical. When Ortho is OFF, the cursor moves freely.

[Polar ] (F10)

Polar tracking creates “Alignment paths” at specified angles.

[Osnap] (F3)

Running object snap. Specific object snaps can be set to stay active untill you turn them off.

[Otrack] (F11)

Object Snap tracking

Creates Alignment paths at precise positions using objects snap locations.

[ LWT ]

Line weight. Displays the width assigned to each object. Model.

Switches your drawing between paperspace and model space.

### 6 UCS ICON (User coordinate system) (Fig 2)

Location: Lower left corner of the screen. The UCS icon indicates the location of the Origin. The UCS icon appearance can be changed using: **View/ Display/ Icon / Properties.**

### 7 Origin

The location where the x,y, and Z axes intersect. 0,0,0

**FUNCTION KEYS**

| | | |
|---|---|---|
| F1 | Help | Explanations of commands. |
| F2 | Flipscreen | Toggles from Text Screen to Graphics Screen. |
| F3 | Osnap | Toggles Osnap On and off. |
| F4 | Tablet | Toggles the tablet On and Off. |
| F5 | Isoplane | Changes the Isoplane from Top to Right to Left. |
| F6 | Coordinate display | Changes the display from ON/Off/ |
| F7 | Grid | Toggles the Grid On or Off. |
| F8 | Ortho | Toggles Ortho On or Off. |
| F9 | Snap | Toggles Increment Snap on or off. |
| F10 | Polar | Toggles Polar Tracking On or Off. |
| F11 | Otrack | Toggles Object Snap Tracking On and Off. |

## Special key functions (Fig 3)

**Escape key** cancels the current command, menu or Dialog box.

**Enter key** ends a command, or will repeat the previous command if the command line is blank.

**Space bar** same as the enter key, except when entering text.

## Pull-down "MENU BAR" (Fig 4)

1 The pull-down "MENU BAR" is located at the top of the screen.

file edit view insert format tools draw dimension modify express window help.

by selecting any of the words in the **menu bar**, a **(2) pull down menu** appears. If you select a word from the pull down menu that has an **(3) arrow** a **(4) sub menu** if you select a word with **(5) ellipsis**.... a dialog box will appear.

(Example: draw/boundary....)

## Dialog box

Many commands have **multiple options** and require you to make selections. These commands will display a dialog box. Dialog boxes, such as the **hatch** dialog box shown here, make selecting and setting options easy.

## Tool bars

AutoCAD provides several toolbars to access frequently used commands.

The **standard, object properties, draw, and modify** toolbars are displayed by default.

Toolbars contain **icon buttons**

These icon buttons can be selected to draw or edit objects and manage files.

If you place the pointer on any icon and wait a second, a **tool tip** will appear and a **help message** will appear at the bottom of the screen.

Fig 2

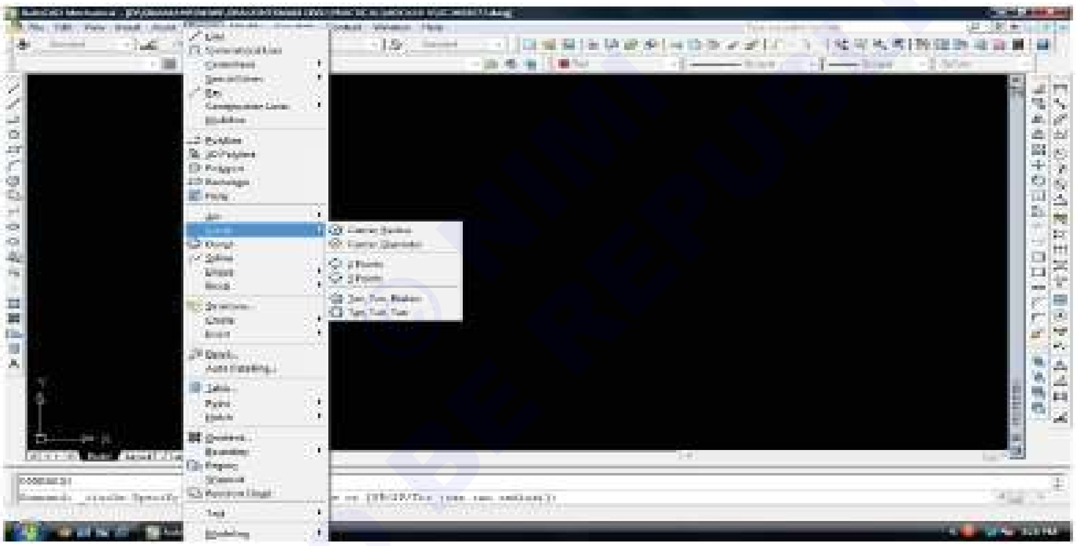
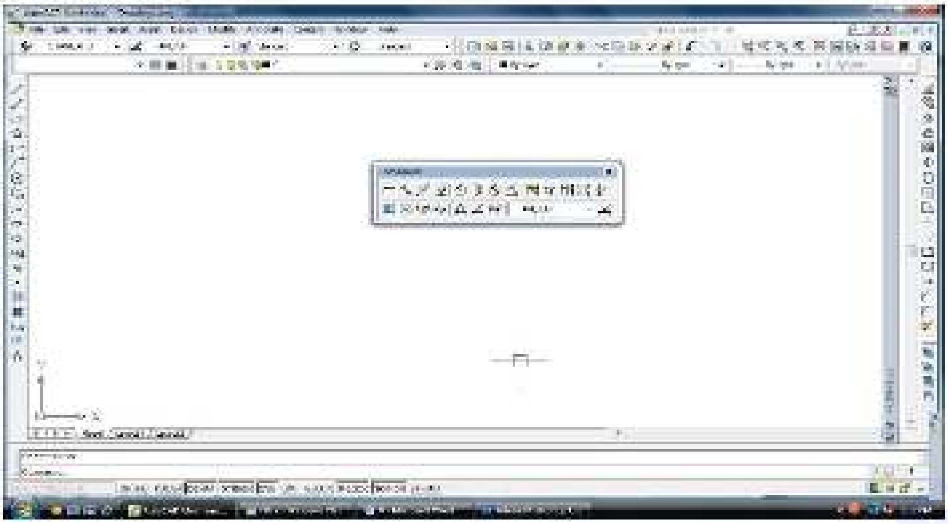


Fig 3

Fig 4



# Use of Elementary commands, by CAD tool bar

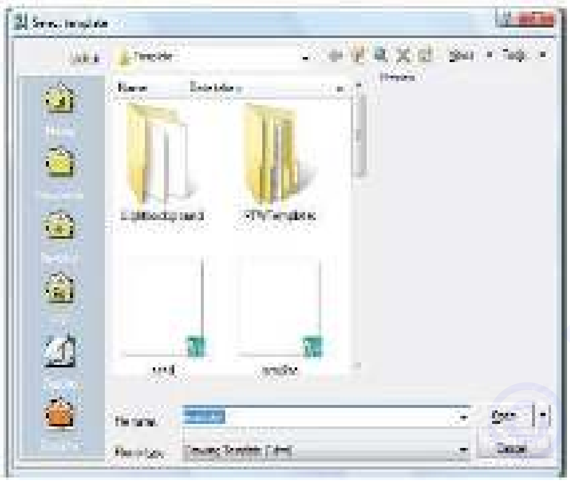
**Objectives :** At the end of this exercise you shall be able to
- **starting a new drawing**
- **opening a template**
- **create a template.**

**Starting a new drawing (Fig 1)**

Pulldown menu: file, new.

When you invoke this command Autocad displays the select template dialogue box.(If you selected "show startup dialogue box' from option dialogue box you cannot see the following dialogue box. Instead of this you can see the start up dialogue box itself)

Fig 1



**Opening a template (Fig 2&3)**

The template that you create by using F 8. It will appear as a blank screen, but there are many variables that have been preset. This will allow you to start drawing immediately. You will learn how to set those variables before you complete this workbook, but for now will concentrate on learning the AutoCAD commands and hopefully, have some fun.

Let's start by opening the "1 Workbook"

Fig 2

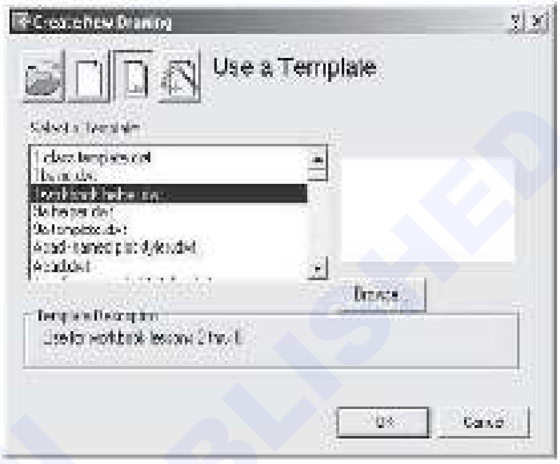

1 Select file/new

2 Select use a template box (third from the left).

3 Select 1 workbook helper. dwt from the list of templates.

4 Select the ok button.(Fig 3)

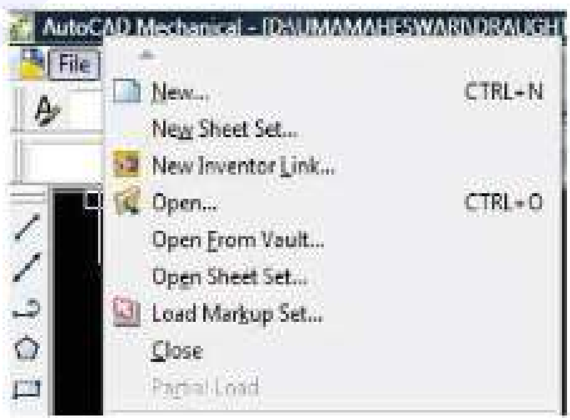
Fig 3




**Create a template.**

**Now you can create a template. This will be a very easy task. (Fig 4)**

Fig 4




1 Start AutoCAD as follows. (Fig 5,6 & 7)

Start button/programs/AutoCAD.

> **The 3 letter extension for drawing file is drawing If a dialog box appears select the "Cancel" Button.**

2 Select **file/open.**

3 Select the **directory** in which the files located.(click on the)

Fig 5

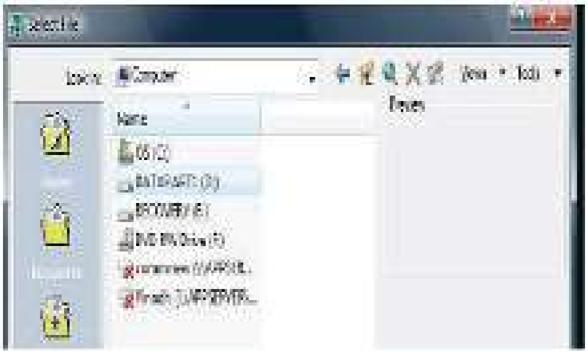


Fig 6

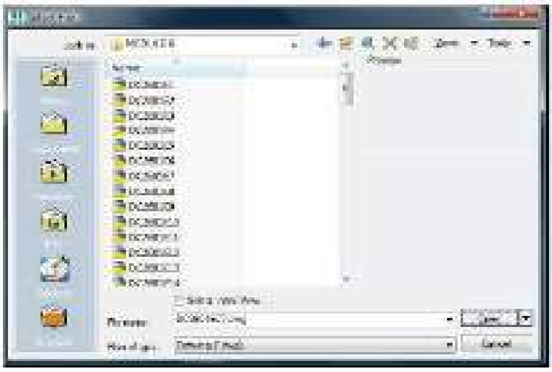
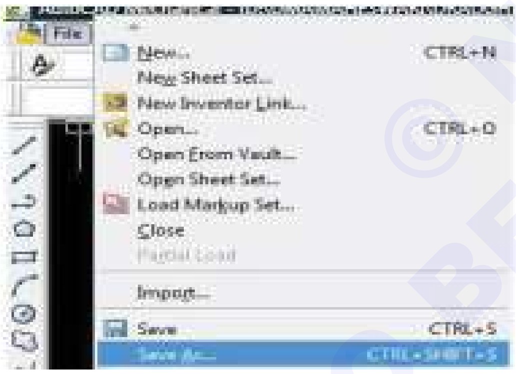


Fig 7




4 Select the file **"Workbook** and then **"Open"** button.

5 Select **"File / save as"**

6 Select the **"File of type"** down arrow to display different saving formats. Select " Autocad drawing template (*.dwt)".

**The 3 letter extension for template is "dwt".**

A list of all the AutoCAD templates will appear. (Your list may be different)

7 Type the new name "1 Workbook" in the file name". box and then select the save button.

The "1" before the name will place the file at the top of the list. (Fig 7 & 9)

**AutoCAD displays numerical first and then alphabetical.**

Fig 8

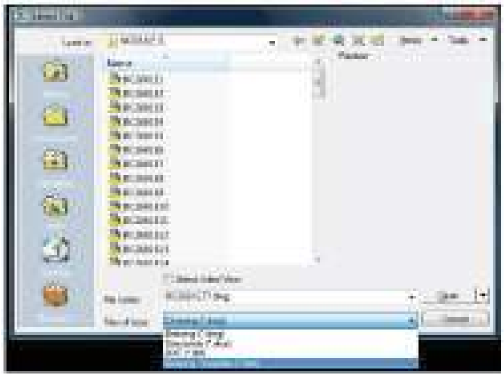
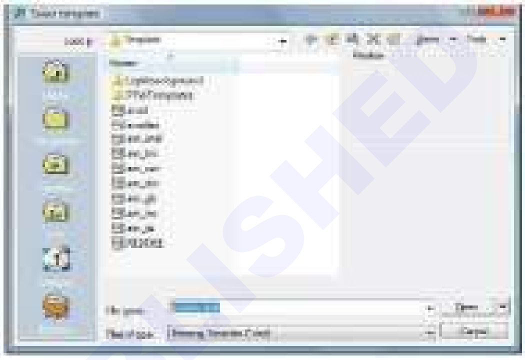


Fig 9

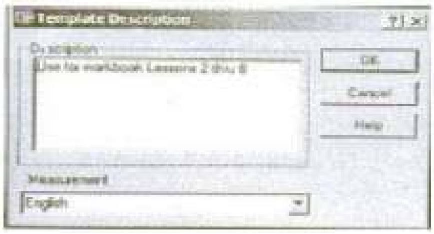


8 Type a description and the select the "OK" button.

Now you have a template to use for lesson 2 through 8. At the beginning of each of the exercises you will be instructed to open this template. (Fig 10)

Using a template as a master setup drawing is good CAD management.

Fig 10




**Creating a new drawing (Fig 11)**

**New command**

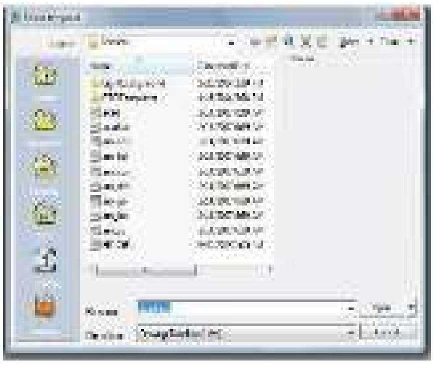
Create a new drawing file.

| | | |
|---|---|---|
| 1 | Choose | File, new. or |
| 2 | Press | Ctrl + N or |
| 3 | Click | The new icon or |
| 4 | Type | New at the command prompt. Command: new |
| 5 | Choose | One of the options for creating a new drawing. |
| 6 | Click | The ok button. |

7. Save the drawing as another name.

TIP: New drawings can also be created from template files.

Fig 11



**Open existing drawings (Fig 12)**

| | | |
|---|---|---|
| 1 | Choose | File, open. or |
| 2 | Press | Ctrl + O |
| 3 | Click | The open icon. or |
| 4 | Type | Open at the command prompt.command: open |
| 5 | Press | Enter |
| 6 | Double click | The desired directory to find the drawing to open. |
| 7 | Click | the drawing name to open. |
| 8 | Click | The ok button. |

Fig 12

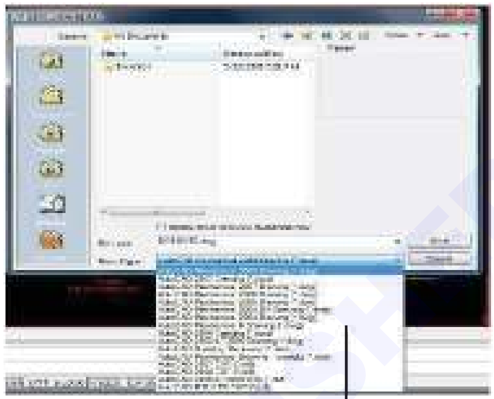
Preview shows a bitmap image of the drawing selected. This image is the view that was last saved in the drawing.

**Saving drawings (Fig 13)**

Saves the most recent changes to a drawing. The first time an unnamed drawing is saved the "Save As" Dialog box appears. AutoCAD saves its drawings as files with extensions ending in . DWG.

| | | |
|---|---|---|
| 1 | Choose | File, save or save as |
| 2 | Type | Save or save as at the command prompt command: Save or Save as |
| 3 | Press | Enter |
| 4 | Type | A new drawing name or keep the existing drawing name. |
| 5 | Click | The ok button. |

Fig 13



Various file type can be saved as

**TIP:** Clicking the dropdown list for file type changes the format that the drawing can be saved in.

**Quick save**

The Qsave command is equivalent to clicking Save on the file menu.

If the drawing is named, AutoCAD saves the drawing using the file format specified on the open and save tab of the Options dialog box and does not request a file name. If the drawing is unnamed, AutoCAD displays the save drawing. As dialog box **(see save as)** and saves the drawing with the file name and format you specify.

1 Press Ctrl + S.

or

2 Click The save icon.

or

3 Type Qsave at the command prompt, Command: Qsave.

**Tips:** Drawings can be saved as different versions of AutoCAD (e.g. R13, R14, R2000, etc.)

AutoSave settings under Tools, options...

**Existing AutoCAD (Fig 14)**

1 Choose File, exit.

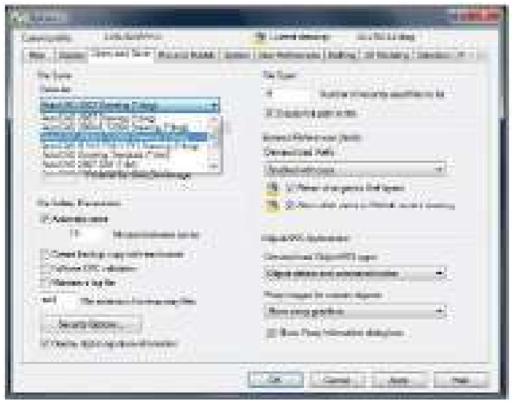
or

2 Type Quit at the command prompt.
Command: Quit

3 Press ENTER.

4 Click Yes to save changes or No to discard changes.

Fig 14



## Drawing area control

**Objectives :** At the end of this exercise you shall be able to
- **identify method of entering commands**
- **practice drawing command set up**
- **practice drawing area set up.**

**Methods of entering commands**

AutoCAD has 3 different methods of entering commands. All 3 methods will accomplish the same end result. AutoCAD allows you to use the method you prepare. The following are descriptions of all 3 methods and an example of how each one would be used to start command such as the line command.

1 Pull down Menu (select draw / line).

a Move the cursor to the Menu Bar.

b Click on a Menu header such as “Draw”.

c Slide the cursor down the list of commands and click to select.

2 Tool bars (select the line icon from the draw tool bar).

Move the cursor to an icon on a toolbar and press the left mouse button.

3 Keyboard (Type L and <enter>).

Type the command on the command line.

What is a shortcut menu?

In addition to the methods listed above, AutoCAD has shortcut menus. Shortcut Menus give you quick access to command options. Shortcut Menus are available when brackets [] enclose the options, on the command line. (Example below) To activate a Shortcut Menu, press the right mouse button.

Example

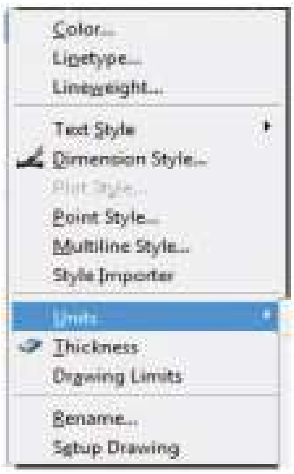
Select: draw /circle / center, radius._circle specify center point for circle or **[3P / 2P/ Ttr (tan tan radius)]:**

If you press the right mouse button now, the shortcut menu on the left will appear. This allows you to select the options 3P, 2P, or Ttr with the mouse rather than typing your selection.

**Drawing units setup (Fig 1)**

Every object we construct in a CAD system is measured in Units. We should determine the system of units within the CAD system before creating the first geometric entities.

Fig 1




1 In the menu bar select:

**[Format] [Units] (Fig 2,3 & 4)**

The AutoCAD menu bar contains multiple pull down menus, where all of the AutoCAD commands can be accessed. Note that many of the menu items listed in the pull-down menus can also be accessed through the Quick Access toolbar and / or Ribbon panels.

2 Click on the length type option to display the different types of length units available. Confirm the length type is set to decimal.

3 On your own, examine the other settings that are available.

Fig 2

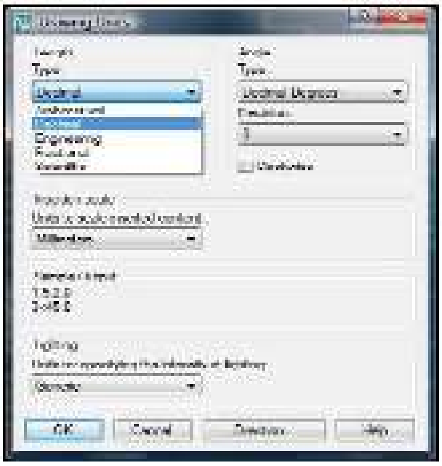


Fig 3

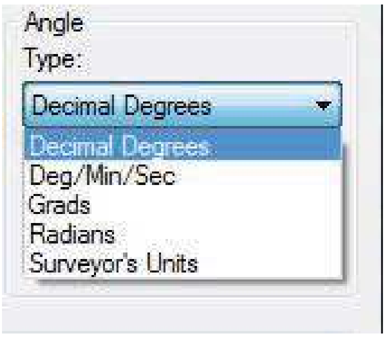
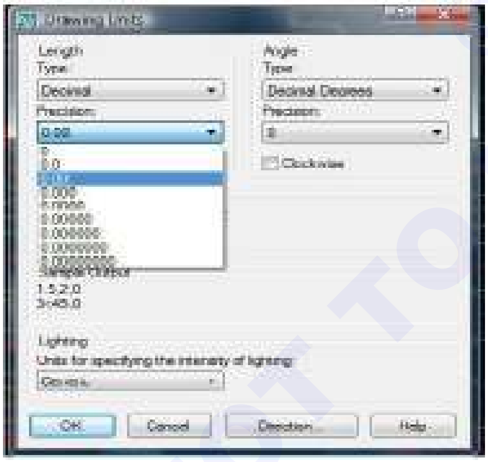



Fig 4



4 In the drawing Units dialog box, set the length type to decimal. This will set the measurement to the default English units, inches.

5 Set the precision to two digits after the decimal point as shown in the above Figure.

6 Pick ok to exit the drawing units dialog box.

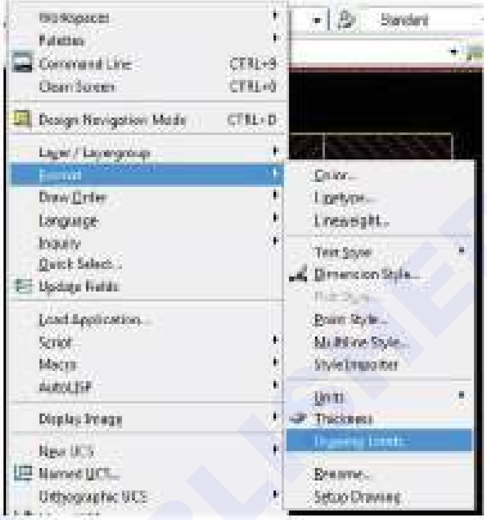
**Drawing area setup (Fig 5)**

Next, we will set up the **drawing limits** by entering a command in the command prompt area. Setting the Drawing Limits controls the extents of the display of the grid. It also serves as a visual reference that marks the working area. It can also be used to prevent construction outside the grid limits and as a plot option that defines an area to be plotted / printed. Note that this setting does not limit the region for geometry construction.

1 In the menu bar select:

**[Format] [Drawing Limits]**

Fig 5



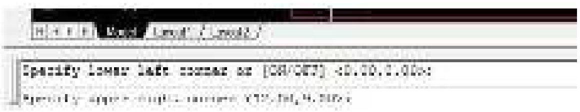
2 In the command prompt area, the message "Reset model space limits: Specify lower left corner or [on/off] <0.00,0.00>." is displayed. Press the **ENTER** key once to accept the default coordinates <**0.00,0.00**>.

Fig 6

3 In the command prompt area, the message "specify upper right corner <12.00,9.00>" is displayed. Press the ENTER key again to accept the default coordinates <12.00,9.00>. (Fig 6)

4 On your own, move the graphic cursor near the upper right corner inside the drawing area and note that the drawing area is unchanged. (The drawing limits command is used to set the drawing area, but the display will not be adjusted until a display command is used.) (Fig 7)

Fig 7



**Setting limits of a drawing**

In AutoCAD The drawing must be drawn in full scale. So limits are needed to size up a drawing area. The limits are determined by the following factor.

i Size of drawing.

ii Space needed for dimensions, notes and other details.

iii Space between different views.

iv Space for the border and a title block etc.

**Limits**

Pull down: Format, drawing limits.

Command: Limits.

The command **LIMITS** allows you to change the upper and lower limits of the drawing.

Example: Set the drawing screen to A4 size (210 x 297)

Command: LIMIT.

Specify lower left corner or (ON/OFF) <0.000,0.000>:

Specify upper right corner <12.000,9.000>: 210,297

Give ZOOM command with ALL option to view all the drawing

area (A4 size)

MVSETUP = Multiview Setup

MVSETUP offers two different setup options depending on whether you are in Model Space or in a Layout (Paper Space).

In model space- you set the units type, drawing scale factor, and paper size at the command prompt using MVSETUP. Using the settings you provide, a rectangular border is drawn at the grid limits.

In Paper Space - you can insert one of several predefined title blocks into the drawing and create a set of layout viewports within the title blocks. You can specify a global scale as the ratio between the scale of the title block in the layout and the drawing on the Model tab. The model tab is most useful for plotting multiple views of a drawing within a single border.

MVSETUP commands

No (to not create a new layout tab - we will do this in another lesson)

A (Metric units)

48 (Scale factor - common arch, scale factor is 1:1)

24 Width- see table below for paper size.

(example 210 x 297) Since we are printing in “land scape “ mode, we enter the bigger number of the paper size first.

18 Length - Smaller number from the list below.

Once MVSETUP is finished, it will show a rectangle. This is the area where your grid wil show up if you have the grid on. This box is pretty much useless so just erase it. You will not need it.

From here, set up dimensions styles, text styles. layer.

If these settings will used in other drawings here are two suggestions, the first of which is recommended because it is less error prone.

1 After creating the desired settings, do a save-as and save as . dwt. All of the settings that you created will be saved.

2 After using this drawing, open it and erase all objects. The settings will remain but you will have to hunt down the objects that need to be erased in layouts.

**2 Setting units of a drawing**

Every object you create is measured in drawing units. Before you start to draw, you must decide what one drawing unit will represent based on what you plan to draw. Then you create your drawing at actual size with that convention. For example, a distance of one drawing unit typically represents one millimeter, one centimeter, one inch, or one foot in real - world units.

UNITS Command is used to set the units of measure, angle measurement, direction and precision.Pull down Menu: Format, UNITS

Command: UNITS

If you enter-units at the command prompt, UNITS displays prompts on the command line.There are five fundamental types of units i.e. Decimal, architectural, engineering, fractional & scientific.

The text window displays the following prompt.

There are five fundamental types of units i.e. Decimal, architectural, engineering, fractional & scientific.

There are five fundamental types of units i.e.

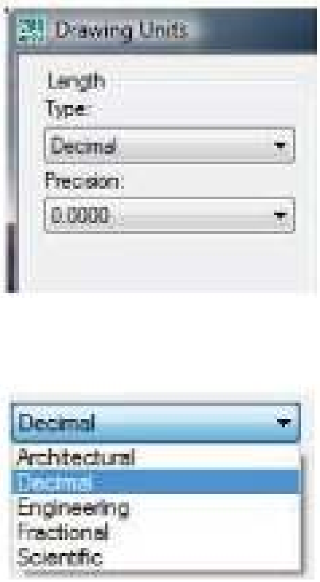
| Icon/Button | Description |
|---|---|
| Fig 8<br><br> | Decimal, Architectural, Engineering, Fractional & Scientific.<br>Report formats: (Examples)<br>1 Scientific (1.55E + 01)<br>2 Decimal (915.50)<br>3 Engineering 1'-3.50"<br>4 Architectural 1'-3 1/2"<br>5 Fractional 15 1/2<br>Enter choice, 1 to 5 <Current >: Enter a value (1-5) or press ENTER<br>The following prompt for decimal precision is displayed if you specify the scientific, decimal, or engineering format. Enter number of digits to right of decimal point (0 to 8 ) <Current >: Enter a value (0-8) or press ENTER.<br>The following prompt for the denominator of the smallest fraction is displayed if you specify the architectural or fraction format.<br>Enter denominator of smallest fraction to display.<br>(1,2,4,8,16,32,64,128,or 256) <current>: Enter a value (1,2,4,8,16,32,64,128,or 256) or press ENTER |
| Fig 9<br><br> | **Inserting scale**<br>Controls the units of measurement for blocks and drawings that are inserted into the current drawing. A block or a drawing that is created with units that are different from the units specified with this option is scaled when inserted. The insertion scale is the ratio of the units used in the source block or drawing and the units used in the target drawing. Select Unitless to insert the block without scaling it to match the specified units. |

Fig 10


The next prompts is for angle formats and precision.

System of angle measure: (Exmaple)

1 Decimal degree 45.000

2 Degree/minutes/seconds 45d0'0.

3 Grads 50.000g.

4 Radians 0.78454r.

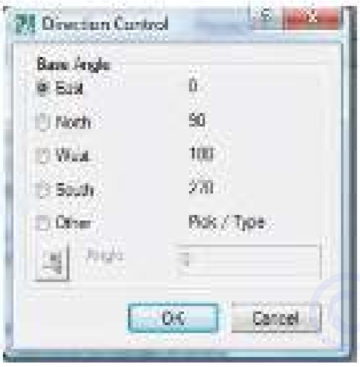
5 Surveyor's units N 45d0'0"E.

Enter choice ,1 to 5< Current>:Enter a value (1-5) or press ENTER.

Enter number of fractional places for display of angles (0-8) <Current>:Enter a value (0-8) or press ENTER.

The next prompt is for the direction for angle 0.

Fig 11




**Direction for angle 0:**

**East 3 o'clock = 0.**

**North 12 o'clock = 90.**

**West 9 o' clock = 180.**

**South 6 o' clock = 270.**

Enter direction for angle 0<current>: Enter a value or press ENTER.

The default direction for 0 degrees is to the east quadrant, or 3 o' clock. The default direction for positive angular measurement is counterclockwise.

Measure angles clockwise? [Yes/No]

<current>: Enter y or n or press ENTER.

Select the unit you want from the dialogue box. This unit is used for dimensioning of the drawing. Input from the user accepted in this unit only.



## Drafting setting a display commands

**Objectives :** At the end of this exercise you shall be able to
- **practice the drafting setting**
- **identify the visual reference**
- **identify esc, undo, redo**
- **practice display commands.**

### Drafting Settings

Drafting settings includes the commands for initial setting of a drawing. Some of the drafting settings are **snap, grid, polar tracking, osnap.**

Switches the grid on/off

Set the size of the grid in the current drawing units

**Snap:** Snap is used to move the cursor at a defined value. This will set a position on the drawing quickly and accurately. The snap mode can be switched ON / OFF by pressing function key F9.

Fig 1

**Grid:** Grid command is used to display dots, which is easy for us to fix the points. But these dots were not printed. Grid points have default spacing of one unit. We can change the spacing too. This mode can be ON / OFF by using the function key F7. (Fig 1)

**Object snap settings**

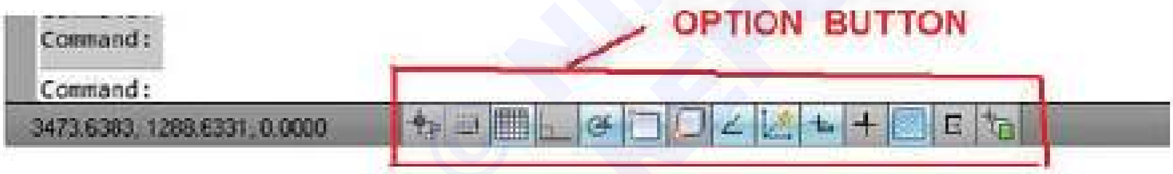
Object snap settings are used to pick a geometric point on an object. Object snap mode can be ON / OFF by using the function key F3 or by clicking O snap button on the status bar. There are various options for object snap settings such as end point, mid point, centre, quadrant etc.

**Ortho:** Ortho command forces lines to be drawn exactly perpendicular directions. While using this command we have to turn ortho ON/OFF (otherwise press F8 according to our need.(Fig 2)

The grid and snap mode option can be turned ON or OFF through the status bar. The status bar area is located at the bottom left of the AutoCAD drawing screen, next to the cursor coordinates.

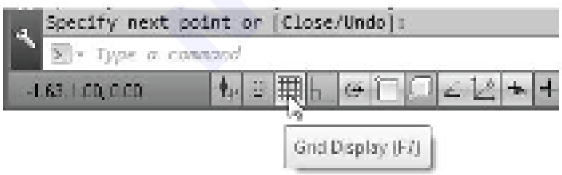
Fig 2

Fig 3




The second button in the status bar is the snap mode option and the third button is the grid display option. Note that the buttons in the status bar area serve two functions: (1) the status of the specific option, and (2) as toggle switches that can be used to turn these special options on and off. When the corresponding button is highlighted, the specific option is turned on. Using the buttons is quick and easy way to make changes to these drawing aid options. Another aspect of the buttons in the Status Bar is these options can be switched on and off in the middle of another command. (Fig 3 & 4)

Fig 4




**Grid on (Fig 5)**

1 Left-click the grid button in the status bar to turn on the **grid display** option. (Notice in the command prompt area, on the massage “<Grid on>” is also displayed.)

Fig 5

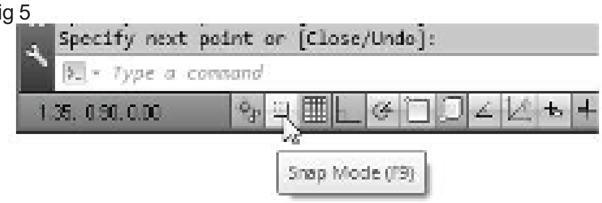
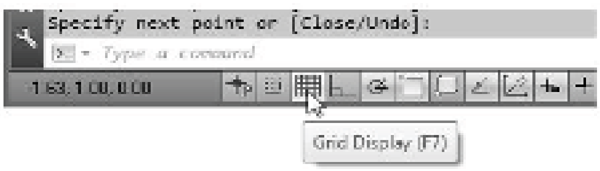



Fig 6




2 Move the cursor inside the graphics window, and estimate the distance in between the grid lines by watching the coordinates display at the bottom of the screen. (Fig 6)

The grid option creates a pattern of lines that extends over an area on the screen. Using the grid is similar to placing a sheet of grid paper under a drawing. The grid helps you align objects and visualize the distance between them. The grid is not displayed in the plotted drawing.

The default grid spacing. Which means the distance in between two lines in the screen, is 0.5 inches. We can see that the sketched horizontal line in the sketch is about 4.5 inches long. (Fig 7,8 & 9)

Fig 7

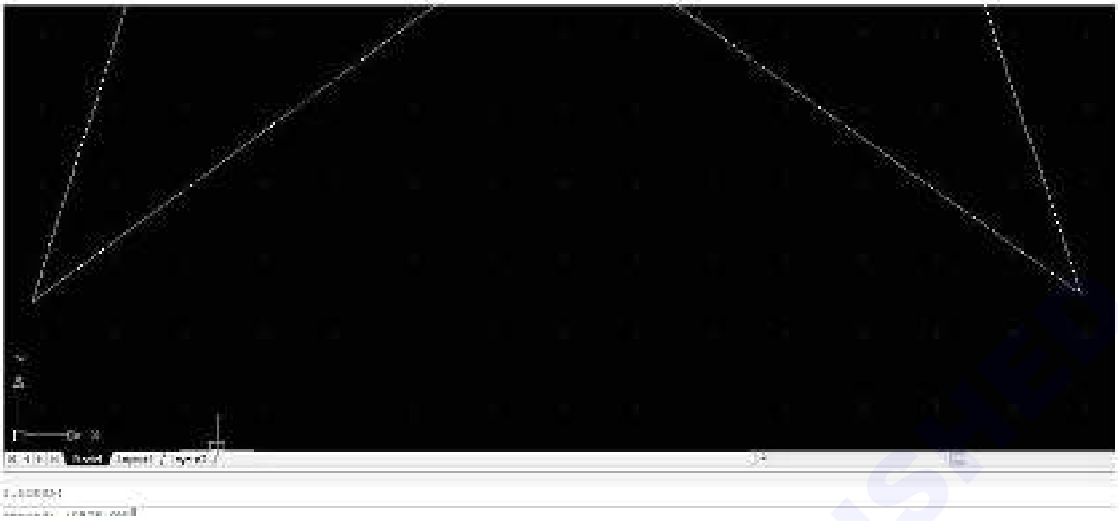


Fig 8

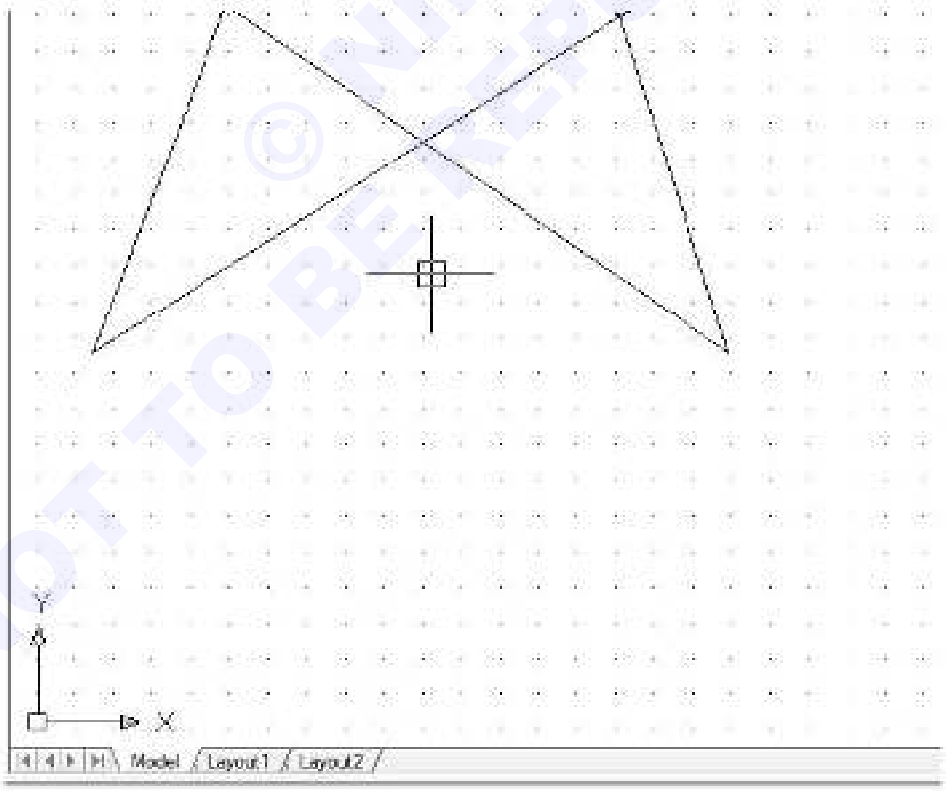
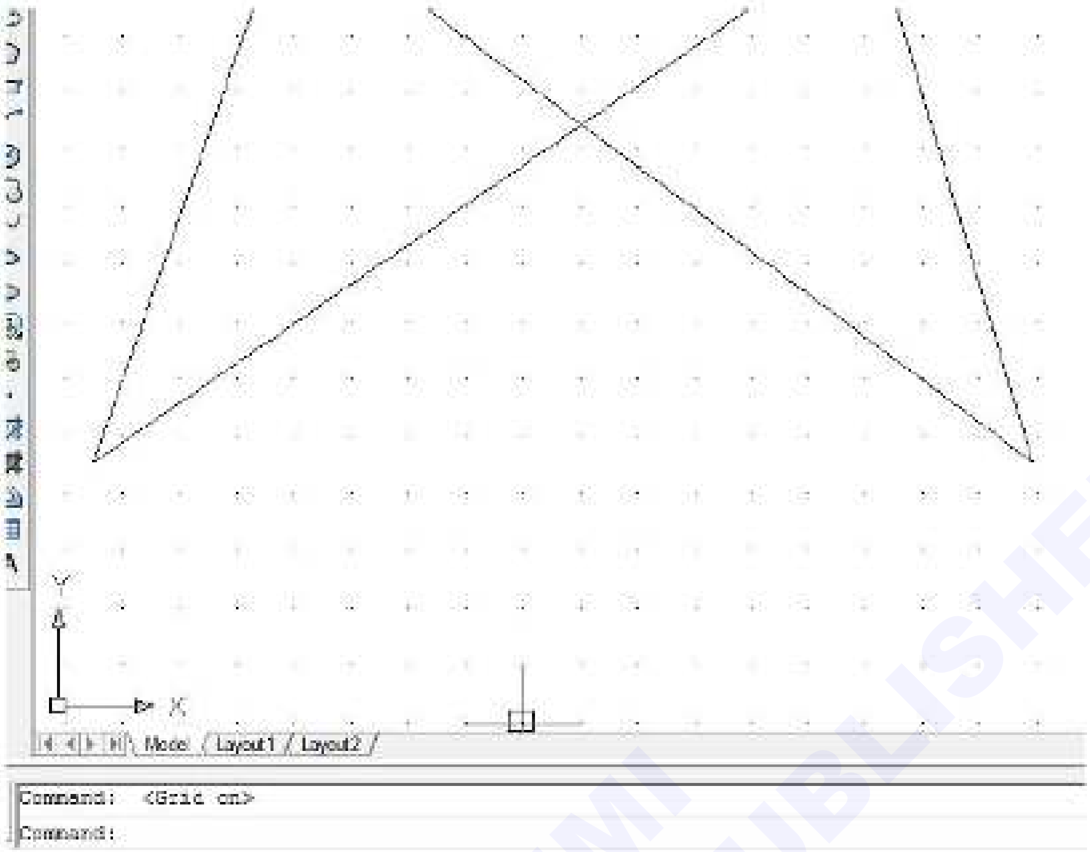


Fig 9






**Snap mode on**

1 Left- click the snap mode button in the status bar to turn on the snap option.

Fig 10

2 Move the cursor inside the graphics window, and move the cursor diagonally on the screen. Observe the movement of the cursor and watch the coordinates display at the bottom of the screen. (Fig 10)

SNAP mode is on, the screen cursor and all input coordinates are snapped to the nearest point on the grid. The default snap interval is 0.5 inches, and aligned to the grid points on the screen.

**In case of any mistake**

**Pressing the ESC key**

The Esc key at the top of the key board will get you out of most problems you encounter using AutoCAD. Here are some examples of the times you would press Esc key.

- If a command is not responding the way you expect.
- If you want to cancel a command you started.
- If you clicked a point on the screen unintentionally.
- If a dialogue box appears on the screen accidently.

In all these cases above, pressing Esc once will free the command line.

**Example**

Issue the line command, click a point on the screen and then press the esc key to cancel the command.

**Using undo**

You can undo the last command by typing U at the command line and pressing the enter key, or by clicking on the Undo icon on the tool bar.

**Using redo** 

The Redo command will reinstate the last command you applied undo to. You may undo as may commands as like you, but you may only redo once.

## Display commands

### Zoom

Zoom command enlarges or reduces the view of the drawing. When we are working on a drawing it is always required to bring the area of our interest to focus on to the screen. The zoom tool bar may be accessed from the standard tool bar at the top of the screen or from the dropdown menu > view >Tool bars....> Zoom. The icons are

| Icon | Function |
|---|---|
| Realtime | This allow you to select a window or box around the area you want to magnify. |
| Dynamic | This is both zoom and pan. When the command is issued a view box will be displayed with the drawing inside. The view box can be resized (Zoom) and moved around pan. |
| Scale | The drawing is at a scale of 1.A zoom scale of 2 doubles the magnification of the drawing, while 0.5 halves it. |
| Center | Allows you to pick a point which will be the center of the zoom area. |
| In | Just click on it zoom in on the drawing. You may preset the amount it zooms in a the command line. |
| Out | Just click on it zoom out from the drawing. You may preset the amount it zooms out at the command line. |
| All | This zooms to show the complete electronic page you set up. It zooms out to the electronic sheet limits. |
| Extents | This will zoom to fit the complete drawing on the screen. |
| Previous | This displays the last view created by zoom, pan or view command. |

Pan

Pull down menu: view, pan.

The cursor changes to a hand cursor.


By holding down the pick button on the pointing device, you lock the cursor to its current location relative to the view port coordinate system. Graphics within the window are moved in the same direction as the cursor.

when you reach a logical extent (edge of the drawing space), bar is displayed on the hand cursor on the side where the extend has been reached. Also a message is displayed in the status bar as “already bottom most extent”. Depending upon whether the logical extent is at the top, bottom, or side of the drawing, the bar is either horizontal (top or bottom) or vertical (left or right side).

When you release the pick button, panning stops. You can release the pick button move the cursor to another location in the drawing, and the press the pick button again to pan the display from that location.

On your own, move the graphic cursor near the upper-right comer inside the drawing area and note that the drawing area is unchanged. (The Drawing Limits command is used to set the drawing area, but the display will not be adjusted until a display command is used.)

Inside the Menu Bar area

Select: **[View] [Zoom] [All]**

Zoom All command will adjust the display so that all objects in the drawing are displayed to be as large as possible. If no objects are constructed, the Drawing Limits are used to adjust the current viewport.

Move the graphic cursor near the upper - right comer inside the drawing area and note that the display area is updated.

In the menu bar area select: [View] [pan] [Real-time]

The available pan commands enable us to move the view to a different position. The pan - realtime function acts as if you are using a video camera. (Fig 11,12)

Move the cursor, which appears as a hand inside the graphics window, near the center of the drawing window, then push down the left - mouse - button and drag the display toward the right and top side until we can see the sketched line. (Notice the scroll bars can also be used to adjust viewing of the display.)

Fig 11

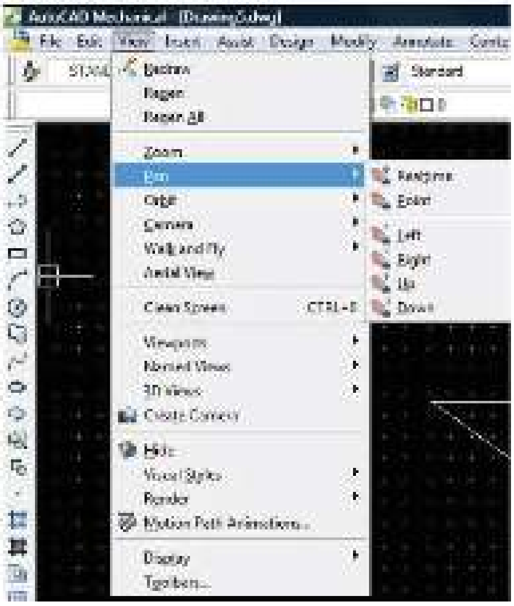
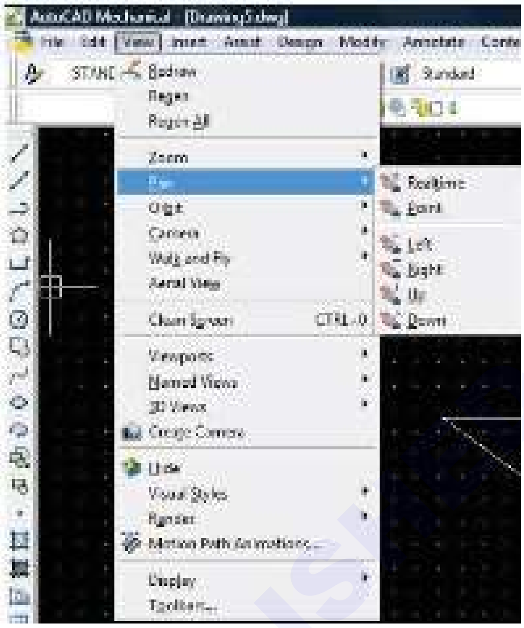


Fig 12



## Commands & co-ordinate system

**Objectives :** At the end of this exercise you shall be able to
- **use draw command line**
- **practice co-ordinate system**
- **use modify command erase.**

**Draw commands Line**

From tool bar: Line

Draw menu: Line

Command : Line, L

Example:

**Command: L - Line**

Specify first point: Select one point on the screen

Specify next point or [Undo]: Select second point on the screen

Specify next point or [Undo]:

**Continue**

Continue a line from the end point of the most recently drawn line

If the most recently drawn line is an arc, its end point defines the starting point of the line, and the line is drawn tangent to the arc.

**Close**

Ends the last line segment at the beginning of the first line segment, which forms a closed loop of line segments.You can close after you have drawn a serious of two or more segments.

**Undo**

Erase the most recent segment of a line sequence. Entering "U" more than once back tracks through line segments in the order you created them.

**Co-ordinate system in autocad**

All drawings are superimposed on an invisible grid, or co-ordinate system, with a horizontal X-axis and a vertical Y-axis.

You can establish grid and snap setting that match the units of the co-ordinate system or some multiple or fraction of it.

1 Absolute co-ordinate system (X, Y): To enter an absolute coordinate, specify a point by entering its X and Y values in the format X,Y. (Fig 1)

Use absolute coordinate when you know the precise X and Y values in the point from the origin. The following sequence of coordinates draw a triangle, as shown below.

**Command _** Line specify first point: 2,2

Specify next point or [undo]: 8,2

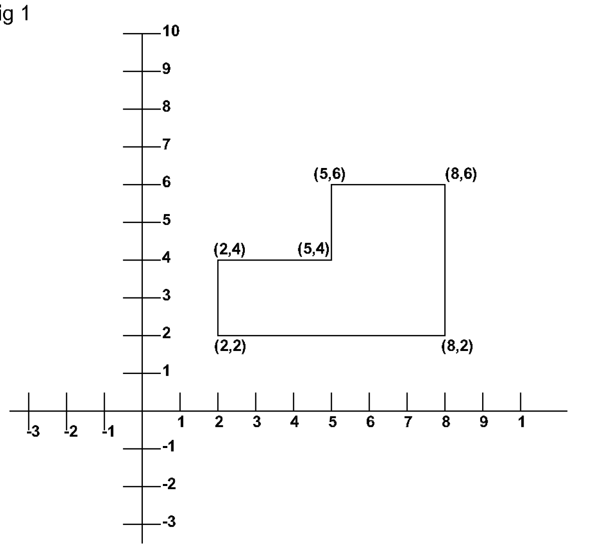
Specify next point or [undo]: 8,6

Specify next point or [undo]: 5,6

Specify next point or [undo]: 5,4

Specify next point or [undo]: 2,4

Fig 1

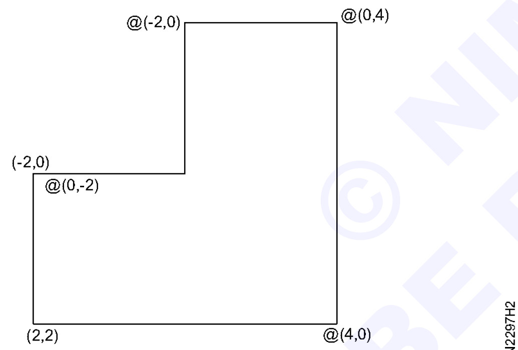



ABSOLUTE CO-ORDINATE SYSTEM

**Relative rectangular co-ordinate system @ X distance, Y distance**

Use relataive coordinates when you know the position of a point with respect to the previous point, the relative rectangular coordinate is represented in the following format.**(**Fig 2)

Fig 2




RELATIVE RECTANGULAR CO-ORDINATE SYSTEM

**X displacement, Y-displacement**

Command:_ line specify first point:2,2

Specify next point or [undo]: @ 4,0

Specify next point or [undo]: @ 0,4

Specify next point or [Close/ undo]: @ 0,-2

Specify next point or [Close/ undo]: @ -2,0

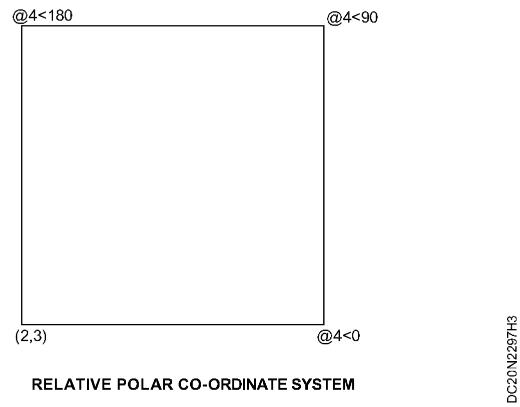
Specify next point or [Close/ undo]: @ c

**Relative polar co-ordinate system @ distance angle (Fig 3)**

Polar co-ordinate system uses a distance and an angle with reference to the previous point to locate a point. Angle is measured in anti-clock direction, taking 0° towards right.

The relative polar co-ordinate is representing in the following format.

Fig 3




RELATIVE POLAR CO-ORDINATE SYSTEM

Fig 4


**@Distance<angle**

Command: _ line specify first point:2,3.

Specify next point or [undo]: @ 4<0.

Specify next point or [undo]: @ 4<90.

Specify next point or [close / undo]: @ 4<180.

Specify next point or [close / undo]:c.

**Drawing lines with the line command (Fig 4)**

1 Move the graphics cursor to the first icon in the draw panel. This icon is the **line** icon. Note that a brief description of the line command appears next to the cursor.

2 Select the icon by clicking once with the **Left - mouse-button,** which will activate the line command.

3 In the command prompt area, near the bottom of the AutoCAD drawing screen, the message " - line specify point:" is displayed. AutoCAD expects us to identify the starting location of a straight line. Move the graphics cursor inside the graphics window and watch the display of the coordinates of the graphics cursor at the bottom of the AutoCAD drawing screen. The three numbers represent the location of the cursor in the X,Y, and Z directions. We can treat the graphics window as if it was a piece of paper and we are using the graphics cursor as if it were a pencil with which to draw.

We will create a freehand sketch of a five - point star using the Line command. Do not be overly concerned with the actual size or the accuracy of your freehand sketch.

4 We will start at a location about one - third from the bottom of the graphics window. Left - click once to position the starting point of our first line. This will be point 1 of our sketch. Next move the cursor upward and toward the right side of point 1. Notice the rubber band line that follows the graphics cursor in the graphics window. Left - click again (pint 2) and we have created the first line of our sketch.(Fig 5)

Fig 5

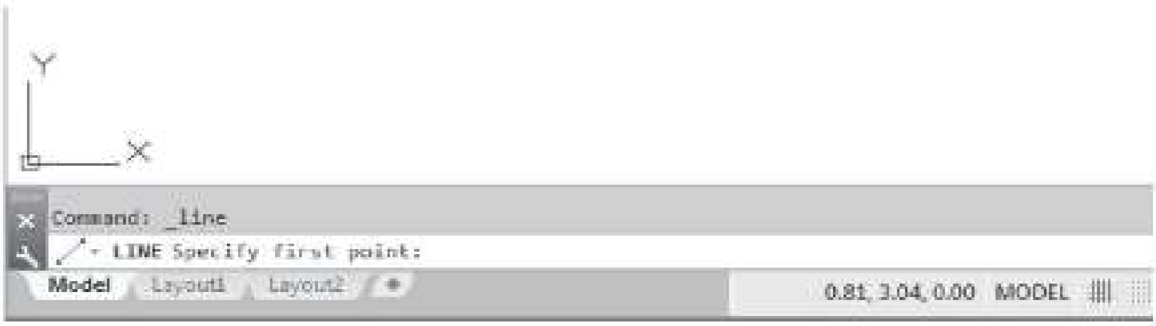
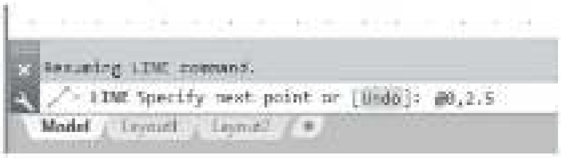



Fig 6

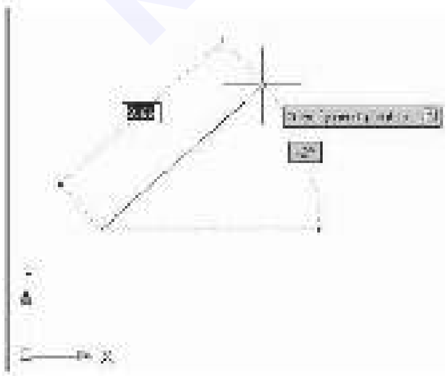



5 Move the cursor to the left of point 2 and create a horizontal line about the same length as the first line on the screen. (Fig 6)

6 Repeat the above steps and complete the freehand sketch by adding three more lines (from point 3 to point 4, point 4 to point 5, and then connect to point 5 back to point 1). (Fig 7 & 8)

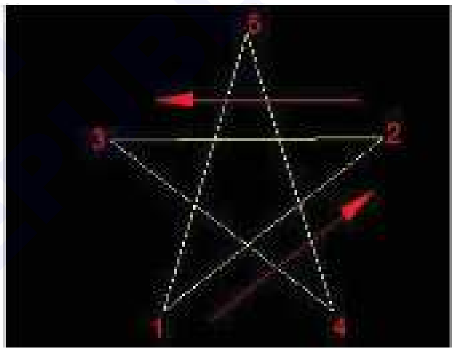
Fig 7

Fig 8



7 Notice that the Line command remains activated even after we connected the last segment of the line to the starting point (point 1) of our sketch. Inside the graphics window, **Click once** with the **right - mouse-button** and a popup menu appears on the screen. (Fig 9)

Fig 9




8 Select enter with the left - mouse - button to end the line command. (This is equivalent to hitting the [ENTER] key on the keyboard.)

9 Move the cursor near point 2 and point 3, and estimate the length of the horizontal line by watching the displayed coordinates for each point. (Fig 10)

Fig 10

**ERASE**

There are 3 methods to **erase** (delete) objects from the drawing. You decide which one you prepare to use. They all work equally well.

**METHOD 1**

**Select the Erase command first and then select there objects**

1 Start the Erase command by using one of the following.

**TYPING = E <enter>.**

**PULLDOWN = MODIFY / ERASE**

**TOOLBAR = MODIFY**

2 Select objects: **Pick one or more objects**

Select objects: **Press <enter> and the objects will disappear.**

**METHOD 2**

**Select the objects first and then the Erase command from the shortcut menu (Fig 11)**

1 Select the object (s) to be erased.

2 Press the right mouse button.

3 Select **"Erase"** from the short - cut menu.

**METHOD 3**

**Select the objects first and then the delete key**

1 Select the object (s) to be erased.

2 Press the delete key.

**Very important : If you want the erased objects to return, press U <enter> or Ctrl + Z or the Undo arrow icon. This will "Undo" the effects of the last command.**

**Using the ERASE command**

One of the advantages of using a CAD system is the ability to remove entities without leaving any marks. We will erase two of the lines using the Erase command.

1 Pick Erase in the modify toolbar. (The icon is a picture of an eraser at the end of a pencil.) The message "Select objects" is displayed in the command prompt area and AutoCAD awaits us to select the objects to erase.

2 Left - click the SNAP MODE button on the status bar to turn OFF the SNAP MODE option so that we can more easily move the cursor on top of objects. We can toggle the Status Bar options ON or OFF in the middle of another command. (Fig 12)

3 Select any two lines on the screen; the selected lines are displayed as dashed lines as shown in the figure below.

To deselect an object from the selection set, hold down the [SHIFT] key and select the object again.

Fig 11

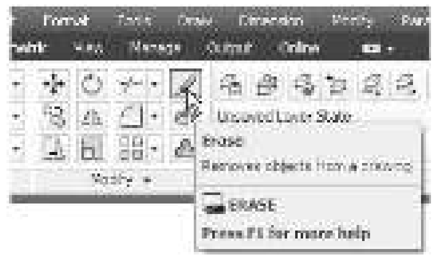



Fig 12


4 Right - mouse - click once to accept the selections. The selected two lines are erased.

**The last command**

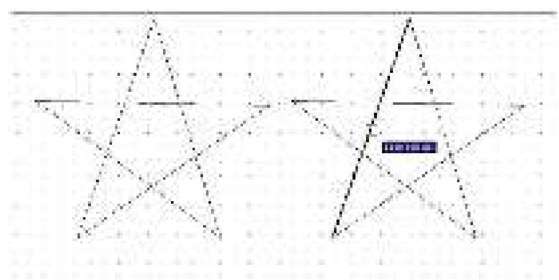
1 Inside the graphics window, click once with the right-mouse-button to bring up the popup option menu.

2 Pick repeat erase, with the left - mouse - button, in the popup menu to repeat the last command. Notice the other options available in the popup menu.

3 Move the cursor to a location that is above and toward the left side of the entities on the screen. Left - mouse - click once to start a corner of a rubber - band window.

Move the cursor toward the right and below the entities, and then left-mouse-click to enclose all the entities inside the selection window. Notice all entities that are inside the window are selected. (Fig 13)

Fig 13



Inside the graphics window, right-mouse-click once to proceed with erasing the selected entities.

When your own create a free hand sketch of your choice using the line command. Experiment with using the different commands we have discussed so far, Reset the status button so that only the GRID DISPLAY option is turned ON as shown. (Fig 14,15 & 16)

Fig 14

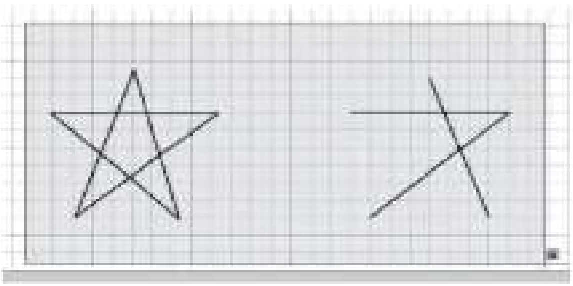
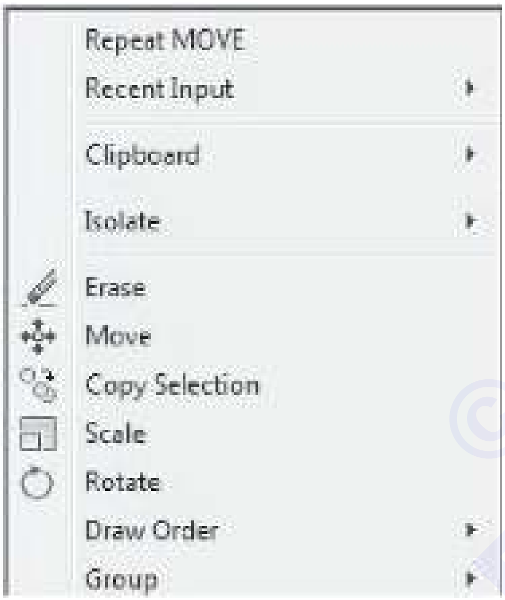


Fig 15

Fig 16




**Practice - I**

**Instructions**

1 Start a **New file**

2 **Draw** the objects below using

**LINE** command.

Ortho (f8) **ON** for **Horizontal** and **Vertical** lines.

Ortho (f8) **OFF** for lines drawn on an **Angle.**

Increment Snap (f9) **ON** Osnap (f3) **OFF.**

3 **Save** this drawing using:

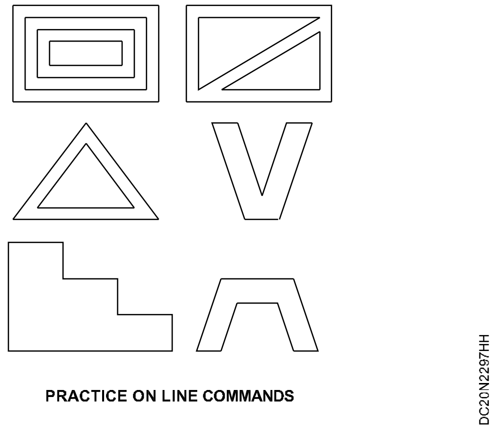
**Practice - II (Fig 17)**

**Instructions**

1 Using drawing DRG NO **ERASE** the missing lines.

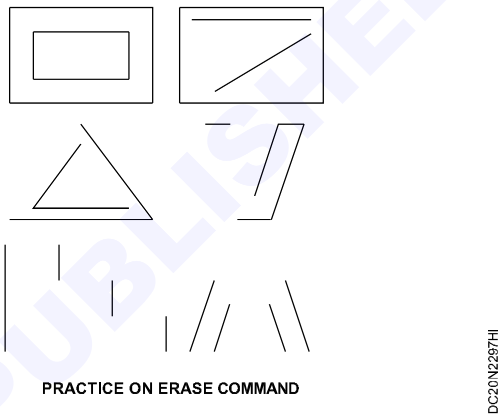
2 **Save** this drawing using:

Fig 17




File / Save as / DRG NO.

Fig 18




**Practice - III (Fig 18)**

**Instructions**

1 Start a **New** file. **(Fig 19)**

2 **Draw** the objects below using.

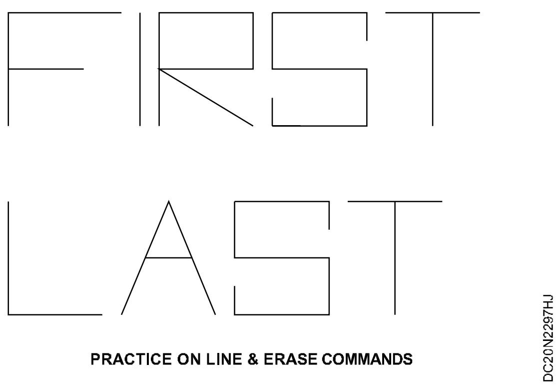
Draw / Line.

Ortho (f8) **ON** for **Horizontal** and **Vetical** Lines.

Ortho (f8) **OFF** for lines drawn on an **Angle**.

Increment Snap (f9) **ON**

Fig 19




Osnap (f3) **OFF**

3 **Save** this drawing using.

File / Save as DRG NO.

**Practice - IV (Fig 20)**

**Instructions**

1 Start a New file.

2 **Draw** the objects below using

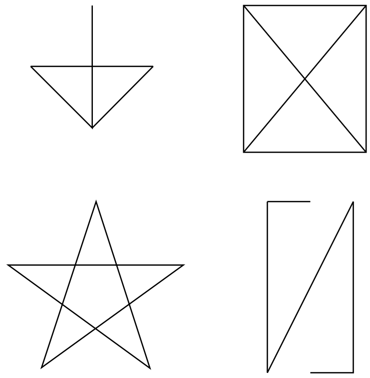
Draw / Line.

Osnap (f3) **OFF.**

3 **Save** this drawing using.

File / Save as (give file name).

Fig 20



PRACTICE ON LINE COMMANDS

DC20N2297HK

## Basic commands - I

**Objectives :** At the end of this exercise you shall be able to
- **create circle**
- **create arcs**
- **create polygon.**

### Creating circles

The menus and toolbars is **AutoCAD 2013** are designed to allow the CAD operators to quickly activate the desired commands. (Fig 1)

Fig 1

1 In the Draw toolbar, click on the little triangle below the circle icon. Note that the little triangle indicates additional options are available.

2 In the arcs a circle based on two endpoints of the diameter.

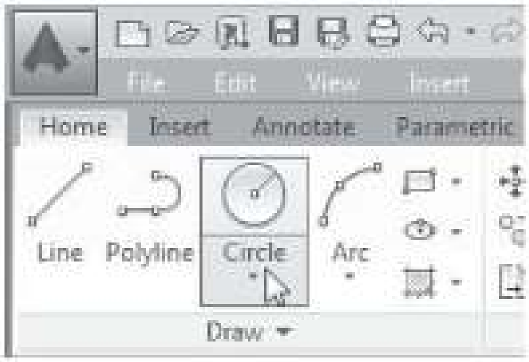
Notice the different options available under the circle submenu. (Fig 2)

- **Center, radius:** Draws a circle based on a center point and a radius.
- **Center, diameter:** Draws a circle based on a center point and a diameter.
- **2 points:** Draws a circle based on two.
- **3 Points:** Draws a circle based on three points on the circumference.
- **TTR - Tangent, Tangent, Radius:** Draws a circle with a specified radius tangent to two objects.
- **TTT - Tangent, Tangent, Tangent:** Draws a circle tangent to three objects.

**Circle**

AutoCAD provides the following ways of drawing circles.

Fig 2




**1 Centre and radius (Fig 3)**

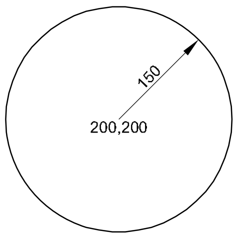
This is the classical method. The first point define the circle's center,

The second one radius

Example

| | |
|---|---|
| Command. | : Circle or C. |
| 3P / 2P / TTR /<Center point>. | : 200,200. |
| Diameter / <Radius>. | : 150. |

Fig 3




PRACTICE ON CIRCLE COMMAND

DC20N2297J3

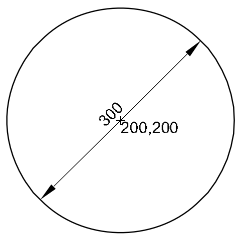
## 2 Centre and diameter (Fig 4)

After the circle's center has been defined the diameter can be given

Example

| | |
|---|---|
| Command | : Circle or C |
| 3P/2P/TTR/<Center Point> | : 200, 200 |
| Diameter/<Radius> | : D |
| Diameter | : 300 |

Fig 4




PRACTICE ON CIRCLE COMMAND

DC20N2297J4

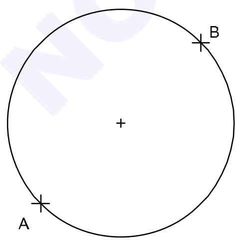
## 3 2 Points (Fig 5 )

With this option, the user can specify two points constituting the end points of the circles diameter.

Example

| | |
|---|---|
| Command | : Circle or C |
| 3P/2P/TTT/<Center point> | : 2P |
| First point on Diameter | : 200,200 |
| Second point on Diameter | : 400,400 |

Fig 5




PRACTICE ON CIRCLE COMMAND

DC20N2297J5

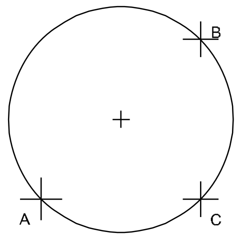
## 4 3 Points (Fig 6)

With this option the user can specify two points constituting the end points of the circles diameter.

Example

| | |
|---|---|
| Command | : Circle or C |
| 3P/2P/TTR/<Center point> | : 3P |
| First point on Diameter | : 200,200 |
| Second point on Diameter | : 400,400 |
| Third point on Diameter | : 300,350 |

Fig 6




PRACTICE ON CIRCLE COMMAND

DC20N2297J6

## 5 Tangent, tangent and radius (Fig 7)

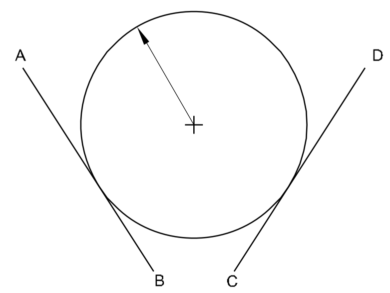
This option allows the user to define two tangential points and then the circle's radius. In order to invoke this option it should have two entities draw. The circle can be drawn between Tangentially to two lines, two circles, or two Arc's or combination of any two.

Example

| | |
|---|---|
| Command | : Circle or C |
| 3P/2P/TTR/<Center point> | : TTR. |
| Enter Tangent Space | : Pick by using mouse on the entity drawn already. |
| Radius | : 100 |

AutoCAD provides 11 different ways of drawing Arcs.

Fig 7




PRACTICE ON CIRCLE COMMAND

DC20N2297J7

## 1 3 Points (Fig 8 & 9)

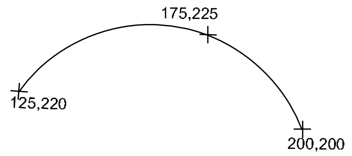
In this method three points define the Arc's Start point, Second point that the Arc passes through, and the arc's end point.

## 2 Start point, centre, end point (S,C,E) (Fig 10)

Center refers to the center point of the circle of while the arc is a part.

Example

Fig 8




PRACTICE ON ARC COMMAND

DC20N2297J8

Fig 9

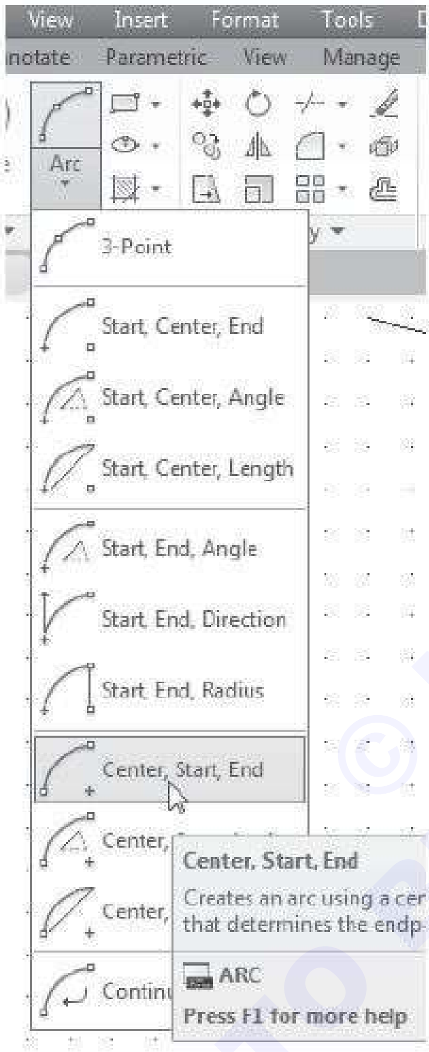
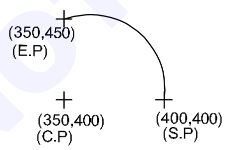



Fig 10




PRACTICE ON ARC COMMAND

DC20N2297JA

| | |
|---|---|
| Command | : Arc or A |
| Center/<Start point> | : 400,400. |
| Center/End<Second point> | : C. |
| Center point | : 350,400. |
| Angle/Length of chord/ <End point> | : 50,450. |

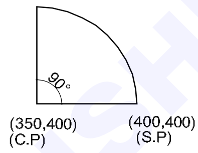
### 3 Start point, centre, included angle (S,C,A) (Fig 11)

In this method first specify the start point of the arc, then the center point or the arc, and then the include angle between the start point and the end point of the arc.

Example

| | |
|---|---|
| Command | : Arc or A |
| Center/<Start point> | : 400,400. |
| Center/End<Second point> | : C. |
| Center point | : 350,400. |
| Angle/Length of Chord/ <End point> | : A. |
| Included Angle | : 90. |

Fig 11




PRACTICE ON ARC COMMAND

DC20N2297JB

### 4 Start point centre, length of chord (S,C,L) (Fig 12)

In this method first specify the start point of the arc, then the center point of the arc and then the chord length.

Example

| | |
|---|---|
| Command | : Arc or A. |
| Center/<Start point> | : 400,400. |
| Center/End<Second point> | : C. |
| Center Point | : 350,400. |
| Angle/Length of Chord/ <End point> | : L. |
| Length of Chord | : 80. |

### 5 Start point, end point, radius (S,E,R) (Fig 13)

In this method first specify the start point of the arc, then the end point and finally the radius of the arc.

Example

| | |
|---|---|
| Command | : Arc or A. |
| Center/<Start point> | : 400,400. |
| Center/End<Second point> | : E. |
| End point | : 350,450. |
| Angle/Direction/Radius/ <Center point> | : R. |
| Radius | : 75. |

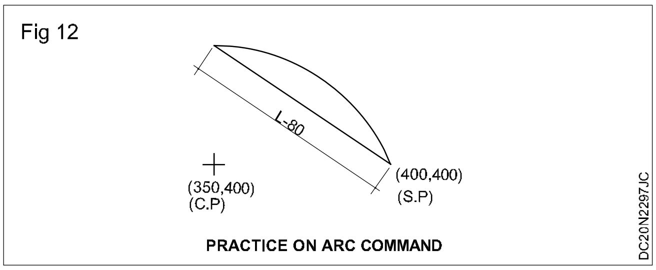



Fig 12

PRACTICE ON ARC COMMAND

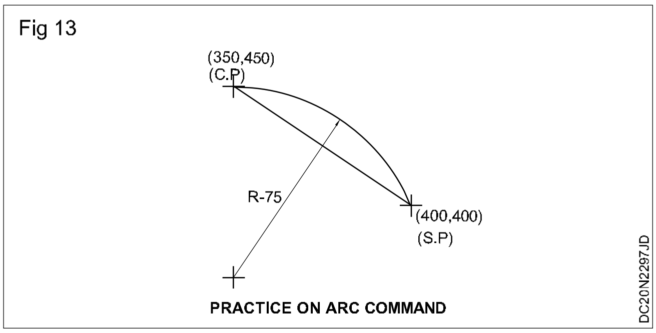



Fig 13

PRACTICE ON ARC COMMAND

**6 Start point, end point, included angle (S,E,A) (Fig 14)**

In this method first specify the start point of the arc, then the end point and finally the included angle of the arc.

Example

| | |
|---|---|
| Command | : Arc or A. |
| Center/<Start Point> | : 400,400. |
| Center/End<Second point> | : E. |
| End point | : 350,450. |
| Angle/Direction/Radius/ <Center point> | : A. |
| Included angle | : 90. |

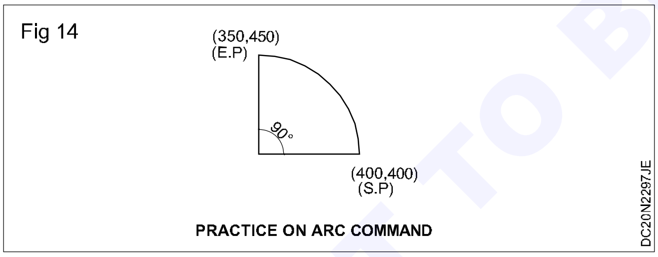



Fig 14

PRACTICE ON ARC COMMAND

**7 Start point, end point, starting direction (S,E,D) (Fig 15)**

In this method first specify the start point of the arc, then the end point and finally the starting direction of the arc from the start point.

Example

| | |
|---|---|
| Command | : Arc or A. |
| Center/<Start point> | : 400,400. |
| Center/End<Second point> | : E. |
| End point | : 350,450. |
| Angle/Direction/Radius/ | |
| <Center point> | : D. |
| Direction from start point | : 90. |

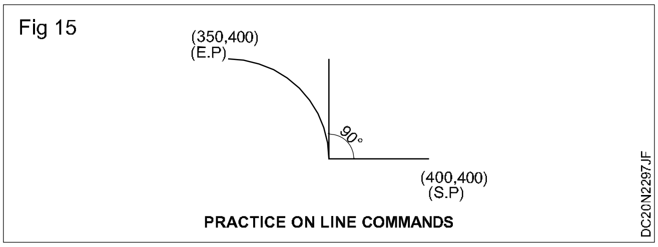



Fig 15

PRACTICE ON LINE COMMANDS

**8 Start point, end point, centre point (S,E,C) Fig 16**

In this method first specify the start point of the arc, then the end point and finally the center point of the arc.

Example

| | |
|---|---|
| Command | : Arc or A. |
| Center/<Start Point> | :400,400. |
| Center/End<Second point> | : E. |
| End point | : 250,450. |
| Angle/Direction/Radius/ <Center point> | : 350,400. |

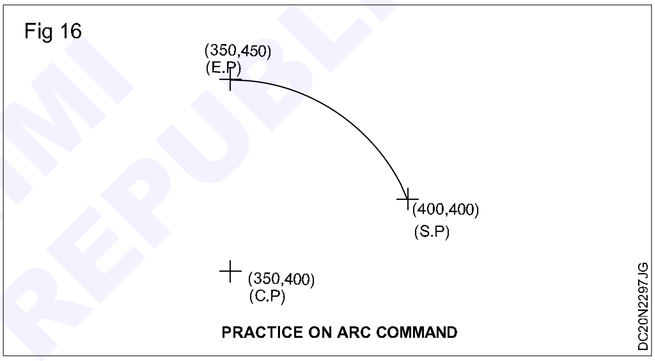



Fig 16

PRACTICE ON ARC COMMAND

**9 Centre point, start point, end point (C,S,E) (Fig 17)**

In this method first specify the center point of the arc, then the start point and finally the end point of the arc.

Example

| | |
|---|---|
| Command | : Arc or A. |
| Center/<Start point> | : C. |
| Center point | : 350,400. |
| Stat point | : 400,400. |
| Angle/Length of chord/ <End point> | : 350,450. |

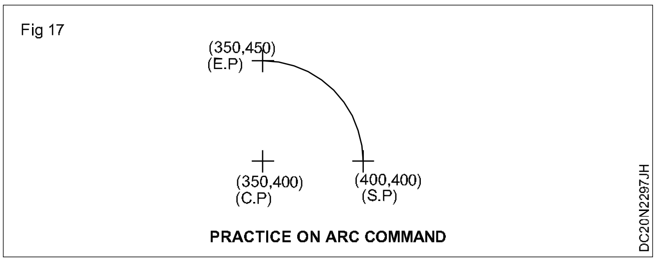



Fig 17

PRACTICE ON ARC COMMAND

### 10 Centre point, start point, length of the chord (C,S,L) (Fig 18)

In this method first specify the center point of the arc, then the start point and finally the length of chord.

Example

Command : Arc or A.

Center/<Start point> : C.

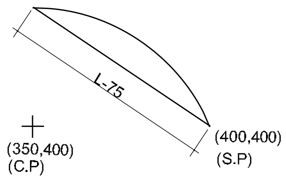
Center point : 350,400.

Stat point : 400,400.

Angle/Length of chord/<End point> : L.

Length of chord : 75.

Fig 18




PRACTICE ON ARC COMMAND

### 11 Centre point, start point, included angle (C,S,A) (Fig 19)

In this method first specify the center point of the arc, then the start point and finally the included angle.

Example

Command : Arc or A.

Center/<Start point> : C.

Center point : 350,400.

Stat point : 400,400.

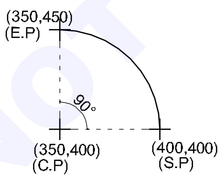
Angle/Length of chord/<End point> : A.

Included angle : 90.

**Ellipse**

This command approximates an ellipse is to choose the default options:

Fig 19




PRACTICE ON ARC COMMAND

### 1 Ellipse by axis and eccentricity (Fig 20)

Example

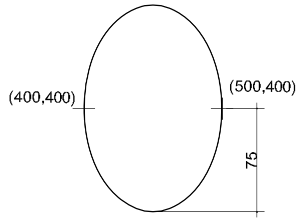
Command : Ellipse or EL.

Axis end point of ellipse or (Arc/Center) : 400,400.

Other end point of axis : 500,400.

Distance to other axis or [Rotation] : 75.

Fig 20




PRACTICE ON ELLIPSE COMMAND

### 2 Ellipse by axis and rotation (Fig 21)

Example

Command : Ellipse or EL.

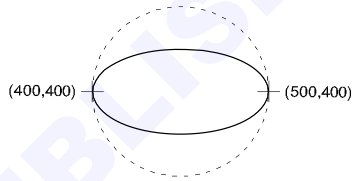
Axis end point of ellipse or (Arc/center) : 400,400.

Other end point of axis : 500,400.

Distance to other axis or [Rotation] : R.

Rotation around major axis : 60.

Fig 21




PRACTICE ON ELLIPSE COMMAND

### 3 Ellipse by centre and two axes (Fig 22)

Example

Command : Ellipse or EL.

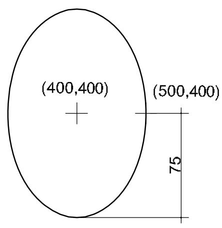
Axis end point of ellipse or (Arc/center) :400,400.

Center of ellipse : 400,400.

Axis end point : 500,400.

Distance to other axis or [Rotation] : 75.

Fig 22




PRACTICE ON ELLIPSE COMMAND

### 4 Ellipse by centre, one axis, and rotation (Fig 23)

Example

Command : Ellipse or EL.

Axis end point of ellipse or (Arc/center) : C.

Center of ellipse : 400,400.

Axis end point : 500,400.

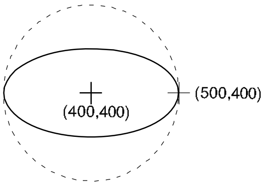
Distance to other axis or [Rotation] : R.

Rotation around major axis : 60.

**Polygon**

This command allows the user to draw regular 2D polygons.

Fig 23




PRACTICE ON ELLIPSE COMMAND

DC20N2297JN

**1 Centre of polygon, inscribed circle, radius (Fig 24)**

Example

Command : POL.

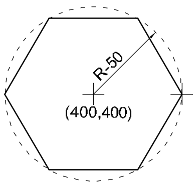
POLYGON Enter number of sides <default> : 6.

Center of polygon or [Edge] : 400,400.

[Inscribed in circle/ Circumscribed about circle]<I> : I.

Specify radius of circle : 50.

Fig 24




PRACTICE ON POLYGON COMMAND

DC20N2297JO

**2 Centre of polygon, circumscribed about circle radius of circle (Fig 25)**

Example

Command : Polygon/POL.

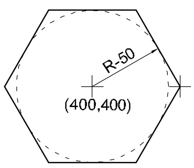
POLYGON Enter number of sides<default> : 6.

Center of polygon or [Edge] : 400,400.

[Inscribed in circle/ Circumscribed about circle]<I> : C.

Radius of circle : 50.

Fig 25




PRACTICE ON POLYGON COMMAND

DC20N2297JP

**3 Edge option (Fig 26)**

Example

Command : Polygon/POL

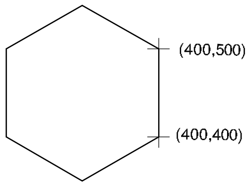
POLYGON Enter number of sides <default> : 6.

Center of polygon or [Edge] : E.

First end point of edge : 400,400.

Second end point of edge : 400,500.

Fig 26




PRACTICE ON POLYGON COMMAND

DC20N2297JQ

**Doughnut (Donut) (Fig 27)**

This command allows the user to draw filled circles and rings

**Example of filled circle option (Fig 28)**

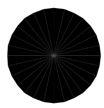
Command : Donut.

Inside diameter <default> : 0.

Out side diameter <default> : 50.

Center of doughnut : 100,100.

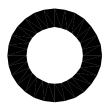
Fig 27



PRACTICE ON DOUGHNUT COMMAND

DC20N2297JR

Fig 28



PRACTICE ON DOUGHNUT COMMAND

DC20N2297JS

**Example for rings (Fig 29)**

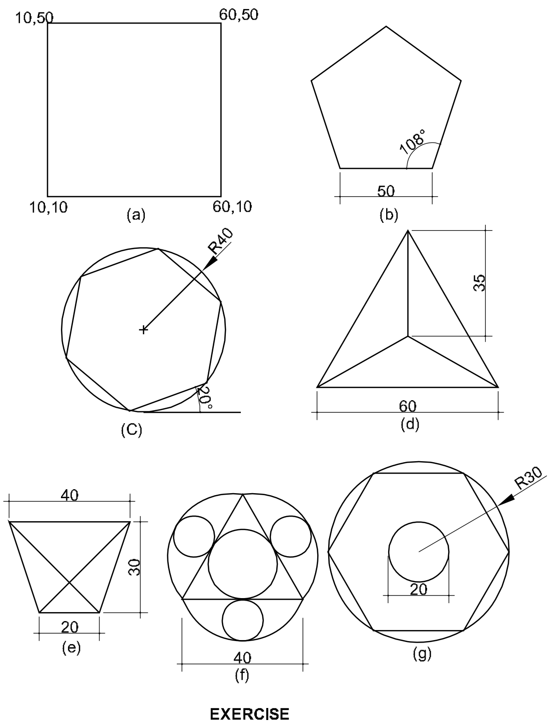
Command : Donut.

Inside diameter <default> : 30.

Out side diameter <default> : 50.

Center of doughnut : 100,100.

Fig 29




EXERCISE

## Basic commands - II

**Objectives :** At the end of this exercise you shall be able to
- **erase oops move copy offset rotate**
- **scale fillet trim champer extend break**
- **join mirror array stretch lengthen explode.**

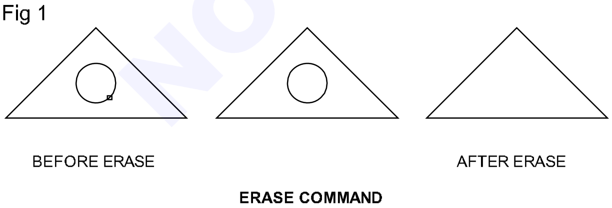
### Modifying commands

Modifying commands are used for modifying the existing drawings. Thus it helps to prepare a final drawing incorporating the necessary changes and a lot of time is saved. Modifying commands are properties, erase, copy, mirror, offset, array,move,rotate, scale, trim, extend, explode etc.

**1 Erase (Fig 1)**

This command allows the user to specify entities permanently removed from the drawing. The selection can be made with any of the standard SELECT OBJECT method.

Fig 1




ERASE COMMAND

Tool bar : Modify, Erase.

Pull down : Modify, Erase.

Command : Erase./ E.

Example

Command : Erase or E.

Select objects : Select the objects using mouse.

Select objects :

**2 Oops (Fig 2)**

This command restore objects that have been unexpectedly erased by the previous ERASE command

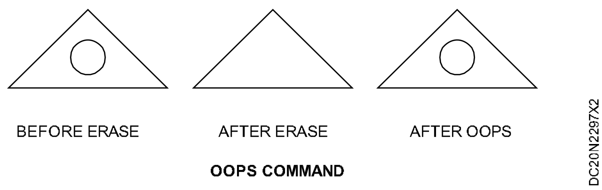
Example

Command : Erase or E

Select objects : Select the objects using mouse

Command : Oops

Fig 2



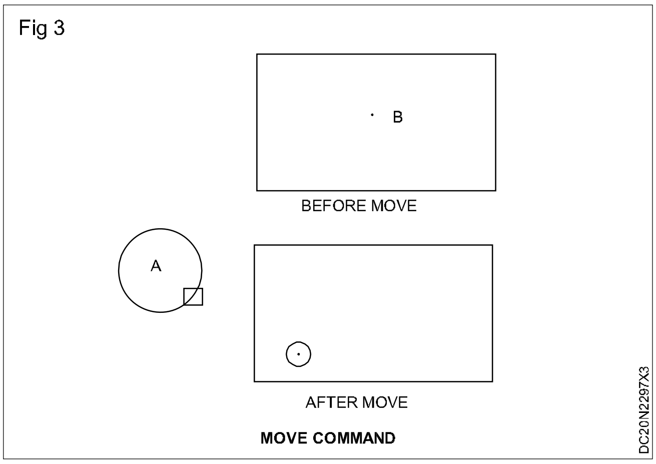

OOPS COMMAND

**3 Move (Fig 3)**

This command is used to move a single or a set of objects to a new location on a drawing.

Tool bar : Modify, Move.

| | |
|---|---|
| Pull down | : Modify, Move. |
| Command | : Move / M. |
| Example | |
| Command | : Move or M. |
| Select objects | : Select circle. |
| Select objects | : One found. |
| Select objects | : |
| Base point or displacement | : Click A as basepoint. |
| Second point of displacement | : Select B. |



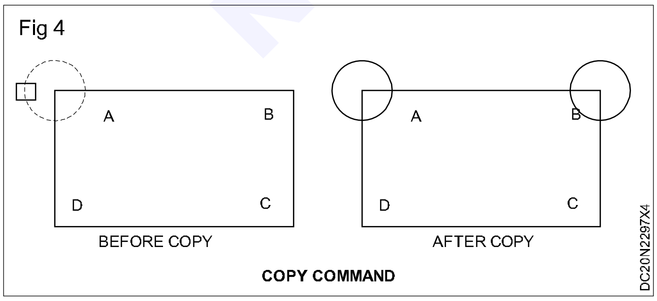

**4 Copy (Fig 4)**

| | |
|---|---|
| Tool bar | : Modify, Copy. |
| Pull down | : Modify, Copy. |
| Command | : Copy. |

This command is used to copy the existing drawing to another place.

Example

| | |
|---|---|
| Command | : Copy or Co or CP |
| Select objects | : Select object to Copy |
| Select objects | : One found |
| Base point or displacement | : Select a base point. |
| Second point of displacement | : Drag cursor at desired place and click mouse. |

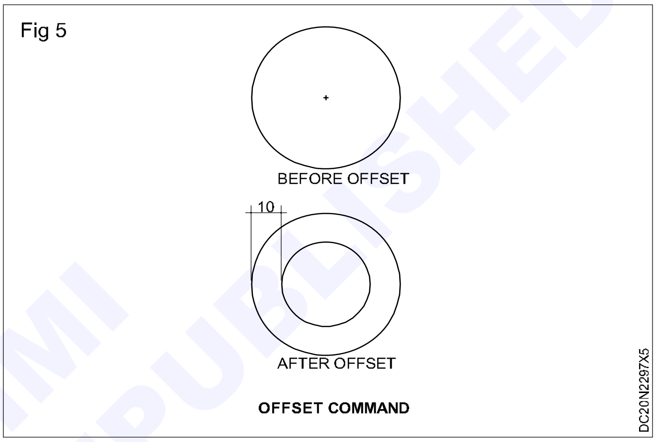



**5 Offset (Fig 5)**

| | |
|---|---|
| Tool bar | : Modify, Offset. |
| Pull down | : Modify, Offset. |
| Command | : Offset / O. |

This command is used to draw parallel lines, concentric circle, arcs etc. When offset is used, it is necessary to specify the offset distance and side of offset.

| | |
|---|---|
| Command | : Offset or O. |
| Offset distance or through <current> | : 10. |
| Select the object | : Select the circle. |
| Side to offset | : Specify the side for offsetting. |




**6 Rotate (Fig 6)**

This command is used to rotate an object or set of objects to a specified angle.

| | |
|---|---|
| Tool bar | : Modify, Rotate. |
| Pull Down | : Modify, Rotate. |
| Command | : Rotate / Ro. |
| Example | |
| Command | : Rotate / Ro. |
| Select objects | : Select the object by window. |
| Select objects | : Three found. |
| Select objects | : |

Specify base point or displacement: Click A as basepoint.

Specify rotation angle or [Copy / Reference] < default>:

Specify rotation angle or [Copy / Reference] < default>: 20.

**7 Scale (Fig 7)**

This command is used to change the size of an object

| | |
|---|---|
| Tool bar | : Modify, Scale |
| Pull down | : Modify, Scale |
| Command | : Scale / SC |

Example

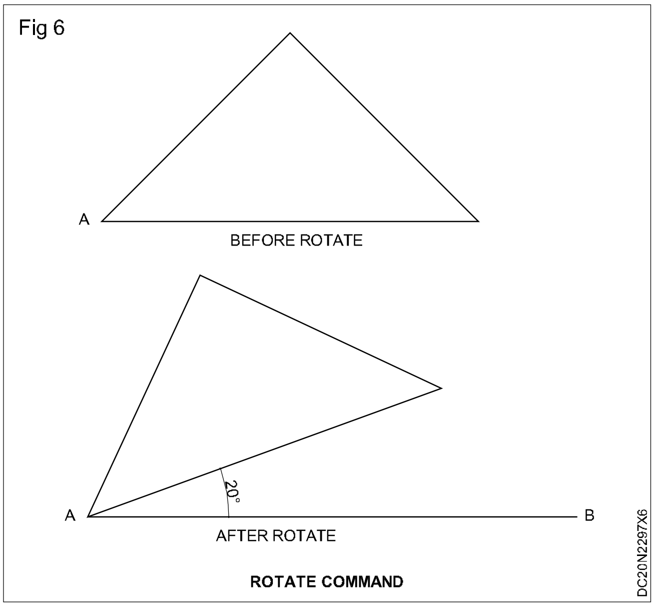


Fig 6

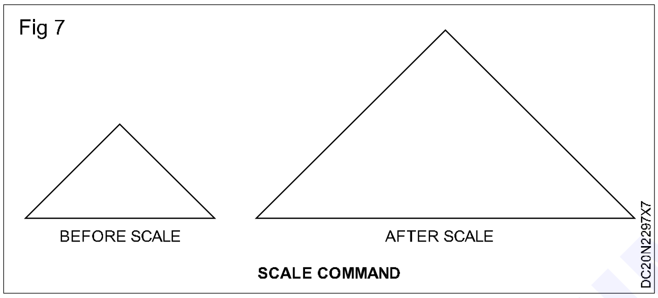


Fig 7

Command : Scale / SC

Select objects : Select the object by window.

Select objects : Three found.

Select objects :

Specify scale factor or : 2.

[Copy/Reference]<Default>

## 8 Fillet (Fig 8)

This command is used to connect two parallel lines, arcs etc., smoothly by a curve of specified radius.

Tool bar : Modify, Fillet.

Pull down : Modify, Fillet.

Command : Fillet or F.

Example

Command : Fillet or F

Current settings : TRIM, Radius = 0,0000

Select first object or [Undo/Polyline/Radius/Trim/Multiple]: R

Specify fillet radius<0.0000>

Select first object or [Undo/Polyline/Radius/Trim/Multiple]: Select A

Select second object or shift - selected to apply corner: Select B

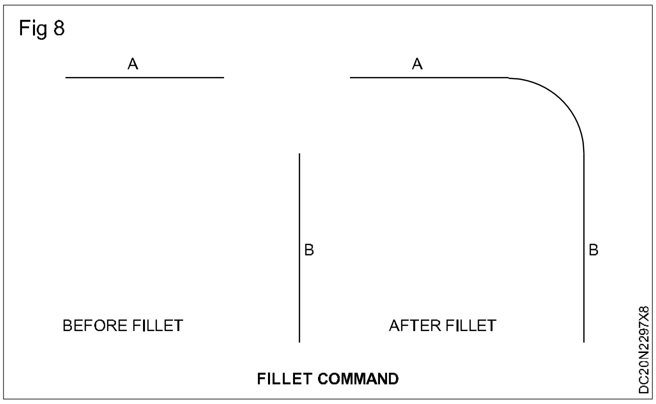


Fig 8

## 9 Trim (Fig 9)

This command is used to removed a part of a line, circle or arc based on a cutting edge.

Tool bar. : Modify, Trim.

Pull Down. : Modify, Trim.

Command : Trim or TR

Example

Command : TR TRIM.

Select objects or <Select all>: Select cutting edge, 1 found

Select objects:

Select object to trim of shift - select to extend or

[Fence / Crossing / Project / Edge / eRase / Undo]: Select object to trim.

Select object to trim or shift - select to extend or

[Fence / Crossing / Project / Edge/ Erase/ Undo]:

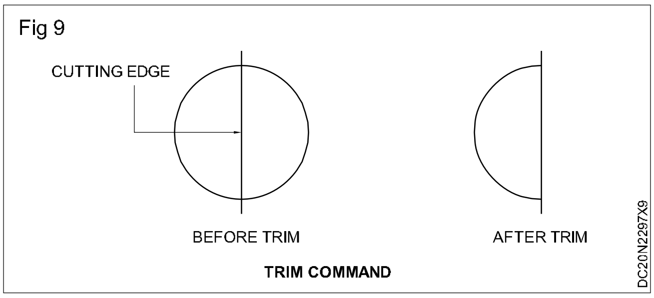


Fig 9

## 10 Chamfer (Fig 10)9.9.

This command is used to join two non parallel lines with an intermediate line. It produces an inclined surface at the edge of two interesting lines.

Tool bar : Modify, Chamfer.

Pull down : Modify, Chamfer.

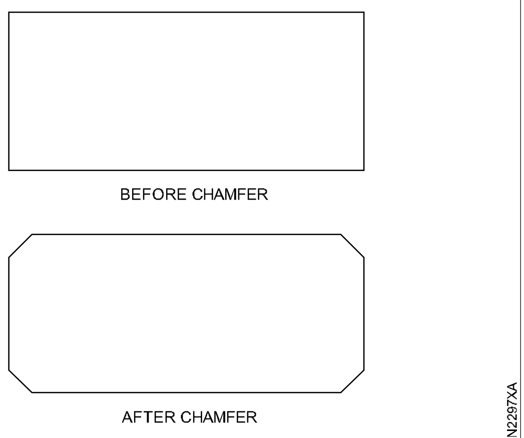
Command : Chamfer or CHA.

Example

Command : Chamfer or CHA.

(TRIM mode) Current chamfer Dist1 <Default>, Dist2 <Default>.

Fig 10




CHAMFER COMMAND

Select first line or [Undo Polyline/Distance/Angle/.

Trim/method/Multiple] : D.

Specify first chamfer distance <0.5000>.

Specify second chamfer distance <3.0000>.

Select first line:

Select second line:

**11 Extend (Fig 11)**

This command is used to extend the shorter lines to meet another object.

Tool bar : Modify, Extend.

Pull down : Modify, Extend.

Command : Extend or EX.

Example

Command : Extend or EX.

Select boundary edges.

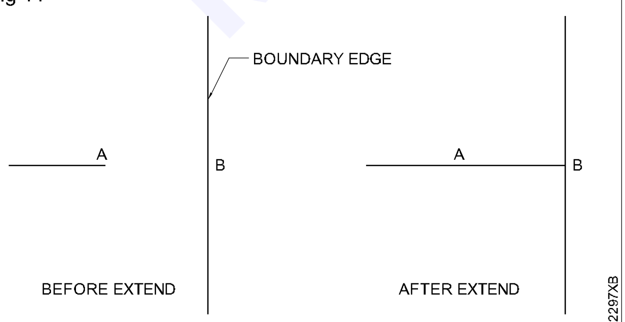
Select objects or <Select all> : Select A, 1 found.

Select objects:

Select object to extend or shift - select to trim or [Fence/Crossing/Project/Edge/Undo]:Select B.

Select object to extend or shift - select to trim or [Fence/Crossing/Project/Edge/Undo]:

Fig 11




EXTEND COMMAND

**12 Break (Fig 12)1.11.**

This command is used to erase a part of an object between two points.

Tool bar : Modify, Break.

Pull Down : Modify, Break.

Command : Break or BR.

Example1 : To break a line

Command : Break or BR.

Select objects : Select A.

Specify second break point : Select B.

Fig 12


BREAK COMMAND

**13 Join (Fig 13)2.12.**

This command is used to join two lines.

Tool bar : Modify, Join.

Pull down : Modify, Join.

Command : Join or J.

Example

Command : Join or J. Select source object.

Select lines to join to source : Select A and B.

Fig 13


JOIN COMMAND

**14 Mirror (Fig 14)**

Tool bar : Modify, Mirror.

Pull down : Modify, Mirror.

Command : Mirror or MI.

This command is used to create a miror image of the select objects. After selecting the objects the beginning point and end point of a mirror line is entered.

Example

Command : Mirror.

Select object : Select the object.

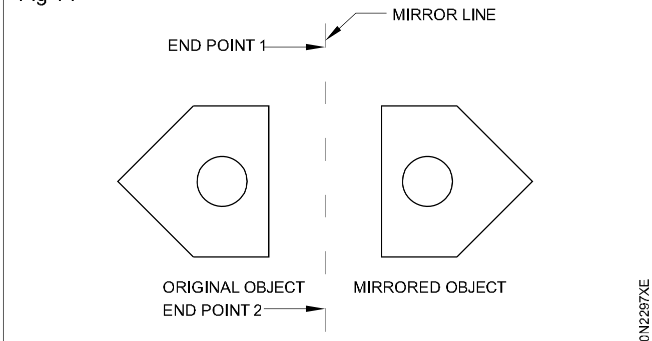
Select object :

First point of mirror line : Specify the first point.

Second point : Specify the second point.

Delete old object ? retaining <N> : Enter Y for deletion, N for the previous object.

Fig 14




MIRROR COMMAND

### 15 Array (Fig 15)

Tool bar : Modify, Array.

Pull down : Modify, Array.

Command : Array or AR.

This command is used to make multiple copies of an object in rectangular or polar (circular) patterns.

Example : 1

Command : Array.

Select objects : Select circle of radius 5.

Rectangular or polar array ( R/P) : R.

Number or rows (----) <1> : 4.

Number of columns (III) <1> : 3.

Unit cell or distance between Rows (----) : 3.

Distance between columns (III) : 3.

Example : 2

Command : Array.

Select objects : Select circle C1.

Rectangular or polar Aarray ( R/P) : P.

Base /<Centre point of Array> : Select circle C2.

Number or Items : 4.

Angle to fill <360> : Press to accept 360°.

Rotate objects as they are copied ? <Y> : Enter Y or N.

### 16 Stretch (Fig 16)

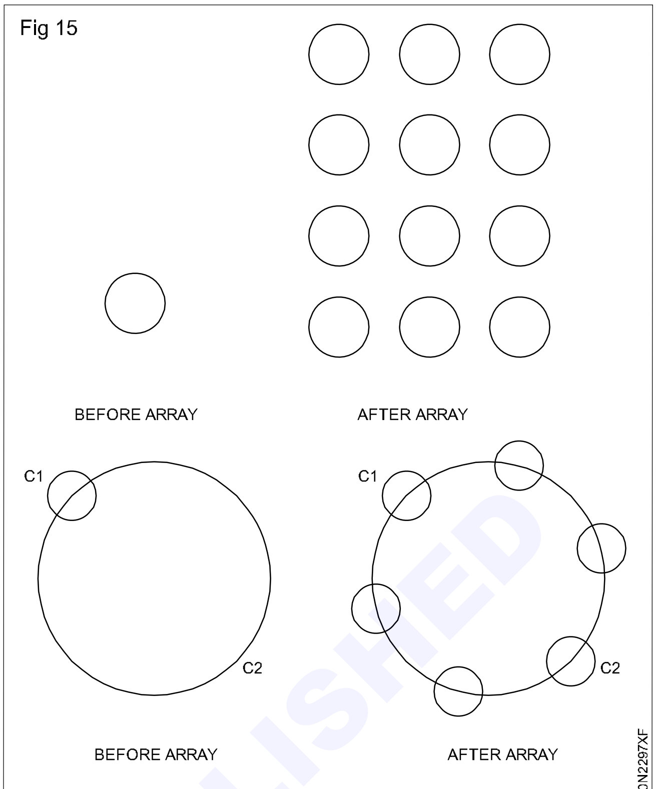
Tool bar : Modify, Stretch.

Pull down : Modify, Stretch.

Command : Stretch or S.

This command is used to lengthen or shorten the line or

Fig 15




ARRAY COMMAND

objects.

Example : 1

Command : STRETCH.

Select objects to stretch by crossing - window

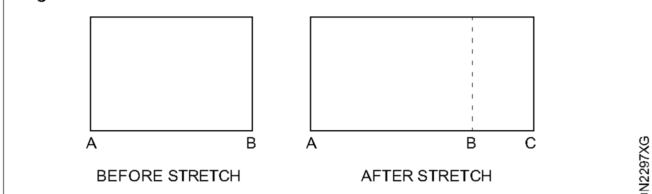
Select objects : Select A and B by crossing - window.

Select objects :

Specify base point or [Displacement] <Displacement>.

Specify second point: Mouse click at C.

Fig 16




STRETCH COMMAND

### 17 Lengthen (Fig 17)

Tool bar : Modify, Lengthen.

Pull down : Modify, Lengthen.

Command : Lengthen or LEN.

This command is used to lengthen or shorten a line.

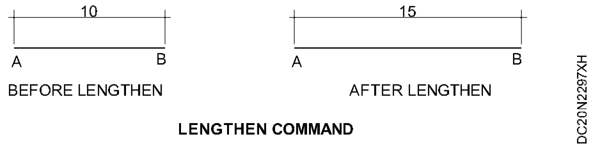
Example : 1

Command : LEN or LENGTHEN.

Select an object or [Delta/Percent/Total/Dynamic]: T

(Current length: 10).

Fig 17




LENGTHEN COMMAND

Specify total length of [Angle] <1.0000)>:15.

Select an object to change or [Undo]: Select line AB

Select an object to change or [Undo]

**18 Explode (Fig 18)**

| | |
|---|---|
| Tool bar | : Modify, Explode. |
| Pull down | : Modify, Explode. |
| Command | : Explode or X. |

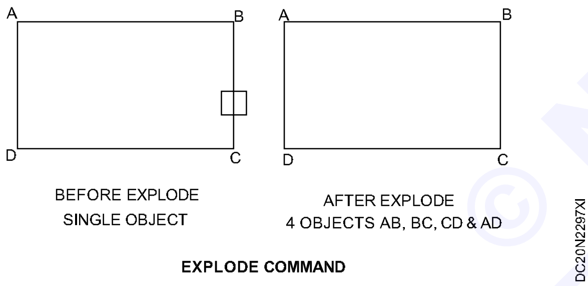
This command will split the component objects such as blocks, polylines, regions etc. If you explode a polyline the result will be ordinary lines or arcs.

Example : 1

Command : EXPLODE or X.

Select an object : Select the rectangle.

Fig 18




EXPLODE COMMAND

**19 SCALE (Fig 19)**

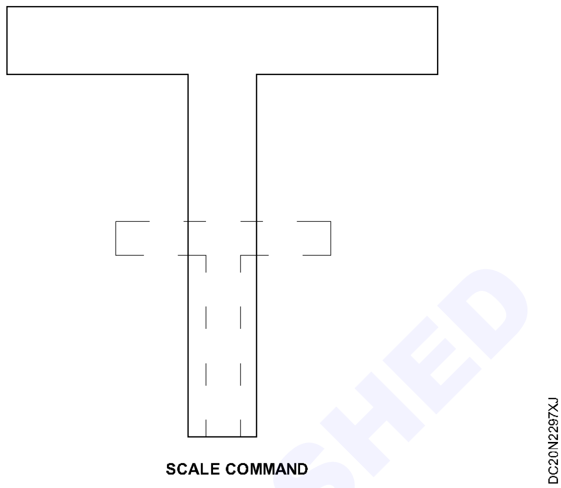
| | |
|---|---|
| Choose | Modify, Scale. |
| Click | the Scale icon. |
| Type | SCALE at the command prompt. |
| | Command : SCALE. |
| | Select objects: (Select Objects). |
| Pick | A pivot point to scale about base point : (point). |
| Type | A rotation angle <Scale factor> / Reference: (number). |
| | or |
| Pick | A scale factor< Scale Factor>/ Reference: (Point). |
| | Scale factor / Reference: (points). |

Scale by specifying length

You can show AutoCAD the reference length (by pointing to the two endpoints of a line to be scaled), and then specify the new length. You can specify the new length by pointing, or by dragging the object.

| | | |
|---|---|---|
| 1 | Type | R to define a reference length |
| | | Scale factor / Reference: (R) |

Fig 19



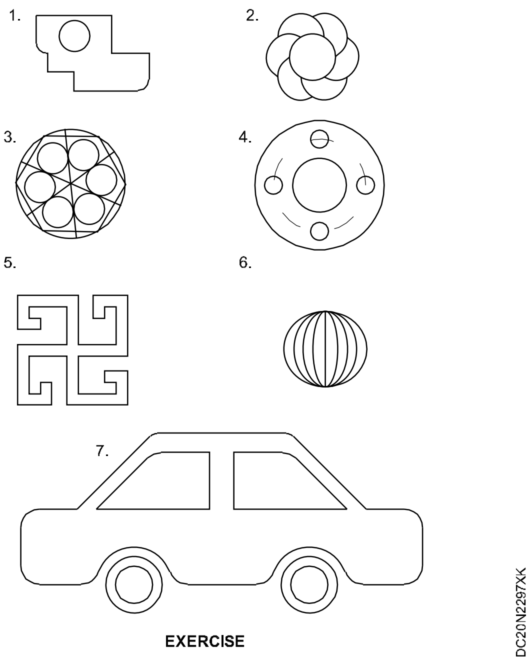

SCALE COMMAND

| | | |
|---|---|---|
| 2 | Choose | A reference scale factor. |
| | | Reference length; (number or points) |
| 3 | Choose | A new scale factor. |
| | | New length: (number of points) . |

can be closed to form enclosed to form enclosed shapes. A closed multiline automatically joins the beginning and end of the shape. When you are drawing a multiline shape, the command option 'c' closes the shape otherwise just press enter to finish the command.

**Editing multiline (Fig 20)**

Fig 20




EXERCISE

# Basic commands - III

**Objectives :** At the end of this exercise you shall be able to
- **point rectangle**
- **revision cloud spline multilines**
- **construction line (xline) ray hatch.**

**1 Point**

This command is used to display a point on the screen (Drawing area).

Command : Point.

Point : 5,6.

Changing the point type.

Normally the point appears as a dot on the screen, the style in these dialog box by clicking the pointing device (mouse) then select the OK button.

Command : PDMODE.

Pull down : Format, point style.

While using the pull - down menu, the point style dialogue box will appear select a point style in this dialog box by clicking the pointing device (mouse) then select the OK button.

Command : PDMODE.

New value for PDMODE<current>: Enter new value (2) .

Command : Point.

Point : (2.2).

**2 Rectangle**

This command is used to draw Rectangle.

Example

Command : RECTANGLE / REG.

First corner or (Chamfer / Elevation / Fillet / Thickness / Width) : 2,1

Other corner (Area / Dimension / Rotation): 5,6.

Chamfer : Used for chamfering the edges.

Fillet : Used for filleting the edges.

Width : to change the width.

**Thickness:** allows to draw rectangle that projects in Z-direction by the specified value of thickness.

**Elevation:** allows to draw a rectangle at a specified distance from the XY-plane along the Z-axis.

**3 Poly line**

This command is used to draw poly lines. The PLINE command functions like the LIKE command with additional option like arc, length, width, etc.

Example

Command : P LINE.

Start point : select a point.

Current the width is 0.0000.

Next point or (Arc / Half width / Length / Undo / Width): Select P1.

Next point or (Arc / Close / Half width / Length / Undo / Width): Select P2.

1 **Width:** To change the width of the poly line, enter W at last prompt. It asks you to enter the starting width and ending width of the poly line.

2 **Undo:** This erase the most recently drawn poly line segment. This can be invoked by entering U at the last prompt.

3 **Length:** This asks you to enter the length of a new poly line segment. This can be invoked by entering U at the last prompt.

4 **Half width:** This is used to specify the starting and ending half width or a poly line. This can be invoked by entering H at last prompt.

5 **Arc:** This is used to draw poly arcs from the previous point. It provides the various option for drawing poly arcs. The Arc option can be invoked by entering a last prompt.

**4 Revision cloud (Fig 1)**

This command is used to high light your mark-ups.

Example

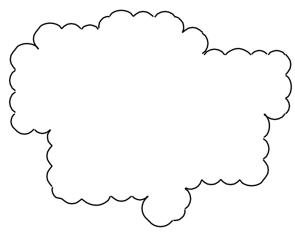
Command : REVCLOUD.

Minimum arc length: 2.0000 Maximum arc length: 3.0000 Style: Normal specify start point or (Arc length / object / Style) <Object>: Specify start point.

Guide crosshairs along cloud path:

Revision cloud finished.

Fig 1



REVISION CLOUD COMMAND

DC20N2297Y1

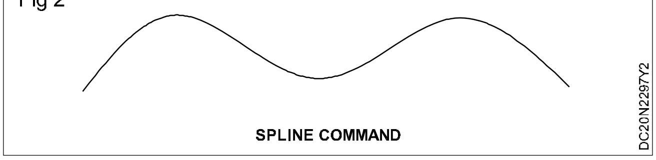
**5 Spline (Fig 2)**

Example

Command : SPLINE.

Specify first point or [Object]: Click on the first point.

Fig 2




Specify next point: <Ortho off>.

Specify next point or [Close/Fit tolerance] <start tangent>: Click on the point.

Specify next point or [Close/Fit tolerance] <start tangent>: Click on the point.

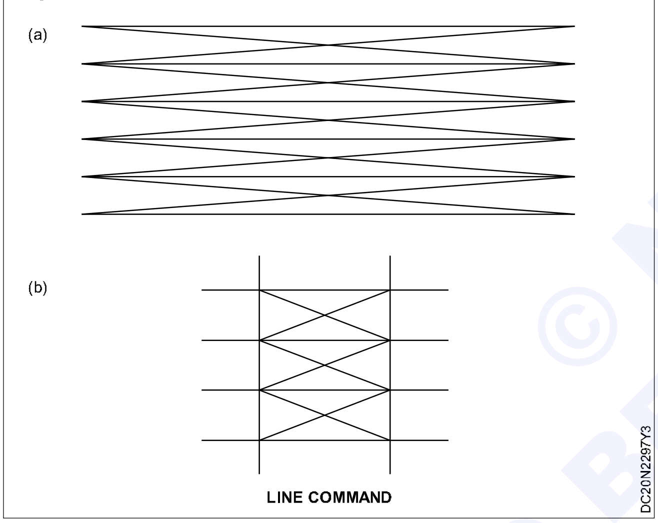
Specify next point or [Close/Fit tolerance] <start tangent>: Click on the point.

Specify next point or [Close/Fit tolerance] <start tangent>: Click on the point.

Specify next point or [Close/Fit tolerance] <start tangent>: Enter.

**Practice 1: Instructions (Fig 3a)**

Fig 3




1 Start a New file and select 1 workbook helper. Dwt.

2 Draw the objects below using:

DRAW / LINE.

ORTHO ON for Horizontal lines.

OBJECT SNAP = ENDPOINT.

3 Save this drawing as. (Fig 3b)

**Practice 2: Instructions a (Fig 4a)**

1 Start a New file and select 1 workbook helper. Dwt

2 Draw the 2 vertical and 4 horizontal lines using.

DRAW / LINE.

ORTHO (F8) = ON.

SNAP (F9) = OFF.

3 Then draw the diagonal lines using.

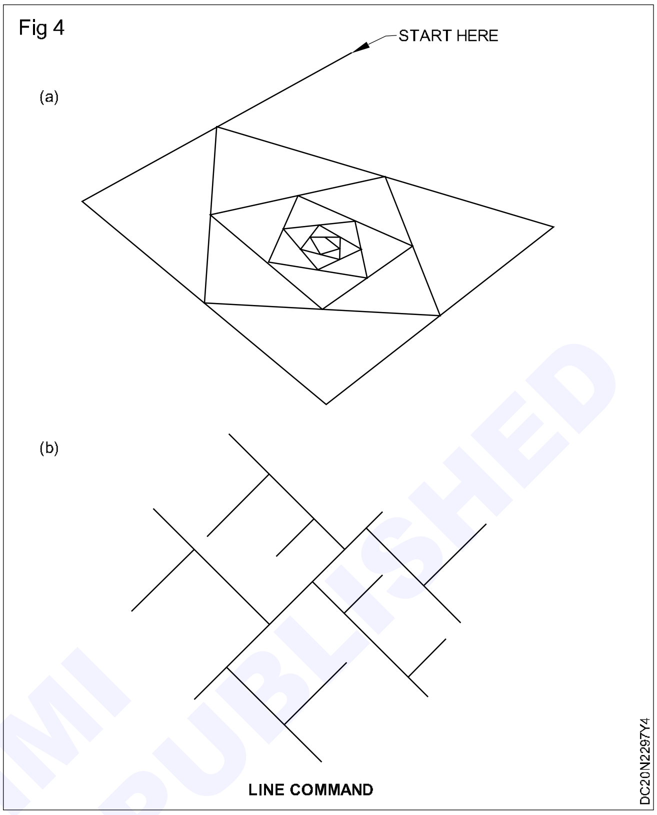
DRAW / LINE.

ORTHO & SNAP = OOF.

OBJECT SNAP = INTERSECTION.

4 Save this drawing as. ( Fig 4b)

Fig 4




**Practice 3: Instructions**

1 Start a New file and select 1 workbook dwt.

2 Using FORMAT / UNITS:

Set the units to DECIMALS.

Set the precision to 0.00.

3 Using FORMAT / DRAWING LIMITS set the drawing limits to :

Lower left corner = 0,0.

Upper right corner = 12,9.

4 Use view/zoom/ all to make the screen adjust to the new limits.

5 Turn OFF the GRIDS (F7) SNAP (F9) and ORTHO (F8)

(Your screen should be blank and your crosshair should move freely).

6 Draw the Lines below using.

DRAW / LINE.

OBJECT SNAP = MIDPOINT.

7 Save this drawing as.

**Practice 4: Instructions**

1 Using a new file and select 1 workbook helper. dwt.

2 Using FORMAT / UNITS

Set the units to ARCHITECTURAL

Set the precision to ½"

**A warning may appear asking you if you "are sure you want to change the units"? Select the OK button.**

3 Using FORMAT / DRAWING LIMITS set the drawing limits to.

Lower left corner = 0.0

Upper right corner = 25, 20

4 Use VIEW / ZOOM / ALL to make the screen adjust to the new limits

5 Turn OFF the GRIDS (F7) SNAP (F9) and ORTHO (F8)

(Your screen should be blank and your crosshair should move freely)

6 Draw the Lines below using.

DRAW / LINE

OBJECT SNAP = MIDPOINT.

7 Save this drawing as.

**Practice 5: Instructions (Fig 5a)**

1 Start a New file and select 1 workbook helper. dwt.

2 Draw the house below using at least 4 commands.

3 You can change the GRID and INCREMENT SNAP setting to whatever you like.

4 You decide when to turn Ortho and Snap On or Off. Have some fun with this one.

5 Save this drawing as.

**Practice 6: Instructions (Fig 5b)**

1 Start a New file and select 1 workbook helper. dwt.

2 Draw the rectangles below using the options, dimension, chamfer, fillet and width.

3 Save this drawing as.

**Practice 7: Instruction (Fig 6a)**

1 Start a New file and select 1 workbook dwt.

2 Using FORMAT / UNITS:

Set the units to FRACTIONAL

Set the precision to ¼".

3 Using FORMAT / DRAWING LIMITS set the drawing limits to:

Lower left corner = 0,0.

Upper right corner = 12,9.

4 Use VIEW / ZOOM / ALL to make the screen adjust to the new limits.

5 Turn OFF the GRIDS (F7) SNAP (F9) and ORTHO (F8).

Fig 5

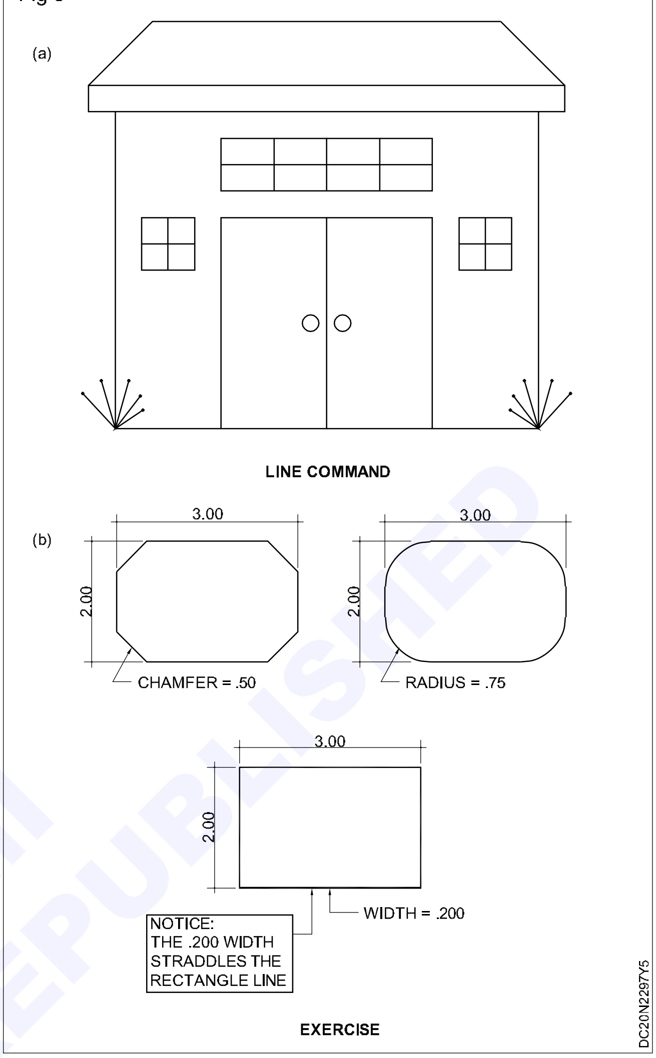
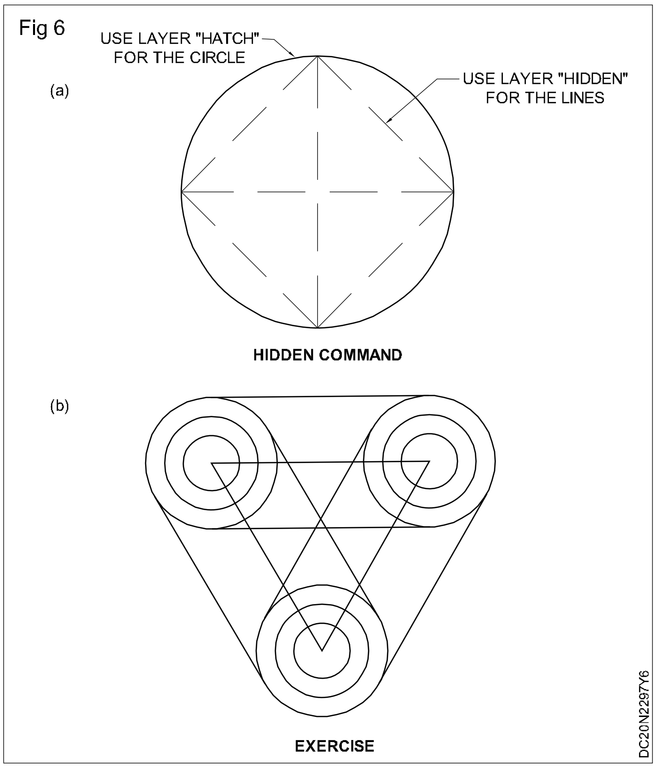



Fig 6



(Your screen should be blank and your crosshair should move freely).

6 Draw the objects below using:

DRAW / CIRCLE (CENTER, RADIUS) and LINE.

OBJECT SNAP = QUADRANT.

7 Save this drawing as.

**Practice 8: Instructions (Fig 6b)**

1 Start a New file and select 1 workbook dwt.

2 Using FORMAT / UNITS.

Set the units to FRACTIONAL.

Set the precision to ½".

3 Using FORMAT / DRAWING LIMITS set the drawing limits to:

Lower left corner = 0,0.

Upper right corner = 20,15.

4 Use view/zoom/all to make the screen adjust to the new limits.

5 Turn OFF the GRIDS (F7) SNAP (F9) and ORTHO (F8).

(Your screen should be blank and your crosshair should move freely).

6 Draw the objects below using

DRAW / CIRCLE (CENTER, RADIUS) and LINE.

OBJECT SNAP = CENTER and TANGENT.

Very important: Use the Tangent option at each end of the line. AutoCAD needs to be told that you want each end of the line to be tangent to a circle.

7 Save this drawing as.

**6 Multilines (Fig 7)**

This command allows you to draw between 1 and 16 lines parallel to each other. You must tell AutoCAD the distance between the parallel lines.

Pull down menu : Draw, Multiline.

Command : Draw multiline, ml.

Once the command is issued, Autocad responds with

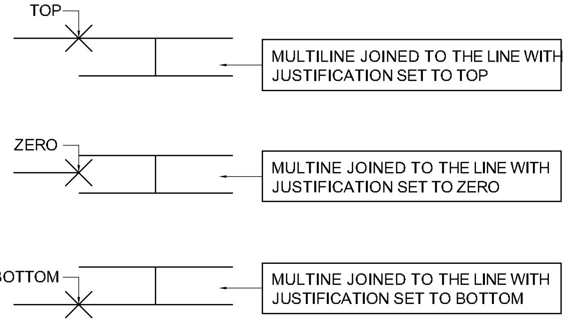
Current settings: Justification = Top, Scale = 1.00, Style= STANDARD.

Specify start point or [Justification/Scale/Style]:

Scale is the distance in units between the parallel lines. Justification determines where the start point of a vertex is. Both these settings are illustrated in the diagram below. Top, Zero and Bottom refer the justification.

Multiline can be closed to form enclosed to form enclosed shapes. A closed multiline automatically joins the beginning and end of the shape. When you are drawing a multiline shape, the command option 'c' closes the shape otherwise just press enter to finish the command.

Fig 7




MULTILINES COMMAND

Editing multiline

Command line: medit

Menu: Modify, object, multiline

When the command is issued, the multiline edit tools dialogue box is displayed. The box is divided in to four columns. Each column helps you to edit a different type of intersection.

**7 Construction line (X line) (Fig 8)**

X line is a linear object, which starts at infinite and ends at infinite, or we can say that it is a line, which has no start or end point but passes through a specified point. These lines are used for projections.

Command : X line.

Specify a point or [hor/ver/ang/bisect/offset]: use one of the point fixing methods or enter.

An option. Eg. H.

Specify through point: Use one of the point fixing methods

**8 RAY (Fig 9)**

Ray creates semi infinite lines commonly used as construction lines. A ray has a finite starting point and extends to infinity.

Command : Ray.

Menu : Draw, Ray.

Specify start point : Fix a point on the screen.

Specify through point

AutoCAD draws a ray and continue to prompt for though points so you can create multiple rays. Press to end the command.

**9 Hatch (Fig 10)**

Hatch is used to fill an area defined by lines arcs, circles or poly line with either a predefined pattern, a user defined pattern or a simple hatch pattern. It is used to show the section of solids or objects.

Tool bar: Draw, Hatch.

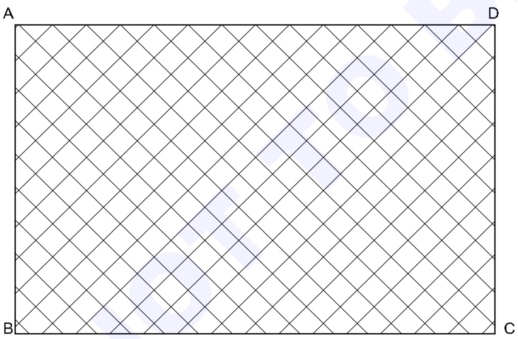
Pull down menu: Draw hatch B.

Command: Hatch or H.

Fig 8


Fig 9

Fig 10




HATCH COMMAND

DC20N2297YA

This allows you to hatch a region enclosed within a boundary by selecting the objects to be hatched. When you invoke the HATCH command. The hatch and gradient dialogue box is displayed. This dialogue box has several options which give various aspects of hatching.

**Command: Hatch or H**

1 Select type and pattern from predefined, user defined and customer select colour from gradients.

2 Mouse click on add pick point.

3 Click inside ABCD.

4 Change angle and scale if you want click on preview. If it is ok then click on in the dialogue.

Example

**Command: Hatch, H (Fig 11)**

1 Select type and pattern from predefined user defined and custom or select colour from gradient

2 Mouse click on add pick point.

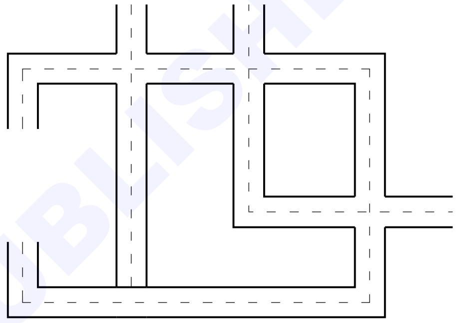
3 Mouse inside ABCD.

4 Change angle and scale if you want.

5 Click on preview.

6 If it is ok then click on OK in the dialogue box.

Fig 11



MULTILINES

DC20N2297YB

**List**

AutoCAD lists out the properties and the geometrical parameters of the selected objects.

Pull down menu :- Tools, inquiry, list.

Command: list.

Select objects: use any object selection method select rectangle ABCD.

Select objects: 1 found.

Select objects:

Properties of the rectangle ABCD = LWPOLYLINE layer: “0”

Space: Model space, Handle = d8a, Closed, Constant width 0.0000

Area 16486.7990, perimeter 551.6401.

**Distance**

Pull down menu: Tools, inquiry, distance.

To measure the distance between two points.

Command: Dist.

Specify first point: Select A.

Specify second point: Select B.

Distance = 118.6843, Angle in XY Plane = 0, Angle from

XY Plane = 0.

Delta X = 118.6743, Delta Y = 0.0000, Delta Z = 0.0000.

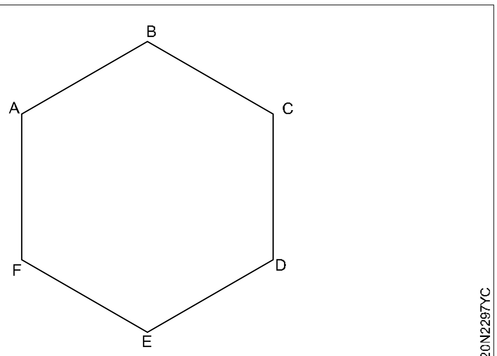
**Area (Fig 12)**

Calculate the area and perimeter of object or of defined areas.

Pull down menu: Tools, inquiry, area.

Command Area.

Fig 12




AREA COMMAND

Specify first corner point or [ Object / Add / Subtract] first point A.

Specify next corner point or press ENTER for total: Select next point B.

Specify next corner point or press ENTER for total: Select next point C.

Specify next corner point or press ENTER for total: Select next point D.

Specify next corner point or press ENTER for total: Select next point E.

Specify next corner point or press ENTER for total: Select next point F.

Specify next corner point or press ENTER for total.

Area = 8316.3401, Perimeter = 339.4622.

REGEN.

Command : Regen.

This command makes Auto CAD to regenerate the entire drawing to update it. By using this commands, the circles and arcs can be smoothened.

## Creation of object in different layers on CAD Workspace

**Objective :** At the end of this exercise you shall be able to
- **plotting drawings.**

Printing or plotting of a drawing can be done by using a printer or a plotter.

**Print or plot command (Fig 1)**

Various input facilities are available for printing a drawing. Facilities like key board, menu bar or tool bar with mouse are explained below.

**1 Printing a drawing by using key board**

Type print or plot at the command prompt area using key board and press the enter key. Now the command prompt area appears as shown below:

Command : PRINT or PLOT

Now a dialogue box namely plot appears on the screen.

**2 Printing a drawing by using menu bar with mouse**

Pick file from menu bar and plot from pull-down menu. Now a dialogue box namely plot appears on the screen.

**3 Printing a drawing by using tool bar with mouse**

Pick the icon of plot, from standard toolbar. Now a dialogue box namely plot appears on the screen.

For printing a drawing, follow the procedure shown below:

1 Pick the plot device tab.

2 Select the printer name (Say, HP deskjet) from the combo box.

3 Pick plot setting tab.

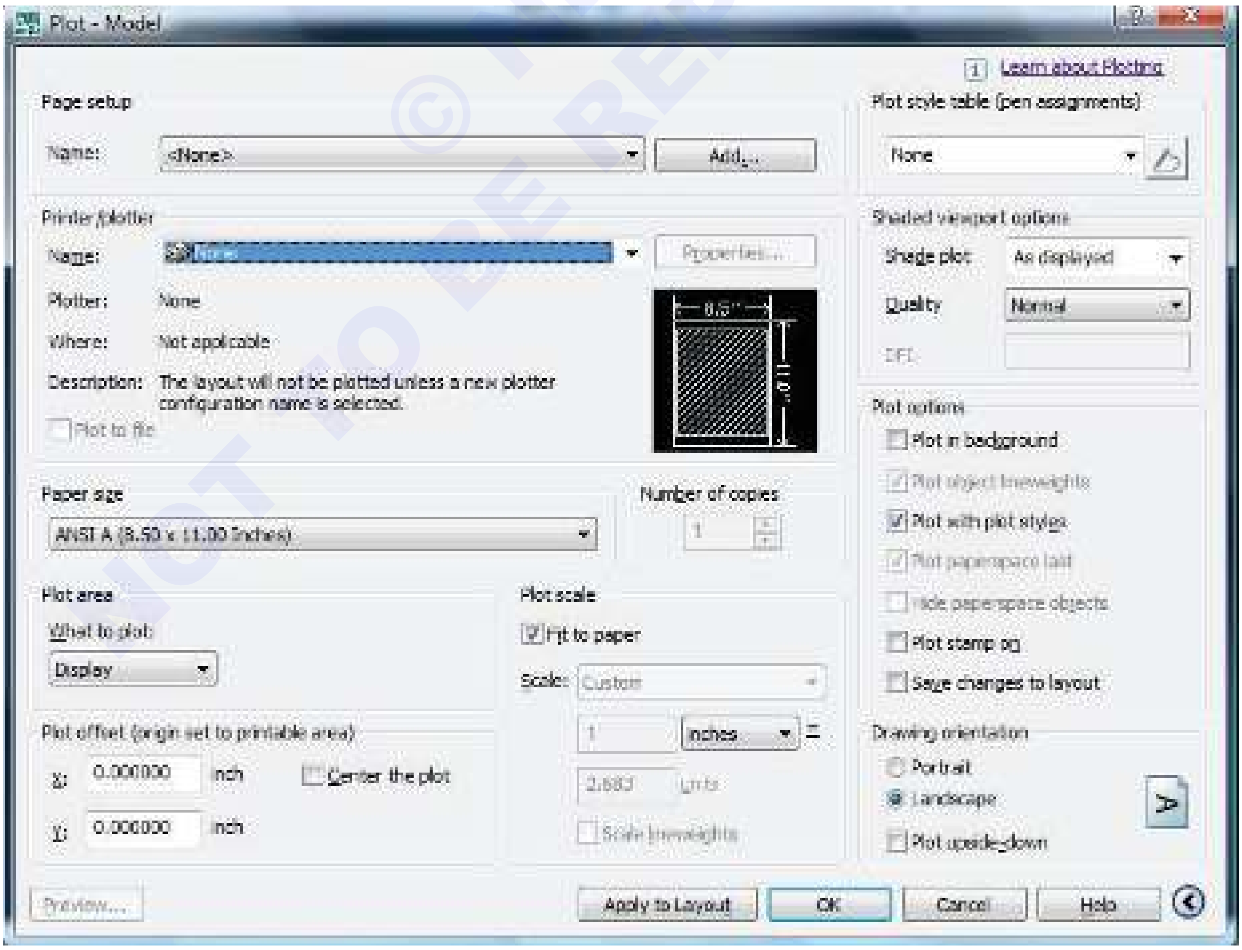
4 Select a paper size (say, A4-210 x 297 mm) from the combo box provided against the paper size.

5 Pick the drawing orientation option (say portrait)

6 Then select the scale 1:1 from the combo box under plot scale.



Fig 1



7 Pick the window button under the heading plot area. Now, the cursor and drawing appears on the screen and command prompt area show, specify first corner: (Here, specify the first corner for the window on the screen).

Specify opposite corner: ( Here, Specify the opposite corner for the window).

8 Pick the full preview button provided on the bottom left of the dialogue box.

9 Now the paper lay out with selected drawing appears on the screen.

10 Then click the right button of the mouse and pick exit from the button menu.

11 The dialogue box again appears on the screen.

12 Click OK button.

Now, the plotted drawing is obtained from the plotting device.

## Layers

**Objective:** At the end of this exercise you shall be able to
- **layers**.

### Layers (Fig 1)

An Auto CAD drawing can be constructed over several layers. A layer is like a transparent sheet of paper which holds drawing objects. For example, a drawing of the plans of a house could be constructed as follows: the walls would occupy a layer called 'walls', the doors and windows would be placed on a layer called 'fittings' etc. When the drawing is structured in this way you have control over numerous aspects of the work. Auto CAD supplies you with one default layer named 0. Any other layer must be created by the user, although you can assign as many layers as you like to a drawing.

### Setting up a new layer

Here we will set up two layers called hatch and fittings. To create a new layer first issue the layer command.

Pull down menu: Format, Layer

Command line: Layer, LA

In the layer properties dialogue box, click on new

Fig 1

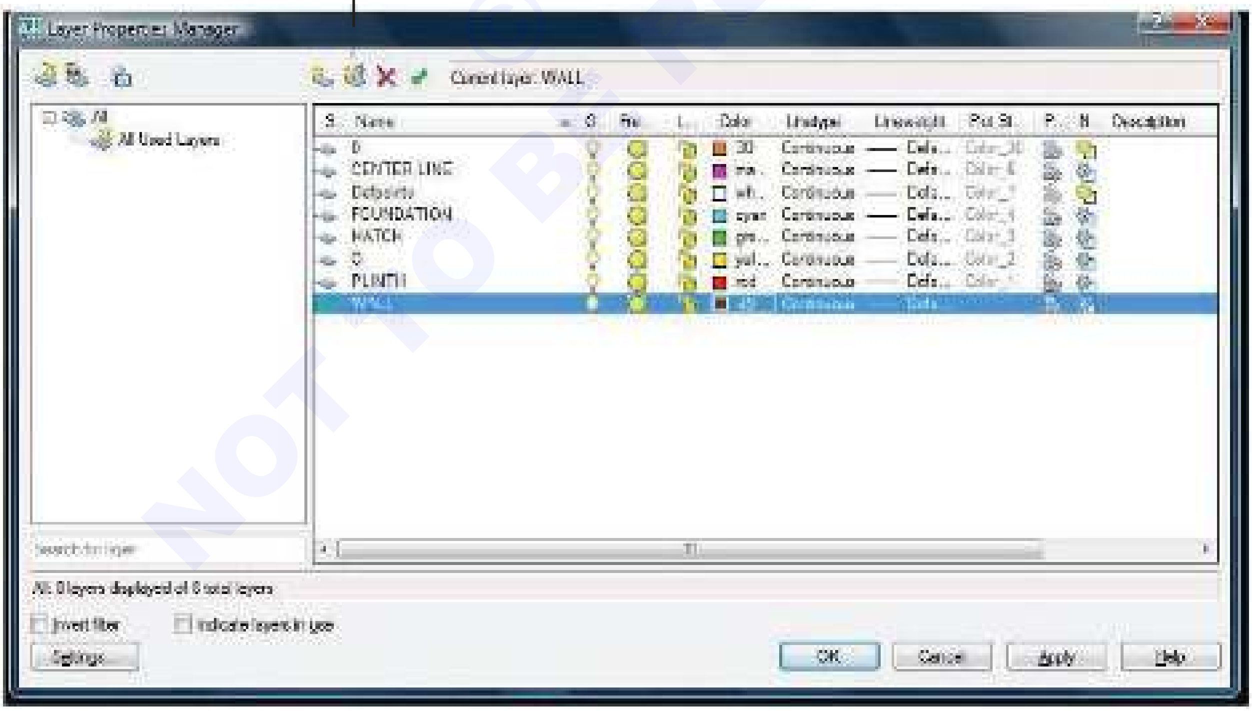


Fig 2


Click on the colour for the hatch colour in the select colour dialogue box

click ok

Click on line type (Fig 2 & 3)

Fig 3


click ok

select line type

click on line weight

click on apply m click on ok on the layer properties manager dialogue box

**Making a layer current (Fig 4)**

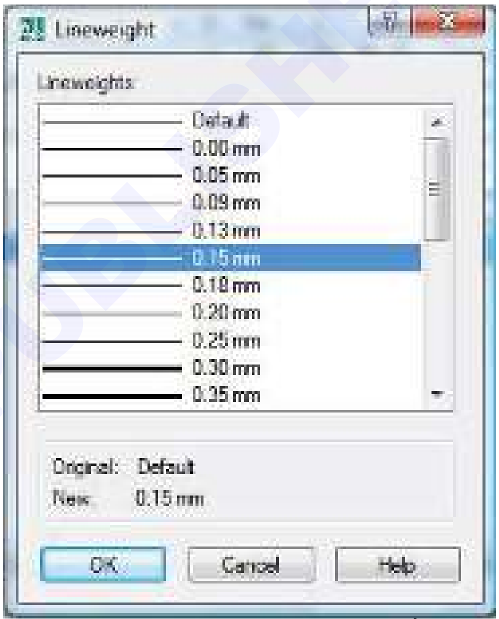
A layer must be current before you can draw on it. To make the layer (hatch) current, carryout the following easy steps

i Click on the layer name in the layer properties manager dialogue box, then click on the current button.

ii Click ok to return to the drawing editor.

iii The object properties toolbar at the top of the screen (see below) will show the name of the current layer and its colour. Try drawing something it will appear in colour 53. (Fig 5,6 & 7)

Fig 5




click ok

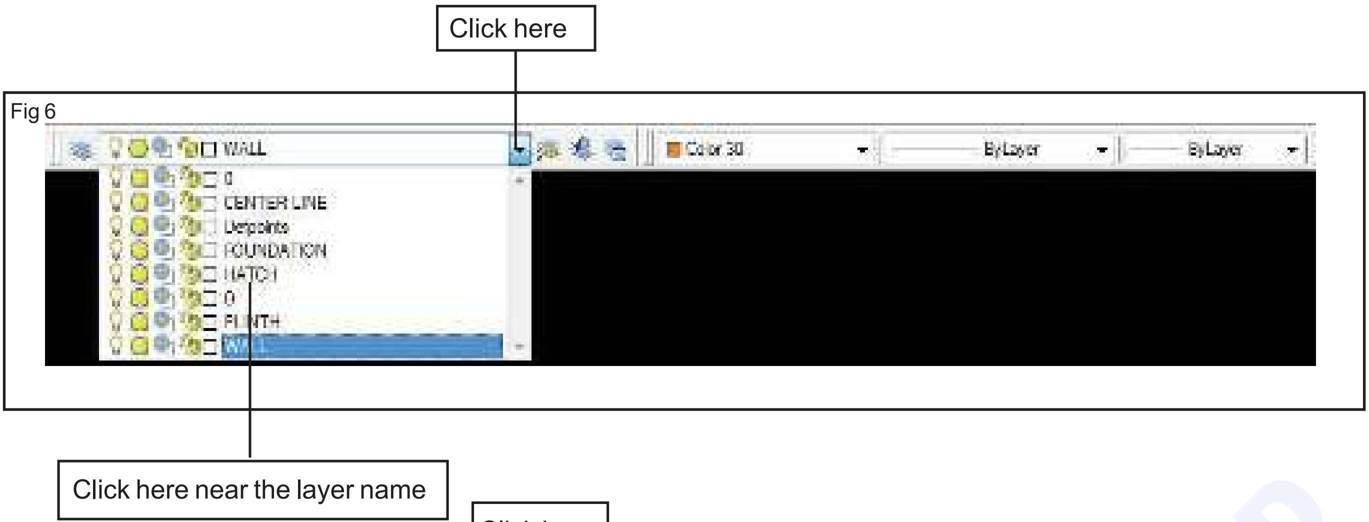
select line weight

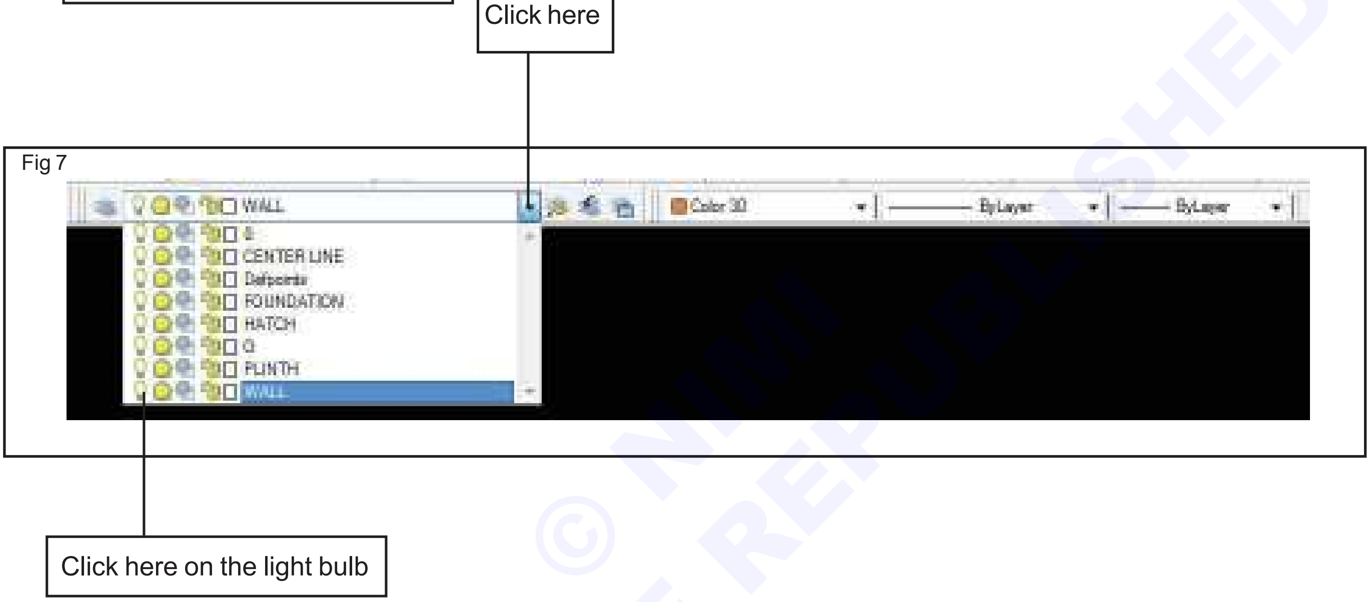
Fig 4


layers icon

current layer and color

Alternatively, to make a layer current from within the Drawing editor.




Click on the drawing editor any where.

**Making layer visible or invisible**

Complex drawings may become cluttered, when can make it difficult to select objects for editing or drawing. This clutter may be reduced by making a layer invisible if you are not working on it. When layer is made invisible, the objects drawn on it disappear from the screen, but they still exist and are part of the drawing. Layers which are invisible are not click out on the drawing editor anywhere. Clickout on the drawing editor anywhere.

Several layers can be made invisible if required. The icon for visible is a glowing light bulb. Invisibility is shown by a dull light bulb.

Practice 1 : Instructions (Fig 8)

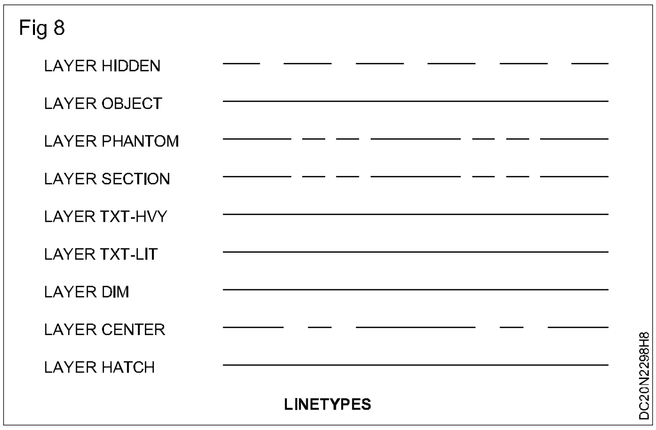
1 Start a New file and select 1 workbook helper. dwt

2 Draw the LINES below using:

Draw / Line

Ortho (f 8) ON (to help you draw horizontal lines)

Increment snap (f 9) ON




3 Change to the appropriate layer before drawing each line.

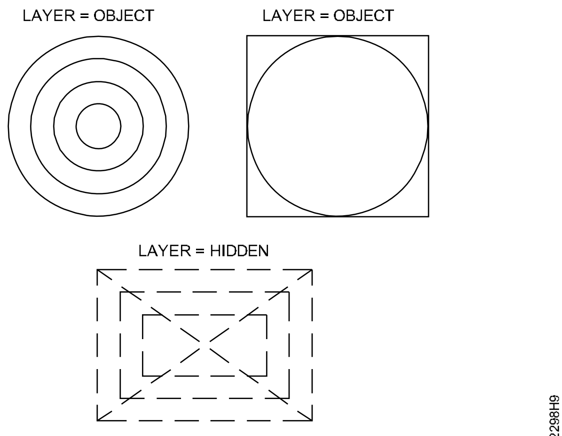
4 Save this drawing using:

File / Save as / (File name)

Practice 2 : Instructions (Fig 9)

1 Start a New file and select 1 workbook dwt

Fig 9




LAYERS

2 Change the GRID SPACING to .40 and SNAP to .20

Using: TOOLS/DRAFTING SETTINGS

3 Draw the objects below, use the layers indicated.

4 Save this drawing using:

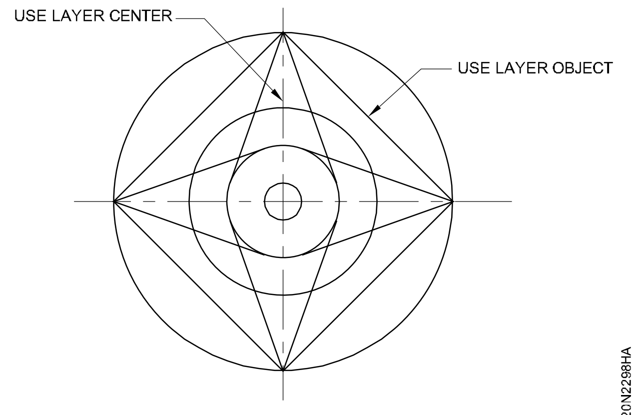
File/Save as/ (File Name)

**Practice 3 : Instructions (Fig 10)**

1 Start a New file and select 1 workbook dwt

2 Draw the 4 circles with the following Radii: 1,2,3, & 5

Fig 10




EXERCISE

(use Object snap "Center" so all Circles have the same center)

3 Draw the lines using

DRAW/LINE

ORTHO and SNAP = OFF

OBJECT SNAP = QUADRANT and TANGENT 4. Use Layers: Object and Center

5 Save this drawing as (File name)

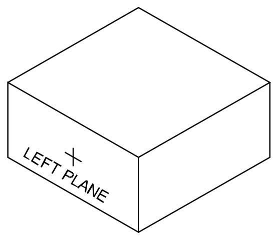
## Plotting of Drawing from CAD

**Objectives :** At the end of this exercise you shall be able to
- **identify ISO axes**
- **practice ISO drawings.**

### ISO metric drawing

Isometric drawing have three principal planes. They are isoplane right, isoplane top and the isoplane left.(Fig 1)

Fig 1




LEFT
ISOMETRIC DRAWING
DC20N2299H1

### ISO planes

To turn on an isometric plane

1 Click Tools menu>> Drafting Settings.

2 In the Drafting settings dialog box, snap and grid tab, under snap type, select isometric snap.

3 Click OK.

You can cycle through the three isometric planes by pressing F5.

Command: Isoplane ( or Isoplane for transparent use)

Enter isometric plane setting [left/top/right] <top>: enter an option or press ENTER.

The isometric plane affects the cursor movement keys only when Snap mode is on and the snap style is isometric. If the snap style is Isometric, Ortho mode uses the appropriate axis pair even if Snap mode is off. The current isometric plane also determines the orientation of isometric circles drawn by ELLIPSE. You can cycle through the isometric planes by pressing CTRL+ E or F5.

### Left

Selects the left - hand plane, defined by the 90 - degree and 150-degree axis pair.

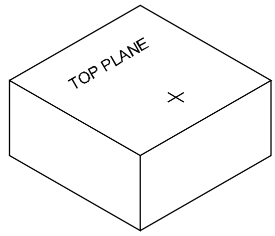
### Top

Selects the top face of the cube, called the top plane, defined by the 30- degree and 150 - degree axis pair. (Fig 2)

### Right

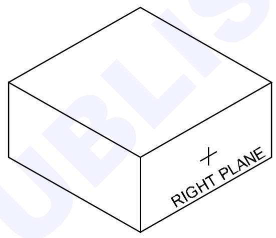
Selects the right - hand plan, defined by the 90-degree and 30- degree axis pair.(Fig 3)

Fig 2




TOP
ISOMETRIC DRAWING
DC20N2299H2

Fig 3




RIGHT PLANE
ISOMETRIC DRAWING
DC20N2299H3

When the snap style has been set to isometric, you will find isocircle. Option under ellipse command. Use this to draw circle and arcs in isometric plane.

### Example

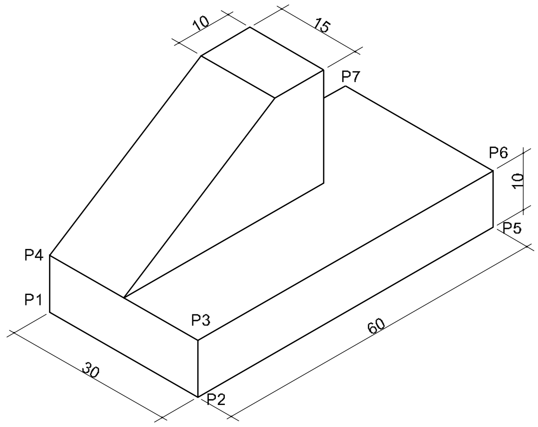
1 Create the isometric drawing shown in the (Fig 4)

### Step- 1

Change the isometric view by using snapcommand.

Command: snap

Fig 4




ISOMETRIC DRAWING
DC20N2299H4

Specify snap spacing or [ON/OFF/Aspect/Style / Type]<0.5000>:s Enter snap grid style [Standard/ Isometric] <S>:i

Specify vertical spacing <0.5000>.

**Step- 2**

Change the isoplane to isoplane left by pressing Ctrl+E or F5. Now draw lines between points P1, P2, P3 and P1.

**Step- 3**

Change the isoplane to isoplane right by pressing Ctrl + E or F5. Now draw lines between points P3, P2, P5, and P6.

**Step- 4**

Change the isoplane to isoplane top by pressing Ctrl +E or F5. Now draw lines between points P6, and P7.

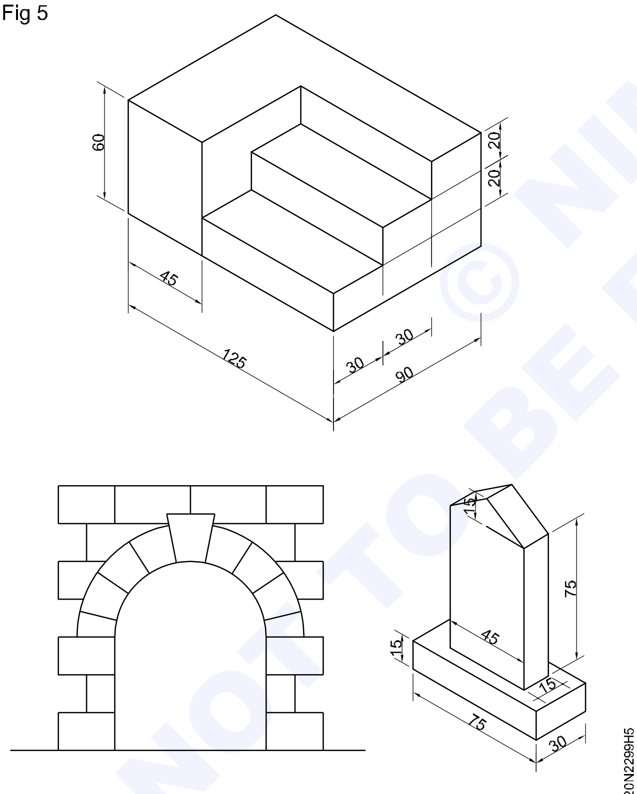
**Step- 5**

Change the corresponding plane by pressing Ctrl +E or F5 and continue the procedure.

Create the isometric drawing shown Fig 5

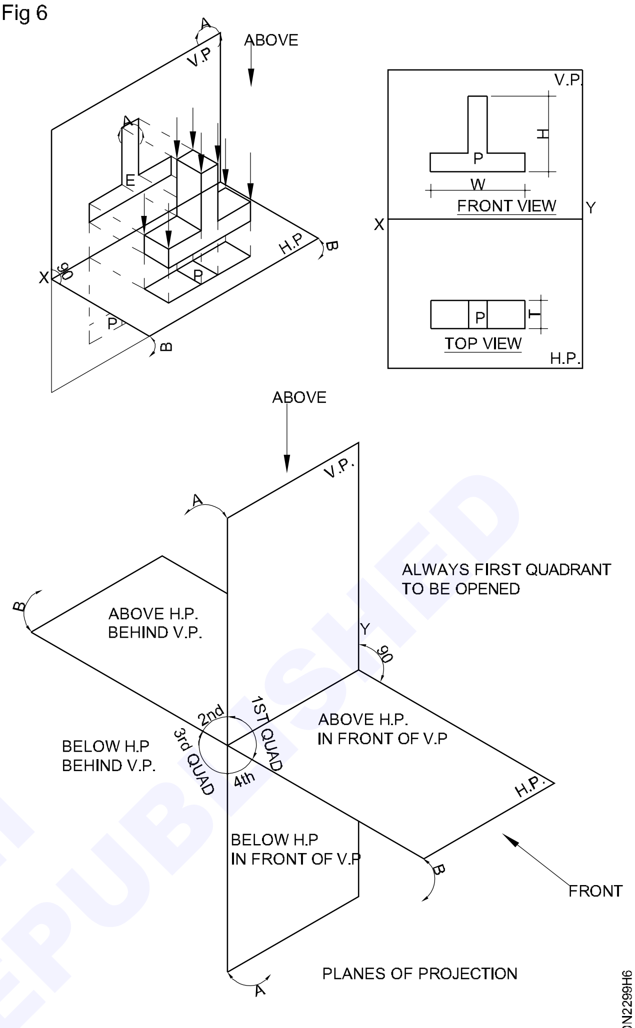
Create the orthographic projection drawing shown in Fig 6

Fig 5




ISOMETRIC DRAWING

Fig 6




PROJECTIONS

# Dimensioning & text

**Objectives :** At the end of this exercise you shall be able to
- **dimensioning**
- **text & text style.**

**Dimensioning commands**

While manufacturing an object, the drawing must contain size description such as the length, width, height, angle, radius, diameter and location of the object. These are added to the drawing with the help of dimensioning.

### 1 Dimension - linear (Fig 1)

This command is used to measure horizontal and vertical dimensions between two points.

Tool bar : Dimension, Linear

Pull Down : Dimension, Linear

Command : DIM LIN /DLI

Example

Command : DIM LIN / DLI

Specify first extension line origin of : Selection point A

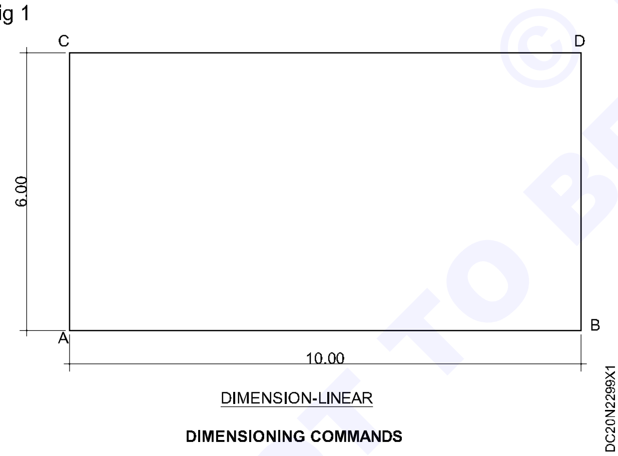
Specify second extension line original : Select point B

Specify dimension line location or

[Mtext/Text/Angle/Horizontal/Vertical/Rotated]: Mouse click on the position where the dimension is to be placed

Dimension text = 6.00

Fig 1




DIMENSION-LINEAR

DIMENSIONING COMMANDS

### 2 Dimension - aligned (Fig 2)

This command is used to measure inclined dimension between two points.

Tool bar : Dimension, Aligned

Pull down : Dimension, Aligned

Command : DIM ALI /DAL

Example

Command : DIM ALI/DAL

Specify first extension line origin or : Select point A

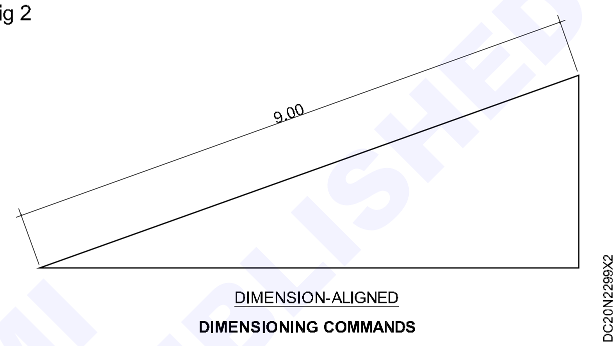
Specify first extension line origin : Select point B

Specify dimension line location or

[Mtext/Text/Angle/Horizontal/Vertical/Rotated]: Mouse click on the position where the dimension is to be placed

Dimension text = 9.00

Fig 2




DIMENSION-ALIGNED

DIMENSIONING COMMANDS

### 3 Dimension - ARC length (Fig 3)

This command is used to measure the length of an arc.

Tool bar : Dimension, Arc length

Pull Down : Dimension, Arc length

Command :DIMARC/DAR

Example

Command : DIM ARC / DAR

Command : DAR DIMARC

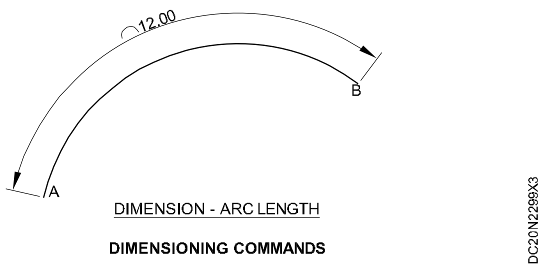
Select arc or polyline arc segment

Specify arc length dimension location,

Or [Mtext/Text/Angle/Partial/Leader]: Mouse click on the position where the dimension is to be placed

Dimension text = 12.00

Fig 3




DIMENSION - ARC LENGTH

DIMENSIONING COMMANDS

### 4 Dimension - radius(Fig 4)

This command is used to measure the radius of an arc or circle.

Tool bar : Dimension, Radius

Pull Down : Dimension, Radius

Command : DIM RA/DRA

Example:

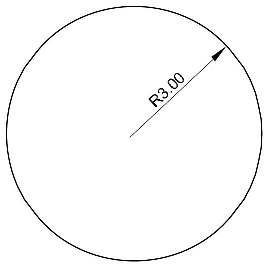
Command : DIM RA / DRA

Select arc or circle : Select the circle

Dimension text = 3.00

Specify dimension line location or [Mtext /Text/Angle]

Fig 4




DIMENSION - RADIUS

DIMENSIONING COMMANDS

DC20N2299X4

## 5 Dimension - jogged (Fig 5)

Tool bar : Dimension, Jogged

Pull Down : Dimension, Jogged

Command : DIM JO/DJO

Example

Command : DIM JO/DJO

Select arc or circle : Select the circle

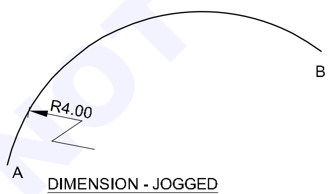
Specify center location override: Select center

Dimension text = 4.00

Specify dimension line location or [Mtext /Text/Angle]

Specify jog location: Mouse click on the position where the dimension is to be placed.

Fig 5




DIMENSION - JOGGED

DIMENSIONING COMMANDS

DC20N2299X5

## 6 Dimension - diameter (Fig 6)

This command is used to measure the Diameter of a circle.

Tool bar : Dimension, Diameter

Pull Down : Dimension, Diameter

Command : DIM DIA/DDI

Example:

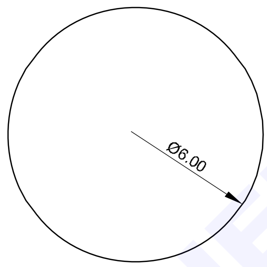
Command : DIM DIA/DDI

Select arc or circle : Select the circle

Dimension text = 6.00

Specify dimension line location or [Mtext /Text/Angle] Mouse click on the position where the dimension is to be placed.

Fig 6




DIMENSION -DIAMETER

DIMENSIONING COMMANDS

DC20N2299X6

## 7 Dimension - Angular (Fig 7)

This command is used to measure the Angle between two non parallel straight lines.

Tool bar : Dimension, Angular

Pull Down : Dimension, Angular

Command : DIM ANG/DAN

Example

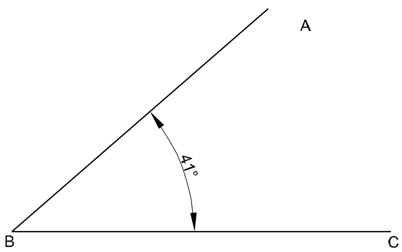
Command : DIM ANG/DAN

Select arc, circle, line, or <specify vertex>: Select AB

Specify dimension line location or [Mtext /Text/Angle]: Mouse click on the position where the dimension is to be placed.

Dimension text = 41

Fig 7




DIMENSION - ANGULAR

DIMENSIONING COMMANDS

DC20N2299X7

## 8 Dimension - continue (Fig 8)

This command is used to continue dimensioning after the first dimensioning has been executed.

Tool bar : Dimension, Continue

Pull Down : Dimension, Continue

Command : DIM CON/DCO

Example

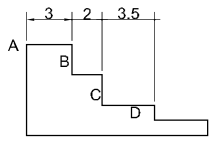
Command : DIM CON/DCO

Specify a second extension line origin or [Undo/Select] <Select>: Select C

Specify a second extension line origin or [Undo/Select] <Select>: Select D

Specify a second extension line origin or [Undo/Select] <Select>: Cancel

Fig 8




DIMENSION - CONTINUE

DIMENSIONING COMMANDS

DC20N2299X8

## 9 Dimension - base line (Fig 9)

This command is used to give dimension when number or dimensions of a part have a common datum.

Tool bar : Dimension, Base line

Pull Down : Dimension, Base line

Command : DIM LEA/LE

Example

Command : DIM LEA/LE

Specify first leader point, Select point A

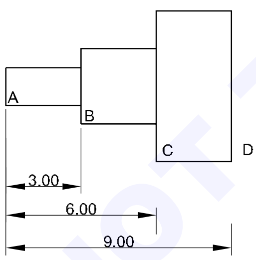
Specify next point: Select point B

Specify next point:

Specify text width <0.0000>:

Enter first line of annotation text <Mtext>: WOODEN BLOCK

Fig 9




DIMENSION -BASELINE

DIMENSIONING COMMANDS

DC20N2299X9

## 10. Dimension - leader (Fig 10)

This command is used to give leader lines i.e. used to describe some features in the drawing.

Tool bar : Dimension Leader

Pull Down : Dimension Leader

Command : DIM LEA/LE

Example

Command : DIM LEA/LE

Specify first leader point, Select point A

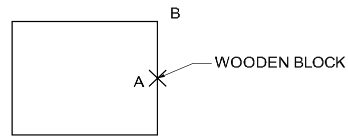
Specify next point: Select point B

Specify next point

Specify text width <0.0000>

Enter first line of annotation text <Mitest> WOODEN BLOCK

Fig 10




DIMENSION - LEADER

DIMENSIONING COMMAND

DC20N2299XA

## 11 Dimension - style (Fig 11 to 16)

Tool bar : Dimension, Dimension style

Pull Down : Dimension, Dimension style

Command : D

This command is used to select or change the properties of a dimension. When you enter this command the dimension style manager dialogue box will be displayed. This dialogue box provides various options for modifying the dimension. Click on modify and give the new values.

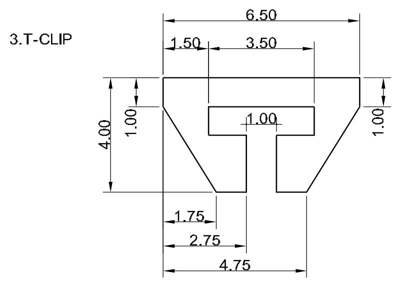
**Dimension style**

Pull down menu: Dimension, Dimension style

When you select this, a dimension style manager dialogue box will appear on the screen.

A dimension style is a saved set of dimension settings defining the appearance and behaviour of the dimensions. By creating dimension styles. You can set all relevant dimension system variables and control the layout and appearance of all dimensions within a drawing.

Fig 11




T - CLIP

DC20N2299XB

**Description**

Sets the dimension line properties

1 Colour displayed and sets the colour for dimension line.

2 Line type sets the type of the dimension line.

3 Line weight sets the line weight of the dimension line.

Fig 12

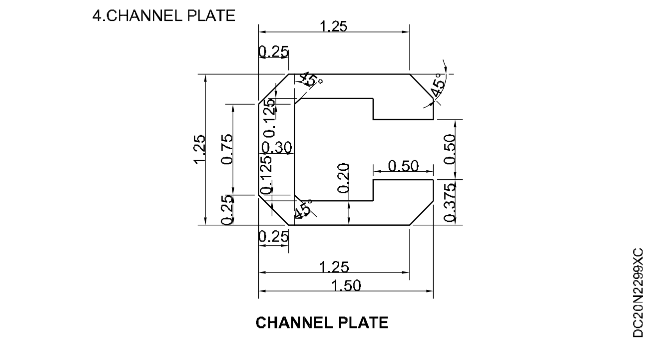



Fig 14

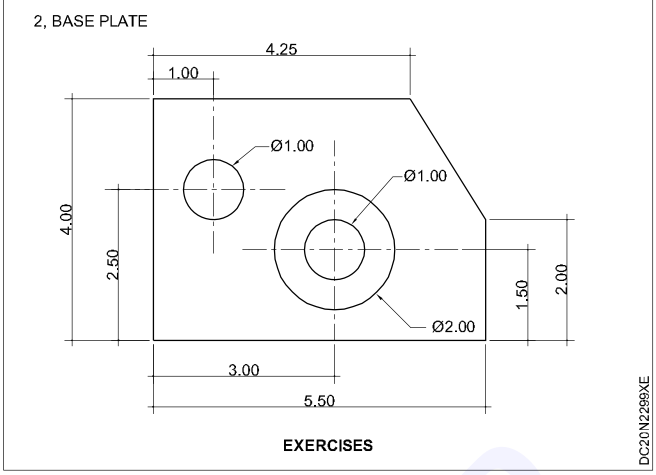



Fig 13

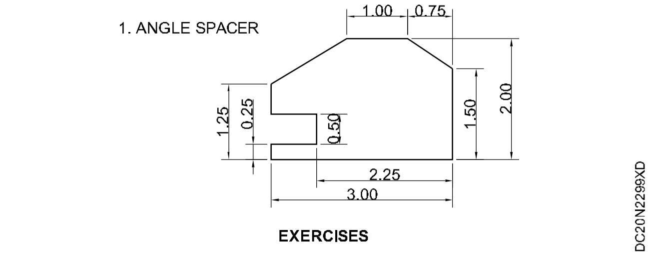



Fig 16

Fig 15

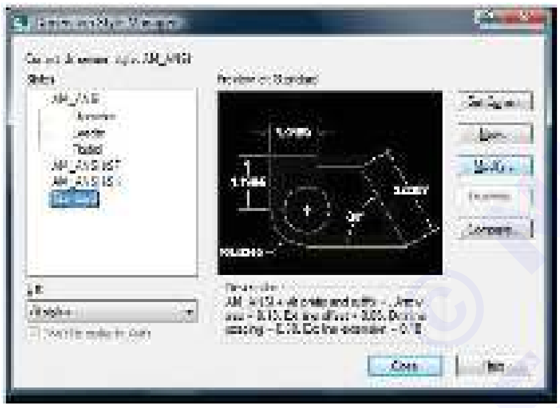
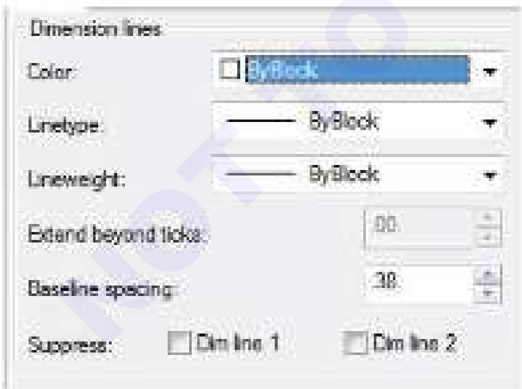


Fig 17



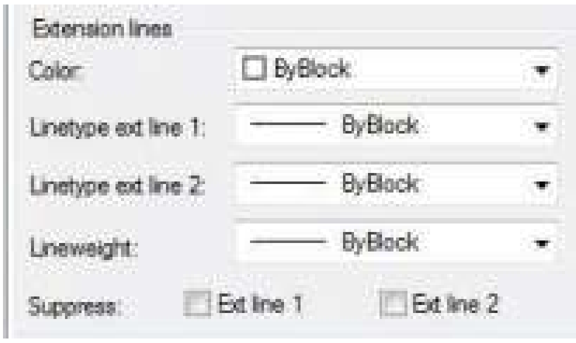

4 Extend beyond ticks specifies a distance to extend the dimension line past the extension line when you use oblique, architectural, tick, integral, and no marks for arrow heads.

5 Base line spacing sets the spacing between the dimension lines of a base line dimension. Enter a distance.

6 Suppress suppresses display of dimension line when they are outside.

**Description**

Fig 18




Set the extension line properties

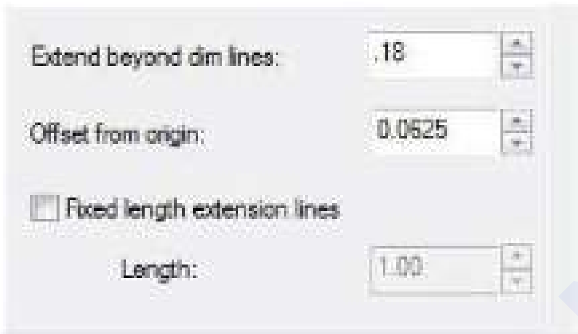
1 Colour displayed and sets the colour for extension line.

2 Line type sets the type of the extension lines.

3 Line weight sets the line weight of the extension lines.

4 Suppress suppresses display of extension lines.

Fig 19




1 External beyond dim lines specifies a distance to extension lines from the origin points that define the dimension.

2 Offset from origin specifies the distance to offset the extension lines from the origin points that define the dimension.

3 Fixed length extension lines, set the length of the extension line.



Fig 20

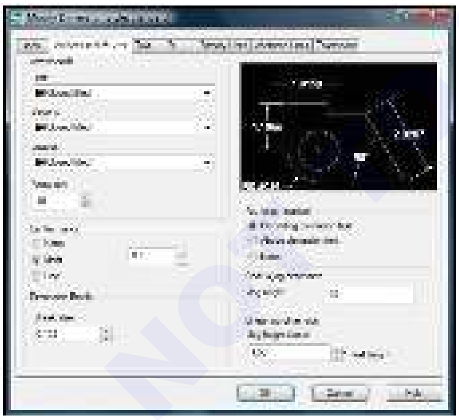
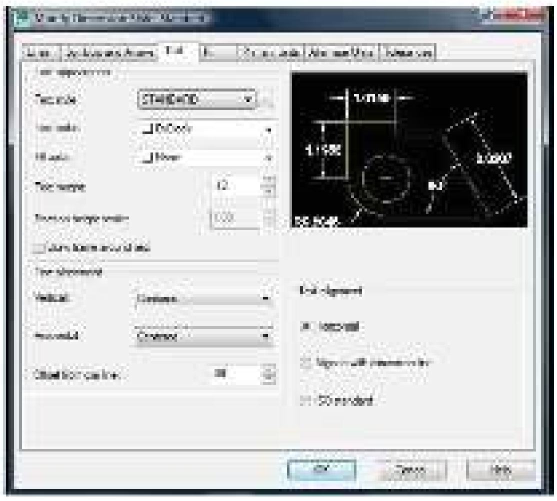


Fig 21



**Description**

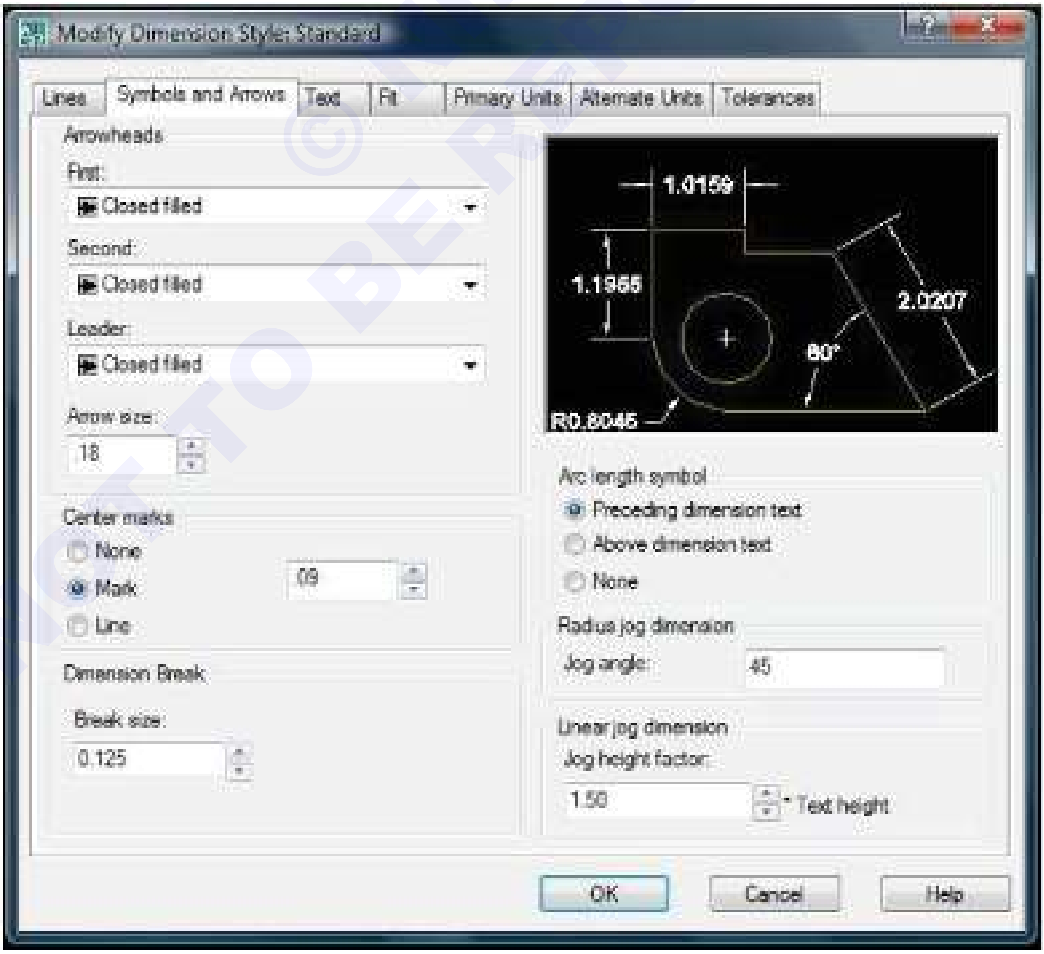
Fig 22


1 Here you can set the types of arrow heads.

2 Arrow size sets the size of arrow.

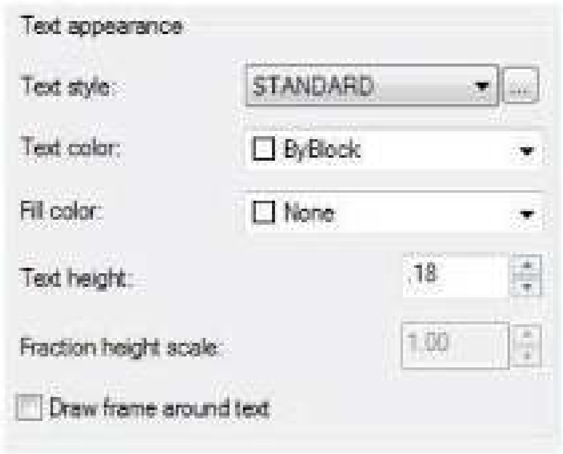
**Symbols and arrows tab**

Fig 23



**Description**

Fig 24




1 Text style button displays the text style dialogue box, which you can use to define or modify text styles.

2 Text colour displays and sets the colour for the dimension text.

3 Text height displays and sets the current dimension text style.

4 Draw frame around text draws a frame around dimension text.

**Tex tab**

Fig 25

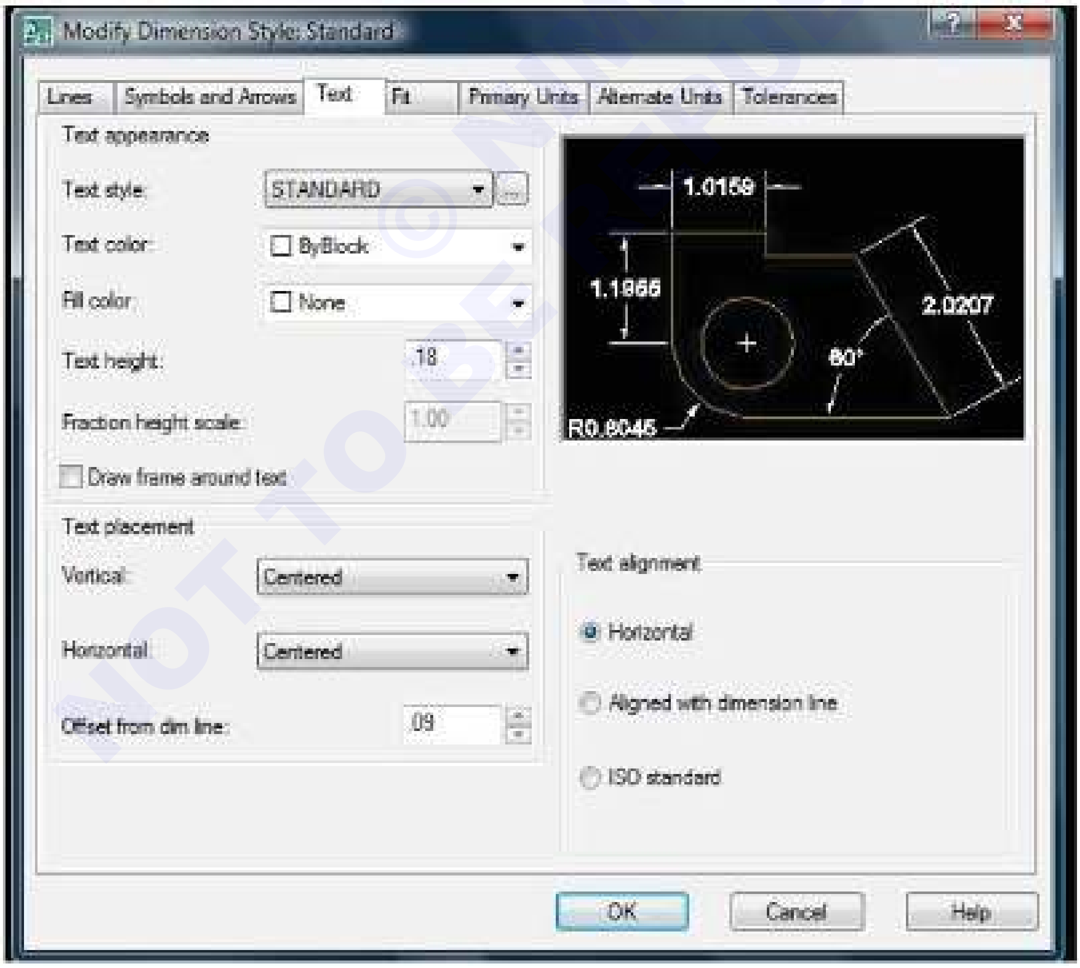



Fig 26

1 Vertical position controls the vertical justification of dimension text along the dimension line.

2 Horizontal position controls the horizontal justification of dimension text along the dimension line and extension line.

3 Offset from dimension line displays and sets the current text gap, which is the distance around the dimension text when the dimension line is broken to accommodate the dimension text.

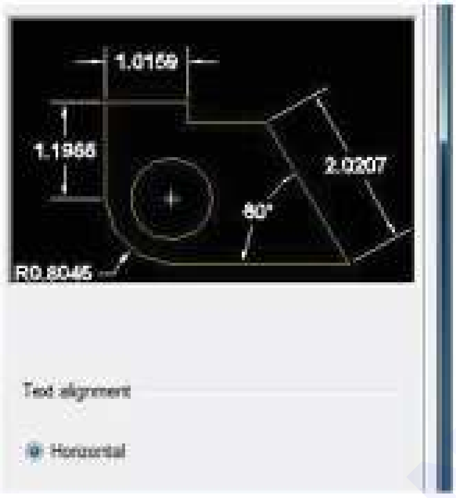



Fig 27

1 Horizontal places text in a horizontal position.

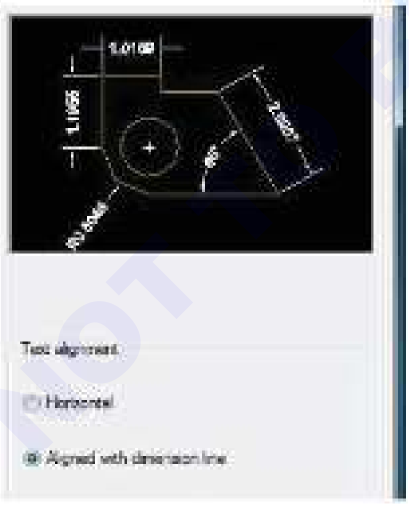



Fig 28

2 Aligned with dimension line aligns text with the dimension line.

Fig 29


3 ISO standards aligns text with the dimension line when the text is inside the extension lines, but aligns horizontally when text is outside the extension lines.

**Primary units tab**

Fig 30


**Description**

1 Unit format sets the current for all dimension types accept angular. Options to select from include scientific, decimal, engineering, architectural, fractional etc.

2 Precision displays and sets the number of decimal places in the dimension text.

3 Fractional format sets the format for fractions. Options to select from include diagonal, horizontal, and not stacked.

4 Decimal separator sets the separator for decimal formats. Options to select from include period (.), comma (.), or space.

Fig 31


1 Prefix includes the prefix you enter in the dimension text. You can enter text or use control codes to display special symbols. For example, entering the control code % %c displays the diameter symbol.

2 Suffix includes the suffix you enter in the dimension text. You can enter text or use control codes to display special symbols.For example,entering the text mm results in the dimension text similar to that shown in the illustration.

3 Measurement scale defines measurements scale options as follows: Linear scale factor sets a scale factor for linear dimension measurements for all dimension types except angular.

Control code % displays the diameter symbol.

Primary units tab

Dimensioning: Create the following exercise using CAD commands.

**Text**

This command is used for entering the related details on a drawing. Text is used for entering details in the title blocks, for labelling the parts of drawing, For giving specifications and for making annotations etc. There are two types of text used in Auto CAD.(Fig 32 & 33)

1 Single line text or D text.

2 Multiline text or M text.

**1 Single line text or D text (Fig 34)**

| | |
|---|---|
| Pull down | : Draw, TEXT, single line text |
| Command | : TEXT or DT |
| Current text style | : "Standard" |
| Text height | : 0.2000 |

Specify start point of text or [Justify/Style]: Select start point

Specify height<0.2000>: 25

Specify rotation angle of text <0>

Type on the screen: TEXT

**2 Multiline text or M text (Fig 35)**

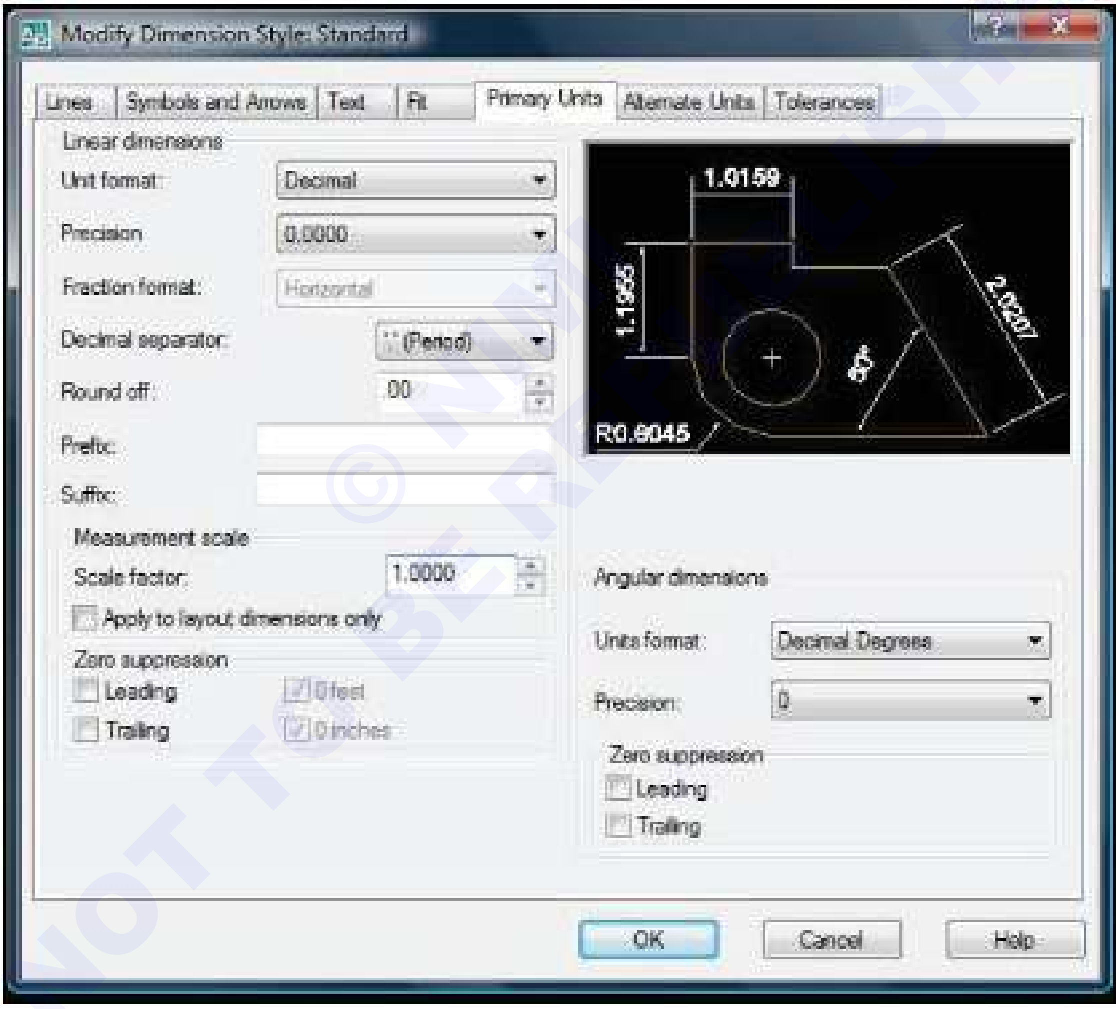
| | |
|---|---|
| Pull down | : Draw, Text, Multi line text |
| Command | : MText or MT |
| Current text style | : " Standard" |
| Text height | : 0.20000 |
| Specify first corner | : Click on the first corner |

Specify opposite comer or [Height/Justify/

Line spacing /Rotation/Style/Width]: click on the second corner Give text height, type, style, etc.

Enter the text, And press button OK.

Fig 32




### Text style

This command is used to change the text style.

After giving changes click on apply.

Computer aided drafting exercise 15-16

Plotting

Objectives: At the end of thess lessons, you shall be able to practice

Plotting drawings.

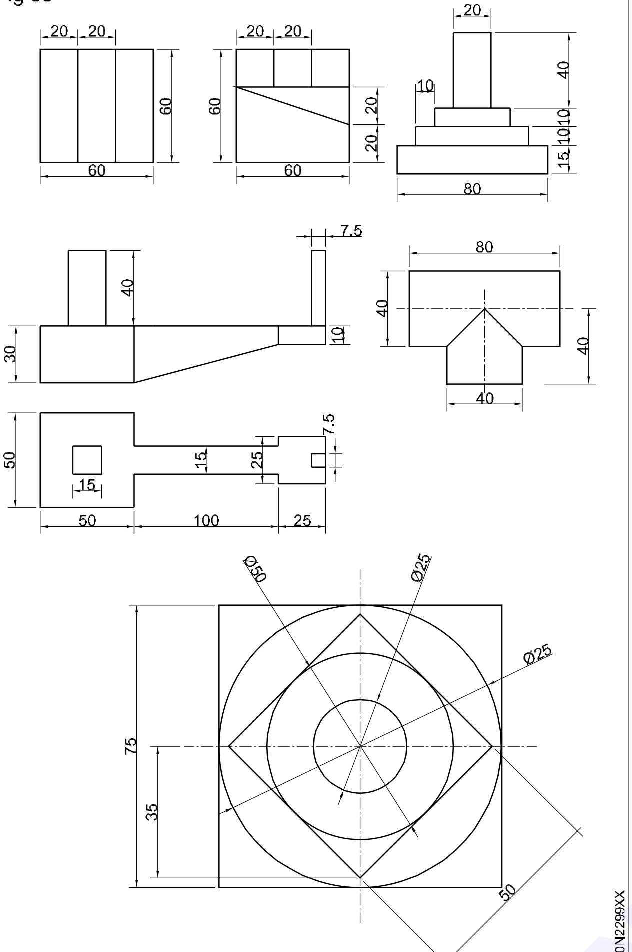
**Plotting drawings**

Printing or plotting of a drawing can be done by using a printer or a plotter.

Print or plot command

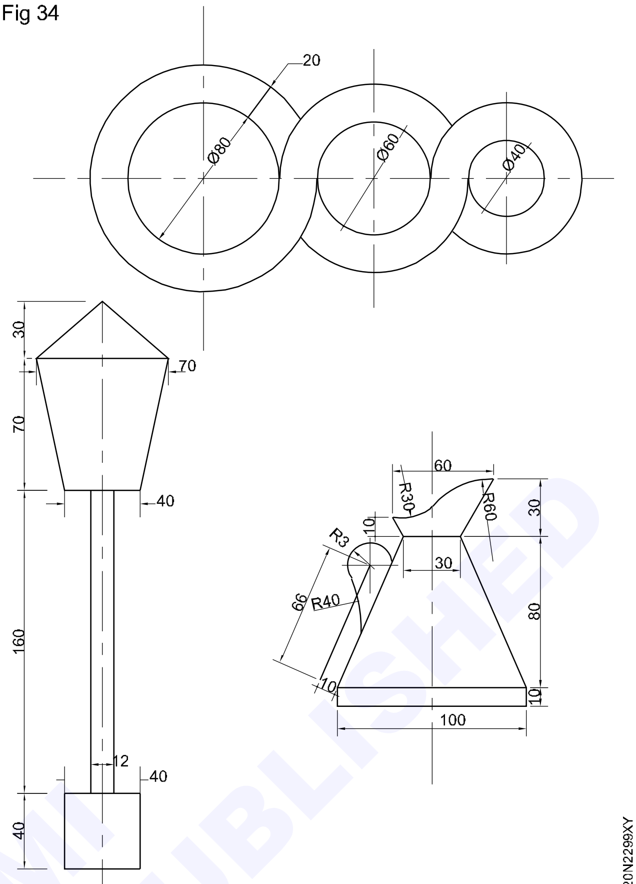
Various input facilities are available for printing a drawing. Facilities like key board, menu bar or tool bar with mouse are explained below.

Fig 33




EXERCISES

Fig 34




EXERCISES

Fig 35

# Properties & blocks

**Objectives :** At the end of this exercise you shall be able to
- **match properties**
- **identify line weight**
- **practice block.**

### Match properties

This command is used to copies the properties from one object to one or more objects.

Pull down menu: Modify, match properties

Command: Match properties, MA

Select the source object: Pick the object whose property to be matched.

Select destination object(s) or [settings]: Select the object to which properties are to be copied or press

Select destination object(s) or [settings]

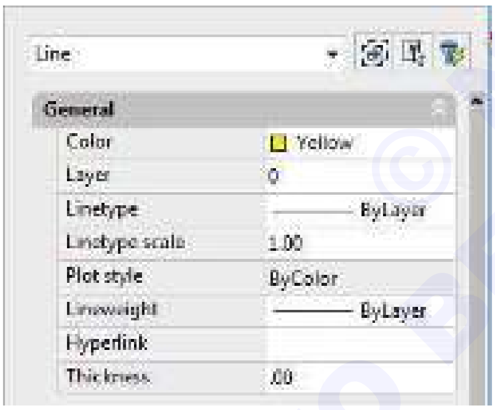
### Change the properties (Fig 1)

Command: CHPROP

When you select an object in the drawing area, the object properties window displays all the properties they have in common.

The properties that are in grey cannot be modified.

Fig 1




### Line type

Pull down menu : format, line type

Command : L type

After invoke this command a 'Line type manager' dialogue box will appear on the screen.

click here
Clik ok

Select line type from here

Click Ok in the 'line type manager' dialogue box.

### Object snaps (Fig 2,3,4 & 5)

Suppose you want to draw a line from the center of the circle to the middle of the vertical line you extended earlier. AutoCAD has a feature that makes this very easy. These are the object snaps (or Osnaps "Oh-Snaps"). Type os <ENTER>. You will see this dialog box appear.

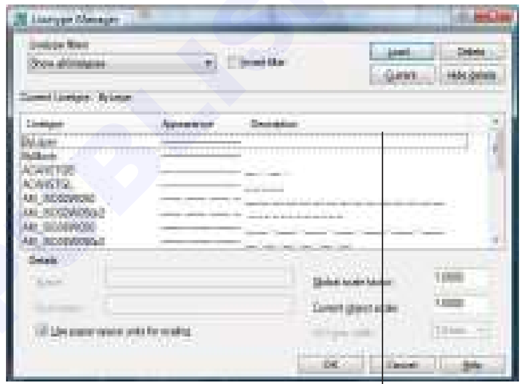
Fig 2

| ICON | SETTING | ICON | SETTING |
|---|---|---|---|
| | Endpoint | | Insertion Point |
| | Midpoint | | Perpendicular |
| | Center | | Tangent |
| | Node | | Nearest |
| | Quadrant | | Apparent Intersection |
| | Intersection | | Parallel |
| | Extension | M2P | Midpoint between 2 points |

OBJECT SNAP COMMAND

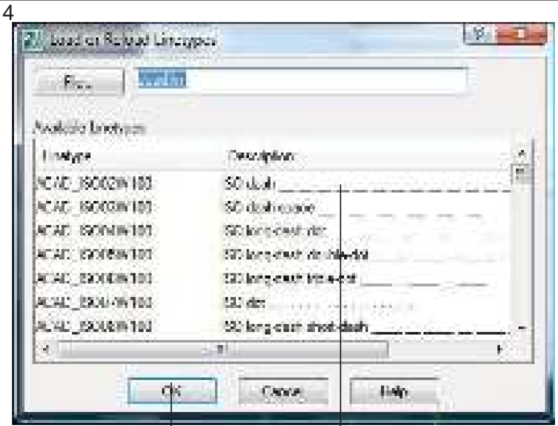
DC20N2299Y1

Fig 3



click here

Fig 4



Click ok

Select line type from here

Fig 5

Fig 7

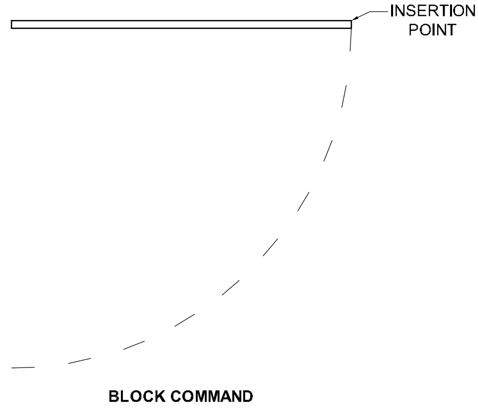
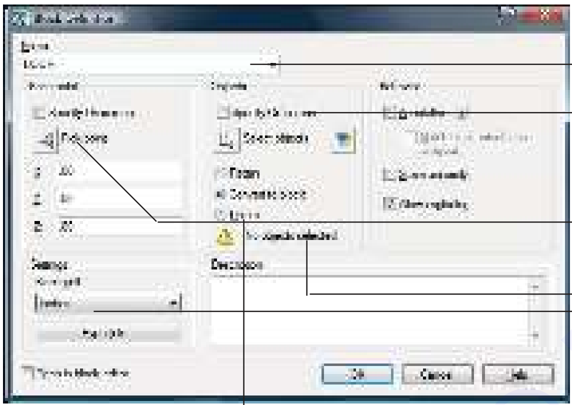



Fig 6



3 Type the name in this area, door.

4 Click on select objects. AutoCAD hides the dialogue box. Pull a selection window around the door and press enter. The dialogue box will return.

5 Click here and pick an insertion point, use object snap.

6 Select.

7 Unit offered here are the drawing units.

8 Click on ok

## Block

This is used for storing a part of drawing or entire drawing or symbols that are needed in the same drawing or for other drawing. This is stored with a desired scale factor. All the objects inside a block considered as a single object.

| | |
|---|---|
| Tool bar | : Draw block, make |
| Pull down menu | : Draw, block, make |
| Command | : Block or B |

When you invoke the command BLOCK a block definition dialogue box is displayed.

1 Draw a door. (Fig 7)

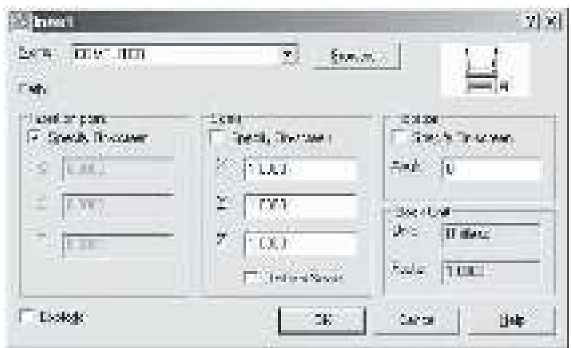
2 Click on draw pull down menu, click on block, click on make

## Insert block (Fig 8)Fig 8)

Once the block has been created you may insert it in the drawing.

- Click on the insert menu
- Click on block
- The insert dialogue box will appear
- Click on the down arrow all the blocks created in the current drawing will be listed. Select the block name.
- At this point you are returned to the drawing with the block attached to the cross hairs at the insertion point you defined.

Fig 8



- Move the block in to position on the screen. The command line asks for the insertion point and lists several options.[Scale, X/Y/Z/Rotate/Pscale/PX/PY/PZ/PRotate]

These options refer to the scaling and rotation of the block. If you simply pick a point on the screen the block will be inserted without being scaled(at the size it was drawn)

- The block is now locked in to position in the drawing.

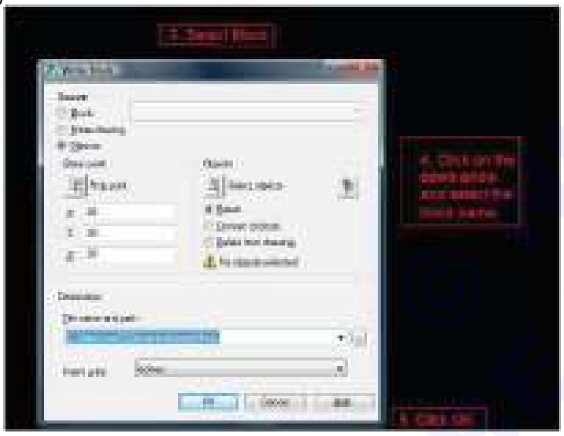
**Write block (Fig 9)F**

If a block is converted in to a drawing file then you can use it in any other drawing.

- Type WBLOCK at the command line and press enter.
- The write block dialogue box appears.
- Select block
- Click on the down arrow and select the block name.

At this stage AutoCAD takes the block and converts it to a drawing. This drawing can be treated like Auto CAD drawing You can open it as a separare drawing, explode it, edit & draw in the usual way

Fig 9



**Divide**

This command  is used to divide a line or arc or circle in to number of parts.

Command : Divided, div

Select object to divide: Select the line AB

A ________________B

Before divide

A B

Before divide

If you cannot see the division on the screen, change the point style.

**Point style (Fig 10)**

Pull down menu: Format, point style

Select new pointstyle from this box

Click OK

Then the points are visible clearly.

Fig 10

## 2D drafting of flush door, panel door, window, hand railing, wash basin, sewerage pipe joints etc

**Objectives :** At the end of this exercise you should able to
- **draw the flush door and panel door**
- **draw the window and hand rail**
- **draw the sanitary fittings.**

PROCEDURE

TASK 1 : **Draw a flush door to the standard size as per I.S specification, and unite the commands of procedure**

_ _ _ _ _ _ _ _

TASK 2 : **Draw a panel door to the standard size as per I.S specification and illustrate the commands for the development of the object**

_ _ _ _ _ _ _ _

TASK 3 : **Draw a window to the standard size as I.S specification and give the commands for the drawing of the window**

_ _ _ _ _ _ _ _

TASK 4 : **Draw a door handle to the standerd size as per I.S specification**

_ _ _ _ _ _ _ _

TASK 5 : **Draw sanitary fittings-wash basin-C.I pipe joints-as parts. Standards using CAD commands illustrate the commands used for the development**

_ _ _ _ _ _ _ _

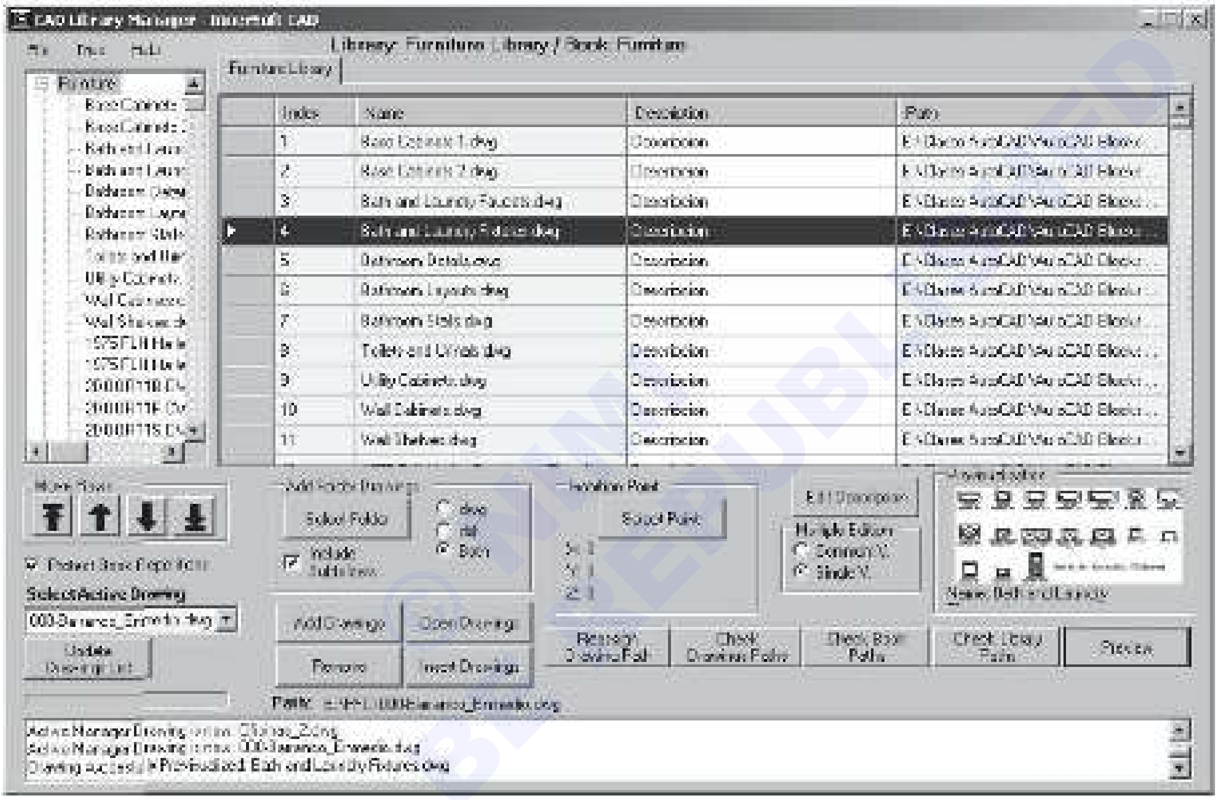
## Preparing library folder by creating blocks of prepared drawings

**Objective :** At the end of this exercise you should able to
- **prepare a library folder for the drawing created by you.**

PROCEDURE

TASK 1 : **A sample library folder is given study the folder - with referring to the given folder (Fig 1)**

Fig 1




— — — — — — — —

## Plan,section and elevation of buildings with specifications for the given line drawing to suitable scale

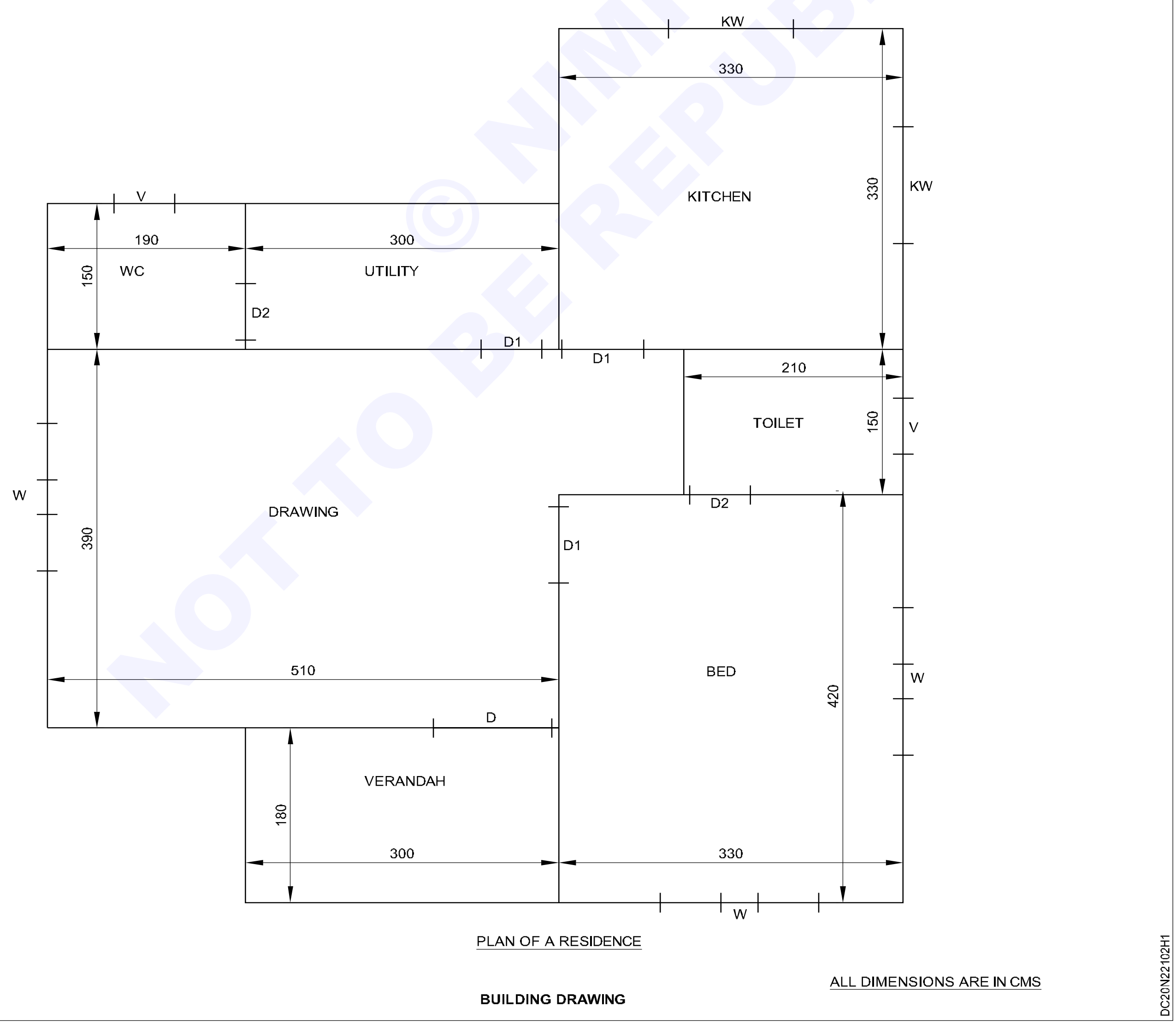
**Objectives :** At the end of this exercise you shall be able to
- **identity the size of rooms**
- **identify the number and positions of wall opening**
- **draw the line diagram of the residential building.**

## PROCEDURE

TASK 1 : **Prepare the given line sketch in a scale of 1:50 (Fig 1)**

1 Select a scale, of 1:50
2 Draw a right angled corner indicates the corner of bed room.
3 Draw parallel lines and perpendicular lines as per the room. arrangements, according to the size and shape of various rooms.
4 By using outlines finish the positions of rooms.
5 Erase the unwanted construction line, if any position
6 Furnish the details of rooms, position of doors, windows etc.
7 Dimension the figure as per the datas given.
8 Specify the scale, and related notes.
9 Complete the required line sketch.

Fig 1



# A House single storeyed residential building with single bed room and attached bathroom with R.C.C. flat roof slab

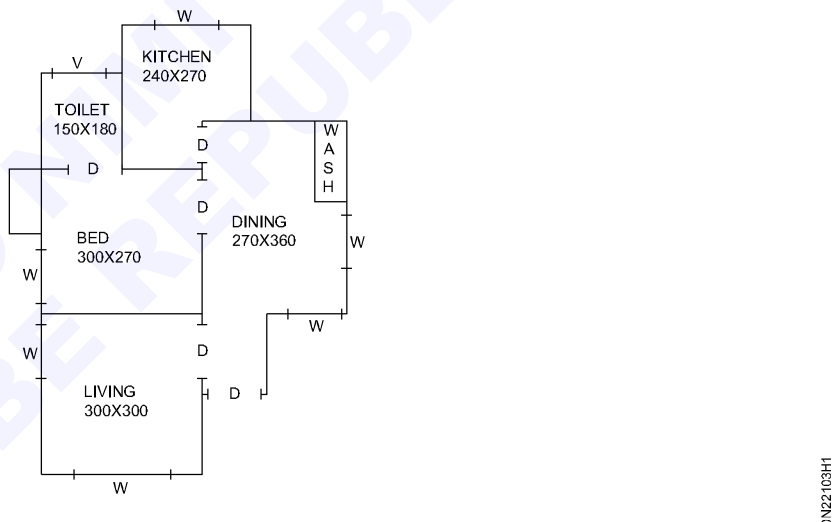
**Objectives :** At the end of this exercise you shall be able to
- **identify the thickness of wall**
- **draw the plan of building**
- **draw the section of the building**
- **draw the elevation of residence.**

## PROCEDURE

TASK 1: **Draw the plan, elevation and sectional elevation of the building as for the line diagram (Fig 1)**

1 Select a scale of 1:50
2 Layout the drawing sheet for plan, section and elevation.
3 Prepare the plan starting from the corner of Living room.
4 Draw wall thickness as per the scale.
5 Create the rooms as per the figure.
6 Erase the unnecessary construction lines.
7 Mark the position of door, windows etc.
8 Furnish the dimensions and notes where ever needed.
9 Complete the plan.

Fig 1




LINE DIAGRAN FOR RESIDENCE

TASK 2 : **Draw the section**

1 Draw a horizontal line shows the ground level.
2 Identify the position of cutting plane.
3 Create projection lines for walls, as per the room size.
4 Draw the basement line, roof line, parapet line etc.
5 Furnish the foundation details as shown.
6 Hatch the section as per the materials used.
7 Furnish the dimensions,
8 Complete the section.

TASK 3 : **Draw the Elevation (Fig 2)**

1 Draw projection lines from plan and section.

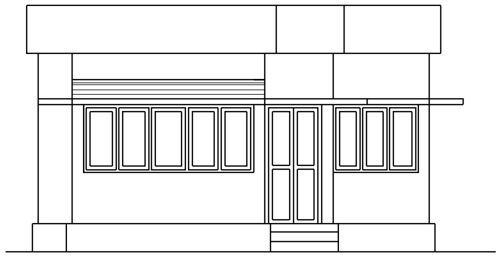
2 Remove the unwanted projection lines and develop. The elevation.

3 Furnish the door, window, sunshade details etc.

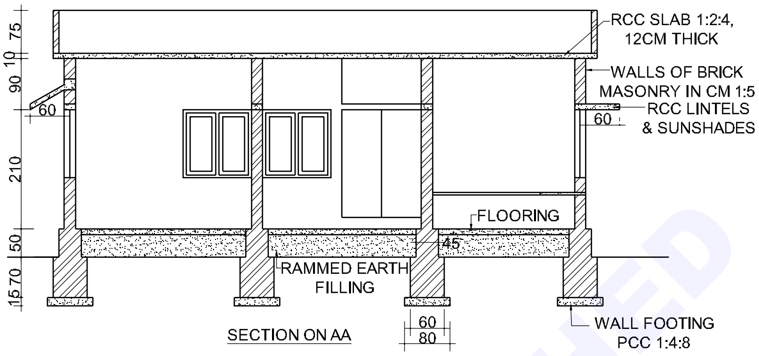
4 Finish the required elevation by outlines.

5 Complete the working drawing with specification schedule of joinery and other details.

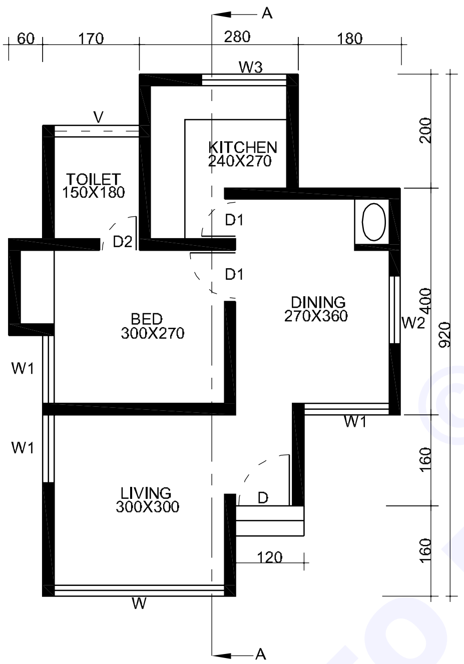
Fig 2



ELEVATION




SECTION ON AA




PLAN

SCHEDULE OF JOINERY

| MARK | ITEM | SIZE | TYPE | NOS. |
|---|---|---|---|---|
| D | DOOR | 110X210 | PANELLED | 1 |
| D1 | DOOR | 100X200 | PANELLED | 2 |
| D2 | DOOR | 90X200 | PANELLED | 1 |
| W1 | WINDOW | 300X150 | GLAZED | 1 |
| W2 | WINDOW | 120X150 | GLAZED | 1 |
| W3 | WINDOW | 150X120 | GLAZED | 1 |
| V | VENTILATOR | 150X60 | GLAZED | 1 |

SPECIFICATIONS

1) FOUNDATION:-
2) WALLS:-
3) LINTELS:-
4) ROOF SLAB:-
5) PLASTERING:-
6) FLOORING:-
7) PAINTING:-

NOTE:- PROVIDE FOUNDATION ACCORDING TO THE CONDITION OF SOIL

**PLAN AND SECTION OF A BUILDING**

DC20N22103H2



TASK 4 : **Draw the plan, section and elevation of the residential of the building using the AutoCAD**

**Draw the plan of the residence**

1 Open the AutoCAD software.

2 Draw the building outline of the house by using the "Line" command. Click the "Line" icon to activate the command. Left-click to start and end the line.

3 Offset the building outline the desired thickness of the exterior wall. Use the "Offset" command.

4 Draw all interior walls by using the same "Line" and "Offset" commands.

5 Use the "Trim" command to trim any messy intersections on the exterior or interior conditions. Left click the "Trim" icon to activate the tool. Select the "cutting edge" line followed by the line that you would like to trim off.

6 Cut openings for doors and windows by drawing lines and then trimming away the opening. If you want 100cm door draw a line perpendicular to the wall, offset it 100cm and trim away the excess lines.

7 Draw the doors and windows where the new openings exist.

8 Activate the text command to enter the names of rooms and their sizes.

9 Activate the dimension icon and click the edges of each wall that you would like to dimension to. This will give the drawing a more professional look and also gives people a sense of the space.

10 Insert the table and prepare the details of joinery.

11 Using area command find the area of the building.

**Draw the section of the residence**

1 Draw the base line to draw the section of the residence

2 According to the section line shown in the plan, the width of walls, rooms has to be drawn according to the design using line, offset, trim commands.

3 Use the hatch commands to show the R.C.C. rubble masonry in the section.

4 Activate the text commands for mentioning the name and size of the rooms.

5 Using dimension command complete the dimensioning of the section drawing.

6 Plot the drawing to a printer or to a PDF format. Hit the plot icon to open the plot settings. Choose the layout type, pen settings and windows view that you would like to use.

**Draw the elevation of the residence**

1 Draw the base line to draw the elevation of the residence.

2 Draw the projected lines from the plan to create front view of the residence using line command.

3 Draw the elevation of the residence using modify commands like offset, trim, fillet, extend to complete the outline

4 Using block, insert block commands prepare the doors and windows in elevation.

5 Assign proper line weights to create the effective appearance of the building.

6 Plot the drawing to a printer or to a PDF format. Hit the plot icon to open the plot settings. Choose the layout type, pen settings and windows view that you would like to use.

— — — — — — — —

# A residential building with double bedded room (R.C.C flat roof)

**Objective :** At the end of this exercise you shall be able to
- **develop the working drawings of two bed room residence.**

## PROCEDURE

TASK 1 : **Prepare the working drawing of a two bedroom residence through AutoCAD ( Fig 1 )**

1 Line sketch showing arrangements of rooms.

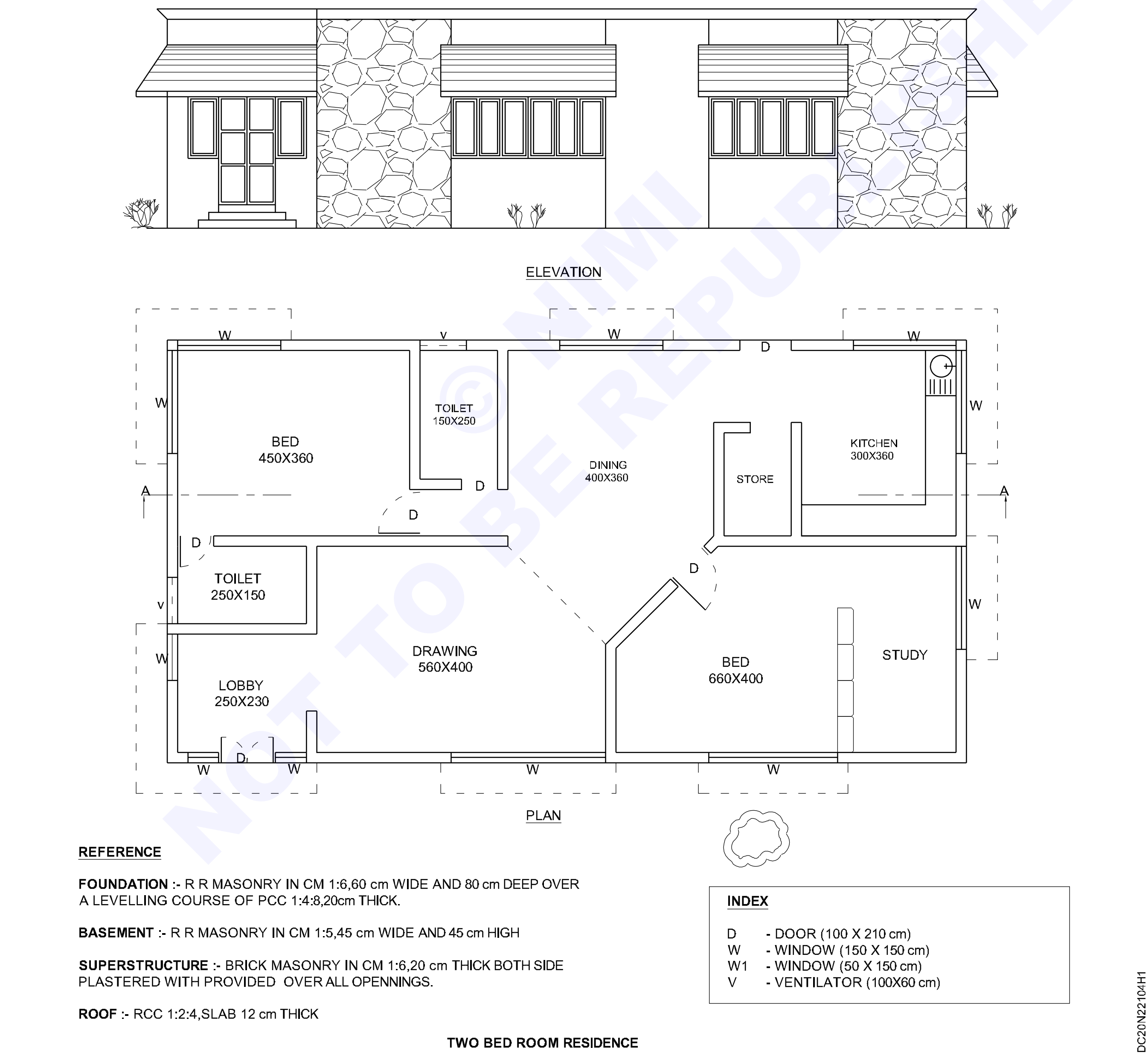
2 Give standard dimensions for the building elements.

3 Develop the working drawings through Auto CAD

4 Table a print out in A3 sheet.

**Create your own elevation**

Fig 1



# Two roomed house with RCC slope roof with gable ends

**Objectives :** At the end of this exercise you shall be able to
- **draw the ground and first floor plan**
- **draw the sectional view of the building**
- **draw the elevation of the residence.**

## PROCEDURE

TASK 1 : **Prepare plan, section and elevation of a R.C.C roof with gable ends. ( Fig 1 )**

1 Draw the plan.

2 Draw the ground floor plan and first floor plan of the building using various commands in AutoCAD.

3 Draw the sectional view.

4 Create the section of the building and provide foundation as shown in Fig 1.

5 Draw the elevation.

6 Draw the elevation of the residence by projection lines from both plan and elevation.

7 Complete the drawing by printing dimension and other related notes.

Fig 1


INDEX

| MARK | ITEM | SIZE | NOS. |
|---|---|---|---|
| D1 | DOOR | 100X200 | 8 |
| D2 | DOOR | 80X200 | 4 |
| W1 | WINDOW | 150X120 | 8 |
| W2 | WINDOW | 100X120 | 7 |
| V1 | VENTILATOR | 100X60 | 7 |
| W3 | WINDOW GABLE | 120X120 | 1 |

NB:- FOUNDATION MAY BE CANGED ACCORDING TO SOIL CONDITION

**R.C.C. SLOPED ROOF RESIDENCE**

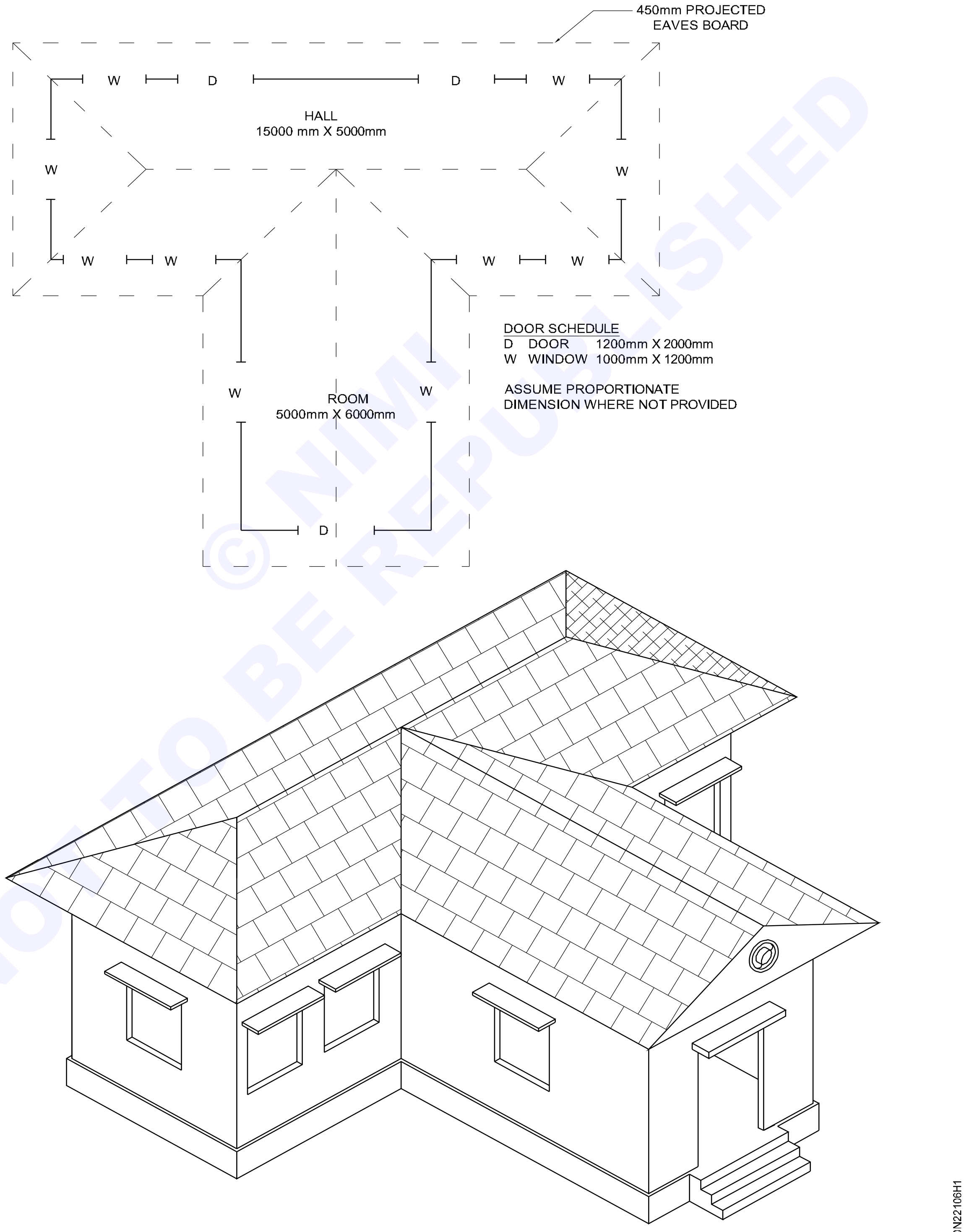
DC20N22105H1

## A house with fully tiled roof with hips and valleys

**Objectives :** At the end of this exercise you shall be able to
- **draw the plan of the building**
- **develop the front elevation and sectional elevation.**

TASK 1 : **Draw the plan, elevation and sectional view for the given line diagram, using CAD (Fig 1)**

Fig 1




ISOMETRIC & ORTHOGRAPHIC PROJECTION

# Design and create a double storied residential building (3BHK) with positioning layout of furniture electrical appliances and plumbing / sanitory fittings

**Objectives :** At the end of this exercise you shall be able to
- **design the interior layout for the residence plan**
- **render the plan and all furnitures with pleasing colours**
- **dimension and name the plan completely.**

PROCEDURE

TASK 1 : **Organization of interior space (manual) (Fig 1)**

1 Print the previously drawn ground floor plan & first floor plan.

2 Economic utilisation of space is very important in designing interior.

3 Where should be minimum circulation area and best use of available space for the activity to be performed.

4 Minimum number of doors and partitions should be considered for free flow of space and spacious look.

5 To get a spacious look select limited variety of textures, patterns and colours.

6 The 'Interior activity diagram' should be drawn showing the division of interior space with proper circulation.

7 Where should be acoustical and visual barriers between entry and private area.

8 While designing seating for living room L-shaped or U-shaped seating makes the most economical use of space because it can accommodate a large group of people, leaving ample circulation space.

9 Do not clutter a small space with more items than needed.

10 Low seating helps in making the room look larger.

11 The dining table could be circular or rectangular.

12 Work triangles consists of the three essential elements in the kitchen, the clean up or sink area, the cooking centre, the mixing centre and the refrigeration plat from should be 600mm.

14 The position of the bed depends on a number of factors. The window should be parallel to the bed position.

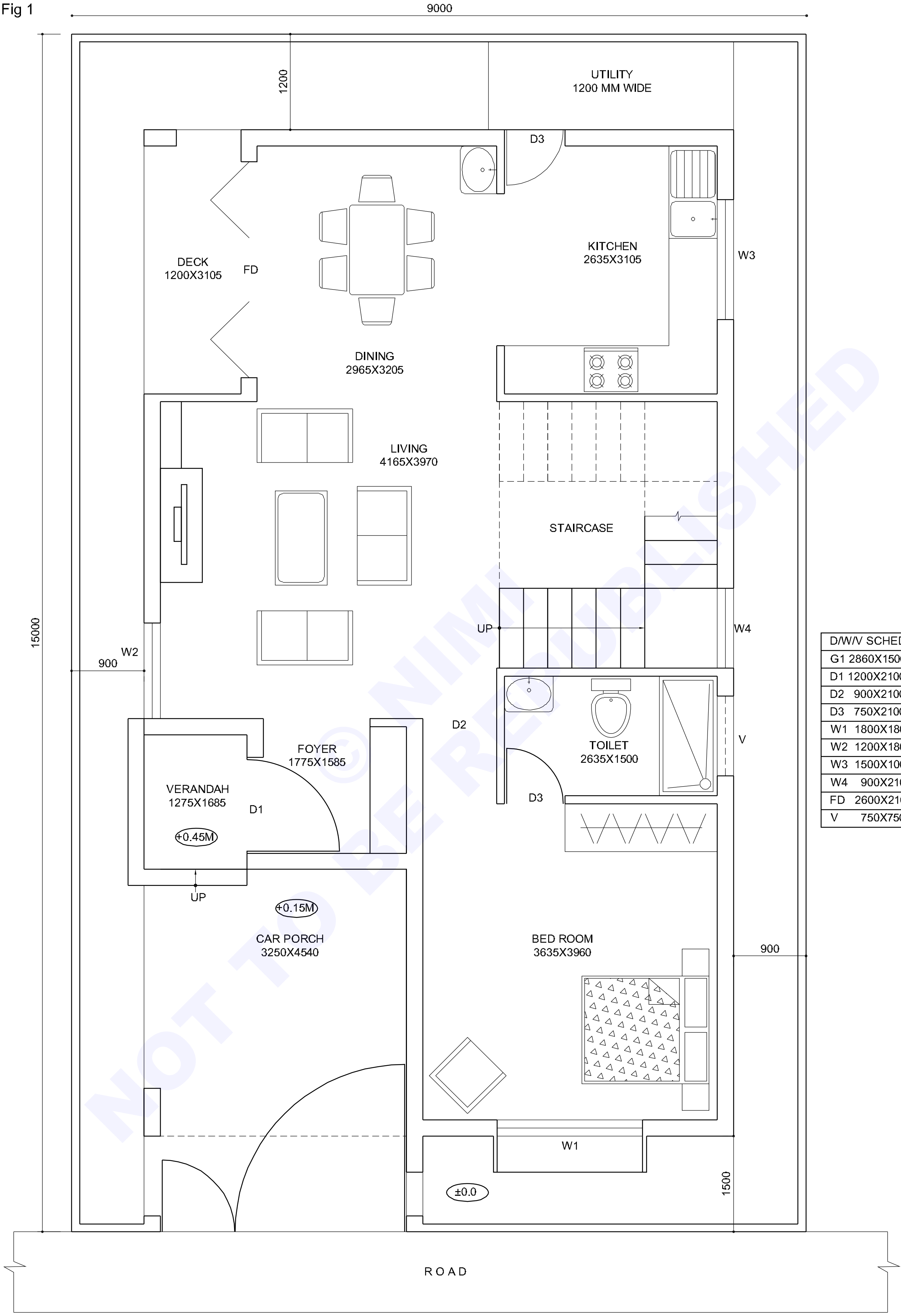
15 The window should not be over the hand.

16 The toilet can be divided into two types of areas the dry area including the sink and the toilet and a wet area. which includes the bathing area. In well-planned toilets, you must separate these two areas.

17 Some cabinets or open shelves must be placed in the bathroom for storage.

18 With all consideration of furnitures and fixtures complete the sketch of organisation of space planning as Fig 1

Fig 1




| D/W/V SCHEDULE | |
|---|---|
| G1 | 2860X1500 |
| D1 | 1200X2100 |
| D2 | 900X2100 |
| D3 | 750X2100 |
| W1 | 1800X1800 |
| W2 | 1200X1800 |
| W3 | 1500X1000 |
| W4 | 900X2100 |
| FD | 2600X2100 |
| V | 750X750 |

DC20N22107H1

**GROUND FLOOR PLAN**

TASK 2 : **Rendering ground floor and first floor plan with furniture layout (Fig 2)**

1 With reference to the organisation plan, the detailed furniture layout should be designed.

2 Choosing colour scheme should be considered carefully while rendering the plans and furnitures.

3 For the living room a single solid colour on the floor, or unpatterned floors tend to sketch the space. These include stone, tiles, wood etc.

4 Lighter the shade and the more reflective the surface, the more effective it will be in lightening up the room,

5 For dining avoid using carpet below the table.

6 Use the same flooring material as in the living.

7 For kitchen you can choose from a variety of tiles and stones.

8 Any type of flooring can be used in the bedroom from carpet to wood flooring to tiles or terazzo.

9 You must combine the shape, colour, texture for furniture to provide a pleasing environment.

10 Concrete, brick paving, slate, unpolished kota, sand stone are effective floor materials for the porch, out door sit out, inner courtyard, terraces and balconies.

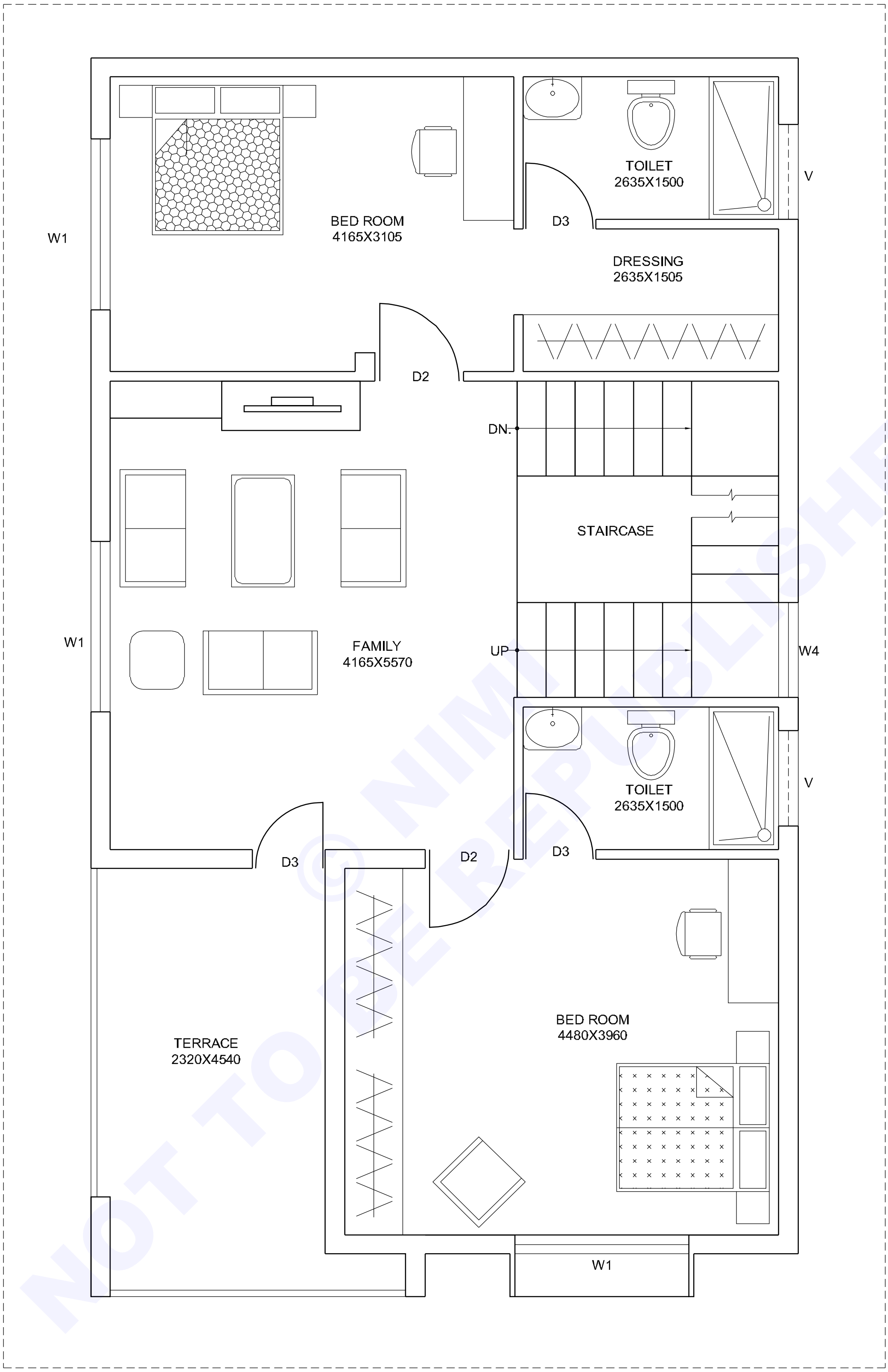
11 Plan the garden simultaneously with the house so that the levels of drive way, terraces are co-ordinated.

12 The amount of soft surfacing (Lawn or ground cover) should be considered in designing the landscape.

13 Complete the drawing in colour

**Note: Provide electrical fittings as per I.S. standard.**

Fig 2




| D/W/V SCHEDULE | |
|---|---|
| D2 | 900X2100 |
| D3 | 750X2100 |
| W1 | 1800X1800 |
| W4 | 900X2100 |
| V | 750X750 |

DC20N22107H2

FIRST FLOOR PLAN

## Create and use model space view ports

**Objective :** At the end of the exercise you shall able to
- **creating view ports for a model.**

PROCEDURE

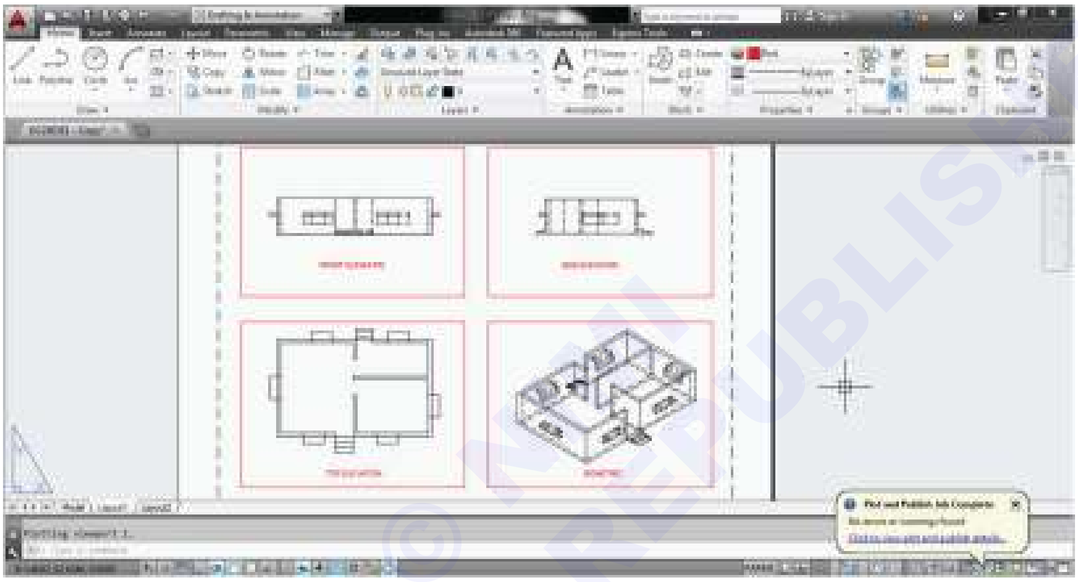
TASK 1 : **Create and use model space port (Fig 1)**

1 Create the elevations and plan as per the given commands.

2 Follow the given commands as per creating view ports.

3 Create and model space viewport.

Fig 1



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# Create a standard engineering layout

**Objective :** At the end of this exercise you shall be able to
- **creating a engineering layout.**

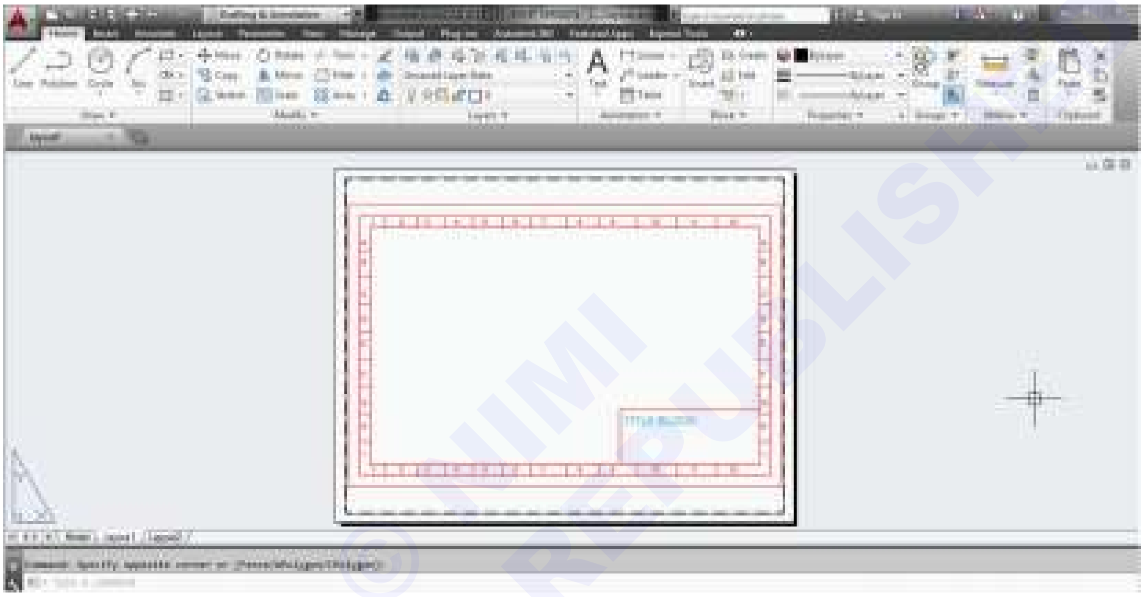
## PROCEDURE

TASK 1 : **Creating a engineering layout (Fig 1)**

1 Follow the CAD commands and complete the lay out as give in figure.

2 Create a standard engineering layout.

Fig 1

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## Create and edit wire frame model

**Objectives :** At the end of this exercise you shall be able to
- **creating and editing a wire frame.**

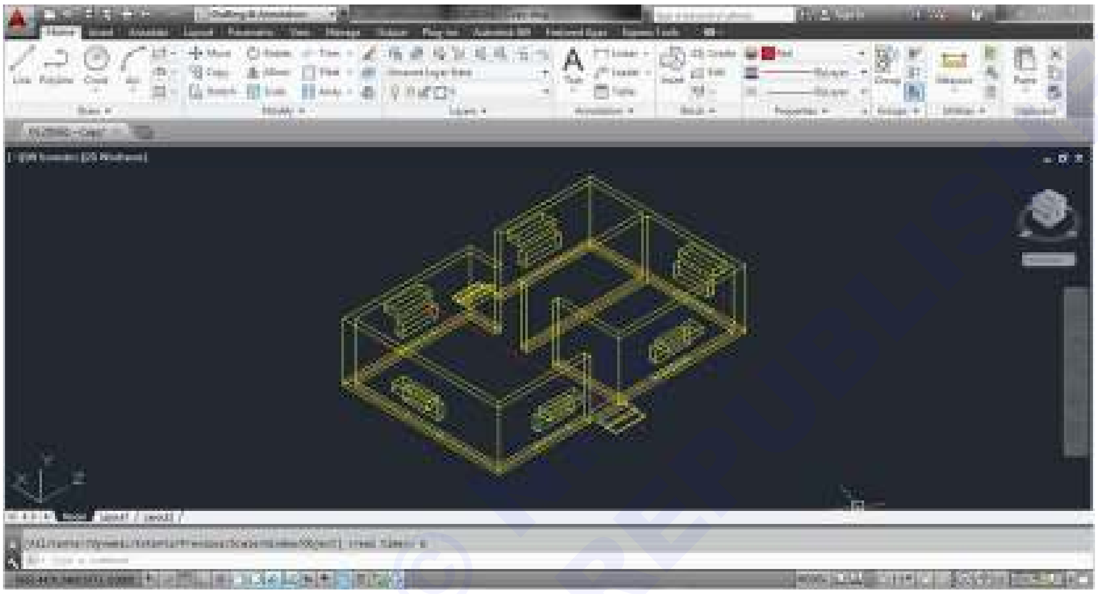
PROCEDURE

TASK 1 : **Create a wire frame model and edit it (Fig 1)**

1 Follow the CAD commands to create the wire frame model given.

2 Create and edit wireframe model.

Fig 1





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## Create and edit solid mesh and surface modeling

**Objective :** At the end of this exercise you shall be able to
- **create and editing a solid mesh and surface.**

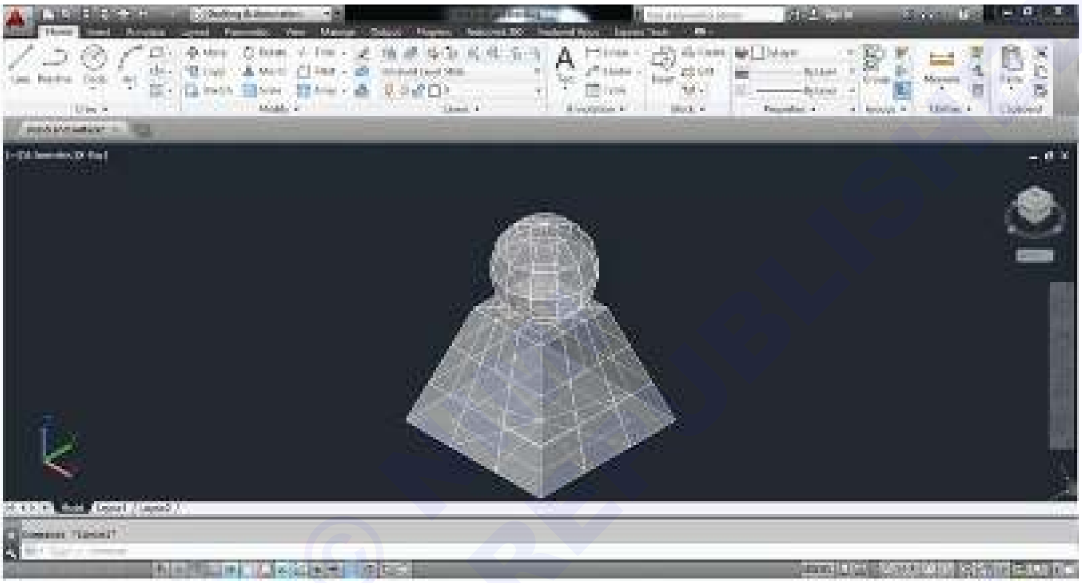
PROCEDURE

TASK 1 : **Creating a solid mesh and editing and surface modeling (Fig 1)**

1 Use CAD commands it create the models and for editing.

2 Create and edit solid mesh and surface modeling.

Fig 1



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## Create and edit simple 2D region and 3D solid model

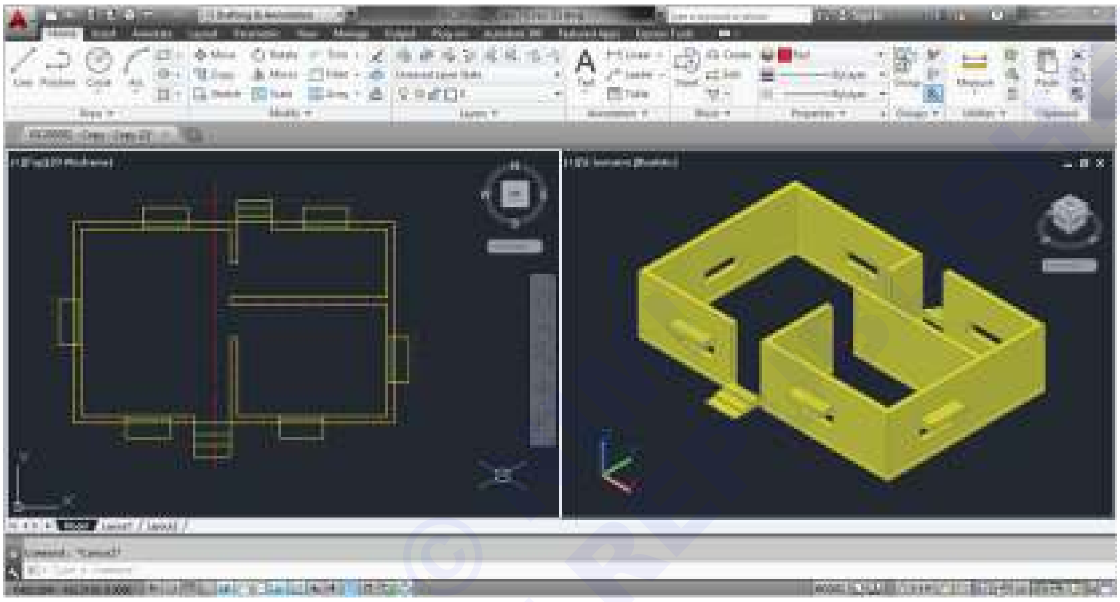
**Objective :** At the end of this exercise you shall be able to
- **creating and editing a 2D region and 3D solid model.**

PROCEDURE

TASK 1 : **Creating a 2D drawing and draw the same in 3D (Fig 1)**

1 Create and edit simple 2D regions and 3D solid models.

Fig 1



## Generate 3D text and dimensions using a variety of 3D display techniques

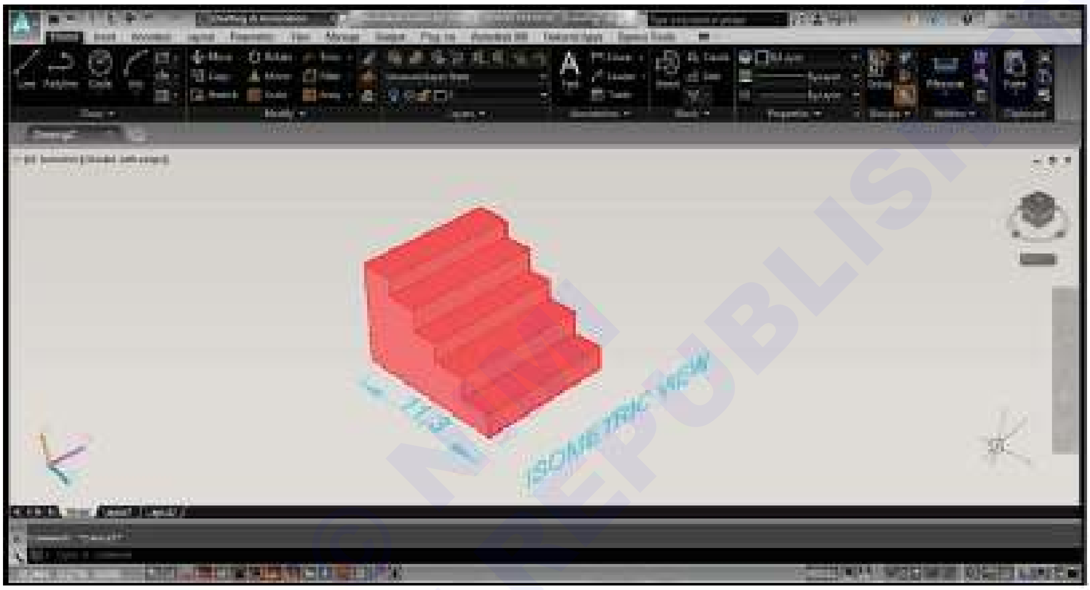
**Objective :** At the end of this exercise you shall be able to
- **generate 3D text and 3D dimension display.**

### PROCEDURE

TASK 1 : **Generate a 3D Text and dimensions using 3D display techniques (Fig 1)**

1 Generate 3D text and dimension using a variety of 3D display techniques.

Fig 1

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# Render a 3D model with a variety of lights and materials

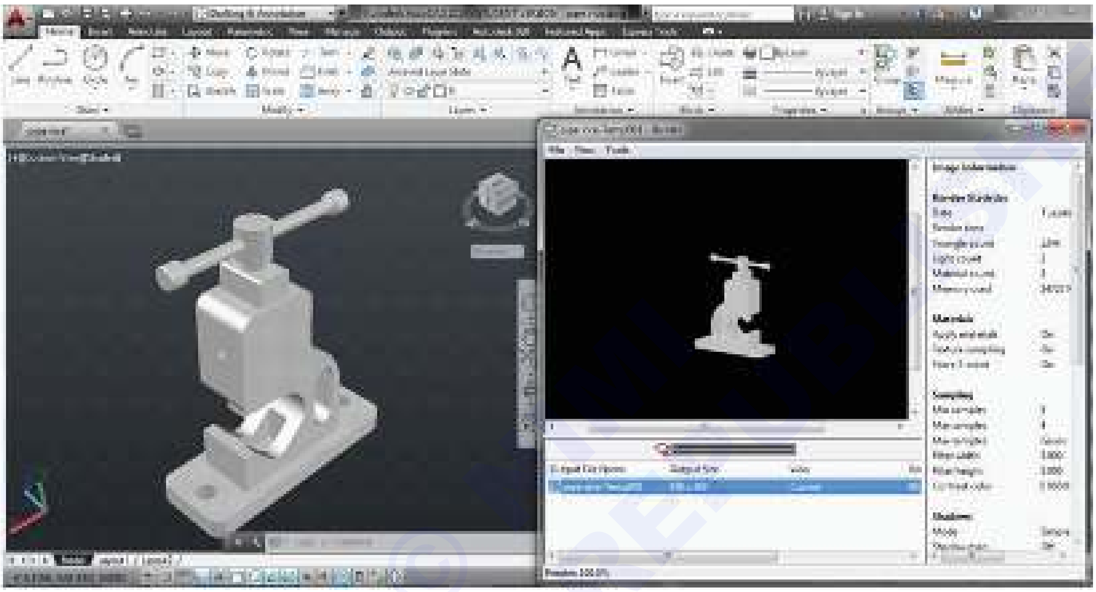
**Objective :** At the end of this exercise you shall be able to
- **rendering a 3D model with lights.**

## PROCEDURE

TASK 1 : **Prepare a 3D model with lights (Fig 1)**

1 Render a 3D model with a variety of lights and materials.

Fig 1



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## Primary health centre for rural area with R.C.C flat roof

**Objective :** At the end of this exercise you shall be able to
- **draw the working drawings of a primary health centre through AutoCAD.**

PROCEDURE

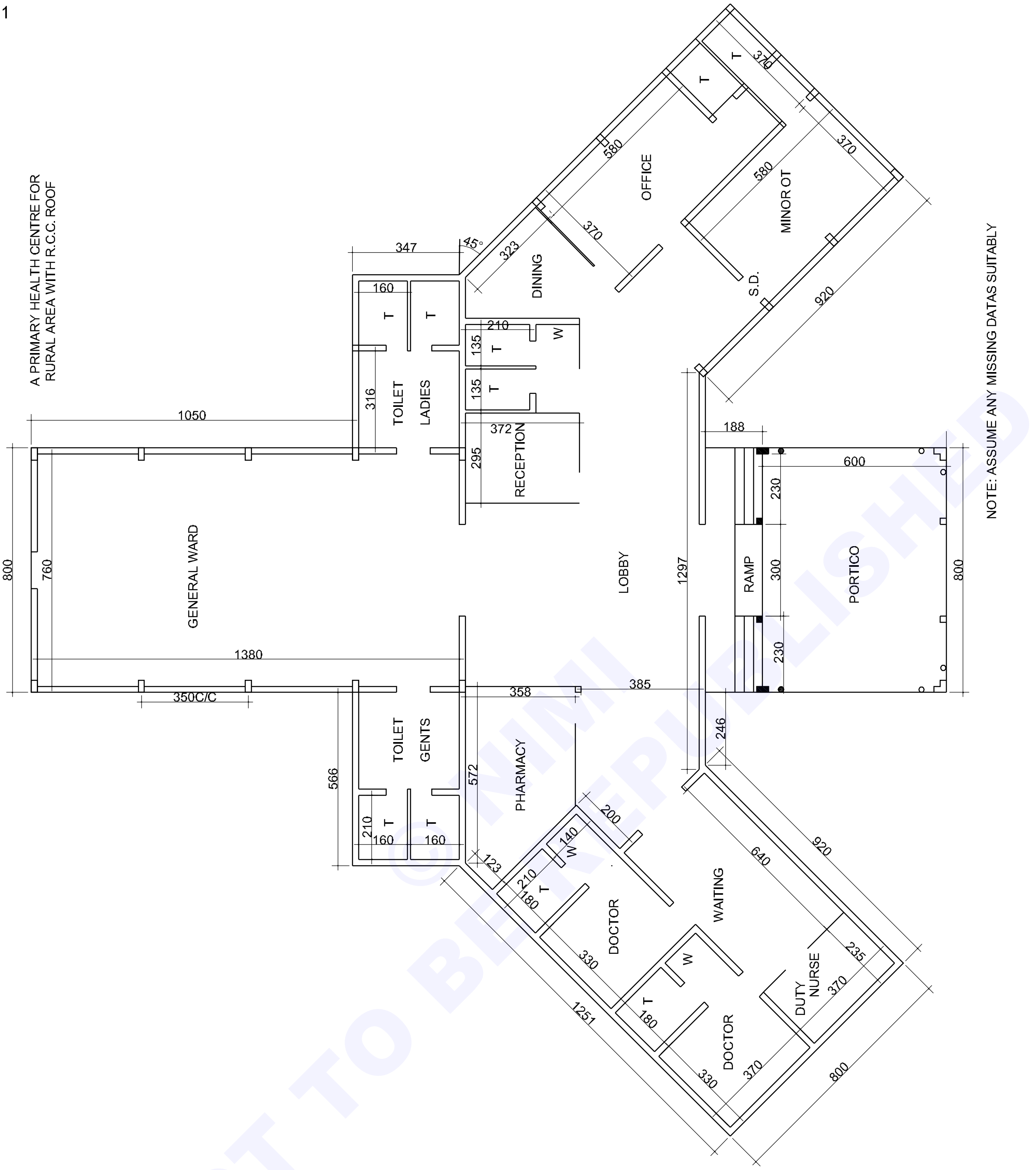
TASK 1 : **Prepare the working drawings of a primary health centre as per given line sketch through AutoCAD (Fig 1)**

1 Prepare the working drawing as per the sketch given through AutoCAD.

2 Take print out in A2 sheet.

**Take standard dimensions for the structural elements for a public building.**

Fig 1




PRIMARY HEALTH CENTRE

## Village library building with R.C.C flat roof

**Objectives :** At the end of this exercise you shall be able to
- **draw the plan of a village library of R.C.C flat roof**
- **draw the sectional elevation**
- **draw the elevation.**

## PROCEDURE

TASK 1 : **Prepare plan, section and elevation of a village library as per given line sketch (Fig 1)**

1 Line sketch showing the arrangement of room.

2 Height of wall 4m.

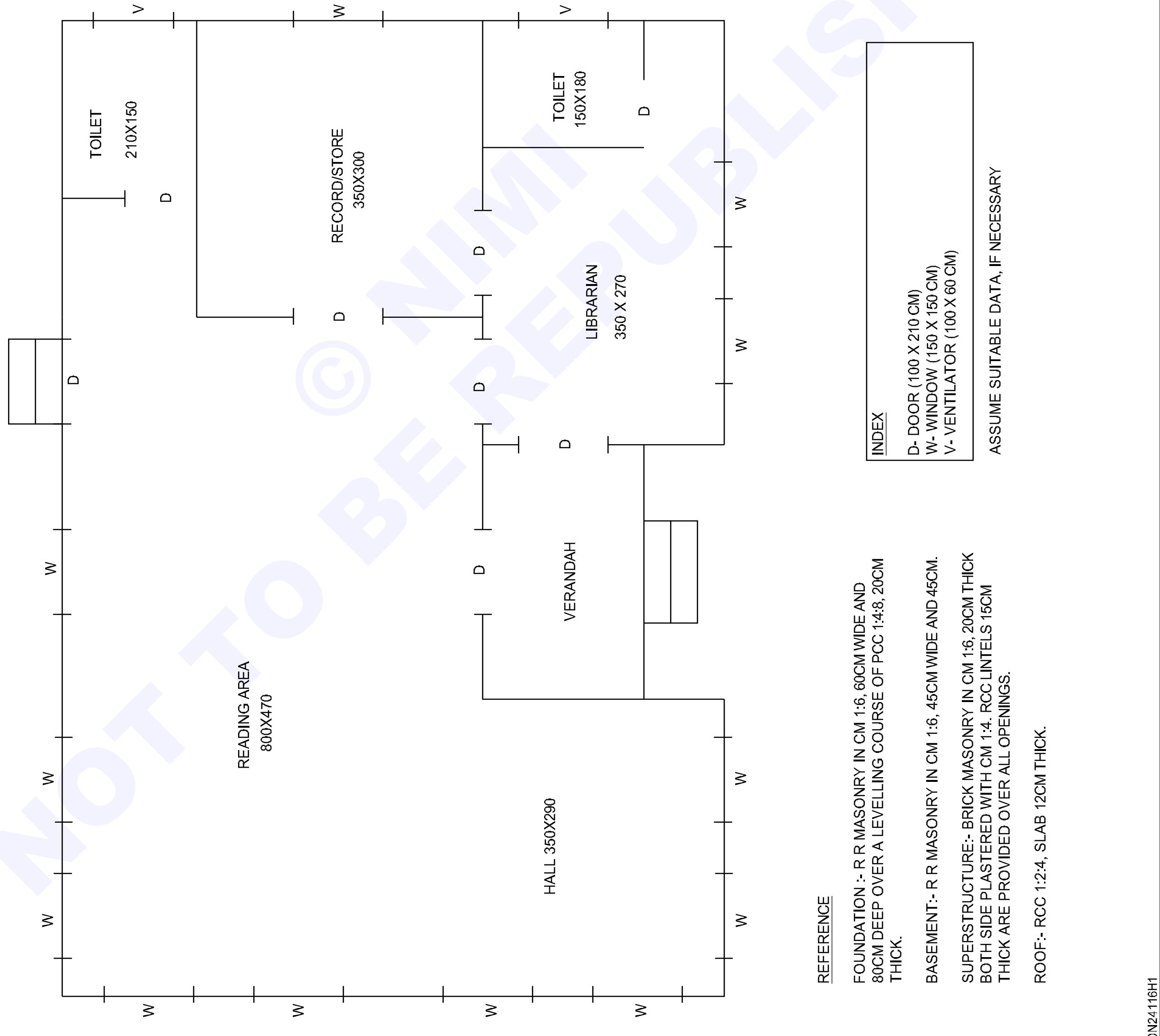
3 Assume standard data's for other elements of building

4 Prepare the working drawing through AutoCAD.

5 Prepare the working drawing.

6 Take a print in A3 sheet in scale of 1:100.

Fig 1




LINE SKETCH OF A VILLAGE LIBRARY

# A small restaurant building with R.C.C flat roof

**Objective:** At the end of this exercise you shall be able to
- **prepare working drawings of restaurant building through AutoCAD.**

## PROCEDURE

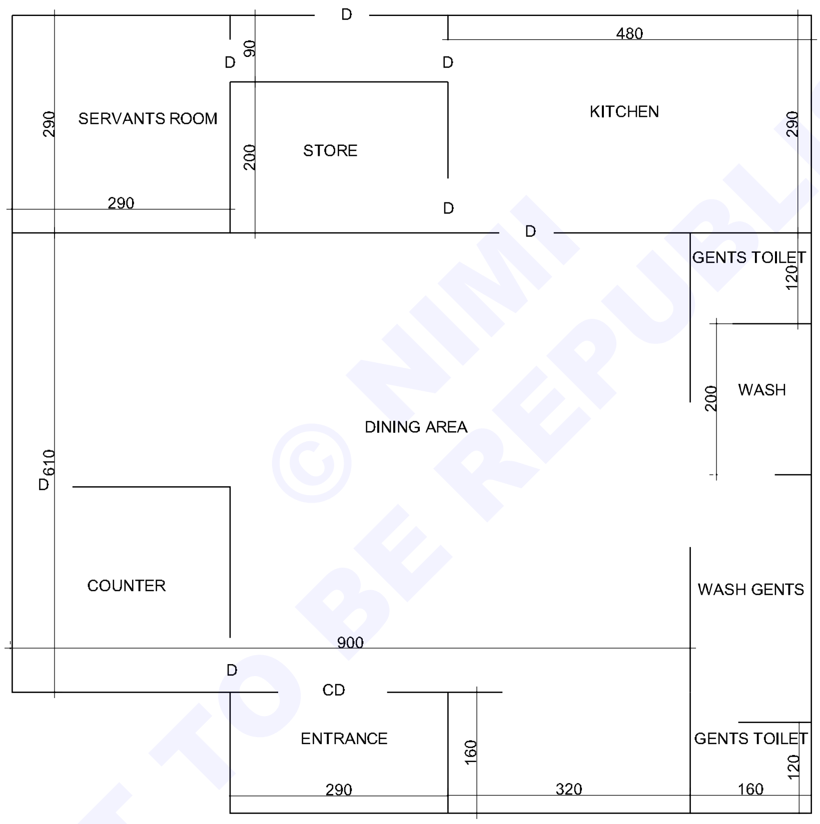
TASK 1 : **Prepare the working drawing of a restaurant building as per given in line diagram (Fig 1)**

1 Prepare working drawing of a restaurant building through AutoCAD.

2 Take a print in A3 sheet in scale of 1.00

**Take standard dimensions for all elements for a restaurant building.**

Fig 1




RESTAURANT BUILDING

REFERENCE

FOUNDATION :- R R MASONRY IN CM 1:6, 60CM WIDE AND 80CM DEEP OVER A LEVELLING COURSE OF PCC 1:4:8, 20CM THICK.

BASEMENT:- R R MASONRY IN CM 1:6, 45CM WIDE AND 45CM.

SUPERSTRUCTURE:- BRICK MASONRY IN CM 1:6, 20CM THICK BOTH SIDE PLASTERED WITH CM 1:4. RCC LINTELS 15CM THICK ARE PROVIDED OVER ALL OPENINGS.

ROOF:- RCC 1:2:4, SLAB 12CM THICK.

INDEX

D- DOOR (100 X 210 CM)
W- WINDOW (150 X 150 CM)
V- VENTILATOR (100 X 60 CM)

ASSUME SUITABLE DATA, IF NECESSARY

DC20N24117H1



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# A Single storeyed school building with R.C.C flat roof

**Objective :** At the end of this exercise you shall be able to
- **draw the working drawings of a school building with R.C.C flat roof.**

## PROCEDURE

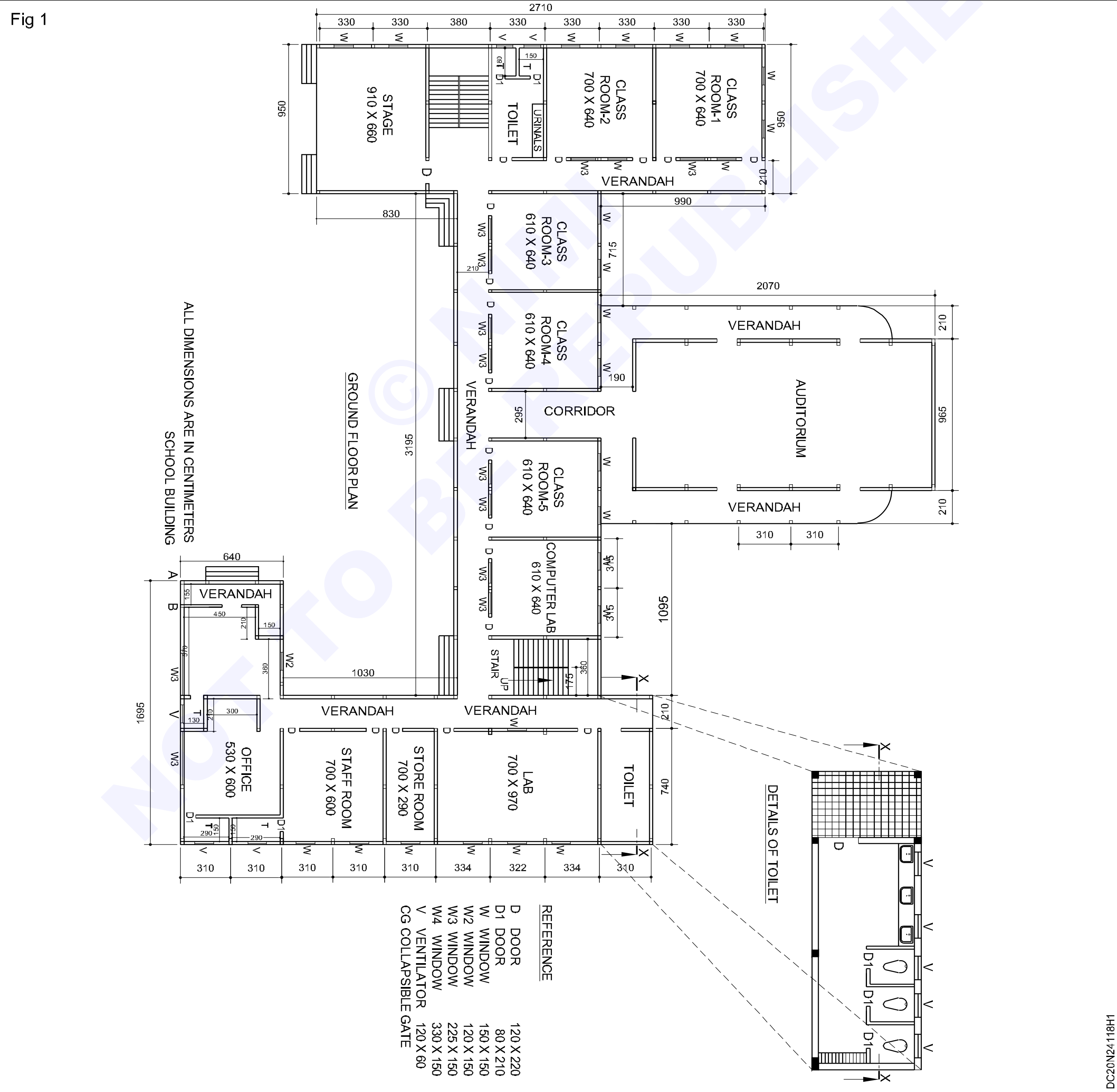
TASK 1 : **Prepare the working drawings of a school building with R.C.C framed structure flat roof (Through AutoCAD) (Fig 1)**

### DATA

1 Take standard dimensions for structural elements for a public building.

2 Prepare the drawings precisely and accuretly by the experience from previous drawing.

Fig 1



# Workshop building with north light steel roof truss over R.C.C Column

**Objectives :** At the end of this exercise you shall be able to
- **prepare the working drawing of a workshop**
- **building with north light steel roof truss.**

## PROCEDURE

TASK 1 : **Prepare the working drawing of a workshop building as per given line sketch (Fig 1)**

**DATA**

1 Give R.C.C flat roof for office buildig with a height of 400cm.

2 Give north light trussed roof for workshop with height of wall 600cm.

3 Provide a mezzanine floor at 270cm height.

4 Column size (30 x 50) cm.

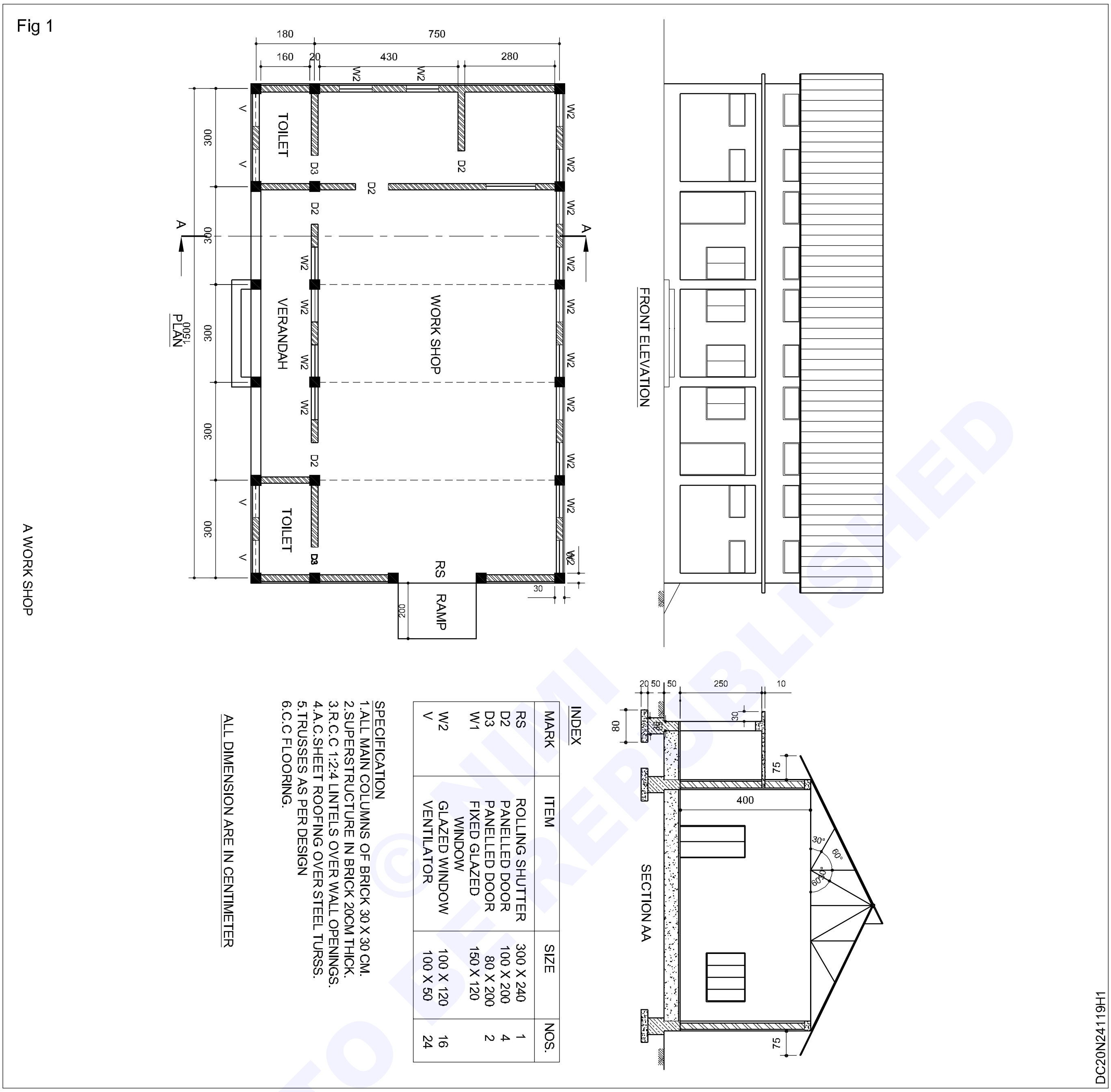
5 Develop plan as per line sketch showing the lines of trusses.

6 Draw a sectional elevation crossing R.C.C roof and mezzanine floor.

7 Draw the elevation and complete the working drawing.

8 Take print out in a scale of 1:100.

**Take standard dimensions of a north light trussed roof.**




INDEX

| MARK | ITEM | SIZE | NOS. |
|---|---|---|---|
| RS | ROLLING SHUTTER | 300 X 240 | 1 |
| D2 | PANELLED DOOR | 100 X 200 | 4 |
| D3 | PANELLED DOOR | 80 X 200 | 2 |
| W1 | FIXED GLAZED WINDOW | 150 X 120 | |
| W2 | GLAZED WINDOW | 100 X 120 | 16 |
| V | VENTILATOR | 100 X 50 | 24 |

SPECIFICATION
1. ALL MAIN COLUMNS OF BRICK 30 X 30 CM.
2. SUPERSTRUCTURE IN BRICK 20CM THICK.
3. R.C.C 1:2:4 LINTELS OVER WALL OPENINGS.
4. A.C.SHEET ROOFING OVER STEEL TURSS.
5. TRUSSES AS PER DESIGN
6. C.C FLOORING.

ALL DIMENSION ARE IN CENTIMETER

## Service plans

**Objectives :** At the end of this exercise you shall be able to
- **draw the sanitary service plan.**

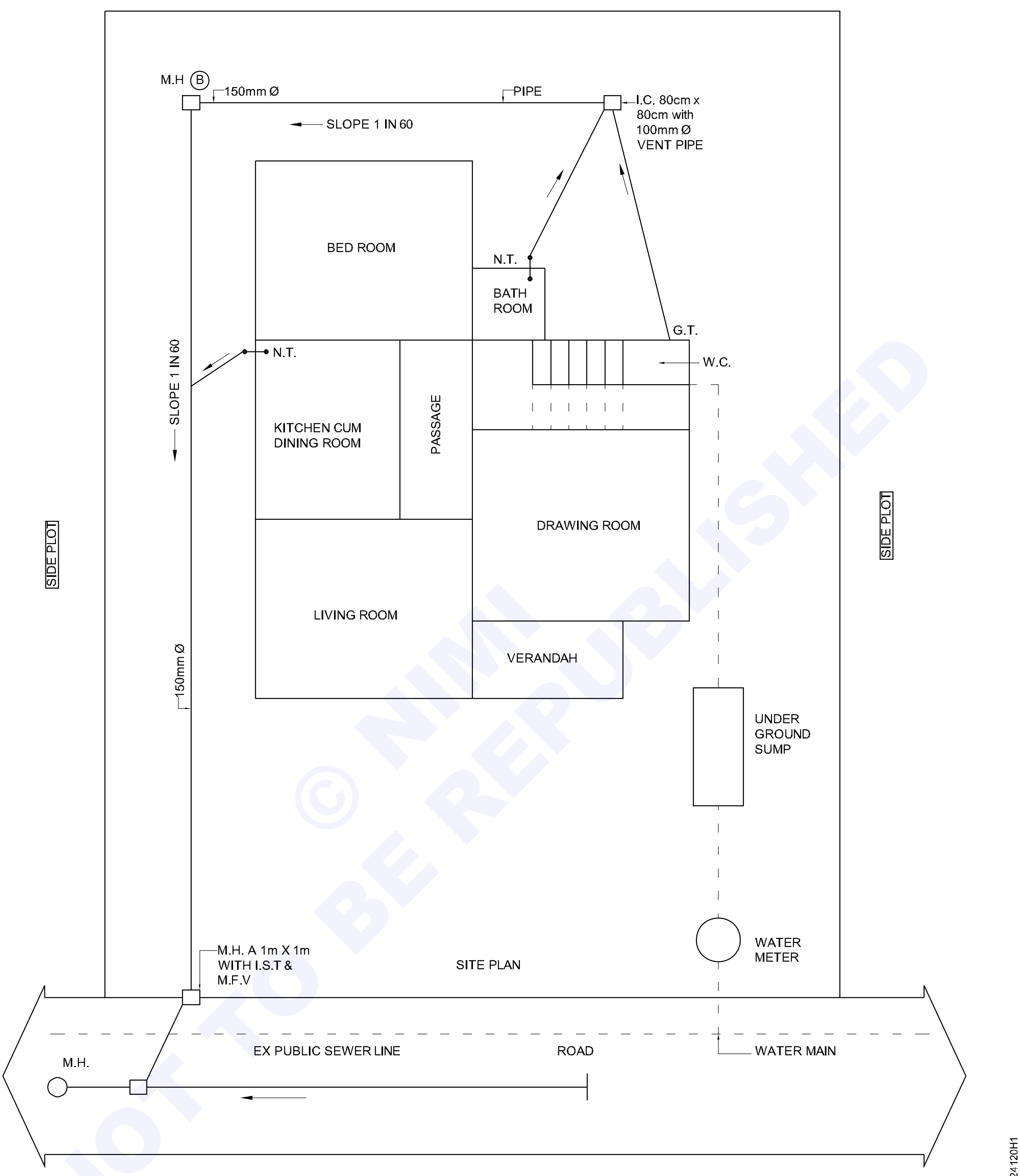
PROCEDURE

TASK 1 : **Prepare the sanitary service plan of the given building (Fig 1)**

1 To draw the sanitary service plan
2 Draw the line sketch of the building in a scale 1:100 and mark the sanitary fittings
3 Give setbacks as per drawing given.
4 Draw the layout of public sewer line.
5 Draw the layout of house drain to the public sewer.
6 Mark the positions of gully traps, inspection chambers, manholes etc where ever necessary.
7 Complete the drawing.
8 Complete the drawing as per given sketch.

**Prepare the drawing manually and through AutoCAD.**

Fig 1




SANITARY SERVICE PLAN

# Singly reinforced R.C.C rectangular beam

**Objectives :** At the end of this exercise you shall be able to
- **prepare the longitudinal section of the beam showing reinforcement details**
- **prepare the top and bottom plan showing arrangement of bars**
- **prepare the cross sectional view of the beam at midspan and at support.**

## PROCEDURE

TASK 1 : **Draw the single reinforced beam to a suitable scale using CAD software (Fig 1)**

1 Longitudinal section of the beam showing reinforcement details.

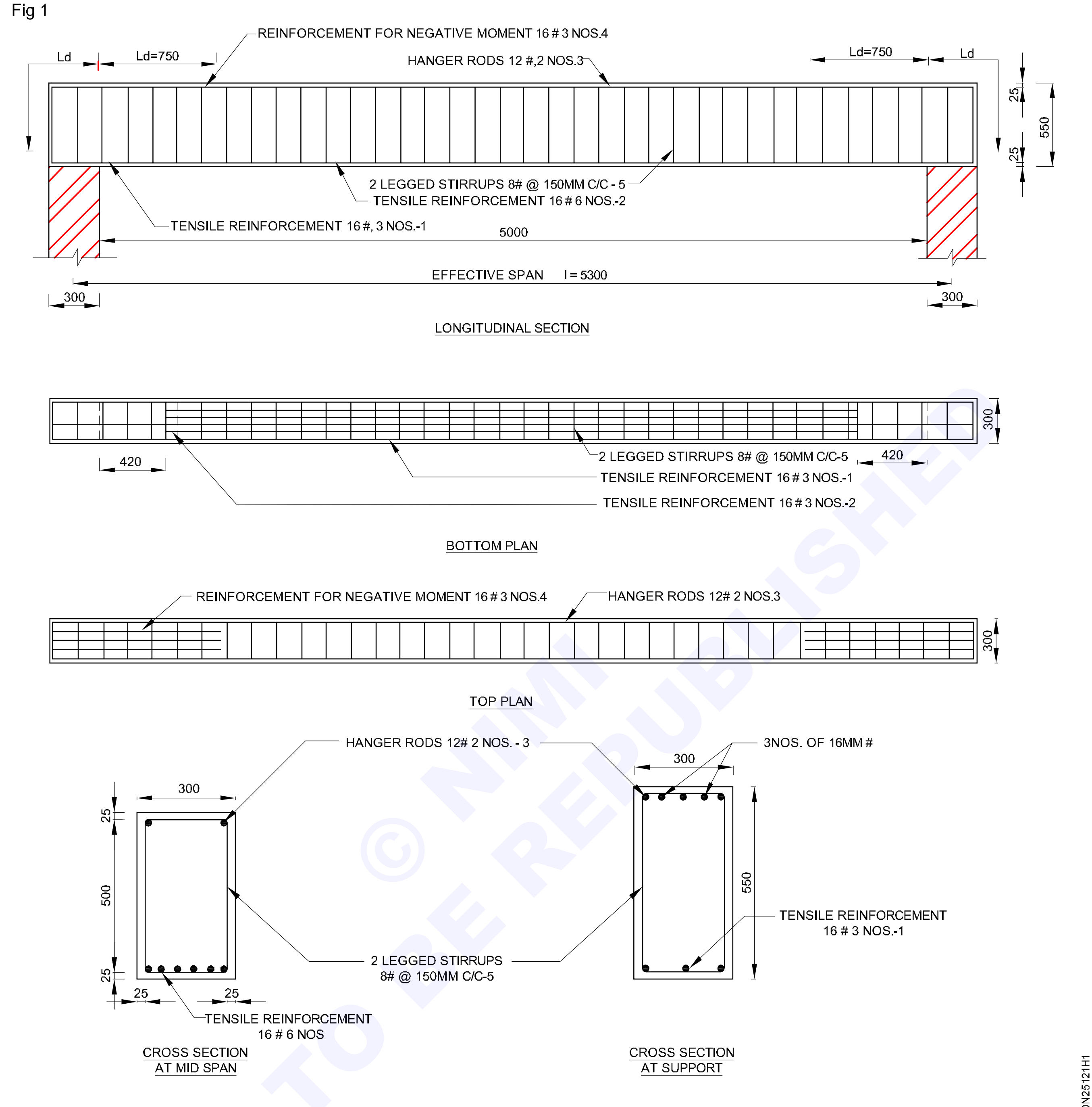
2 Top and bottom plans showing arrangement of bars.

3 Cross sectional view of the beam at mid span and at support.

**DATA**

- The following are the particulars of a singly reinforced partially fixed beam.
- Clear span - 5000 mm.
- Width of supports -300 mm.
- Size of beams $- 300 \times 550$ mm.
- Clear cover to steel rods -25 mm.
- Main reinforment (tensile) - 16 mm Fe 415 steel - 6 Nos.
- Hanger rods - 12 mm Fe 415 steel 2 Nos.
- Shear reinforcement - Two legged stirrups 8 mm Fe 415 steel @ 150 mm.
- Reinforcement at top at supports for negative moment 16 mm Fe 415 steel 3 nos for a length of 0. 14l and anchored sufficiently. Anchorage and curtailment of reinforcement may be adopted with standard value and any more data required may be assumed suitably.
- Prepare drawing using basic commands.
- Save drawing as R.C.C beam.

Fig 1



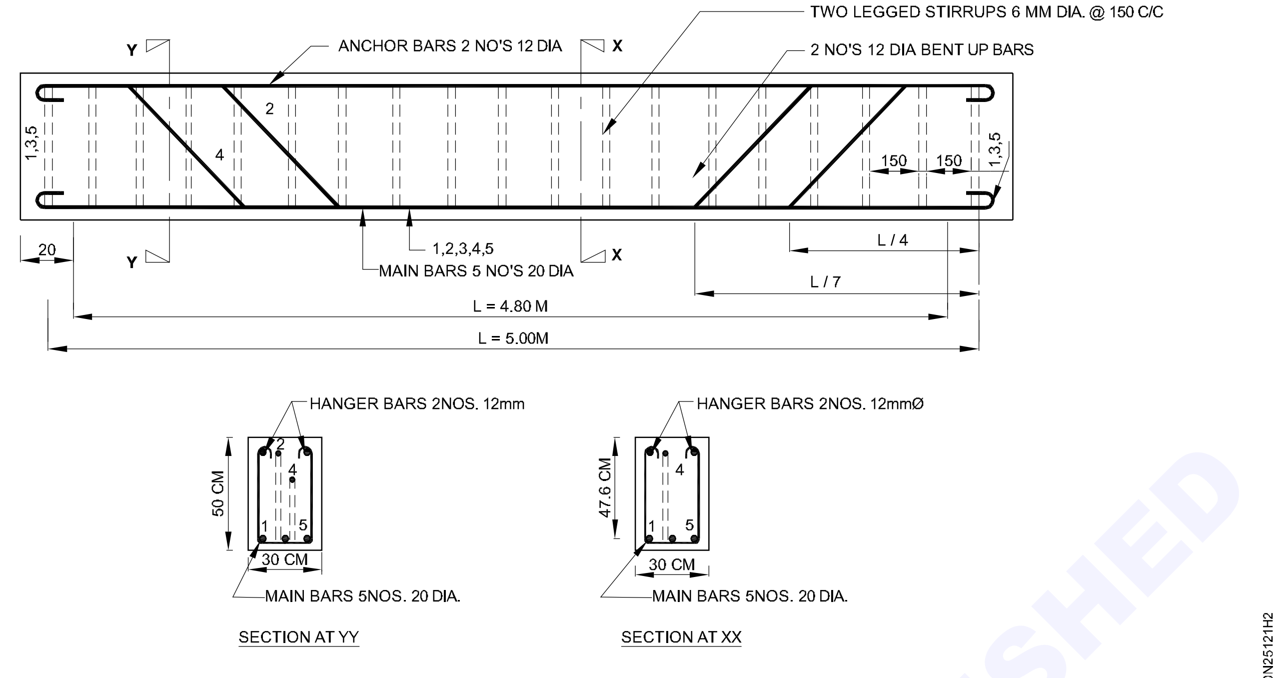

DETAILS OF SINGLE REINFORCED BEAM

TASK 2 : **Draw to a suitable scale, the longitudinal section, cross section near the support and cross section at the centre of span of a rectangular R.C.C beam simply supported with the following data (Fig 2)**

**DATA**

- Clear span (l) -4.80 m.
- Effective span (L) - 5.00 m.
- Width of beam - 30 cm.
- Overall depth of beam - 50c m.
- Effective depth of beam - 47.6 cm.
- Main reinforcement consists of 20 mm. dia. bars, out of 5 bars, 2 numbers alternative bars bent up; one bar bent up at L/7 and the other at L/4 from the centre of supports.
- Provide 2 Nos bar of 12 mm Ø as anchor bars.
- Provide two - legged stirrups of 6 mm Ø @ 15 cm c/c.

Fig 2




DETAILS OF SINGLE REINFORCED BEAM

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## Double reinforced R.C.C rectangular beam (partially fixed)

**Objectives :** At the end of this exercise you shall be able to
- **prepare the longitudinal section of the double reinforced R.C.C beam with reinforcement details**
- **prepare the top and bottom plan showing arrangement of bars**
- **prepare cross sectional view of the beam at mid span and support.**

PROCEDURE

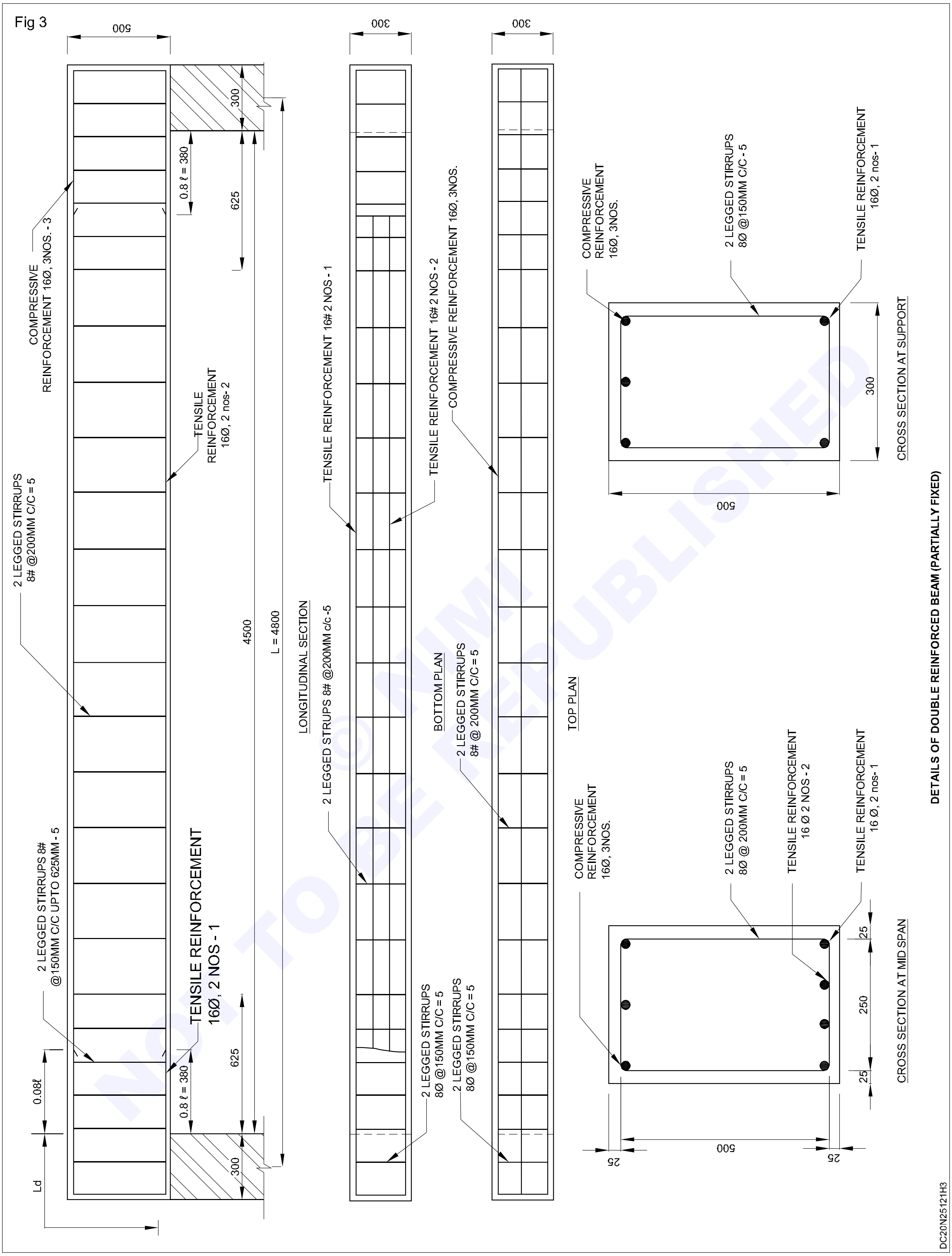
TASK 1 : **Draw following views of double reinforced beam to suitable scale (Fig 3)**

1 Longitudinal section of the beam showing reinforcement details.
2 Top and bottom plans showing arrangement of bars.
3 Cross sectional view of the beams at mid span and at supports.

**DATA**

- The following are the particulars of a double reinforced partially fixed beam.
- Clear span - 4500 mm
- Width of supports - 300 mm
- Size of beam - 300 x 550 mm
- Tensile reinforcement - 16 mm Fe 415 - 4 Nos
- Compressive reinforcement - 16 mm Fe 415 steel, 3 Nos.
- Shear reinforcemtent - 8 mm Fe 415
- Steel 2 legged stirrups at 150mm clc upto a distance of 625mm from the face of supports. On each side and at 200 mm c/c the remaining portion.
- Anchorage and curtailment of reinforcement may be same as previous exercise.
- Prepare the drawing using AutoCAD

Fig 3




DETAILS OF DOUBLE REINFORCED BEAM (PARTIALLY FIXED)

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TASK 2 : **Draw to a suitable scale, the longitudinal section, a cross section near the support and cross section in the centre of span of a rectangular. R.C.C. simply supported beam (Fig 4)**

**DATA**

| | |
|---|---|
| Clear span ( $\ell$ ) | = 7.00 m. |
| Effective span (L) | = 7.30 m. |
| Width of beam | = 300 mm. |
| Overall depth of beam | = 850 mm. |
| Tensile bars bent up at L/7 from middle of bearings. | = 5 No's 20Ø with two bars |
| Anchor bars | = 2 No's 12Ø |
| Side face reinforcement | = 4 No's 12Ø (two on each face) |
| Stirrups | = 8 Ø 240mm c/c |

**When the depth of beam increases 750 mm side face reinforcement is to be provided along the two faces. Spacing between side face reinforcement should not be more than 300mm.**

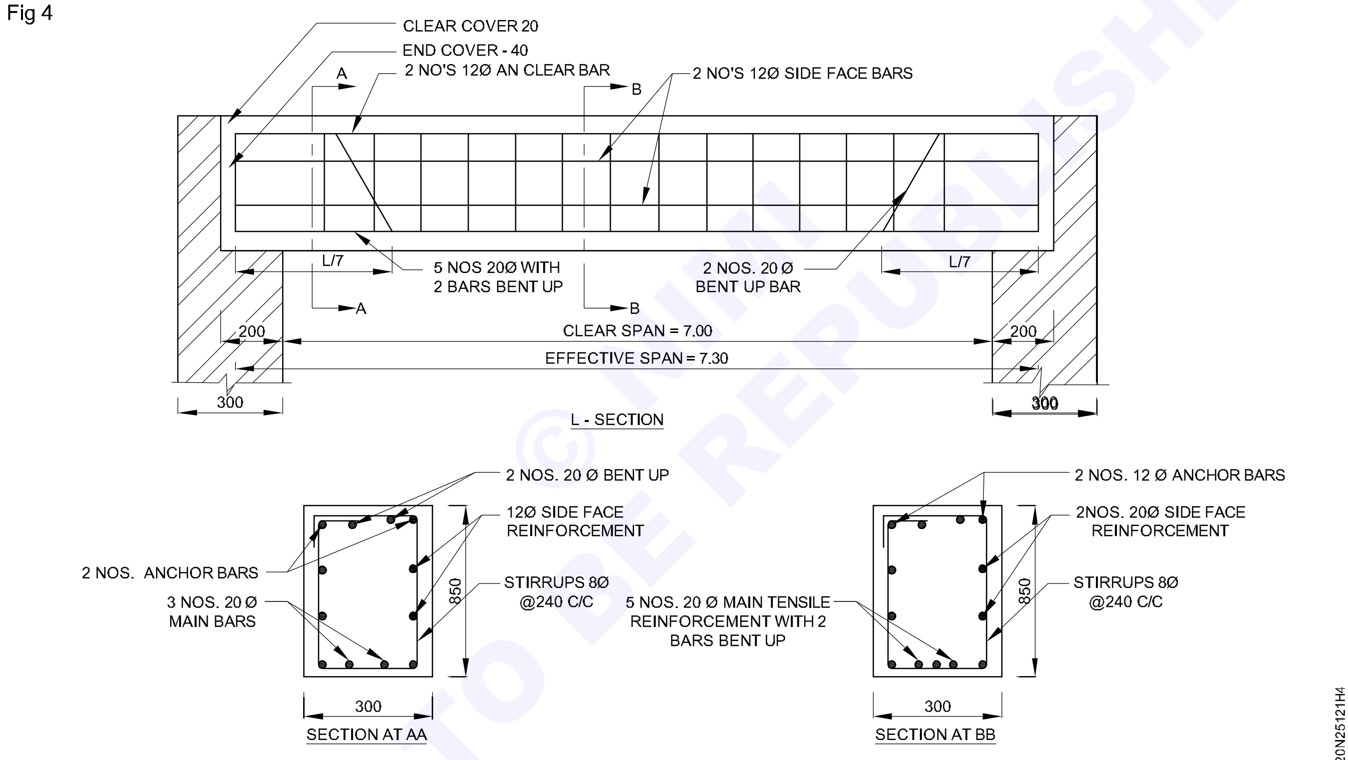
Area of side face reinforcement

As = 0.1 % of the web area $\frac{0.1 \times 300 \times 850}{100} = 25.50\text{mm}^2$

Provide 4 No's 12 Ø in all, two on each face giving a total area of as = 45.2 mm$^2$

Stirrups = 2 legged 8 mm Ø at 240 mm c/c throughout .

Fig 4




DETAILS OF SINGLE REINFORCED BEAM

## R.C.C lintel and sunshade

**Objective :** At the end of this exercise you shall be able to
- **prepare the R.C.C lintel (longitudinal and cross section)**
- **prepare the R.C.C lintel with sunshade.**

PROCEDURE

TASK 1 : **A.R.C.C lintel is supported on walls of 300 mm thick wall over a span of 2 metre. It is reinforced with 3nos, 12 mm diameter steel bars and two 10mm bar for anchoring. 8 mm stirrups at 200 mm c/c and depth of lintel is 150 mm. (Fig 1)**

1 Draw the following views.

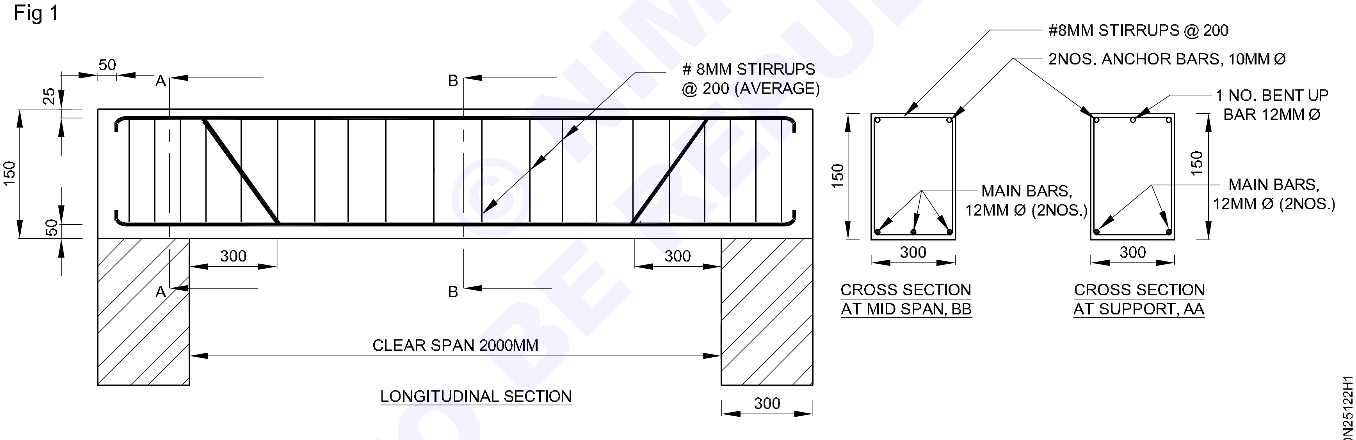
2 Longitudinal views.

3 Cross section at mid - span and at support.

**DATA**

- Clear span of lintel - 2m (2000 mm).
- Bearing on either side - 300 mm.
- Size of lintal 300x150mm
- Width of brick wall - 300 mm.
- Reinforcement details:
- main bar: 12 mm Ø Fe 415 steel - 3 Nos. With one number bent up at support.
- Stirrups: 8 mm Ø at 200 mm c/c, 2 Nos of 10 mm Ø bars at top.
- Same as previous exercise.
- Use hatch commands wherever necessary.

Fig 1




DETAILS OF R.C.C. LINTELS



TASK 2 : **Draw the following views to a suitable scale (Fig 2)**

1 Longitudinal section of lintel.

2 Cross section of lintel and sunshade at mid span and at support.

3 Plan of lintel and sunshade.

4 Hanger rods.

5 Shear reinforcement.

**DATA**

- The following are the particulars of a lintel with sunshade.
- Clear span of lintel - 2000 mm.
- Bearing on either side - 300 mm.
- Size of lintel $-300 \times 200$ mm.
- Width of brick wall - 300 mm.
- Width of sunshade - 900 mm.
- Thickness of sunshade - 100 mm at support and 50 mm at free end.

**Reinforcement details**

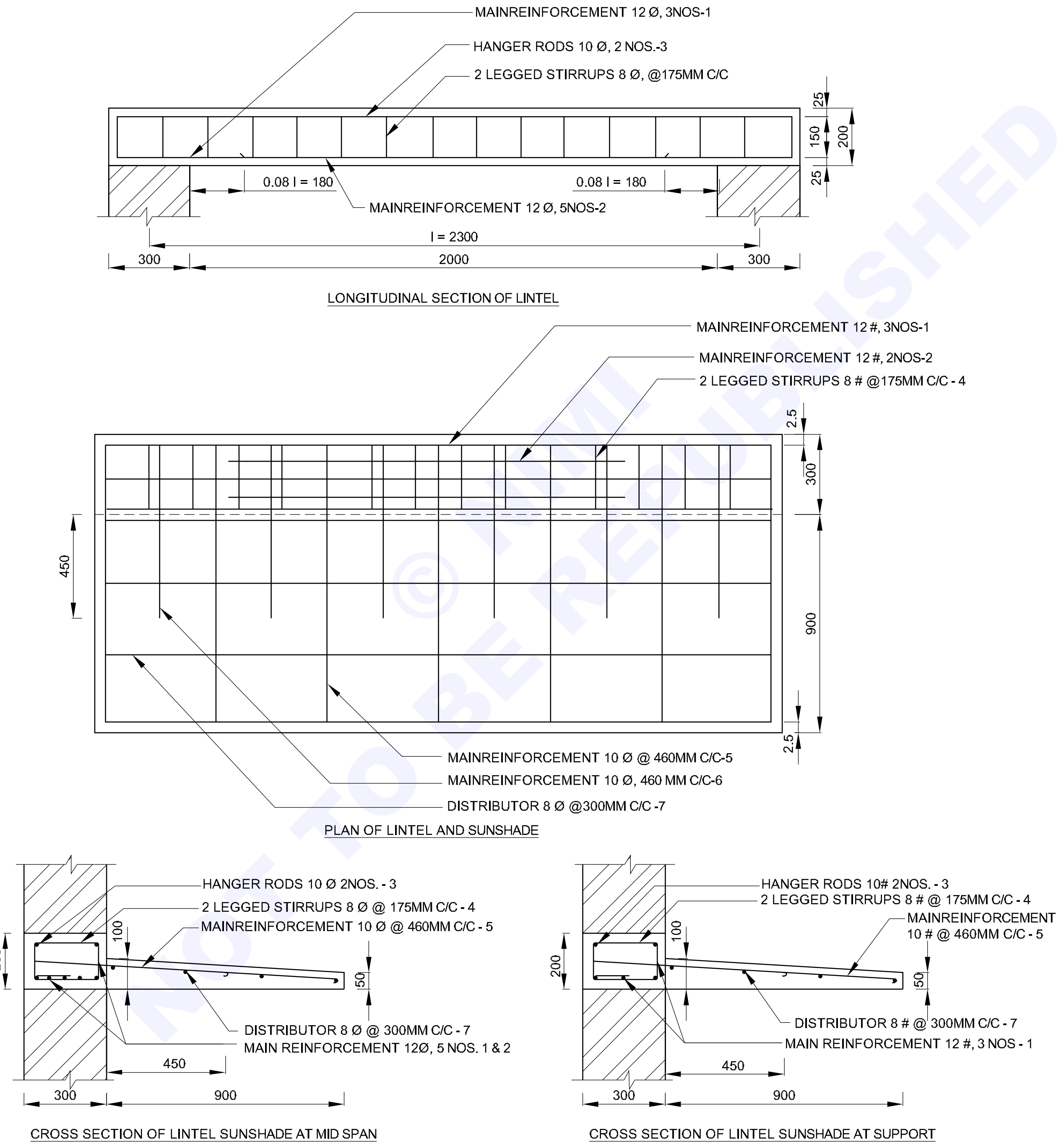
- Lintel - 12 mm Fe 415 steel ( 5 Nos), 2 Nos curtailed at 0.08 $\ell$ from face of the wall.

- Hanger reinforcement - 10 mm.
- Fe 415 steel 2 Nos.
- Shear reinforcement - Fe 415 steel 8 mm, 2 legged stirrups 175 mm c/c.

**Sunshade**

- Main reinforcement - Fe 415 steel 10 mm @.
- 230 mm c/c..
- Distributors - Fe 415 steel 8 mm.
- 300 mm c/c.
- Anchorage and curtailment of reinforcement may be adopted with standard values and any more data required may be assumed suitably.

Fig 2




DETAILS OF R.C.C. LINTELS

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## R.C.C stair and details of step

**Objectives :** At the end of this exercise you shall be able to
- **prepare section along the flight length**
- **prepare bar bending details.**

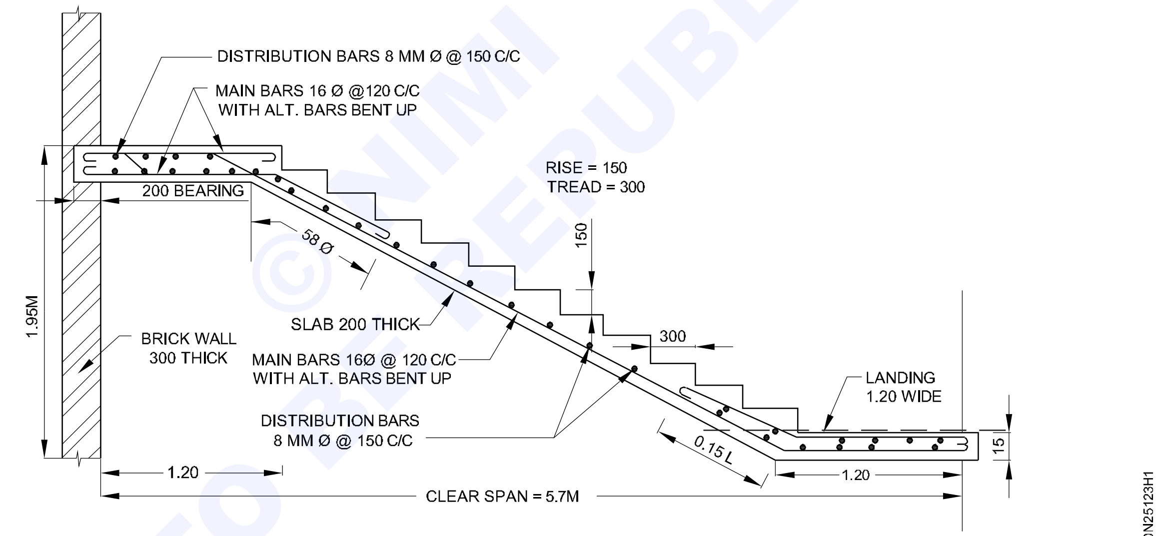
PROCEDURE

TASK 1 : **Draw the reinforcement details of cross section of the flight of a slab type stair (Fig 1)**

**DATA**

- Clear span (including landing) = 5.7 m.
- Width of landing on both sides = 1.2 m.
- Rise = 1.5 cm.
- Going = 30 cm.
- Thickness of slab = 20 cm.
- Main reinforcement = 16 mm. Ø @ 12 cm. c/c.
- Distribution reinforcement = 8 mm. Ø @ 15cm. c/c.
- Clear cover = 16 mm.
- Bearing of slab = 20 cm. on brick wall.
- Draw single straight flight R.C.C slab stair using CAD software.

Fig 1




SINGLE STRAIGHT FLIGHT OF R.C.C. INCLINED SLAB STAIRS

TASK 2 : **Draw the following views of dog legged stair case to a suitable scale (Fig 2)**

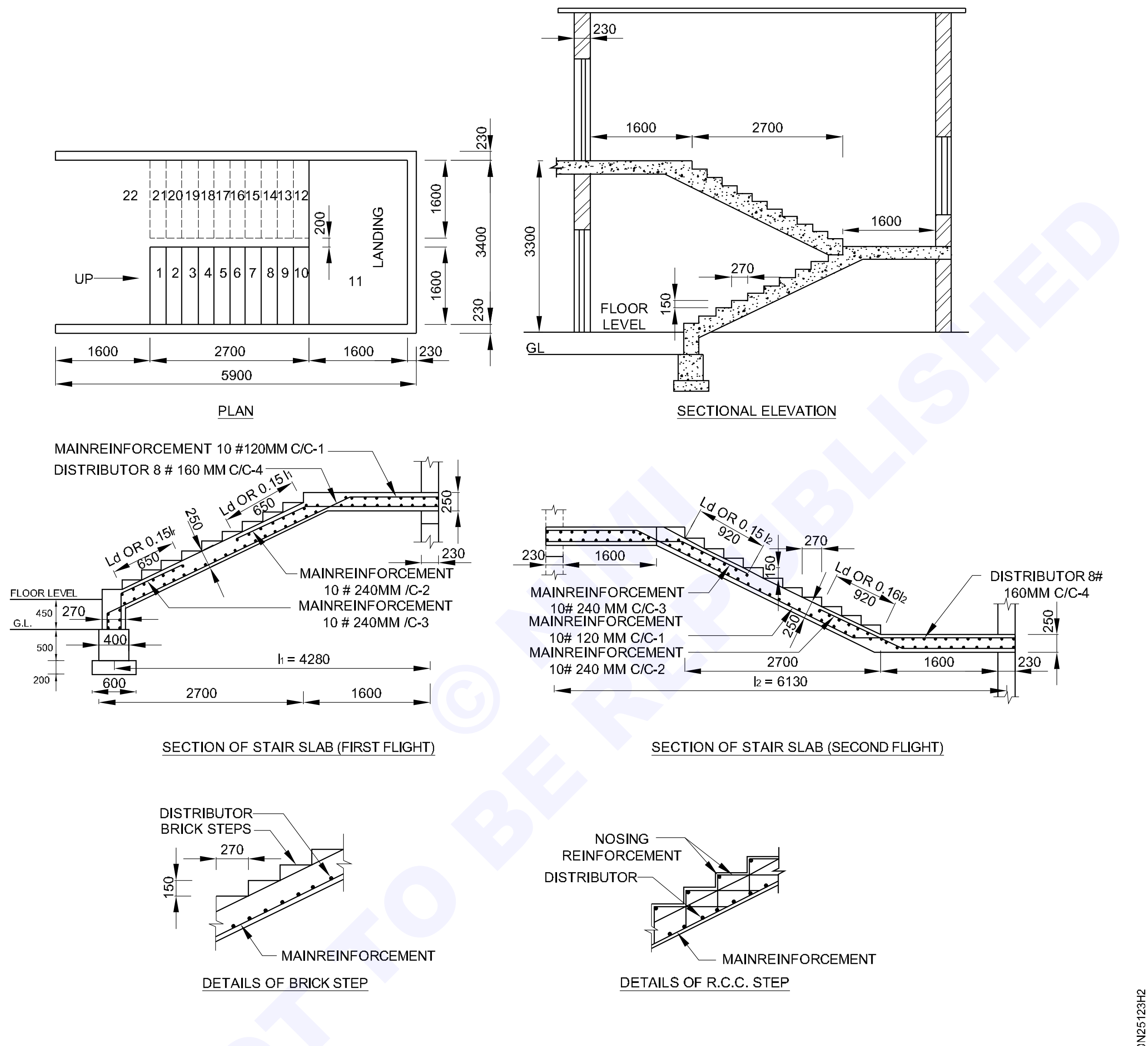
1 Plan and elevation of dog legged stair.
2 Section of waist slab (first flight).
3 Section of waist slab (second flight).
4 Details of steps.

**DATA**

- The following are the particulars of a dog legged staircase.
- Clear size of staircase room - 5.9 m x 3.4 m.
- Width of suppoprting walls - 230 mm.
- Vertical distance between the floors - 3.3 m.
- Width of flight - 1600 mm.
- Width of landing - 1600 mm.
- Number of flights - 2.
- No. of riser in each flight - 11.
- N0. of treads in each flight - 10.
- Rise - 150 mm.
- Tread - 270 mm.
- Thickness of waist slab - 250 mm.
- Main reinforcement 10 mm Fe 415 steel @ 120 mm c/c.

- Distributors - 8 mm Fe 415 steel @ 160 mm c/c
- 50% of the main reinforcement are provided at the bottom of landing slab and extended to the top of waist for a length of 0.15 $\ell$ or Ld whichever is greater.
- Anchorage and curtailment of reinforcement may be with standard values and any more data required may be suitably assumed.
- Draw single R.C.C doglegged stair using Auto CAD software.

Fig 2




**DOG LEGGED STAIRCASE**



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## Bar bending schedule

**Objectives :** At the end of this exercise you shall be able to
- **prepare L-section and X-section of an R.C.C lintal**
- **calculate length of mainbar, crank bar stirrup holder and stirrup**
- **calculate numbers of each bar**
- **prepare bar bending schedule.**

TASK 1 : **Calculate the quantity of reinforcement required for a R.C.C lintel over a door of a size 200 x 210 cm and prepare bar bending schedule (Fig 1)**

**DATA :** Size of lintel = 25 x 15 cm.

Mainbar- 12mm ø - 4 Nos.

(2 No straight, 2 Nos cranked).

Stirrup holder - 8 mm ø - 2 Nos.

Stirrup - 6 mm ø 13 cm c/c (average).

Wall thickness = 25 cm.

Bearing - 15cm.

Covering - 2.5 cm around.

Length of lintel = $200+(2\times15)=200+30$.

= 230 cm.

Effective length = L - 2 end cover.

= 230 - 2 x 4 = 230 - 8.

= 222 cm.

Width of lintel = 25 cm

Effective width of lintel = 25 - 2 x cover - 1 dia of stirrup

= $25-2\times-(1\times0.6)$.

= 20.4 cm.

No. of main bar = 4 Nos.

No. of straight bar = 2 Nos.

No. of cranked bar = 2 Nos.

Length of straights bar = $\ell$ + 18 ø .

= $222+(18\times1.2)$.

= 243 .6 cm.

Length of cranked bar = l + 18 ø + 0.84d .

∴ d = 15 - 2 x cover - 1 dia of stirrup.

= 15 - (2 x2.5) - 1 x 0.6 = 9.4cm

Length of cranked bar =222 + . (18 x 1.2) + (0.84 x 9.4)

= 251. 49 cm .

Number of stirrup = $\frac{l}{\text{spacing}}+1$.

$=\frac{222}{13}+1=18.08$

= 19 Nos .

Length of stirrup = 2 (b+d) + 18 ø.

= 2 (20.4 + 13.4) + (18 x 0.6)

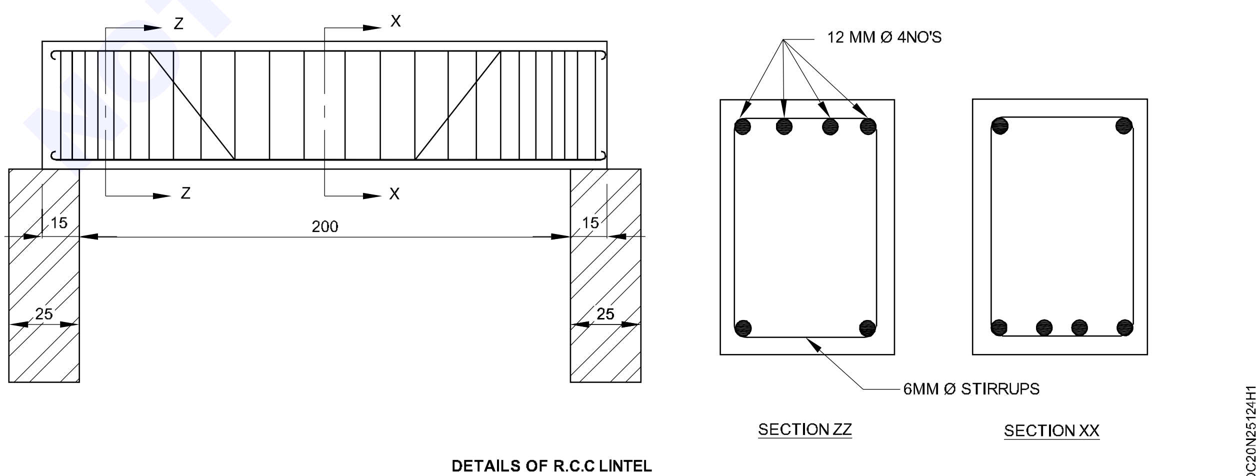
= 78.4 cm.

Length of stirrup holder = l + 18 ø .

= 222 + (18 × 0.8).

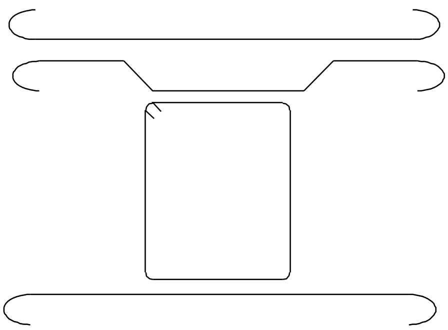
= 236.4 cm.

Fig 1




DETAILS OF R.C.C LINTEL

**Table 1 Barbending schedule**

| Sl. No | Description particular | Shape of bars with sketch | No.of bar | length of each bar in m | Total length in m | Weight/ metre kg | Total weight kg |
|---|---|---|---|---|---|---|---|
| 1 | Main straight bar 12 mm |  | 2 | 2.436 | 4.872 | 0.39 | 1.900 |
| 2 | Main cranked bar 12 mm ø | | 2 | 2.515 | 5.03 | 0.89 | 4.477 |
| | Stirrup 6 mm ø | | 19 | 0.784 | 14.896 | 0.22 | 3.277 |
| | Stirrup holder 8 mm ø | | 2 | 2.364 | 4.728 | 0.39 | 1.843 |
| | | | Total weight = 11.497 = say 12kg | | | | |
| | | | Total weight In quintal $\frac{12}{100} = 0.12$ quintal | | | | |

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TASK 2 : **Calculate the quantity of reinforcement based on shapes of reinforcement required for R.C.C beam (Fig 2,3 & 4)**

**DATA**

Consider a beam of clear length of 4m, 300 mm wide and 450 mm depth. It consists of 2 - 12 diameter bars at top, and 2 - 16 diameter and 1-12 diameter bars at the bottom. Diameter of stirrup is 8 mm spaced at 180 mm center to center. Clear cover to reinforcement provided is 40 mm.

Stirrups are spaced at 180 mm center to center. Stirrups are provided between walls or support for a beam.

No. of stirrups required for given beam =

$$\frac{[(4000+460)-2\times 40]}{180}+1+25.33=26$$

Length a =

Length b = $300-2\times 40=220$

Therefore length of 1 stirrup S1 = $2\times(370+220+90)=$ 1360mm.

Where 90 mm is the minimum hook length as per IS 2502 Table 2

Fig 3

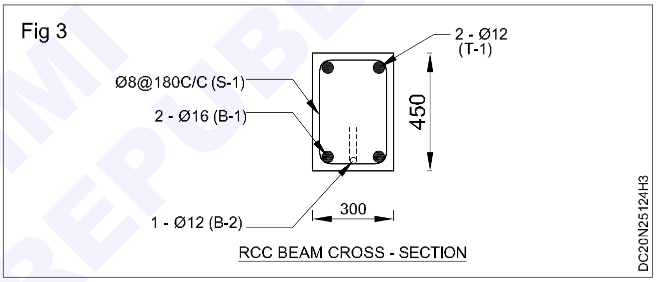



Fig 4

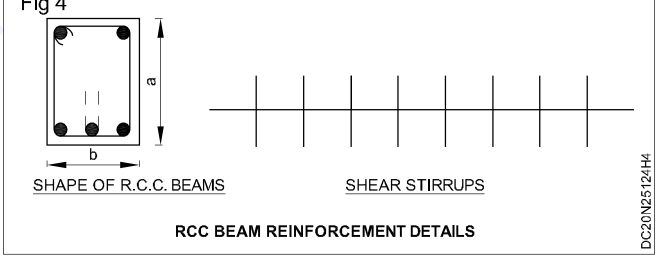



Fig 2

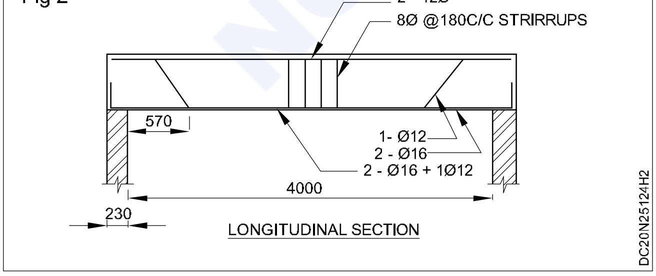
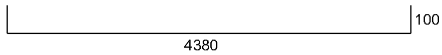
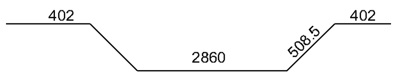
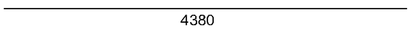
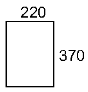


Table 2

**Bar bending schedule for R.C.C beam**

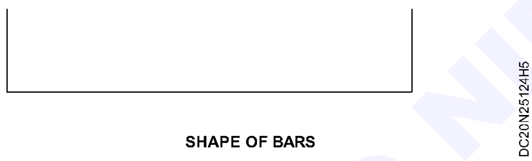
| No | Discription | Shape of bar with sketch | No.of bar | Length of each bar (mm) | Total length (m) | weight per meter (kg) | Total weight in kg |
|---|---|---|---|---|---|---|---|
| 1 | Main bar straight 16 mm# |  | 2 | 4580 | 9.160 | 1.58 | 14.47 |
| 2 | Main cranked bar 12mm # |  | 1 | 4681 | 4.681 | 0.89 | 4.17 |
| 3 | Top bar 12mm# (Hanger bar) |  | 2 | 4380 | 8.76 | 0.89 | 7.80 |
| 4 | Stirrups 8mm# |  | 26 | 1360 | 35.36 | 0.39 | 13.79 |
| | | | | | | Total | 40.23 kg |

Now we will calculate the length of reinforcement based on shapes of reinforcement required for reinforced concrete beam in above example.

we will start with bottom reinforcement, B1.

Bar shape of B1 is as shown below. (Fig 5)

Fig 5




Length of B1 = clear distance between walls + 2 x width of walls - 2 x bar cover + 2 x hook.

Hook length = 6 $\times$ 16 = 96 consider as 100 mm.

Hook length is calculated as 6 x diameter of bar for reinforcement conforming to IS : 1786 - 1961.

Length of B1 = 4000 + 2 $\times$ 230 - 2 $\times$ 40 + 2 $\times$ 100 = 4580mm.(Fig 6)

Length of bar B2 is calculated based on shape of this bar.

The bar bends up near the support as shown below.

**Length of bar B2 :** Length of straight bar + 2 bend length

H = 450 - 2 $\times$ 40 - 2 $\times$ 12/2 = 358 mm

**B2** = 4000 + 2 $\times$ 230 - 2 $\times$ 40 + (2 $\times$ 0.42 $\times$ 358) = 4681mm

**Length of bar T1** = 4000 + 2 $\times$ 230 -2 $\times$ 40 = 4380 mm (Fig 7 & 8)

Fig 6

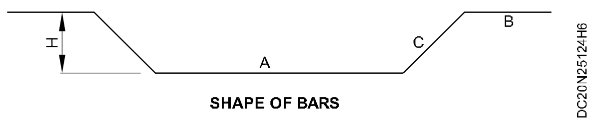
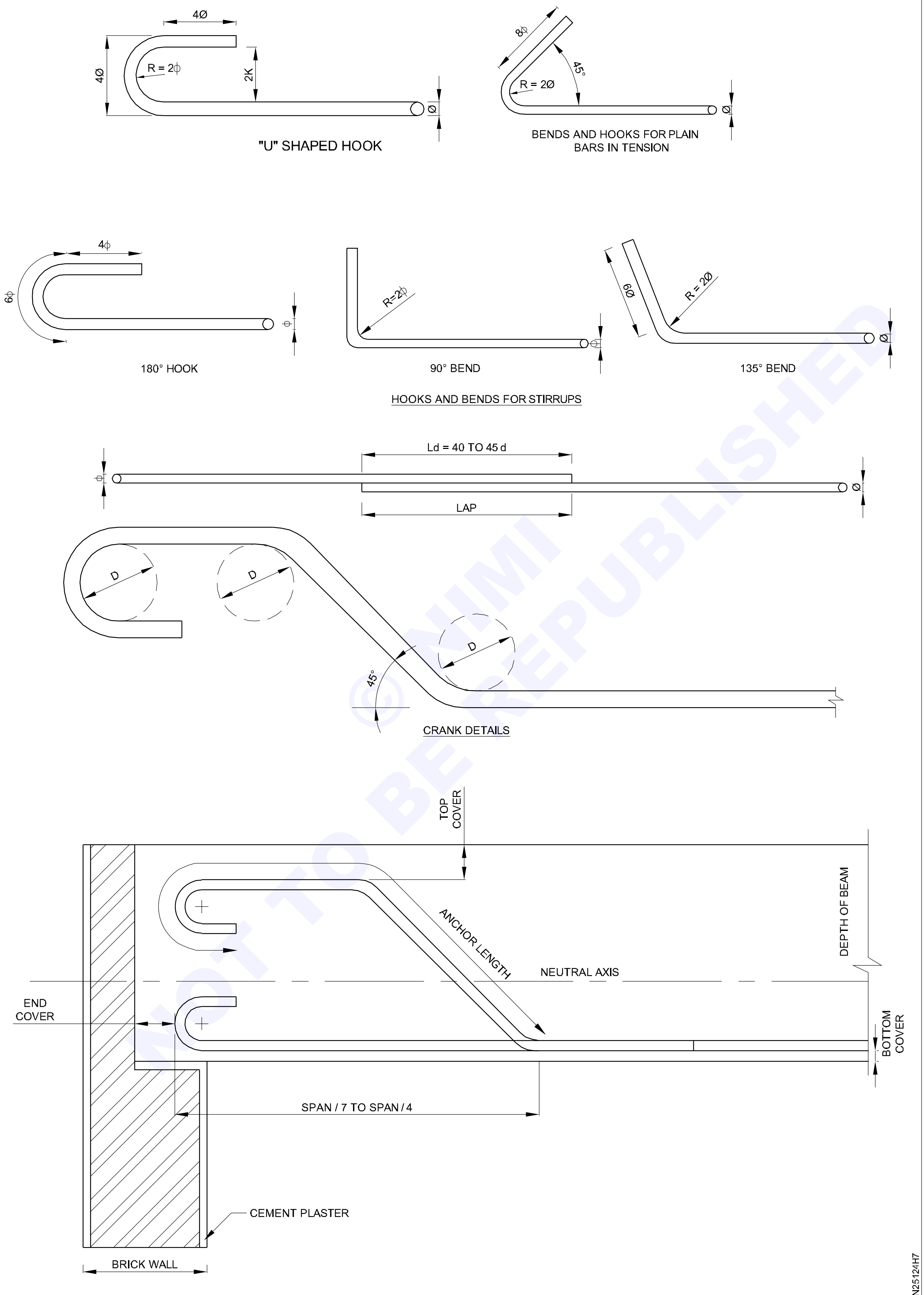
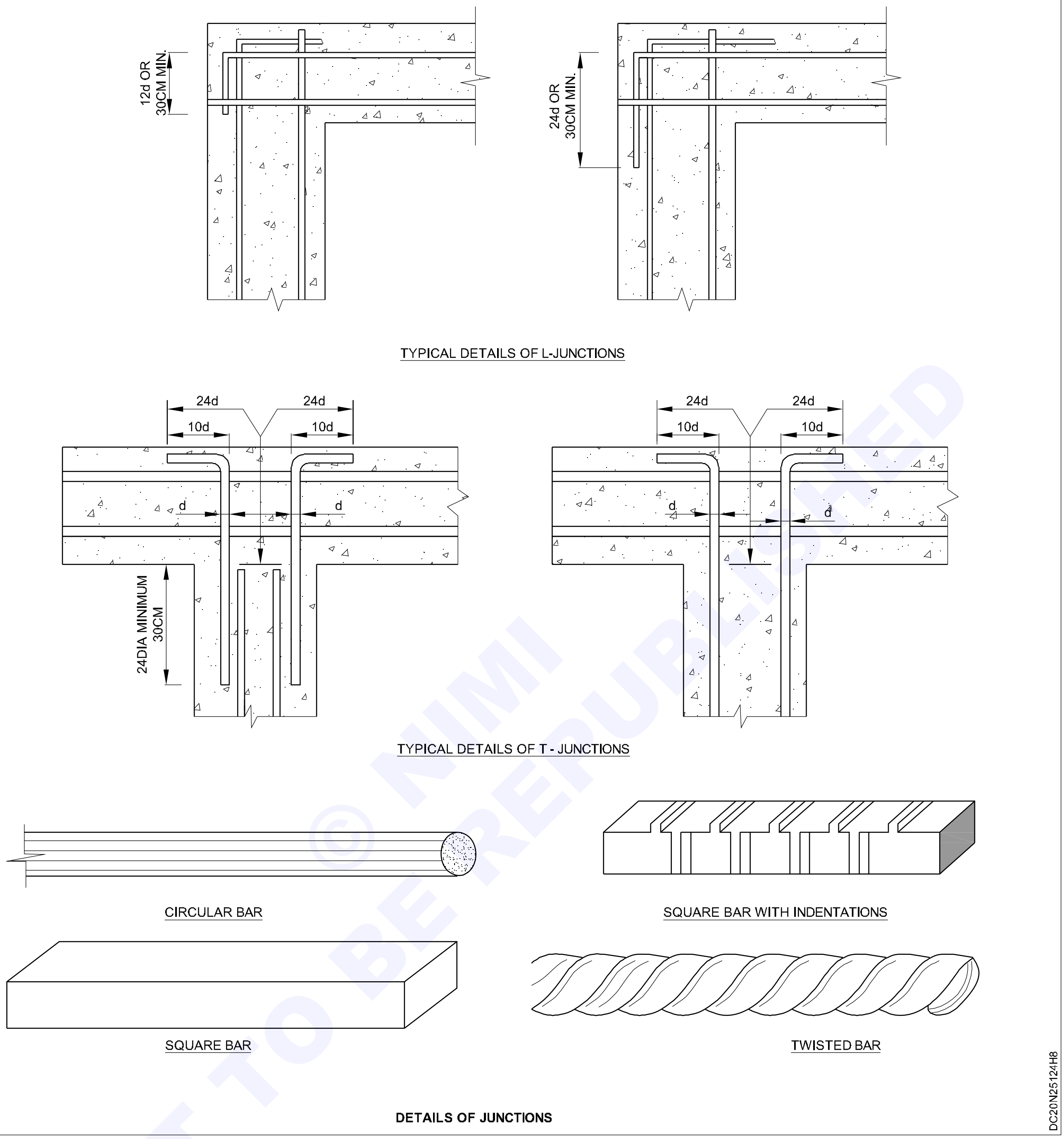


Fig 7




HOOKS, BENDS AND CRANK DETAILS

Fig 8




**DETAILS OF JUNCTIONS**

## Simply supported one way slab

**Objectives :** At the end of this exercise you shall be able to
- **prepare L-section and X-section of one way slab**
- **draw plan of the one way slab**
- **calculate length and numbers of different bars**
- **prepare bar bending schedule.**

PROCEDURE

TASK 1 : **Draw the following views of R.C.C one way slab in CAD software using basic commands (Fig 1)**

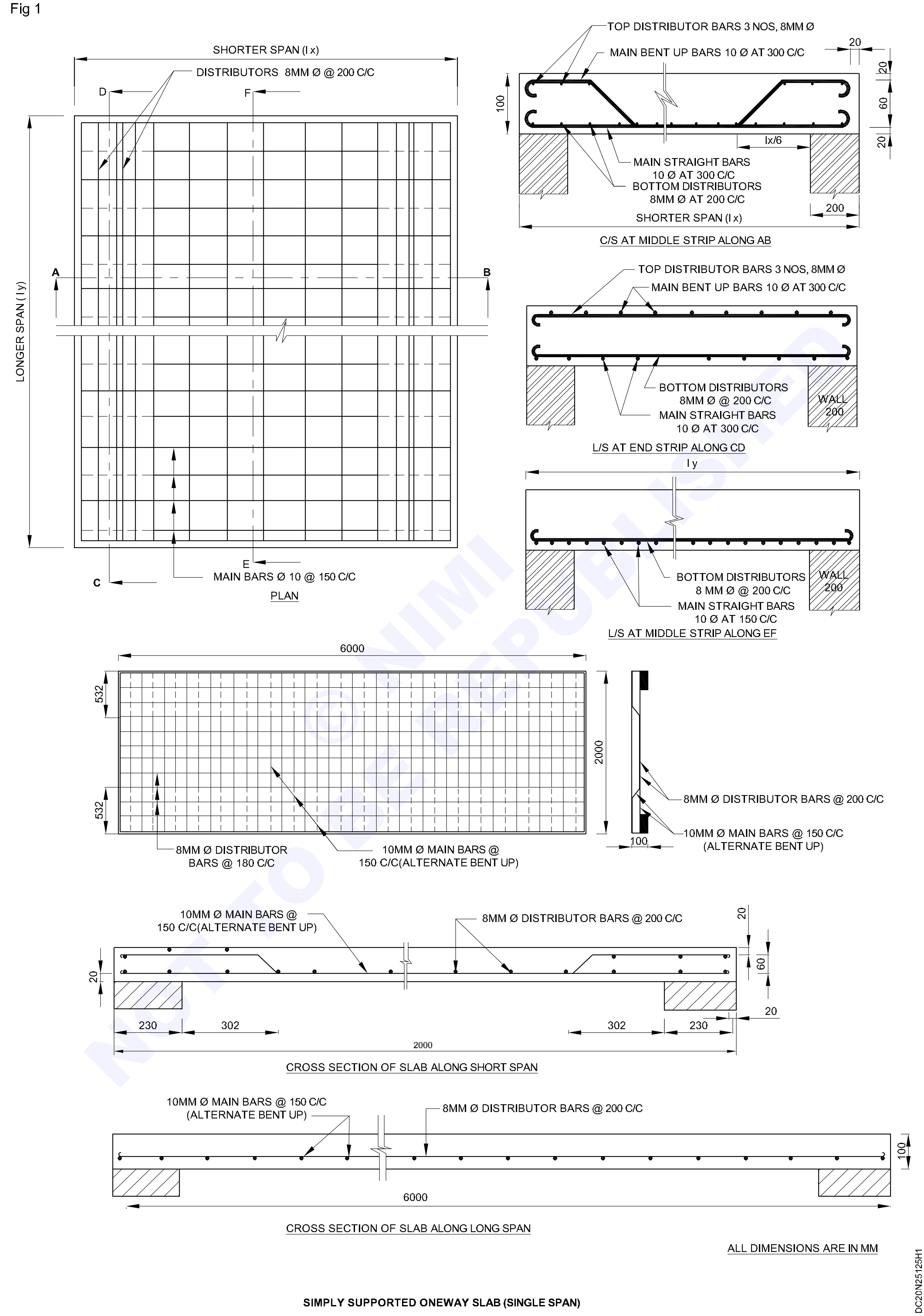
1 The reinforcement plan.

2 Longitudinal sections.

**DATA**

- Clear span - 5.54 x 1.54m
- Wall thickness - 230 mm.
- Slab thickness - 100 mm.
- Main bar - 10 mm Ø @ 150 mm c/c. (Alternate bent up).
- Distributors - 8 mm Ø @ 200 mm c/c.
- Provide minimum distributers on top layer at end strips.
- Draw the different views using CAD soft

Fig 1




SIMPLY SUPPORTED ONEWAY SLAB (SINGLE SPAN)

TASK 2 : **Calculate the quantity of reinforcement required for R.C.C slab and prepare the bar bending schedule (Fig 1 & 2)**

**DATA**

Size of room 320 $\times$ 350 cms.

Wall thickness - 300 mm.

Main reinforcement 10 mm bar 15cm c/c.

Distributor bar 8 mm bar 20 cm c/c.

Top and bottom cover 20 mm.

End cover 50 mm.

Slab thickness 10 cm.

Prepare drawings using cad software.

**Calculations:**

Total length of slab = 350 + (2 $\times$ 30).

= 410 cm.

Total width of slab = 320 + (2 $\times$ 30).

=380 cm.

Effective length of slab : 410 - 2 end cover.

= 410 - (2 $\times$ 5) = 410 - 10.

= 400 cm.

Effective width of slab = 380 - 2 end cover.

= 380 - ( 2 $\times$ 5 ) = 380 - 10.

= 370 cm.

Number of main bar = $\frac{l}{\text{spacing}}+1$.

(Where 'l' is the effective length of longer span).

$$=\frac{400}{15}+1=27.66$$

= 28 Nos.

No of straight bar = $\frac{28}{2}=14$ Nos.

No of cranked bar = 28 - 14 = 14 Nos.

Length of straight bar = l + 18.

= 370 + (18 $\times$ 1).

= 388 CM.

Length of cranked bar = l + 18 + 0.84d.

d = D - 2 x cover - 1 dia of the main bar.

= 10 - ( 2 x 2 ) - ( 1 x 1 ) .

= 10 - 4 - 1 = 5 cm.

d = 5 cm.

Length of cranked bar = 370 + ( 18 $\times$ 1) + ( 0.84 $\times$ 50.

= 392 cm.

Number of distributers = no. of distributers over straight bar + no. of distributers under cranked bar.

No. of distributers over straight bar = $\frac{l}{\text{spacing}}+1$.

( Where 'l' is the length of shorter span).

$$=\frac{370}{20}+1.$$

= 19.5 = 20 Nos.

No. of distributers under cranked bar (Assume bars are cranked at 1/5th span) .

y = ( 30 - 5) + 320 $\times$ 1/5.

= 25 + 64.

= 89 cm.

x = y - d.

= 89 - 5 = 84 cm.

No. of distrubuters under cranked bar = $2\left(\frac{x}{\text{Spacing}}+1\right)$

$$=2\left(\frac{84}{20}+1\right)=100-40=11 \text{ Nos.}$$

Total no. of distributers.

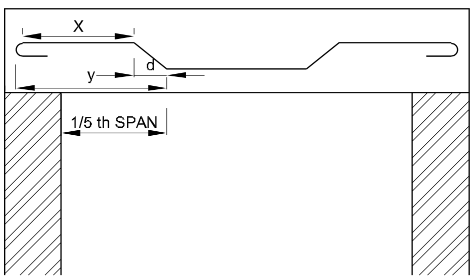
$$=\left(\frac{l}{\text{Spacing}}+1\right)+2\left(\frac{x}{\text{Spacing}}+1\right)$$

= 20 + 11 = 31 Nos.

Length of distributers bar = l + 18Ø.

= 400 + 18 x 0.8 = 414.4 cm.

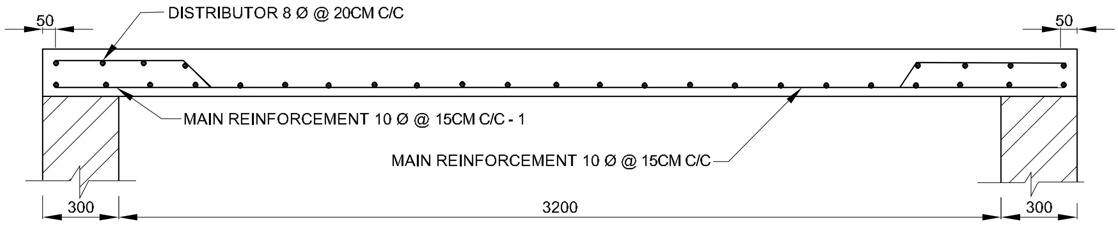
Fig 1



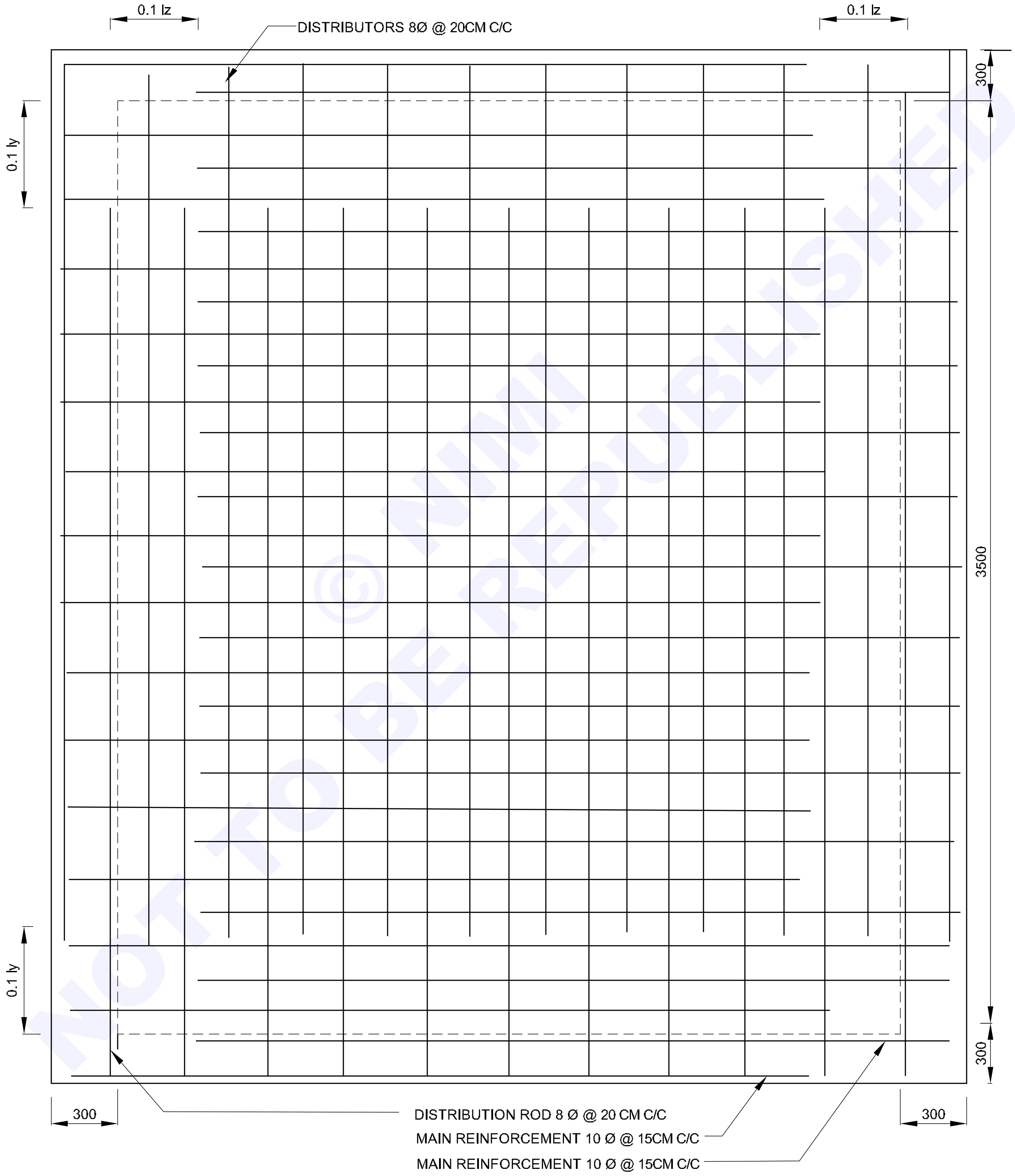

DETAILS OF R.C.C. ROOF SLAB

DC20N25125J1

Fig 2



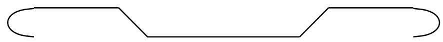
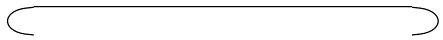

SECTION ALONG SHORTER SPAN




PLAN AT BOTTOM

DETAILS OF R.C.C. ROOF SLAB

DC20N25125J2

| Sl.No | Description | Shape of bar | No.of bars | Length of each bar in m | Total length in m | Weight metre in kg | Total weight in kg |
|---|---|---|---|---|---|---|---|
| 1 | Main bar straight bar 10 mm dia at 15 cm c/c |  | 14 | 3.88 | 54.32 | 0.62 | 33.68 |
| 2 | Main bar cranked bar 10 mm dia at 15 cm c/c |  | 14 | 3.922 | 54.91 | 0.62 | 34.04 |
| 3 | Distributers bar 8 mm dia at 20 cm c/c |  | 31 | 4.144 | 128.46 | 0.39 | 50.10<br>117.82 |

Add 5% for wastage $= \frac{117.82 \times 5}{100} = 5.89\text{kg}$

Weight = 117.82 + 5.89 = 123.71 kg.

say = 124 kg.

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## R.C.C two way slab

**Objectives :** At the end of this exercise you shall be able to
- **prepare L- section and X- section of a two way slab ( corners not held down)**
- **prepare top and bottom plan.**

PROCEDURE

TASK 1 : **Draw the simply supported two way slab (corners not held down) using CAD software (Fig 1)**

1 Section along shorter span showing reinforcement details.

2 Section along longer span showing reinforcement details.

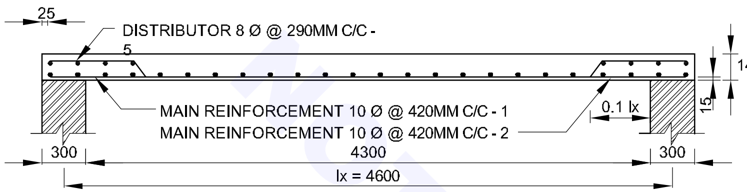
3 Plan showing the reinforcement details at bottom and at top.

4 Bar bending schedule.

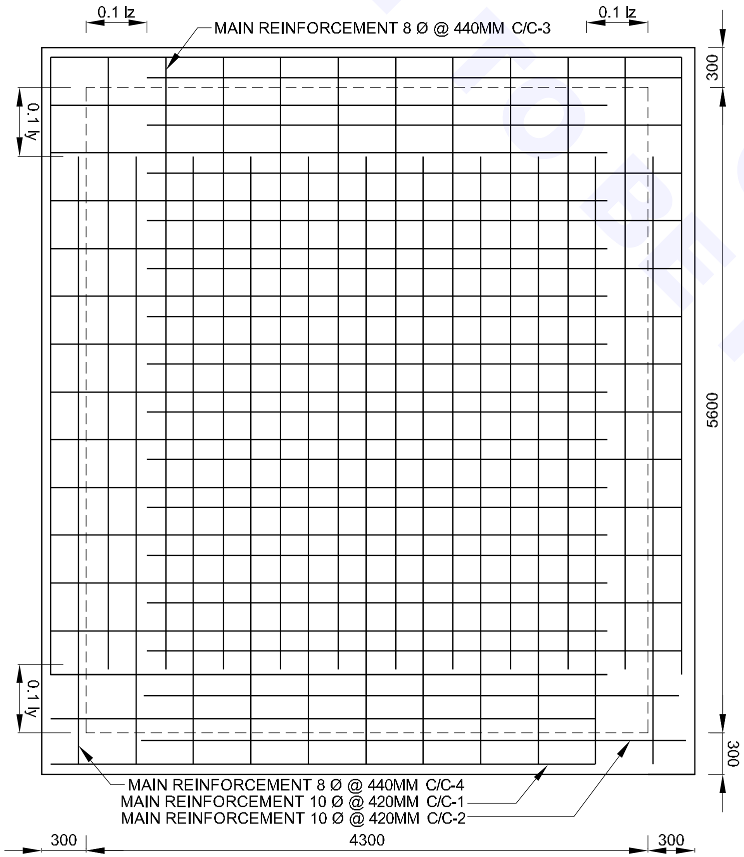
**DATA**

- The following are the particulars of a simply supported two way slab, and in which corners are not held down.
- Size of the room - 4.3 x 5.6 m.
- Thickness of slab - 140 mm.
- Width of supporting walls - 300 mm.
- Clear cover - 15 mm.
- Reinforcement along shorter span Fe 415 steel - 10 mm @ 210 mm c/c.
- Reinforcement along longer span - 8 mm Fe 415 steel @ 220 mm c/c.
- Distributors at top for the main reinforcement in both directions 8 mm Fe 415 steel @ 290 mm c/c.
- Anchorage and curtailment of reinforcement may be adopted with standard values and any more data required may be assumed suitably.
- Draw the simply supported two way slab (corners not held down) using CAD software, with suitable scale, assume any other missing data.

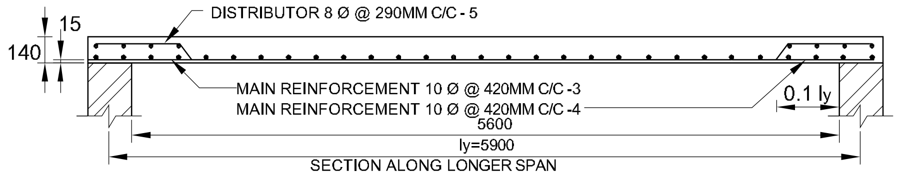
Fig 1



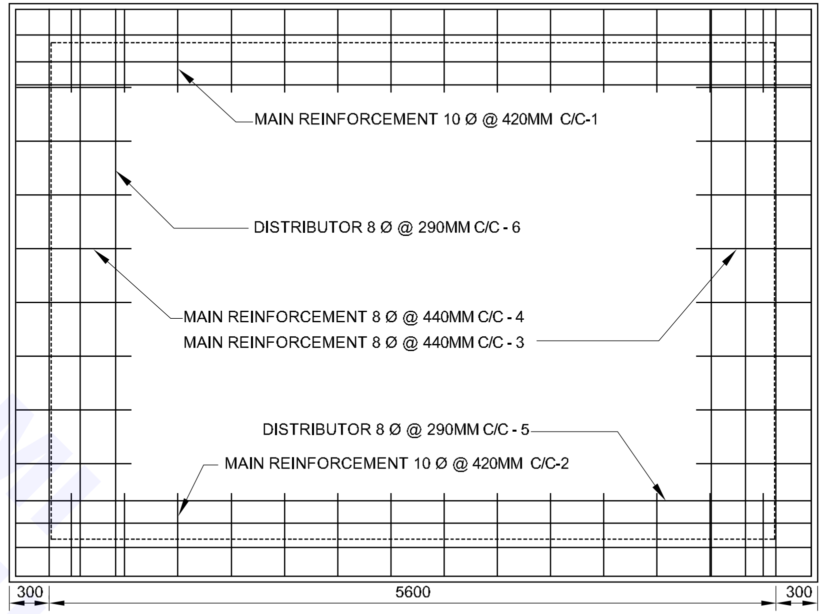
SECTION ALONG SHORTER SPAN



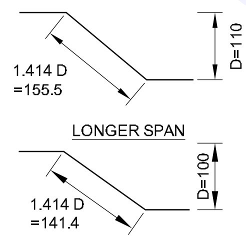
PLAN AT BOTTAM



SECTION ALONG LONGER SPAN



PLAN AT TOP



CRANK LENGTH
SHORTER SPAN

BAR BENDING SCHEDULE

| TYPE NO. | SIZE & GRADE | SHAPE & DIMENSION | LENGTH IN 'M' | NUMBER | WEIGHT/ UNIT LENGTH IN 'N/M' | TOTAL WEIGHT IN 'N/M' |
|---|---|---|---|---|---|---|
| 1 | 10 # | 4115 625 155.5 | 4.896 | 6150/420 + 1 = 15.6(SAY 16) | 6.17 | 483.33 |
| 2 | 10 # | 625 155.5 4115 | 4.896 | 6150/420 = 14.6(SAY 15) | 6.17 | 453.12 |
| 3 | 8 # | 141.4 765 5285 | 6.191 | 4850/440 + 1 = 12 | 3.95 | 293.45 |
| 4 | 8 # | 765 141.4 5285 | 6.191 | 4850/440 = 11 | 3.95 | 269.00 |
| 5 | 8 # | 6150 | 6.150 | 625/290 +1 = 3.15 (SAY 4) (4+4=8) | 3.95 | 194.34 |
| 6 | 8 # | 4850 | 4.850 | 765/290 + 1 = 3.6(SAY 4) (4+4+8) | 3.95 | 153.26 |
| | | | | | TOTAL WEIGHT | 1848.50 |

ADDING 5% OF ABOVE TOTAL WEIGHT FOR WASTAGE DURING CUTTING, BENDING ETC. 92.33 N
TOTAL QUANTITY OF STEEL REQUIRED 1938.83 N

SIMPLY SUPPORTED TWO WAY SLAB ( CORNERS NOT HELD DOWN)

DC20N25125X1

TASK 2 : **Draw restrained two way slab (corners held down) (Fig 1 & 2)**

1 Section along shorter span middle strip showing reinforcement details.

2 Section along longer span middle strip showing reinforcement details.

3 Plan showing arrangement of reinforcement at bottom.

4 Plan showing arrangement of reinforcement ar top.

5 Bar bending schedule.

**DATA**

- The following are the particulars of a simply supported two way slab and in which corners are held down.
- Size of room - 7. 00 x 5.00 m
- Width of support - 300 mm
- Thickness of slab - 150 mm
- Clear cover - 15 mm
- Reinforcement in the middle strip.
- Reinforcement along shorter span 12 mm Fe 415 steel @ 100 mm c/c
- Reinforcement along longer span 12 mm Fe 415 steel @ 150 mm c/c
- Reinforcement in the edge strips
- 12 mm Fe 415 steel @ 160 mm c/c. along both spans.
- Distributors at top for the main reinforcement 12 mm. Fe 415 steel @ 160 mm c/c.
- Torsion reinforcement
- Both at top and bottom 10 mm Fe 415 steel @ steel @ 110mm c/c in both directions forming a mesh.
- Anchorage and curtailment of reinforcement may be adopted with standard values and any more data required may be assumed suitably.

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Fig 1

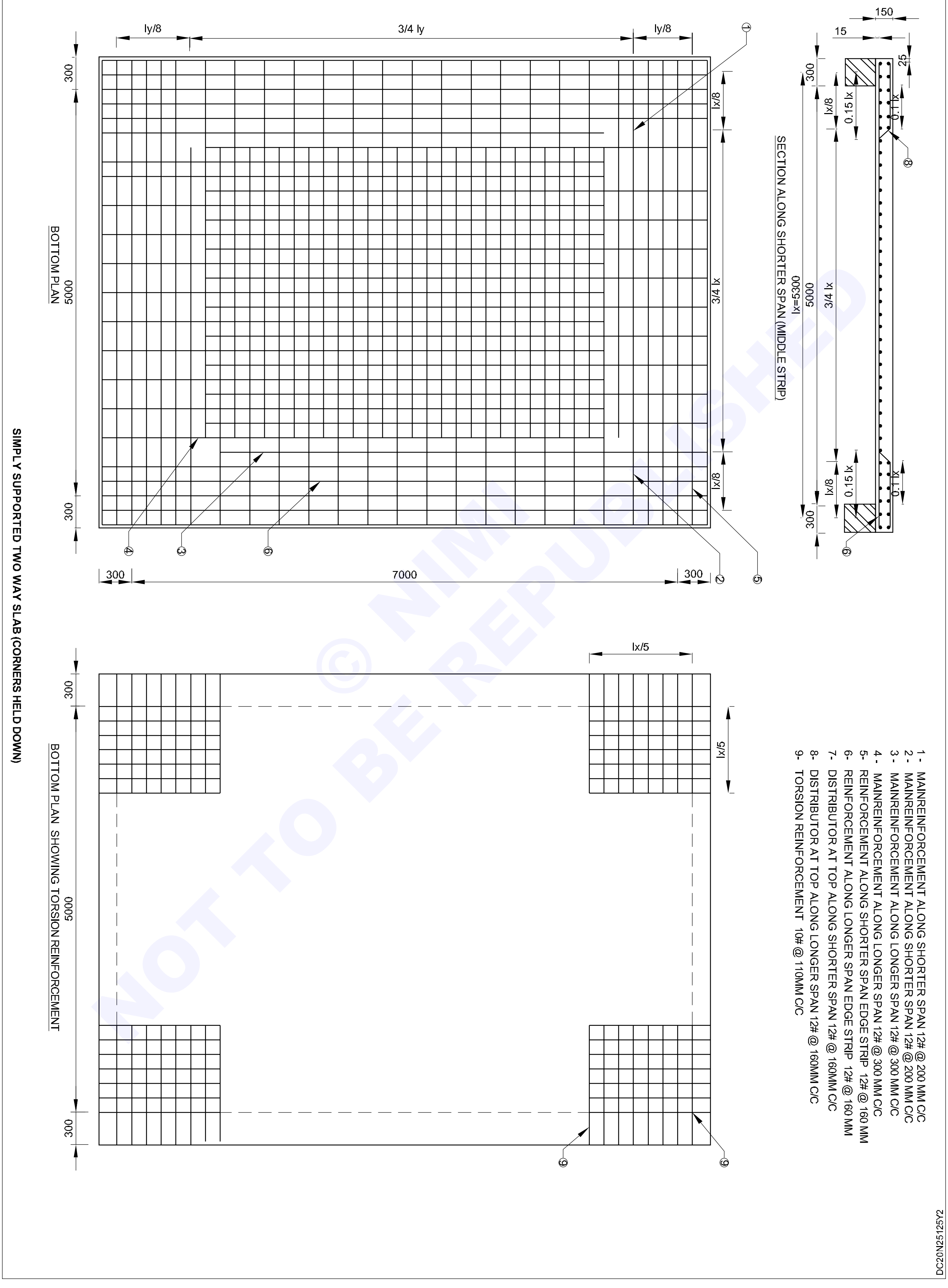
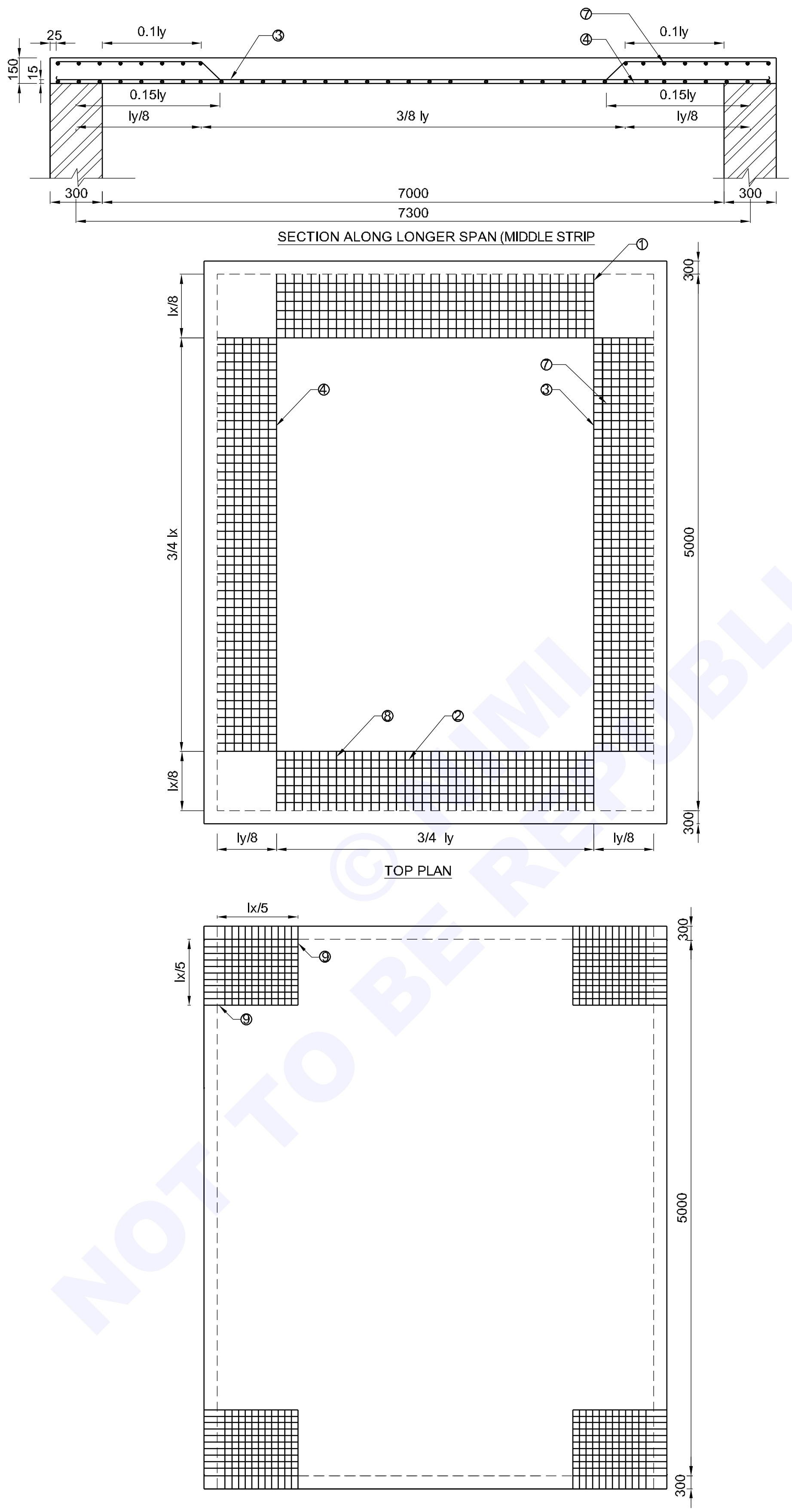

SIMPLY SUPPORTED TWO WAY SLAB (CORNERS HELD DOWN)
BOTTOM PLAN
ly/8
3/4 ly
ly/8
300
5000
300
lx/8
3/4 lx
lx/8
300
7000
300
SECTION ALONG SHORTER SPAN (MIDDLE STRIP)
lx=5300
5000
150
15
25
0.15 lx
0.1 lx
BOTTOM PLAN SHOWING TORSION REINFORCEMENT
lx/5
1 - MAINREINFORCEMENT ALONG SHORTER SPAN 12# @ 200 MM C/C
2 - MAINREINFORCEMENT ALONG SHORTER SPAN 12# @ 200 MM C/C
3 - MAINREINFORCEMENT ALONG LONGER SPAN 12# @ 300 MM C/C
4 - MAINREINFORCEMENT ALONG LONGER SPAN 12# @ 300 MM C/C
5- REINFORCEMENT ALONG SHORTER SPAN EDGE STRIP 12# @ 160 MM
6- REINFORCEMENT ALONG LONGER SPAN EDGE STRIP 12# @ 160 MM
7- DISTRIBUTOR AT TOP ALONG SHORTER SPAN 12# @ 160MM C/C
8- DISTRIBUTOR AT TOP ALONG LONGER SPAN 12# @ 160MM C/C
9- TORSION REINFORCEMENT 10# @ 110MM C/C
DC20N25125Y2

Fig 2




DC20N25125Y2

SIMPLY SUPPORTED TWO WAY SLAB (CORNERS HELD DOWN)

## Tee beam and inverted beam

**Objectives :** At the end of this exercise you shall be able to
- **prepare longitudinal and cross section of T - beam**
- **prepare details of reinforcement in beam.**
- **prepare L-section Y-section and plan of a combination slab.**

PROCEDURE

TASK 1 : **Draw cross section and longitudinal section of a T beam (Fig 1)**

**DATA**

Draw to a suitable scale X - section and L - section of a T beam continuous on two 6 metres clear span supported on R.C.C. square column 40 × 40 cm. from the following data.

Beam size = 40 cm. × 66 cm. overall

Tension bars = 5 Nos 20 mm. dia. with two bars bent up at 0.90 m. from support.

Compression bars = 2 Nos 18 mm. diameter.

Stirrups = 10 mm. dia @ 150 mm. c/c near supports for a distance of 1.05 meter and balance at 300 mm c/c.

**Slab**

Thickness = 150 mm.

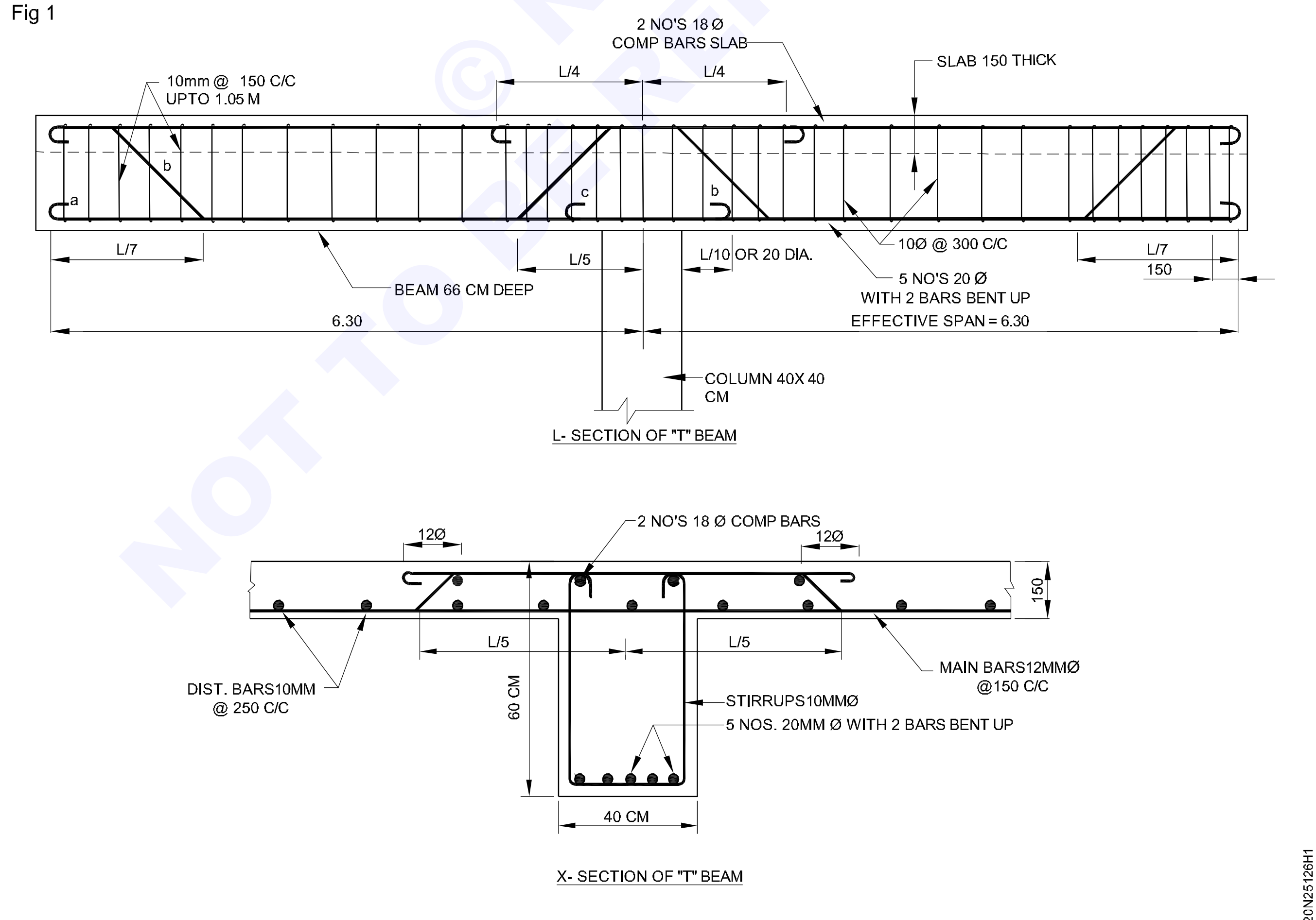
Main bars = 12 mm. dia @ 150mm. c/c with alt. bars bent up.

Distribution bars = 10 mm. dia. @ 250 mm. c/c.

Column (Reinforcement not to be shown)

How the T beam supporting an R.C.C square column using CAD software.

Fig 1




TEE BEAM

TASK 2 : **Draw the cross section of an inverted beam along with part of a simply supported slab from following data (Fig 1)**

Beam.

Overall depth = 600 mm.

Width = 350 mm.

Steel tensile bar = 5 Nos with 2 bars bent up 20 mm. dia.

Hanger bars = 2 Nos 10 mm. dia.

Stirrups = 6 mm. dia @ 200 mm. c/c.

Clear cover = 25 mm.

Slab.

Thickness overall = 160 mm.

Steel.

Main bars = 12 mm. at 180 mm. centre to centre with alternate bars bent at 800 mm. from centre of beam.

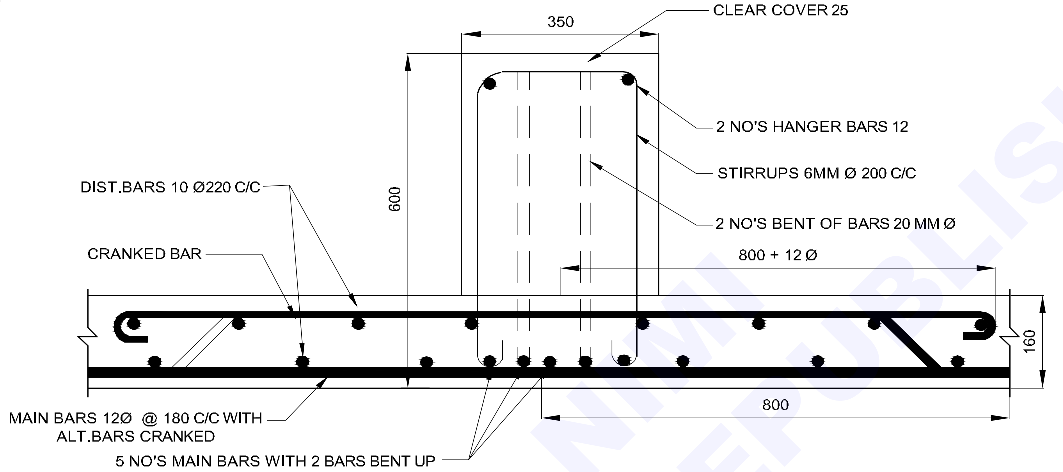
Distribution bars = 10 mm. dia. at 220 mm. centre to center.

Provide distribution bars in the bent up part of main bars near the top of slab.

Clear cover = 13 mm.

Draw the cross section of an inverted beam using CAD software.

Fig 1




INVERTED BEAM

DC20N25126J1



## R.C.C cantilever beam

**Objectives :** At the end of this exercise you shall be able to
- **prepare R.C.C cantilever beam fixed with R.C.C column**
- **prepare R.C.C centilever beam resting on brick wall.**

TASK 1 : **Draw the following views of R.C.C cantilever beam fixed with R.C.C column. (Fig 1)**

1 Longitudinal section.

2 Plan of main reinforcement.

3 Cross section at fixed end.

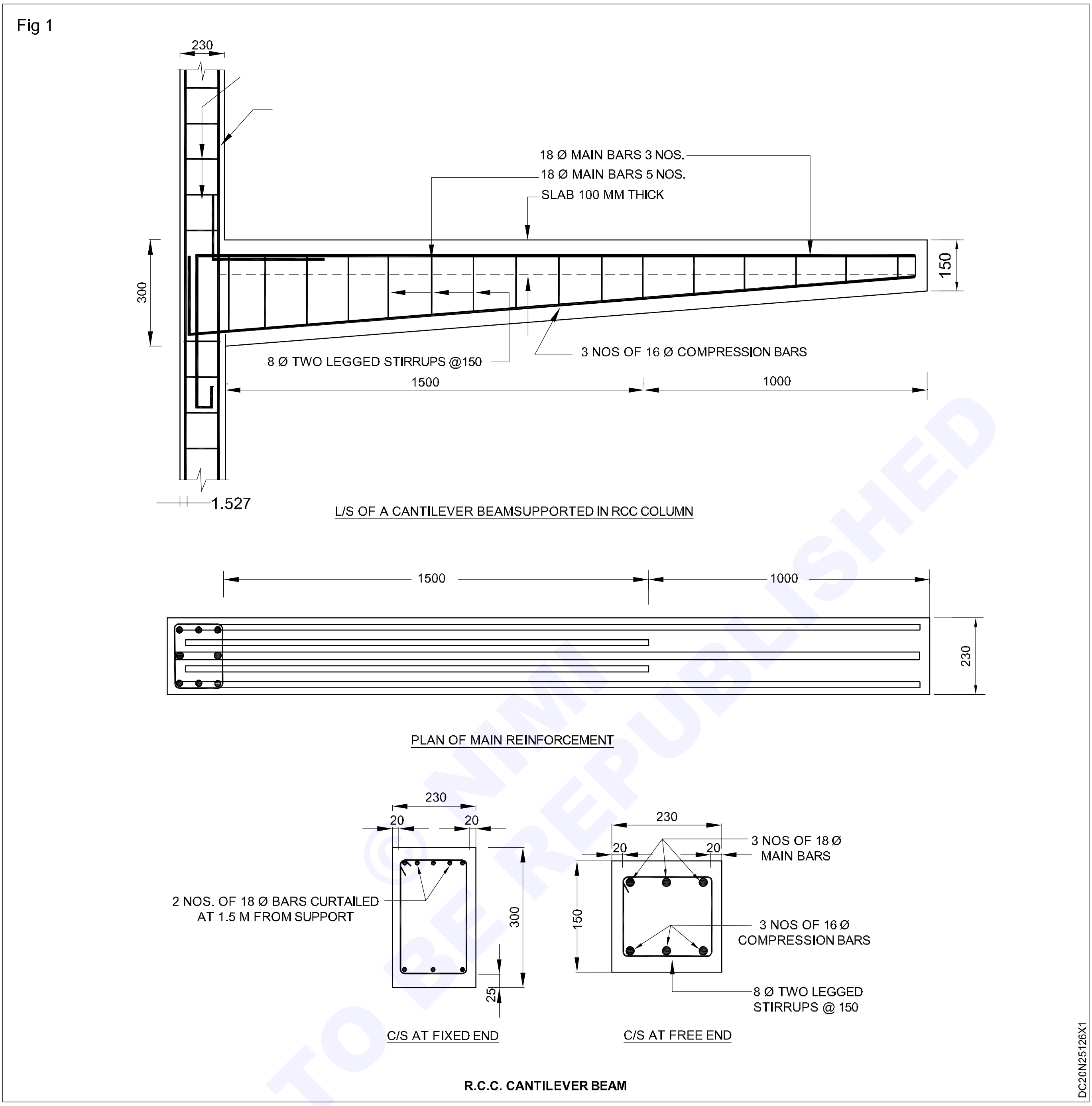
4 Cross section at free end.

**DATA**

The beam is 2.5 m long, depth 300 mm at fixed end and 150 mm at free end respectively. It is provided with 5 nos. of 18 mm dia. bars in tensile zone in which two of them are curtailed $\frac{3}{5}$ span. 3 nos of 16 mm dia. bars in bottom.

Stirrups are 10 mm dia. at 150 mm c/c. R.C.C column is 230 $\times$ 230 mm reinforced with 8 nos. of 18 mm dia. bars and stirrups of 12 mm dia bars at 200 mm c/c.

Draw the R.C.C cantilever beam using Auto CAD.






— — — — — — — —

TASK 2 : **Draw the following views of R.C.C contilever beam resting over brick wall (Fig 1)**

1 Longitudinal section.

2 Plan of main reinforcement.

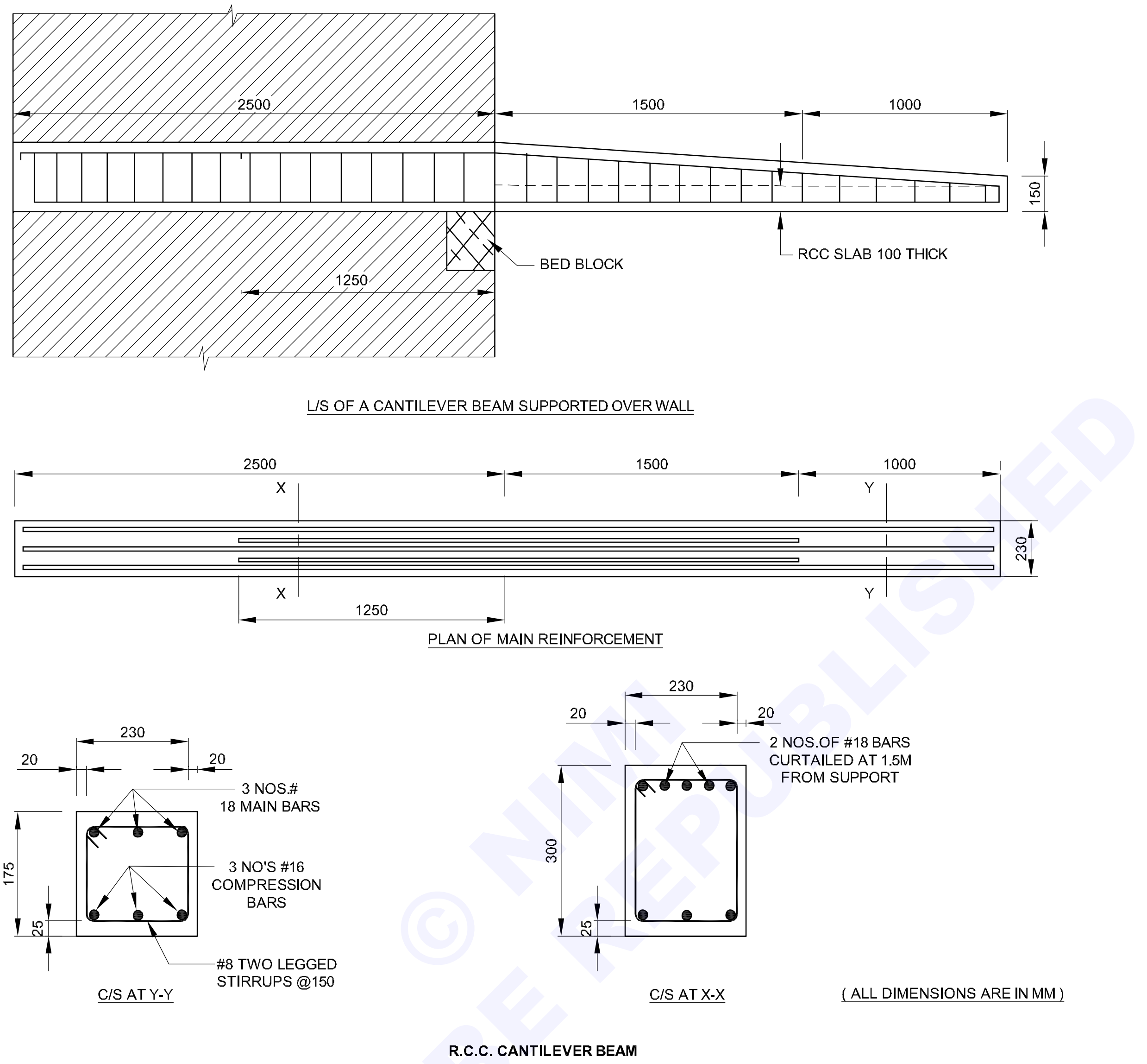
3 Cross section at free end.

4 Cross section at fixed end.

**DATA**

Draw the L/S and C/S at free end and fixed end of R.C.C centilever beam resting over brick wall. The beam is 2.5 m long, 300mm at fixed end and 150 mm at free end, It is provided with 5 nos. of 18 mm dia. bars in tensile zone in which two of the are curtailed at $\frac{3}{5}$ span. 3 nos of 16 mm dia. bars in compression zone. Stirrups are 10 mm dia. at 150 mm c/c. Same as previous task.

Fig 1




R.C.C. CANTILEVER BEAM



## R.C.C retaining wall

**Objectives :** At the end of this exercise you shall be able to
- **prepare vertical section of cantilever retaining wall**
- **prepare reinforcement details of stem, toe, and heal.**

TASK 1: **Draw R.C.C cantilever retaining wall (Fig 1 & 2)**

1 The section across the stem showing all details.

2 The plan showing the base slab reinforcement.

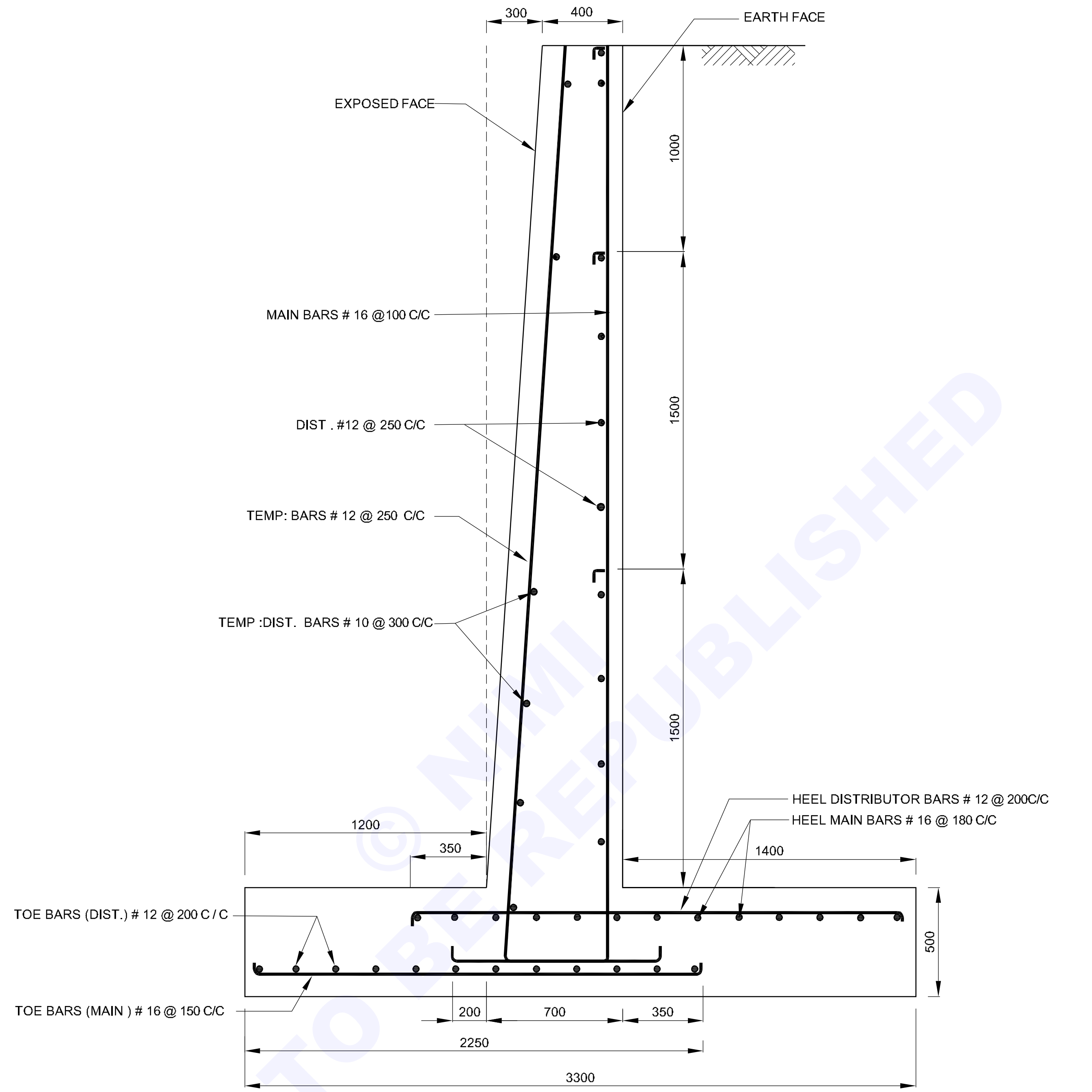
3 The enlarging drawing showing details at stem and slab joint

4 The sectional elevation for a length of 5 meter showing the main reinforcement.

**DATA**

- A cantilever retaining wall has the following details : Size of base slab 330 $\times$ 50 cm, stem 70 cm thick at bottom and 40 cm at top, height of stem 400 cm, earth face vertical.
- Stem reinforcement: Main bars @ 16 mm @ 100 c/c, alternate bars are curtailed at 1.50m, 3.0m from bottom. Distribution bars # 12 mm @ 250 c/c.
- Exposed face reinforcement : Main bars # 12 mm @ 250 c/c, distribution bars # 10 mm @ 300 c/c
- Heel reinforcement : # 16 mm @ 180 c/c both ways.
- Toe reinforcement : mainbars # 16 mm @ 150 c/c and distribution bars # 12 mm @ 200 c/c
- Draw the R.C.C cantilever retaining wall by using CAD software to a suitable scale, as per the given data.

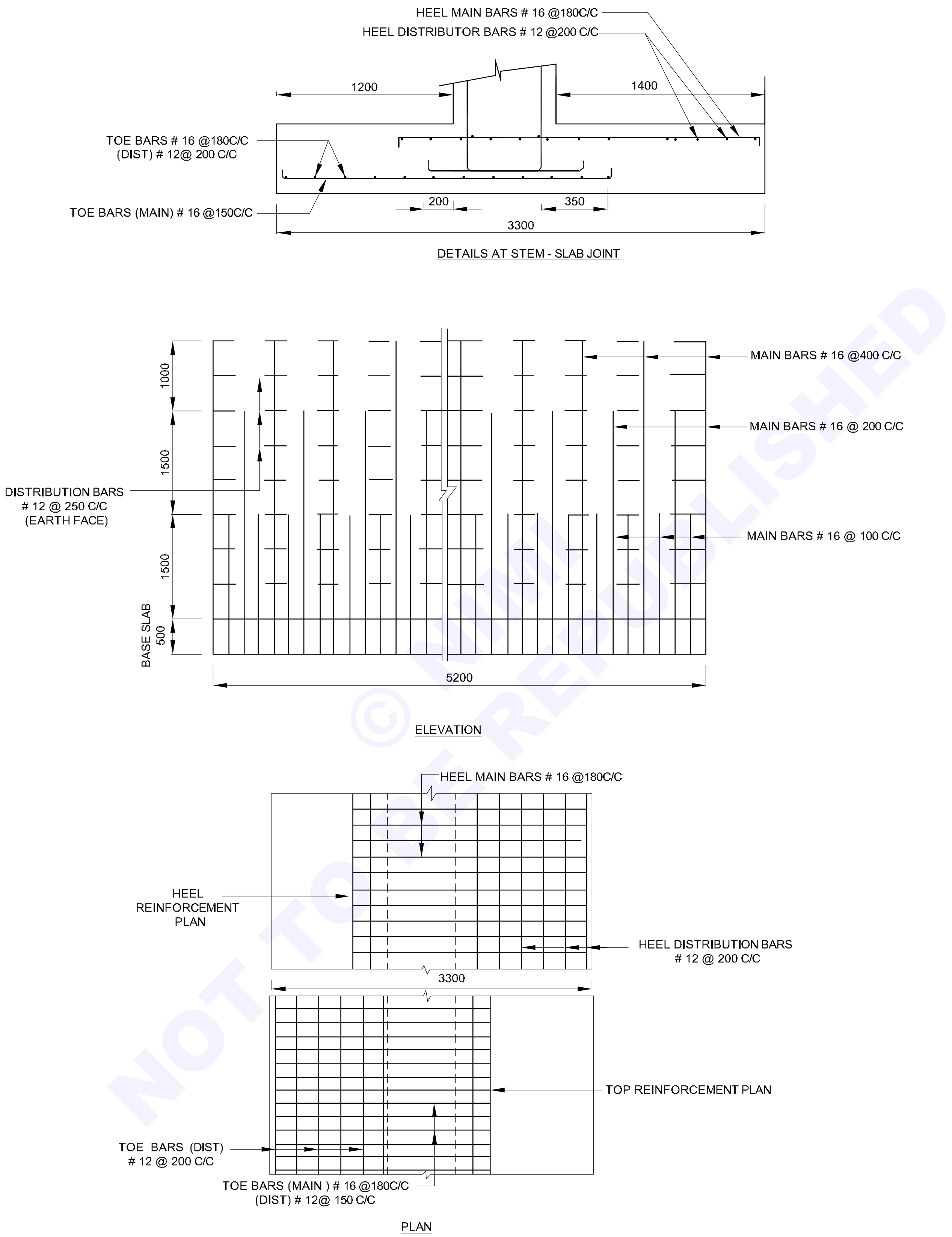
Fig 1




SECTIONAL VIEW ACROSS STEM

C/S OF R.C.C. CANTILEVER RETAINING WALL ( WITHOUT KEY )

Fig 2




ALL DIMENSION ARE IN MM
NOT TO SCALE

DC20N25126Z2

**R.C.C. CANTILEVER RETAINING WALL ( WITHOUT KEY )**

# R.C.C column with footing

**Objectives :** At the end of this exercise you shall be able to
- **prepare plan and vertical section of R.C.C square and circular column**
- **prepare details of bars used in column**
- **prepare reinforced beams to column connection.**

## PROCEDURE

TASK 1 : **Draw the sectional elevation and sectional plan of R.C.C square column 60 x 60 cm showing full details of reinforcement (Fig 1)**

**DATA**

Column

Size - 60 cm. × 60cm.

Main reinforcement = 8 Nos 25 mm bars.

Ties = 8 mm @ 20 cm . c/c

Cover = 4 cm.

Footing

Size at bottom = 3.5 m. × 3.5 m.

Size at top = 70 cm. × 70 cm.

Thickness at column face = 70 cm.

Thickness at ends = 30 cm.

Reinforcement = 12 mm @ 15 cm. bothways

Cover = 5 cm.

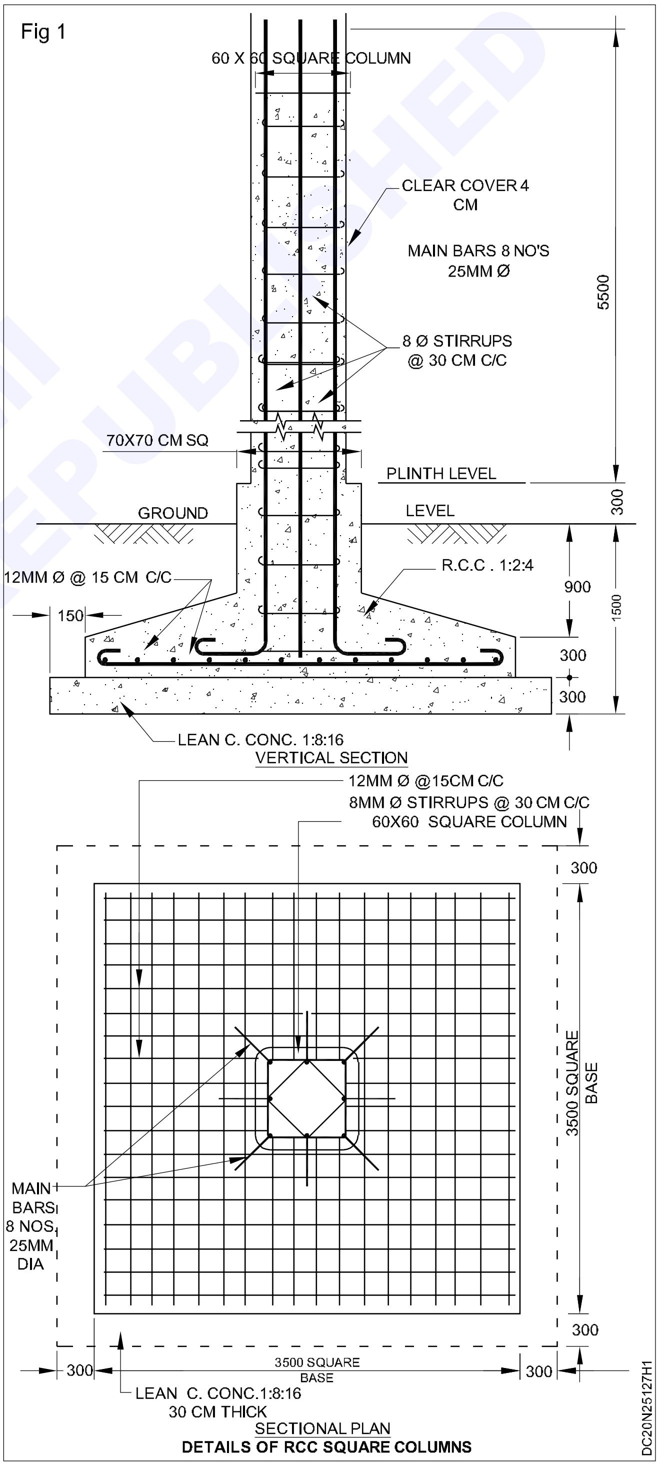
Lean concrete 1: 8: 16 below foundation is 30 cm. thick and projects15 cm. on all the four sides.

Depth below G.L. = 1.5 m.

Plinth level = 30 cm. above G.L.

Ht. of ceilng above plinth level = 5.5 m.

Draw the R.C.C square columns drawings using CAD software to a suitable scale. Assume all other missing data.



## Construction Exercise 2.5.128
## Draughtsman Civil - Reinforced Cement Concrete Structure

# R.C.C Continuous column with footing

**Objectives :** At the end of this exercise you shall be able to
- **prepare R.C.C continuous column with footing**

TAKE 1 : **Draw R.C.C continuous columns showing position of reinforcement (Fig 1)**

Sectional plan

Sectional elevation

**DATA**

Column

Size - 60 cm × 60 cm

Main reinforcement - 8 Nos 20 mm Ø bars

Cover - 4 cm

Ring - 8 mm Øbar 18 cm c/c

Beams

Over all depth - 60 cm

Width - 40 cm

Steel tensile - 4 Nos 20 mm Ø bars

Compression - 4 Nos 20 mm bars

Stirrups - 8 mm Ø 20 cm c/c

Clear cover - 25 mm

Assume all other missing data.

Draw R.C.C. continuous column using CAD software.

## Construction Exercise 2.5.129
## Draughtsman Civil - Reinforced Cement Concrete Structure

# R.C.C framed structure, portal frame

**Objectives :** At the end of this exercise you shall be able to
- **prepare vertical section of an R.C.C framed structure**
- **prepare reinforced details in beam and coloumn.**

PROCEDURE

TASK 1 : **Draw the sectional elevation of R.C.C framed structure (portal frame) beam to column connection (Fig 2)**

**DATA**

- All datas and details are given in Figure.
- Draw the sectional elevation of R.C.C framed structure beam to column connection using AutoCAD software to a suitable scale. Assume all missing details.

Fig 1

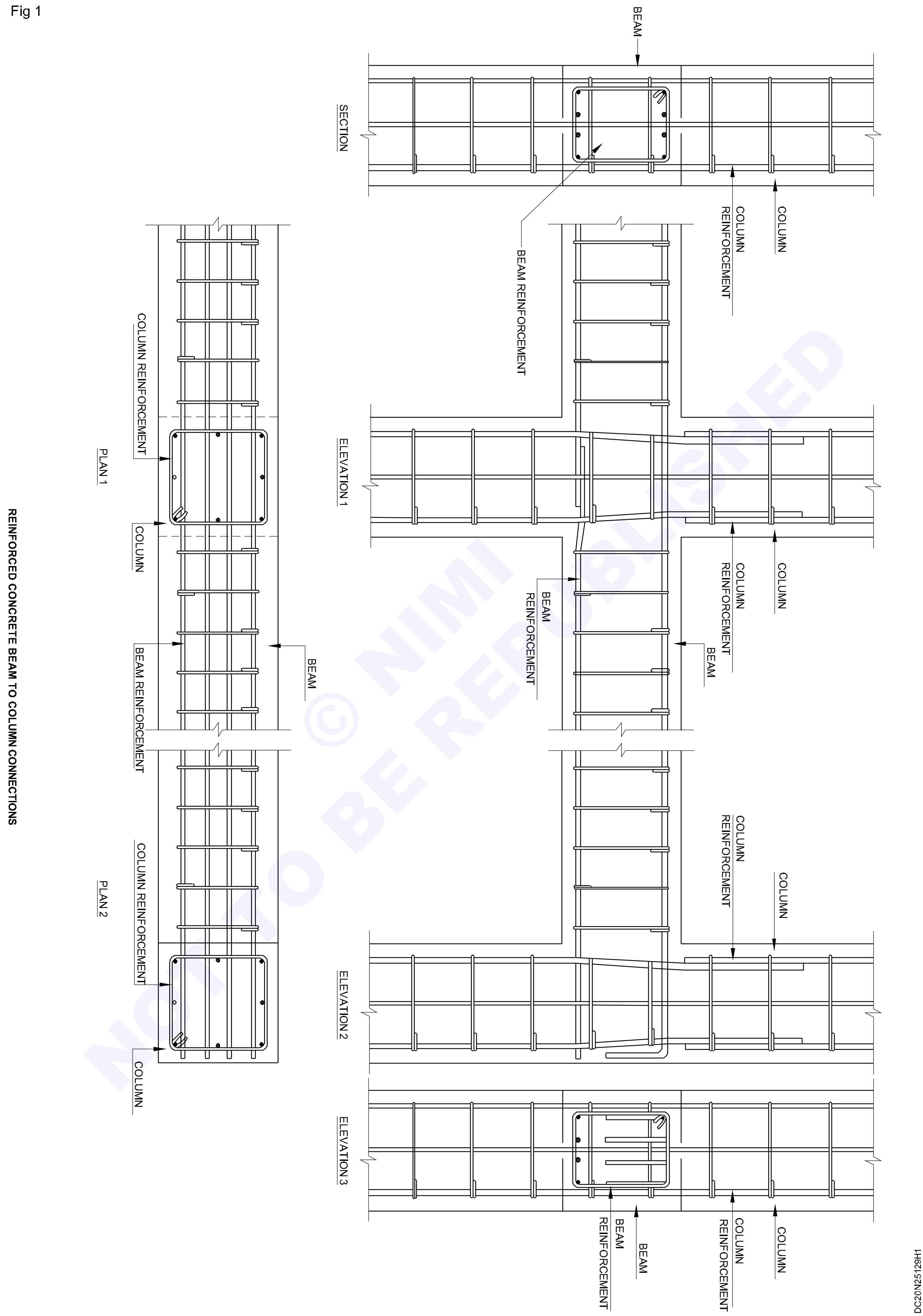
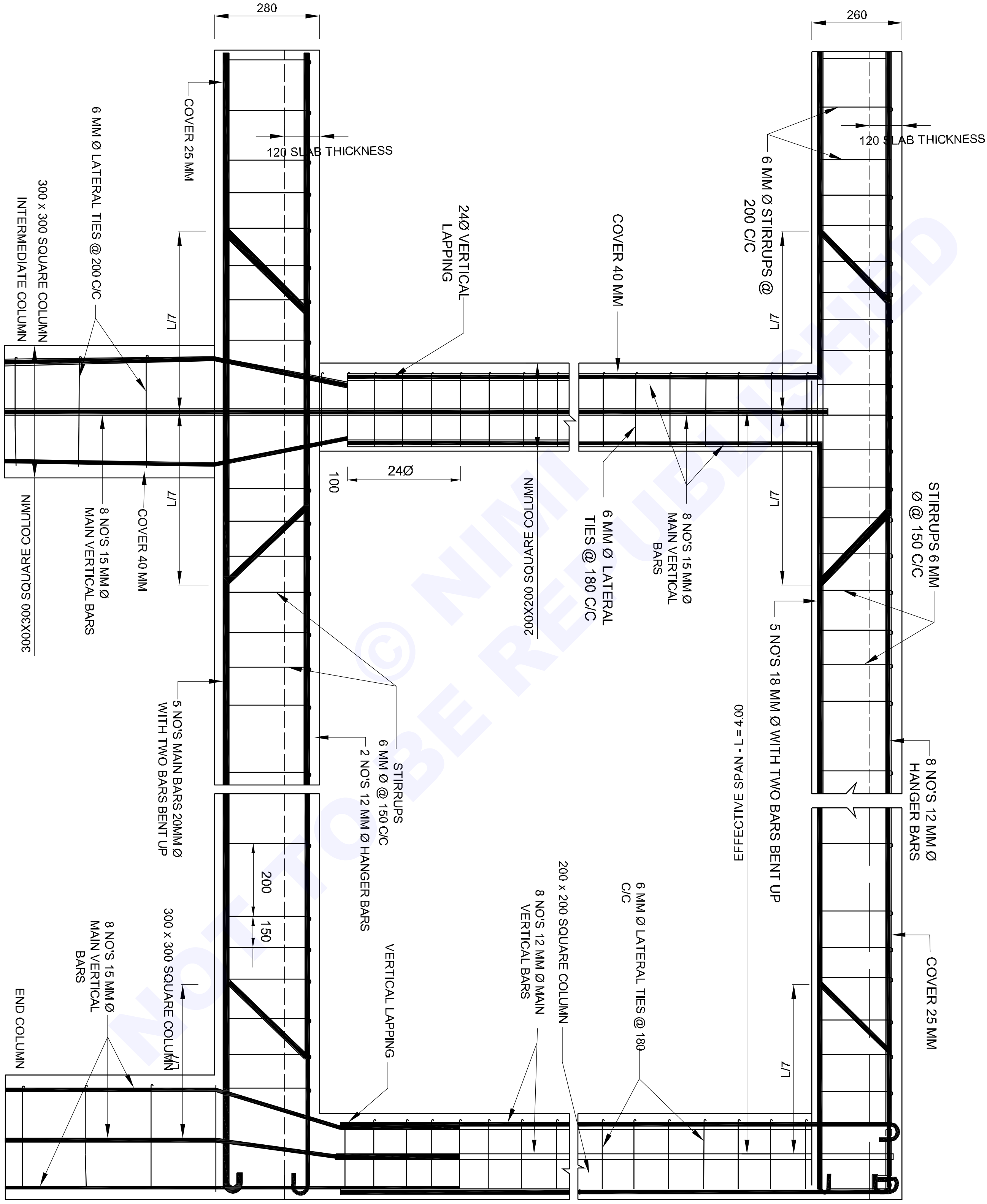

REINFORCED CONCRETE BEAM TO COLUMN CONNECTIONS
PLAN 1
PLAN 2
SECTION
ELEVATION 1
ELEVATION 2
ELEVATION 3
BEAM
BEAM REINFORCEMENT
COLUMN
COLUMN REINFORCEMENT
DC20N25129H1

Fig 2




DC20N25129H2

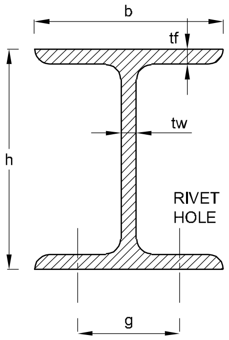
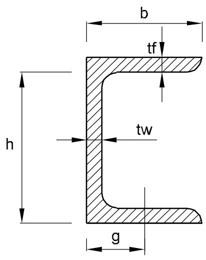
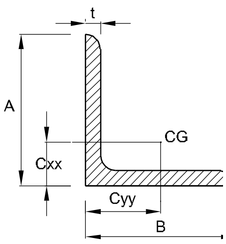
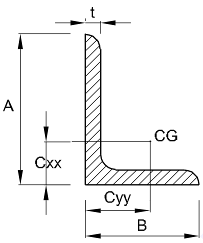
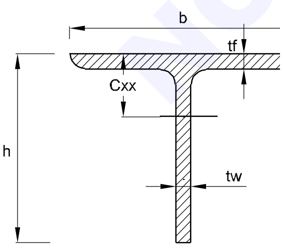
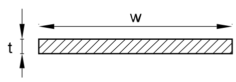
## Different steel sections

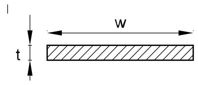
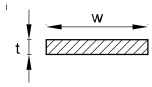
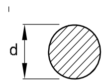
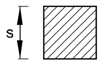
**Objective :** At the end of this exercise you shall be able to
- **draw the different steel section used for steel structures as per I.S standards.**

PROCEDURE

**DATA**

- Dimensions are given in Figure.
- 'b' - width of flange.
- h - total depth of section including the flange thickness.
- tf - thickness of flange.
- tw - thickness of web.
- Sketch the drawing attached using AutoCAD.

| Sl. No | Structural Sections | Description | Example | Weight(kg) per merer | important dimension (mm) h | b | $t_t$ | $t_w$ | g |
|---|---|---|---|---|---|---|---|---|---|
| | INDIAN STANDARD [IS] ROLLED AND SLIT STEEL SECTIONS FOR STRUCTURALUSES | | | | | | | | |
| 1 |  | IS Junior beam | ISJB 225 | 12.8 | 225 | 80 | 5.0 | 3.7 | 40 |
| 2 | | IS Light beam | ISLB 225 | 23.5 | 225 | 100 | 8.8 | 5.8 | 55 |
| 3 | | IS Medium WT beam | ISMB 225 | 31.2 | 225 | 110 | 11.8 | 6.5 | 60 |
| 4 | | IS Wide flange beam | ISMB 225 | 33.9 | 225 | 150 | 9.9 | 6.4 | 60 |
| 5 | | IS Column section | ISHB 225 | 43.1 | 225 | 225 | 9.1 | 6.5 | 140 |
| 6 |  | IS Junior channel | ISJC 200 | 13.9 | 200 | 70 | 7.1 | 4.1 | 40 |
| 7 | | IS Light channel | ISLC 250 | 28.0 | 250 | 100 | 10.7 | 6.1 | 90 |
| 8 | | IS Medium WT chennel | ISMC 250 | 30.4 | 250 | 80 | 14.1 | 7.1 | 45 |
| 9 |  | IS Equal angle | ISA 100100 | 9.2 | A-100 | B-100 | t-60 | Cxx= Cyy | 2.67 |
| 10 | | Do | Do | 12.1 | 100 | 100 | 80 | Do | 2.76 |
| 11 | | Do | Do | 14.9 | 100 | 100 | 10.0 | Do | 2.84 |
| 12 | | Do | Do | 17.7 | 100 | 100 | 12.0 | Do | 2.92 |
| 13 |  | IS Unequal angle | ISA 100 75 | 8.0 | A-100 | B-75 | t=6.0 | Cxx= 3.01 | Cyy= 1.78 |
| 14 | | Do | Do | 10.5 | 100 | 75 | 80 | 3.10 | 1.87 |
| 15 | | Do | Do | 13.0 | 100 | 75 | 10.0 | 3.19 | 1.95 |
| 16 | | Do | Do | 15.4 | 100 | 75 | 12.0 | 3. 27 | 2.03 |
| 17 |  | IS Normal tee | ISNT 150 | 22.8 | 150 | 150 | 10.0 | 10.00 3.95 | Cxx- |
| 18 | | IS Tee from ISHB | ISHT 125 | 27.4 | 125 | 250 | 9.7 | 8.8 | 2.37 |
| 19 | | IS Standard tee | ISST 150 | 15.7 | 150 | 75 | 11.6 | 8.0 | 4.75 |
| 20 | | IS Light WT tee | ISLT 100 | 12.7 | 100 | 100 | 10.8 | 5.7 | 2.13 |
| 21 | | IS Junior tee | ISJT 100 | 5.0 | 100 | 60 | 5.0 | 3.4 | 2.81 |
| 22 |  | IS Rolled plate | | W-900- 2500mm t-5.63mm | | | | Length 2-12.5m | |

| | | | | |
|---|---|---|---|---|
| 23 |  | I.S Strip | | W= 100-1550 t=1.6 - 10mm |
| 24 |  | Mild steel flat | | W= 10- 400mm t=3-40mm |
| 25 |  | IS Round bar | ISRQ | d=5-200 mm |
| 26 |  | IS Square bar | ISSQ | s=5-100 mm |

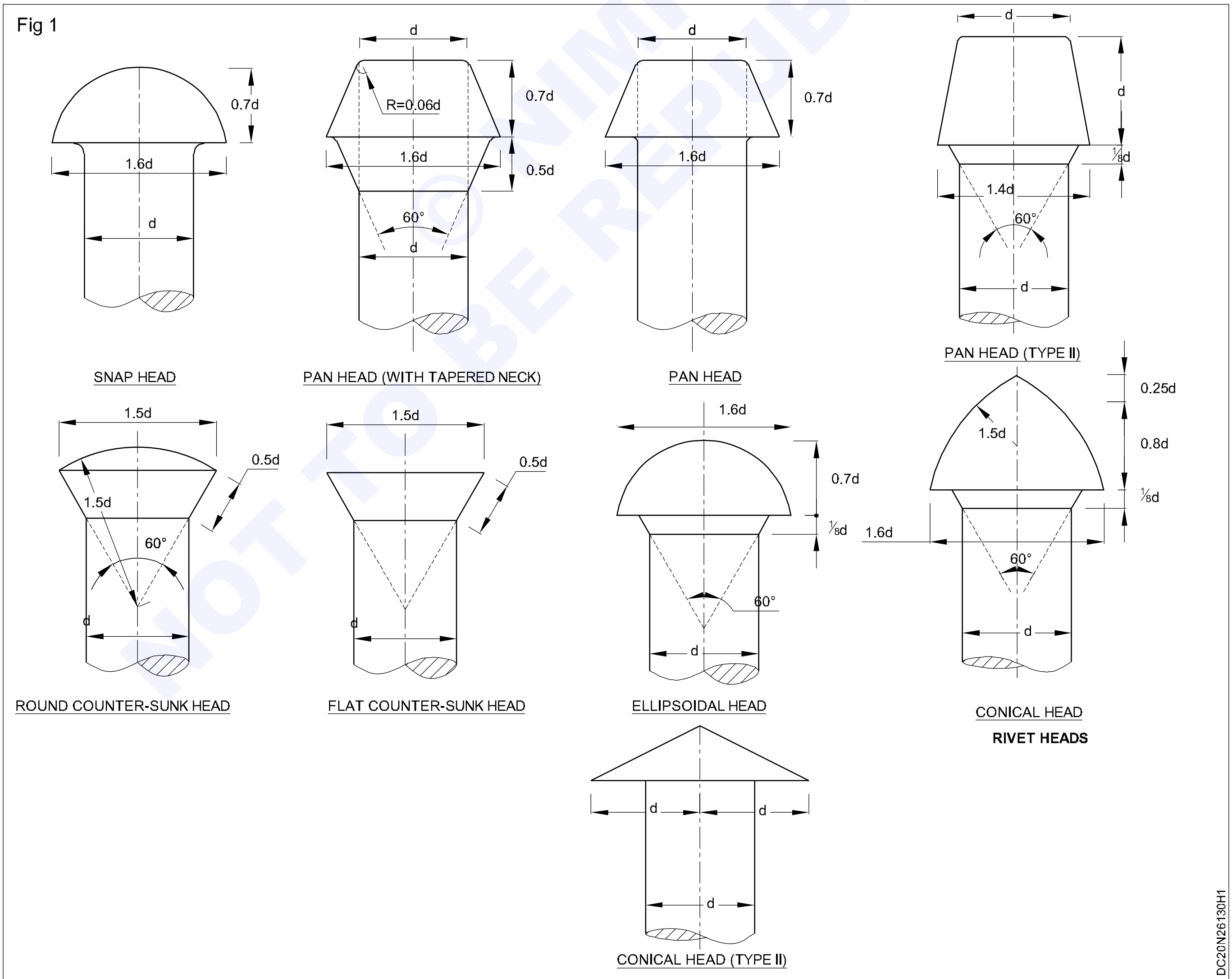
## Different types of rivet heads

**Objective :** At the end of this exercise you shall be able to
- **draw the different types of rivet heads.**

### PROCEDURE

- Dia of rivet d = 20 mm
- Compute the various elements of the rivet for d = 20 mm.
- Draw the various rivet heads according to the dimension using Auto CAD. (Fig 1)

Fig 1



# Various riveted joints

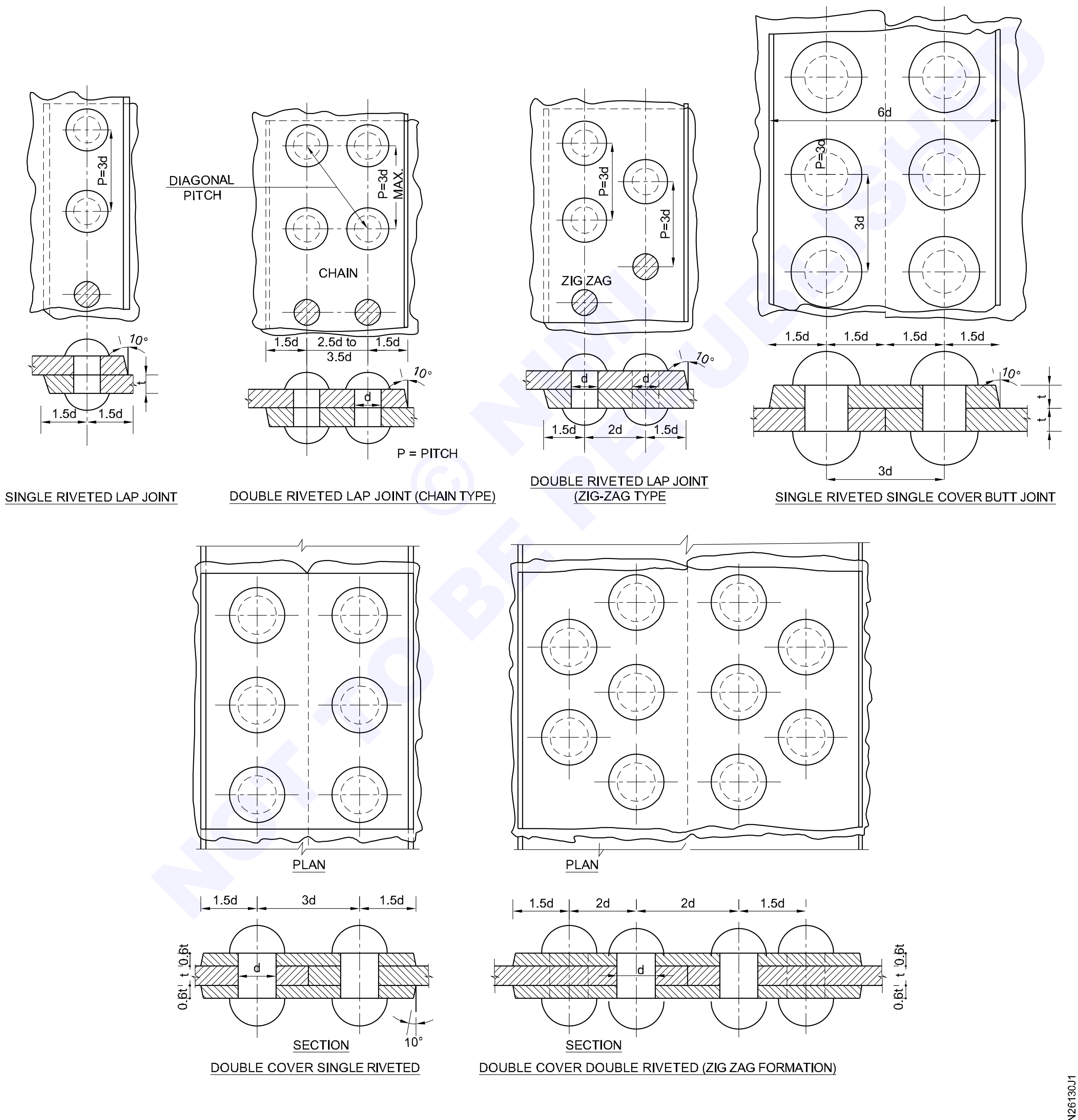
**Objective :** At the end of this exercise you shall be able to
- **draw various riveted joints.**

## PROCEDURE

### DATA

- Plate thickness t = 16 mm.
- $d = 6\sqrt{t}$ .
- Compute the various elements of the joints.
- Draw the various joints using AutoCAD. (Fig 1)

Fig 1




VARIOUS RIVETTED JOINTS

# Bolts

**Objective :** At the end of this exercise you shall be able to
- **draw the views of the following by free hand as well as using instruments.**

PROCEDURE

**Exercises**

Draw the views of various types of bolts like hexagonal bolt, square head bolt, tee bolt, hook bolt, eye bolt, etc. using conventions by free hand and also using instruments.

**Exercise 1**

Draw M30 hexagonal bolt of shank length 100 mm according to a) General proportions (b) Indian Standard IS: 1364.

Hexagonal head bolt M30.

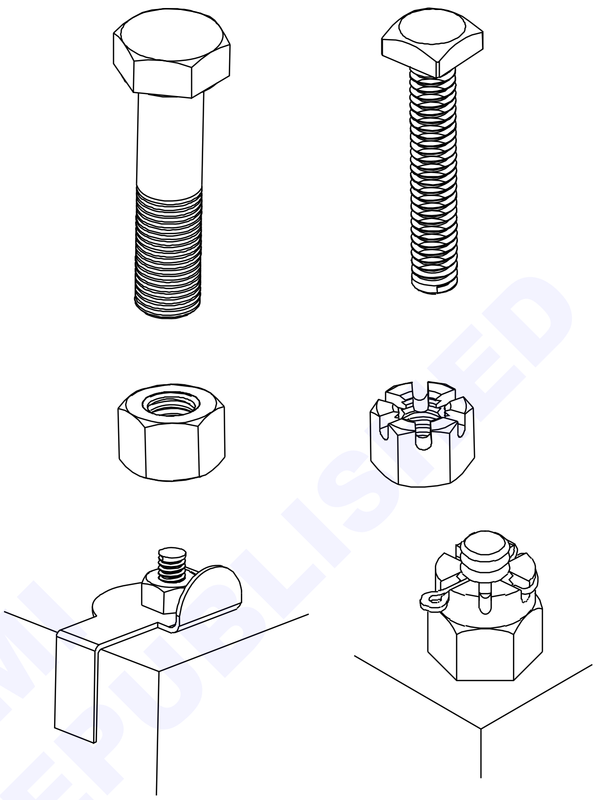
Proportion of bolt head and other features.

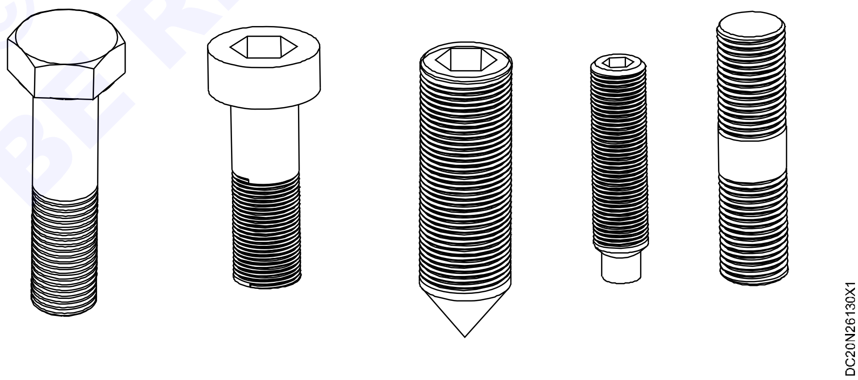
Given dia = 30 mm

Bolt head across flats $= \sqrt{3}$ d or 1.5d + 3 mm

Thickness 0.8 to 0.9 d

Radius of chamfer R = 1.5d or 1.4d. Length of bolt 3 to 4d approx. or more.





## Section and elevation of girders

**Objectives :** At the end of this exercise you shall be able to
- **draw section and elevation of girders.**

PROCEDURE

TASK 1 : **Draw section and elevation of girders**

1 Draw section of built up or compound beams (or) girders. (Fig 1)

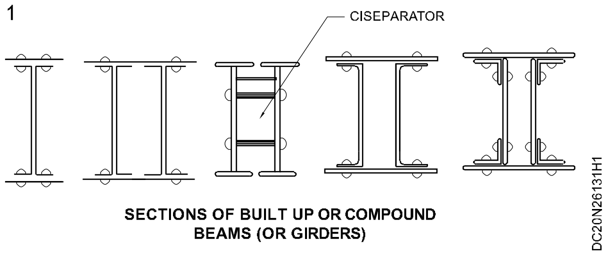
2 Draw elevation and section of box girder ( Fig 2,3).

3 Draw elevation and section of a plate Girder (Fig 4).

4 Draw the elevation of warren in girder, lattile girder and 'N' girder (Fig 5).

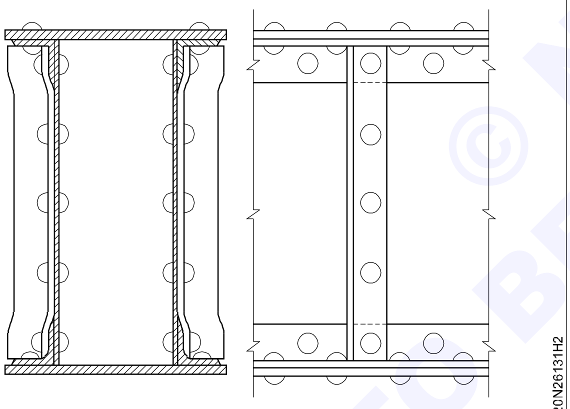
**Note : By refering the steel table select suitable dimension and with guidence of instructor prepare the drawing.**

Fig 1



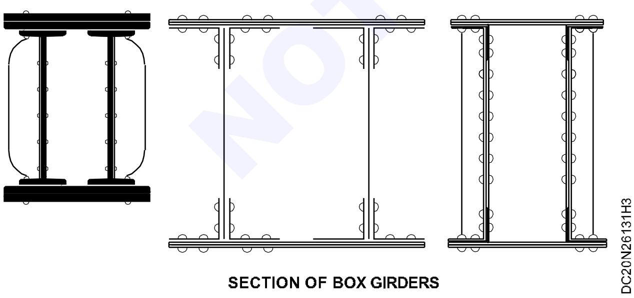

SECTIONS OF BUILT UP OR COMPOUND BEAMS (OR GIRDERS)

Fig 2



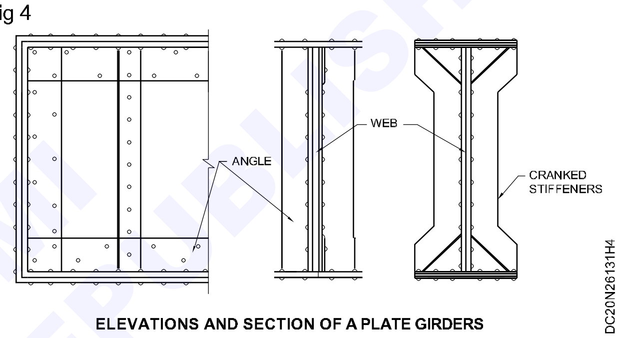

ELEVATION AND SECTION OF A BOX GIRDER

Fig 3



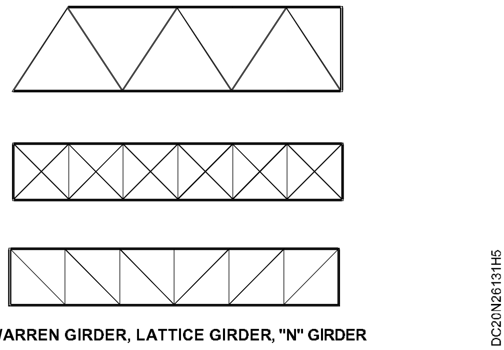

SECTION OF BOX GIRDERS

Fig 4




ELEVATIONS AND SECTION OF A PLATE GIRDERS

Fig 5




WARREN GIRDER, LATTICE GIRDER, "N" GIRDER



— — — — — — — —

# Various beam to beam connections (structural joints)

**Objective :** At the end of this exercise you shall be able to
- **draw various beam to beam connections.**

## PROCEDURE

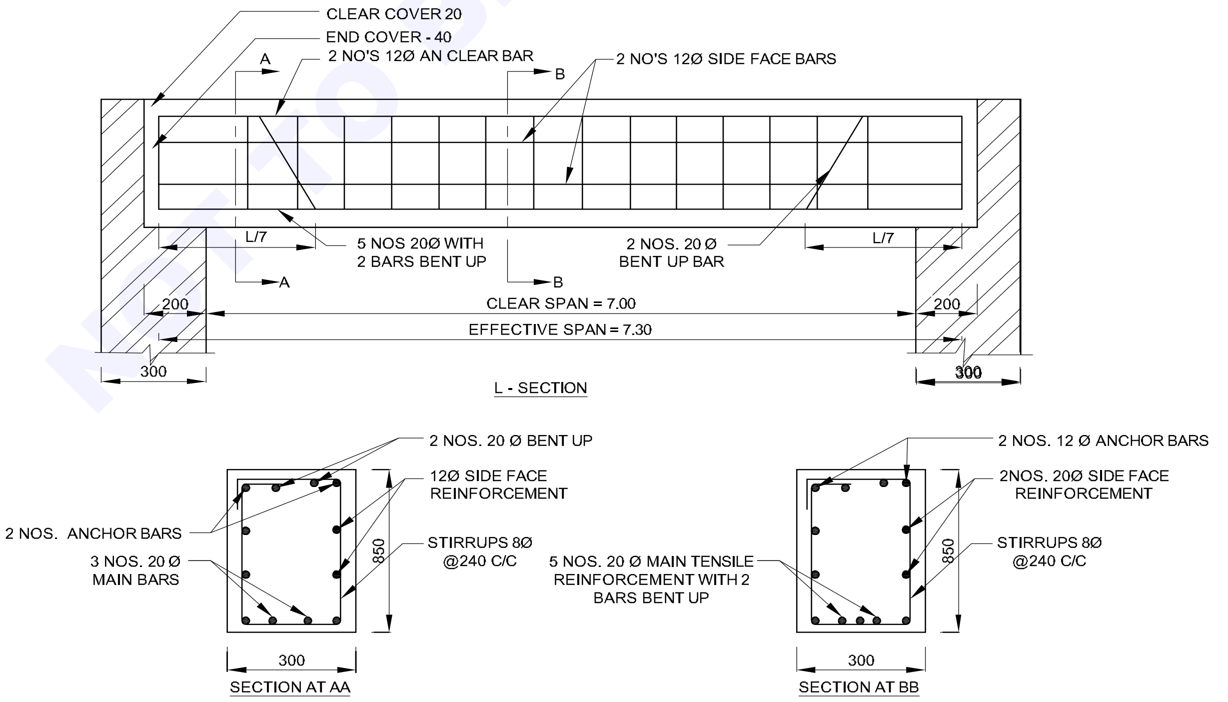
TASK 1 : **Draw various beam to beam connections**

**DATA** (Fig 1)

- Main beams ISLB 500.
- Cross beam ISLB 300.
- Cleat - angles ISA 90 x 90 x 8 mm.
- Rivets 20 mm @ 60mm c/c.
- Draw the connections using AutoCAD.



Fig 4




DETAILS OF SINGLE REINFORCED BEAM

# Plate girder

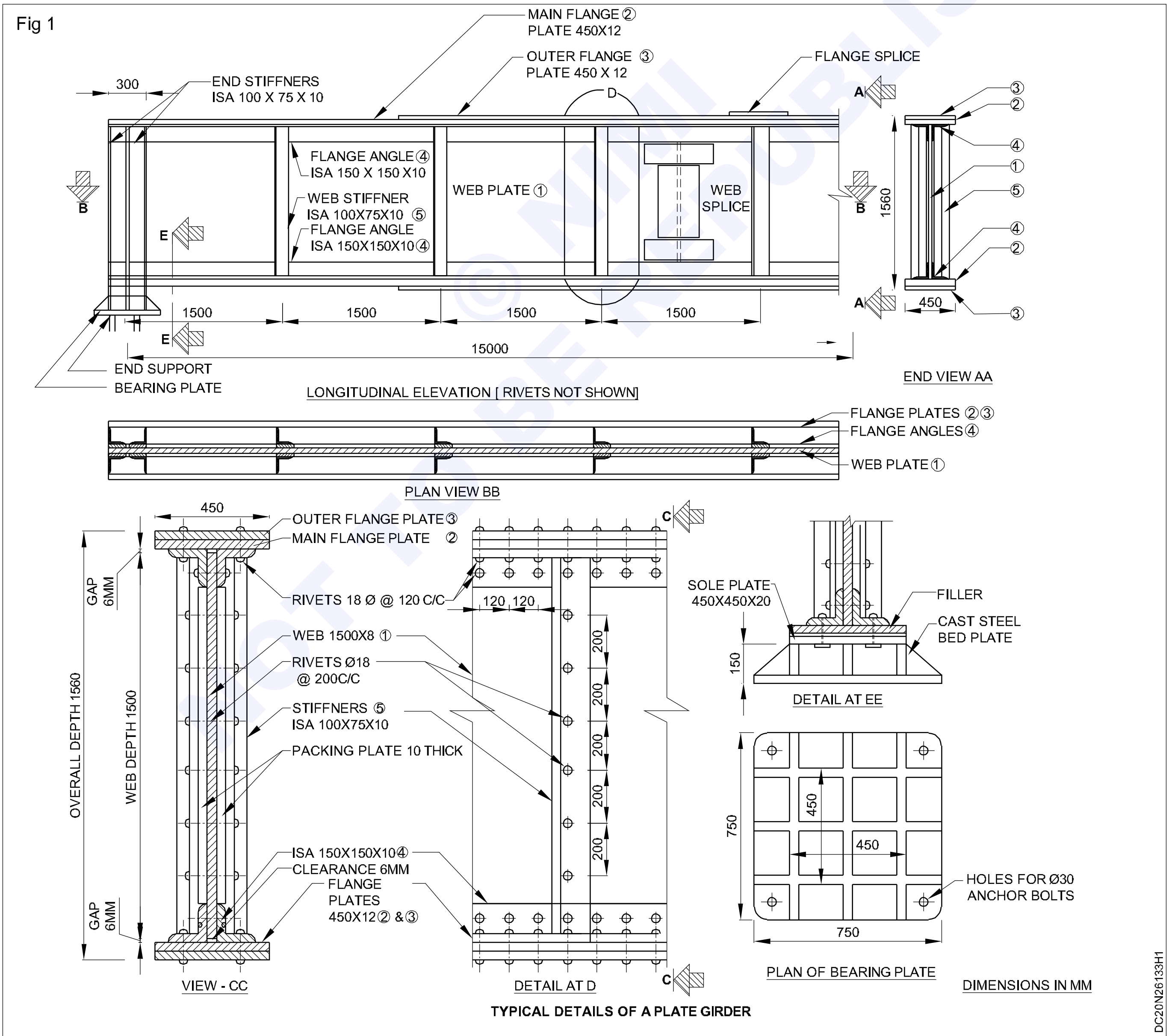
**Objective :** At the end of this exercise you shall be able to
- **draw the plan elevation and section of a plate girder.**

## PROCEDURE

### DATA

- Overall depth - 1560 mm.
- Width - 450 mm.
- Web depth - 1500 mm.
- Web thickness 8 mm.
- Main flange plate - 450 x 12 mm.
- Outer flange plate 450 x 12 mm.
- Flange angle - ISA 150 x 150 x 10 mm.
- Web stiffener - ISA 100 x 75 x 10 mm.
- Sole plate - 450 x 450 x 20 mm.
- Web rivets ø 18 mm at 200mm c/c.
- Flange rivet ø 18mm at 120mm c/c.
- Select a suitable scale and draw the plan, elevation and section using Auto CAD. (Fig 1)
- Dimension the drawings and complete.

Fig 1




TYPICAL DETAILS OF A PLATE GIRDER

## Steel roof truss

**Objectives :** At the end of this exercise you shall be able to
- **draw roof truss steel**
- **draw the joints details.**

PROCEDURE

**DATA**

- Span (effective) - 10 m.
- Slope of roof - 30°
- Principal rafter - ISA 90 x 60 x 6 mm.
- Main strut - ISA 75 x 75 x 6 mm.
- Short strut - ISA 50 x 50 x 6 mm.
- Tie beam - 2ISA 75 x 75 x 6 mm.
- Tie - ISA 60 x 60 x 6 mm.
- Main tie - 2ISA 60 x 60 x 6 mm.
- Purlin - ISA 100 x 75 x 6 mm.
- Sag tie - ISA 50 x 50 x 6 mm.
- Cleat - 75 x 75 x 6 mm.
- Gusset plate - 6 mm thick.
- Tack rivets 16 at 200 mm c/c.
- Draw the truss using Auto cad. (Fig 1)
- Complete the drawing with all dimensions and notes.

## Isometric view of steel stanchion

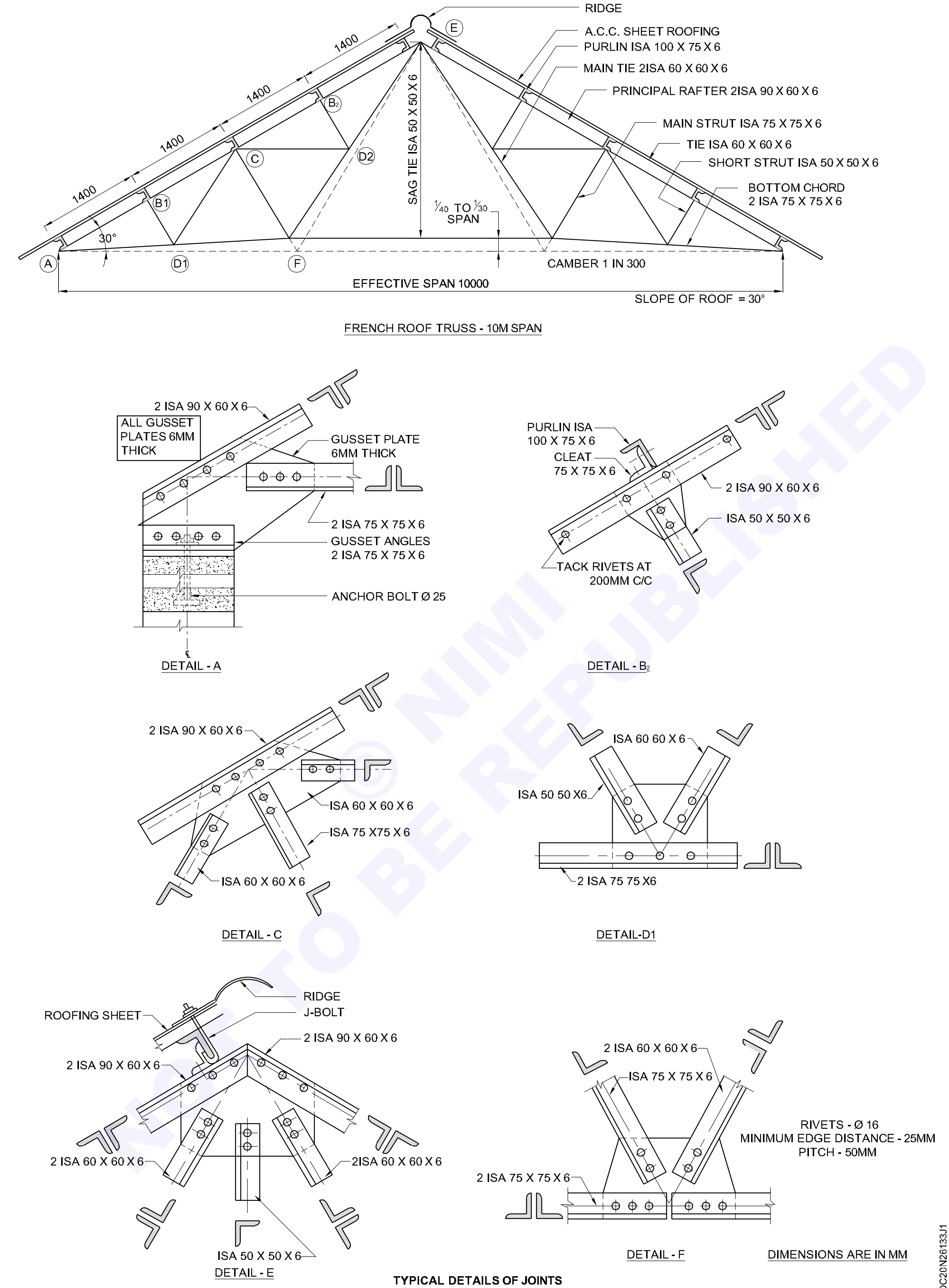
**Objectove :** At the end of this exercise you shall be able to
- **draw the isometric view of a steel stanchion.**

PROCEDURE

**DATA**

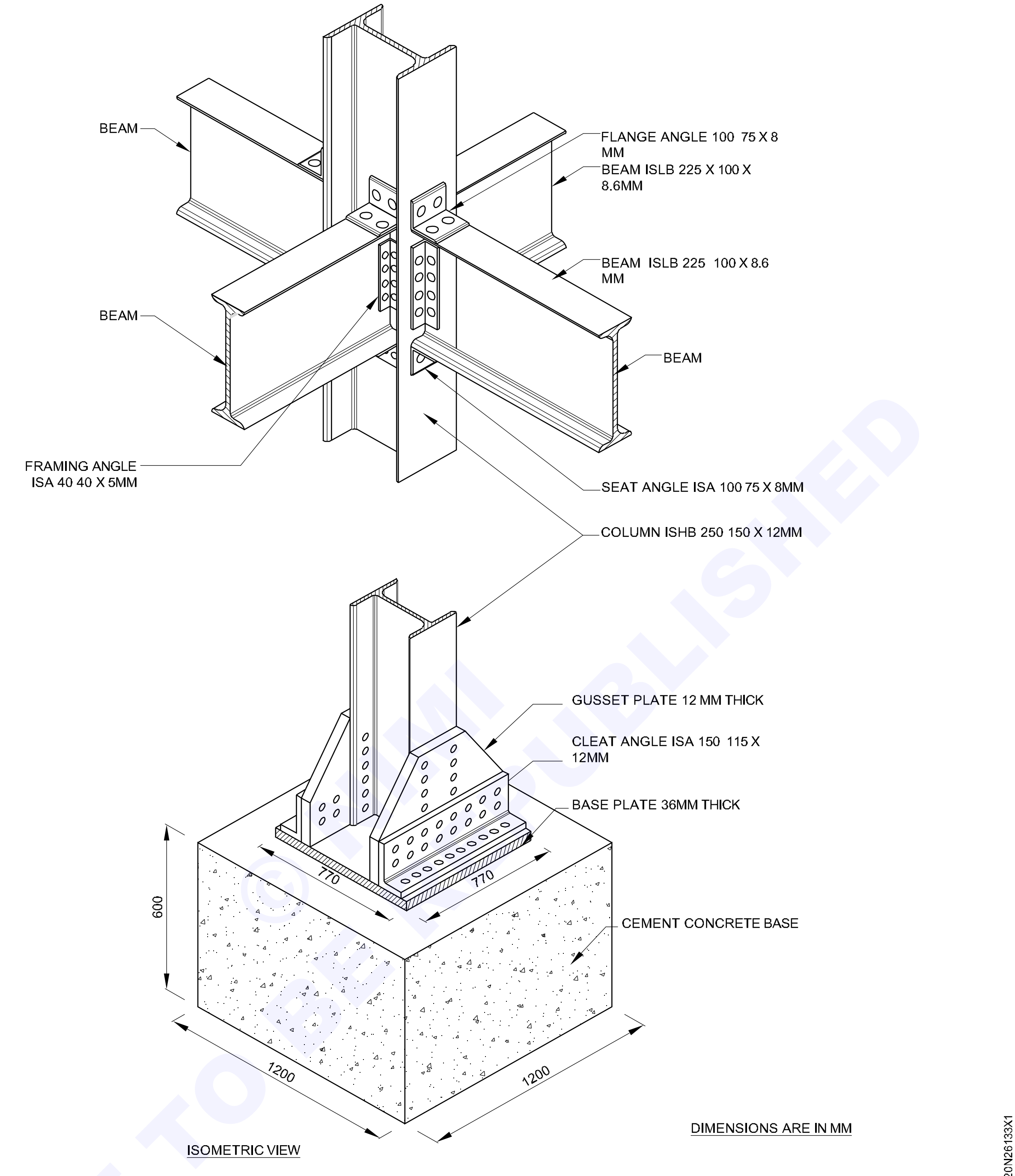
- Concrete base - 1200 x 1200 x 600 mm.
- Base plate - 770 x 770 x 36 mm.
- Cleat angle - ISA 150 x 115 x 12mm.
- Gusset plate - 12 mm thick.
- Column - ISHB 250 x 150 x 12 mm.
- Beam - ISLB 225 100 x 8.6 mm.
- Seat angle - ISA 100 x 75 x 8 mm.
- Flange angle - ISA 100 x 75 x 8 mm.
- Draw the isometric view of the steel stanchion using autocad (Fig 1)

Fig 1




TYPICAL DETAILS OF JOINTS

Fig 1




STEEL STANCHION

# Pipe joints for underground drainage

**Objective :** At the end of this exercise you shall be able to
- **draw the different types of pipe joints.**

## PROCEDURE

**DATA**

- For collar joint.
- D - (Diameter of pipe) = 50 cm.
- t - (thickness of pipe) = 5 cm.

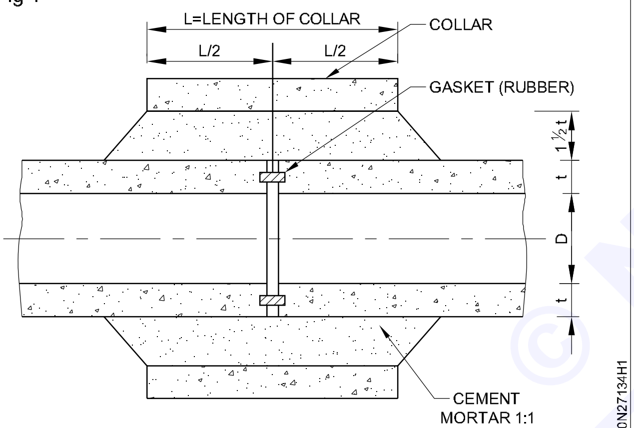
- For other joints (2) to (7).
- D = Diameter of pipe = 10 cm.
- t = thickness of pipe = 1 cm.

TASK 1 : **Draw the typical pipe joints**

1 Draw the pipe joints as per given drawing and data using auto cad. (Fig 1 to 9)

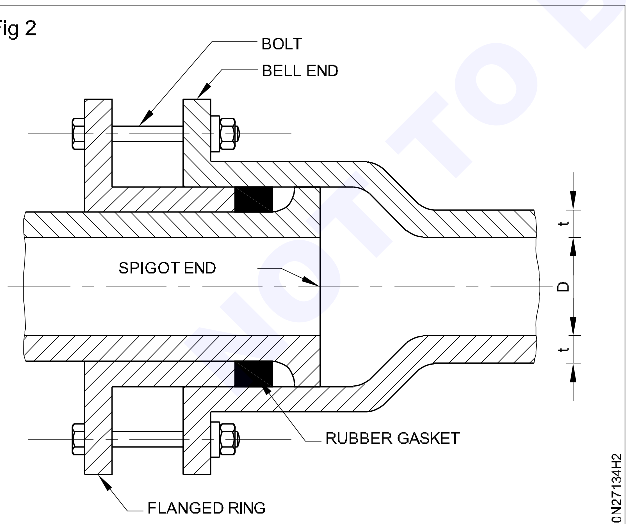
2 Take a print out in a A3 size paper.

Fig 1



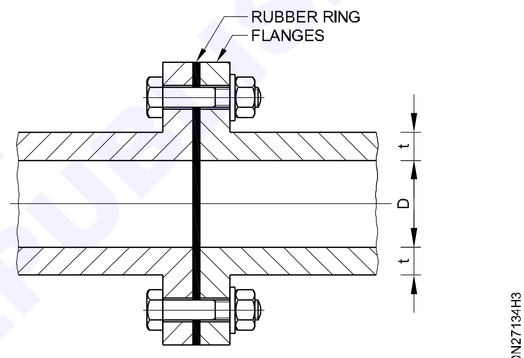

COLLAR JOINT

Fig 2



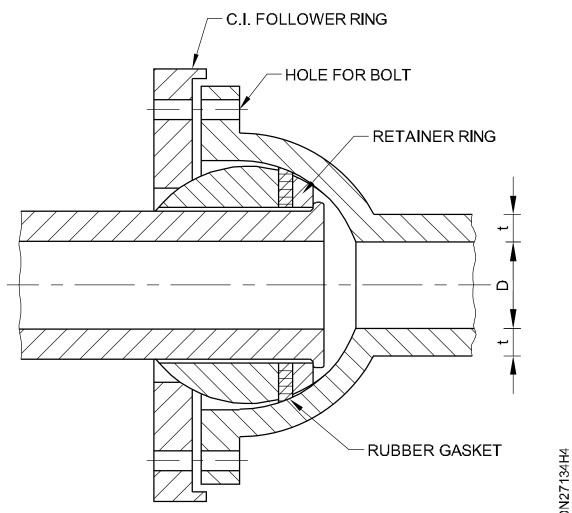

EXPANSION JOINT

Fig 3



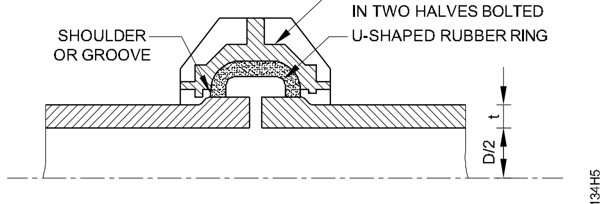

FLANGED JOINT

Fig 4




FLEXIBLE JOINT (UNIVERSAL JOINT)

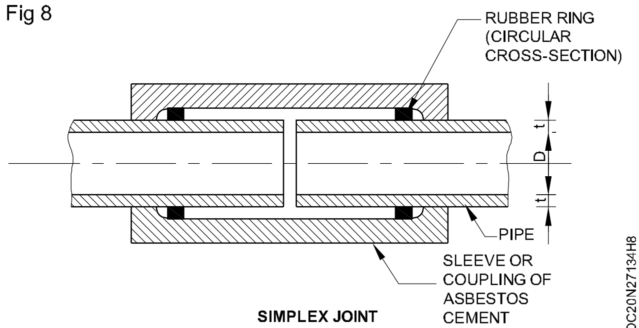
Fig 5




(a) VICTAULIC JOINT

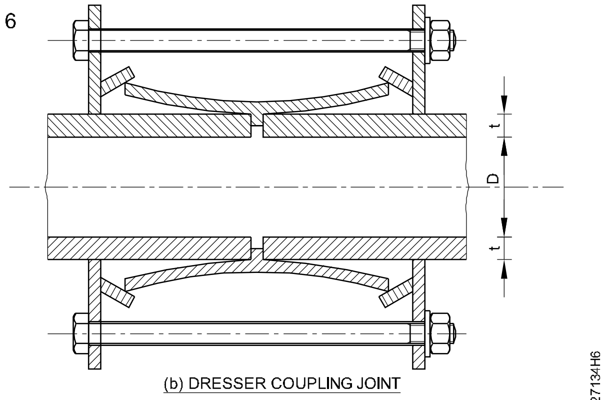
**MECHANICAL JOINT**

Fig 8




**SIMPLEX JOINT**

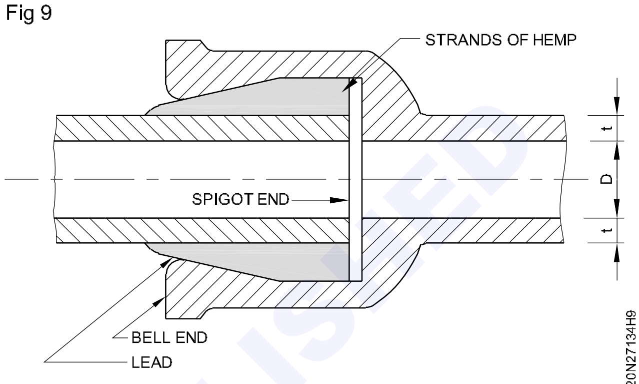
Fig 6




(b) DRESSER COUPLING JOINT

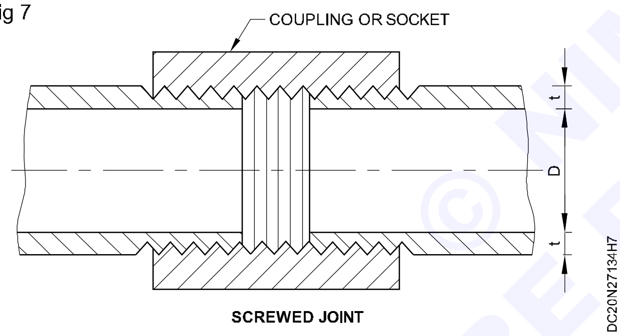
**MECHANICAL JOINT**

Fig 9




**SPIGOT AND SOCKET JOINT**

Fig 7




**SCREWED JOINT**

# Types of Sanitary fittings in Multi-storeyed building

**Objectives :** At the end of this exercise you shall be able to
- **draw the diagram of one pipe system**
- **draw the diagram of two pipe system.**

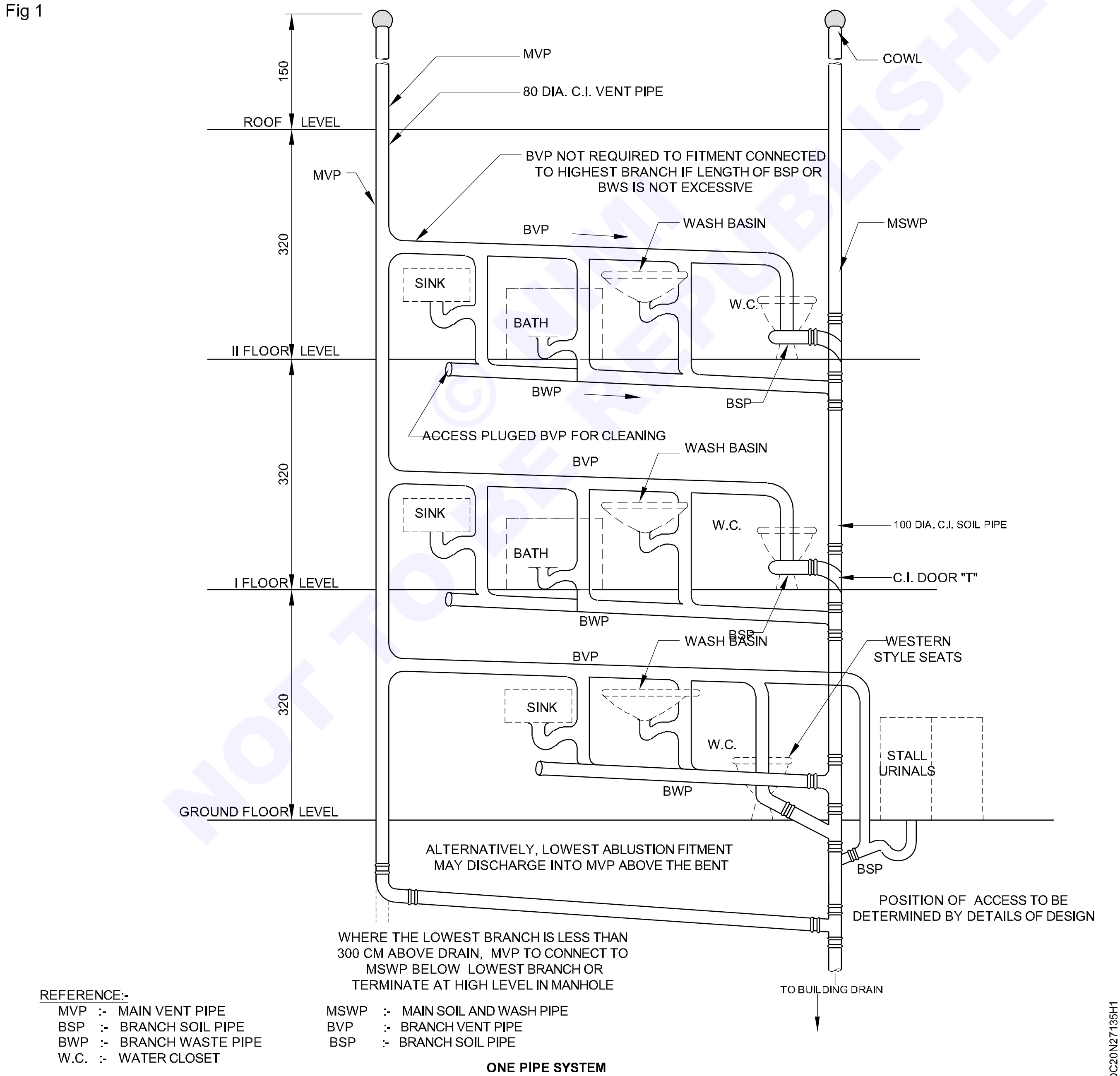
## PROCEDURE

TASK 1 : **Draw the diagram of one pipe system in system of plumbing**

1 Draw the diagrams of one pipe system and two pipe system in house plumbing by using auto cad.(Fig 1)

2 Draw the diagram of two pipe system. (Fig 2)

Fig 1

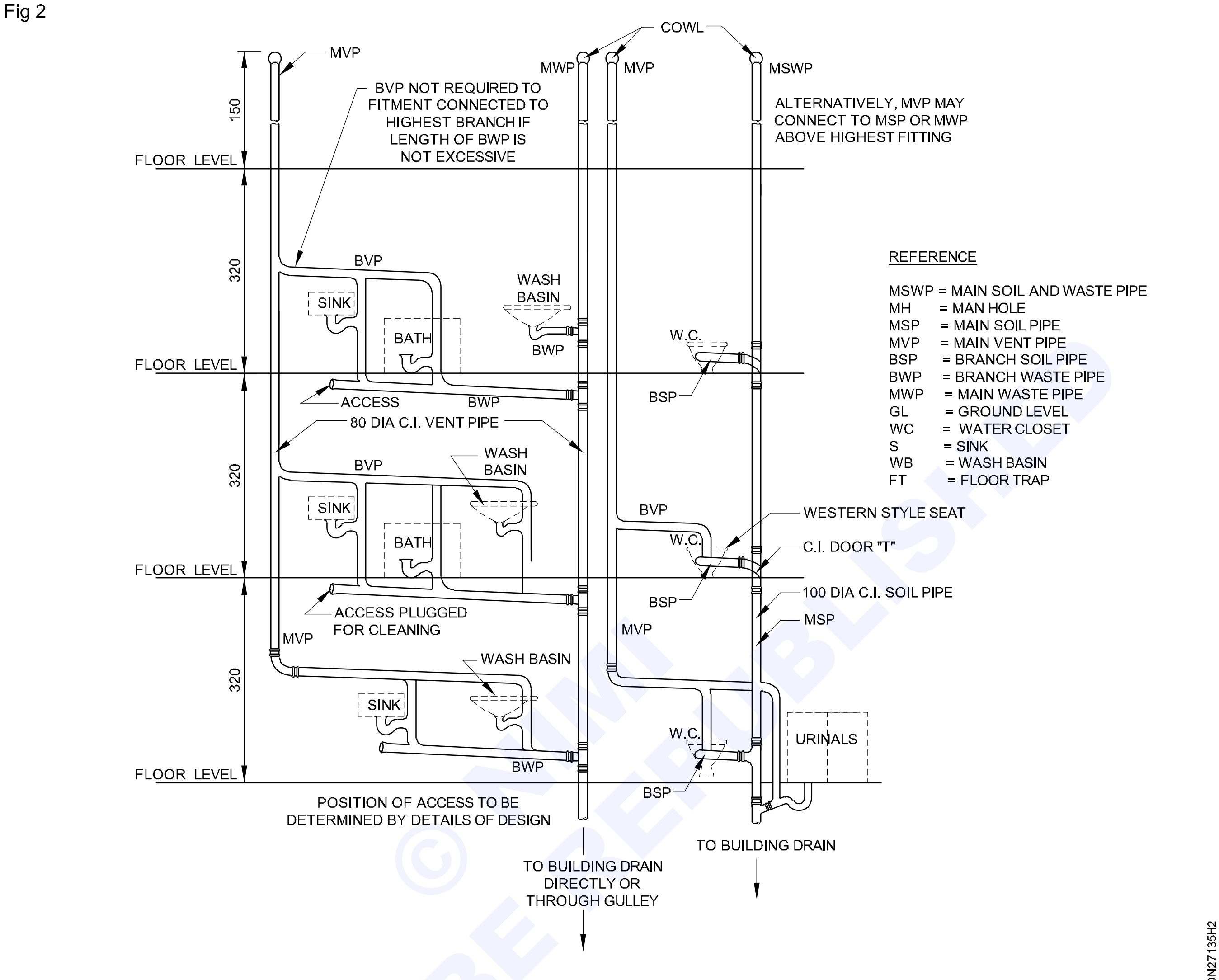


ONE PIPE SYSTEM

3 Draw the pipe accessories such as bend, connector, junction etc as per given sketch.

4 Complete the drawing and take a print.

Fig 2




TWO PIPE SYSTEM

## Man hole and septic tank

**Objectives :** At the end of this exercise you shall be able to
- **design septic tank**
- **draw septic tank**

PROCEDURE

TASK 1 : **Design and draw septic tank.**

**DATA**

For septic tank

Rate of water supply = 135 litres/ capita/ day

Number of users = 50 Nos

Detension period = 24 hrs.

Cleaning period = 2 years interval.

Sludge storage / capital = 0.0708m$^{3.}$

Clean space for sedimentation = 0.30 m deep.

Scum storage / capita = 0.01m$^{3.}$

Sludge digestion / capita = 0.028 m$^3$.

**Design of a septic tank for 50 users**

Assuming the usage of water 135 litre per / capita / day.

No of users = 50.

Total quantity of sewage = 135 $\times$ 50 = 6750.00 litres = 6.75m$^3$.

Assuming a detention period = 24 hours (normal range 12.00 - to - 24.00 hours).

$$\text{Tank capacity} = 6.75 \times \frac{24}{24} = 6.75\ m^3.$$

Assuming the tank is cleaning period = 2 year.

The sludge storage per capita = 0.0708m$^{3.}$

Sludge storage required = 50 $\times$ 0.0708 = 3.54m$^{3.}$

Total capacity =6.75+3.54 =10.29m$^3$ say 10.30m$^3$ .....(1)

Add 25% extra for future expansion.

Then total design capacity.

$$= \frac{10.30 \times 125}{100} = 12.88m^3 = 12.90m^3 ......(2)$$

Assuming the depth of septic tank .......say 2.00 metre.

Then the area of septic tank = 12.9/2.00 = 6.45 m$^{2.}$

Length - width ratio ....... = 3:1 (ration may be in between 2.0 - to - 4.00).

Length x breadth = 3 x breadth x breadth = 6.45m$^2$

(Breadth)$^2$ = 6.45/3 = 2.15.m

Breadth = 1.46m say 1.50 m.

Length = 1.50 $\times$ 3 = 4.50 m.

Assuming free board of 30.00 cm (normal range 40.00 cm - to - 60.00 cm).

Total depth = 2.00 + 0.30 = 2.30 m.

Hence provide septic tank of size (4.50 $\times$ 1.50 $\times$ 2.30) m

Check for spaces:-

Sedimentation volume for clear space of 0.30 m deep = clear space x surface area = 0.30 $\times$ 6.45 = 1.935m3

Scum storage 0.01m$^3$ / capita = 50 $\times$ 0.01 = 0.50 m$^3$

Sludge digestion 0.028m3 / capita = 50 $\times$ 0.028 = 1.40 m$^3$

Sludge storage at 0.0708 m3 / capita = 50 $\times$ 0.028 = 1.40m$^3$

Sludge storage at 0.0708 m$^3$ /capita for 2 years of cleaning interval = 50 $\times$ 0.0708 = 3.54m$^3$

Total space = 1.935 + 0.5 + 1.40 + 3.54 = 7.38 $m^3$ against tank capacity of 10.3 $m^3$

Hance the design is correct.

**1 Septic tank (Fig 1)**

- Draw plan of the septic tank with inner dimension (4.50 m x 1.50 m) wall thickness 20 cm.
- Draw RCC baffle wall 90 cm from the inlet end.
- Draw 10 cm inlet and outlet pipe and complete the plan as per give drawing.
- Draw the L - section at XX by projecting lines from plan and total depth (at middle) 2.30m (2.00m water and 0.3m free board.
- Draw inlet pipe above water level.
- Draw outlet pipe 10 cm ø with bottom level same as sewage level.
- Draw the cover slab 10 cm thick and provide a man hole cover 50 cm dia in the slab.
- Provide floor slope of about 1 in 10 or 1 in 20 and a vent pipe 8 cm with min depth 2 .00m.
- Draw the cross section of the depth tank. ( Section at YY).
- Complete the drawing.

— — — — — — — —

## Man holes

**Objectives :** At the end of this exercise you shall be able to
- **draw shallow man hole .**

### PROCEDURE

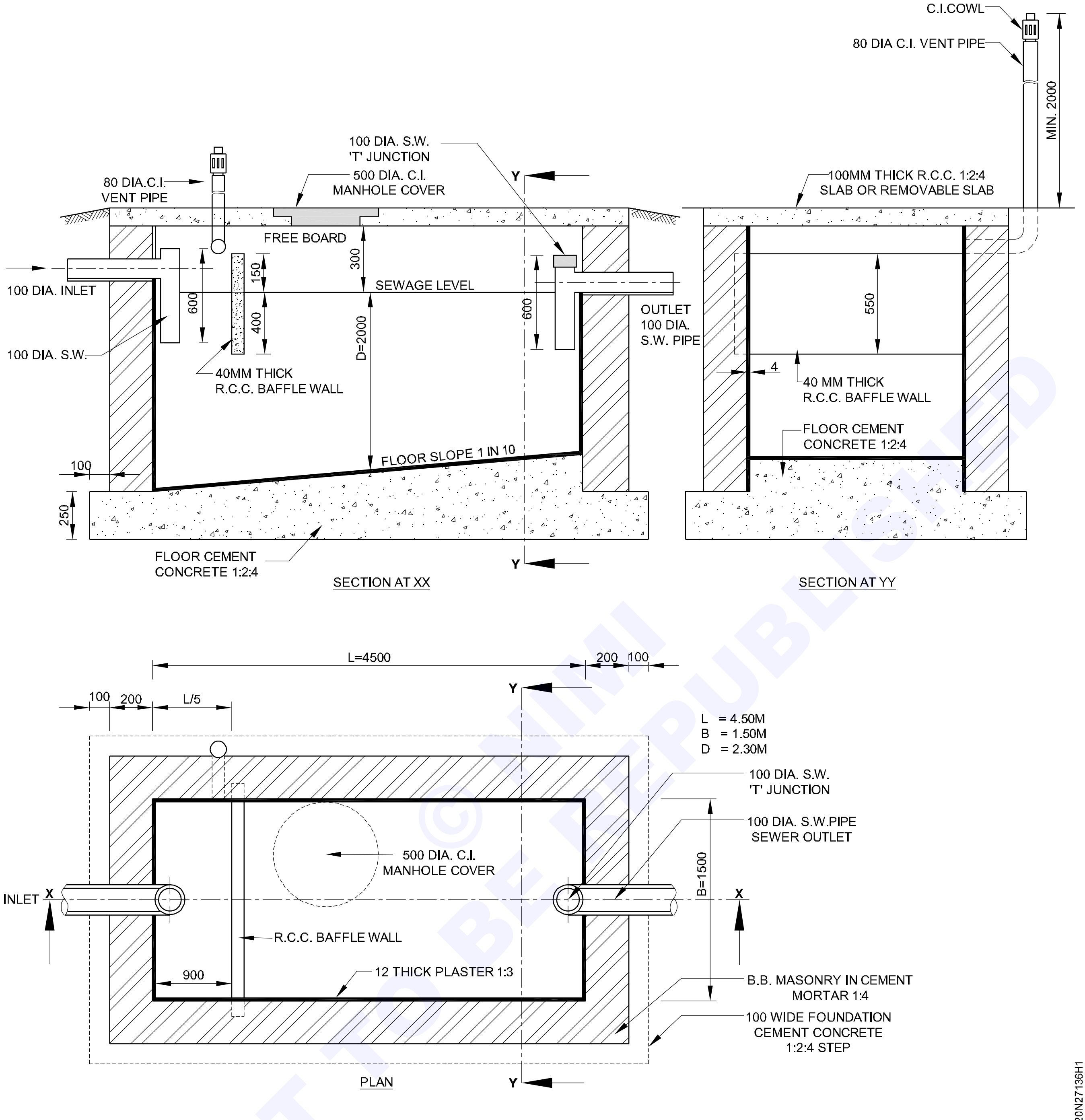
TASK 1 : **Prepare the detailed drawings of a shallow manhole (depth below 2m) (Fig 1)**

**DATA**

- Working chamber - (80 x 80 x 90) cm.
- Walls - 20 cm thick brick masonry in cm 1:4, plastered inside with CM 1:3, 12 mm thick.
- Foundation - C.C 1:2:4, 20 cm thick, with a projection of 10 cm beyond walls.
- Covering slab - 10 cm thick R.C.C 1:2:4.
- Main sewer pipe - 20 cm dia.
- Branch sewer - 15 cm dia.
- manhole - 50 cm diameter.
- Draw sectional plan, longitudinal section (section at AA) and cross - section (section at BB) of the manhole as per given data and sketches.
- Mark the dimensions and complete the drawings.
- Take a print in A3 size paper.

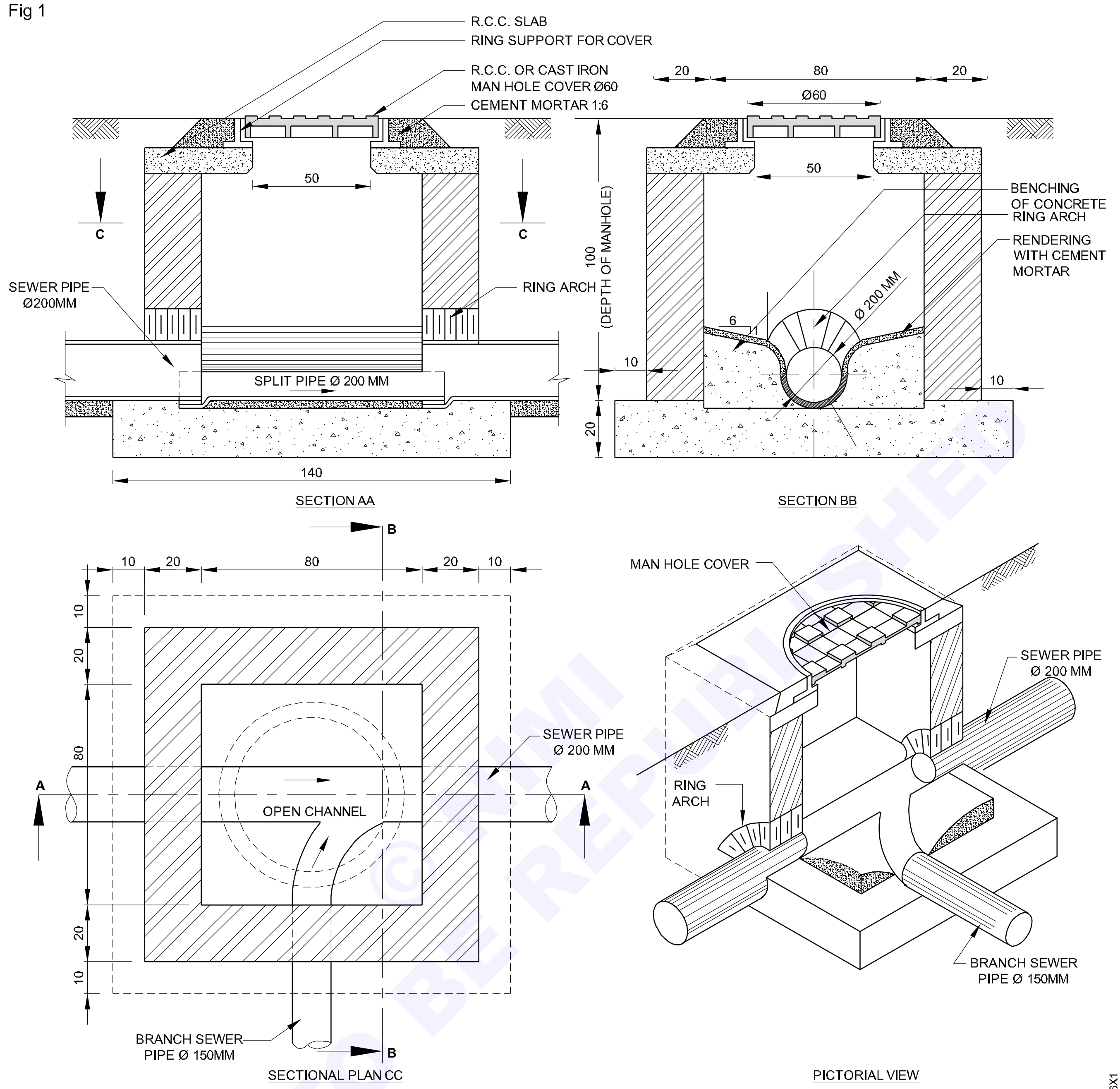
**A man hole of 2m or above is called deep man hole.**

Fig 1




**SEPTIC TANK**

Fig 1




DETAILS OF MANHOLE (DEPTH 1M & BELOW)

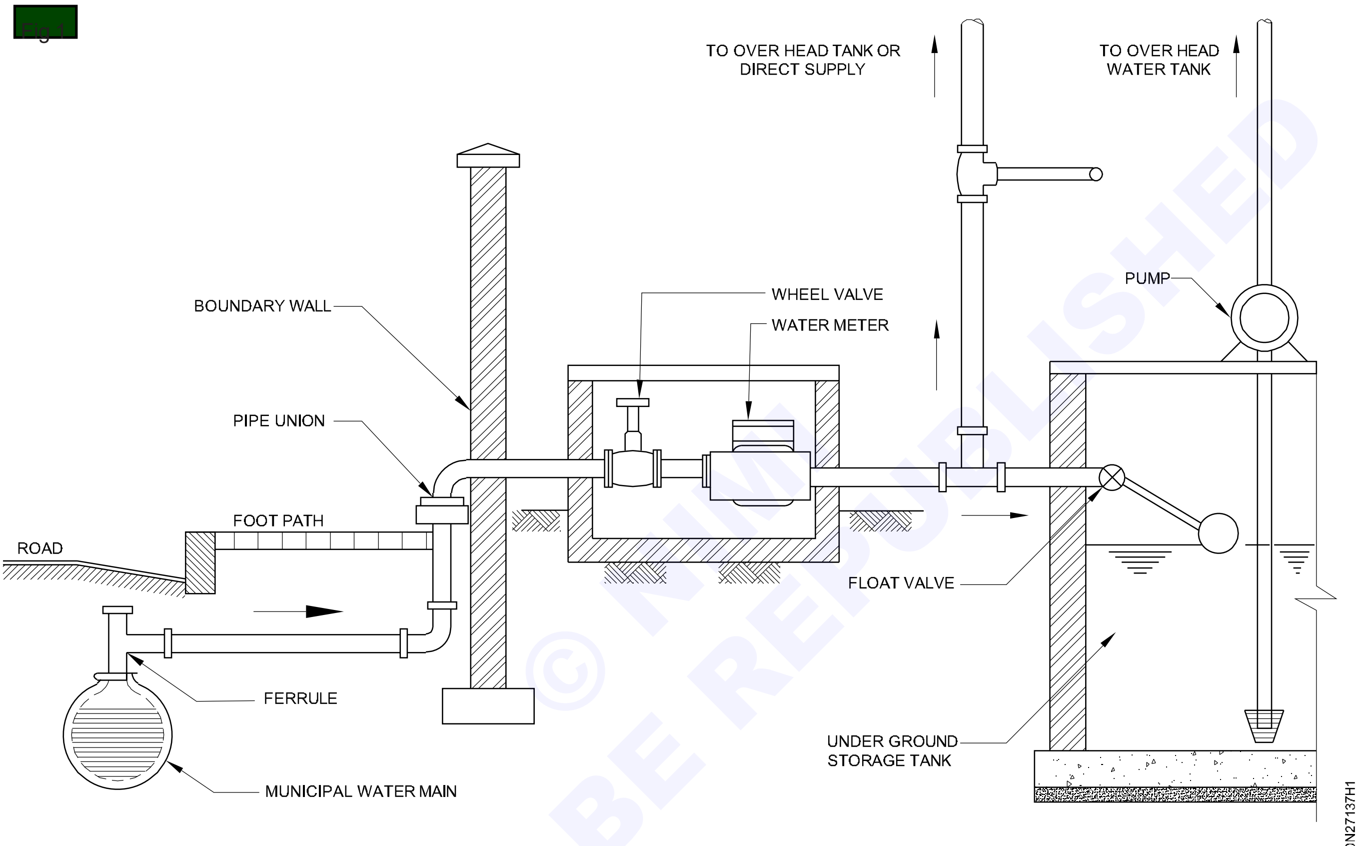
**SHALLOW MAN HOLE**

## Diagram of water supply connection scheme

**Objectives :** At the end of this exercise you shall be able to
- **draw the diagram of water supply connection to isolated residential building**
- **draw the diagram of water supply installation in a flat and in an isolated building.**

TASK 1 : **Prepare a schematic diagram for water supply connection to residential building (Fig 1)**

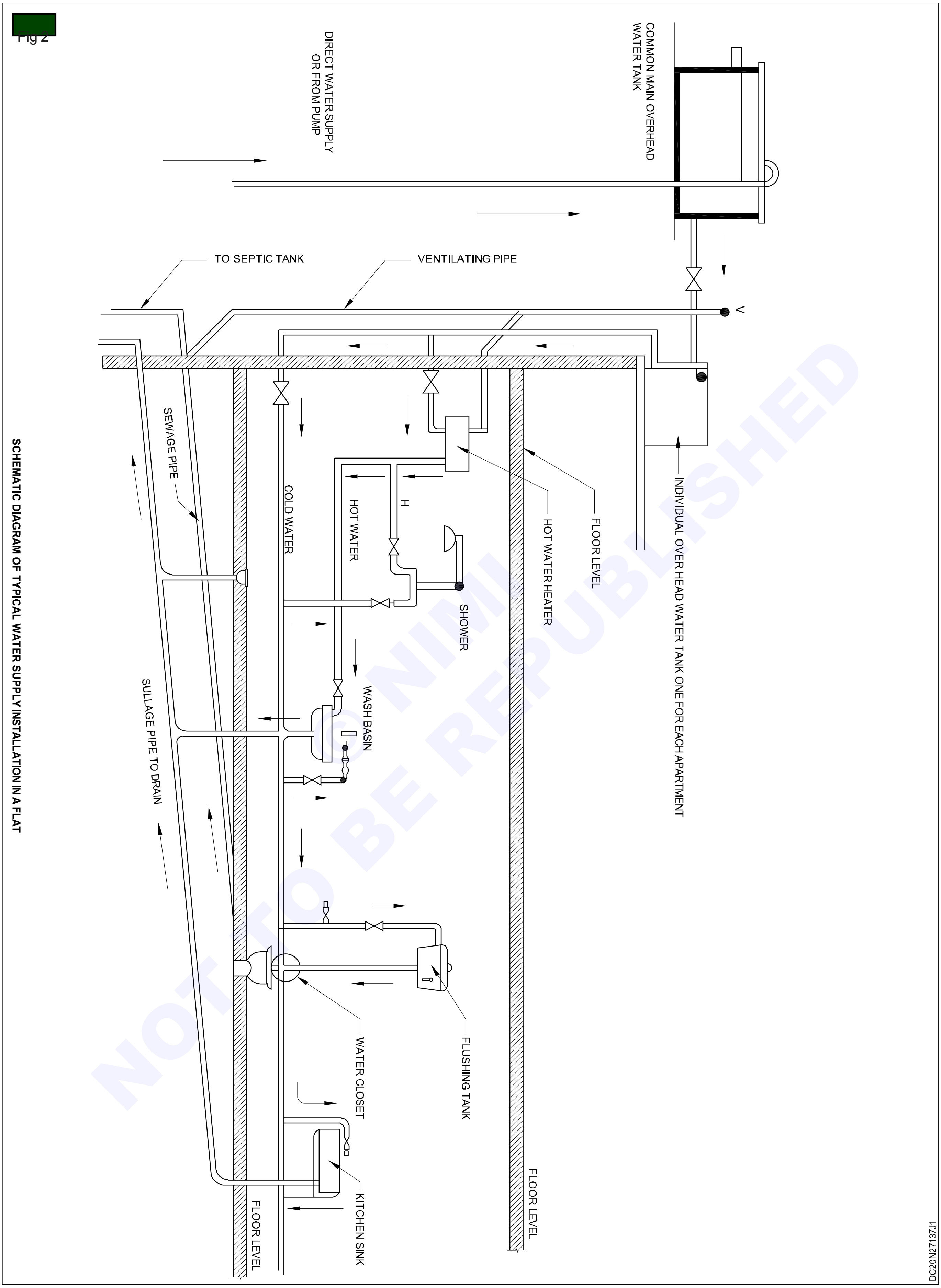
Fig 1




SCHEMATIC DIAGRAM OF WATER SUPPLY CONNECTION

TASK 2 : **Prepare a schematic diagram of typical water supply installation in a flat and in an isolated building (Fig 2)**

- Draw the diagram in the chart as per given reference sketches.



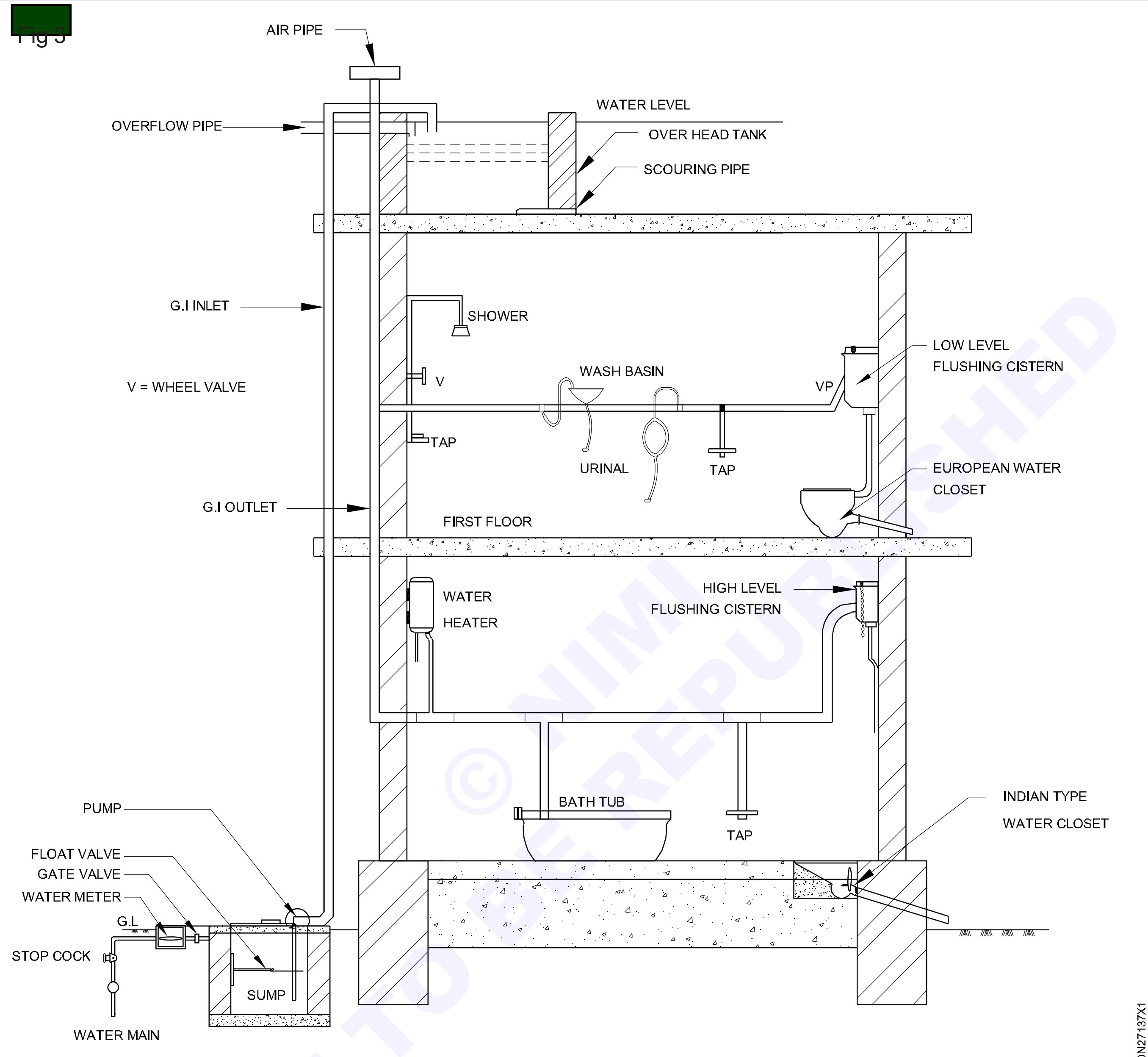

SCHEMATIC DIAGRAM OF TYPICAL WATER SUPPLY INSTALLATION IN A FLAT

— — — — — — — —

TASK 3 : **Prepare a schematic diagram of water supply installation in an isolated building (Fig 3)**

1 Draw the diagram as per given reference sketches.

[redacted]




WATER SUPPLY INSTALLATION IN AN ISOLATED BUILDING

# R.C.C square overhead water tank supported by four column

**Objective :** At the end of this exercise you shall be able to
- **draw the R.C.C overhead water tank.**

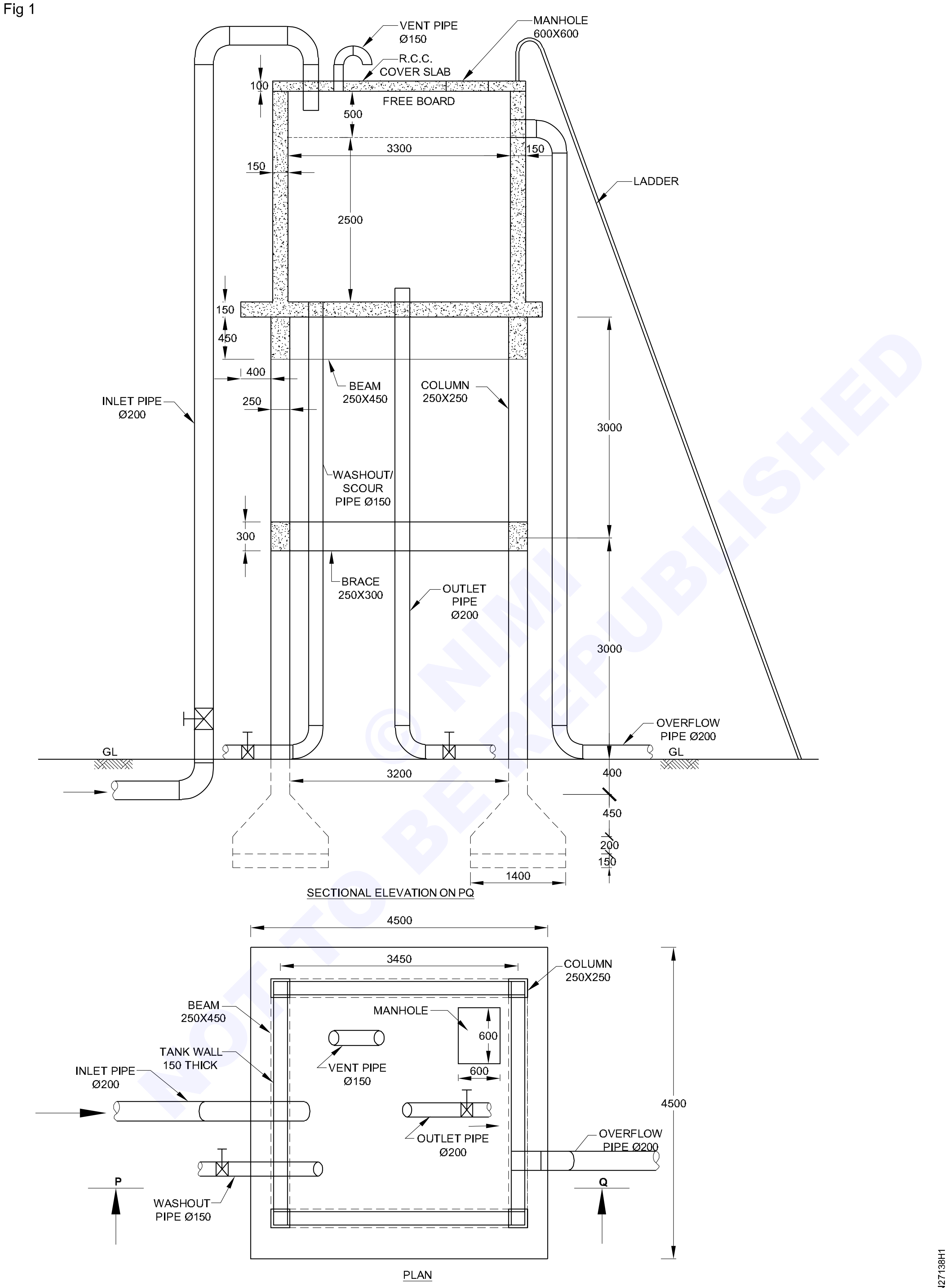
## PROCEDURE

TASK 1 : **Draw the R.C.C square over head tank supported by four columns using Auto CAD software (Fig 1)**

**DATA**

- Size of the tank - 3300 x 3300 mm.
- Height of wall of the tank - 3m.
- Free board - 0.5 m.
- Thickness of bottom slab 150 mm.
- Thickness of tank wall - 150 mm.
- Thickness of cover slab - 100 mm.
- Size of beam at top of column - 250 x 250 mm.
- Size of column - 250 x 250 mm.
- Size of braces - 250 x 300 mm.
- Height of column from G.L - 6m.
- Size of manhole - 600 mm x 600 mm.
- Depth of water inside the tank - 2.5 m.
- Depth of foundation below G.L - 1200 mm.
- Size of column footing - 1400 x 1400 mm.
- Diameter of inlet, outlet and overflow pipes - 200 mm.
- Diameter of scour pipe - 150 mm.
- Diameter of vent pipe - 150 mm.
- Any more data required may be assumed suitably.
- Draw the plan and sectional elevation of the R.C.C overhead tank supported by four columns.
- Dimension the figure and complete the drawing as per given data and sketches.
- Take a print in A3 size paper.

Fig 1




R.C.C. SQUARE OVER HEAD TANK SUPPORTED BY FOUR COLUMNS

## Service plan for isolated building and sewer system

**Objective :** At the end of this exercise you shall be able to
- **prepare drainage plan of a building.**

## PROCEDURE

TASK 1 : **Prepare drainage plan of the building (Fig 1)**

1 To a convenient scale, draw the site plan of the building.

2 Draw the line sketch or detailed plan of the building in the site plan in the same scale.

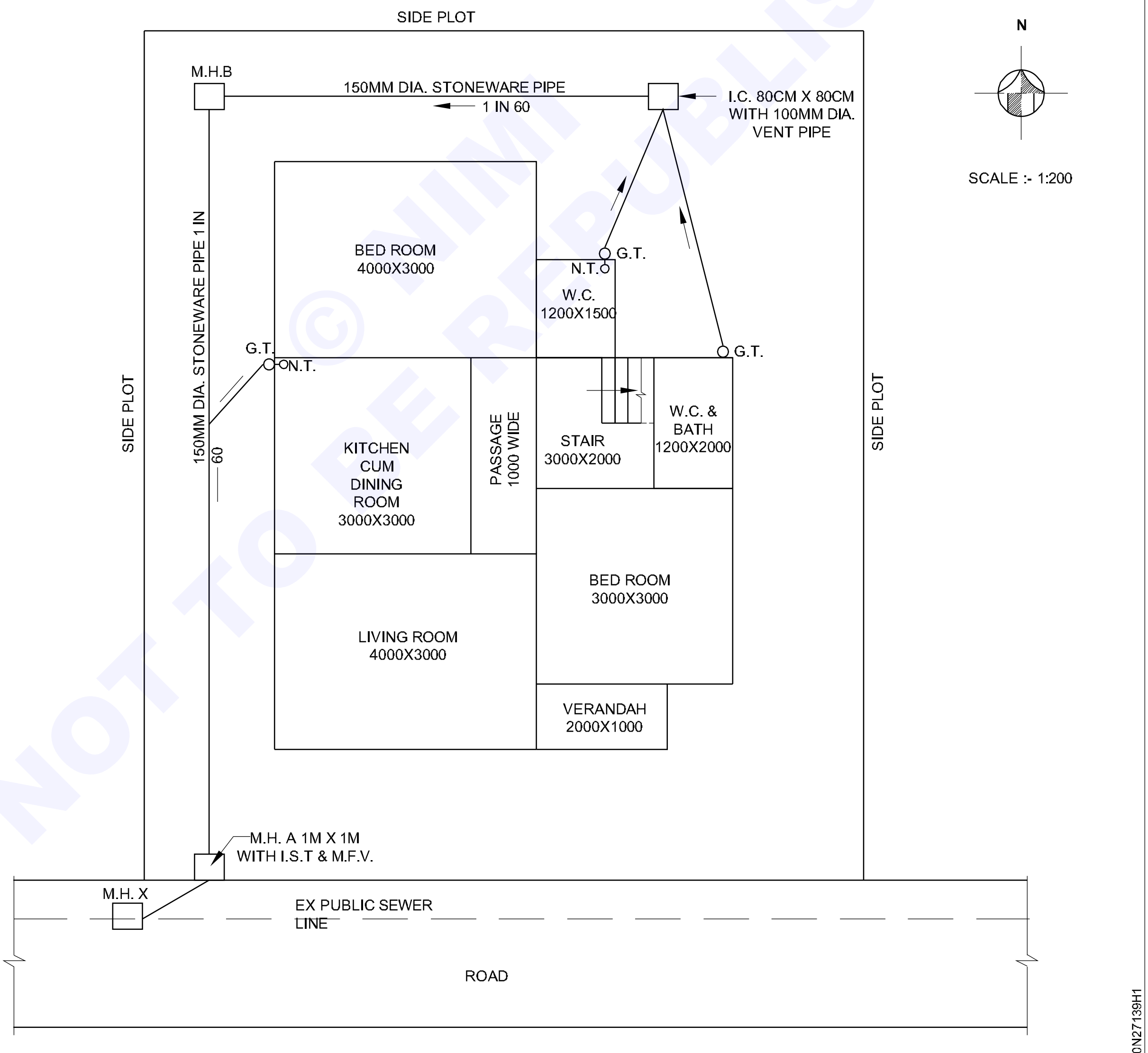
3 Mark the positions of sanitary appliances and toilet fixtures in the building plan by conventional symbols and mark the positions of gully traps outside the building.

4 Draw the sewer lines house sewer in the site plan and mark the positions of inspection chambers, manholes, etc.

5 Draw connection from the gully trap to building sewer and show its direction also.

6 Complete the drainage plan.

Fig 1




DRAINAGE PLAN OF A BUILDING

## Types of sanitary fittings and toilet fixtures

**Objective :** At the end of this exercise you shall be able to
- **draw the different sanitary fittings in building**
- **draw the arrangement of sanitary fittings in toilet and bathroom.**

PROCEDURE

TASK 1 : **Prepare the detailed drawings of the sanitary fittings in toilet and bathrooms (Fig 1)**

1 Draw the details of sanitary fittings as per given drawing using auto CAD and take a print in A3 size paper.

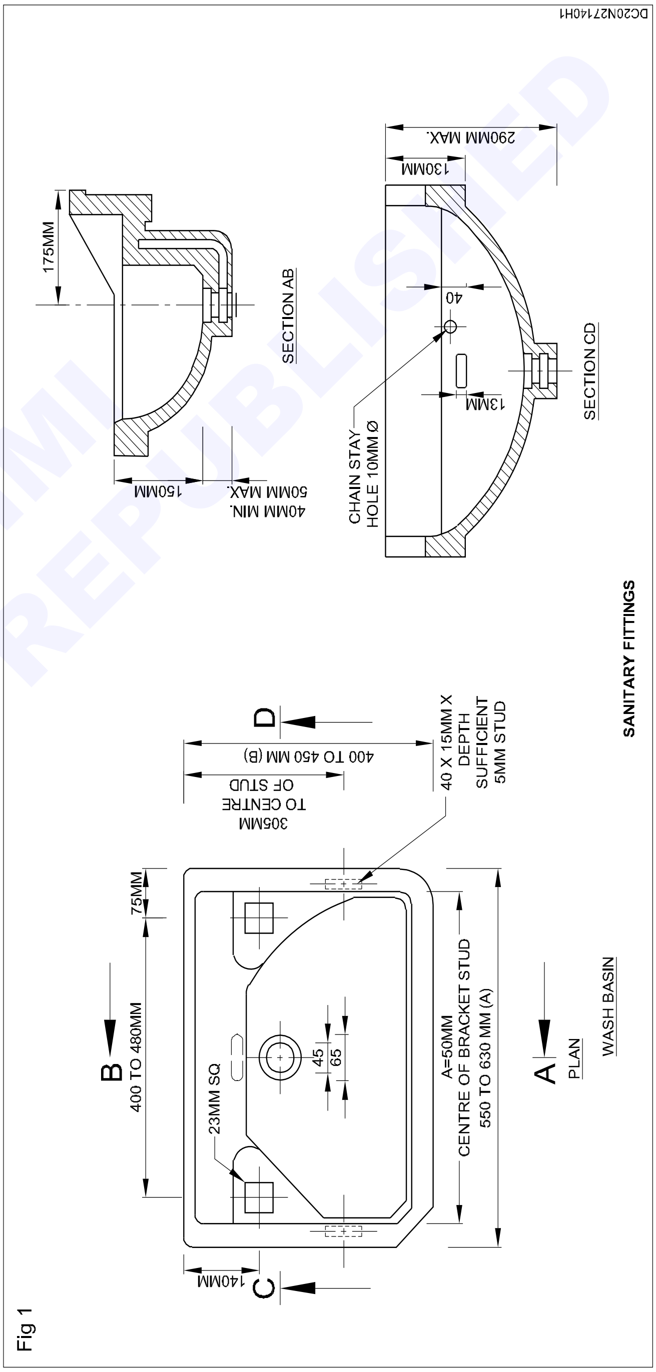


Fig 1



— — — — — — — —

TASK 2 : **Prepare the drawing showing the arrangement of sanitary fittings in toilet and bathrooms. (Fig 1 to 6)**

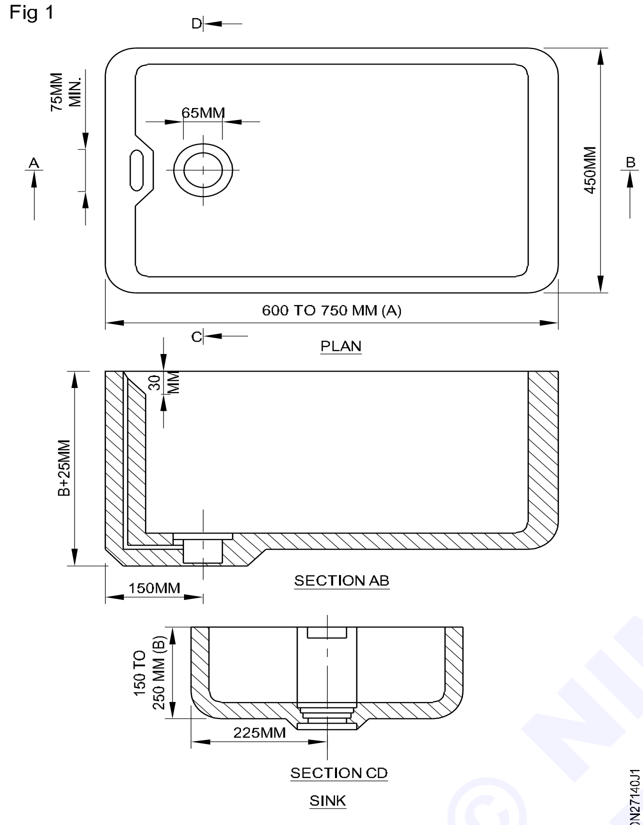
1 Draw the plan of toilet with (1) ordinary W.C and (2) European W.C (3), Bath room with separate W.C (4) combined bath and W.C (5) public lavatory showing all details as per given drawing using Auto CAD.

2 Show the arrangement of sanitary fittings in the plan.

3 Mark the dimensions and complete the drawing.

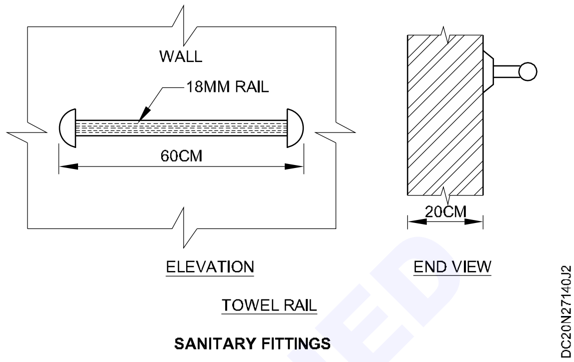
4 Take a print in A3 size paper.

Fig 1



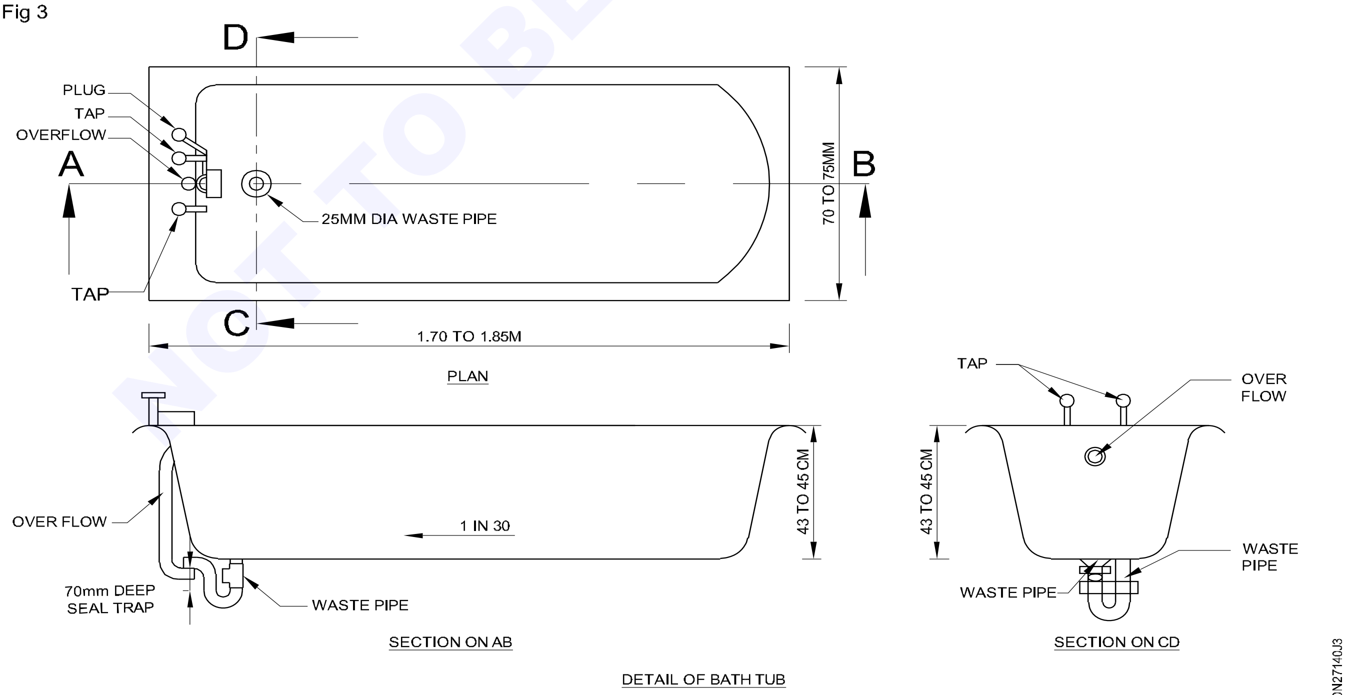

SANITARY FITTINGS

Fig 2



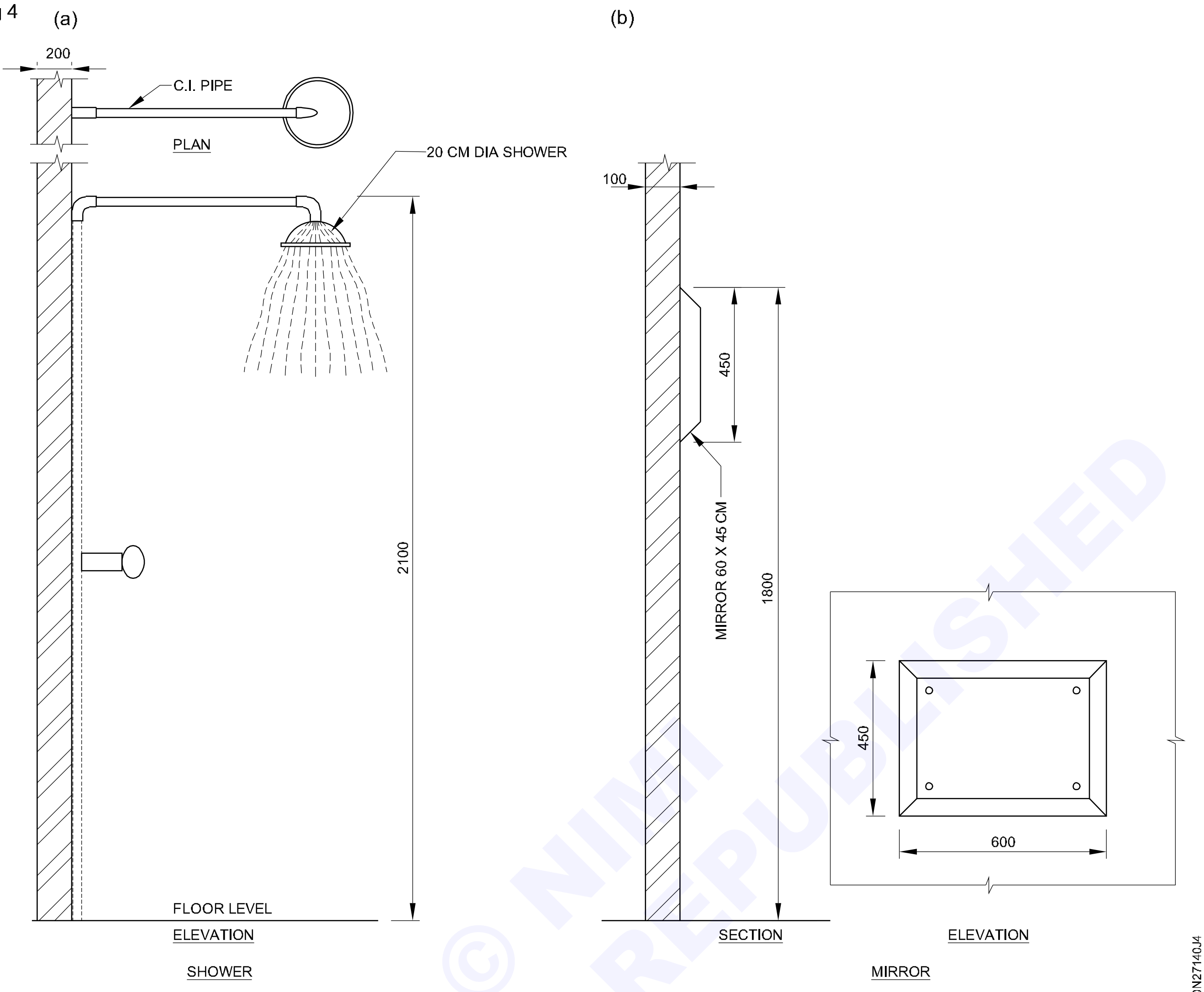

SANITARY FITTINGS

Fig 3



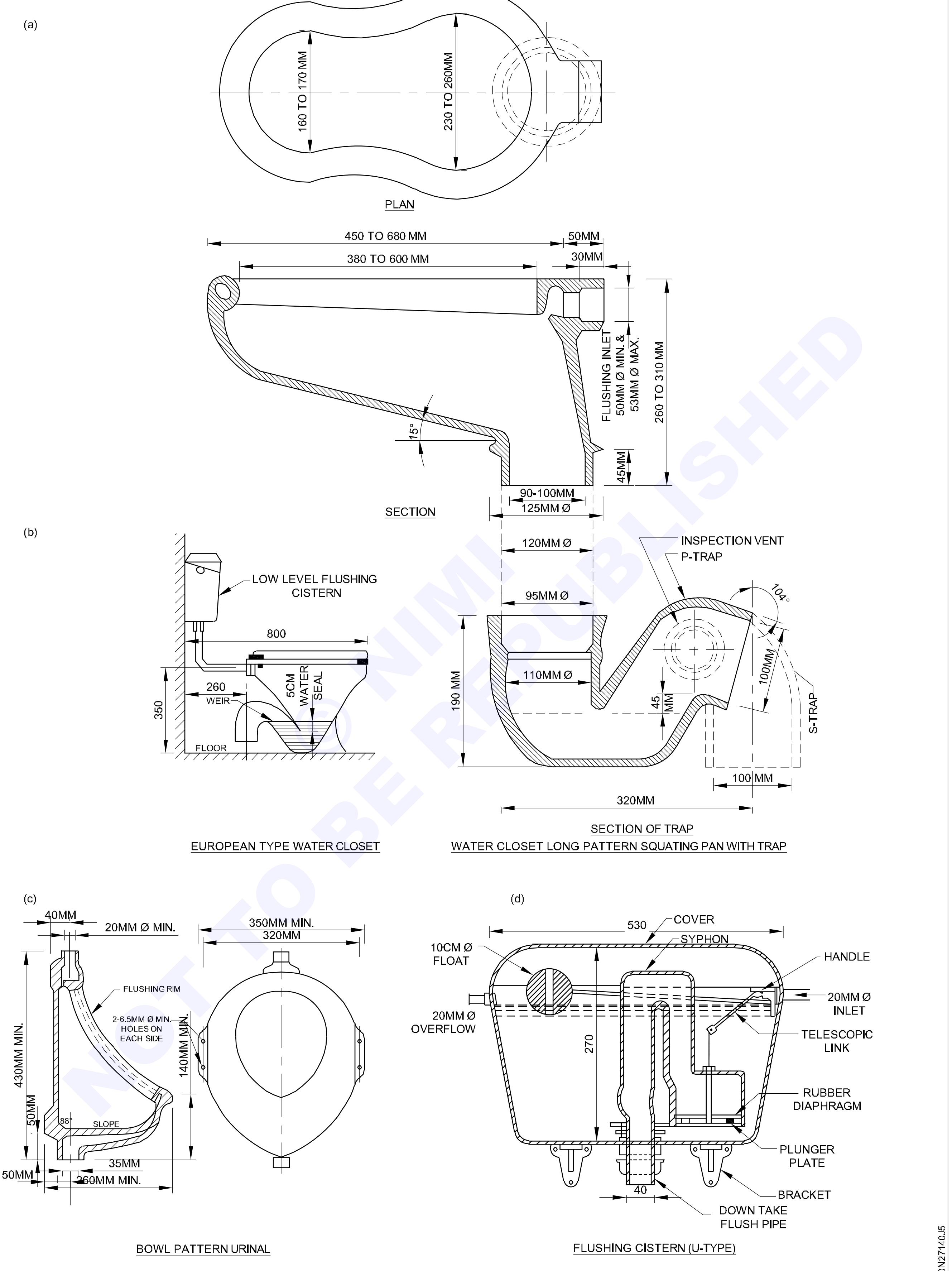

SANITARY FITTINGS

Fig 4




SANITARY FITTINGS

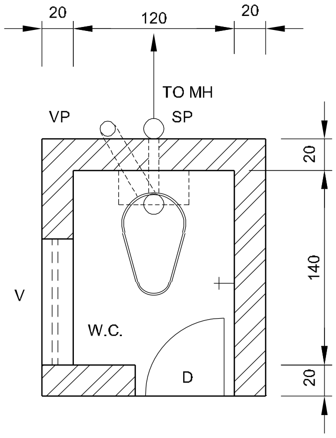
Fig 5



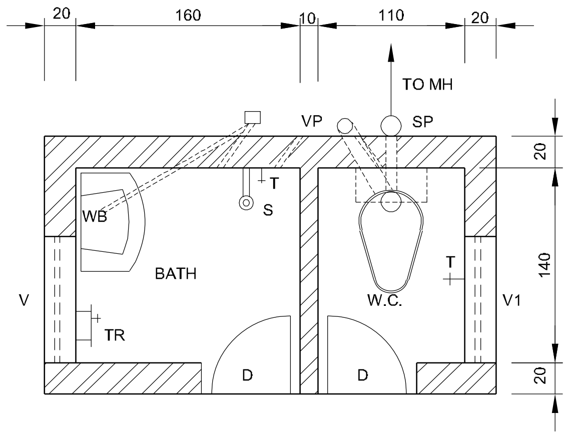



SANITARY FITTINGS

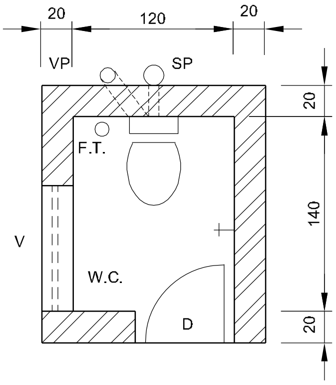
Fig 6



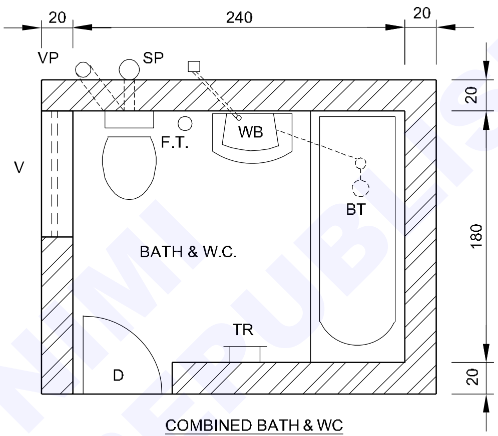

ORDINARY W.C.



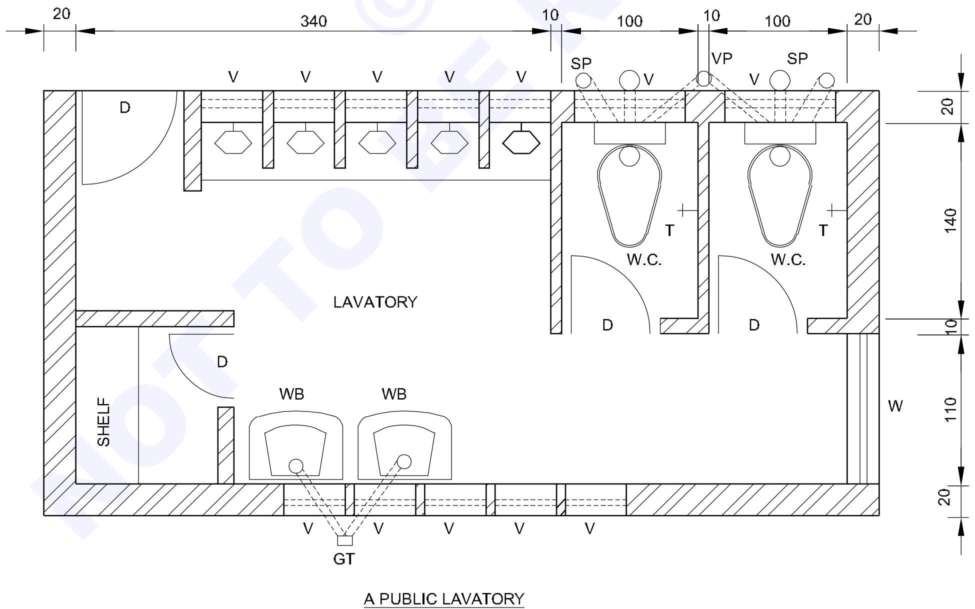

BATH ROOM WITH SEPARATE W.C.




EUROPEAN TYPE
WATER CLOSET




COMBINED BATH & WC




A PUBLIC LAVATORY

NOTE:-

S.P. - SOIL PIPE
M.H. - MAN HOLE
FT - FLOOR TRAP
T.R. - TOWEL RAIL
GT - GULLY TRAP

V.P. - VENT PIPE
W.C. - WATER CLOSET
WB - WASH BASIN
T - TAP
BT - BATH TUB

ALL DIMENSIONS ARE IN CENTIMETERS

DC20N27140J6

A PUBLIC LAVATORY

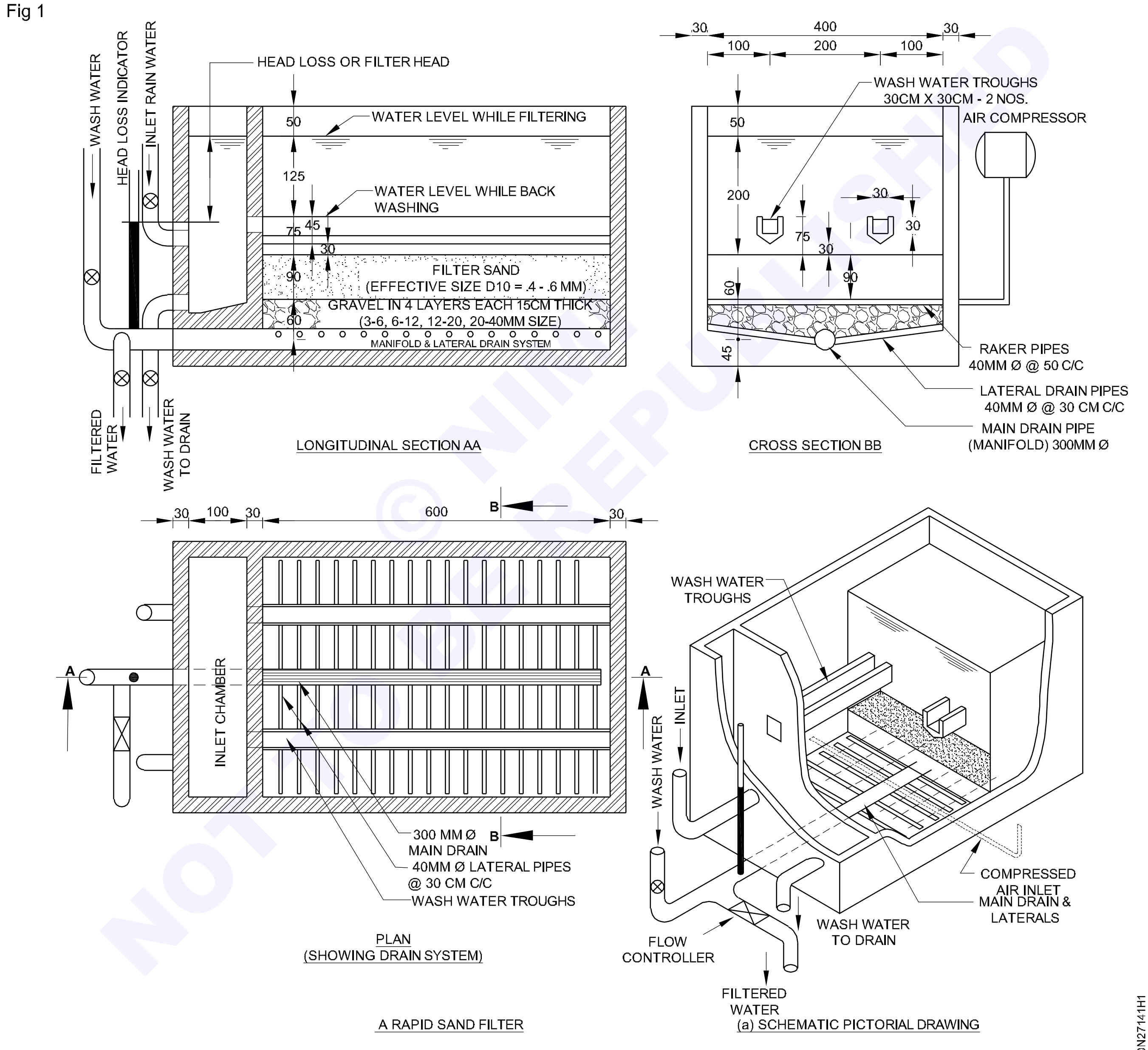
# Flow diagram of water treatment plant ( WTP )

**Objectives :** At the end of this exercise you shall be able to
- **draw the details of rapid sand filter**
- **identify the different layers of filter media.**

## PROCEDURE

TASK 1 : **Draw the rapid sand filter using Auto CAD (Fig 1)**

Fig 1




FILTER UNIT

**DATA**

- Size of filter unit - (6.00 x 4.00) m.
- Size of inlet chamber - ( 1.00 x 4.00) m.
- Wall thickness - 30 cm.
- Thickness of foundation - 45 cm.
- Dia. of main drain - 30 cm.
- Laterals - 4 cm dia @ 30 cm c/c.
- Slope of laterals 1 in 50.
- Raw water inlet - 20 cm ø.
- Wash water drain pipe - 20 cm ø.
- Wash water troughs - (30 x 30) cm - 2 nos.
- Free board - 50 cm.
- Bottom of wash water trough is 30 cm above the surface of filter media.
- Filter media
- Gravel layer - 60 cm (4 layers each 15 cm thick).
- ( 3-6, 6-12, 12-20, 20-40 mm size).
- Filter sand - 90 cm depth (effective size (0.4 to 0.6 mm)
- ( By using Auto CAD).
- Draw the plan of the filter unit.
- From the plan develop longitudinal section and cross section of the filter.
- Complete the drawing and take a print in A3 size paper.

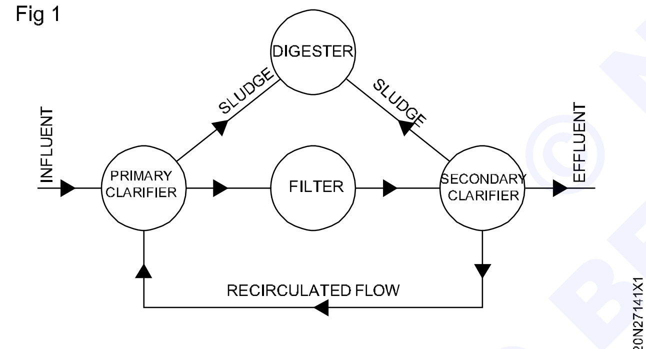
— — — — — — — —

## Flow diagram of sewage treatment plant (STP)

**Objectives :** At the end of this exercise you shall be able to
- **drawing of the flow diagram of aero filter with single stage and two stage treatment**
- **drawing of the flow diagram of bio filtrarion with single stage treatment and two stage treatment.**

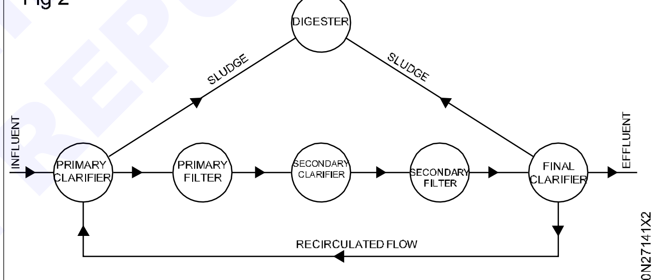
TASK 1 : **Draw the flow diagram of aero filter with single stage and two stage treatment (Fig 1 & 2)**

Fig 1




AERO-FILTER WITH SINGLE STAGE TREATEMENT

Fig 2

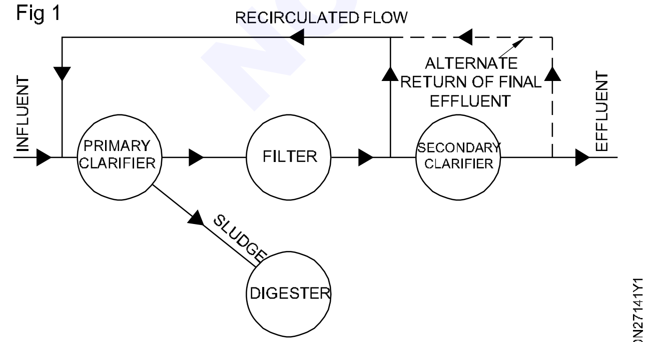



AERO-FILTER WITH TWO STAGE TREATEMENT

— — — — — — — —

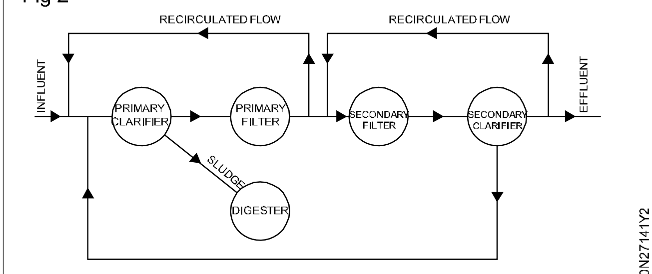
TASK 2 : **Draw the flow diagram of bio filtration with single stage treatment and two stage trearment (Fig 1 &2)**

Fig 1




BIOFILTER WITH SINGLE STAGE COMPLETE TREATEMENT

Fig 2




BIOFILTER WITH TWO STAGE COMPLETE TREATEMENT

— — — — — — — —

## Draw showing road structure and component parts

**Objectives:** At the end of this exercise you shall be able to
- **draw the typical cross section of road showing its parts**
- **draw the cross sectional details of a road showing its structure.**

### DATA

- Right of way : 25.00m
- Road way : 12m
- Carriage way : 8m
- Drainage
  bottom width : 60cm,
  side slope : 1:1,
  depth : 80cm
- Formation
  depth : 1.20m,
  side slope : 2:1
- Shoulder : 2m
- Camber : 1 in 20 (20 cm)
- Structure of road as per given drawing

### PROCEDURE

- Draw the typical cross-section of a road and show its different parts as per the given data (Fig 1).
- Draw the sectional view of the road structure showing its parts (Fig 2)
- Take the print out of both figures in an A3 sheet.



## Typical cross section of a road - II

**Objectives:** At the end of this exercise you shall be able to
- **draw the cross section of a road in embankment (cad drawing)**
- **identify the various parts of a road.**

### DATA

**Road in embankment (Fig 1)**

- Width of formation is 10.00m
- Depth or height of filling or embankment is 150cm.
- Size of drain - Top width 120cm, Bottom width 60cm, depth 80cm
- Side slopes (S.1) is 2:1
- Land width 30.00m

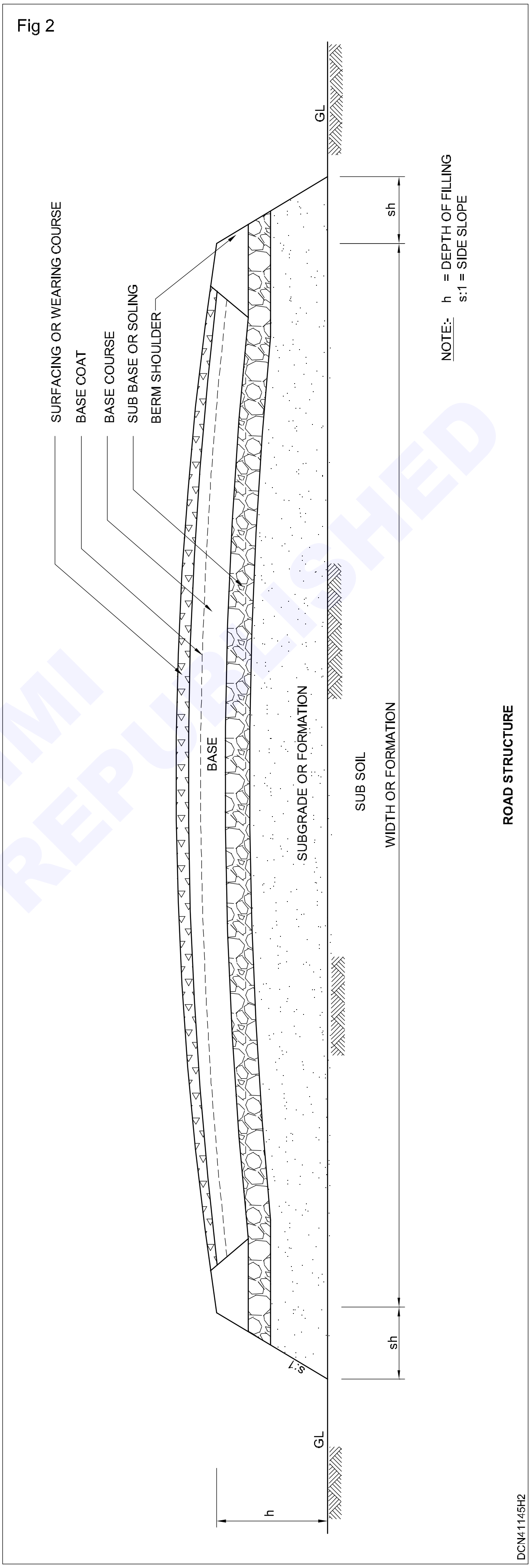
**Note:**

**show shoulder, borrow pits, building line,control line, etc.**

**Road in cutting (Fig 2)**

- Width of formation is 1200cm.
- Use other data as per the embankment details.
- Level difference between the top of original ground and formation is about 500cm, ground cutting n:1 is 0.5:1.


TYPICAL CROSS-SECTION OF A ROAD IN EMBANKMENT




ROAD STRUCTURE

Fig 1

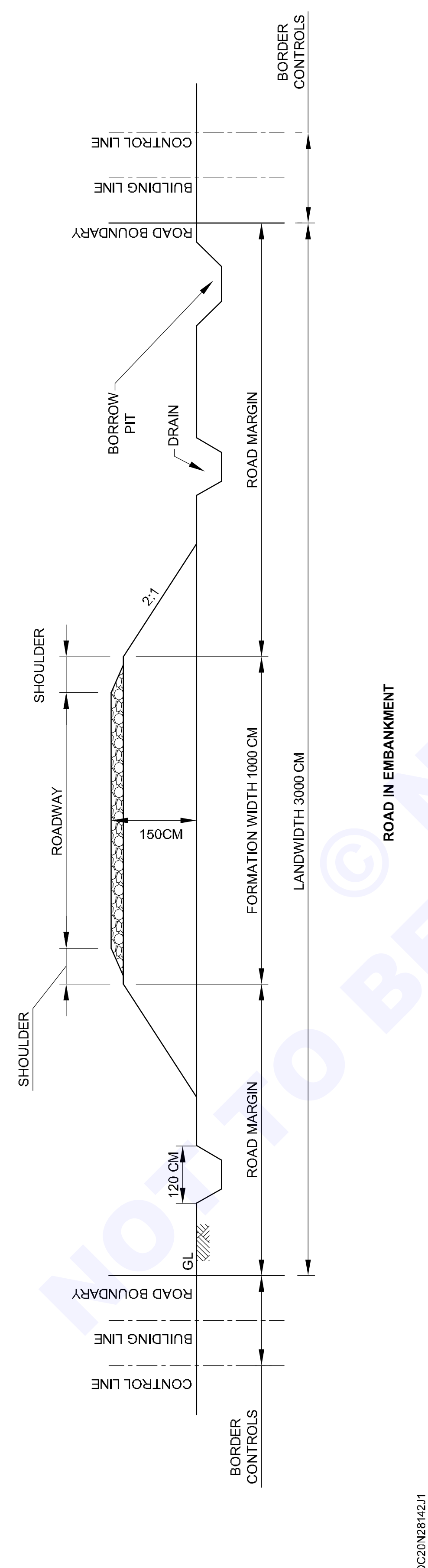
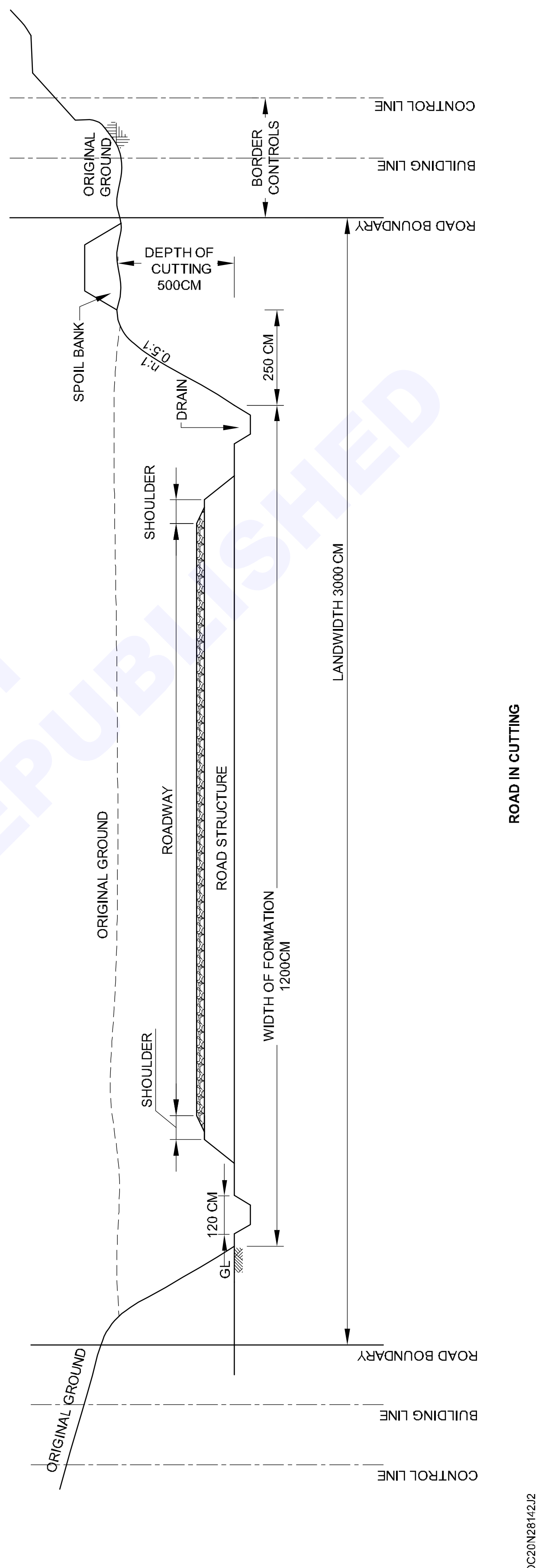

BORDER CONTROLS
CONTROL LINE
BUILDING LINE
ROAD BOUNDARY
BORROW PIT
DRAIN
ROAD MARGIN
2:1
SHOULDER
ROADWAY
150CM
FORMATION WIDTH 1000 CM
LANDWIDTH 3000 CM
ROAD IN EMBANKMENT
SHOULDER
ROAD MARGIN
120 CM
GL
ROAD BOUNDARY
BUILDING LINE
CONTROL LINE
BORDER CONTROLS
DC20N28142J1

Fig 2

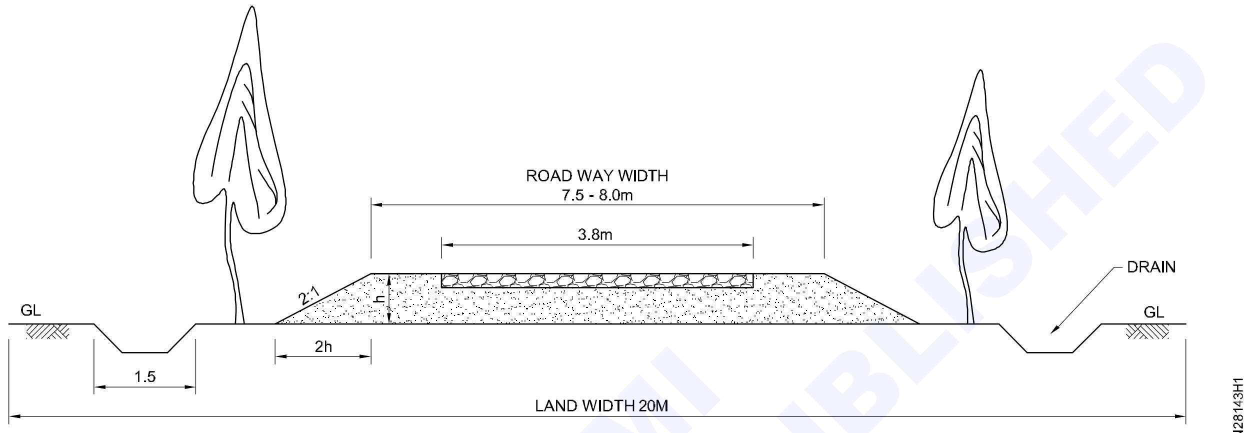

CONTROL LINE
ORIGINAL GROUND
BORDER CONTROLS
BUILDING LINE
ROAD BOUNDARY
DEPTH OF CUTTING 500CM
SPOIL BANK
0.5:1
n:1
250 CM
DRAIN
SHOULDER
LANDWIDTH 3000 CM
ORIGINAL GROUND
ROADWAY
ROAD STRUCTURE
WIDTH OF FORMATION 1200CM
ROAD IN CUTTING
SHOULDER
120 CM
GL
ROAD BOUNDARY
ORIGINAL GROUND
BUILDING LINE
CONTROL LINE
DC20N28142J2

# Prepare a drawing of cross sections showing the different types of roads according to location

**Objectives:** At the end of this exercise you shall be able to
- **identify the difference between various types of roads**
- **draw the different types of road.**

### Village road (Fig 1)

Fig 1



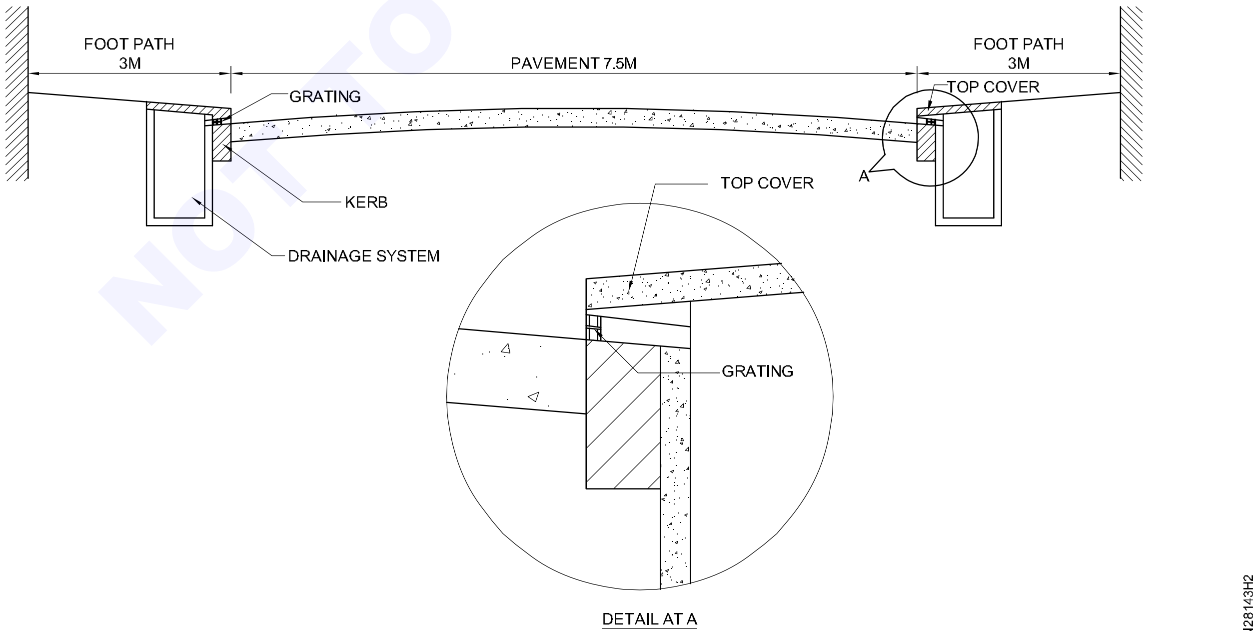

TYPICAL CROSS-SECTION OF A VILLAGE ROAD

## DATA

- Land width : 20 m
- Road way : 8.00m
- Carriage way : 3.8m
- Depth of filling : 90cm, S:1 = 2:1
- Top width of drainage : 1.50m

### District road (Fig 2)

Fig 2



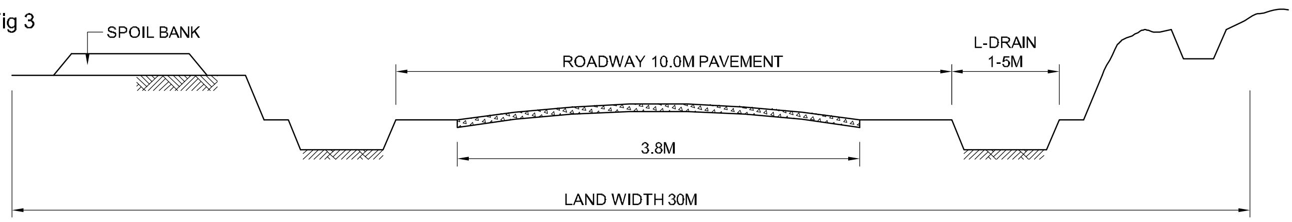

TYPICAL CROSS-SECTION OF A DISTRICT ROAD

## DATA

- Pavement width : 7.5m
- Foot path : 3m on either side
- Kerb : R.C.C 20cm width
- Provide drainage of 60cm width and 90cm depth with an RCC side wall of 20cm width with grating.

**Major district road (Fig 3)**

Fig 3



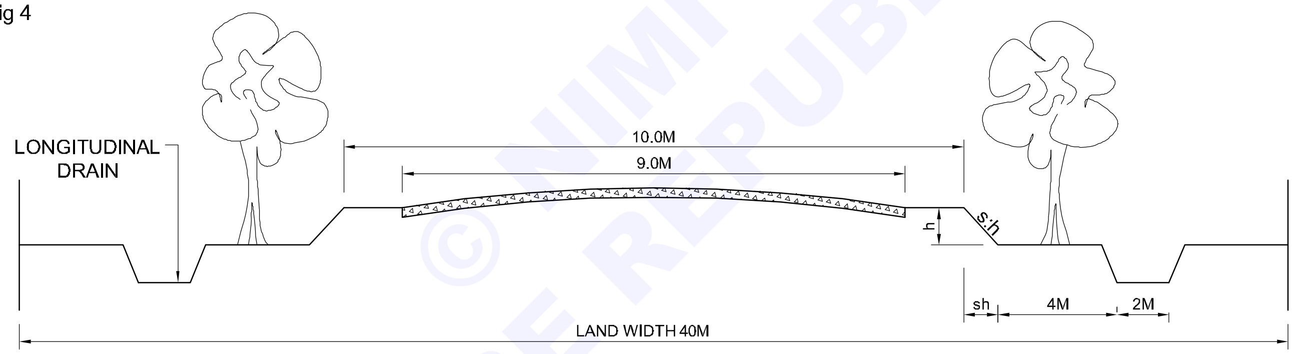

TYPICAL CROSS-SECTION OF A MAJOR DISTRICT ROADS

## DATA

- Land width : 30.0m
- Roadway : 10.0m
- Carriage way : 3.8m
- Longitudinal drain : Top width 1.50m
- Bottom width : 75cm
- Provide suitable depth and side slope.

**State Highway (Fig 4)**

Fig 4




CROSS SECTION OF TWO LANE STATE HIGHWAYS (SH) IN RURAL AREA

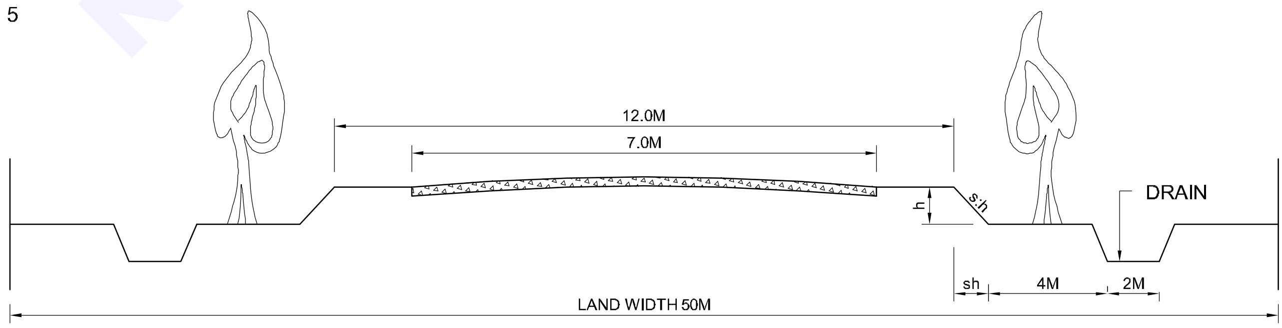
## DATA

- Land width : 40.00m
- Road way : 10.00m
- Carriage way : 9.00m
- Side slope : 1:1
- Drainage

  Bottom width : 2.00m

**National highway (Fig 5)**

Fig 5



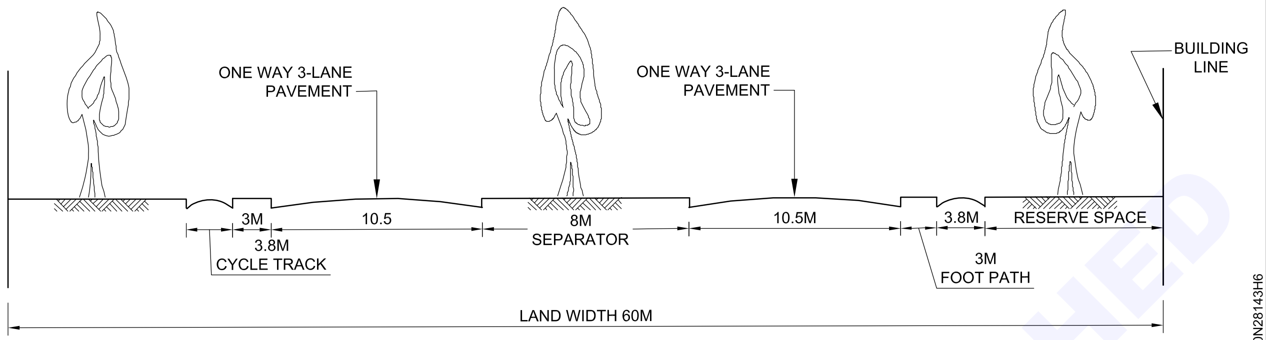

TYPICAL CROSS SECTION OF NATIONAL HIGHWAY

## DATA

- Land width : 50.00m
- Road way : 12.00m
- Carriage way : 7.00m
- Side slope : 2:1
- Width of arboriculture : 4.00m
- Top width of drain : 2.00m

**Urban road (Fig 6)**

Fig 6




TYPICAL CROSS SECTION OF URBAN ROAD

## DATA

- Land width : 60.0m
- Carriage way : 3 lane road of two way, 10.5m each.
- Traffic separator : 8.00m
- Foot path : 3m
- Cycle tract : 3.8m

## PROCEDURE

- Prepare drawing in auto cad.
- Show the details and furnish the dimensions.
- Take the print out of the drawing in A3 sheet, in such a way that first three drawings in a sheet and other three in the second sheet.

# Prepare a drawing of Cross-sections showing the different types of roads- according to location & materials.

**Objectives:** At the end of this exercise you shall be able to
- **draw the types of roads as per materials used**
- **identify the method of construction.**

## DATA

**Earth road (Fig 1)**

- Land width : 12.00n,
  Formation width : 7.5m
- Depth of filling : 1.50m,
  Side slope : 2:1

**Gravel road (Fig 2)**

- Formation width : 10.00m
- Shoulder : 1.5m
- Depth of filling : 1.80m
- Side slop : 1.5:1
- Thickness of gravel layer : 20cm

**Water bound macadam road (Fig 3)**

- Pavement width : 7.5m
- Brick edging : 30cm thick
- Camber : Composite camber of 1 in 50

**Concrete road**

- Thickness of concrete slab: 20cm
- Sub-base thickness : 30cm

**Bituminous road**

- Base concrete thickness : 30cm

- Levelling course : 15cm
- Binder course : 10cm
- Surfacing course : 10cm
- Seal coat : 3cm
- Sub base : 15cm
- Base course : 10cm
- Binder course : 10cm
- Pavement surface : 7.5cm

## PROCEDURE

- Draw cross sectional elevation of road as per the datas given.

a Earth road

b Gravel road

c Macadam road

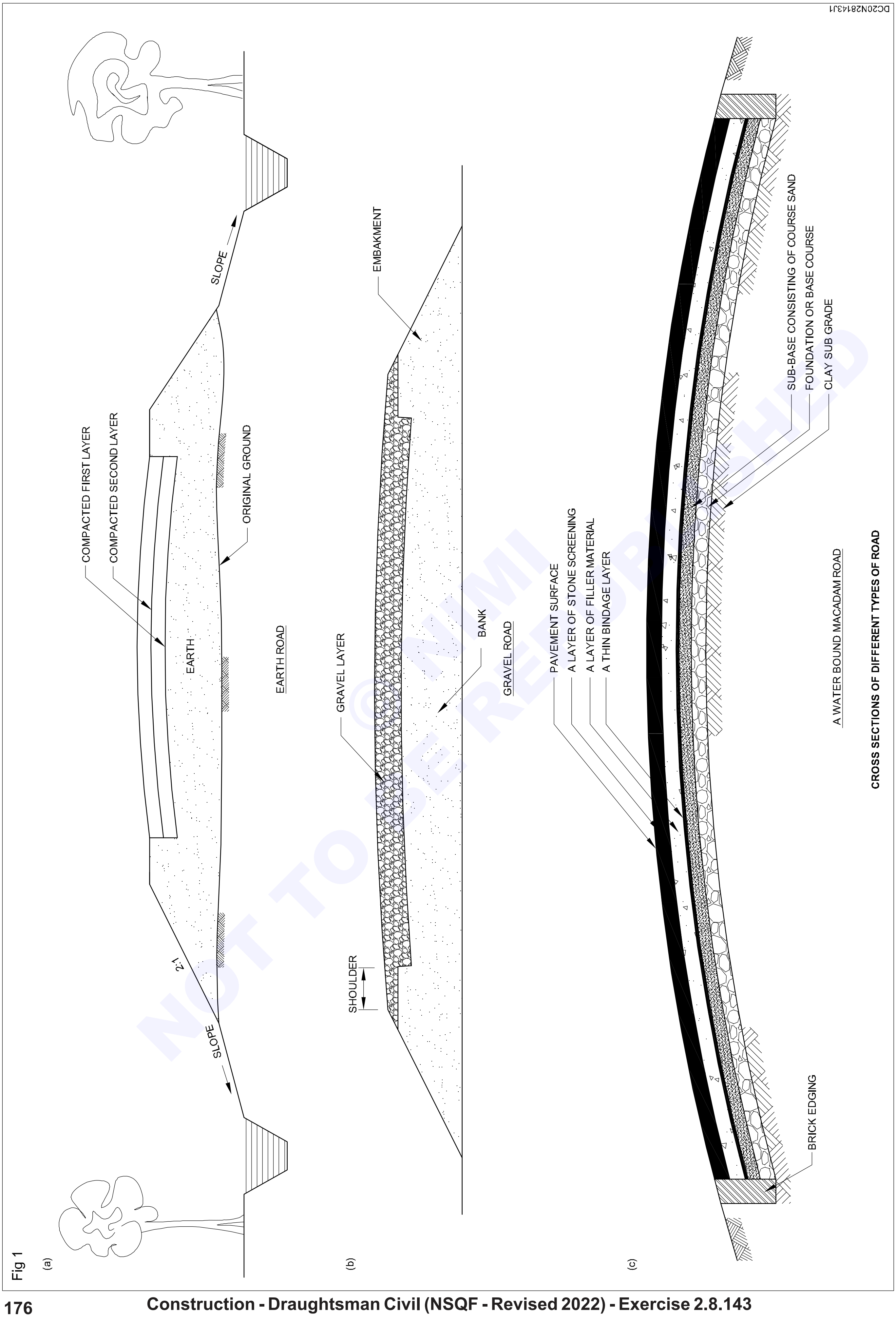
d Bituminous road

  a Part of the cross sectional showing the details

  b Bitumen surfacing over macadam road

  c Cement concrete road

- Take printout of the same in A3 sheet


DC20N2814311
Fig 1
(a)
COMPACTED FIRST LAYER
COMPACTED SECOND LAYER
ORIGINAL GROUND
EARTH
SLOPE
SLOPE
2:1
EARTH ROAD
(b)
EMBAKMENT
GRAVEL LAYER
BANK
SHOULDER
GRAVEL ROAD
(c)
PAVEMENT SURFACE
A LAYER OF STONE SCREENING
A LAYER OF FILLER MATERIAL
A THIN BINDAGE LAYER
SUB-BASE CONSISTING OF COURSE SAND
FOUNDATION OR BASE COURSE
CLAY SUB GRADE
BRICK EDGING
A WATER BOUND MACADAM ROAD
CROSS SECTIONS OF DIFFERENT TYPES OF ROAD

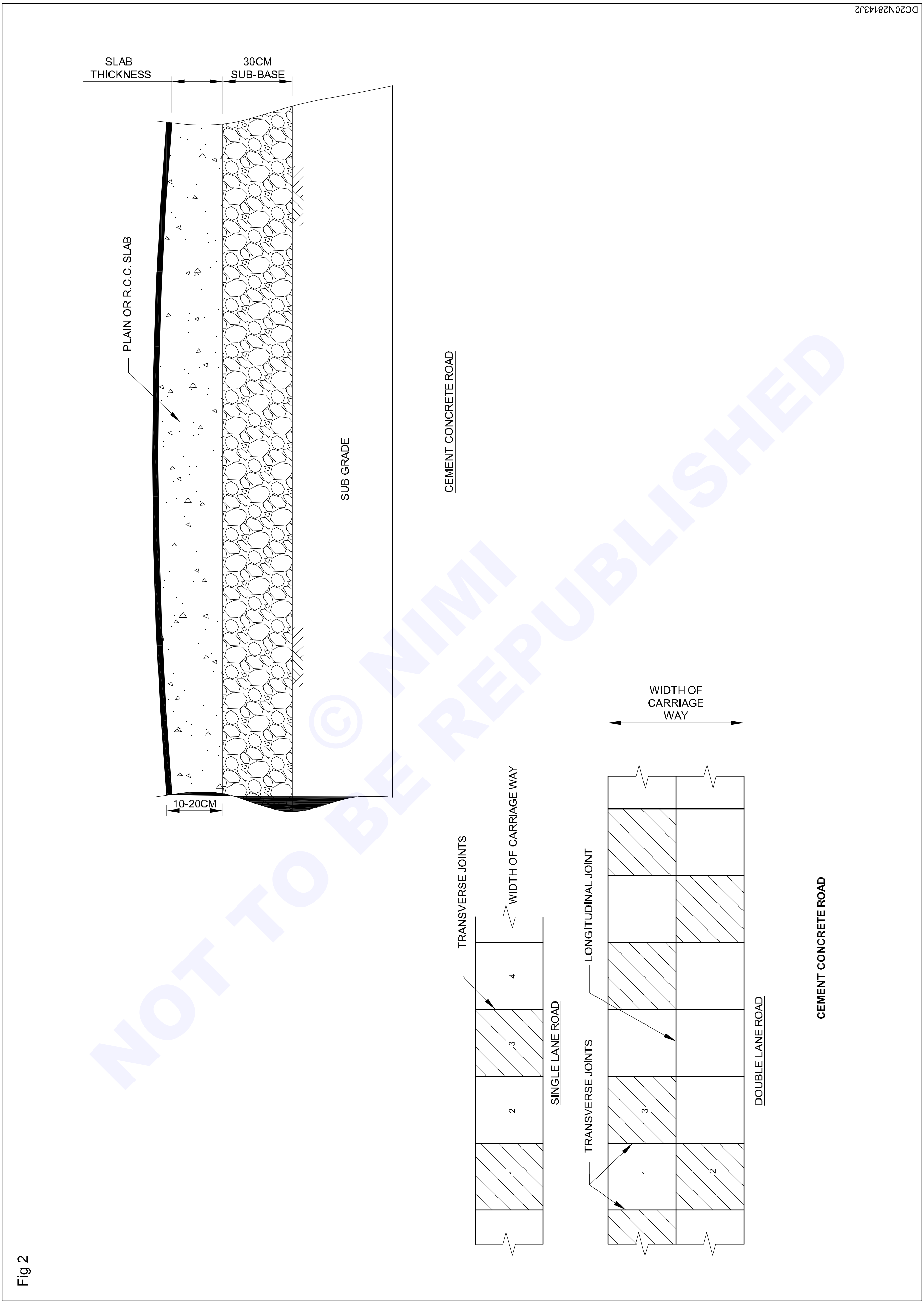

SLAB THICKNESS
30CM SUB-BASE
PLAIN OR R.C.C. SLAB
SUB GRADE
10-20CM
CEMENT CONCRETE ROAD
WIDTH OF CARRIAGE WAY
TRANSVERSE JOINTS
4
3
2
1
SINGLE LANE ROAD
WIDTH OF CARRIAGE WAY
LONGITUDINAL JOINT
TRANSVERSE JOINTS
3
1
2
DOUBLE LANE ROAD
CEMENT CONCRETE ROAD

Fig 2

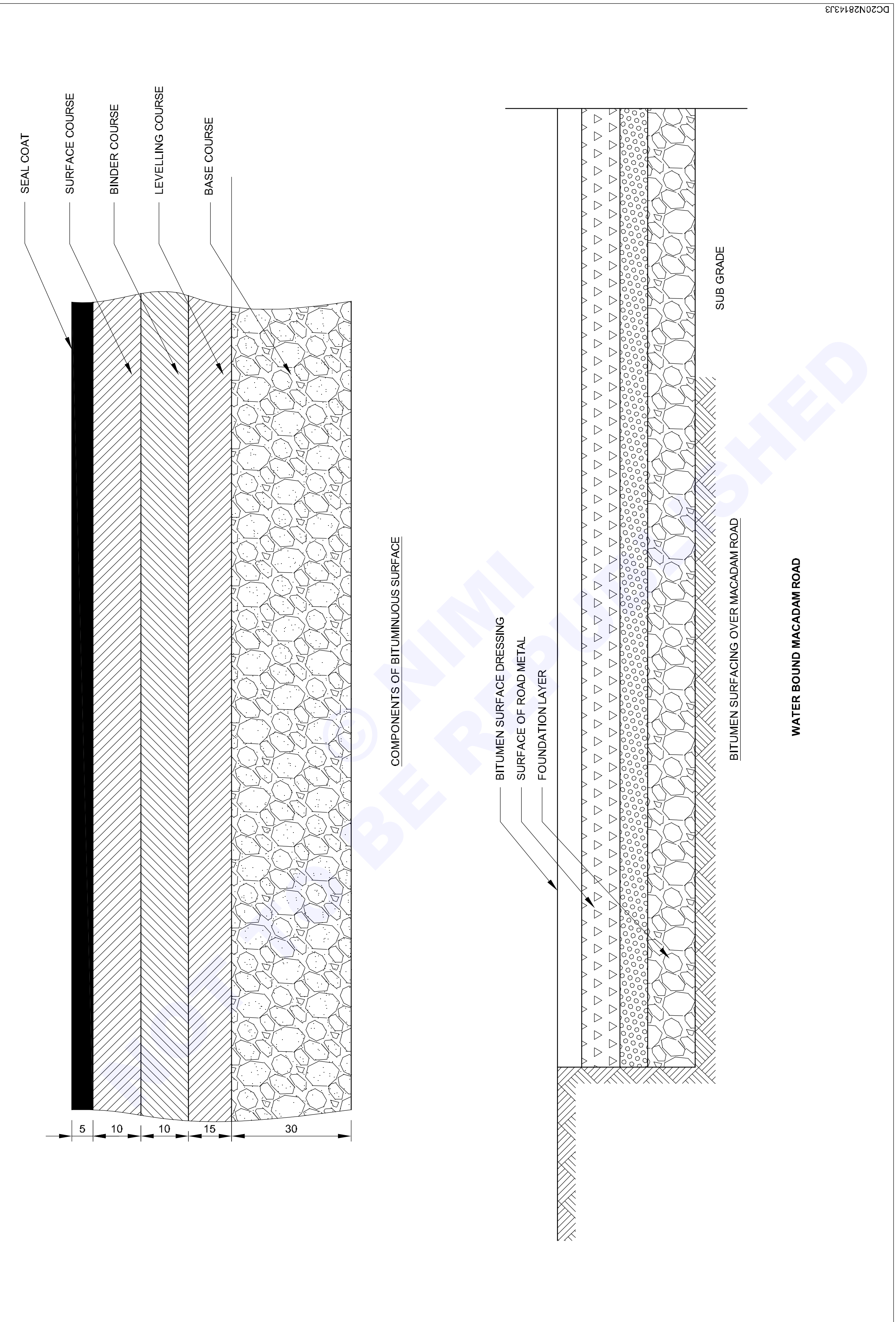

DC20N28143J3
SEAL COAT
SURFACE COURSE
BINDER COURSE
LEVELLING COURSE
BASE COURSE
5
10
10
15
30
COMPONENTS OF BITUMINUOUS SURFACE
BITUMEN SURFACE DRESSING
SURFACE OF ROAD METAL
FOUNDATION LAYER
SUB GRADE
BITUMEN SURFACING OVER MACADAM ROAD
WATER BOUND MACADAM ROAD

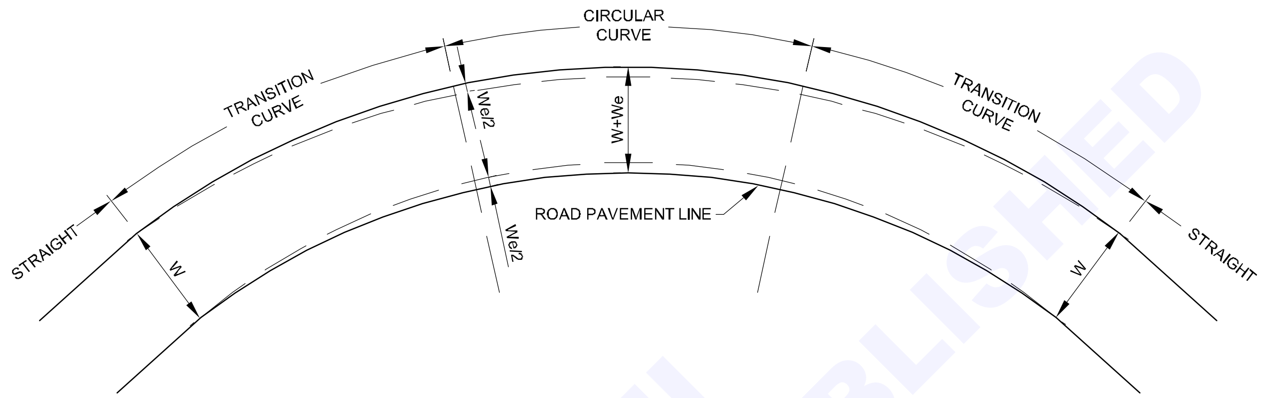
Fig 3

## Prepare a drawing of road curves & gradient.

**Objectives:** At the end of this exercise you shall be able to
- **draw the plan of a road in curve showing widening of pavement**
- **draw a typical longitudinal section of a road.**

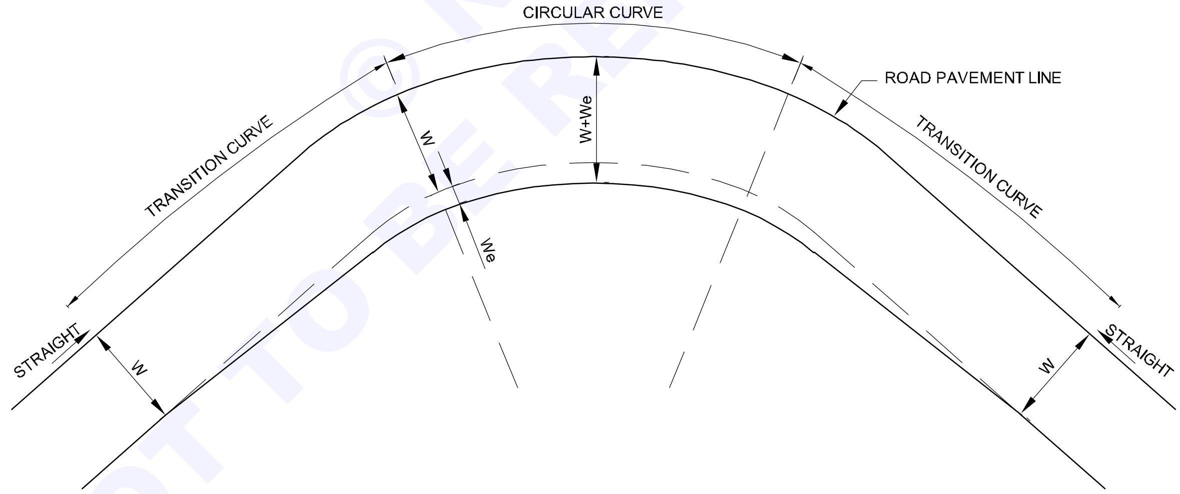
**Plan of a road in curve (Figs 1 & 2)**

Fig 1




WIDENING OF PAVEMENT OF HORIZONTAL CURVE

Fig 2




WIDENING OF PAVEMENT ON SHARP CURVE



## DATA

- Width of road : 7.00m
- Mechanical widening : 36cm
- Mean radius of curve : 100.00m

RLS of formation: 206.0000, 205.500, 205.000, 204.500, 204.000, 204.830, 830, 205.665, 206.500, 207.330, 208.105 and 209.000

**Longitudinal section of a road (Fig 3)**

## DATA

- Chain age : 100 to 600
- Regular interval : 50 m

## PROCEDURE

- Draw the plan of the given road in curve
- Show the position of transition curve, circular curve, widening area etc.
- Draw the typical figure showing the widening in a sharp curve.
- Draw the longitudinal section of the road as per given data.
- Take out a print in A3 sheet after aligning the three drawings properly.

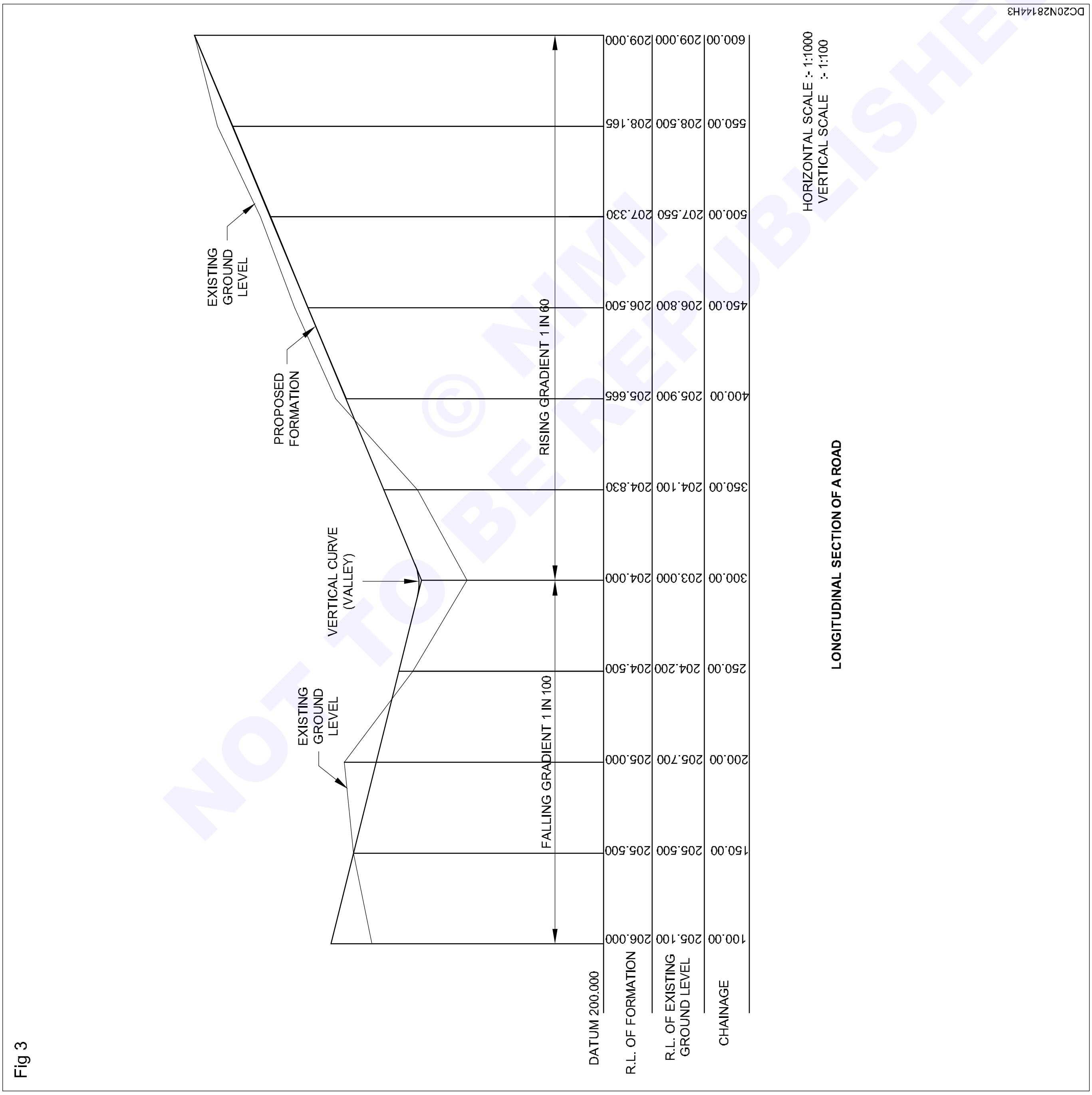



Fig 3

## Types of Culverts

**Objectives:** At the end of this exercise you shall be able to
- **draw half sectional plan and top plan of the pipe culvert**
- **draw the sectional elevation of the pipe culvert through waterway (Section A-A)**
- **draw the end view of a pipe culvert from waterway.**

## DATA

- Ø of concrete pipe : 100cm (external)
- Thickness of pipe : 5cm
- Slope of pipe : 1 in 167
- Width of road : 780cm
- Width of approach : 830cm
- Foundation level : +49.10
- Bed level : +50.00
- Road level : +51.80
- Wing wall : Splayed with 45°

## PROCEDURE

**Prepare the drawings by Auto Cad as per the given sketch**.

TASK 1: **To draw the half sectional plan and top plan of a pipe culvert (Fig 1a)**

1 Draw the centre line of the roadway and the pipe.

2 Draw the sectional plan at the left of centre line of road way and top plan on the right.

3 Complete the plan and hatch the sectioned structure.

— — — — — — —

TASK 2: **To draw the sectional elevation of a pipe culvert through water way (Section A-A) (Fig 1b)**

1 Draw the levels of the culvert.

2 Draw projectors from plan and intersect accordingly and complete the sectional elevation.

3 Hatch the sectioned structure.

— — — — — — —

TASK 3: **To draw the end view of a pipe culvert (Fig 1c)**

1 Copy the plan and move towards right and paste it.

2 Rotate the plan suitably to draw the end view.

3 Project the lines from plan and sectional elevation and complete the end view.

4 Delete the rotated plan.

5 Take a print out in A3 sheet.

— — — — — — —

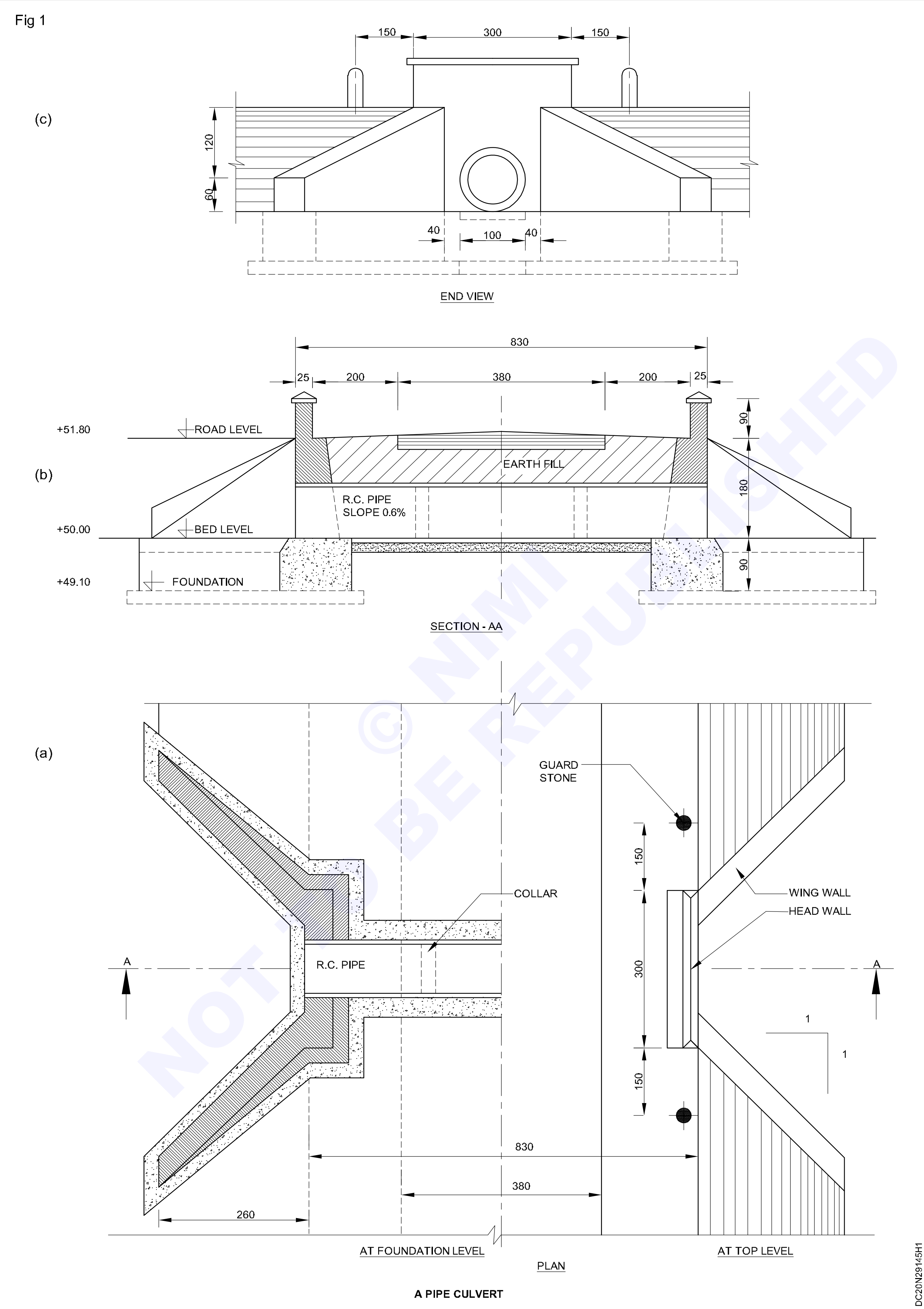


Fig 1
150
300
150
(c)
120
60
40
100
40
END VIEW
830
25
200
380
200
25
90
+51.80
ROAD LEVEL
EARTH FILL
(b)
180
R.C. PIPE
SLOPE 0.6%
+50.00
BED LEVEL
90
+49.10
FOUNDATION
SECTION - AA
(a)
GUARD
STONE
150
COLLAR
WING WALL
HEAD WALL
A
R.C. PIPE
300
A
1
1
150
830
380
260
AT FOUNDATION LEVEL
PLAN
AT TOP LEVEL
A PIPE CULVERT
DC20N29145H1

# Box culvert

**Objectives:** At the end of this exercise you shall be able to
- **draw the half sectional plan and top plan of a box culvert**
- **draw the sectional elevation of box culvert through waterway (Section A-A)**
- **draw the end view of the box culvert.**

## DATA

- Foundation level : +95.80
- Bed level : +97.00
- Formation levelL : +100.80
- Rcc box duct : 180x180 (internal)
- Road width : 780cm
- Wing wall : splayed at 45°

## PROCEDURE

**Prepare the drawing by Auto Cad as per the given sketch**

TASK 1: **To draw half top plan and half sectional plan of a box culvert (Fig 1a)**

1 Draw half sectional plan and top plan as per the given sketch.

2 Hatch the sectional area and complete.

— — — — — — —

TASK 2: **To draw the sectional elevation of a box culvert through section A-A (Fig 1b)**

1 Draw the sectional elevation as per the given sketch.

2 Hatch the sectional structures.

— — — — — — —

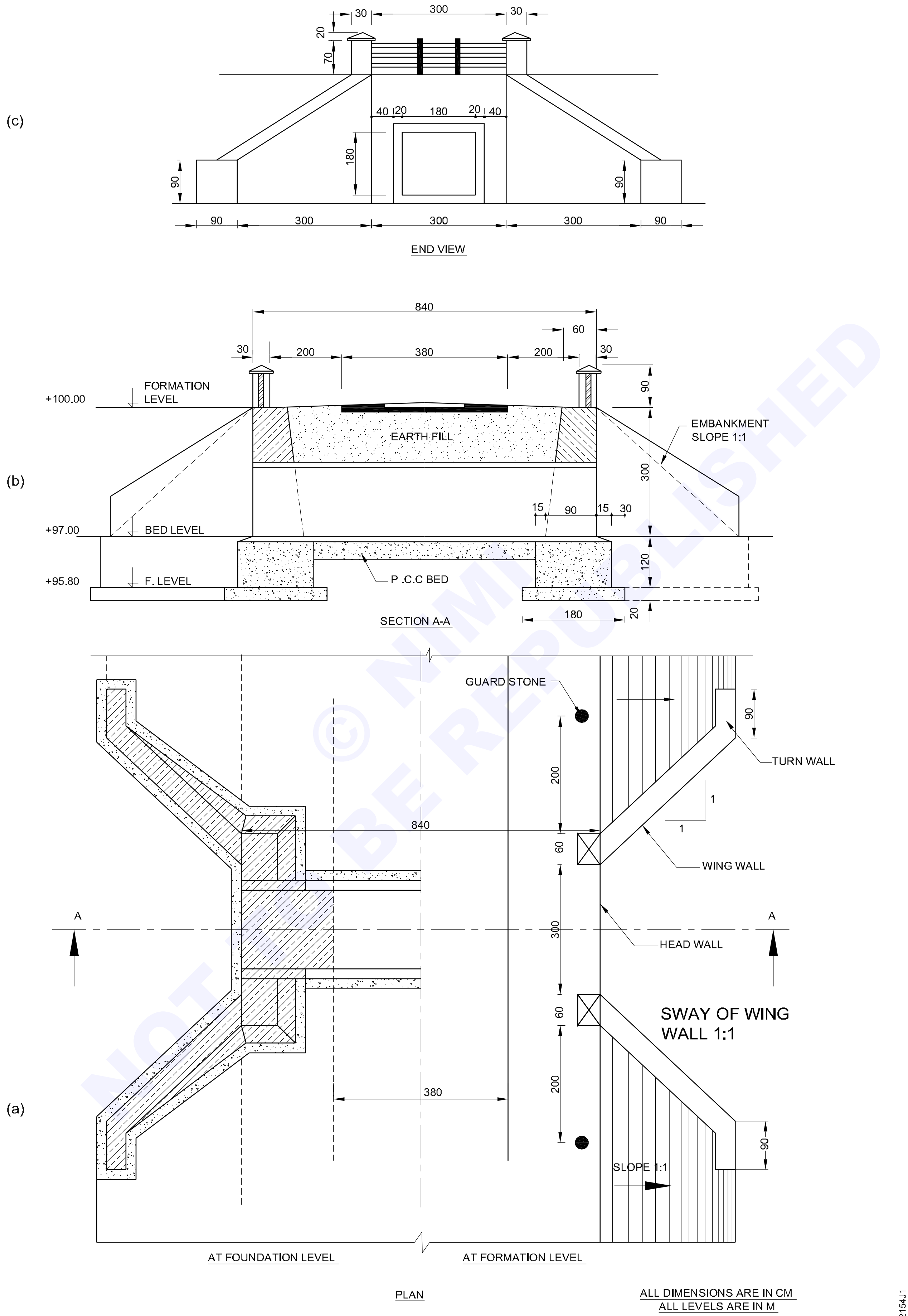
TASK 3: **To draw the end view of box culvert (Fig 1c)**

1 Draw the end view as per the given sketch.

2 Take a print out in A3 sheet.

— — — — — — —

Fig 1




A BOX CULVERT

## Preparing drawing of an arched bridge

**Objectives:** At the end of this exercise you shall be able to
- **draw half sectional plan and top plan of the double span arch bridge**
- **draw half front elevation and half sectional elevation**
- **draw details of the pier.**

### DATA

- Foundation level : +39.50
- Bed level : +41.00
- Springing level : +42.80
- Road level : +45.00
- Parapet level : +45.90
- Width of abutment above springing level : 75cm
- Width of abutment in springing level : 90cm
- Width of abutment in bed level : 105cm
- Width a foundation level : 145cm
- Width of foundation : 185cm
- Arch span : 300cm
- Arch rise : 120cm
- Arch thickness : 50cm
- Pier top width : 60cm
- Pier bottom width : 100cm
- Pier footing width : 140cm
- Pier foundation width : 180cm
- Width of road : 7.50m
- Width of approach : 8.40m

### PROCEDURE

TASK 1: **To draw the half sectional plan and half top plan of a two spanned arch bridge(Fig 1a)**

1 Draw the figure using Auto Cad as per the given sketch.

2 Draw centre line of the pier and centre line of the road way.

3 Draw sectional plan of abutment on the right side of the centre line or pier.

4 Draw the top plan on the left side of centre line of the pier.

— — — — — — —

TASK 2: **To draw half sectional elevation and half front elevation of the two spanned arch bridge (Fig 1b)**

1 Draw the section line AB.

2 Draw the levels of the structure foundation level, bed level, road level, etc.

3 Project the lines from the plan to intersect the corresponding levels and complete the section A-B as shown in figure.

4 Dimension the figure and hatch the sectioned structure.

— — — — — — —

TASK 3: **To draw the details of pier (Fig 1c)**

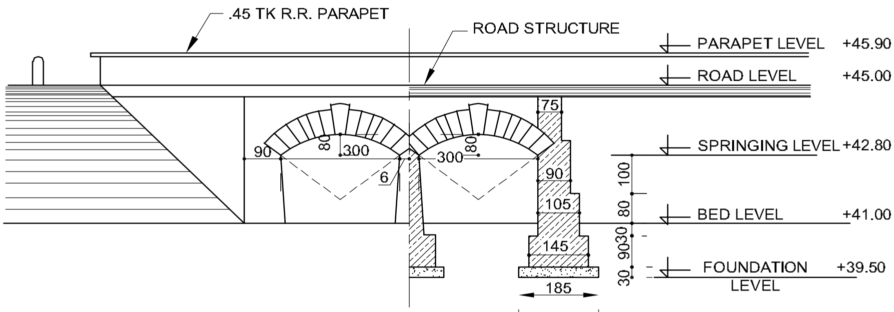
1 Draw the sectional details of the pier as shown in figure.

2 Take a print out in A3 sheet.

— — — — — — —

Fig 1

(a)

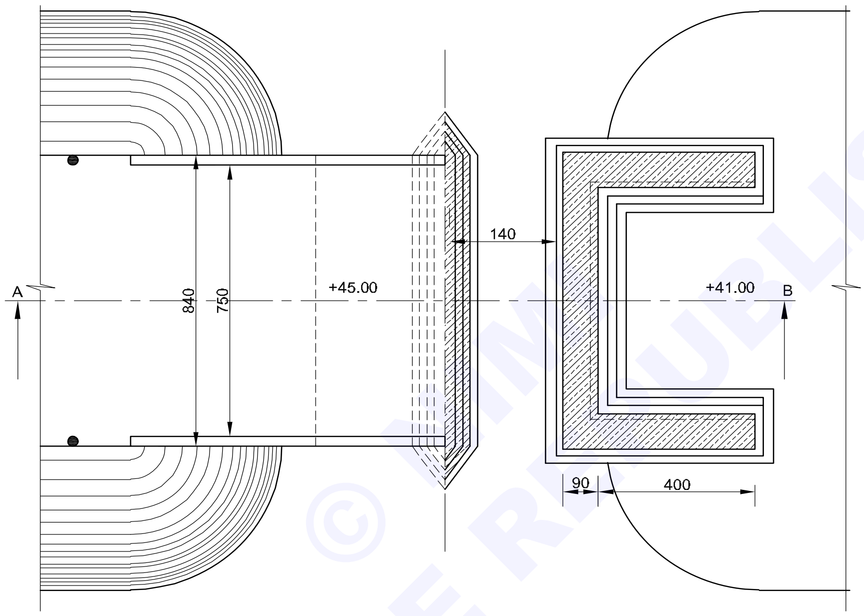



HALF ELEVATION

HALF SECTION

SECTION - AB

(b)

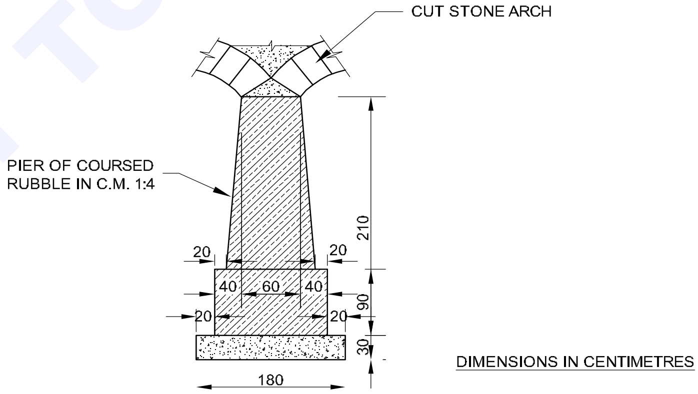



TOP PLAN

FOUNDATION PLAN

A DOUBLE SPAN ARCH BRIDGE

(c)




DIMENSIONS IN CENTIMETRES

DETAILS OF PIER

**A DOUBLE SPAN ARCH BRIDGE**

DC20N29146H1

## R.C.C Slab culvert

**Objectives:** At the end of this exercise you shall be able to
- **draw the half plan in section and half plan at top**
- **draw half sectional elevation and half front elevation along road way (section-A-A)**
- **draw the half sectional elevation and half front elevation along water way (section-B-B).**

## DATA

- Foundation level : + 20.70
- Bed level : + 22.00
- Bearing level of slab : + 24.50
- Formation level : + 25.00
- Top width of abutment : 75cm
- Bottom width above bed level : 90cm
- Bottom width below bed level : 120cm
- Foundation width below bed level : 120cm
- Length of lenear water way : 400cm
- Width of road way : 750cm
- Width of approach : 840cm

PROCEDURE

TASK 1: **Draw half plan in section and half plan at top of slab culvert (Fig 1)**

1 Prepare the drawing by Auto Cad as per the given sketch.

2 Draw the centre lines of road way and water way.

3 Draw the half sectional plan at the left of centre line of roadway.

4 Draw the half plan at the top on the right of the centre line of roadway.

5 Hatch the sectional structures.

6 Dimension of figures as per the drawing and put notes wherever necessary.

— — — — — — —

TASK 2: **To draw half sectional elevation and half front elevation through section A-A**

1 Draw section line A-A on the prepared plan.

2 Draw levels of the culvert.

3 Project lines from the plan to intersect the levels and complete the figure as per the given sketch. (Bed level, foundation level, formation level etc.........)

4 Dimension the figure, hatch the sectioned area and put notes wherever necessary.

— — — — — — —

TASK 3: **To draw half sectional elevation and half front elevation along the water way**

1 Draw section line B.B on the prepared plan.

2 Copy the figure, move to right of the plan and paste it.

3 Rotate the figure suitably to produce lines for section BB.

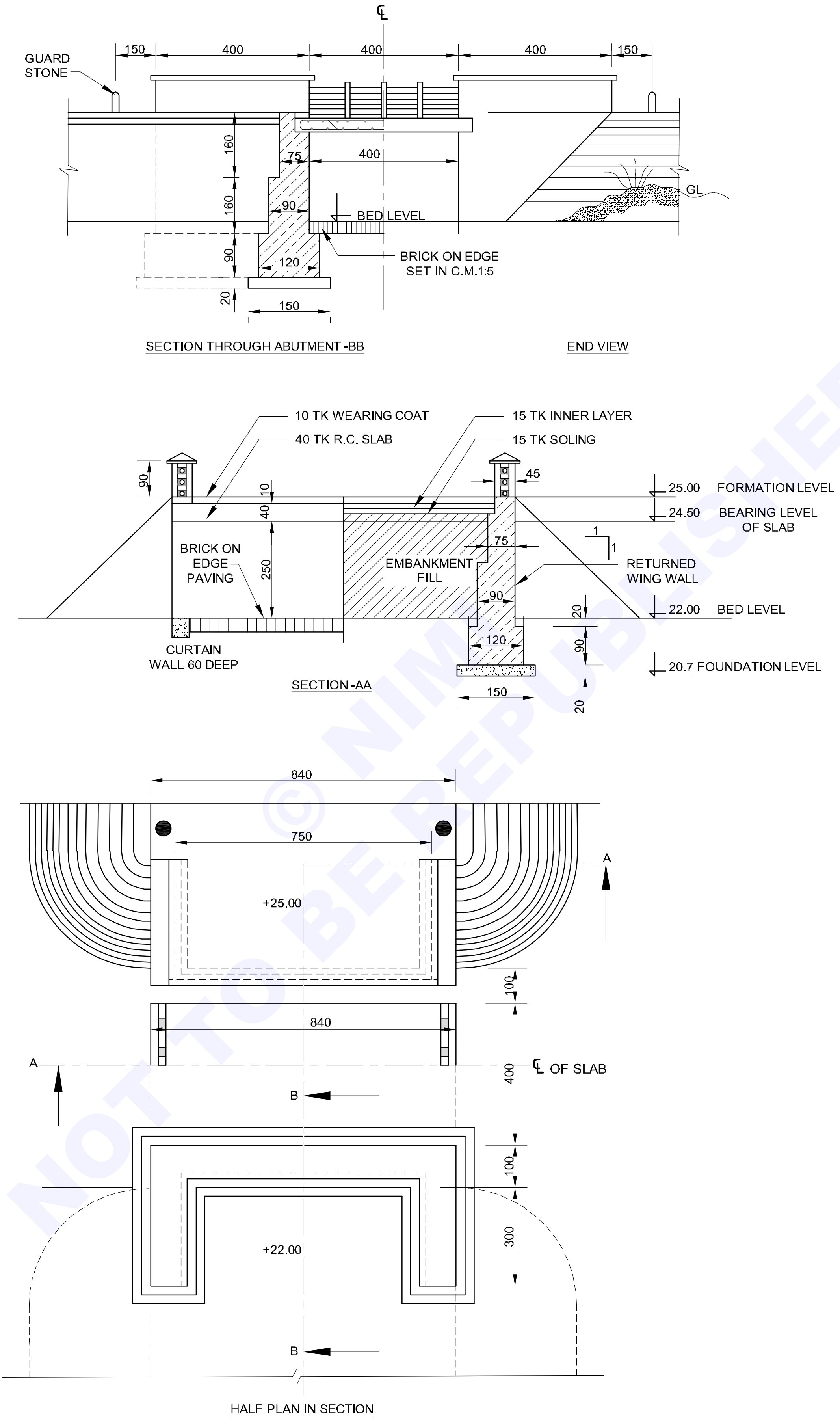
4 Project lines from the plan to intersect the levels of the culvert from section A-A.

5 Complete the section B-B as per the given sketch.

6 Dimension the view and hatch the sectioned structure.

7 Take print out in A3 sheet.

Fig 1




A SLAB CULVERT

DC20N29147H1

## Steel Foot over bridge across a High way

**Objectives:** At the end of this exercise you shall be able to
- **draw the half elevation of steel foot over bridge**
- **draw the section of A.A steel foot over bridge**
- **draw the details A,B,C,D of steel foot over bridge.**

### DATA

- Ground level : +95.80m
- Bottom level of bridge : +102.35m
- Top level of parapet : +104.15m
- Span : 20660mm
- Bridge width : 2100 mm

TASK 1: **Prepare the drawing by Auto CAD as per given sketch**

1 Draw half elevation as per given sketch.

— — — — — — —

TASK 2: **To draw the sectional elevation of a steel foot over bridge through section AA.**

1 Draw the sectional elevation as per the given sketch.

— — — — — — —

TASK 3: **To draw the details of A,B,C,D of steel foot over bridge.**

1 Draw the details of A,B,C,D as per the given sketch.

2 Take a print out in A3 sheet.

— — — — — — —

# T - Beam bridge

**Objectives:** At the end of this exercise you shall be able to
- **draw half plan at foundation and half plan at top of a T-beam bridge with square returns**
- **draw half longitudinal section along the road and half front elevation**
- **draw half cross section along the centre line of pier and half across the road.**

## DATA

**Hydraulic particulars**

- Bed width of canal : 6600 mm
- Bed level of canal : +18.70m
- Full supply level : +20.00m
- Width of linear waterway : 6000mm
- Top bund level : +20.70m

**Bridge particulars**

- Road level : +21.00,
- Kerb level : 21.15m
- Top of parapet level : +21.85m
- Length of roughstone revetment on both sides : 2000mm
- Thickness of revetment : 300mm
- Abutment, wing and pier are in C.R. Masorry II, Sort in C.M.1 : 5
- Top width of abutment, straight wing wall and pier : 700mm
- Bottom width of wing wall : 1200mm
- Bottom width of abutment : 1400mm
- Bottom width of pier : 600mm
- Length of return wall : 4000mm
- Length of abutments and pier : 8700mm
- Foundation concrete offset : 300mm
- Thickness of foundation concrete : 300mm
- Front vertical and rear battered for the abutments and return walls
- Number of Tee beams : 3
- Size of Tee beam : 300x450mm
- Size of bed block in C.C. 1:2:4 : 600x600 x150mm
- Thickness of R.C slab : 300mm
- Size of parapet wall and pillars in C.C. 1:3:6 : 300mm
- Size of R.C.C. vertical post for hand rail : 100x100 x700mm
- Size of hand rail : 25mm pipe
- Width of R.C. kerb on either side : 300mm
- Width of roadway : 6700mm
- Width of roadway in the approach : 7700mm
- For tee beams sliding plate bearing is provided.

## PROCEDURE

**Prepare the drawing by Auto Cad as per the given sketch**

TASK 1: **To draw the half foundation plan and half top plan of a T-beam bridge with square returns (Fig 1a)**

1 Draw centre line of roadway and waterway.

2 Draw half sectional plan of abutment on left of centre line of water way.

3 Draw top view of roadway on the other side.

4 Hatch the sectional portion.

5 Draw parapet wall and stone pitching on top view.

6 Dimension the figure as per the drawing.

— — — — — — —

TASK 2: **To draw the half longitudinal section along the road and half front elevation (section ABCD) (Fig 1b)**

1 Draw the section line ABCD on the plan as shown.

2 Project the lines from the plan.

3 Draw all the levels like road level, MWl, FSL, Bed level and foundation level.

4 Complete the drawing as per the given sketch.

— — — — — — —

TASK 3: **To draw half cross section along the centre line of pier and half across the road (section-PQRS) (Fig 1c)**

1 Draw sectional line PQRS as shown in the plan.

2 Copy the plan and paste on the right of existing plan.

3 Rotate the plan suitably to produce lines for section PQRS.

4 Produce lines from the plan and intersect these lines by producing lines from section ABCD.

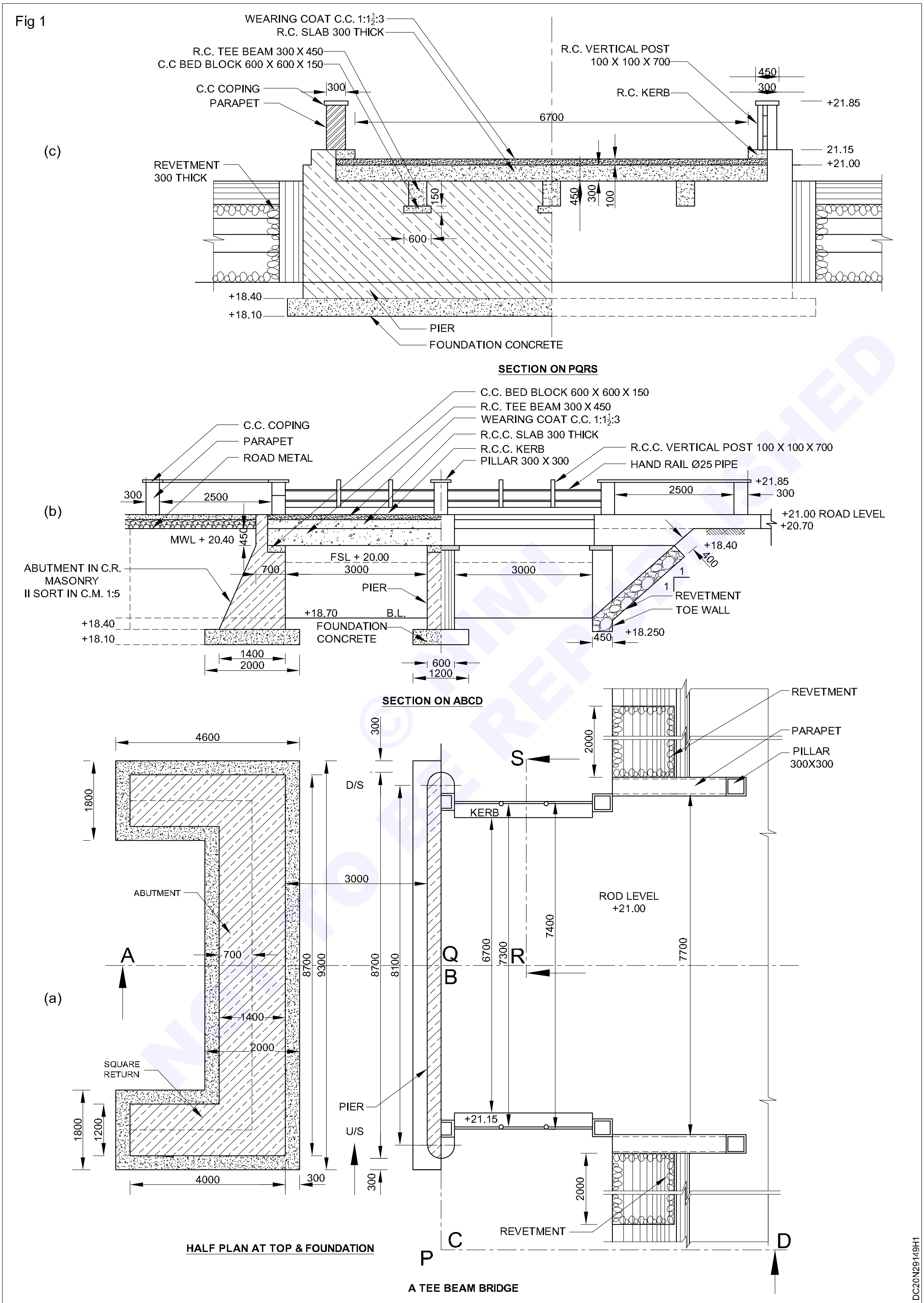
5 Complete the section PQRS as per the given sketch.

6 Dimension the views.

7 Hatch the views wherever necessary.

8 Give notes as per the given sketch.

9 Take a print out in A3 sheet.



A TEE BEAM BRIDGE

DC20N29149H1

## Draw typical cross section to rail track

**Objective:** At the end of this exercise you shall be able to
- **draw a permanent way in embankment.**

## DATA

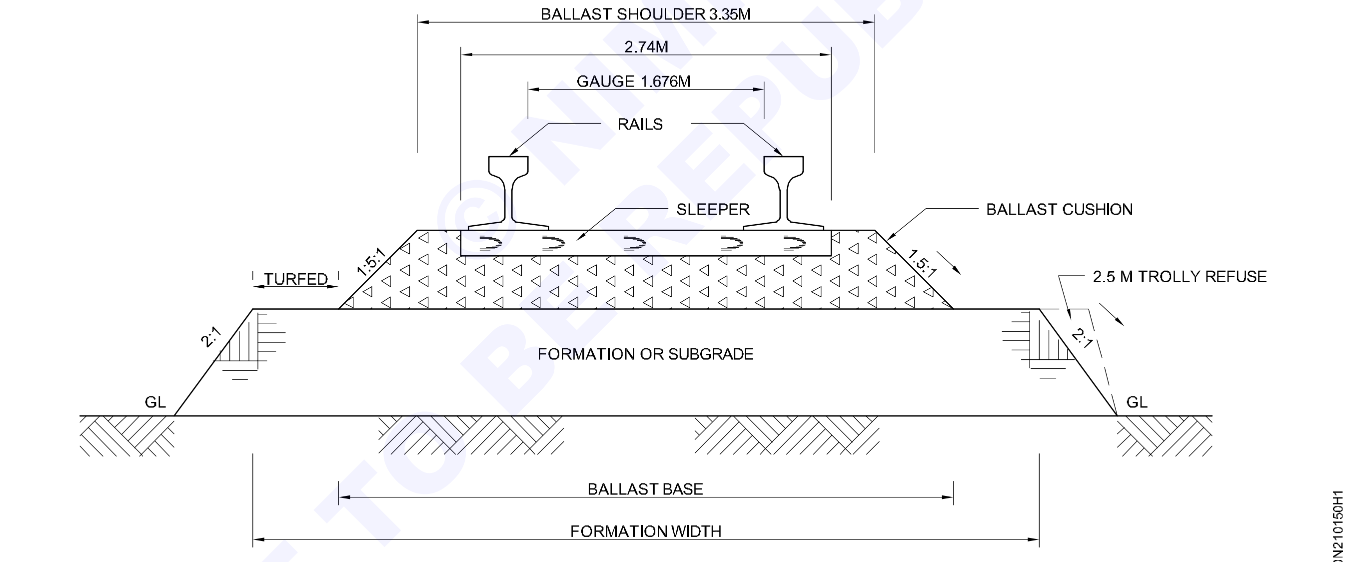
| | | |
|---|---|---|
| • Gauge | : | 1.676m |
| • Ballast shoulder | : | 3.350m |
| • Formation width | : | 6.10m |
| • Rail | : | Flat footed |

## PROCEDURE

1 Draw the cross sectional elevation of the permanent way using the above data and the given sketch using Auto Cad. (Fig 1)

2 Take a print out in A3 sheet.

Fig 1



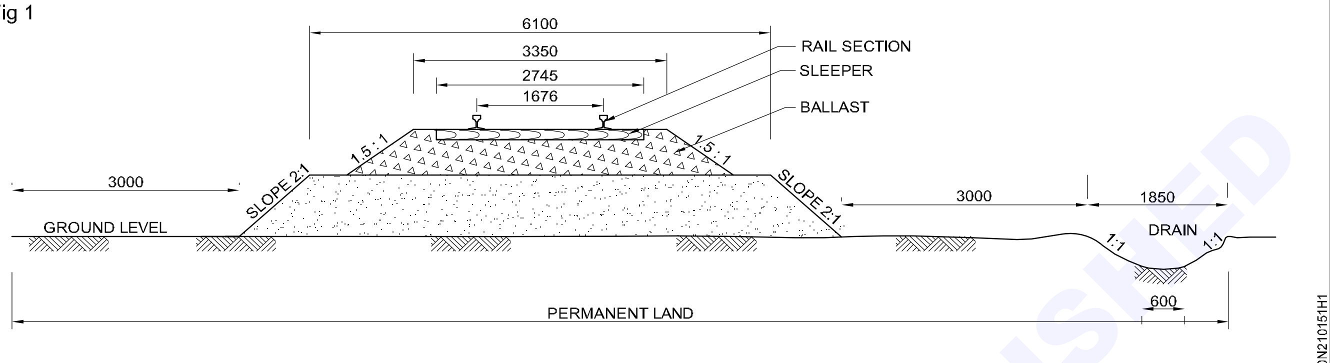

**A PERMANENT WAY IN EMBANKMENT (BROAD GAUGE)**

# Cross section of single line broad gauge track in embankment and cutting

**Objectives:** At the end of this exercise you shall be able to
- **draw a typical cross section of single line railway in embankment**
- **draw a typical cross section of single line railway in cutting.**

### Cross section of single line broad gauge in embankment (Fig 1)

Fig 1



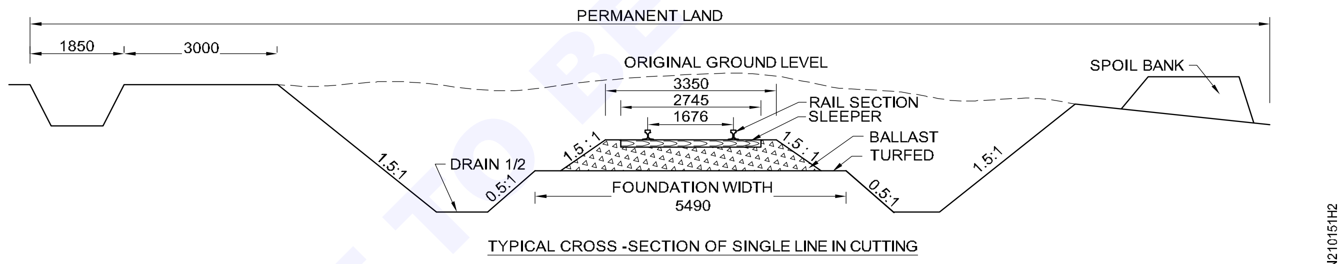

TYPICAL CROSS-SECTION OF SINGLE LINE IN EMBANKMENT

## DATA

- Gauge : 1676 mm
- Sleeper : 2745 mm
- Ballast shoulder : 3350 mm
- Formation width : 6100 mm
- Thickness of ballast : 200 mm
- Depth of embankment : 100 cm

### Cross section of single line broad gauge in cutting (Fig 2)

Fig 2




TYPICAL CROSS-SECTION OF SINGLE LINE IN CUTTING

## DATA

- Gauge: 1676 mm
- Sleeper : 2745 mm
- Ballast shoulder : 3350mm
- Thickness of ballast : 200mm
- Formation width : 5490mm
- Top and bottom width of drain : 1.20 and 0.6m

## PROCEDURE

1 Prepare drawing by Auto Cad as per the given drawing.

2 Draw typical cross section of single line in embankment.

3 Draw typical cross section of single line in cutting.

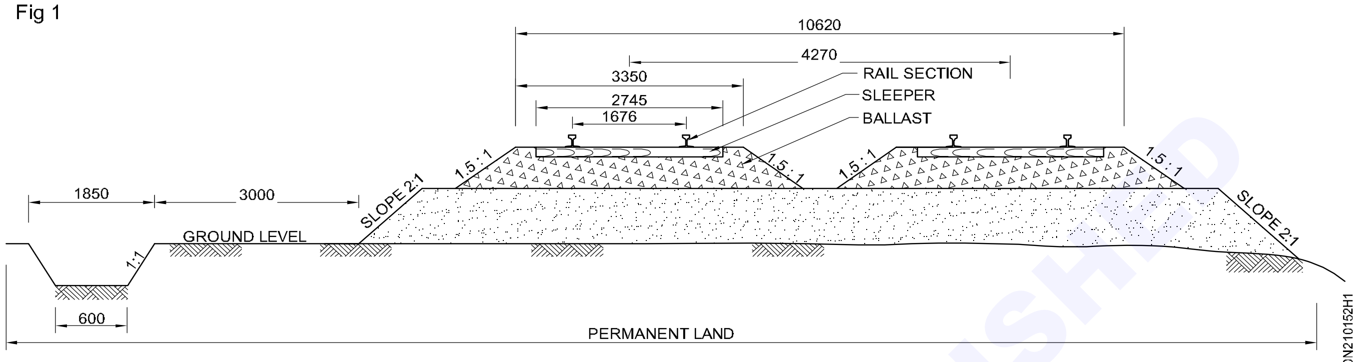
4 Take print out in A3 sheet.

# Cross section of double line broad gauge track in embankment and cutting

**Objectives:** At the end of this exercise you shall be able to
- **draw a typical cross section of double line railway in embankment**
- **draw a typical cross section of double line railway in cutting.**

**Double section line embankment (Fig 1)**

Fig 1



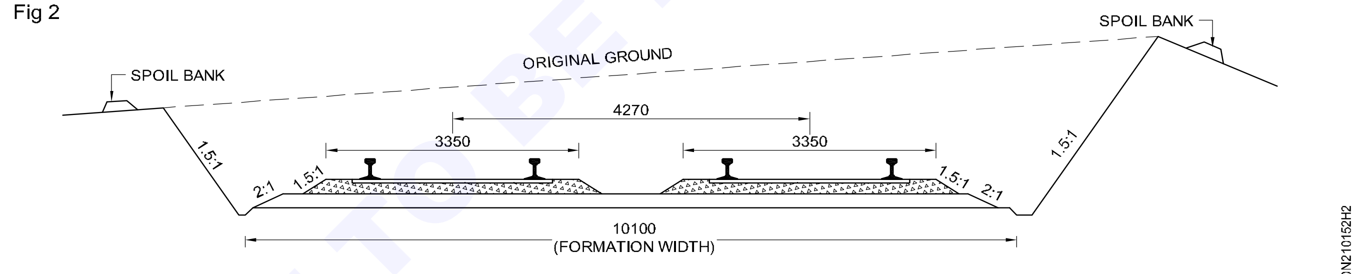

TYPICAL CROSS-SECTION OF DOUBLE LINE IN EMBANKMENT

## DATA

- Gauge : 1676 mm
- Sleeper : 2745 mm
- Ballast shoulder : 3350mm
- c/c distance between two lines : 4270 mm
- Formation width : 10700 mm
- Depth of embankment : 1000mm

**Double line in cutting (Fig 2)**

Fig 2




TYPICAL CROSS-SECTION OF DOUBLE LINE IN CUTTING

## DATA

- Gauge : 1676 mm
- Sleeper : 2745 mm
- Ballast shoulder : 3350mm
- c/c distance between two line : 4270mm
- Formation width : 10100 mm

## PROCEDURE

1 Prepare the drawing by Auto Cad as per the given drawing.

2 Draw typical cross section of double line in emabankment.

3 Draw typical cross section of double line in cutting.

4 Take print out in A3 sheet.

# Drawing a layout plan of signaling points and crossing

**Objectives:** At the end of this exercise you shall be able to
- **drawing layout of a marshalling yard**
- **drawing layout of a siding loop lines**
- **drawing layout of signal**
- **drawing layout of crossing.**

TASK 1: **Layout of signals (Fig 1)**

1 Draw a main line and draw loop line parallel to main line.

2 Draw breaking distance.

3 Draw warner signal and home signal in the main line at breaking distance.

4 Draw starter signal at down the main line.

5 Draw class “B” station signal as per (Fig 2).

6 Draw class “C” station signal as per (Fig 3).

— — — — — —

TASK 2: **Layout of types of crossings (Fig 2)**

1 Draw railway track. (Obtuse angle).

2 Draw railway track.

3 Draw another track with same angle.

4 Draw check rail parallel to track.

5 Square crossing track.

6 Draw a railway gauge (parallel line).

7 Draw another gauge perpendicular to it.

8 Draw wing rail.

— — — — — —

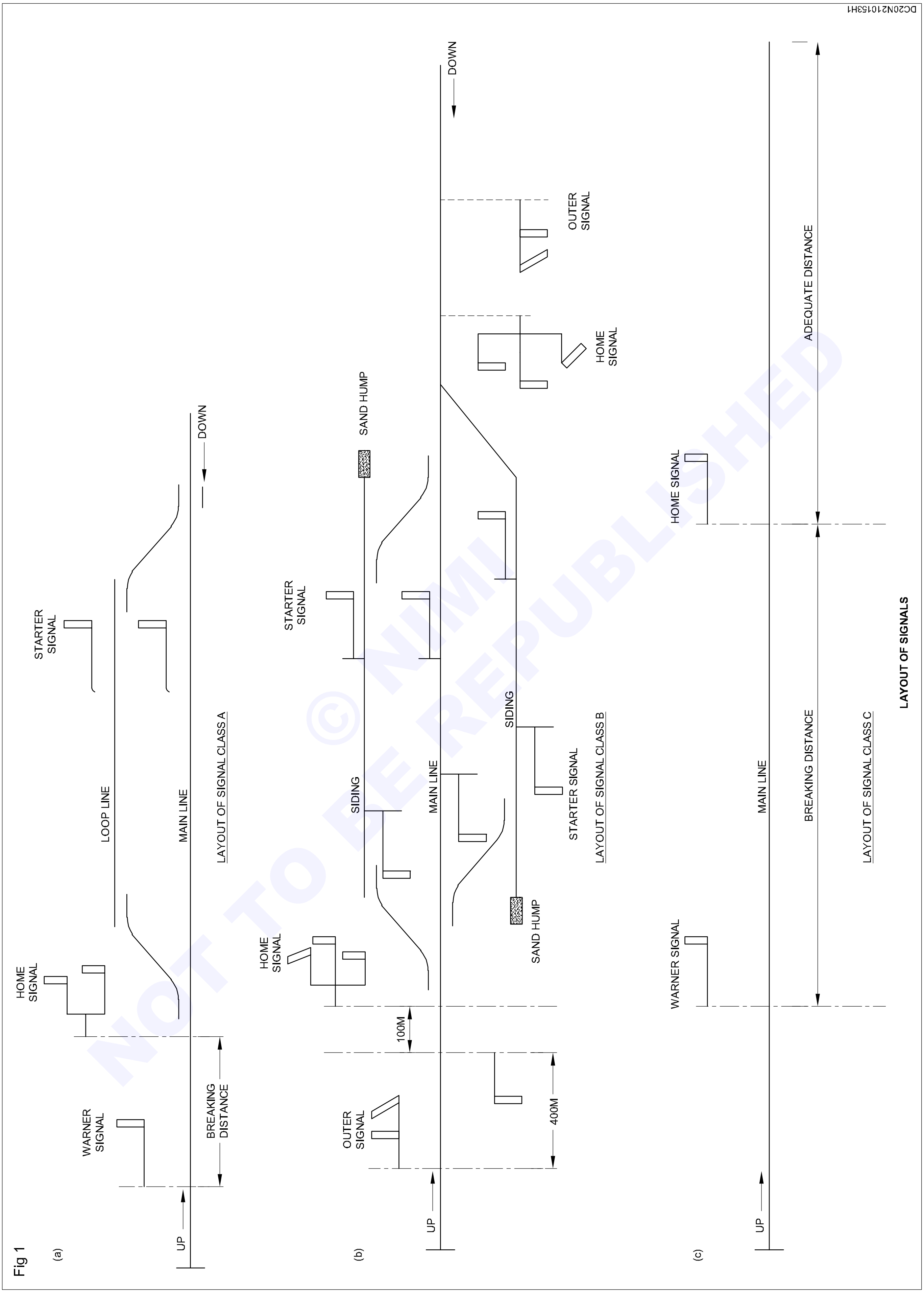
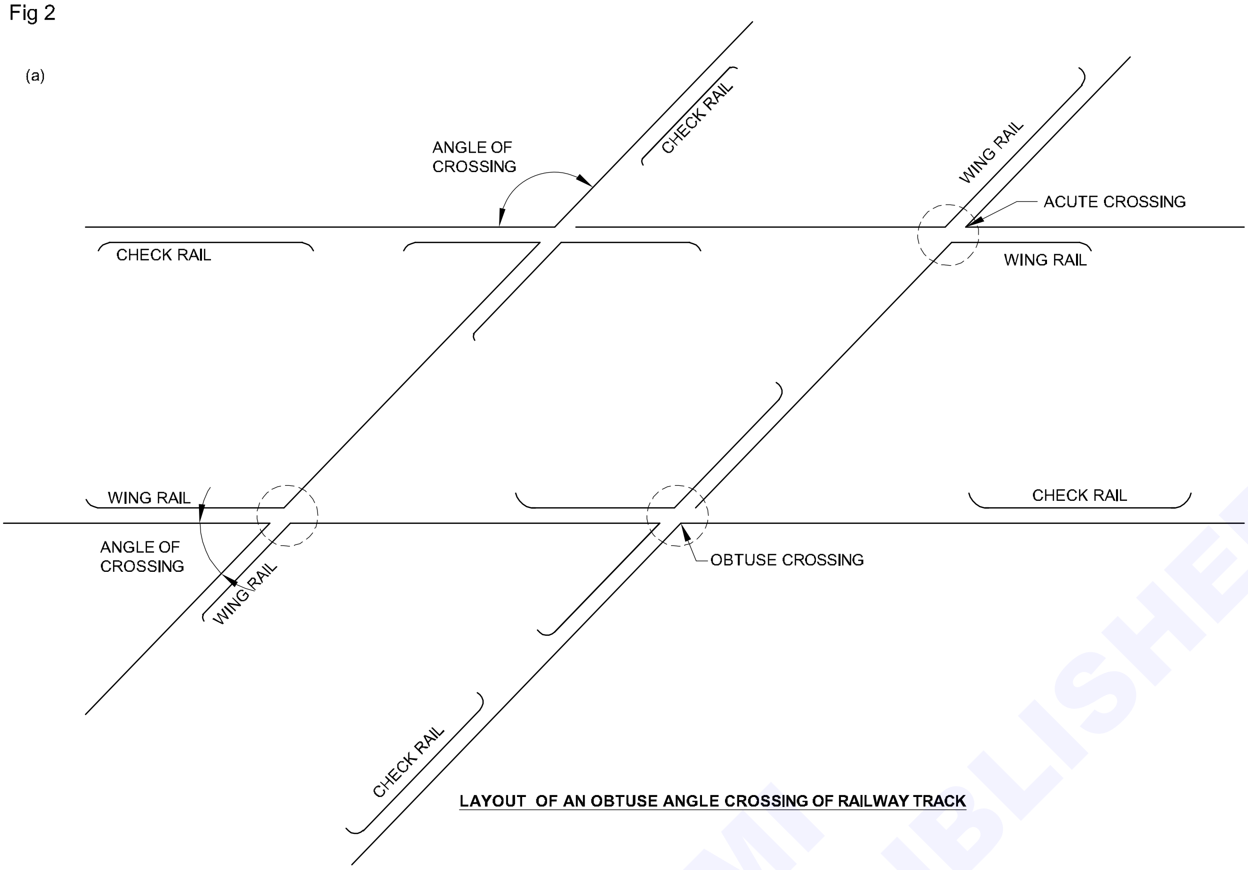

DC20N210153H1
(a)
UP
DOWN
WARNER SIGNAL
BREAKING DISTANCE
HOME SIGNAL
LOOP LINE
MAIN LINE
STARTER SIGNAL
LAYOUT OF SIGNAL CLASS A
(b)
UP
DOWN
OUTER SIGNAL
400M
100M
HOME SIGNAL
SIDING
MAIN LINE
SAND HUMP
STARTER SIGNAL
SIDING
SAND HUMP
STARTER SIGNAL
HOME SIGNAL
OUTER SIGNAL
LAYOUT OF SIGNAL CLASS B
(c)
UP
WARNER SIGNAL
MAIN LINE
BREAKING DISTANCE
HOME SIGNAL
ADEQUATE DISTANCE
LAYOUT OF SIGNAL CLASS C
LAYOUT OF SIGNALS
Fig 1

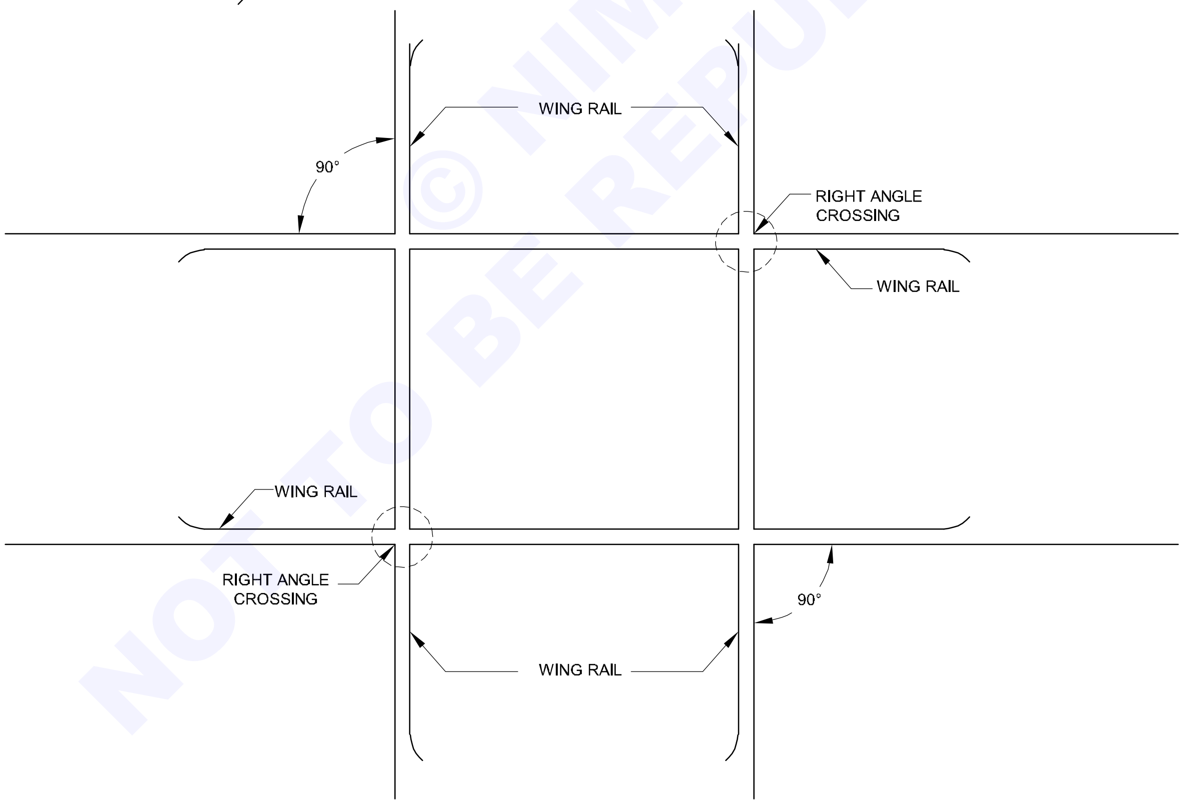
Fig 2

(a)




LAYOUT OF AN OBTUSE ANGLE CROSSING OF RAILWAY TRACK

(b)




LAYOUT OF A SQUARE CROSSING OF RAILWAY TRACK

TYPES OF CROSSING OF RAILWAY TRACK

DC20N210153H2

## Barrages, weir and dams

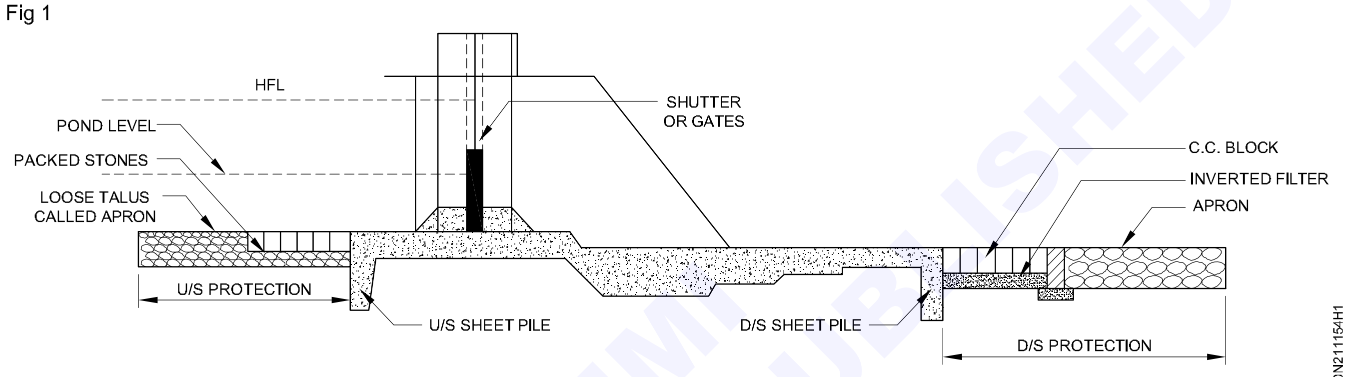
**Objectives:** At the end of this exercise you shall be able to
- **draw a typical cross - section of a barrage**
- **draw the sectional details of weir**
- **draw the typical cross-sections of the different types of dams.**

PROCEDURE

- **Cross - sections of a barrage (Fig 1)**

  Draw the typical cross-section of a barrage

Fig 1




A TYPICAL CROSS-SECTION OF A BARRAGE FOUNDED ON PERVIOUS FOUNDATIONS

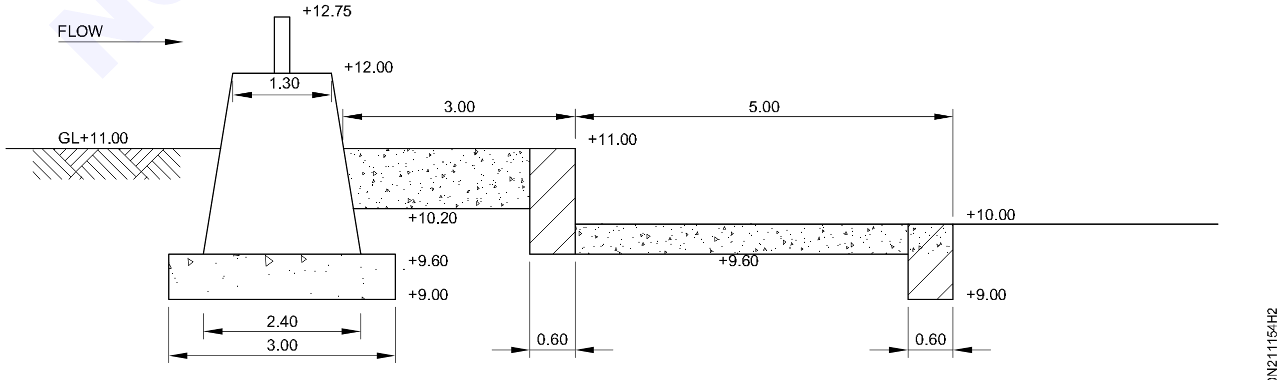
**2 Weir (Fig 2 & 3)**

Draw the cross-section of weir

## DATA

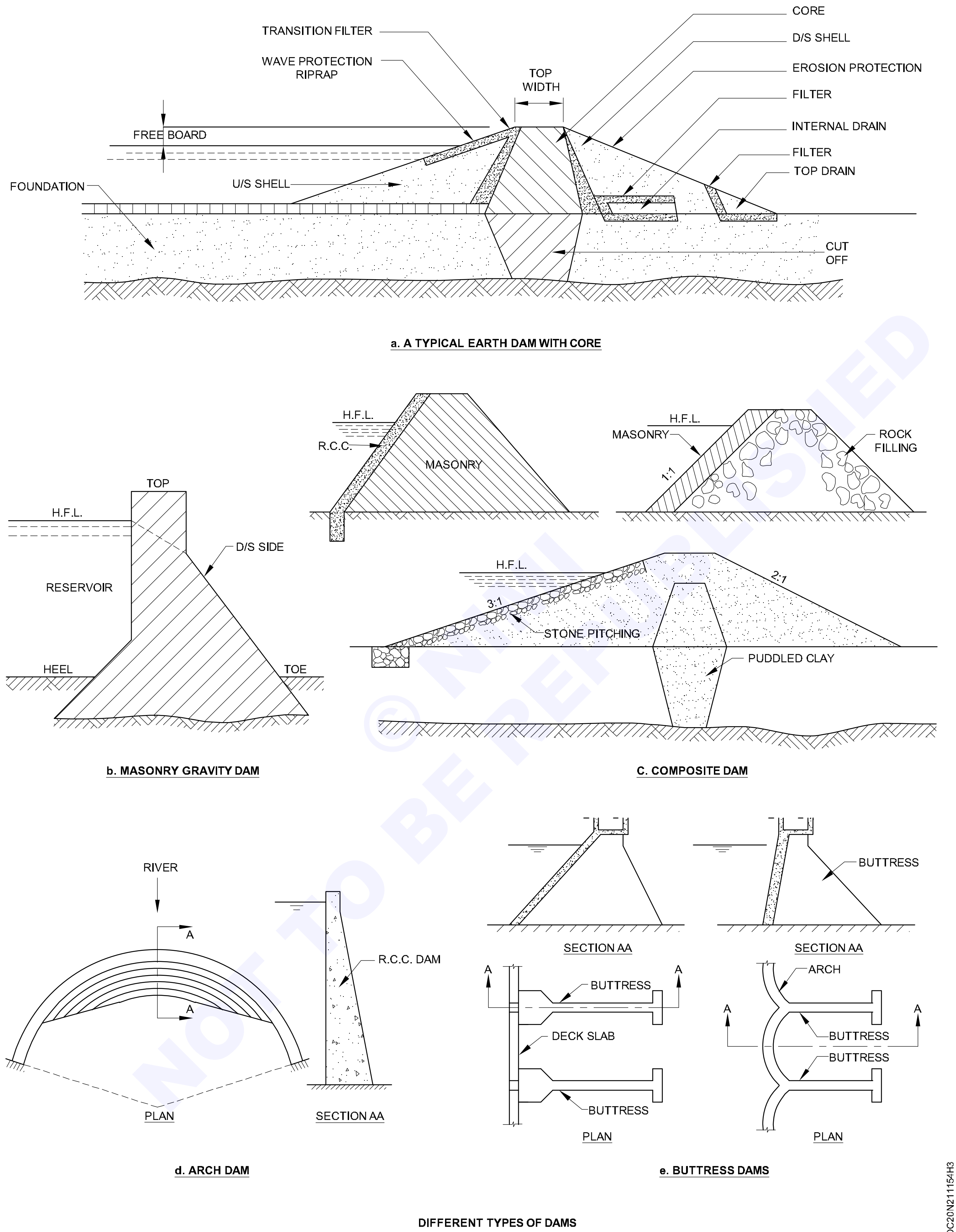
- Crest level : +12.00 FTL (Full tank level)
- Top of shutter level : +12.00MWL
- Ground level : +11.00
- Level of hard soil : +9.50
- Depth of foundation : 0.60m
- Base width of weir : 2.40m
- Top width : 1.30m
- Foundation width : 3.00 m (0.30m projection on either side)
- Down stream aprons : 1st level 3.00 m length, FInd level 5.00 length

Fig 2




WEIR

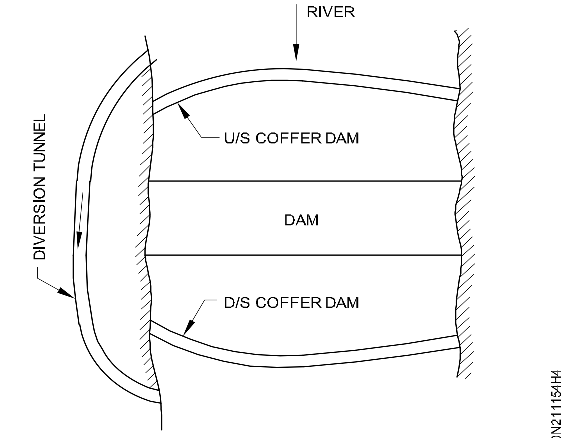
Fig 3




DIFFERENT TYPES OF DAMS

**Coffer clams (Fig 4)**

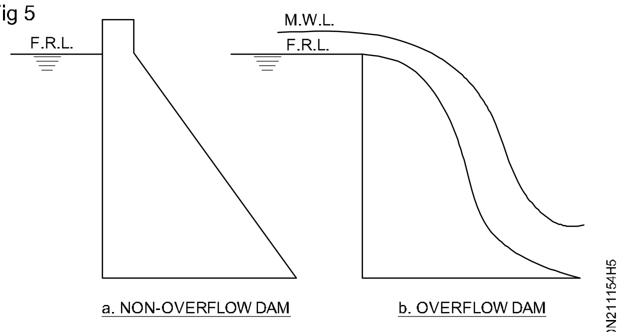
Fig 4




COFFER DAMS

**Non-overflow dams and overflow dam (Fig 5)**

Fig 5




NON OVERFLOW DAM & OVERFLOW DAM

# Longitudinal section of distributaries and c/s of canal

**Objectives:** At the end of this exercise you shall be able to
- **identify the reduced level of existing natural surface**
- **identify the proposed bank level**
- **draw the L-sections of distribute way**
- **draw the cross section of canal in different bed level.**

## DATA

- Bed slope : 1 in 5000
- Full supply depth : 1.50m
- Bed width : 3.50m
- Free board : 60cm

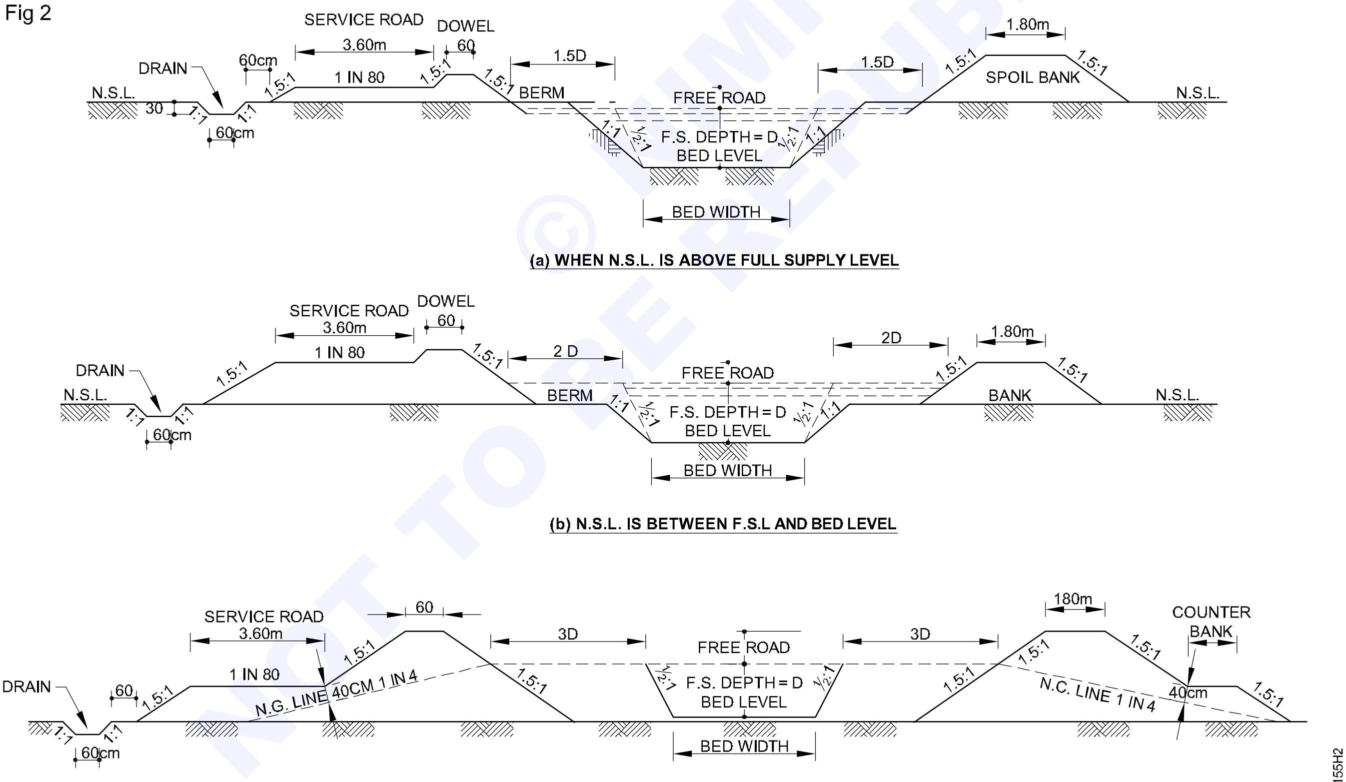
## PROCEDURE

1 a Draw the L-sections of a canal alignment from a chain age 0.0 to 5000

Draw the details of aqueducts as per the given figure.(Fig 1)

b Draw the section of canal in different bed level as per the drawing attached.(Fig 2)

Fig 2



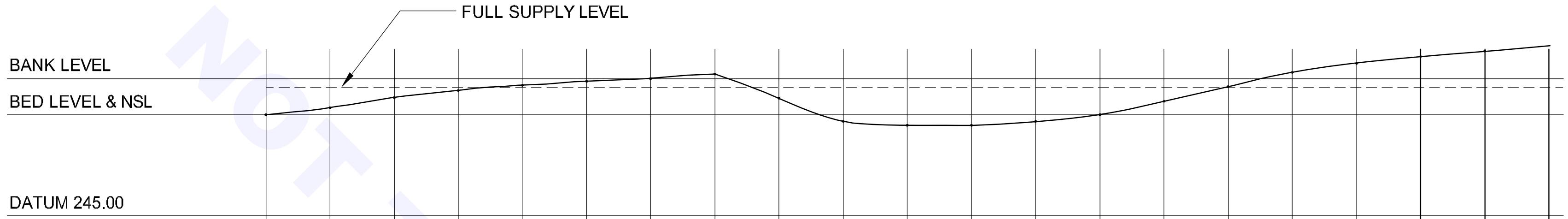

(a) WHEN N.S.L. IS ABOVE FULL SUPPLY LEVEL

(b) N.S.L. IS BETWEEN F.S.L AND BED LEVEL

(c) WHEN N.S.L. IS BELOW BED LEVEL

TYPICAL SECTIONS OF A DISTRIBUTORY

Fig 1




| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEPTH OF CUTTING | - | 0.35 | 0.90 | 1.15 | 1.40 | 1.55 | 2.10 | 2.25 | 0.70 | - | - | - | - | - | 1.00 | 1.65 | 2.60 | 2.75 | 2.90 | 3.35 | 3.70 |
| DEPTH OF FILLING | 0.00 | 1.65 | 1.10 | 0.85 | 0.60 | 0.45 | - | - | 1.30 | 2.55 | 2.70 | 2.60 | 2.95 | 2.45 | 1.00 | 0.35 | - | - | - | - | - |
| BED SLOPE | 1 IN 5000 (FALLING) | | | | | | | | | | | | | | | | | | | | |
| FULL SUPPLY DEPTH | 1.50M | | | | | | | | | | | | | | | | | | | | |
| BED WIDTH | 3.50M | | | | | | | | | | | | | | | | | | | | |
| TOP OF BANK | 253.00 | 252.95 | 252.90 | 252.85 | 252.80 | 252.75 | 252.70 | 252.65 | 252.60 | 252.55 | 252.50 | 252.45 | 252.40 | 252.35 | 252.30 | 252.25 | 252.20 | 252.15 | 252.10 | 252.05 | 252.00 |
| PROPOSED BED LEVEL | 251.00 | 250.95 | 250.90 | 250.85 | 250.80 | 250.75 | 250.70 | 250.65 | 250.60 | 250.55 | 250.50 | 250.45 | 250.40 | 250.35 | 250.30 | 250.25 | 250.20 | 250.15 | 250.10 | 250.05 | 250.00 |
| NATURAL SURFACE LEVEL | 251.00 | 251.30 | 251.80 | 252.00 | 252.20 | 252.30 | 252.80 | 252.90 | 251.30 | 250.00 | 249.80 | 249.50 | 249.80 | 249.90 | 251.30 | 251.90 | 252.80 | 252.90 | 253.00 | 253.40 | 253.70 |
| CHAINAGE | 0 | 250 | 500 | 750 | 1000 | 1250 | 1500 | 1750 | 2000 | 2250 | 2500 | 2750 | 3000 | 3250 | 251.30 | 3750 | 4000 | 4250 | 4500 | 4750 | 5000 |

LONGITUDINAL SECTION OF A DISTRIBUTORY

DC20N21155H1

## Head Regulators

**Objectives:** At the end of this exercise you shall be able to
- **identify the different parts of canal head regulator**
- **draw the details of canal head regulators.**

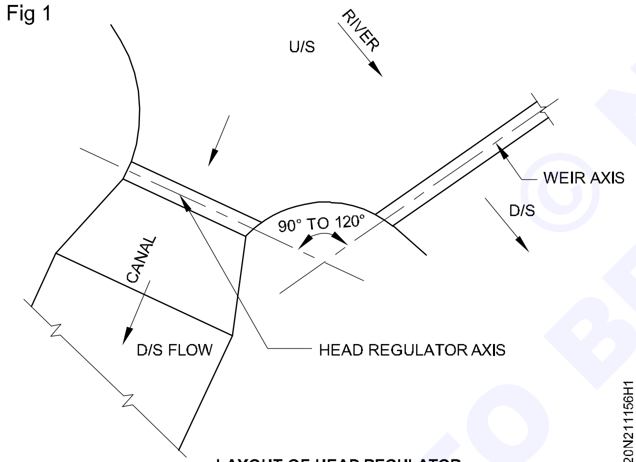
### DATA

- HFL : +21.00
- Pond level : +20.20
- FSL : +18.80
- Bed level of canal : +16.00
- Bed level of silt excluder : +16.20
- Sluice chamber size : 1.10x1.30
- Road level : +20.50
- Width of road : 3.00
- Platform : +23.60
- (Assume any missing data suitably)

### PROCEDURE

1 Draw the schematic diagram showing the position of head regulators. (Fig 1)

Fig 1

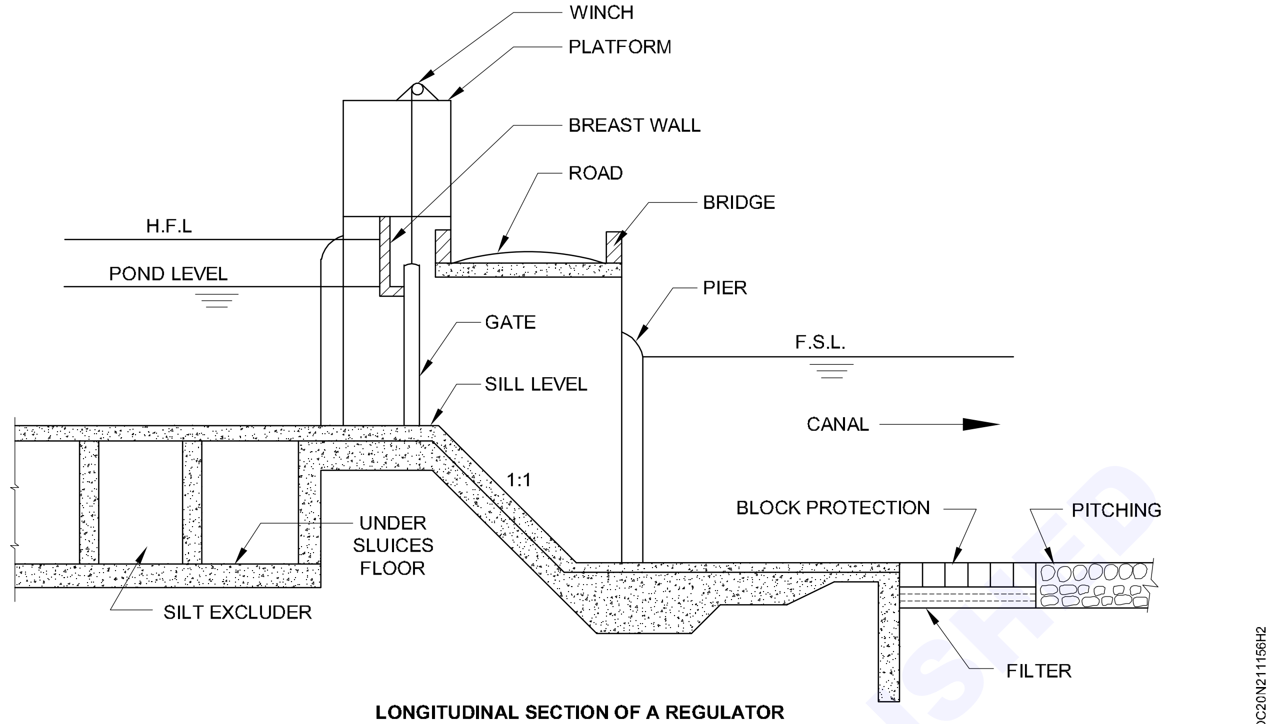



LAYOUT OF HEAD REGULATOR

2 Draw the detailed longitudinal section of a regulator. (Fig 2)

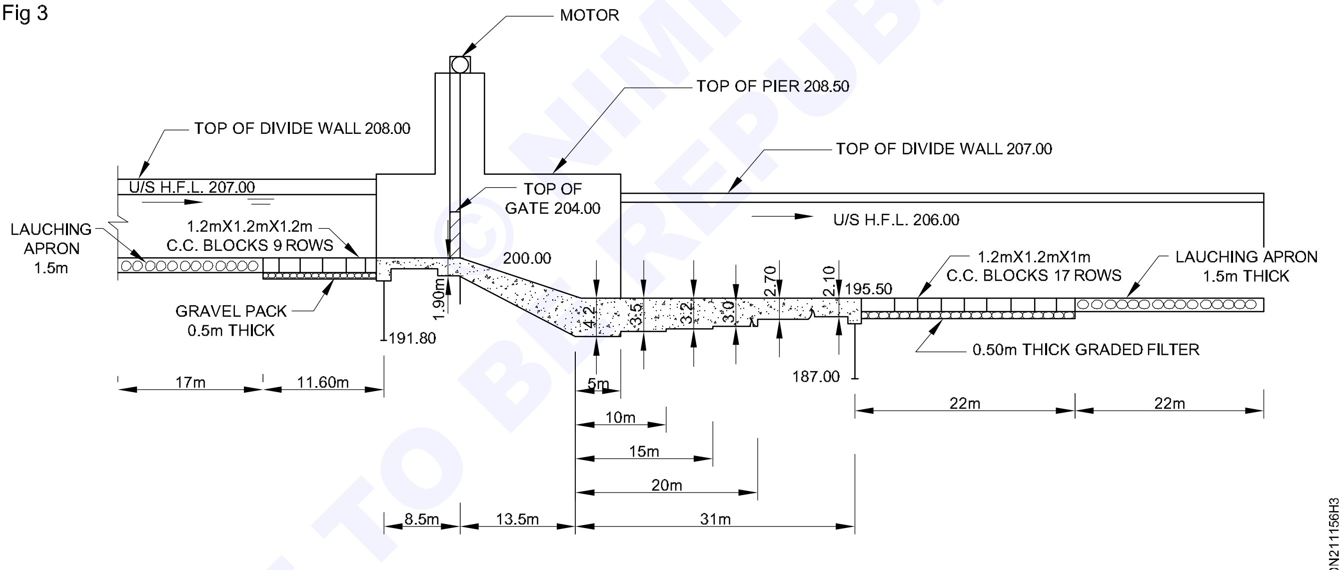
3 Draw the details of the diversion headworks (Fig 3)

Fig 2




**LONGITUDINAL SECTION OF A REGULATOR**

Fig 3




**DETAILS OF THE DIVERSION HEADWORKS**

## Cross drainage works

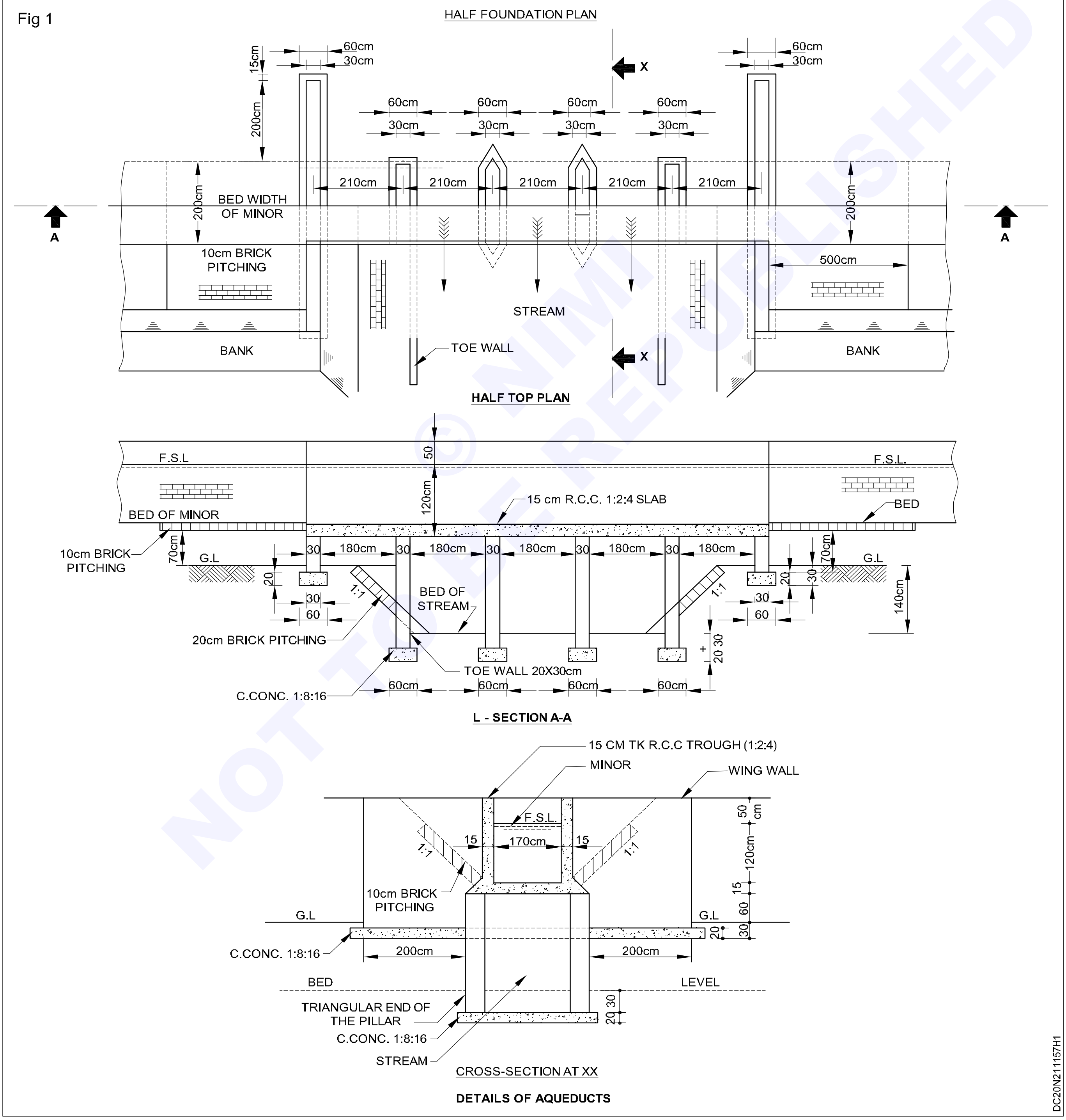
**Objectives:** At the end of this exercise you shall be able to
- **identify the different cross drainage works**
- **draw the details of aqueduct, super passage, level crossing.**

PROCEDURE

- **a Aqueducts (Fig 1)**

  Draw the details of aqueducts as per the given figure

Fig 1



- **b A syphon aqueducts (Fig 2)**

- Draw the details of a syphon aqueducts as per the given figure.

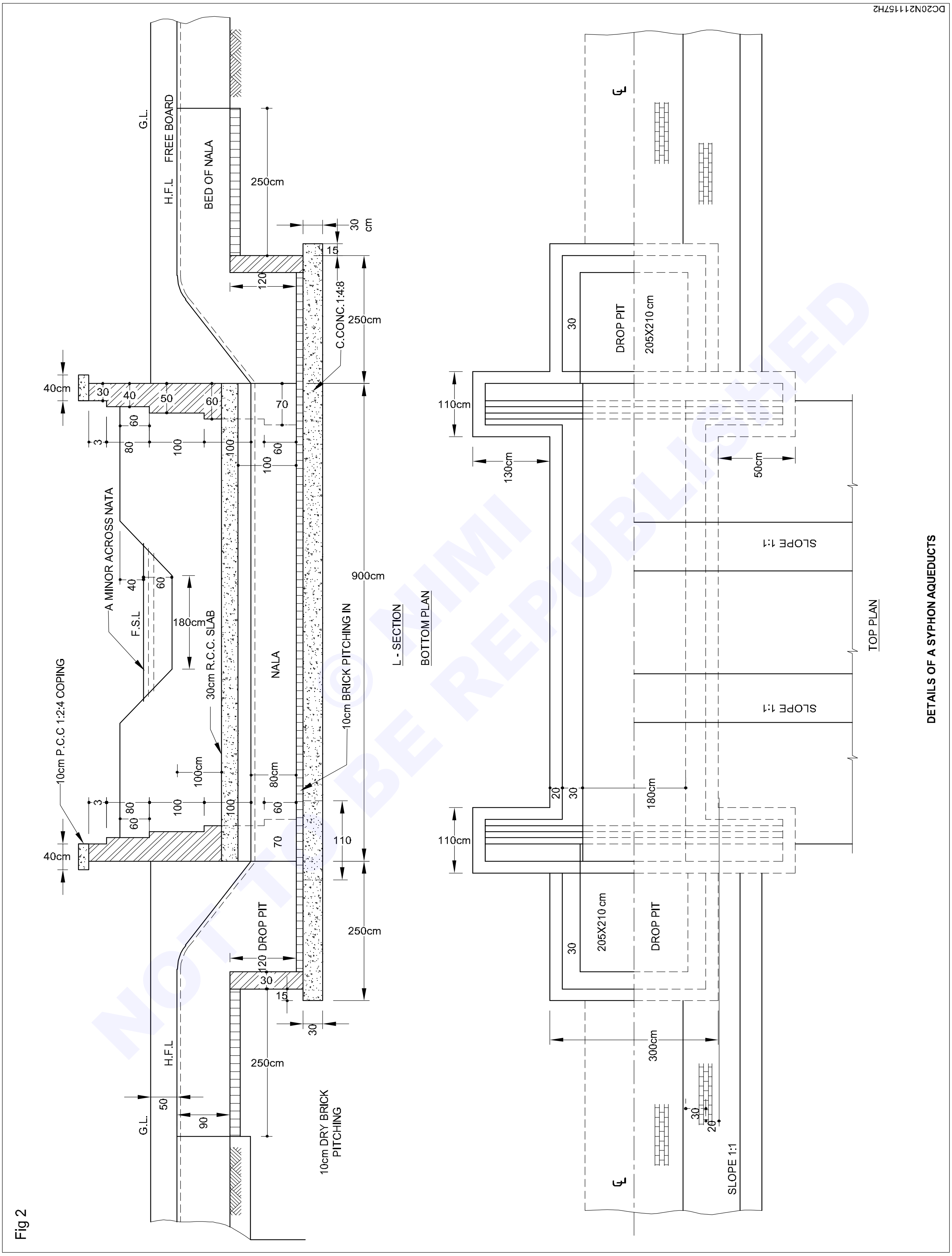
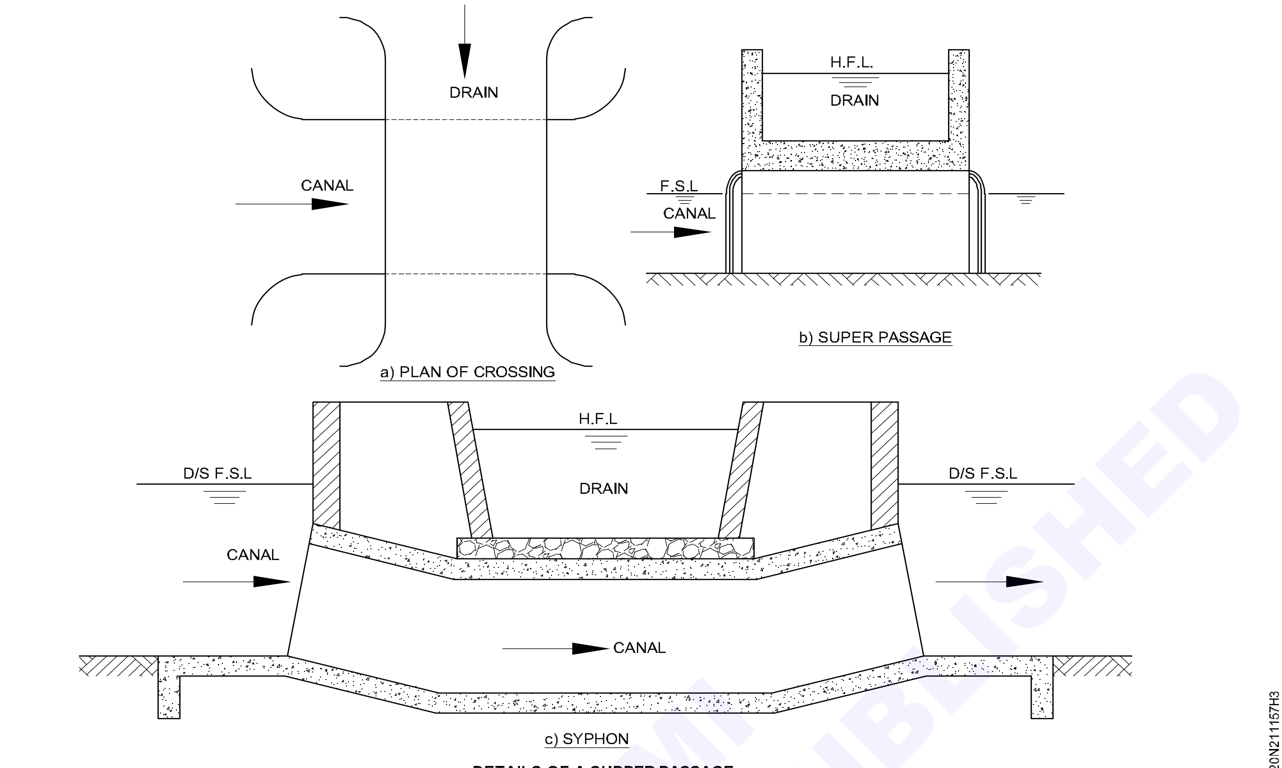


Fig 2

## 2 Supper passage (Fig 3)

Draw the details of a supper passage

Fig 3

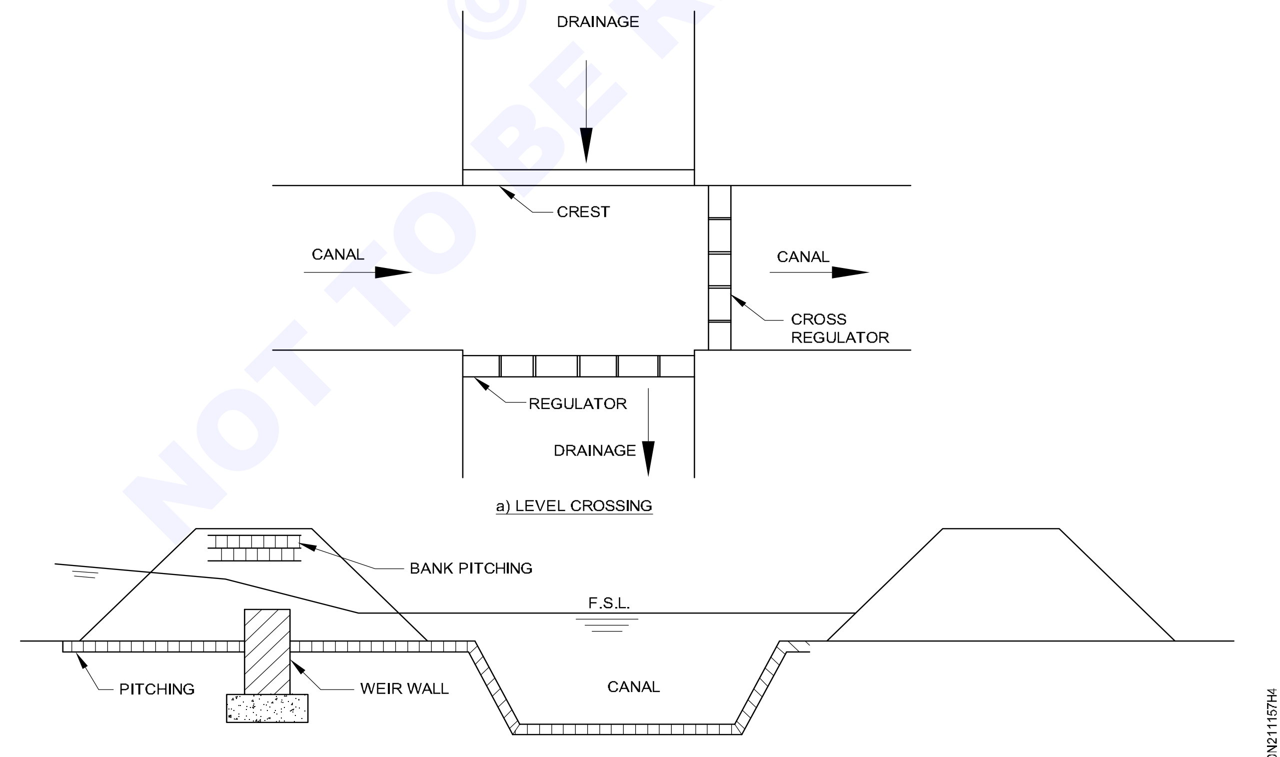



DETAILS OF A SUPPER PASSAGE

## 3 Level crossing (Fig 4)

Draw the details of a level crossing

Fig 4




DETAILS OF A LEVEL CROSSING

Exercise 2.11.158

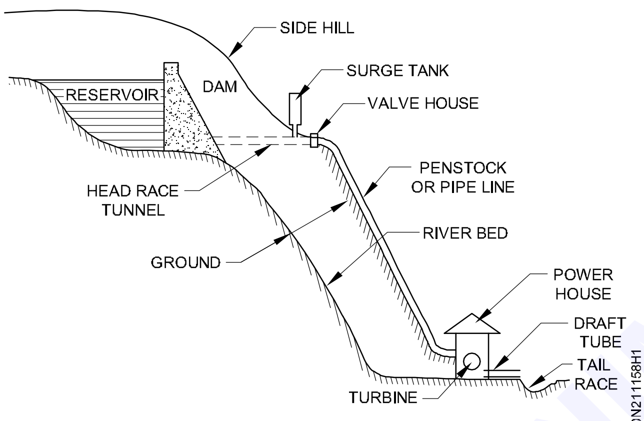
## Hydro electric project

**Objectives:** At the end of this exercise you shall be able to
- **identify the different components of hydro electric power project**
- **draw the schematic diagram of high head hydro electric project.**

PROCEDURE

- Identify and draw the schematic diagram of a high head hydro electric project.(Fig 1)

Fig 1




SECTION THROUGH A HIGH HEAD SCHEME




Exercise 2.11.159

## Alignment including longitudinal and cross sections of canals with the given data.

| Refer Ex.No.2.11.155Refer Ex.No.2.11.155 |
|---|

# Estimate of a single storey building

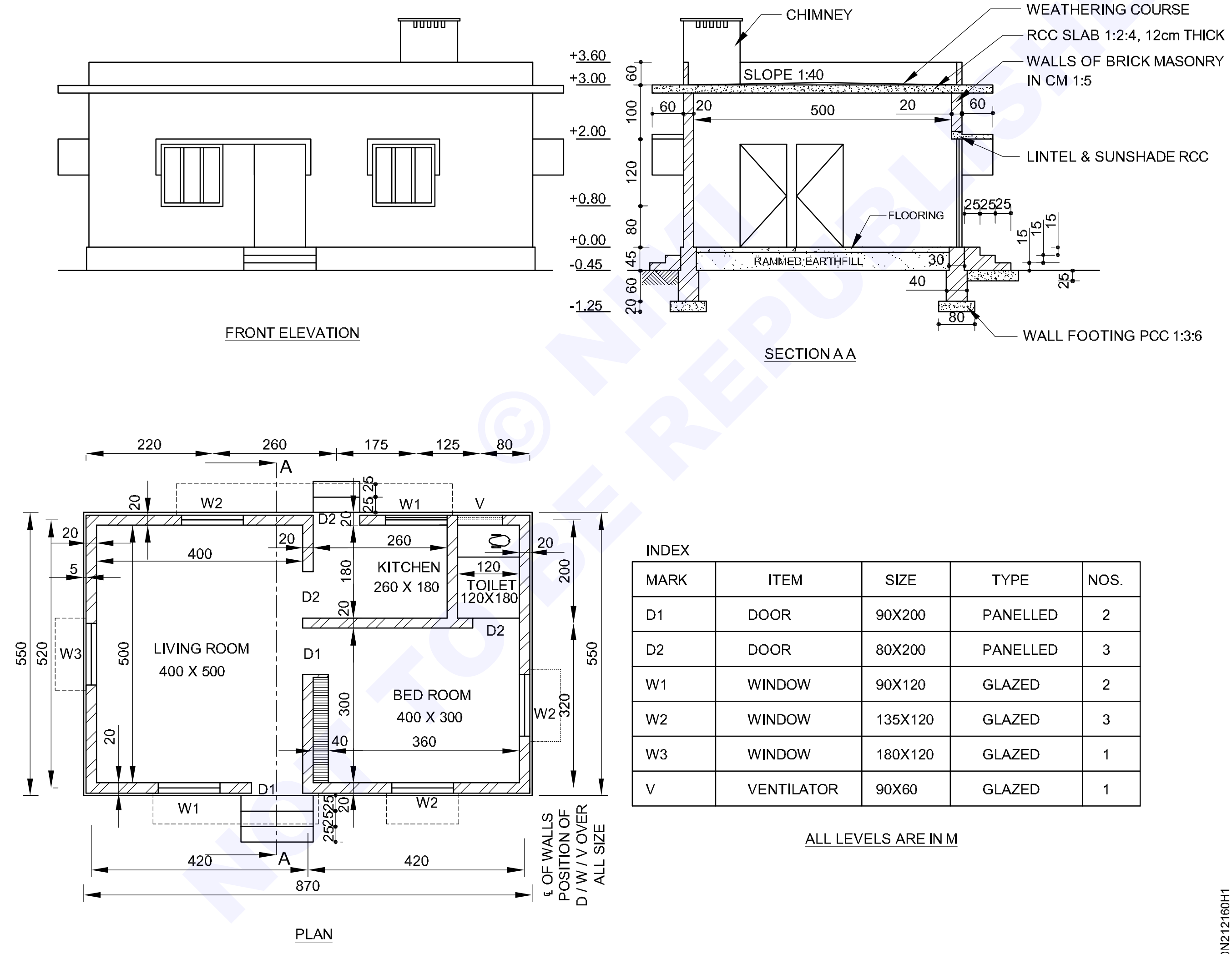
**Objectives:** At the end of this exercise you shall be able to
- **prepare the estimate of the given building by long wall short wall method**
- **prepare the estimate of the given building by centre line method**
- **prepare the abstract of the estimate.**

## PROCEDURE

TASK 1: **Prepare the estimate by longwall shortwall method (Fig 1)**

**DATA: Given drawing**

Fig 1




INDEX

| MARK | ITEM | SIZE | TYPE | NOS. |
|---|---|---|---|---|
| D1 | DOOR | 90X200 | PANELLED | 2 |
| D2 | DOOR | 80X200 | PANELLED | 3 |
| W1 | WINDOW | 90X120 | GLAZED | 2 |
| W2 | WINDOW | 135X120 | GLAZED | 3 |
| W3 | WINDOW | 180X120 | GLAZED | 1 |
| V | VENTILATOR | 90X60 | GLAZED | 1 |

ALL LEVELS ARE IN M

**ESTIMATION BY LONG WALL SHORT WALL METHOD**

**Long wall short wall method**

| Item No. | Description | No. | Length (M) | Breadth (M) | Height (M) | Qty | Explanatory notes |
|---|---|---|---|---|---|---|---|
| 1 | Site clearing and levelling | | | | | L.S | |
| 2 | Earthwork excavation in all classes of soil (except in hard rock and medium rock requiring blasting) and depositing on bank with initial lead upto 30 m and lift upto 1.5 m including block filling breaking clots watering ramming and sectioning of spoil bank etc. complete for foundation. | | | | | | |
| | Long wall | 2 | 9.20 | 0.80 | 0.80 | 11.776 $m^3$ | L = 8.40 + 2 x $\frac{0.80}{2}$ = 9.20 m |
| | Wall between kitchen & bedroom | 1 | 5.00 | 0.80 | 0.80 | 3.2 $m^3$ | L = 4.20 + 2 x $\frac{0.80}{2}$ = 5.00 m |
| | Short wall Side of living | 1 | 4.40 | 0.80 | 0.80 | 2.81 $m^3$ | L = 5.20 - 2 x $\frac{0.80}{2}$ = 4.40 m |
| | Side of bedroom | 2 | 2.40 | 0.80 | 0.80 | 3.072 $m^3$ | L = 3.20 - 2 x $\frac{0.80}{2}$ = 2.40 m |
| | Side of kitchen & Toilet | 3 | 1.20 | 0.80 | 0.80 | 2.304 $m^3$ | L = 2.00 - 2 x $\frac{0.80}{2}$ = 1.20 m |
| | Step front | 1 | 1.70 | 0.90 | 0.20 | 0.306 $m^3$ | L = 1.30 + 2 x 0.20 = 1.70 m |
| | Step back | 1 | 1.70 | 0.65 | 0.20 | 0.221 $m^3$ | L = 1.30 + 2 x 0.20 = 1.70 m |
| | | | | | Total | 23.675 $m^3$ | |
| 3 | Plain cement concrete 1:4:8 (1 part cement 4 part sand, 8 parts of | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | broken stone, 40 mm nominal size) including cost and conveyance for all materials to site and all labour charges for consolidation, watering, curing etc. complete. | | | | | | |
| | Long wall | 2 | 9.20 | 0.80 | 0.20 | 2.94 $m^3$ | |
| | Wall between kitchen & bedroom | 1 | 5.00 | 0.80 | 0.20 | 0.8 $m^3$ | |
| | Short wall :- Side of living | 1 | 4.40 | 0.80 | 0.20 | 0.70 $m^3$ | |
| | Side of bedroom | 2 | 2.40 | 0.80 | 0.20 | 0.76 $m^3$ | L is same as item no 2 |
| | Side of kitchen & Toilet | 3 | 1.20 | 0.80 | 0.20 | 0.57 $m^3$ | |
| | Step front | 1 | 1.70 | 0.90 | 0.20 | 0.30 $m^3$ | |
| | Step back | 1 | 1.70 | 0.65 | 0.20 | 0.221 $m^3$ | |
| | | | | | Total | 6.03 $m^3$ | |
| 4 | RR Masonry in cement mortar 1:6 (1 part cement and 6 part sand) including cost and conveyance of all materials to site and all labour charges, watering curing etc. | | | | | | |
| | complete for foundation S and plinth | | | | | | |
| | i) Foundation | | | | | | |
| | a) Long wall | 2 | 8.80 | 0.40 | 0.60 | 4.224 $m^3$ | $L = 8.4 + 2 \times \frac{0.40}{2}$ $= 8.80$ m |
| | Wall between bedroom and kitchen | 1 | 4.60 | 0.40 | 0.60 | 1.104 $m^3$ | $L = 4.204 + 2 \times \frac{0.40}{2}$ $= 4.60$ m |
| | b) Short wall | | | | | | |
| | Side of living | 1 | 4.80 | 0.40 | 0.60 | 1.152 $m^3$ | $L = 5.2 - 2 \times \frac{0.40}{2}$ $= 4.80$ m |
| | Side of bedroom | 2 | 2.80 | 0.40 | 0.60 | 1.314 $m^3$ | $L = 3.2 - 2 \times \frac{0.40}{2}$ $= 2.80$ m |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Side of kitchen and toilet | 3 | 4.80 | 0.40 | 0.60 | 1.152 $m^3$ | $L = 2.00 - 2 \times \frac{0.40}{2}$ <br> $= 1.60$ m |
| | ii) Plinth | | | | | | |
| | a) Long wall | 2 | 8.70 | 0.30 | 0.45 | 2.349 $m^3$ | $L = 8.40 + 2 \times \frac{0.30}{2}$ <br> $= 8.70$ m |
| | Wall between kitchen and bedroom | 1 | 4.50 | 0.30 | 0.45 | 0.607 $m^3$ | $L = 4.20 + 2 \times \frac{0.30}{2}$ <br> $= 4.50$ m |
| | Side of living | 1 | 4.90 | 0.30 | 0.45 | 0.661 $m^3$ | $L = 5.20 - 2 \times \frac{0.30}{2}$ <br> $= 4.90$ m |
| | Side of bedroom | 2 | 2.90 | 0.30 | 0.45 | 0.783 $m^3$ | $L = 3.20 - 2 \times \frac{0.30}{2}$ <br> $= 2.90$ m |
| | Side of kitchen and toilet | 3 | 1.70 | 0.30 | 0.45 | 0.688 $m^3$ | $L = 2.00 - 2 \times \frac{0.30}{2}$ <br> $= 1.70$ m |
| | | | | | Total | 14.06 $m^3$ | |
| 5 | Damp proof course 2.5 cm thick cement mortar 1:3 | | | | | | |
| | i) Long wall | 2 | 8.70 | 0.30 | - | 5.33 $m^2$ | |
| | Wall between kitchen and bedroom | 1 | 4.50 | 0.30 | - | 1.35 $m^2$ | |
| | ii) Short wall side of living | 1 | 4.90 | 0.30 | - | 1.47 $m^2$ | Length as same as item 4(ii) |
| | Side of bedroom | 2 | 2.90 | 0.30 | - | 1.74 $m^2$ | |
| | Side of kitchen and toilet | 3 | 1.70 | 0.30 | - | 1.53 $m^2$ | |
| | | | | | | 11.31 $m^2$ | |
| | Deduction | | | | | | |
| | Door - D1 | 2 | 0.90 | 0.30 | - | 0.54 $m^2$ | |
| | Door - D2 | 3 | 0.80 | 0.30 | - | 0.72 $m^2$ | |
| | Total deduction | | | | | 1.26 $m^2$ | |
| | Net quantity | | | | | 10.05 sq.m | |
| 6 | Brick masonry in cement mortar 1:6(one partcement 6 part sand) of size (19x9x9) cm for walls | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | including cost and conveyance of all materials to site, scaf-folding charges and all other labour charges, watering, curing, etc. complete | | | | | | |
| | i) Long wall | 2 | 8.60 | 0.20 | 3.00 | 10.32 $m^2$ | $L = 8.40 + 2 \times \frac{0.20}{2}$ <br> $= 8.60$ m |
| | Wall between kitchen & bedroom | 1 | 4.40 | 0.20 | 3.00 | 2.64 $m^2$ | $L = 4.2 + 2 \times \frac{0.20}{2}$ <br> $= 4.40$ m |
| | ii) Short wall | | | | | | |
| | Side of living | 1 | 5.00 | 0.20 | 3.00 | 3.00 $m^3$ | $L = 5.2 - 2 \times \frac{0.20}{2}$ <br> $= 5.00$ m |
| | Side of bedroom | 2 | 3.00 | 0.20 | 3.00 | 3.60 $m^3$ | $L = 3.2 - 2 \times \frac{0.20}{2}$ <br> $= 3.00$ m |
| | Side of kitchen & toilet | 3 | 1.80 | 0.20 | 3.00 | 3.24 $m^3$ | $L = 2.00 - 2 \times \frac{0.20}{2}$ <br> $= 1.80$ m |
| | Side of shelf | 1 | 0.40 | 0.20 | 0.50 | 0.24 $m^3$ | |
| | Parapet wall : | | | | | | |
| | Long wall | 2 | 8.60 | 0.20 | 0.50 | 1.72 $m^3$ | |
| | Short wall | 2 | 5.00 | 0.20 | 0.50 | 1.00 $m^3$ | |
| | Step:- Front | | | | | | |
| | 1st step | 1 | 1.30 | 0.75 | 0.15 | 0.14 $m^3$ | |
| | 2nd step | 1 | 1.30 | 0.50 | 0.15 | 0.09 $m^3$ | |
| | 3rd step | 1 | 1.30 | 0.25 | 0.15 | 0.04 $m^3$ | |
| | Step back : | | | | | | |
| | 1st step | 1 | 1.30 | 0.50 | 0.15 | 0.09 $m^3$ | |
| | 2nd step | 1 | 1.30 | 0.25 | 0.15 | 0.04 $m^3$ | |
| | | | | Total quantity | | 26.19 $m^3$ | |
| | Deduction: | | | | | | |
| | Doors D1 | 2 | 0.90 | 0.20 | 2.00 | 0.72 $m^3$ | |
| | D2 | 3 | 0.80 | 0.20 | 2.00 | 0.96 $m^3$ | |
| | Window: | | | | | | |
| | W1 | 2 | 0.90 | 0.20 | 1.20 | 0.43 $m^3$ | |
| | W2 | 3 | 1.35 | 0.20 | 1.20 | 0.97 $m^3$ | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | W3 | 1 | 1.80 | 0.20 | 1.20 | 0.43 m³ | |
| | Ventilator | 1 | 0.90 | 0.20 | 0.60 | 0.10 m³ | |
| | Lintels for | | | | | | |
| | Door D1 | 2 | 1.20 | 0.20 | 0.15 | 0.07 m³ | |
| | Door D2 | 3 | 1.10 | 0.20 | 0.15 | 0.09 m³ | |
| | Windows | | | | | | |
| | W1 | 2 | 1.20 | 0.20 | 0.15 | 0.07 m³ | |
| | W2 | 3 | 1.65 | 0.20 | 0.15 | 0.14 m³ | |
| | W3 | 1 | 2.10 | 0.20 | 0.15 | 0.06 m³ | |
| | Ventilator | 1 | 1.20 | 0.20 | 0.15 | 0.03 m³ | Net qty = Total qty - |
| | Total deduction<br>Net quantity | | | | | 4.11 m³<br>22.08 m³ | Total deduction |
| 7 | Reinforced cement concrete 1:2:4 (1 part cement 2 parts sand 4 parts broken stone of 20mm size) including cost and conveyance of all materials to site all labour charges for form work, mixing, laying, vibrating, watering, curing etc. complete but excluding cost of steel reinforcement and its bending. | | | | | | |
| | Roof slabs | 1 | 9.80 | 6.60 | 0.12 | 7.76 m³ | |
| | Lintels for | | | | | | |
| | Door D1 | 2 | 1.20 | 0.20 | 0.15 | 0.07 m³ | |
| | D2 | 3 | 1.10 | 0.20 | 0.15 | 0.09 m³ | |
| | Windows | | | | | | |
| | W1 | 2 | 1.20 | 0.20 | 0.15 | 0.07 m³ | |
| | W2 | 3 | 1.65 | 0.20 | 0.15 | 0.14 m³ | |
| | W3 | 1 | 2.1 | 0.20 | 0.15 | 0.06 m³ | |
| | Ventilator | 1 | 1.20 | 0.20 | 0.15 | 0.03 m³ | |
| | Shade for door D1<br>- top member | 1 | 1.00 | 0.60 | $\frac{0.10+0.05}{2}$ | 0.045 m³ | |
| | Vertical member | 2 | 0.05 | 0.60 | 0.50 | 0.03 m³ | |
| | Door - D2 | 1 | 0.90 | 0.60 | 0.075 | 0.04 m³ | |
| | Vertical member | 2 | 0.05 | 0.60 | 0.50 | 0.03 m³ | |
| | Windows - W1 | | | | | | |
| | Top member | 2x1 | 1.00 | 0.60 | 0.075 | 0.09 m³ | |
| | Vertical member | 2x2 | 0.05 | 0.60 | 0.50 | 0.06 m³ | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Windows - W2 | | | | | | |
| | Top members | 3x1 | 1.95 | 0.60 | 0.075 | 0.19 $m^3$ | |
| | Vertical member | 3x2 | 0.05 | 0.60 | 0.50 | 0.09 $m^3$ | |
| | Windows - W3 | | | | | | |
| | Top members | 1x1 | 1.90 | 0.60 | 0.075 | 0.085 $m^3$ | |
| | Vertical member | 1x2 | 0.05 | 0.60 | 0.50 | 0.03 $m^3$ | |
| | Kitchen slab | 1 | 2.00 | 0.70 | 0.10 | 0.14 $m^3$ | |
| | Shelf slab | 1x4 | 2.10 | 0.50 | 0.05 | 0.21 $m^3$ | |
| | | | | | Total | 9.25 $m^3$ | |
| 8 | Providing steel reinforcement for RCC works including labour chages for bending tying and placing in position etc. complete. | | 9.25 $m^3$@0.8% $m^3$<br>$9.25 \times \frac{0.80}{100} = 0.074\ m^3$<br>= 0.074 x 7850<br>= 580.9 kg | | | | Sp. wt. of steel is 7850 kg/$m^3$ |
| 9 | Supplying and fixing sal wood frames for doors, windows and ventilations | | | | | 5.809 qtl | |
| | Doors D1 (Front door) vertical member | 1x2 | 2.00 | 0.12 | 0.09 | 0.043 $m^3$ | |
| | Horizontal member | 1x2 | 1.10 | 0.12 | 0.09 | 0.023 $m^3$ | |
| | D1 (inside) | | | | | | |
| | Vertical members | 1x2 | 2.05 | 0.12 | 0.09 | 0.044 $m^3$ | |
| | Horizontal members | 1x1 | 1.1 | 0.12 | 0.09 | 0.0118 $m^3$ | |
| | Door - D2 : | | | | | | |
| | D2 (Back door) | | | | | | |
| | Vertical members | 1x2 | 2.00 | 0.12 | 0.090 | 0.0432 $m^3$ | Take horn projection = 10cm and extra 5cm for vertical member which is inserted in the floor. |
| | Horizontal member | 1x2 | 1.00 | 0.12 | 0.09 | 0.0211 $m^3$ | |
| | D2 - (inside door) | | | | | | |
| | Vertical member | 2x2 | 2.05 | 0.12 | 0.09 | 0.0885 $m^3$ | |
| | Horizontal member | 2x1 | 1.00 | 0.12 | 0.09 | 0.0216 $m^3$ | |
| | Windows : | | | | | | |
| | W1 - Vertical member | 2x3 | 1.20 | 0.10 | 0.07 | 0.0504 $m^3$ | |
| | - Horizontal member | 2x2 | 1.10 | 0.10 | 0.07 | 0.0308 $m^3$ | |
| | W2 - Vertical member | 3x4 | 1.20 | 0.10 | 0.07 | 0.1008 $m^3$ | |
| | - Horizontal member | 3x2 | 1.55 | 0.10 | 0.07 | 0.0651 $m^3$ | |
| | W3 - Vertical member | 1x5 | 1.20 | 0.10 | 0.07 | 0.042 $m^3$ | |
| | - Horizontal member | 1x2 | 2.00 | 0.10 | 0.07 | 0.028 $m^3$ | |
| | Ventilator - Vertical | 1x3 | 0.60 | 0.10 | 0.07 | 0.0126 $m^3$ | |
| | - Horizontal | 1x2 | 1.10 | 0.10 | 0.07 | 0.0154 $m^3$ | |
| | | | | Total | | 0.6412 $m^3$ | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 | Supplying and fixing teak wood fully panelled shutters to suite the door frames already fixed inclusive of labour charges for fixing all fittings but exclusive of cost of fittings etc. complete | | | | | | L = 0.90 - 2 x frame thickness + 2 rebate |
| | Door D1 (front) | 1 | 0.75 | - | 1.85 | 1.387 $m^2$ | L = 0.90 - (2 x 0.09) + (2 x 0.015) = 0.75 m |
| | Door D1 (inside) | 1 | 0.75 | - | 1.915 | 1.936 $m^2$ | H = 2.00 - (1 x 0.09) + (1 x 0.015) - (1 x 0.01) |
| | D2 (backside) | 1 | 0.65 | - | 1.85 | 1.202 $m^2$ | = 1.915 m |
| | D2 (inside) | 2 | 0.65 | - | 1.915 | 2.489 $m^2$ | H = 2.00-(2x0.09) + (2x0.015) |
| | | | | Total | | 6.515 sq.m | = 1.85 m |
| 11 | Supplying and fixing teak wood fully grazed shutter to suite the frames of window and ventilations already fixed inclusive of labour charges for fixing all fittings but exclusive of cost of fitting etc. complete | | | | | | Frame of window (10 x 7) cm<br>Rebate 1.5 cm |
| | Window w1 | 2x1 | 0.75 | - | 1.09 | 1.635 $m^2$ | L = 0.90 - (3 x 0.07) + (4 x 0.015) = 0.750m |
| | w2 | 3x1 | 1.16 | - | 1.09 | 3.793 $m^2$ | h = 1.20 - (2 x 0.07) + (2 x 0.015) = 1.09 m |
| | w3 | 1x1 | 1.57 | - | 1.09 | 1.711 $m^2$ | L = 1.35 - (4 x 0.07) + (6 x 0.015) = 1.16 m |
| | Ventilator | 1x1 | 0.75 | - | 0.49 | 0.368 $m^2$ | L = 1.80 - (5 x 0.07) + (8 x 0.015) = 1.57 m |
| | | | | | Total | 7.507 $m^2$ | h = 0.60 + (2 x 0.07) + (2 x 0.015) = 0.49 m |
| 12 | Plastering with cement mortar 1:3,12 mm thick one coat | | | | | | |
| | Ceiling : | | | | | | |
| | i Living room | 1 | 4.00 | 5.00 | - | 20 $m^2$ | |
| | ii Bedroom | 1 | 4.00 | 3.00 | - | 12 $m^2$ | |
| | iii Kitchen | 1 | 2.60 | 1.80 | - | 4.68 $m^2$ | |
| | iv Toilet | 1 | 1.20 | 1.80 | - | 2.16 $m^2$ | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Roof projection:- | | | | | | |
| | i Front and back | 2 | 9.80 | 1.32 | - | 25.87 m² | L= 8.60 + (2 x 0.60) = 9.80 m |
| | ii sides | 2 | 5.40 | 1.32 | - | 14.25 m² | b = ( 2 x 0.6 ) + 0.12 =1.32 m |
| | Sunshades : | | | | | | |
| | Door - D1 | | | | | | |
| | Horizotal | 1 | 1.00 | 1.25 | - | 1.25 m² | |
| | Vertical | 2 | 0.50 | 1.25 | - | 1.25 m² | |
| | D2 | | | | | | |
| | Horizotal | 1 | 0.90 | 1.25 | - | 1.125 m² | |
| | Vertical | 2 | 0.50 | 1.25 | - | 1.25 m² | |
| | Windows - W1 | | | | | | |
| | Horizotal | 2x1 | 1.00 | 1.25 | - | 2.5 m² | |
| | Vertical | 2x2 | 0.50 | 1.25 | - | 2.5 m² | |
| | W2 | | | | | | |
| | Horizotal | 3x1 | 1.45 | 1.25 | - | 5.437 m² | |
| | Vertical | 3x2 | 0.50 | 1.25 | - | 3.75 m² | |
| | W3 | | | | | | |
| | Horizotal | 1x1 | 1.90 | 1.25 | - | 2.375 m² | |
| | Vertical | 1x2 | 0.50 | 1.25 | - | 1.25 m² | |
| | Kitchen slab | 1 | 1.80 | 1.30 | - | 2.34 m² | |
| | Shelf slab | 4 | 1.90 | 0.85 | - | 6.46 m² | |
| | | | | | Total | 110.43 m² | |
| 13 | Plastering with cement mortar 1:4, 12 mm thick 1 coat to inside and outside walls floated hard and trovelled smooth including watering curing. cost and conveyance of all materials to sight and labour charges etc. complete. | | | | | | |
| | i) Inside | | | | | | |
| | Living room | 1 | 18.00 | - | 3.00 | 54 m² | L = Perimeter of room |
| | Bedroom | 1 | 14.00 | - | 3.00 | 42 m² | |
| | Kitchen | 1 | 8.80 | - | 3.00 | 26.4 m² | |
| | Toilet | 1 | 6.00 | - | 3.00 | 18.00 m² | L= 0.4 + 0.1 + 0.4 |
| | Sides of shelf | 1 | 0.90 | - | 3.00 | 2.7 m² | = 0.9 m |
| | | | | | Total | 143.1 m² | Inside plastering |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | ii) Outside | 1 | 28.00 | | 3.00 | 84.00 $m^2$ | L = (8.6x2) + (5.4x2) = 28.00 m |
| | Parapet : | | | | | | |
| | Front & back wall | 2 | 8.60 | - | 1.20 | 20.64 $m^2$ | |
| | Side wall | 2 | 5.00 | - | 1.20 | 12.00 $m^2$ | |
| | Step (Front) : | | | | | | |
| | Front portion | 1 | 1.30 | - | 0.45 | 0.580 $m^2$ | |
| | Side | | | | | | |
| | 1st step | 2 | 0.75 | - | 0.15 | 0.225 $m^2$ | |
| | 2nd step | 2 | 0.50 | - | 0.15 | 0.15 $m^2$ | |
| | 3rd step | 2 | 0.25 | - | 0.15 | 0.075 $m^2$ | |
| | Step back | | | | | | |
| | Front portion | 1 | 1.30 | - | 0.45 | 0.583 $m^2$ | |
| | Side | | | | | | |
| | 1st step | 2 | 0.50 | - | 0.15 | 0.15 $m^2$ | |
| | 2nd step | 2 | 0.25 | - | 0.15 | 0.075 $m^2$ | |
| | | | | | Total | 118.485 $m^2$ | Outside plastering |
| | Grand total (inside and outside plastering) | | | | | 261.28 $m^2$ | |
| | Deduction | | | | | | |
| | Door - D1 | 2 | 0.90 | - | 2.00 | 3.6 $m^2$ | Deduct only one face |
| | D2 | 3 | 0.80 | - | 2.00 | 4.8 $m^2$ | |
| | Window - w1 | 2 | 0.90 | - | 1.20 | 2.16 $m^2$ | |
| | w2 | 3 | 1.35 | - | 1.20 | 4.86 $m^2$ | |
| | w3 | 1 | 1.80 | - | 1.20 | 2.16 $m^2$ | |
| | Ventilator - V | 1 | 0.90 | - | 0.60 | 0.54 $m^2$ | |
| | Total deduction | | | | | 18.12 $m^2$ | |
| | Net quantity | | | | | 243.16 $m^2$ | |
| 14 | Pointing random rubble masonry with cement mortar 1:3 | | | | | | |
| | Basement | 1 | 28.40 | - | 0.45 | 12.87 $m^2$ | |
| | Deduction steps | 2 | 1.30 | - | 0.45 | 1.17 $m^2$ | L = (8.70x2)+(5.50x2) = 28.40 m |
| | Net quantity | | | | | 11.70 $m^2$ | |
| 15 | Flooring with cement concrete 1:4:8 (1 part cement, 4 parts sand 8 parts broken stone 40 mm nominal size) 10 cm thick including watering, curing, cost & conveyance of all material to site all labour charges etc. complete | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Living room : | 1 | 3.90 | 4.90 | - | 19.11 $m^2$ | Plinth offset 5 cm |
| | Bedroom | 1 | 3.90 | 2.90 | - | 11.31 $m^2$ | L= 4.00-(2x0.05)=3.90 m |
| | Kitchen | 1 | 2.50 | 1.70 | - | 4.25 $m^2$ | L= 5.00-(2x0.05)=4.90 m |
| | Toilet | 1 | 1.10 | 1.70 | - | 1.87 $m^2$ | L= 2.60-(2x0.05)=2.50 m |
| | | | Total | | | 36.54 $m^2$ | L= 3.00-(2x0.05)=2.90 m |
| 16 | Flooring with vitrified tiles (60x60) cm size of approved quality including pointing, skirting, cost and conveyance of all materials to site and all labour charges etc. complete | | | | | | L= 1.80-(2x0.05)=1.70 m |
| | i Living room: | | | | | | |
| | Floor | 1 | 4.00 | 5.00 | - | 20.00 $m^2$ | |
| | Skirting | 1 | 18.00 | - | 0.10 | 1.80 $m^2$ | |
| | ii Bedroom: | | | | | | |
| | Floor | 1 | 4.00 | 3.00 | - | 12.00 $m^2$ | |
| | Skirting | 1 | 14.00 | - | 0.10 | 1.40 $m^2$ | |
| | | | | | Total | 35.20 $m^2$ | |
| 17 | Flooring with ceramic tiles of approved quality with size 30 x 30 cm including pointing, skirting, cost and conveyance of all material to site, all labours charges etc. complete. | | | | | | |
| | Kitchen | | | | | | |
| | Floor | 1 | 2.60 | 1.80 | - | 4.68 $m^2$ | |
| | skirting | 1 | 8.80 | - | 0.10 | 0.88 $m^2$ | |
| | | | | | Total | 5.56 $m^2$ | |
| 18 | Dado in the walls of toilet with white glazed tiles over 12 mm thick cement mortar 1:3 including pointing cost and conveyance of all materials to site all labour charges etc. complete | | | | | | |
| | Toilet | | | | | | |
| | Floor | 1 | 1.20 | 1.80 | - | 2.16 $m^2$ | (1.80+1.20)2 - (1x0.80) + (2x0.2)=5.60m |
| | Wall | 1 | 5.60 | - | 1.50 | 8.40 $m^2$ | |
| | | | | | Total | 10.56 $m^2$ | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 19 | White cement washing 2 coats to the surface of slab, shade, walls, etc. adding necessary adhesives, cleaning the surface including cost and conveyance of all material to site, all labour charges etc. complete | | | | | | |
| | Ceiling | Same as in item (12) plastering with cement mortor 1:3 | | | | 110.43 m² | |
| | Walls | Same as item (13) plastering with cement mortor 1:4 | | | | 243.16 m² | |
| | | | | | Total | 344.59 sq.m | |
| 20 | Painting walls with emulsion paint two coats over coat of primer and & two coats of putty after rubbing with sand paper and cleaning the surface including cost and conveyance of all materials to site all labour charges etc. complete. | Same as item (13) plastering with cement mortor 1:4 | | | | 243.16 m² | |
| 21 | Painting on new wood work 2 coats over one coat of priming | | | | | | |
| | Door - D1 | 2x2.25 | 0.90 | - | 2.00 | 8.10 m² | 2.25 times one surface for both sides. |
| | D2 | 3x2.25 | 0.80 | - | 2.00 | 10.80 m² | |
| | Windows - w1 | 2x1 | 0.90 | - | 1.20 | 2.16 m² | One surface for both sides. |
| | w2 | 3x1 | 1.35 | - | 1.20 | 4.86 m² | |
| | w3 | 1x1 | 1.80 | - | 1.20 | 2.16 m² | |
| | Ventilator | 1x1 | 0.90 | - | 0.60 | 0.54 m² | |
| | Iron bars for windows | | | | | | |
| | Window - w1 | 2x1 | 0.69 | - | 1.06 | 1.46 m² | Excluding frame, one flat area for overall |
| | w2 | 3x1 | 1.07 | - | 1.06 | 3.40 m² | |
| | w3 | 1x1 | 1.45 | - | 1.06 | 1.53 m² | |
| | Ventilator | 1x1 | 0.69 | - | 0.46 | 0.31 m² | |
| | | | | | Total | 35.32 m² | |
| 22 | Iron work (mild steel) in hold fast and window gratings. | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Hold fast in door | 5x6 | | | | 30 nos | |
| | in windows | 6x4 | | | | 24 nos | |
| | | | 54 nos @ 1 kg/each | | | 54 nos | |
| | | | | | | 54 kg | |
| | Windows bars 16 mm dia @ 1.58 kg/m | | | | | | |
| | w1 - window | 2x10 | 0.90 | - | - | 118 m | |
| | w2 - window | 3x10 | 1.35 | - | - | 40.5 m | |
| | w3 - window | 1x10 | 1.80 | - | - | 18 m | |
| | Ventilator | 1x4 | 0.90 | - | - | 3.6 m | |
| | Total | 80.1 m @ 1.58 kg/m | | | | 80.1 m | |
| | | | = 126.588 kg | | | 126.586 kg | |
| | Grand total | | | | | 180.588 m | |
| | | | | | | 1.80 qt | |

— — — — — — — —

TASK 2 : **Prepare the estimate of given building by centre line method**

**Centre line method**

Actual centre line length = total centre line length-

Where n = No. of functions

b = Breadth of that work

Total centre line length = (0.10+4+0.20+4+3.6+0.10)2+(0.10+5.10)3+4.2+2

= 38.6 m

Actual C/L Length for earthwork excavation =

$38.6 - 6 \times \frac{0.80}{2} = 36.2$ m

Actual C/L Length for pcc = $38.6-6\times\frac{0.80}{2} = 36.2$ m

Actual C/L Length for foundation=$38.6-6\times\frac{0.40}{2} = 37.4$m

Actual C/L length for Plinth = $38.6 - 6 \times \frac{0.30}{2} = 37.7$ m

Actual C/L Length for DPC = $38.60 - 3 \times \frac{0.30}{2} = 37.7$ m

Actual C/L Length for Brick Masonry=$38.60 - 6 \times \frac{0.20}{2}$

= 38 m

Actual C/L Length for parapet wall = $27.2 \times 6 \times \frac{0.20}{2}$

= 27.2 m

| Item | Description of item | No. | Length | Breadth | Height | Quantity |
|---|---|---|---|---|---|---|
| 1 | Site of clearing and leveling | | | | | L.S |
| 2 | Earth work excavation in all class of soil (except in hard rock and medium rock requiring blasting) and depositing on bank with initial lead upto 30m and lift upto1.5m including back filling breaking clots watering, ramming sectioning of spoil bank etc. complete for foundation. | | | | | |
| | Foundation | 1 | 36.20 | 0.80 | 0.80 | 23.16 $m^3$ |
| | Step | 1 | 1.70 | 0.90 | 0.20 | 0.306 $m^3$ |
| | Step back | 1 | 1.70 | 0.65 | 0.20 | 0.221 $m^3$ |
| | | | | | Total | 23.69 $m^3$ |
| 3 | Plain cement concrete 1:4:8 (1 part cement, 4 part sand, 8 part of broken stone 40mm nominal size) including cost and conveyance of all materials to site and all labour charges consolidation watering curing consideration etc. complete | | | | | |
| | Foundation | 1 | 36.20 | 0.80 | 0.20 | 5.792 $m^3$ |
| | Step | 1 | 1.70 | 0.90 | 0.20 | 0.30 $m^3$ |
| | Step back | 1 | 1.70 | 0.65 | 0.20 | 0.221 $m^3$ |
| | | | | | Total | 6.31 $m^3$ |
| 4 | RR masonry in cement mortar 1:6 (1 part cement and 6 part sand) including cost and conveyance of all labour charges watering curing etc. Complete for foundation and plinth. | | | | | |
| | Foundation | 1 | 37.40 | 0.40 | 0.60 | 8.976 $m^3$ |
| | Plinth | 1 | 37.70 | 0.30 | 0.45 | 5.089 $m^3$ |
| | | | | | Total | 14.065 $m^3$ |
| 5 | DPC 2.5 cm thick cm 1:3 | 1 | 37.70 | 0.3 | - | 11.31 $m^2$ |
| | Deduction | | | | | |
| | Door - D1 | 2 | 0.90 | 0.30 | - | 0.54 $m^2$ |
| | Door - D2 | 3 | 0.80 | 0.30 | - | 0.72 $m^2$ |
| | Total deduction | | | | | 1.26 $m^2$ |
| | Net quantity | | | | | 10.05 $m^2$ |
| 6 | Brick masonry in cm 1:6 (1 part cement, 6 part sand) of size (20x10x10) cm for wall including cost and conveyance of all materials to site scaffolding charges and all other labour charges, watering, curing etc. complete. | 1 | 38.00 | 0.20 | 3.00 | 22.80 $m^3$ |
| | Side shelf | 1 | 0.40 | 0.20 | 3.00 | 0.24 $m^3$ |
| | Parapet wall | 1 | 27.20 | 0.20 | 0.50 | 2.72 $m^3$ |
| | Step - Front | | | | | |
| | 1st step | 1 | 1.3 | 0.75 | 0.15 | 0.14 $m^3$ |
| | 2nd step | 1 | 1.3 | 0.50 | 0.15 | 0.09 $m^3$ |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 3rd step | 1 | 1.3 | 0.25 | 0.15 | 0.04 $m^3$ |
| | Step - Back | | | | | |
| | 1st step | 1 | 1.3 | 0.50 | 0.15 | 0.09 $m^3$ |
| | 2nd step | 1 | 1.3 | 0.25 | 0.15 | 0.04 $m^3$ |
| | | | | | Total | 26.16 $m^3$ |
| | Deduction | | | | | |
| | Door - D1 | 2 | 0.90 | 0.20 | 2.00 | 0.72 $m^3$ |
| | D2 | 3 | 0.80 | 0.20 | 2.00 | 0.96 $m^3$ |
| | Window - w1 | 2 | 0.90 | 0.20 | 1.20 | 0.43 $m^3$ |
| | Window - w2 | 3 | 1.35 | 0.20 | 1.20 | 0.97 $m^3$ |
| | Window - w3 | 1 | 1.80 | 0.20 | 1.20 | 0.43 $m^3$ |
| | Ventilator - v | 1 | 0.90 | 0.20 | 0.60 | 0.108 $m^3$ |
| | Lintel | | | | | |
| | Door - D1 | 2 | 1.20 | 0.20 | 0.15 | 0.072 $m^3$ |
| | Door - D2 | 3 | 1.10 | 0.20 | 0.15 | 0.099 $m^3$ |
| | Window - w1 | 2 | 1.20 | 0.20 | 0.15 | 0.072 $m^3$ |
| | Window - w2 | 3 | 1.65 | 0.20 | 0.15 | 0.148 $m^3$ |
| | Window - w3 | 1 | 2.10 | 0.20 | 0.15 | 0.063 $m^3$ |
| | Ventilator - v | 1 | 1.20 | 0.20 | 0.15 | 0.036 $m^3$ |
| | Total deduction | | | | | 4.07 $m^3$ |
| | Net quantity | | | | | 22.09 $m^3$ |

## Estimation of double storied building

**Objectives:** At the end of this exercise you shall be able to
- **prepare detailed estimate of a double storied building**
- **prepare the abstract of the same building using CPWD rates.**

### DATA

- Given ground floor plan
- Given first floor plan
- Given sectional elevation
- Given specification

TASK 1: **Prepare the detailed estimate of double storied residential building consisting two quarters in each storey from the given drawing and general specification. Prepare the estimate of ground and first floor. (Fig 1 & 2)**

**Double storeyed building**

**Example 1**

Prepare a detailed estimate of double storeyed residential building consisting four two-roomed quarters (two quarters in each storey) from the given drawings figs. 1 and 2 and general specifications. The estimate of ground floor and first floor should be prepared separetely. The estimate of the Mumty room (staircase room in the 2nd floor) should be included in the estimate of the first floor. Assume suitable rates. Workout also plinth area rates of the building.

**General specifications**

**Foundation and Plinth:** Foundation concrete shall be of lime concrete with over burnt brick ballast. Foundation and plinth masonry shall be of first class brickwork in lime mortar.

Damp of Proof Course-D.P.C shall be provided at the plinth level with 2.5 cm thick layer of C.C of cement coarse sand and stone chips in the production of 1: $1\frac{1}{2}$ :3 mixed with standard water proofing compound.

**Superstructure:** 30cm thick walls of the main rooms in ground floor shall be of first class brick work in lime mortar. All 20cm thick walls in ground floor and first floor shall be first class brickwork with 1:6 cement local sand mortar. 10cm partition walls shall be first class brickwork with 1:3 cement coarse sand mortar with hoop iron or equivalent reinforcement every fourth layer.

**Roof and Floor**: Floor of ground floor shall be of 2.5cm C.C.1:2:4 over 7.5cm lime concrete. Floor of first floor shall be 2.5cm C.C.1:2:4 over R.C.C. slab. Roof of first floor shall be 7.5cm lime concrete terracing over R.C.C. slab. All R.C.C. slab be of C.C.1:2:4 of cement, coarse sand, stone chips, reinforced with 1% reinforcement.

**Door and Window**: Door and window chowkhats shall be of sal wood of 10cmx7.5cm in section. All door and window shutters shall be 3cm thick pannelled of Deodar wood. Mumty room window shall be fully glazed with 3cm thick Deodar wood. 4cm R.C.C. Jalli shall be provided over bath and W.C. doors over Mumty room glazed windows for ventilation. All windows shall be provided with 20mm dia bars. Iron hold fasts shall be provided for fixing doors and windows chowkhats.

**Plastering**: All walls shall be plastered with 12mm thick 1:6 cement local sand mortar. Ceiling and underside of R.C.C. work shall be finished with 6mm thick 1:3 cement and medium sand mortar. All inside wall shall be provided with 20cm high skirting with 12mm thick 1:3 cement coarse sand mortar, neat cement finished. Dado of 12mm thick cement coarse sand 1:3 mortar neat cement finished shall be provided in kitchen and W.C. up to 50 cm height and in bathroom upto 100 cm height. Steps shall be provided with 20mm thick plaster with 1:3 cement coarse sand mortar neat cement finished.

**Painting, white washing and colour washing:** All doors and windows shall be painted two coats over one coat of priming. Back of chowhats shall be painted with two coats of coaltar. Inside walls, ceiling, undersides of sunshades shall be white washed three coats. Outside shall be colour washed two coats over one coat of white washing.

**Rain water pipes**: 6 numbers 100mm dia. A.C. rain water down pipes shall be provided.

**Electrification, water supply and sanitary works:** Provision for internal electrification, water supply and sanitary works shall be provided on percentage basis and windows shall be painted two coats over one coat of priming. Back of chowhats shall be painted with two coats of coaltar. Inside walls, ceiling, undersides of sunshades shall be white washed three coats. Outside shall be colour washed two coats over one coat of white washing.

**Rain water pipes**: 6 numbers 100mm dia. A.C. rain water down pipes shall be provided.

**Electrification, water supply and sanitary works:** Provision for internal electrification, water supply and sanitary works shall be provided on percentage basis.

**Ground floor centre to centre length of walls**

**Main rooms**

Back long walls of all rooms including stair case room C. to C length

= 2 (3.50 + 3.00) + 2.30 + 4 x 30 + 30/2 +.30/2 = 16.80m

Front long wall of bed and living room on one side of stair case room C to C length

= 3.50 + 3.00 + 30 +.30/2 +.30/2 = 7.10m

Cross or short wall C. to C length

= 3.50 + 0.30/2 + 0.30/2 = 3.80m

**Front Verandah**

Study room, front long wall C to C length

= 3.70 + 0.20/2 + 0.20/2 = 3.90m

Study room cross or short wall C to C length

= 2.00 + 0.30/2 + 0.20/2 = 2.25m

Verandah wall in between study rooms C to C length
= 8.90 + 0.20/2 + 0.20/2 = 9.10m

**Back Verandah**

Kitchen, back wall C to C length

= 2.50 + 0.20/0.20/2 = 2.70m

Kitchen, cross or short wall C to C length

= 2.50 +. 30/2 + 0.20/2 = 2.75m

Bath and W.C. two sets combined, back long wall C to C length

= 2 x 1.20 + 0.20 + 2 x 0.20/2 = 2.80m

Bath and W.C cross or short wall C to C length

= 1.40 + 1.00 + 10 + 0.30/2 + 0.20/2 = 2.75m

Verandah wall in between kitchen and W.C. C to C length

= 4.15 + 0.10 + 0.10 + 0.10 = 4.45m

**First floor centre to centre length of walls**

**Main Rooms**

Back long wall of all rooms including stair case room C to C length

= (3.70 + 3.10) X 2 + 2.30 + (4x20) +.20/2 + 0.20/2 = 16.90m

Front long wall of bed and living room on one side of staircase room C to C length

= (3.70 + 3.10) + 0.20 + 2 x 0.20/2 = 7.20m

Cross or short walls C to C length

= 3.70 + 2 x 0.20/2 = 3.90m

**Front Verandah**

Study room - Front long wall C to C length

= 3.70 + 2 x 0.20/2 = 3.90m

Study room - Cross or short wall C to C length

= 2.00 + 2 x 0.20/2 = 2.20m

Verandah wall in between study rooms C to C length

= 3.10 + 2.30 + 3.10 + 2 x 0.20 + 2 x 0.20/2 = 9.10m

**Back Verandah**

Kitchen - Back wall C to C length

= 2.50 + 2 x 0.20/2 = 2.70m

Kitchen - Cross or short wall C to C length

= 2.50 + 2 x 0.20/2 = 2.70m

Bath and W.C. - Two sets combined, back wall C to C length

= 1.20 + 1.20 + 0.20 + 2 x 0.20/2 = 2.80m

Bath and W.C. cross walls C to C length

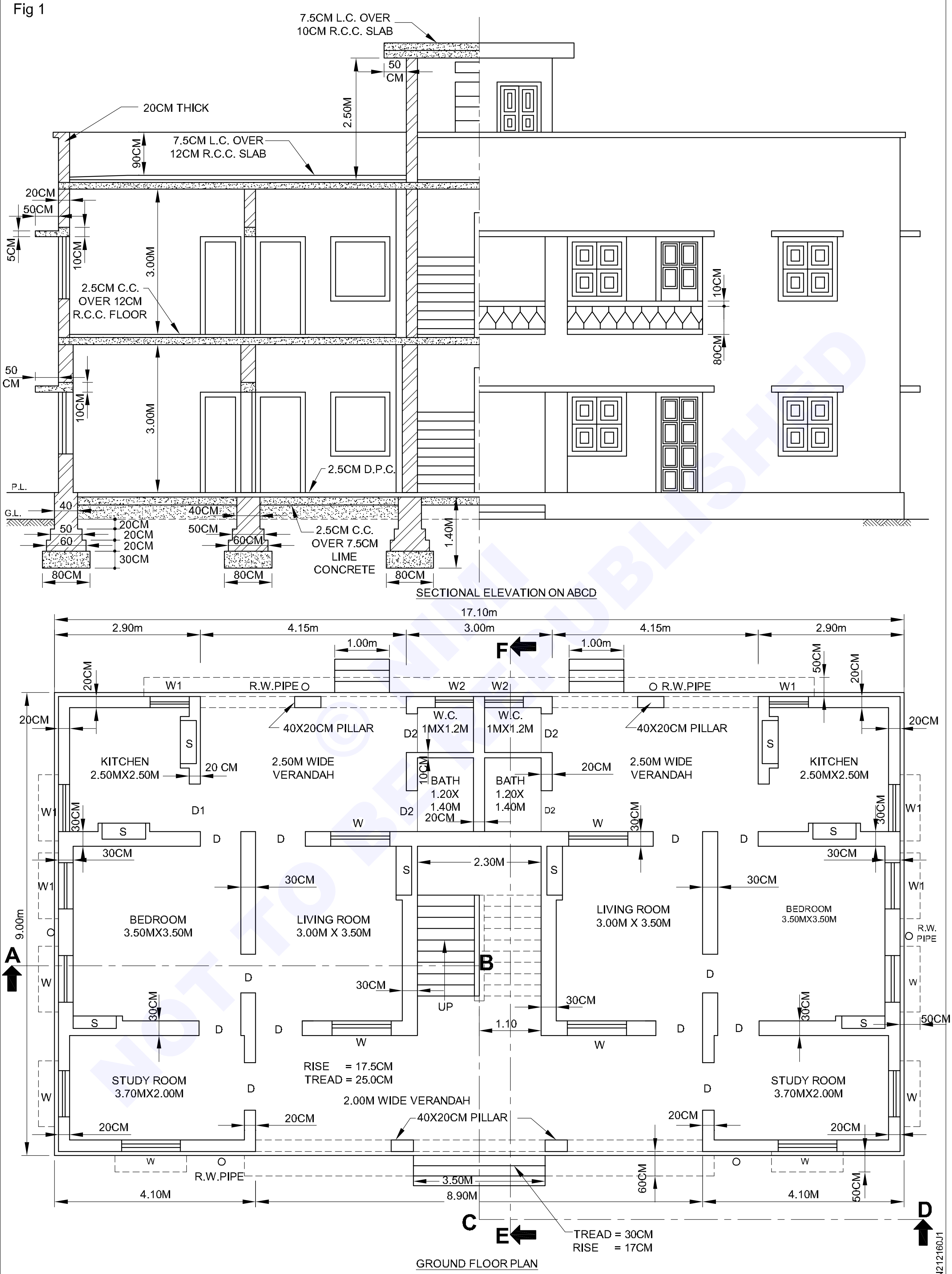
= 1.40 + 1.00 + 0.10 + 2 x 0.20/2 = 2.70m.

Verandah wall in between kitchen and W.C.C to C length

= 4.15 + 2 x 0.20/2 = 4.35m

The estimate has been prepared sub-head wise storey by storey, first the ground floor and then the first floor.

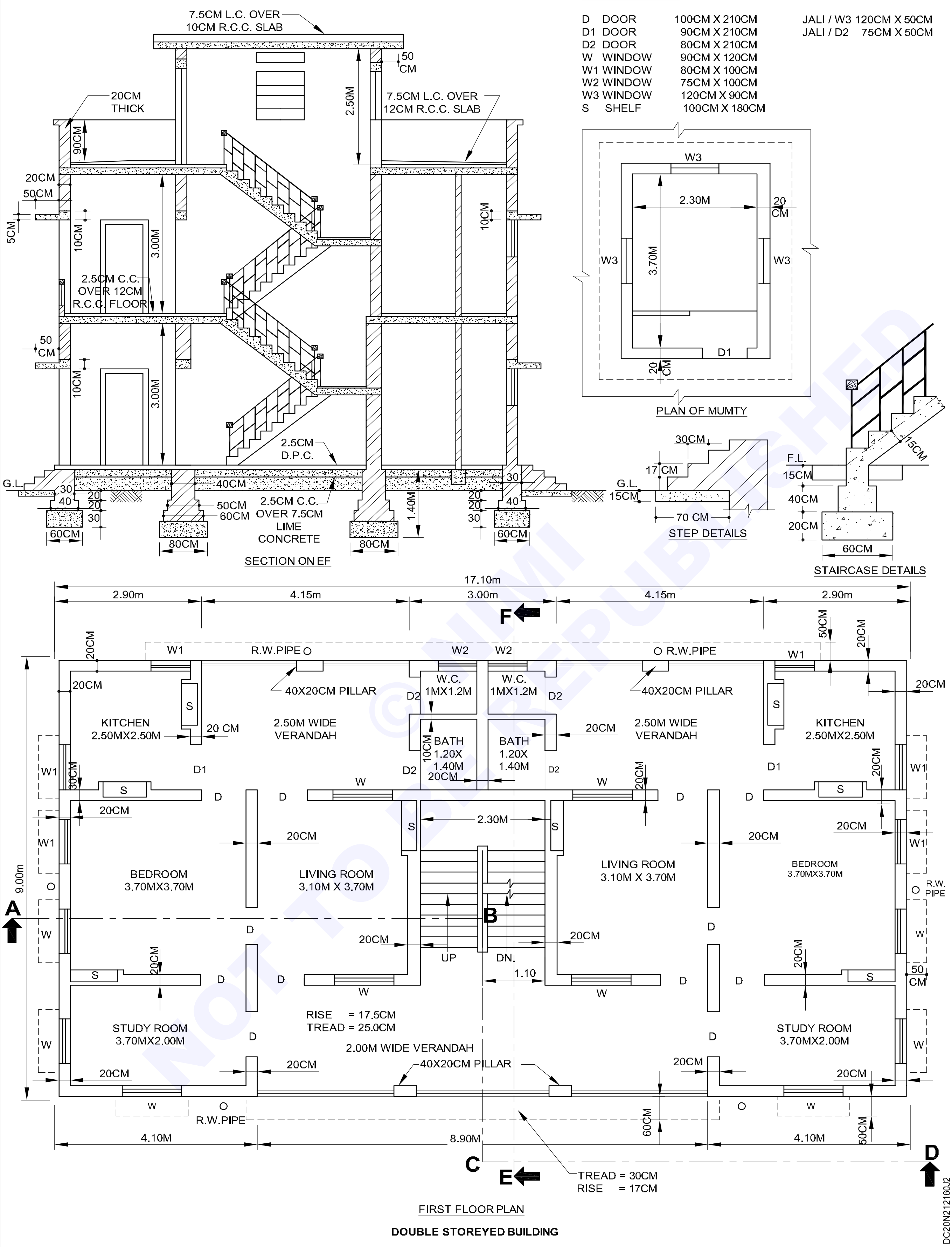
Fig 1




DOUBLE STOREYED BUILDING

DC20N21216OJ1

Fig 2


JOINERY DETAILS
D DOOR 100CM X 210CM
D1 DOOR 90CM X 210CM
D2 DOOR 80CM X 210CM
W WINDOW 90CM X 120CM
W1 WINDOW 80CM X 100CM
W2 WINDOW 75CM X 100CM
W3 WINDOW 120CM X 90CM
S SHELF 100CM X 180CM
JALI / W3 120CM X 50CM
JALI / D2 75CM X 50CM
7.5CM L.C. OVER 10CM R.C.C. SLAB
20CM THICK
7.5CM L.C. OVER 12CM R.C.C. SLAB
2.50M
90CM
50 CM
20CM
50CM
5CM
10CM
3.00M
2.5CM C.C. OVER 12CM R.C.C. FLOOR
2.5CM D.P.C.
G.L.
40CM
50CM
60CM
2.5CM C.C. OVER 7.5CM LIME CONCRETE
1.40M
60CM
80CM
SECTION ON EF
PLAN OF MUMTY
2.30M
3.70M
20 CM
W3
D1
30CM
17 CM
15CM
70 CM
STEP DETAILS
F.L.
15CM
40CM
20CM
60CM
STAIRCASE DETAILS
17.10m
2.90m
4.15m
3.00m
4.15m
2.90m
F
R.W.PIPE
W1
W2
40X20CM PILLAR
W.C. 1MX1.2M
BATH 1.20X 1.40M
KITCHEN 2.50MX2.50M
2.50M WIDE VERANDAH
BEDROOM 3.70MX3.70M
LIVING ROOM 3.10M X 3.70M
STUDY ROOM 3.70MX2.00M
UP
DN
1.10
B
A
9.00m
RISE = 17.5CM
TREAD = 25.0CM
2.00M WIDE VERANDAH
4.10M
8.90M
C
D
E
TREAD = 30CM
RISE = 17CM
FIRST FLOOR PLAN
DOUBLE STOREYED BUILDING
DC20N21216OJ2

**Ground floor**

**Details of measurement and Calculation of quantities**

| Item No. | Particulars and items of works | No. | Length m | Breadth m | Height or depth m | Quantity | Explanatory notes |
|---|---|---|---|---|---|---|---|
| | **I. Earthwork** | | | | | | |
| 1 | Site clearance and setting out | 1 | - | - | - | 1 Job | |
| | Earthwork in excavation in foundation Main rooms back long wall full length, length end to end, | 1 | 17.60 | 0.80 | 0.90 | 12.67$m^3$ | L = 16.80+0 .80=17.60 m |
| | Front long walls of bed and living rooms | 2 | 7.90 | 0.80 | 0.90 | 11.38$m^3$ | L = 7.10+0.80=7.90 m |
| | Cross or short walls | 6 | 3.00 | 0.80 | 0.90 | 12.96$m^3$ | L = 3.80-0.80=3.00 m |
| | Study rooms - | | | | | | |
| | Front walls (long) | 2 | 4.50 | 0.60 | 0.60 | 3.24$m^3$ | L=3.90+0.60=4.50 m |
| | Cross walls (short) | 4 | 1.55 | 0.60 | 0.60 | 2.23$m^3$ | L=2.25-0.60/2 - 0.80/2 = 1.55m |
| | Kitchen - | | | | | | |
| | Back walls (long) | 2 | 3.30 | 0.60 | 0.60 | 2.38$m^3$ | L= 2.70 + 0.60=3.30 m |
| | Cross walls (short). | 4 | 2.05 | 0.60 | 0.60 | 2.95$m^3$ | L= 2.75 - 0.60/2 - 0.80/2 = 2.05 m |
| | Bath and W.C - | | | | | | |
| | Back wall (long) | 1 | 3.40 | 0.60 | 0.60 | 1.22$m^3$ | L = 2.80 + 0.60 = 3.40 m |
| | Cross wall (Short) | 3 | 2.05 | 0.60 | 0.60 | 2.21$m^3$ | L = 2.75 - 0.60/2 - 0.80/2 = 2.05 m |
| | Verandah pillars | 4 | 0.80 | 0.60 | 0.60 | 1.15$m^3$ | Foundation 80x60 m |
| | Front ver, pillars dwarf wall sum total length | 1 | 6.90 | 0.40 | 0.40 | 1.10$m^3$ | L=9.10-2 x 0.60/2 - two pillars = 9.10 - 0.60 2 x 0.80 = 6.90 m |
| | Back verandah plinth dwarf walls | 2 | 2.95 | 0.40 | 0.40 | 0.94$m^3$ | L=4.35-2x.60/2- one pillar = 4.35-.60-.80= 2.95 m |
| | Staircase base | 1 | 1.10 | 0.60 | 0.70 | 0.46$m^3$ | |
| | Step front | 1 | 2.50 | 0.70 | 0.25 | 0.44$m^3$ | L=2.30+.10+.10=2.50 m |
| | Step back | 2 | 1.20 | 0.70 | 0.25 | 0.42$m^3$ | L= 1.00 +.10+.10=1.20 m |
| | | | | | Total | 55.75$m^3$ | |
| 2 | **Earthwork in filling** in plinth bedrooms | 2 | 3.40 | 3.40 | 0.425 | 9.82$m^3$ | Ht.=50-7.5=42.5 cm = 0.425 m |
| | Living rooms | 2 | 2.90 | 3.40 | 0.425 | 8.38$m^3$ | |
| | Study rooms | 2 | 3.60 | 1.90 | 0.425 | 5.81$m^3$ | |
| | Kitchen | 2 | 2.40 | 2.40 | 0.425 | 4.90$m^3$ | |
| | Bath and W.C | 2 | 1.10 | 2.40 | 0.425 | 2.24$m^3$ | |
| | Verandah front | 1 | 8.80 | 1.90 | 0.425 | 7.11$m^3$ | |
| | Verandah back | 2 | 4.05 | 2.40 | .425 | 8.26$m^3$ | |
| | | | | | Total | 46.52 cu.m | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | **II. Concrete -**<br>Lime concrete in foundation | | | | | | |
| | Main rooms -<br>Back long wall full length end to end | 1 | 17.60 | 0.80 | 0.30 | 4.22$m^3$ | L. Same as excavation |
| | Front long walls of bed and living rooms | 2 | 7.90 | 0.80 | 0.30 | 3.79$m^3$ | L. Same as excavation |
| | Cross short walls | 6 | 3.00 | 0.80 | 0.30 | 4.32$m^3$ | L. Same as excavation |
| | Study rooms<br>Front long walls | 2 | 4.50 | 0.60 | 0.20 | 1.08$m^3$ | L. Same as excavation |
| | Cross short walls | 4 | 1.65 | 0.60 | 0.20 | 0.79$m^3$ | L = 2.25-.60/2-.60/2= 1.65 m |
| | Kitchens<br>Back walls (long) | 2 | 3.30 | 0.60 | 0.20 | 0.79$m^3$ | L.Same as excavation |
| | Cross walls (short) | 4 | 2.15 | 0.60 | 0.20 | 1.03$m^3$ | L.2.75-.60/2-.6 0/2=2.15 m |
| | Bath and W.Cs.<br>Back walls (long) | 1 | 3.40 | 0.60 | 0.20 | 0.41$m^3$ | L.Same as excavation |
| | Cross walls (short) | 3 | 2.15 | 0.60 | 0.20 | 0.77$m^3$ | L=2.75-.60/2-.60/2=2.15 m |
| | Verandah pillars | 4 | 0.80 | 0.60 | 0.20 | 0.38$m^3$ | |
| | Font verandah<br>Plinth dwarf wall | 1 | 7.50 | 0.40 | 0.20 | 0.60$m^3$ | L=9.10-2x.40/2-2x0.60 =7.50 m |
| | Back verandah plinth dwarf wall | 2 | 3.35 | 0.40 | 0.20 | 0.54$m^3$ | L=4.35-2x.40/2-1x.60 =3.35 m |
| | Staircase base | 1 | 1.10 | 0.60 | 0.20 | 0.13$m^3$ | |
| | Step front | 1 | 2.50 | 0.70 | 0.15 | 0.26$m^3$ | |
| | Step back | 2 | 1.20 | 0.70 | 0.15 | 0.25$m^3$ | |
| | | | | | Total | 19.36 cu.m | |
| 5 | **R.C.C work 1:2:4 excluding steel reinforcement bars and its bending including centering and shutering and binding steel** | | | | | | |
| | R.C.C slab<br>Bed and living rooms | 2 | 7.40 | 3.80 | 0.12 | 6.749$m^3$ | Bearing - ends full wall (30 cm), sides half wall (15 cm). |
| | Front verandah including study rooms | 1 | 17.10 | 2.35 | 0.10 | 4.019$m^3$ | Bearing - outer full wall (20 cm), inner half wall (15 cm) |
| | Back verandah including kitchen, bath and W.C rooms | 1 | 17.10 | 2.85 | 0.10 | 4.874$m^3$ | Total of slab = 15.642 cu.m |
| | Lintels - Over doors main room | 8 | 1.30 | 0.30 | 0.10 | 0.312$m^3$ | (a) 15 cm bearing |
| | Over windows W main rooms | 8 | 1.20 | 0.30 | 0.10 | 0.288$m^3$ | (a) |
| | Over shelves S in 30 cm wall | 6 | 1.30 | 0.30 | 0.10 | 0.234$m^3$ | (a) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Over entrance of stair case | 1 | 2.70 | 0.30 | 0.20 | 0.162m$^3$ | |
| | Over doors D study room | 2 | 1.30 | 0.20 | 0.10 | 0.052m$^3$ | (b) |
| | Over doors $D_1$ kitchen | 2 | 1.20 | 0.20 | 0.10 | 0.048m$^3$ | (b) |
| | Over doors $D_2$ bath and W.C | 4 | 1.05 | 0.20 | 0.10 | 0.084m$^3$ | (b) |
| | Over windows W study room | 4 | 1.20 | 0.20 | 0.10 | 0.096m$^3$ | (b) |
| | Over windows $W_1$ kitchen | 2 | 1.10 | 0.20 | 0.10 | 0.044m$^3$ | (b) Side windows |
| | S kitchen | 2 | 1.30 | 0.20 | 0.10 | 0.052m$^3$ | (b) |
| | Over R.C.C. Jalli over door $D_2$ of Bath and W.C | 4 | 1.05 | 0.20 | 0.10 | 0.084m$^3$ (b) | Total of (a)s= 0.834 cu.m<br>Toal of (b)s = 0.460 cu.m |
| | Over front verandah 20 cm thick | 1 | 9.20 | 0.20 | 0.20 | 0.368m$^3$ | Continuous over pillars |
| | Over back verandah continuous including window $W_1$, $W_2$ | 1 | 13.60 | 0.20 | 0.15 | 0.408m$^3$ | 15 cm thick |
| | Sunshades Over window W, 4 in main rooms and 4 in study rooms | 8 | 1.20 | 0.50 | 0.05 | 0.240m$^3$ | Average 5 cm thick |
| | Over window $W_1$ of kitchen | 2 | 1.10 | 0.50 | 0.05 | 0.055m$^3$ | Two side windows |
| | Over front verandah | 1 | 9.20 | 0.60 | 0.05 | 0.276m$^3$ | |
| | Over back verandah continuous including back windows $W_1$ & $W_2$ | 1 | 13.60 | 0.50 | 0.05 | 0.340m$^3$ | Length same' as for lintel |
| | Slabs of shelves 25 cm wide 4 cm thick | 8x3 | 1.10 | 0.25 | 0.04 | 0.264m$^3$ | Bearing 5 cm.<br>Total of sunshades and shelf slabs = 1.175 cu.m |
| | **Staircase** - | | | | | | |
| | Inclined slabs.... | 2 | 2.54 | 1.10 | 0.15 | 0.838m$^3$ | $L = \sqrt{2^2 + 1.575^2} = 2.54$ m |
| | Above wall at base | 1 | 1.10 | 0.50 | 0.15 | 0.083m$^3$ | |
| | Landing slab middle | 1 | 2.60 | 1.05 | 0.15 | 0.410m$^3$ | |
| | Landing slab 1st floor level | 1 | 2.60 | 0.75 | 0.15 | 0.293m$^3$ | B = .60+.15=.75 m |
| | Steps without reinforcement | 8 x 2x 1.10 x$^1/_2$(.25x.175) | | | | 0.385m$^3$ | Triangular section |
| | | | | | Total | 21.058 cu.m | Total of staircase slabs (excluding base) =1.541 cu.m |
| 6 | 2.5 cm C.C 1:2:4 nosing in steps | | | | | | |
| | Staircase steps | 9x2 | 1.10 | - | - | 19.80m | |
| | Front steps | 3 | 2.30 | - | - | 6.90m | |
| | Back steps | 3x2 | 1.00 | - | - | 6.00m | |
| | | | | | Total | 32.70 m | |
| 7 | R.C. 1:2:4 Newal post 10 cm x 10 cm, 1 m high including reinforcement complete work | 2 | - | - | - | 2 Nos | |
| 8 | R.C.C 1:2:4 Hand rail in staircase includin reinforement complete work | 2 | 2.74 | - | - | 5.48 m | L = 2.54+.20=2.74 m |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9 | 4 cm thick R.C.C Jalli including reinforcement complete work | 4 | 0.75 | - | 0.50 | 1.50 sq.m | Over door $D_2$ |
| 10 | **2.5 cm Damp proof course C.C. $1:1\frac{1}{2}:3$ with water proofing compound- Main Rooms** | | | | | | |
| | Back long wall | 1 | 17.20 | 0.40 | - | 6.88m$^2$ | L=16.80+.40=17.20 m |
| | Front long walls | 2 | 7.50 | 0.40 | - | 6.00m$^2$ | L = 7.10+.40=7.50 m |
| | Cross short walls | 6 | 3.40 | 0.40 | - | 8.16m$^2$ | L=3.80-.40=3.40 m |
| | Study rooms - | | | | | | |
| | Front walls (long) | 2 | 4.20 | 0.30 | - | 2.52m$^2$ | L=3.90+.30=4.20 m |
| | Cross walls (short) | 4 | 1.90 | 0.30 | - | 2.28m$^2$ | L=2.25-.40/2-.30/2=1.90 m |
| | Kitchen | | | | | | |
| | Back walls (long) | 2 | 3.00 | 0.30 | - | 1.80m$^2$ | L=2.70+.30=3.00 m |
| | Cross walls (short) | 4 | 2.40 | 0.30 | - | 2.88m$^2$ | L=2.75-.40/2-.30/2=2.40 m |
| | Bath and W.C | | | | | | |
| | Back walls (long) | 1 | 3.10 | 0.30 | - | 0.93m$^2$ | L=2.80+.30=3.10 m |
| | Cross walls (short) | 3 | 2.40 | 0.30 | - | 2.16m$^2$ | L=2.75-.40/2-.30/2=2.40 m |
| | Verandah pillars | 4 | 0.50 | 0.30 | - | 0.60m$^2$ | |
| | | | | | Total | 34.21m$^2$ | |
| | **Deduct** | | | | | | |
| | Door sills main rooms D | 8 | 1.00 | 0.40 | - | 3.20m$^2$ | |
| | Door sills study room D | 2 | 1.00 | 0.30 | - | 0.60m$^2$ | |
| | Door sills kitchen $D_1$ | 2 | 0.90 | 0.30 | - | 0.54m$^2$ | |
| | Door sills Bath & W.C. $D_2$ | 4 | 0.75 | 0.30 | - | 0.90m$^2$ | |
| | | | Total of deduction 5.24m$^2$ | | | | |
| | | | | Net | Total | 28.97 sq.m | |
| **11** | **III. Brick work First class brick work in lime mortar in foundation and plinth main rooms back wall full length** | | | | | | |
| | 1$^{st}$ Footing | 1 | 17.40 | 0.60 | 0.20 | 2.09m$^3$ | L = 16.80 + 0.60 = 17.40 m |
| | 2$^{nd}$ footing | 1 | 17.30 | 0.50 | 0.20 | 1.73m$^3$ | L = 17.40 - 0.10 = 17.30 m |
| | Plinth wall | 1 | 17.20 | 0.40 | 0.70 | 4.82m$^3$ | L = 17.30 - 0.10 = 17.20 m |
| | Front long walls | | | | | | |
| | 1$^{st}$ footing | 2 | 7.70 | 0.60 | 0.20 | 1.85m$^3$ | L = 7.10+ 0.60 = 7.70 m |
| | 2$^{nd}$ footing | 2 | 7.60 | 0.50 | 0.20 | 1.52m$^3$ | L = 7.70 - 0.10 = 7.60 m |
| | Plinth wall | 2 | 7.50 | 0.40 | 0.70 | 4.20m$^3$ | L = 7.60 - 0.10 = 7.50 m |
| | Cross walls | | | | | | |
| | 1$^{st}$ footing | 6 | 3.20 | 0.60 | 0.20 | 2.30m$^3$ | L = 3.80 - 0.060 = 3.20 m |
| | 2$^{nd}$ footing | 6 | 3.30 | 0.50 | 0.20 | 1.98m$^3$ | L = 3.20 - 0.10 = 3.30 m |
| | Plinth wall | 6 | 3.40 | 0.40 | 0.70 | 5.71m$^3$ | L = 3.30 - 0.10 = 3.40 m |
| | **Study rooms Front walls** | | | | | | |
| | Footing | 2 | 4.30 | 0.4 | 0.20 | 0.69m$^3$ | L = 3.90 + 0.40 = 4.30 m |
| | Plinth walls | 2 | 4.20 | 0.30 | 0.70 | 1.76m$^3$ | L = 4.30 - 0.10 = 4.20 m |
| | **Cross walls** | | | | | | |
| | Footing | 4 | 1.80 | 0.40 | 0.20 | 0.58m$^3$ | L = 2.25 - 0.50/2 - 0.40/2 = 1.80 m |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Plinth wall | 4 | 1.90 | 0.30 | 0.70 | $1.60m^3$ | L = 1.80 + 0.10 = 1.90 m |
| | Kiitchen | | | | | | |
| | **Back walls** | | | | | | |
| | Footing | 2 | 3.10 | 0.40 | 0.20 | $0.50m^3$ | L = 2.70 + 0.40 = 3.10m |
| | Plinth wall | 2 | 3.00 | 0.30 | 0.70 | $1.26m^3$ | L = 3.10 + 0.10 = 3.00m |
| | Cross walls footing | 4 | 2.30 | 0.40 | 0.20 | $0.74m^3$ | L = 2.75 -. 50/2 - 0.40/2 = 2.30 m |
| | Plinth wall | 4 | 2.40 | 0.30 | 0.70 | $2.02m^3$ | L = 2.30 + 0.10 = 2.40 m |
| | **Bath and W.C** | | | | | | |
| | **Back walls** | | | | | | |
| | Footing | 1 | 3.20 | 0.40 | 0.20 | $0.26m^3$ | L = 2.80 + 0.40 = 3.20 m |
| | Plinth wall | 1 | 3.10 | 0.30 | 0.70 | $0.65m^3$ | L = 3.20 - 0.10 = 3.10 m |
| | **Cross walls** | | | | | | |
| | Footing | 3 | 2.30 | 0.40 | 0.20 | $0.55m^3$ | L = 2.75 - 0. 50/2 0.40/2 = 2.30m |
| | Plinth wall | 3 | 2.40 | 0.30 | 0.70 | $1.51m^3$ | L = 2.30 + 0.10 = 2.40m |
| | **Verandah pillars** | | | | | | |
| | Footing | 4 | 0.60 | 0.40 | 0.20 | $0.19m^3$ | |
| | Plinth wall | 4 | 0.50 | 0.30 | 0.70 | $0.42m^3$ | |
| | **Front verandah plinth dwarf wall sum total length** | 1 | 7.80 | 0.20 | 0.70 | $1.09m^3$ | L = 9.10 - 2 x 0.30/2 - 2 x 0.50 = 7.80 m |
| | **Back verandah plinth** dwarf wall | 2 | 3.55 | 0.20 | 0.70 | $0.99m^3$ | L = 4.35 - 2 x 0.30/2 - 1 x 0.50 = 3.55m |
| | Staircase base | 1 | 1.10 | 0.50 | 0.40 | $0.22m^3$ | |
| | Stair front 1st | 1 | 2.30 | 0.60 | 0.20 | $0.28m^3$ | |
| | Step front 2nd | 1 | 2.30 | 0.30 | 0.15 | $0.10m^3$ | |
| | Step back 1st | 2 | 1.00 | 0.60 | 0.20 | $0.24m^3$ | |
| | Step back 2nd | 2 | 1.00 | 0.30 | 0.15 | $0.09m^3$ | |
| | | | | | Total | 41.94 cu.m | |
| 12 | **First class brick work in lime mortar in superstructure in 30 cm walls of main rooms** | | | | | | |
| | Back wall full length | 1 | 17.10 | 0.30 | 3.00 | $15.39m^3$ | L = 16.80 + 0.30 = 17.10 m |
| | Front long walls | 2 | 7.40 | 0.30 | 3.00 | $13.32m^3$ | L= 7.10 + 0.30 = 7.40 m |
| | Cross walls | 6 | 3.50 | 0.30 | 3.00 | $18.90m^3$ | L = 3.80 - 0.30 = 3.50 m |
| | Staircase room front wall | 1 | 2.30 | 0.30 | 0.60 | $0.42m^3$ | Above lintel |
| | | | | | Total | 48.03 cu.m | |
| | **Deduct** | | | | | | |
| | Door openings D | 10 | 1.00 | 0.30 | 2.10 | $6.30m^3$ | |
| | Window opening W | 8 | 0.90 | 0.30 | 1.20 | $2.59m^3$ | 4 in main rooms and |
| | Shelves opening | 6 | 1.00 | 0.20 | 1.80 | $2.16m^3$ | 2 in kitchen |
| | Lintels (30 cm wall) | Same as marked in item 5 | | | | $0.834m^3$ | |
| | | | | Total of deduction | | 11.884 | |
| | | | | | Net Total | 36.15 cu.m | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 13 | **First class brickwork in 1:6 cement local sand mortar in superstructure** in 20 cm walls | | | | | | |
| | Study rooms front walls | 2 | 4.10 | 0.20 | 3.00 | 4.92$m^3$ | L=3.90+.20=4.10 m |
| | Study rooms cross walls | 4 | 2.00 | 0.20 | 3.00 | 4.80$m^3$ | L=2.25-.30/2-.20/2=2.00 m |
| | Kitchen back walls | 2 | 2.90 | 0.20 | 3.00 | 3.48$m^3$ | L=2.70+.20=2.90 m |
| | Kitchen cross walls | 4 | 2.50 | 0.20 | 3.00 | 6.00$m^3$ | L=2.75-.30/2-.20/2=2.50m |
| | Bath and W.C back wall | 1 | 3.00 | 0.20 | 3.00 | 1.80$m^3$ | L=2.80+.20=3.00 m |
| | Bath & W.C cross wall | 3 | 2.50 | 0.20 | 3.00 | 4.50$m^3$ | L=2.75-.30/2-.20/2=2.50 m |
| | Verandah pillars | 4 | 0.40 | 0.20 | 2.20 | 0.70$m^3$ | |
| | Front verandah wall above lintel | 1 | 8.90 | 0.20 | 0.60 | 1.07$m^3$ | Ht.above lintel 60 cm. |
| | Back verandah walls above lintel | 2 | 4.15 | 0.20 | 0.65 | 1.08$m^3$ | Ht. above lintel 65 cm |
| | | | | | Total | 28.35$m^3$ | |
| | **Deduct** | | | | | | |
| | Door openings D | 2 | 1.00 | 0.20 | 2.10 | 0.84$m^3$ | Study room doors. |
| | Door openings D1 | 2 | 0.90 | 0.20 | 2.10 | 0.756$m^3$ | Kitchen doors |
| | Door openings $D_2$ | 4 | 0.75 | 0.20 | 2.10 | 1.26$m^3$ | Bath and W.C doors |
| | Window openings W | 4 | 0.90 | 0.20 | 1.20 | 0.86$m^3$ | Study room windows. |
| | Window openings $W_1$ | 4 | 0.80 | 0.20 | 1.00 | 0.64$m^3$ | Kitchen windows |
| | Window openings $W_2$ | 2 | 0.75 | 0.20 | 1.00 | 0.30$m^3$ | W.C. room windows |
| | R.C. Jalli over doors $D_1$ | 4 | 0.75 | 0.20 | 0.50 | 0.30$m^3$ | |
| | Shelves opening kitchen | 2 | 1.00 | 0.10 | 1.80 | 0.36$m^3$ | Back of shelves 10 cm |
| | Lintel (20 cm wall) | Same as marked in item 5 | | | | 0.46$m^3$ | |
| | Lintel over back wall of W.Cs | 1 | 3.00 | 0.20 | 0.15 | 0.09$m^3$ | |
| | Lintel over windows $W_1$ on back walls of kitchen | 2 | 1.15 | 0.20 | 0.15 | 0.07$m^3$ | |
| | | | | Total | of deduction | 5.936$m^3$ | |
| | | | | | Net total | 22.414 cu.m | |
| 14 | **10 cm thick first class brick work in partition wall in 1:3 cement, coarse sand mortar with hoop iron or 6 mm dia. steel reinforcement every fourth layer** | 2 | 1.20 | - | 3.00 | 7.20 sq.m | |
| **15** | **IV Wood work - Door and window Sal wood work in chaukhats in doors and windows** | | | | | | |
| | Door D(10 cm x 7.5 cm section) | 12 | 5.30 | 0.10 | 0.075 | 0.477$m^3$ | 5 cm in insertion into floor |
| | Door $D_1$ | 2 | 5.20 | 0.10 | 0.075 | 0.078$m^3$ | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Door $D_2$ | 4 | 5.10 | 0.10 | 0.075 | 0.153$m^3$ | |
| | Window W | 12 | 4.20 | 0.10 | 0.075 | 0.378$m^3$ | |
| | Window $W_1$ | 4 | 3.60 | 0.10 | 0.075 | 0.108$m^3$ | |
| | Window $W_2$ | 2 | 3.50 | 0.10 | 0.075 | 0.053$m^3$ | |
| | | | | | Total | 1.247 cu.m | |
| 16 | **3 cm thick panelled shutters of Deodar wood in doors and windows** | | | | | | h = (2.10-0.075)+.015 = 2.04m |
| | Door D | 12 | 0.88 | - | 2.04 | 21.524$m^2$ | 15 mm rebate |
| | Door $D_1$ | 2 | 0.78 | - | 2.04 | 3.182$m^2$ | 15 mm rebate |
| | Door $D_2$ | 4 | 0.63 | - | 2.04 | 5.141$m^2$ | 15 mm rebate |
| | Window W | 12 | 0.78 | - | 1.08 | 10.109$m^2$ | 15 mm rebate |
| | Window $W_1$ | 4 | 0.68 | - | 0.88 | 2.394$m^2$ | 15 mm rebate |
| | Window $W_2$ | 2 | 0.63 | - | 0.88 | 1.109$m^2$ | 15 mm rebate |
| | | | | | Total | 43.459 sq.m | |
| 17 | Doors and windows fittings of oxydized iron | Same as in item (16) | | | | 43.459 sq.m | May also be taken per no. of different fittings |
| | **V.Steel and Iron work** | | | | | | |
| 18 | Steel reinforcement bars including bending in | | | | | | |
| | R.C.C work | $-2 \times \left(\frac{0.90+0.30}{2}\right) \times 0.45 = 0.54$ | | | | 16.226 q | @ 1% of R.C.C work in item 5 excluding steps = 1% of (21.055-.385)= 1/100x20.67 cu.m |
| 19 | **Iron work in hold fasts and window bars -** | | | | | | |
| | Hold fasts in doors | 18 x | 6@1kg | each | = | 108 kg | 6 Nos in each door |
| | Hold fasts in windows | 18 x | 4@1kg | each | = | 72 kg | 4 Nos in each window |
| | **20 mm dia. window bars @ 2.47 kg per m - 12** windows 90 x 120c m (W) | 12 x | 8x1.20 | = | 115.20m | | 8 bars 1.20 m each |
| | 4 Windows 80x100 cm ($W_1$) | 4x | 7x1.00 | = | 28.00m | | 7 bars 1.00 m each |
| | 2 windows 75x 100 cm ($W_2$) | 2x | 6x1.00 | = | 12.00m | | 6 bars 1.00 m each |
| | | | | Total | 155.20 m | | |
| | | @ 2.47 kg per m = | | | | 383.34 kg | |
| | | | | | Total = | 563.34 kg 5.633 q | |
| 20 | **Iron grill work in stair case railing two flights (80 cm high)** | 1 | 5.38 | | 0.80 | 4.304 sq.m | L=2x2.54+.30=5.38 m |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **VI.Plastering and Pointing** | | | | | | |
| 21 | **12 mm plastering with 1 :6 cement local sand mortar in walls** | | | | | | Excluding skirting and dado at bottom |
| | **Inside Plastering** | | | | | | |
| | Bed Rooms | 2 | 14.00 | - | 2.80 | 78.40$m^2$ | L=Inner perimeter = 14.00 m |
| | Living rooms | 2 | 13.00 | - | 2.80 | 72.80$m^2$ | L=Inner perimeter = 13.00 m |
| | Staircase room | 1 | 11.60 | - | 2.80 | 32.48$m^2$ | L=Inner perimeter = 11.60 m |
| | 30 cm face of wall below stair case entrance lintel | 2 | 0.30 | - | 2.00 | 1.20$m^2$ | |
| | Shelves - Jambs, sills and soffits | 6 | 5.60 | 0.20 | - | 6.72$m^2$ | L=(1.0+1.8)x2=5.60 m |
| | Shelves - Jambs, sills and soffits | 2 | 5.60 | 0.10 | - | 1.12$m^2$ | L=(1.0+1.8)x2=5.60 m |
| | Study rooms | 2 | 11.40 | - | 2.80 | 63.84$m^2$ | L=Inner perimeter = 11.40 m |
| | Kitchens | 2 | 10.00 | - | 2.50 | 50.00$m^2$ | L=Inner perimeter =10.00m |
| | Bathrooms | 2 | 5.20 | - | 2.00 | 20.80$m^2$ | L=(1.4+1.2)x2=5.20 m |
| | W.C | 2 | 4.40 | - | 2.50 | 22.00$m^2$ | L=(1.0+1.2)x2=4.40 m |
| | **Front verandah** | | | | | | |
| | Long wall inner | 1 | 8.90 | - | 2.80 | 24.92$m^2$ | Openings to be deducted |
| | **Long wall outer above** pillar | 1 | 8.90 | - | 0.80 | 7.12$m^2$ | |
| | Side walls | 2 | 2.00 | - | 2.80 | 11.20$m^2$ | |
| | Back verandah - Long walls inner | 2 | 4.15 | - | 2.80 | 23.24$m^2$ | |
| | Long wall outer above pillar | 2 | 4.15 | - | 0.80 | 6.64$m^2$ | |
| | Side walls | 4 | 2.50 | - | 2.80 | 28.00$m^2$ | |
| | Pillars 3 faces | 4 | 0.80 | - | 2.00 | 6.40$m^2$ | L = 40 + 20+ 20 = 80 cm |
| | 20 cm face of wall below verandah lintel | 6 | 0.20 | - | 2.00 | 2.40$m^2$ | Total of Study. Kitchen, Bath and W.C rooms, Verandahs, etc, of 20 cm wall = 268.80 sq.m, above skirting and Dado |
| | | | | | Total | 459.28 $m^2$ | |
| | **Deduct** | | | | | | |
| | Door openings D | 12 | 1.00 | - | 2.10 | 25.20$m^2$ | One face only |
| | Door openings $D_1$ | 2 | 0.90 | - | 2.10 | 3.78$m^2$ | One face only |
| | Door openings $D_2$ | 4 | 0.75 | - | 2.10 | 6.30$m^2$ | One face only |
| | Window openings | 4 | 0.90 | - | 1.20 | 4.32$m^2$ | One face only |
| | R.C.C Jalli | - | - | - | - | - | No deduction being small |
| | Staircase entrance openings | 2 | 2.30 | - | 2.00 | 9.20$m^2$ | |
| | | | | Total of deduction | | 48.8sq.m | |
| | | | Net total of inside plaster | | | 410.48$m^2$ | |
| | **Outside plastering** | | | | | | |
| | Outer side (including plinth and 10 cm below G.L) | 1 | 52.00 | - | 3.77 | 196.79$m^2$ | L = Outer perimeter = 2 (17.10 + 9.00) = 52.20 m Ht.= 3.0 + 0.50+0 .05 + 0.10 + 0.12 = 3.77 m |
| | **Deduct** | | | | | | |
| | Window openings W | 8 | 0.90 | - | 1.20 | 8.64$m^2$ | One face. |
| | Window openings $W_1$ | 4 | 0.80 | - | 1.00 | 3.20$m^2$ | |
| | Window openings $W_2$ | 2 | 0.75 | - | 1.00 | 1.50$m^2$ | |
| | Front verandah openings | 1 | 8.10 | - | 2.20 | 17.82$m^2$ | L = 8.90 - 2 x 0.40 = 8.10m |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Back verandah openings | 2 | 3.75 | - | 2.20 | 16.50m$^2$ | L=4.15-.40=3.75 m |
| | Step front | 1 | 2.30 | - | 0.65 | 1.50m$^2$ | Ht.=.50+.05+.10=.65 m |
| | Step back | 2 | 1.00 | - | 0.65 | 1.30m$^2$ | |
| | | | | Total of deductions | | 50.46 m$^2$ | |
| | | Net Total of outside plastering | | | | 146.33 m$^2$ | |
| | | **Grand Total of inside and outside plastering = 556.81 sq.m** | | | | | |
| 22 | **6 mm plastering with 1 :3 cement, medium sand mortar in ceilings** | | | | | | |
| | Bedrooms | 2 | 3.50 | 3.50 | - | 24.50m$^2$ | |
| | Living rooms | 2 | 3.00 | 3.50 | - | 21.00m$^2$ | |
| | Study rooms | 2 | 3.70 | 2.00 | - | 14.80m$^2$ | |
| | Kitchens | 2 | 2.50 | 2.50 | - | 12.50m$^2$ | |
| | Baths | 2 | 1.20 | 1.40 | - | 3.36m$^2$ | |
| | W.Cs | 2 | 1.20 | 1.00 | - | 2.40m$^2$ | |
| | Front verandah | 1 | 8.90 | 2.00 | - | 17.80m$^2$ | |
| | Back verandahs | 2 | 4.15 | 2.50 | - | 20.75m$^2$ | |
| | Soffits of front verandah Lintels | 1 | 8.10 | 0.20 | - | 1.62m$^2$ | L= 8.90 - 2 x 0 .40= 8.10 m |
| | Soffits of back verandah lintels | 2 | 3.75 | 0.20 | - | 1.50m$^2$ | L = 4.15 - 0.40 = 3.75 m |
| | **Staircase** | | | | | | |
| | Inclined slab | 2 | 2.54 | 1.10 | - | 5.59m$^2$ | |
| | Landing slab middle | 1 | 2.30 | 0.90 | - | 2.07m$^2$ | |
| | Landing slab (1st Floor level) | 1 | 2.30 | 1.10 | - | 2.53m$^2$ | |
| | Soffit of lintel at entrance | 1 | 2.30 | 0.30 | - | 0.69m$^2$ | |
| | Under sides of sunshades | | | | | | |
| | Sunshades W | 8 | 1.20 | 0.50 | - | 4.80m$^2$ | Total of sun shade = 18.22 sq.m* |
| | Sunshades $W_1$ kitchen side | 2 | 1.10 | 0.50 | - | 1.10m$^2$ | |
| | Front verandah sunshade | 1 | 9.20 | 0.60 | - | 5.52m$^2$ | Total excluding bed rooms |
| | Back verandah sunshade continous | 1 | 13.60 | 0.50 | - | 6.80m$^2$ | and living rooms=103.83 sqm |
| | | | | | Total | 149.33m$^2$ | |
| 23 | **Skirting 20 cm high with12 mm thick 1:3 cement coarse sand mortar neat cement finished -** | | | | | | |
| | Bedrooms | 2 | 14.00 | - | - | 28.00m | Lengths inner perimeter |
| | Living rooms | 2 | 13.00 | - | - | 26.00m | |
| | Jambs of main rooms doors D | 10 | 0.30 | - | - | 3.00m | |
| | Staircase room | 1 | 9.90 | - | - | 9.90m | |
| | Jambs at entrance | 2 | 0.30 | - | - | 0.60m | |
| | Study rooms | 2 | 11.40 | - | - | 22.80m | |
| | Front verandah long wall | 1 | 8.90 | - | - | 8.90m | |
| | Front verandah side walls | 2 | 2.20 | - | - | 4.40m | |
| | Back verandah long walls | 2 | 4.15 | - | - | 8.30m | |
| | Back verandah side walls | 4 | 2.70 | - | - | 100.80m | |
| | Pillars 3 faces | 4 | 0.80 | - | - | 3.20m | |
| | Jambs study rooms door D | 2 | 0.20 | - | - | 0.40m | Total of study room, verandah etc= 69.30 m |
| | | | | | Total | 126.30m | |
| | Deduct door opening D | 12 | 1.00 | - | - | 12.00m | |
| | | | | Net Total | | 114.30 m | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 | **Dado 12 mm thick 1:3 cement coarse sand mortar neat cement finished (in kitchen, bath and W.C)** | | | | | | |
| | Kitchen 50 cm high | 2 | 10.00 | - | 0.50 | 10.00$m^2$ | Lengths inner perimeter |
| | W.C 50 cm high | 2 | 4.40 | - | 0.50 | 4.40$m^2$ | |
| | Bathroom 1 m high | 2 | 5.20 | - | 1.00 | 10.40$m^2$ | |
| | Jambs of kitchen door $D_1$ | 2 | 0.20 | - | 0.50 | 0.20$m^2$ | |
| | Jambs of W.C door $D_2$ | 2 | 0.20 | - | 0.50 | 0.20$m^2$ | |
| | Jambs of bath door $D_2$ | 2 | 0.20 | - | 1.00 | 0.40$m^2$ | |
| | | | | | Total | 25.60$m^2$ | |
| | **Deduct -** | | | | | | |
| | Kitchen door $D_1$ | 2 | 0.90 | - | 0.50 | 0.90$m^2$ | |
| | W.C door $D_2$ | 2 | 0.75 | - | 0.50 | 0.75$m^2$ | |
| | Bath door $D_2$ | 2 | 0.75 | - | 1.00 | 1.50$m^2$ | |
| | | | | Total of deduction | | 3.15$m^2$ | |
| | | | | | Net Total | 22.45$m^2$ | |
| 25 | **20 mm plastering with 1:3 cement coarse sand mortar neat cement finished in steps** | | | | | | |
| | Front steps tread and riser | 1 | 2.30 | 1.21 | - | 2.78$m^2$ | B = 2 x 0.30 + 3 x 0.17 + 0.10 =1.21 m |
| | Back steps, tread and riser | 2 | 1.00 | 1.21 | - | 2.42$m^2$ | |
| | Sides of front and back steps | 3 x 2 | - | 0.60 | 0.27 | 0.97$m^2$ | |
| | | 3 x 2 | - | 0.30 | 0.17 | 0.31$m^2$ | |
| | Stair case steps, tread and riser | 2 x 8 | 1.10 | 0.425 | - | 7.48$m^2$ | B = 25 + 17.5 = 42.5 cm = 0.425 m |
| | | | | | Total | 13.96 $m^2$ | |
| | **VII. Flooring** | | | | | | |
| 26 | **2.5 cm C.C 1:2:4 floor over and including 7.5 cm lime concrete** | | | | | | |
| | Bedrooms | 2 | 3.50 | 3.50 | - | 24.50$m^2$ | |
| | Living rooms | 2 | 3.00 | 3.50 | - | 21.00$m^2$ | |
| | Staircase room | 1 | 2.30 | 3.50 | - | 8.05$m^2$ | |
| | Sill of entrance | 1 | 2.30 | 0.30 | - | 0.69$m^2$ | |
| | Study rooms | 2 | 3.70 | 2.00 | - | 14.80$m^2$ | |
| | Kitchens | 2 | 2.50 | 2.50 | - | 12.50$m^2$ | |
| | Bathrooms | 2 | 1.20 | 1.40 | - | 3.36$m^2$ | |
| | W.Cs | 2 | 1.20 | 1.00 | - | 2.40$m^2$ | |
| | Front verandah | 1 | 8.90 | 2.00 | - | 17.80$m^2$ | |
| | Back verandahs | 2 | 4.15 | 2.50 | - | 20.75$m^2$ | |
| | | | | | Total | 125.85$m^2$ | |
| 27 | **2.5 cm C.C. 1:2:4 floor (without lime concrete)** | | | | | | |
| | Sills of door D | 10 | 1.00 | 0.30 | - | 3.00$m^2$ | |
| | Sills of door D (study room) | 2 | 1.00 | 0.20 | - | 0.40$m^2$ | |
| | Sills of door $D_1$ | 2 | 0.90 | 0.20 | - | 0.36$m^2$ | |
| | Sills of door $D_2$ | 4 | 0.75 | 0.20 | - | 0.60$m^2$ | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Sills of verandah opening over plinth dwarf wall** | | | | | | |
| | Front verandah | 1 | 8.10 | 0.20 | - | 1.62m$^2$ | L=8.90-2x.40=8.10 m |
| | Back verandah | 2 | 3.75 | 0.20 | - | 1.50m$^2$ | L=4.15-.40=3.75 m |
| | Staircase landing | 1 | 2.30 | 0.90 | - | 2.07m$^2$ | Over R.C.C landing slab |
| | | | | | Total | 9.55m$^2$ | |
| | **VIII Painting** | | | | | | |
| 28 | **Painting two coats over one coat of priming** | | | | | | |
| | Panelled door D | 12 x $2^1/_4$ | 1.00 | - | 2.10 | 56.70m$^2$ | 1 1/8 for one face |
| | Panelled door $D_1$ | 2 x $2^1/_4$ | 0.90 | - | 2.10 | 8.51m$^2$ | 1 1/8 for one face |
| | Panelled door $D_2$ | 4 x $2^1/_4$ | 0.75 | - | 2.10 | 14.18m$^2$ | 1 1/8 for one face |
| | Panelled Window W | 12 x $2^1/_4$ | 0.90 | - | 1.20 | 29.16m$^2$ | 1 1/8 for one face |
| | Panelled Window $W_1$ | 4 x $2^1/_4$ | 0.80 | - | 1.00 | 7.20m$^2$ | 1 1/8 for one face |
| | Panelled Window $W_2$ | 2 x $2^1/_4$ | 0.75 | - | 1.00 | 3.38m$^2$ | 1 1/8 for one face |
| | Painting window bars W | 12 | 0.75 | - | 1.05 | 9.45m$^2$ | One clear flat area in between chaukhat |
| | Painting Window bars $W_1$ | 4 | 0.65 | - | 0.85 | 2.21m$^2$ | |
| | Painting Window bars $W_2$ | 2 | 0.60 | - | 0.85 | 1.02m$^2$ | |
| | Iron grill in staircase railing | 1 | 5.38 | - | 0.80 | 4.30m$^2$ | |
| | | | | | Total | 136.11m$^2$ | |
| 29 | **Coaltar painting two coats on back of chaukhats** | | | | | | |
| | Door D | 12 | 5.10 | 0.10 | - | 6.12m$^2$ | Lengths same as for chaukhats in item 15 |
| | Door $D_1$ | 2 | 4.60 | 0.10 | - | 0.92m$^2$ | |
| | Door $D_2$ | 4 | 4.45 | 0.10 | - | 1.78m$^2$ | |
| | Window W | 12 | 4.20 | 0.10 | - | 5.04m$^2$ | |
| | Window $W_1$ | 4 | 3.60 | 0.10 | - | 1.44m$^2$ | |
| | Window $W_2$ | 2 | 3.50 | 0.10 | - | 0.70m$^2$ | |
| | | | | | Total | 16.00 m$^2$ | |
| | **IX. White washing and colour washing** | | | | | | |
| 30 | White washing 3 coats - Walls (inside) | | Same as for inside plasting in item (21) | | | 410.48m$^2$ | |
| | Ceiling, under side of sunshades etc. | | Same as for ceiling plastering in item (22) | | | 149.33m$^2$ | |
| | | | | | Total | 559.81m$^2$ | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 31 | **Colour washing two coats over one coat of white washing (outside)** | | | | | | |
| | walls (outside) | Same as for outside wall plastgering in item (21) | | | | 146.33$m^2$ | Portion below G.L to be deducted |
| | Upper surface of sunshades | Same as marked* in item (22) | | | | 18.22$m^2$ | Under surface same as lower surface. |
| | | | | | Total | 164.55$m^2$ | Edges neglected |
| | Deduct 10 cm portion below G.L. | 1 | 47.90 | - | 0.10 | 4.79 | L - Outer perimeter - steps |
| | | | | Net | Total | 159.76 sq.m | = (2 x 17.10 + 2 x 9.00) - (2.30 + 2 x 1.00) = 47.90m |
| | **X. Misc. Items** | | | | | | |
| 32 | 10 mm dia. A.C rain water pipes (6 Nos).... | 6 | 3.60 | - | - | 21.60 m | L = 3.00 + 0.12 + 0.50 = 3.62 = 3.60 m |

## First Floor

### Details of Measurement and Calculation of quantities

| Item No. | Particulars items and of works | No. | Length m | Breadth m | Height or depth m | Quantity | Explanatory notes |
|---|---|---|---|---|---|---|---|
| | **II. Concrete** | | | | | | |
| 1 | **Lime concrete in roof terracing 7.5 cm thick complete with surface finishing** | | | | | | |
| | Roof of 1st floor in between parapet | 1 | 16.70 | 8.60 | - | 143.62m$^2$ | Mumty room tobe deducted. |
| | Roof of stair case room (mumty room) including chujja projection | 1 | 3.70 | 5.10 | - | 18.87m$^2$ | L=2.30+2x.20+2x.50=3.70 m |
| | | | | | Total | 162.49m$^2$ | B= 3.70+2x.20+2x.50=5.10m |
| | Deduct mumty room at 1st floor level | 1 | 2.70 | 4.10 | - | 11.07 | |
| | | | | | Net Total | 151.42m$^2$ | |
| 2 | **R.C.C work 1:2:4 excluding steel reinforcement and its bending but including centering and shuttering and binding steel** | | | | | | |
| | **Roof slab** | same as in item (5) of G.F | | | 15.642 | | Slab of all rooms and verandahs |
| | **Lintels** | | | | | | |
| | Over main room doors D | 8 | 1.30 | 0.20 | 0.10 | 0.208m$^3$ | Bearing 15 cm |
| | Over main room | | | | | | |
| | Over main room window W | 8 | 1.20 | 0.20 | 0.10 | 0.192m$^3$ | |
| | Over main room shelves | 4 | 1.30 | 0.20 | 0.10 | 0.104m$^3$ | |
| | Over entrance of staircase | 1 | 2.70 | 0.20 | 0.20 | 0.108m$^3$ | |
| | Over doors D study room | 2 | 1.30 | 0.20 | 0.10 | 0.052m$^3$ | |
| | Over doors $D_1$ kitchen | 2 | 1.20 | 0.20 | 0.10 | 0.048m$^3$ | |
| | Over doors $D_2$ Bath and W.C | 4 | 1.05 | 0.20 | 0.10 | 0.084m$^3$ | |
| | Over window W study room | 4 | 1.20 | 0.20 | 0.10 | 0.096m$^3$ | |
| | Over window $W_1$ kitchen | 2 | 1.10 | 0.20 | 0.10 | 0.044m$^3$ | Side windows |
| | Over shelves kitchen | 4 | 1.30 | 0.20 | 0.10 | 0.104m$^3$ | |
| | Over R.C.C Jalli over door $D_2$ of bath and W.C | 4 | 1.05 | 0.20 | 0.10 | 0.084m$^3$ | |
| | Over front verandah | 1 | 9.20 | 0.20 | 0.20 | 0.368m$^3$ | 20 cm thick |
| | Over back verandah including window $W_1$ $W_2$ | 1 | 13.60 | 0.20 | 0.15 | 0.408m$^3$ | 15 cm thick |
| | Sun shades, shelf slab | Same as in item (5) of G.F | | | | 1.175m$^3$ | |
| | Stair case inclined slab and landings | Same as in item (5) of G.F | | | | 1.541m$^3$ | |
| | Steps (without reinforcement ) | | 8 x 21.10 $^1/_2$ (0.25x 0.175) | | | 0.385m$^3$ | |
| | Mumty room - | | | | | | |
| | Roof slab including chujja projections | 1 | 3.70 | 5.10 | 0.10 | 1.887m$^3$ | |
| | Lintel over door | 1 | 1.20 | 0.20 | 0.10 | 0.024m$^3$ | |
| | Lintel over windows | 3 | 1.50 | 0.20 | 0.10 | 0.090m$^3$ | Bearing 15 cm |
| | | | | | Total | 22.644m$^3$ | |

| Item No. | Particulars items and of works | No. | Length (m) | Breadth (m) | Height or depth (m) | Quantity | Explanatory notes |
|---|---|---|---|---|---|---|---|
| 3 | 2.5 cm c.c 1 : 2 : 4 nosing in steps of stair case neat cement finished | 9 x 2 | 1.10 | - | - | 19.80 m | |
| 4 | R.C.C 1:2: 4 newal post in stair case 10 cm x 10 cm 1 m high including reinforcement complete work | 3 | - | - | - | 3 Nos | One at first floor one at middle and one at mumty floor |
| 5 | **R.C.C 1:2:4 handrail over grill including reinforcement complete work** - Stair Case inclined | 1 | 5.38 | - | - | 5.38m | |
| | Upper landing | 1 | 1.30 | - | - | 1.30m | |
| | Front verandah | 1 | 8.10 | - | - | 8.10m | L=8.90-2x.40=8.10 m |
| | Back verandah | 2 | 3.75 | - | - | 7.50m | L=4.15-.40=3.75 m |
| | | | | | Total | 22.28 m | |
| 6 | **4 cm thick R.C.C Jalli including reinforcement complete work** - Over doors of Bath and W.Cs | 4 | 0.75 | - | 0.50 | 1.50$m^2$ | |
| | Over windows of mumty room | 3 | 1.20 | - | 0.50 | 1.80$m^2$ | |
| | | | | | Total | 3.30$m^2$ | |
| **7** | **III Brick work**<br>**First class brickwork in 1:6 cement local sand mortar in superstructure** | | | | | | |
| | Main rooms- | 1 | 17.10 | 0.20 | 3.00 | 10.26 | L = 16.90 + 0.20 = 17.10 m |
| | Front long walls | 2 | 7.40 | 0.20 | 3.00 | 8.88 | L = 7.20 + 0.20 = 7.40 m |
| | Cross walls | 6 | 3.70 | 0.20 | 3.00 | 13.32 | L = 3.90 - 0.20 = 3.70 m |
| | Stair case room front wall | 1 | 2.30 | 0.20 | 0.60 | 0.28 | Above lintel |
| | | | | | Total | 32.74 | |
| | **Deduct** | | | | | | |
| | Door opening D | 10 | 1.00 | 0.20 | 2.10 | 4.20$m^3$ | |
| | Window opening W | 8 | 0.90 | 0.20 | 1.20 | 1.73$m^3$ | |
| | Shelve opening | 4 | 1.00 | 0.10 | 1.80 | 0.72$m^3$ | Back of shelf 10 cm |
| | Lintels over door | 10 | 1.30 | 0.20 | 0.10 | 0.26$m^3$ | |
| | Lintels over window W | 8 | 1.20 | 0.20 | 0.10 | 0.20$m^3$ | |
| | Lintels over shelves | 4 | 1.30 | 0.20 | 0.10 | 0.10$m^3$ | |
| | | | Total of deduction | | | 7.21$m^3$ | |
| | | | Net Total for main rooms | | | 25.53 $m^3$(i) | |
| | Study room, kitchen, Bath and W.Cs front and back verandahs | Same as for item (13) GF 22.414 (ii) | | | | | |

| Item No. | Particulars items and of works | No. | Length (m) | Breadth (m) | Height or depth (m) | Quantity | Explanatory notes |
|---|---|---|---|---|---|---|---|
| | Mumty room all 4 walls | 1 | 12.80 | 0.20 | 2.50 | 6.40m$^3$ | Total centre line length = 12.80 m |
| | Deduct door D1 | 1 | 0.90 | 0.20 | 2.10 | 0.378m$^3$ | |
| | Deduct Window W2 | 3 | 1.20 | 0.20 | 0.90 | 0.65m$^3$ | = 1.388 cu m |
| | Deduct Jalli above W3 | 3 | 1.20 | 0.20 | 0.50 | 0.36m$^3$ | |
| | | | Total of Mumty room | | | 5.012m$^3$ (iii) | |
| | Parapet long wall | 2 | 17.10 | 0.20 | 0.975 | 6.67m$^3$ | |
| | Parapet short wall | 2 | 8.60 | 0.20 | 0.975 | 3.35m$^3$ | |
| | | | | Total of para pet | | 10.02 m$^3$(iv) | |
| | | Grand total of (i), (ii), (iii) and (iv) | | | | 62.976 m$^3$ | |
| 8 | **10 cm thick first class brickwork in partition wall with 1:3 cement coarse sand motar with hoop iron of 6 mm dia. steel reinforcement every fourth layer** | 2 | 1.20 | - | 3.00 | 7.20m$^2$ | |
| 9 | **10 cm brick band at top of parapet** | 1 | 52.20 | - | - | 52.20 m | L=2(17.10+9.00) = 52.20 m |
| | **IV. Wood work-doors and windows** | | | | | | |
| 10 | **Sal wood work in chaukhats in doors and windows** - first floor doors and windows | | | Same as in item (15) of G.F | | 1.247m$^3$ | |
| | Mumty room door $D_1$ | 1 | 5.20 | 0.10 | 0.075 | 0.039m$^3$ | |
| | Mumty room window $W_2$ | 3 | 4.20 | 0.10 | 0.075 | 0.095m$^3$ | |
| | | | | | Total | 1.381m$^3$ | |
| 11 | **3 cm thick panelled shutters of deodar wood in doors and windows-first floor doors &windows** | Same as in item (16) of G.F | | | | 43.459m$^2$ | |
| | Mumty room door $D_1$ | 1 | 0.78 | - | 2.04 | 1.591m$^2$ | |
| | | | | | Total | 45.05m$^2$ | |
| 12 | **3 cm thick fully glazed shutters of deodar wood** | | | | | | |
| | Mumty room windows W | 3 | 1.68 | - | 0.78 | 3.931m$^2$ | |
| 13 | **Door and window fittings of oxidized iron** | | | Same as in items (11) and (12) above | | | |
| | | | | = 45.05 + 3.931 | | = 48.981 m$^2$ | |

| Item No. | Particulars items and of works | No. | Length m | Breadth m | Height or depth m | Quantity | Explanatory notes |
|---|---|---|---|---|---|---|---|
| | **V Steel and iron work** | | | | | | |
| 14 | **Steel reinforcement bars** | | | | | | |
| | **including bending** | $22.349 \times \frac{1}{100}$ | $\times 78.5$ | = 17.544q | | | @ 1% of R.C.C work in item (2) excluding stair case steps = 1/100 x (22.734 - 0.385) = 1/100 x 22.349 $m^3$ |
| 15 | **Iron work in hold fasts and windows bars - doors and windows of first floor** | | Same as in item (19) of G.F. | | | 563.34 kg | |
| | Mumty room - | | | | | | |
| | Hold fast in door $D_1$ | 6 | @1 kg | each | - | 6 kg | |
| | Hold fast in windows $W_2$ | 3 x 4 | @ 1 kg | each | - | 12 kg | |
| | 20 mm dia window bars in windows $W_2$ of mumty room @ 2.47 kg per m | 3 x 9 | x 0.90 | x 2.47 | = | 60.02 kg | 6 bars 0.90 m each |
| | | | | | Total | 641.36 kg = 6.414 q | |
| 16 | **Iron grill work in railings -** | | | | | | |
| | Staircase railing two flights | 1 | 5.38 | - | 0.80 | 4.31$m^2$ | |
| | Upper landing | 1 | 1.20 | - | 0.80 | 0.96$m^2$ | |
| | Front verandah railing | 1 | 8.10 | - | 0.80 | 6.48$m^2$ | L = 8.90 - 2 x.40 =8.10 m |
| | Back verandah railing | 2 | 3.75 | - | 0.80 | 6.00$m^2$ | L=4.15 - .40= 3.75 m |
| | | | | | Total | 17.75$m^2$ | |
| | **VI. Plastering and Pointing** | | | | | | |
| 17 | **12 mm plastering with 1:6 cement local sand mortar in walls** | | | | | | |
| | Inside plastering Main rooms | | | | | | Excluding skirting and Dado at bottom |
| | Bed rooms | 2 | 14.80 | - | 2.80 | 82.88$m^2$ | L= Inner perimeter =14.80 |
| | Living rooms | 2 | 13.60 | - | 2.80 | 76.16$m^2$ | L= Inner perimeter = 13.60 |
| | Staircase room | 1 | 12.00 | - | 3.00 | 36.00$m^2$ | L=Inner perimeter = 12.00 |
| | Face of wall below stair case entrance lintel 20 cm wide | 2 | 0.20 | - | 2.00 | 0.80$m^2$ | |
| | Shelves - Jambs, sills and soflits | 4 | 5.60 | 0.10 | - | 2.24$m^2$ | |
| | Study room, kitchens, Bath and W.Cs., Verandahs, etc (of 30 cm wall) | Same as for item (21) in G.F | | | | 268.80$m^2$ | |
| | Mumty room | 1 | 12.00 | | 2.50 | 30.00$m^2$ | |
| | | | | | Total | 496.88$m^2$ | |

| Item No. | Particulars items and of works | No. | Length m | Breadth m | Height or depth m | Quantity | Explanatory notes |
|---|---|---|---|---|---|---|---|
| | Deduct door and window openings | Same as for item (21) in G.F | | | | 48.80m$^2$ | |
| | | Net total of inside plastering | | | | 448.08m$^2$ | |
| | **Outside plastering** | | | | | | |
| | Outside of first floor | 1 | 52.20 | - | 3.00 | 156.00m$^2$ | L=Outer perimeter= 2(17.10+9.00) = 52.20 m |
| | **Deduct** | | | | | | |
| | Window opening W | 8 | 0.90 | - | 1.20 | 8.64m$^2$ | One face |
| | Window opening $W_1$ | 4 | 0.80 | - | 1.00 | 3.20m$^2$ | |
| | Window openings $W_2$ | 2 | 0.75 | - | 1.00 | 1.50m$^2$ | |
| | Front verandah openings | 1 | 8.10 | - | 2.20 | 17.82m$^2$ | L=8.90-2x.40 = 8.10m |
| | Back verandah openigns | 2 | 3.75 | - | 2.20 | 16.50m$^2$ | L=4.15-.40=3.75 m |
| | | | | Total of deduction | | 47.66m$^2$ | |
| | | | | Net Total of outside plastering 1st floor | | 108.94 (i) sq.m | |
| | Parapet wall (outer top and inner) | 1 | 51.20 | - | 2.00 | 102.40m$^2$ | (ii) L=Total length of 4 walls = 51.20 m Ht. = 2 x .90 + .20=2.00 m |
| | Mumty room - Outer side of walls | 1 | 13.60 | - | 2.50 | 34.00m$^2$ | L=Outer perimeter =13.60 m |
| | Deduct door openings $D_1$ | 1 | 0.90 | - | 2.10 | 1.89m$^2$ | |
| | Deduct window openings $W_3$ | 3 | 1.20 | - | 0.90 | 3.24m$^2$ | |
| | Deduct R.C.C Jalli | 3 | 1.20 | - | 0.50 | 1.80m$^2$ | |
| | | | | Net total of mumty | | 27.07m$^2$ (ii) | |
| | | Total of outside plastering (i), (ii) and (iii) = | | | | 238.41m$^2$ | |
| | | Grand total of inside and outside plastering | | | | 686.49m$^2$ | |
| 18 | **6 mm plastering with 1 :3 cement medium sand mortar in ceiling** | | | | | | |
| | Bed rooms | 2 | 3.70 | 3.70 | - | 27.38m$^2$ | |
| | Living rooms | 2 | 3.10 | 3.70 | - | 22.94m$^2$ | |
| | First floor study room, Kitchen, bath and W.C verandahs, staircase, Sunshades, etc | Same as in item (22) of G.F. | | | | 103.83m$^2$ | |
| | Mumty room - Ceiling | 1 | 2.30 | 3.70 | - | 8.51m$^2$ | |
| | Chujjas long | 2 | 5.10 | 0.50 | - | 5.10m$^2$ | L = 3.7 + .4 + 2 x 0.5 = 5.10m |
| | Chujjas short | 2 | 2.70 | 0.50 | - | 2.70m$^2$ | L = 2.30 + 0.40 = 2.70 m |
| | | | | | Total | 170.46m$^2$ | |

| Item No. | Particulars items and of works | No. | Length m | Breadth m | Height or depth m | Quantity | Explanatory notes |
|---|---|---|---|---|---|---|---|
| 19 | **Skirting 20 cm high with 12 mm thick 1:3 cement coarse sand mortar neat cement finished -** | | | | | | |
| | Bedrooms | 2 | 14.80 | - | - | 29.60m | L=Inner perimeter |
| | Livingrooms | 2 | 13.60 | - | - | 27.20m | |
| | Jambs of main room doors D | 10 | 0.20 | - | - | 2.00m | |
| | Study rooms, verandahs, etc | Same as in item (23) of G.F. | | | | 69.30m | |
| | | | | | Total | 128.10m | |
| | Deduct door openings D | 12 | 1.00 | - | - | 12.00m | |
| | | | | | Net total | 116.10m | |
| 20 | **Dado 12 mm thick 1:3 cement coarse sand mortar neat cement finished (in kitchen, bath and W.C)** | Same as in item (24) of G.F. | | | | 22.45m$^2$ | |
| | **VII. Flooring** | | | | | | |
| 21 | **2.5 cm C.C. 1:2:4 floor** | | | | | | |
| | Bed rooms | 2 | 3.70 | 3.70 | - | 27.38m$^2$ | |
| | Living rooms | 2 | 3.10 | 3.70 | - | 22.94m$^2$ | |
| | Study rooms | 2 | 3.70 | 2.00 | - | 14.80m$^2$ | |
| | Ktichens | 2 | 2.50 | 2.50 | - | 12.50m$^2$ | |
| | Bath rooms | 2 | 1.20 | 1.40 | - | 3.36m$^2$ | |
| | W.Cs | 2 | 1.20 | 1.00 | - | 2.40m$^2$ | |
| | Front verandah | 1 | 8.90 | 2.20 | - | 19.58m$^2$ | Including sills openigns |
| | Back verandahs | 2 | 4.15 | 2.70 | - | 22.41m$^2$ | Including sills openings |
| | Staircase landing (first floor levels) | 1 | 2.60 | 0.40 | - | 1.04m$^2$ | |
| | Staircase landing (middle) | 1 | 2.60 | 1.00 | - | 2.60m$^2$ | |
| | Staircase landing (2nd floor levels) | 1 | 2.60 | 0.40 | - | 1.04m$^2$ | |
| | Sills of doors D | 12 | 1.00 | 0.20 | - | 2.40m$^2$ | |
| | Sills of doors $D_1$ | 2 | 0.90 | 0.20 | - | 0.36m$^2$ | |
| | Sills of doors $D_2$ | 4 | 0.75 | 0.20 | - | 0.60m$^2$ | |
| | | | | | Total | 133.41m$^2$ | |
| | **VIII. Painting** | | | | | | |
| 22 | **Painting two coats over one coat of priming** | | | | | | |
| | - First floor doors, windows, window bars, staircase railing grills | Same as in item (28) of G.F. | | | | 136.11m$^2$ | |
| | Front verandah grill | 1 | 8.10 | - | 0.80 | 6.48m$^2$ | One face for both sides |
| | Back verandah grill | 2 | 3.75 | - | 0.80 | 6.00m$^2$ | |
| | Staircase upper landing grill | 1 | 1.20 | - | 0.80 | 0.96m$^2$ | |
| | Mumty room panelled door | 1 x $2^{1}/_{4}$ | 0.90 | - | 2.10 | 4.25m$^2$ | |
| | Glazed windows | 3x1 | 1.20 | - | 0.90 | 3.24m$^2$ | |
| | Window bars | 3x1 | 1.05 | - | 0.75 | 2.36m$^2$ | |
| | | | | Total | | 159.40m$^2$ | |

| Item No. | Particulars items and of works | No. | Length m | Breadth m | Height or depth m | Quantity | Explanatory notes |
|---|---|---|---|---|---|---|---|
| 23 | **Coaltar painting two coats on back of chaukhats - First floor** | | | | | | |
| | doors and windows | Same as in item 29 of G.F. | | | | 16.00$m^2$ | |
| | Mumty room - Door $D_1$ | 1 | 4.60 | 0.10 | - | 0.46$m^2$ | |
| | Windows $W_2$ | 3 | 4.20 | 0.10 | - | 1.26$m^2$ | |
| | | | | | Total | 17.72$m^2$ | |
| 24 | **IX. White washing and Colour washing -** | | | | | | |
| | **White washing 3 coats - Walls (inside)** | Same as inside plastering in item (17) F.F | | | | 448.08$m^2$ | |
| | **Ceiling underside of sunshades** | Same as plastering in item | | (18) | F.F. | 170.46$m^2$ | |
| | | | | | Total | 618.54 $m^2$ | |
| 25 | **Colour washing two coats over one coat of white washing walls (out side)** | Same as out side plastering in item (17) F.F. | | | | 238.41 $m^2$ | |
| | **X Misc. Items** | | | | | | |
| 26 | **100mm dia. A.C. rain water pipe** | 6 | 3.20 | – | | 19.20m | Including bend |

# Prepare abstract of estimate by prevailing rates.

**Objectives:** At the end of this exercise you shall be able to
- **prepare abstract estimate of ground and first floor.**

**Abstract of estimated cost (Ground floor)**

| Item No. | Particulars of items of work | Quantity | Unit | Rate Rs.Ps. | Per | Amount Rs.Ps. |
|---|---|---|---|---|---|---|
| | **I Earthwork** | | | | | |
| 1 | Site clearance and setting out | 1 | Job | | L.S. | |
| 2 | Earthwork in excavation in foundation | 55.75 | cu m | | % cu m | |
| 3 | Earthwork in filling in plinth | 46.52 | cu m | | % cu m | |
| | **II concrete** | | | | | |
| 4 | Lime concrete in foundation | 19.36 | cu m | | / cu m | |
| 5 | R.C.C. work 1:2:4 excluding steel reinforcement bars and its bending but including centering and shuttering and binding steel | 21.058 | cu m | | / cu m | |
| 6 | 2.5cm 1:2:4 nosing in steps neat cement finished | 32.70 | m | | /m | |
| 7 | R.C.C 1:2:4 Newal post 10cm x 10cm, 1 m height including reinforcement complete work | 2 | No. | | each | |
| 8 | R.C.C. 1:2:4 hand rail in staircase including reinforcement complete work. | 5.48 | m | | /m | |
| 9 | 4cm thick R.C.C. Jalli including reinforcement complete work | 1.50 | Sq m | | / sq m | |
| 10 | 2.5 cm Damp proof course C.C 1:2:3 with water proofing compound | 28.97 | Sq m | | / sq m | |
| | **III Brickwork** | | | | | |
| 11 | First class brick work in lime mortar in foundation and plinth | 41.94 | cu m | Rates can be quoted from the prevailing schedule of rates | / cu m | Amount can be calculated by multiplying the quantity with its rate |
| 12 | First class brickwork in lime mortar in superstructure in 30cm wall | 36.45 | cu m | | / cu m | |
| 13 | First class brickwork in 1:6 cement local sand mortar in superstructure in foundation and plinth | 22.74 | cu m | | / cu m | |
| 14 | 10 cm thick first class brickwork in partition wall in 1:3 cement coarse sand mortar with hoop iron or 6mm dia. steel reinforcement every fourth layer | 7.20 | sq m | | / sq m | |
| | **IV Wood work Doors and Windows** | | | | | |
| 15 | Salwood work in chowkhats in doors and windows | 1.201 | cu m | | / cu m | |
| 16 | 4 cm thick panelled shutters of deodar wood in doors and windows | 41.197 | sq m | | /sq m | |
| 17 | Door and window fittings of oxydized iron | 41.197 | sq m | | / sq m | |

| Item No. | Particulars of items of work | Quantity | Unit | Rate Rs. Ps. | Per | Amount Rs. Ps. |
|---|---|---|---|---|---|---|
| | **V. Steel and Iron work** | | | Rates can be quoted from the prevailing schedule of rates | | Amount can be calculated by multiplying the quantity with its rate |
| 18 | Steel reinforcement bars including bending | 16.226 | quintal | | /q | |
| 19 | Iron work in hold fasts and window bars | 5.633 | quintal | | /q | |
| 20 | Iron grill work in stair case railing | 4.304 | sq m | | /sq m | |
| | **VI. Plastering and pointing** | | | | | |
| 21 | 12mm plastering with 1:6 cement local sand mortar in walls | 562.81 | sq m | | / sq m | |
| 22 | 6mm plastering with 1:3 cement medium sand mortar in ceiling | 149.33 | sq m | | / sq m | |
| 23 | Skirting 20cm high with 12mm thick 1:3 cement coarse sand mortar neat cement finished | 114.30 | m | | /m | |
| 24 | Dado 12mm thick 1:3 cement coarse sand mortar neat cemetn finished | 22.45 | sq m | | / sq m | |
| 25 | 20mm plastering with 1:3 cement coarse sand mortar neat cement finished in steps | 13.96 | sq m | | /sq m | |
| | **VII flooring** | | | | | |
| 26 | 2.5cm C.C. 1:2:4 floor over and including 7.5cm lime concrete | 125.85 | sq m | | /sq m | |
| 27 | 2.5 cm C.C. 1:2:4 floor | 9.55 | sq m | | /sq m | |
| | **VIII painting** | | | | | |
| 28 | Painting two coats over one coat of priming | 130.16 | sq m | | /sq m | |
| 29 | Coal tar painting two coats on back of chowkhats | 16.00 | sq m | | /sq m | |
| | **IX White washing and colour washing** | | | | | |
| 30 | White washing 3 coats inside | 565.81 | sq m | | /sq m | |
| 31 | Colour washing 2 coats over one coat of white washing | 159.76 | sq m | | /sq m | |
| 32 | 100 mm dia. A.C. rain water pipe | 21.60 | m | | /m | |

Total

Add 8% for water supply and sanitary works
Add 8% for electrification works

Total

Add 3% for contingencies
Add 2% for workcharged establishment

Grand Total

## Abstract of Estimated Cost (First floor)

| Item No. | Particulars of items of work | Quantity | Unit | Rate Rs.Ps. | Per | Amount Rs.Ps. |
|---|---|---|---|---|---|---|
| | **II. Concrete** | | | | | |
| 1 | Lime concrete in roof terracing 7.5 cm thick complete with surface finishing | 151.42 | sq m | Rates can be quoted from the prevailing schedule of rates | /sq m | Amount can be calculated by multiplying the quantity with its rate |
| 2 | R.C.C work 1:2:4 excluding steel reinforcement and its bending but including contering and shuttering and binding steel | 22.644 | cu m | | /cu m | |
| 3 | 2.5cm C.C. 1:2:4 nosing in steps of stair case neat cement finished | 19.80 | m | | /m | |
| 4 | R.C.C 1:2:4 newal post in stair case 10cm x 10cm, 1m height including reinforcement complete work | 3 | nos | | /nos | |
| 5 | R.C.C 1:2:4 hand rail over grill including reinforcement complete work | 22.28 | m | | /m | |
| 6 | 4cm thick R.C.C jalli including steel reinforcement complete work | 3.30 | sq.m | | sq m | |
| | **III Brick work** | | | | | |
| 7 | First class brickwork in 1:6 cement local sand mortar in superstructure in 20cm thick wall | 63.56 | cu m | | /cu m | |
| 8 | 10cm thick first class brickwork in partition wall with 1:3 cement coarse sand mortar with hoop iron or 6mm dia. steel reinforcement every fourth layer | 7.20 | sq m | | /sq m | |
| 9 | 10 cm thick brick band with 1:6 cement local sand mortar at top of parapet | 52.20 | m | | /m | |
| | **IV Wood work - Doors and Windows** | | | | | |
| 10 | Salwood work in chow khats in doors and windows | 1.331 | cu m | | /cu m | |
| 11 | 3 cm thick panelled shutters of deodar wood in doors and windows | 42.554 | sq m | | /sq m | |
| 12 | 3cm thick fully glazed shutters of deodar wood | 3.931 | sq m | | /sq m | |
| 13 | Door and window fittings of oxydized iron | 46.485 | sq m | | /sq m | |
| | **V Steel and iron work** | | | | | |
| 14 | Steel reinforcement bars including bending | 17.544 | quintal | | /q | |
| 15 | Iron work in hold fasts and window bars | 6.414 | quintal | | /q | |
| 16 | Iron gril in railings | 17.75 | sq m | | /sq m | |

| Item No. | Particulars of items of work | Quantity | Unit | Rate Rs. Ps. | Per | Amount Rs. Ps. |
|---|---|---|---|---|---|---|
| | **VI. Plastering and pointing** | | | | | |
| 17 | 12mm plastering with 1:6 cement local sand mortar in walls | 692.76 | sq m | | /sq m | |
| 18 | 6mm plastering with 1:3 cement medium sand mortar in ceiling | 170.46 | sq m | | /sq m | |
| 19 | Skirting 20cm high with 12mm thick 1:3 cement coarse sand mortar neat cement finished | 116.10 | m | | /m | |
| 20 | Dado 12mm thick 1:3 cement coarse sand mortar neat cement finished | 22.45 | sq m | | /sq m | |
| | **VII flooring** | | | | | |
| 21 | 2.5cm C.C. floor | 133.41 | sq m | | /sq m | |
| | **VIII painting** | | | | | |
| 22 | Painting two coats over one coat of priming | 152.85 | sq m | | /sq m | |
| 23 | Coaltar painting two coats on back of chowkhats | 17.72 | sq m | | /sq m | |
| | **IX White washing and color washing** | | | | | |
| 24 | White washing 3 coats inside | 624.54 | sq m | | /sq m | |
| 25 | Colour washing two coats over one coat of white washing | 238.68 | sq m | | /sq m | |
| | **X Miscellaneous items** | | | | | |
| 26 | 100mm dia. A.C. rain water pipe | 19.20 | m | | / m | |

Total

Add 8% for water supply and sanitary works
Add 8% for electrification works

Total

Add 3% for contingencies
Add 2% for workcharged establishment

Grand Total

# Prepare rate analysis of major items - RCC,PCC,Wood works, stone & Brick masonry & Plastering

**Objectives:** At the end of this exercise you shall be able to
- **prepare the rate analysis of plain cement concrete**
- **prepare the rate analysis of reinforced cement concrete**
- **prepare the rate analysis of stone masonry**
- **prepare the rate analysis of brick masonry**
- **prepare the rate analysis of plastering**
- **prepare the rate analysis of wood work.**

## DATA (specification)

- PCC : 1:5:10
- Coarse aggregate : 40mm
- Unit : $1m^3$
- Take : $10m^3$

**Rate of materials and labour charge can be changed to prevailing local rate or CPWD rate.**

PROCEDURE

**Cement concrete 1:5:10 in foundation of floor with brick ballast 40mm ($1^1/_2$") thick gauge - unit 1 cu m. Take - 10 cu.m**

| Particualr | Qty or Nos | Rate | Cost |
|---|---|---|---|
| | | Rs. Ps. | Rs. Ps. |
| **Materials** | | | |
| Broken stone 40mm gauge | 9.50 cu m | 650.00 per cu m | 6175.00 |
| Sand (local) | 4.75 cu m | 700.00 per cu m | 3325.00 |
| Cement ($28^{1/2}$ bags) | 0.95 cu m | 7650.00 per cu m | 7267.50 |
| | | Total | 16767.50 |
| Labour | | | |
| Mistri (Head mason) | $^1/_2$ no | 350.00 per day | 175.00 |
| Mason | 1 $^1/_2$ no | 300.00 per day | 450. 00 |
| Mazdoor (Beldar) | 12 nos | 220.00 per day | 2640.00 |
| Boy or woman coolie | 18 nos | 200.00 per day | 3600.00 |
| Bhishti (Including curing) | 4 nos | 200.00 per day | 800.00 |
| Sundries T and P etc | Lump sum | 120.00 L.S | 120.00 |
| | | Total | 7785.00 |
| | | Total of materials and labour | 24552.50 |

| Particular | Qty or Nos | Rate | | Cost | |
|---|---|---|---|---|---|
| | | Rs. | Ps. | Rs. | Ps. |
| Add 1 $^{1}/_{2}$% water charges | — | --- | | 368.00 | |
| Add 10% contractor's profit | — | --- | | 2455.25 | |
| | | **Grand total** | | **27375.75** | |
| **Rate per cu m- Rs. 27375.75/10** | **= Rs.2737.57** | | | **for 10 cu m** | |

TASK 2 : **Prepare the rate analysis of RCC work 1:2:4 for beams, slabs, etc.**

## DATA (Specification of the work)

- Stone ballast : 20mm
- Sand (Coarse)
- Ratio : 1:2:4
- Unit : $1m^3$
- Take : $10m^3$

**R.C.C. work in beams, slabs, etc. 1:2:4-unit 1 cu m. Take -10 cu m**

| Particular | Qty or Nos | Rate | | Cost | |
|---|---|---|---|---|---|
| | | Rs. | Ps. | Rs. | Ps. |
| **Materials** | | | | | |
| Stone ballast 20mm gauge | 8.80 cu m | 1800.00 per cu m | | 15840.00 | |
| Sand (coarse) | 4.40 cu m | 1500.00 per cu m | | 6600.00 | |
| Cement (66 pags) | 2.20 cu m | 7650.00 per cu m | | 16830.00 | |
| Steel, mild steel bars @ 1%= | | | | | |
| 0.1 cu m @ 78.5 q/cu m=7.85q | 7.85 q | 4400.00 per q | | 34540.00 | |
| Binding wire | 1.50 kg | 65.00 per q | | 97.50 | |
| | | Total | | 73907.50 | |
| **Labour** | | | | | |
| Mistri (Head Mason) | 1/2 no | 350.00 per day | | 175.00 | |
| Mason | 3 nos | 300.00 per day | | 900.00 | |
| Mazdoor (Beldar) | 12 nos | 220.00 per day | | 2640.00 | |
| Boy or woman coolie | 20 nos | 200.00 per day | | 4000.00 | |
| Bhishti (including curing) | 6 nos | 200.00 per day | | 1200.00 | |
| Sundries T. and P etc | Lump sum | 140.00 L.S | | 140.00 | |
| | | Total | | 9055.00 | |

| Particular | Qty or Nos | Rate | Cost |
|---|---|---|---|
| | | Rs. Ps. | Rs. Ps. |
| Bending cranking and binding steel bars in position blacksmith (II class) | 8 nos | 280.00 per day | 2240.00 |
| Mazdoor (Belder) | 8 nos | 220.00 per day | 1760.00 |
| T. and P | Lump sum | 90.00 L.S | 90.00 |
| | | Total | 4090.00 |
| Centering and shuttering (both erection and dismantling) | | | |
| Timber planks and balies | Lump sum | 1500.00 L.S | 1500.00 |
| Carpenter (II class) | 10 nos | 280.00 per day | 2800.00 |
| Mazdoor (Belder) | 10 nos | 220.00 per day | 2200.00 |
| Nails | Lump sum | 200.00 L.S | 200.00 |
| T. and P. | Lump sum | 70.00 L.S | 70.00 |
| | | Total | 6770.00 |
| Total of materials and labour | — | — | 85673.00 |
| Add $1\frac{1}{2}$% water charges | — | — | 1285.00 |
| Add 10% contractor's profit | — | — | 8567.00 |
| | | Grand total | 95525.30 |
| Rate per cu m - Rs. 95525/10 | = Rs. 9552.50 | | for 10 cu m |

TASK 3 : **Prepare the rate analysis of random rubble masonry**

**DATA (specification of the work)**

- Mortar : Cement mortar 1:6
- Unit : $1m^3$
- Take : $10m^3$

**Random rubble stone masonry in superstructure in 1:6 cement sand mortar - unit 1 cu m Take -10 cu m**

| Particular | Qty or Nos | Rate | Cost |
|---|---|---|---|
| | | Rs. Ps. | Rs. Ps. |
| **Materials** | | | |
| Stone including through bond | | | |
| Stone and wastage | 12.5 cu m | 1200.00 per cu m | 15000.00 |
| Cement (21 bags) | 0.7 cu m | 7650.00 per cu m | 5355.00 |
| Sand or bajri (local) | 4.2 cu m | 700.00 per cu m | 2940.00 |
| | | Total | 23295.00 |

| | | | |
|---|---|---|---|
| **Labour, etc** | | | |
| Mistri (Head mason) | 1/2 no | 350.00 per day | 175.00 |
| Mason | 12 nos | 300.00 per day | 3600.00 |
| Mazdoor (Beldar) | 10 nos | 220.00 per day | 2200.00 |
| Coolie (boy or woman) | 10 nos | 200.00 per day | 2000.00 |
| Bhishti | 1 1/2 nos | 200.00 per day | 300.00 |
| Scaffolding | Lump sum | 325.00 L.S | 325.00 |
| Sundries T and P etc | Lump sum | 90.00 L.S | 90.00 |
| | | Total | 8690.00 |
| | Total of materials and labour | | 31985.00 |
| Add 1 $^{1}/_{2}$ % water charge | | | 480.00 |
| Add 10% contractor's profit | | | 3198.50 |
| Grand total | | | 35663.50 |
| **Rate per cu m -Rs. 35664 / 10 = 35663.50** | | | for 10 cu m |

TASK 4 : **Prepare the rate analysis of brick masonry**

**DATA (specification of the work)**

- Bricks : (19x9x9) cm
- Mortar : 1.6 cement mortar
- Unit : 1m$^3$
- Take : 10m$^3$

**I-class brick work in superstructure with (19x9x9) cm brick with 1:6 cement sand mortar - unit 1 cu m. Take -10 cu m**

| **Particualar** | **Qty or Nos** | **Rate** | **Cost** |
|---|---|---|---|
| | | **Rs. Ps.** | **Rs. Ps.** |
| **Materials** | | | |
| Brick I-class (500 bricks per cu m) | 5000 nos | 4500.00 per 100 nos | 22500.00 |
| Cement (13.5 bags) | 0.45 cu m | 7650.00 per cu m | 3442.00 |
| Sand (local) | 2.7 cu m | 700.00 per cu m | 1890.00 |
| | | Total | 27832.00 |
| **Labour** | | | |
| Mistri (Head mason) | 1/2 no | 350.00 per day | 175.00 |
| Mason | 10 nos | 300.00 per day | 3000.00 |
| Mazdoor (Beldar) | 7 nos | 220.00 per day | 1540.00 |
| Boy or woman coolie | 10 nos | 200.00 per day | 2000.00 |
| Bhishti | 2 nos | 200.00 per day | 400.00 |
| Scaffolding | Lump sum | 280.00 per day | 280.00 |
| Sundries T and P etc | Lump sum | 90.00 per day | 90.00 |
| | | **Total** | **7485.00** |

| | | |
|---|---|---|
| | Total of materials and labour | 35317.50 |
| | Add $1^1/_2$ % water charges | 530.00 |
| | Add 10% contractor's profit | 3531.25 |
| | Grand total | 39378.75 for $10m^3$ |
| | **Rate per cu m -Rs.39379 / 10 = Rs. 3938.00** | |

TASK 5 : **Prepare the rate analysis of wood work**

## DATA (specification of the work)

**Wood work for frame of doors and windows**

- Frame size : 8x12mm
- Door size : 200x120 (salwood)

**1 For fixing the frame in position a lumpsum amount of 100/-may be added**

**2 For soft wood the labour may be reduced to 25%**

| Particular | Qty or Nos | Rate Rs. Ps. | Cost Rs. Ps. |
|---|---|---|---|
| **Materials** | | | |
| Timber 5.48x0.08x0.12 | 0.053 cu m | | |
| (L=2x2.14+1x1.2=5.48) | | | |
| Wastage 5% | 0.003 cu m | | |
| | 0.056cu m | 40000.00 per cu m | 2240.00 |
| **Labour, etc.** | | | |
| Mistri (carpenter) | $\frac{1}{16}$ no | 300.00 per day | 18.75 |
| Carpenter | $\frac{3}{4}$ no | 280.00 per day | 210.00 |
| Coolie (Helper) | $\frac{1}{2}$ no | 200.00 per day | 100.00 |
| Sundries, T and P. etc | Lump sum | 45.00 per day | 45.00 |
| | | Total of labour | 373.75 |
| | Total of materials and labour | | 2613.75 |
| | Add 10% contrctor's profit | | 261.37 |
| | Grand total | | 2875.12 |
| | **Rate per cu m (dividing by 0.053) -Rs. 2875.12/0.053 = Rs. 54247.00** | | |

TASK 6 : **Prepare the rate analysis of plastering**

## DATA

- Thickness of plastering : 12mm
- Cement mortar : 1:6
- Unit : $1m^2$
- Take : $100m^2$

| Particular | Qty or Nos | Rate | Cost |
|---|---|---|---|
| | | Rs. Ps. | Rs. Ps. |
| **Materials** | | | |
| Cement (9 bags) | 0.30 cu m | 7650.00 per cu m | 2295.00 |
| Sand (local) | 1.80 cu m | 700.00 per cu m | 1260.00 |
| | | Total | 3555.00 |
| Labour | | | |
| Mistri (Head mason) | $^1/_3$ no | 350.00 per day | 116.70 |
| Mason | 10 nos | 300.00 per day | 3000.00 |
| Mazdoor (Beldar) including raking of joints | 15 nos | 220.00 per day | 3300.00 |
| Bhishti including (curing) | $^3/_4$ nos | 200.00 per day | 150.00 |
| Scaffolding sundries T.and P. etc | Lump sum | 200.00 per day | 200.00 |
| | | **Total** | **6766.70** |
| | Total of materials and labour | | 10321.70 |
| | Add 1 $^1/_2$ % water charges | | 154.80 |
| | Add 10% contractor's profit | | 1032.17 |
| | Grand total | | 11508.67 |
| **Rate per cu m-Rs.11508/100 = Rs. 115.00** | | | **for 100 sq m** |

# Preliminary estimate

**Objective:** At the end of this exercise you shall be able to
- **prepare preliminary estimate of different structures.**

## DATA

- Plinth area rate : Rs.25,000/$m^2$
- Cubical extend rate : Rs.7500/$m^3$

## PROCEDURE

TASK 1 : **Prepare preliminary estimate of building**

### 1 Plinth area estimate

| | | |
|---|---|---|
| Plinth area of building | = | 100$m^2$ |
| Plinth area rate | = | Rs.25000/$m^2$ |
| Approximate cost of building | = | 25000x100 |
| | = | Rs.25,00,000/- |

**For storeyed building, the plinth area estimate is prepared for each storey seperately.**

### 2 Cube rate estimate

| | | |
|---|---|---|
| Cubical content of building | = | 350$m^3$ |
| (100x3.5 (height) | | |
| Cube rate of building | = | Rs.7500/$m^3$ |
| Cube rate of building | = | 350x7500 |
| | = | Rs.2,625,000/- |

**Per unit basis**

Per student for schools and hostels, per classrooms for schools, per bed for hospitals, per seat for cinema theatre halls, per day for factories, barracks and dormetories.

- Approximate estimate of a hostel building for 100 students @ Rs.20,000/-per students work out as Rs. 20 lakhs.
- Approximate cost of a 100 bed hospital @ 1,00,000 per bed comes to Rs. 1 crore
- Approximate cost of a barrack for 10 days @ 20,000 per days comes to Rs. 2 lakhs.

### 1 Irrigation channels

i Per kilometer basis depending on the capacity of channel.

ii Area of land commanded ie., per hectare basis

- The approximate cost of 10km length of irrigation channel of 3$m^3$/sec, capacity @ Rs. 70,000/per km works out Rs.7 lakhs.
- For an irrigation project having a commanded area 2000 hectares, approximate cost Rs.1000/hectare comes to Rs. 20 lakhs.

### 2 Roads and highways

Per kilometer basis depending on the nature of raod, the width and thickness of mettaling, etc.

For 10km of a state highway approximate cost Rs. 5 lakhs/km work out 50 lakhs.

## Estimation of earth work with software

**Objective:** At the end of this exercise you shall be able to

- **quantities of earth work by trapezoidal and prismoidal formula.**

## PROCEDURE

TASK 1 : **Quantities of earth work by trapezoidal and prismoidal formula**

A railway embankment is 12m wide. The ground is level in direction transverse to the centre line. Calculate the volume contained in a 100m length by trapezoidal rule and prismoidal rule, if the direction side slope is 1.5:1. The centre heights at 20m interval are 3.7m, 2.6m, 3.4m, 2.8m, 3.0m, 2.2m.

**Solution**

For a level section A = (b + sh) h

Slope = 1.5:1, hence s = 1.5

b = 12m

Let the area at different sections be A1, A2,-----

$A_1 = (12 + 1.5 \times 3.7)\ 3.7 = 64.935m^2$

$A_2 = (12 + 1.5 \times 2.6)\ 2.6 = 41.34m^2$

$A_3 = (12 + 1.5 \times 4.0)\ 4.0 = 72.00m^2$

$A_4 = (12 + 1.5 \times 3.4)\ 3.4 = 58.14m^2$

$A_5 = (12 + 1.5 \times 2.8)\ 2.8 = 45.36m^2$

$A_6 = (12 + 1.5 \times 3.0)\ 3.0 = 49.50m^2$

$A_7 = (12 + 1.5 \times 2.2)\ 2.2 = 33.66m^2$

**Trapezoidal rule**

$$V = L\left[\left(\frac{A1 + A7}{2}\right) + A2 + A3 = A4\right]$$

$$= 20\left[\left(\frac{64.935 + 33.66}{2}\right) + 41.34 + 72.00 + 58.14 + 45.36 + 49.50\right]$$

$$= 20[(49.297) + 266.34]$$

$= 6312.34m^3$

**Prismoidal rule**

$$V = \frac{L}{3}[(A_1 + A_7) + 4(A_2 + A_4 + A_6) + 2(A_3 + A_5)]$$

$$= \frac{20}{3}[(64.935 + 33.66) + 4(41.34 + 58.14 + 49.50) + 2(72.00 + 45.36)]$$

$= 6194.9m^3$

A road embankment is 8m wide and 200 m in length, at the formation level with a side slope of 1:5:1. The embankment has a rising gradient of 1 n 100m the ground levels at every 50m along the centre line area as follows:

| Distance (m) | 0 | 50 | 100 | 150 | 200 |
|---|---|---|---|---|---|
| RL (m) | 164.5 | 165.2 | 166.8 | 167 | 167.2 |

The foundation level of zero chain age is 166m. Calculate the volume of earthwork.

**Solution :** rising gradient is 1 in 100m

Formation level increases by 0.5m from every 50m distance.

| Distance | 0 | 50 | 100 | 150 | 200 |
|---|---|---|---|---|---|
| RL (m) | 164.5 | 165.2 | 166.8 | 167 | 167.2 |
| Formation level (m) | 166 | 166.5 | 167 | 167.5 | 168 |
| Depth of filling h (m) | 1.5 | 1.3 | 0.2 | 0.5 | 0.8 |

We know that the area of a cross-section is given by

$A = (b+sh)\,h$

Hence,

$A_1 = (8 + 1.5 \times 1.5)\ 105 = 15.375 m^2$

$A_2 = (8 + 1.5 \times 1.3)\ 1.3 = 12.935 m^2$

$A_3 = (8 + 1.5 \times 0.2)\ 0.2 = 1.66 m^2$

$A_4 = (8 + 1.5 \times 0.5)\ 0.5 = 4.375 m^2$

$A_5 = (8 + 1.5 \times 0.8)\ 0.8 = 7.360 m^2$

Interval L = 50m

**Trapezoidal rule**

$$V = L\left[\left(\frac{A1 + A5}{2}\right) + A2 + A3 + A4\right]$$

$$= \frac{50}{2}\left[\left(\frac{15.375 + 7.360}{2}\right) + 12.935 + 1.66 + 4.375\right]$$

$= 1516.875 m^3$

**Prismoidal rule**

$$V = \frac{L}{3}\left[(A_1 + A_5) + 4(A_2 + A_4) + 2A_3\right]$$

$$= \frac{50}{3}\left[(15.375 + 7.36) + 4(12.935 + 4.375) + (2 \times 1.66)\right]$$

$= 1588.25 m^3$

# Application of survey using total station.

**Objectives:** At the end of this exercise you shall be able to
- **identify the different components of hydro electric power project**
- **draw the schematic diagram of high head hydro electric project.**

## Requirement

**Tools/Instruments**

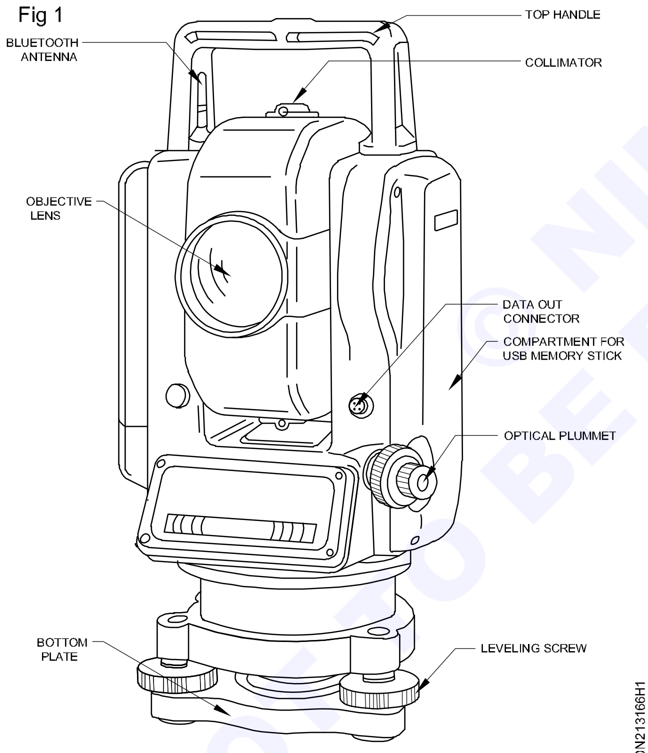
- Total station in carrying box with tripod.

## PROCEDURE

### Set up

The following steps are followed for the set up of a total station at a station point. (Fig 1)

Fig 1




TOTAL STATION - INSTRUMENT COMPONENTS

1 Choose as adequate instrument station. Make sure that an observe can safely operate the instrument with out knocking it over. It is necessary to have the center of the instrument, which is the point of intersection of the transverse axis and the instrument, which is the point of intersection if the transverse axis and the verti cal axis if the instrument, directly over a given point on the ground (the instrument station).

2 Remove the plastic cap from the tripod, and leave the instrument is the case until the tripod is nearly level. Stretch the tripod legs 10-15 cm shorter than their maximum length.

3 Open the legs of the tripod to set tripod head at the level of the operator's upper chest. When the total station is set up on the head, the operator's eye should slightly above the eyepiece. The instrument height important for an effective and comfortable survey. One should not touch or cling to the tripod during the sur vey.

4 At the new station without a reference point on the ground level up the total station at an arbitrary point, where a stake can easily go in and be steady, and put down the stake and the center using the plummet.

5 To occupy an existing a station above a reference point, first roughly develop the tripod head right above the point. For levelling up a small levels is useful. To find out the position, use a plumb bob or drop a stone through the hole in the tripod head.

6 Once roughtly levelled and centered push each tip of the period tripod leg firmly into the ground, applying full height of the observer on the step above the tip. Apply the weight along the tripod leg without bending it.

7 Check the level and center it again. Adjust the level by changing the leg length.

8 Fix a tribrach with a plummet, a tribrach and a prism carrier with a plummet or a total station with a built-in plummet on the tripod head.

9 Adjust the three screws of the branch to center the bubble of a spirit level with the following steps:

a Release the lock of the horizontal circle.

b Rotate the instrument to set the plate level parallel to AB at the 1st position.

c Turn the foot screws A and B in the opposite direction, the same amount to center the plate level. This will adjust the tilt on the aa' axis.

d Rotate the instrument 90° to the set the plate level and the 2nd position.

e Turn the foot screw C to the center plate level, adjusting the tilt along CC".

f Rotate the instrument 90$^0$ to set plate level in the 3$^{rd}$ position.

g Turn the foot screws A and B in the opposite direction, the same amount to eliminate half the centering error.

h Rotate the instrument 90$^0$ to the set the plate level at the 4th position.

i Turn the foot screw C to eliminate half the centering error.

j Repeat b to i until the plate level is centered in all directions (give a little time for slow movement of the bubble in viscous fluid).

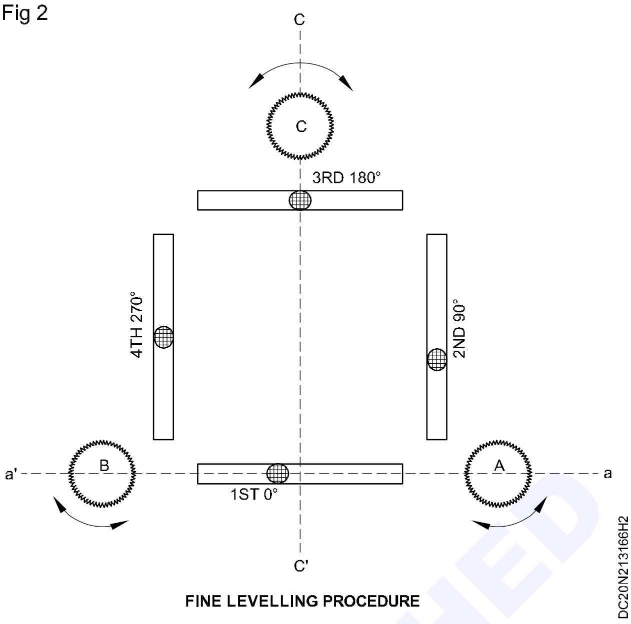
10 Pull out of the optical plummet and use the optic ring to focus the graduation and then focus at the mark on the ground. Or turn on the laser plummet. Rotate the plummet or the total station to check, it is centered within 1cm from the reference point. If not, estimate the amount of offset and carefully translate the entire tripod as much as the offset. Return to 4 and try to level and center again. The total station on the tripod head can be translated 1cm from the center, therefore rough centering within 1cm is necessary. Be careful to see that the center of the optical plummet or the laser point is on an axis perpendicular to the horizontal circle of the total station. If the total station is not level, the plummet line does not coincide with the plumb line.

11 Put the total station in the branch if it is not there.

12 Use the plate level for the final levelling of the total station. Follow the instruction given in Fig 2.

13 When the total station is finely levelled up.Use the plummet to check centering.If plummet point out of centre of the reference. Slightly loosen the fixing screw below the tripod head and translate the tribrach to place the plummet center on the exact point. Do not rotate. When the translation is done, tighten the fixing screw moderately. If any portion of the base of the tribrach goes outside the tripod head, return to 4.

Fig 2




14 Rotate the total station by 180° if the plummet center goes away from the point, slightly loosen the fixing screw and slide the total station halfway to the center.

15 Repeat the steps 12 and 13 until the plummet center stays exactly on the center of the mark.

16 Tighten the fixing screw firmly without applying too much pressure. Never loosen the screw until all the measurements are finished.

17 Measure the instrument height. The centre of the total station is marked on the side of the alidade. The vertical distance between the mark and the ground is the instrument height.

18 Check the plate level from time to time during measurement before the total station tilts beyond the auto matic correction.

## Station setup for a total station

**Objectives:** At the end of this exercise you shall be able to
- **give the necessary inputs to the total station**
- **collect the** data **from the field after station setup.**

### Requirements

**Tools/Instruments**

- Total station in carrying box with tripod, prism and reflector pole.

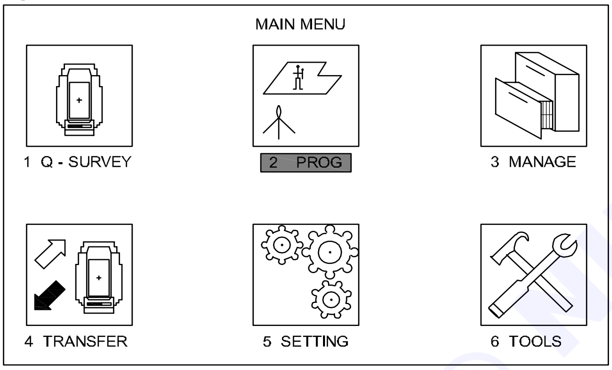
## PROCEDURE

1 After centering and levelling (done in previous exercise)

2 Press MENU

3 Press (**Programs**). (Fig 1)

Fig 1




LEVELLING & CENTERING

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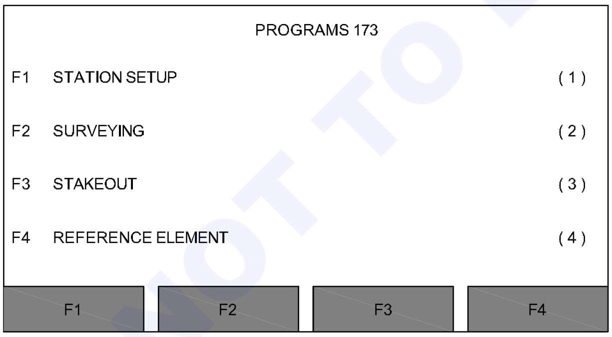
4 Press F1 (Station setup) (Fig 2)

Fig 2




LEVELLING & CENTERING

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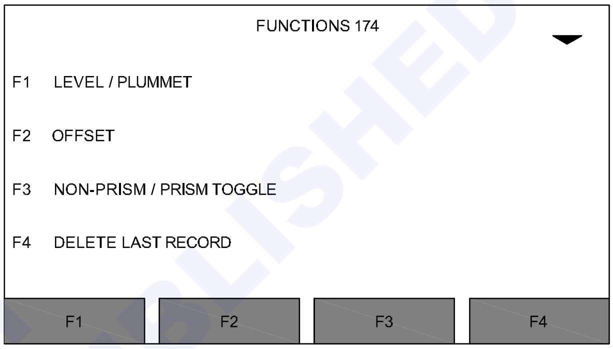
5 Switch on the instrument. (Fig 3)

6 Press FNC key Laser Beam for centering and levelling.

7 FNC 1 for levelling & Plummet. (Fig 4)

Fig 4

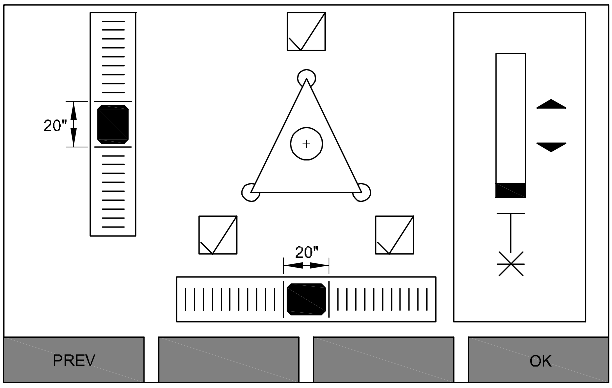



LEVELLING & CENTERING

DC20N213166J4

8 Do the levelling centering with help of foot screw & Tripod legs. (Fig 5)

Fig 5




LEVELLING & CENTERING

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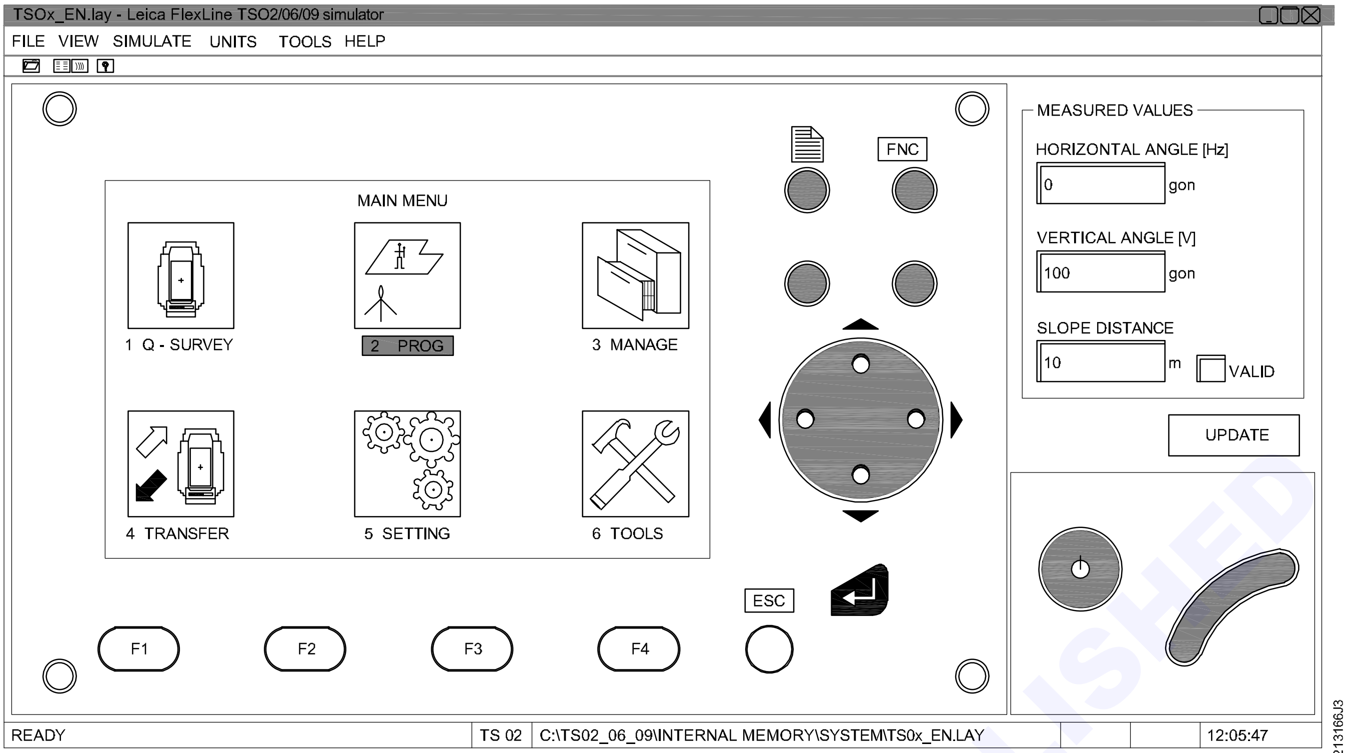
9 Press F1 (Set Job) (Fig 6)

10 Press F1 (NEW) to give a new job name. (Fig 7)

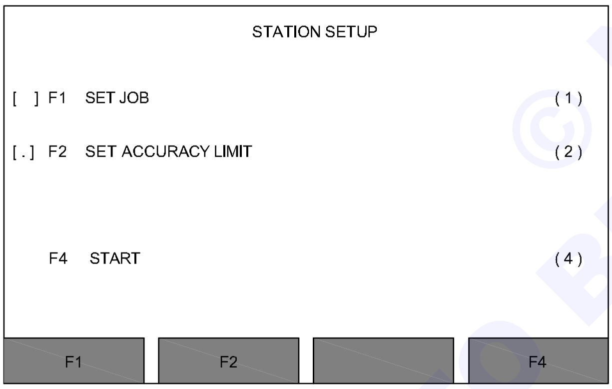
11 To write the name of the job. Press F1 (INPUT) and then using keyboard give the name and then press enter key. (Fig 8)

Fig 3



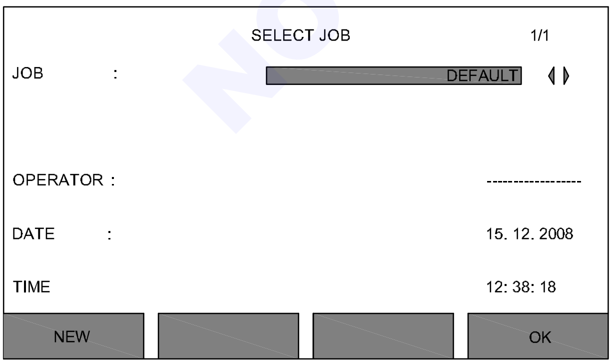

LEVELLING & CENTERING

Fig 6



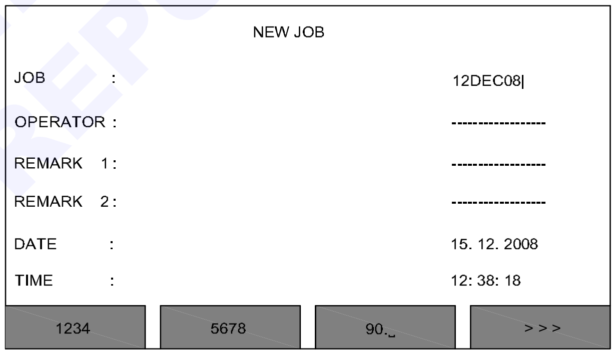

LEVELLING & CENTERING

Fig 7




LEVELLING & CENTERING

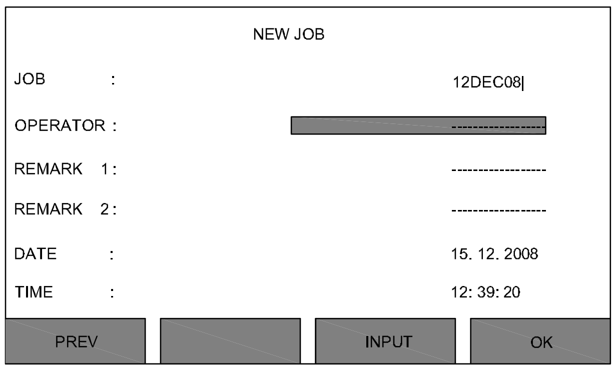
Fig 8




LEVELLING & CENTERING

12 Press F4 (OK) (Fig 9)

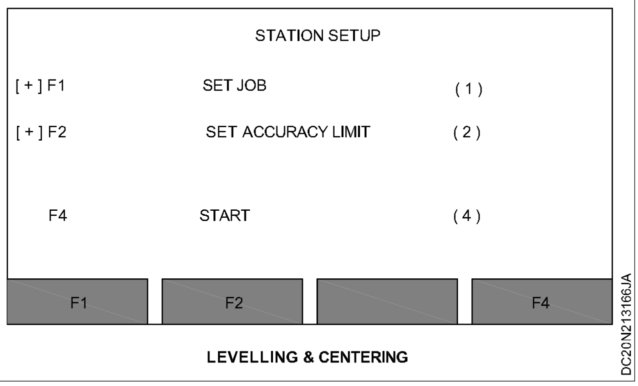
Fig 9




LEVELLING & CENTERING

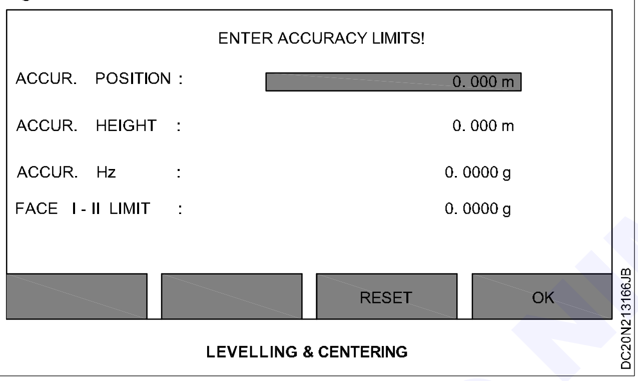
13 Press F2 (Set Accuracy Limit) (Fig 10)

Fig 10



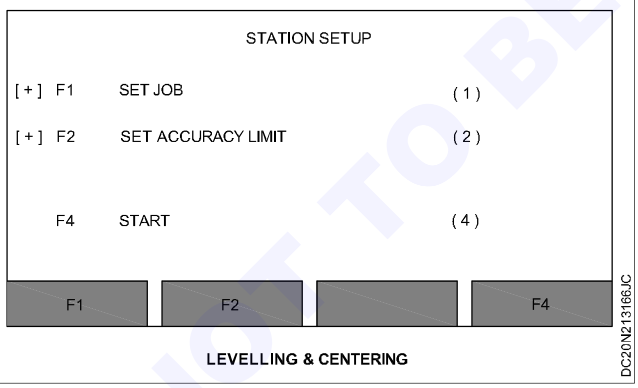

14 Press F4 (OK) OR you may give some accuracy limit. (Fig 11)

Fig 11




15 Press F4 (OK) (Fig 12)

Fig 12




16 Press F4 (OK) (Fig 13)

17 Now select the method of orientation suppose you are selecting the back side coordinate method and press F3 new station. (Fig 14)

18 Now give station point ID and give the easting , nothing & height using key board and press F4 (OK) (Fig 15)

Fig 13

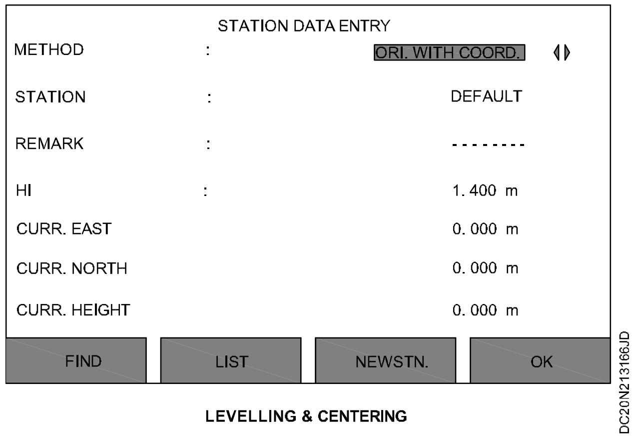



Fig 14

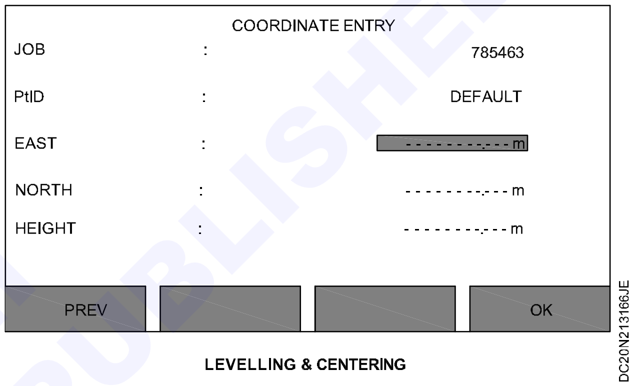
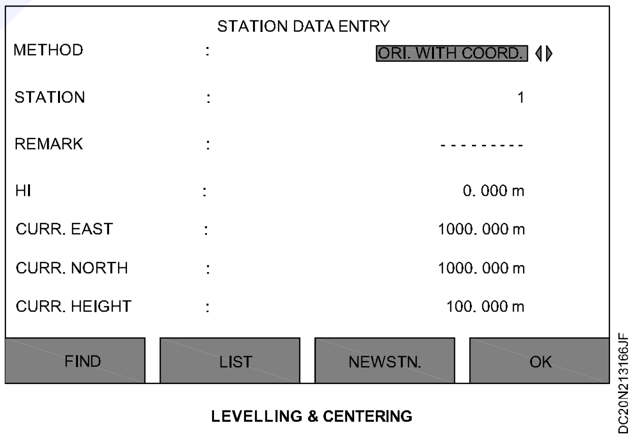



Fig 15




19 Now bring the cursor on instrument height and measure the instrument height and give the height. Press F4 OK. (Fig 16)

20 Now give the back side point ID or you can select from list if back side ID is stored in memory and you can also give the new number of point ID pressing new F3 and give the coordinate. Suppose your backside point ID is 2. (Fig 17)

Fig 16

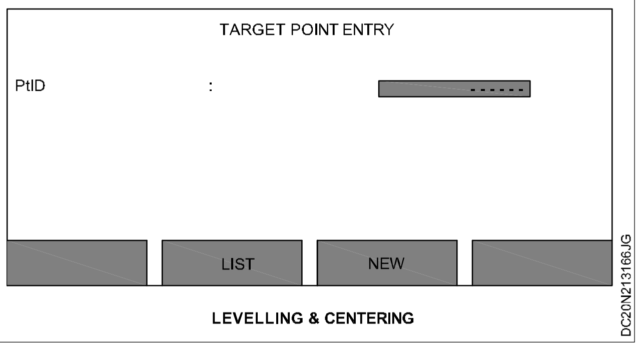
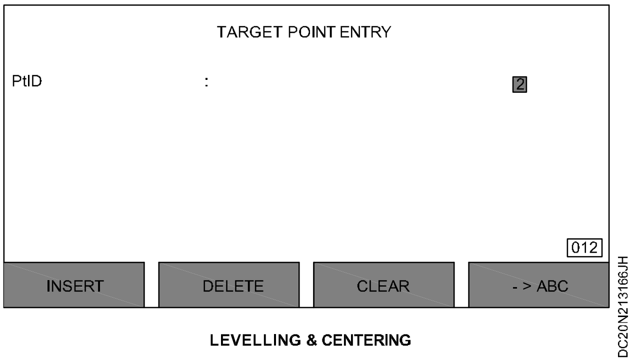
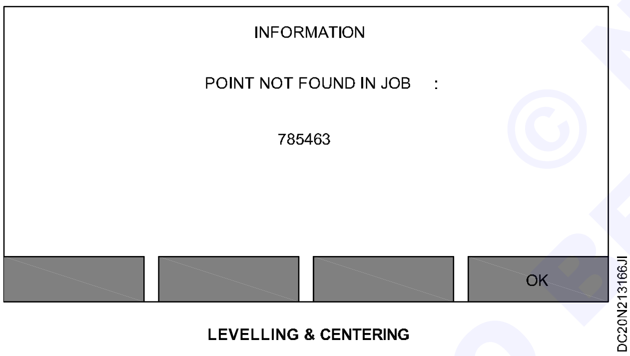



Fig 17




21 Press Enter (Fig 18)

Fig 18




22 Press F4 (Fig 19)

23 Press F3 (ENH) (Fig 20)

24 Give the Easting, Northing and Height of Back side point ID and press F4 OK. (Fig 21)

Fig 19

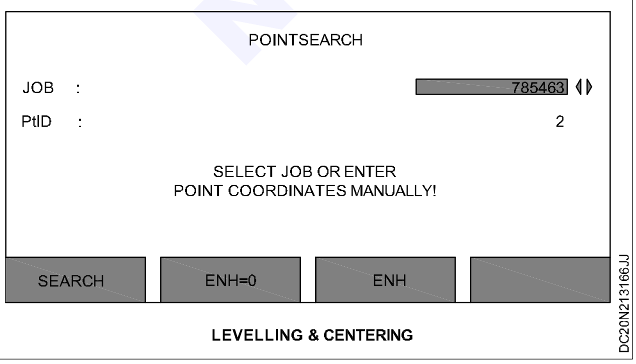



Fig 20

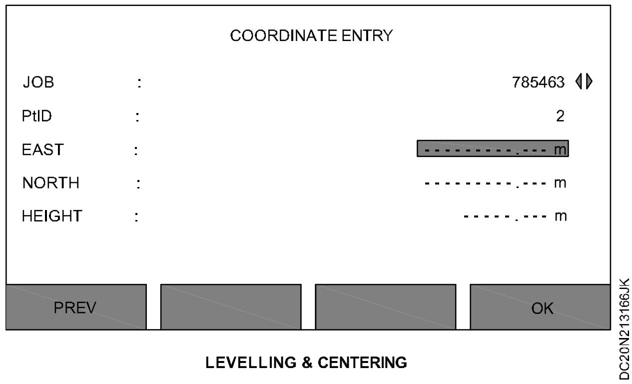
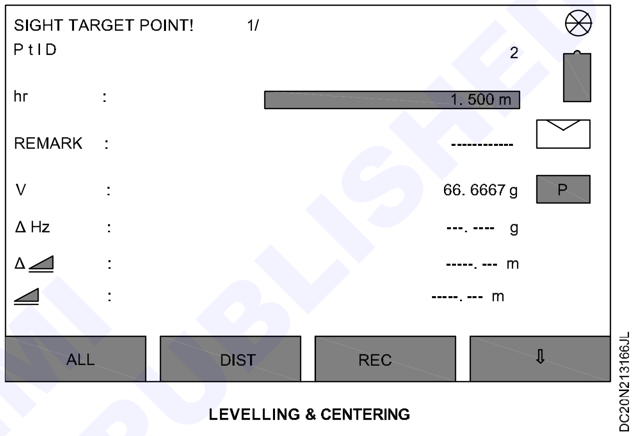



Fig 21




25 Now give reflector height prism say (1.300m) and sight the prism press DIST you can see your error in then press REC. (Fig 22)

26 Press F4 compute. (Fig 23)

27 Press F4 SET now your station and orientation has been set. After that you can do any program suppose you are doing surveying.

Fig 22

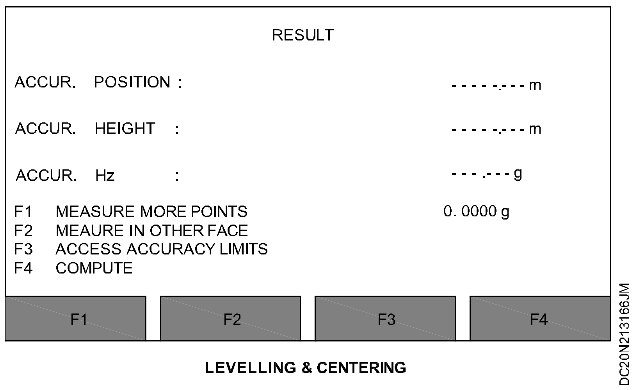
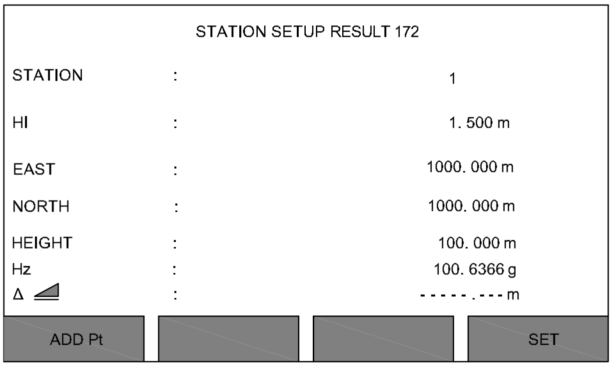


Fig 23




LEVELLING & CENTERING

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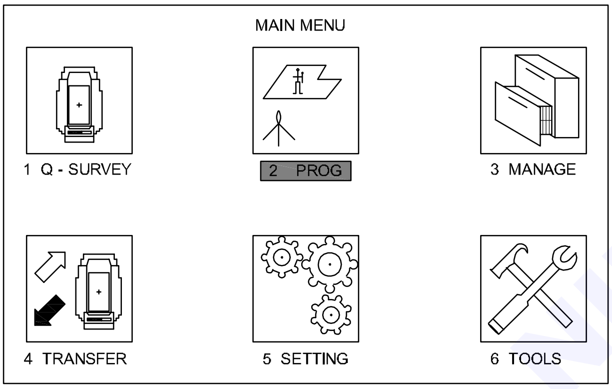
28 In main menu bring the cursor to program icon and press enter key. (Fig 24)

Fig 24




LEVELLING & CENTERING

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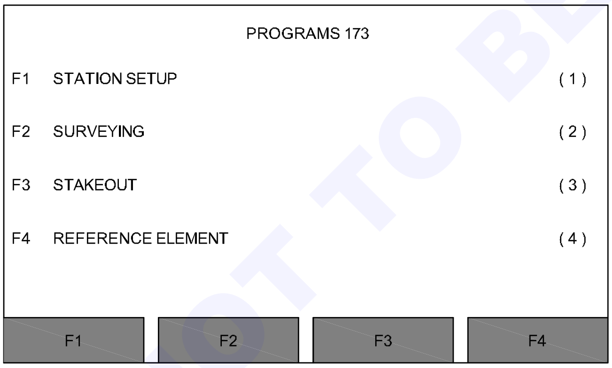
Fig 25

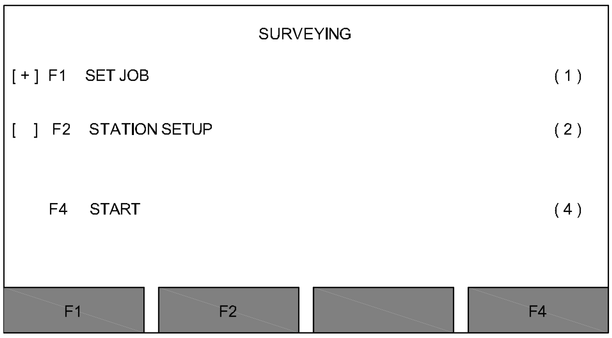



LEVELLING & CENTERING

DC20N213166JP

29 Now press F2 surveying. (Fig 26)

Fig 26




LEVELLING & CENTERING

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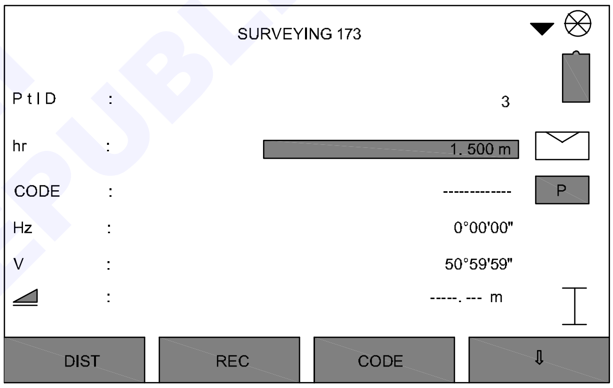
30 Since you have set station setup already, press F4 directly. Now your survey is started by giving pt ID and hr you can collect data. (Fig 27)

31 At last you can start any program in program menu. The state in setup is same for all programs.

Fig 27




LEVELLING & CENTERING

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# Field Procedure for co-ordinate measurement

**Objectives:** At the end of this exercise you shall be able to
- **reset model space limit**
- **draw the given line diagram using absolute co-ordinate method**
- **draw the given figure-using relative co-ordinate method**
- **draw the given figure-using polar co-ordinate method.**

## Requirements

| **Tools / Instruments** | **Materials** |
|---|---|
| • Computer with CAD software<br>• Printer | • Paper A4 size |

## PROCEDURE

TASK 1 : **To draw a line diagram using absolute coordinate method, follow the steps mentioned below (Fig 1)**

1 Command : **LIMITS (↵)**

Reset model space limits:

Specify lower left corner or [ON/OFF]

<0.0000,0.0000> : (↵)

Specify upper left corner <12.0000,9.0000>:120,90 (↵)

2 Command : **ZOOM (↵)**

Specify corner of window, enter a scale factor (nx or nxP), or [All/Center/Dynamic/Extents/Previous/Scale/Window] <real time>: All (↵)

Regenerating model space limits:

3 Command : **LINE** (↵)

Specify first point **20,20** (↵)

Specify first point or [Undo] : **100,20** (↵)

Specify next point or [Undo] : **100,50** (↵)

Specify next point or [Close/Undo] : **90,50 (↵)**

Specify next point or [close/Undo] : **86,65 (↵)**

Specify next point or [Close/Undo] : **75,65 (↵)**

Specify next point or [Close/Undo] : **70,50 (↵)**

Specify next point or [Close/Undo] : **50,50 (↵)**

Specify next point or [Close/Undo] : **30,65 (↵)**

Specify next point or [Close/Undo] : **30,50(↵)**

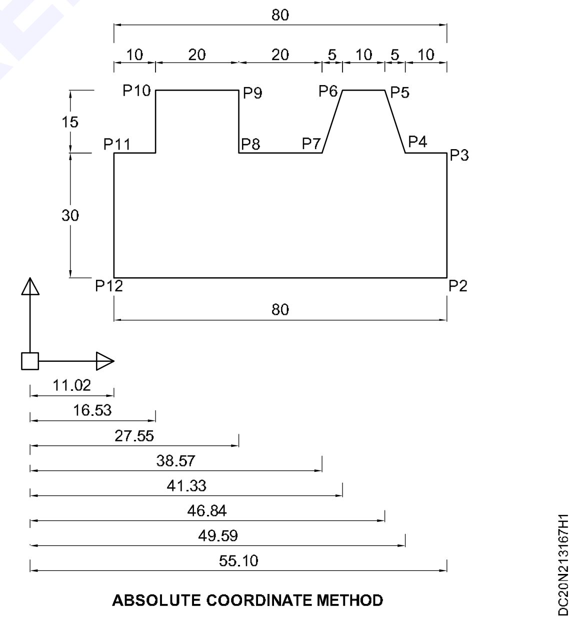
Specify next point or [Close/Undo] : **20,50(↵)**

Specify next point or [Close/Undo] : **C (↵)**

4 Save this file.

**Output**

Fig 1




— — — — — —

TASK 2 : **To draw a line diagram using relative coordinate method, follow the steps mentioned below. (Fig 1)**

1 Command : **LIMITS (↵)**

Reset model space limits:

Specify lower left corner or [ON/OFF] 0.0000,0.0000> : **(↵)**

Specify upper right corner <12,0000,9,0000> : 120,90 **(↵)**

2 Command : **ZOOM**

Specify corner of window, enter a scale factor (nX or nXP), or [All/Center/Dynamic/Extents/Previous/ Scale/ Window] <reak time?: **All (↵)** regenerating model.

3 Command : **LINE (↵)**

Specify first point : **20,20 (↵)**

Specify next point or [Undo] :@ **80,0 (↵)**

Specify next point or [Unod] :@ **0,30 (↵)**

Specify next point or [Close/Undo] : @ : **-10,0 (↵)**

Specify next point or [Close/Undo] : @ **-5,15 (↵)**

Specify next point or [Close/Undo] : @ **-10,0 (↵)**

Specify next point or [Close/Undo] : @**-5,15 (↵)**

Specify next point or [Close/Undo] : @ **-20,0 (↵)**

Specify next point or [Close/Undo] : @ **0,15 (↵)**

Specify next point or [Close/Undo] : @ **-20,0 (↵)**

Specify next point or Close/Undo : @ 0,-15

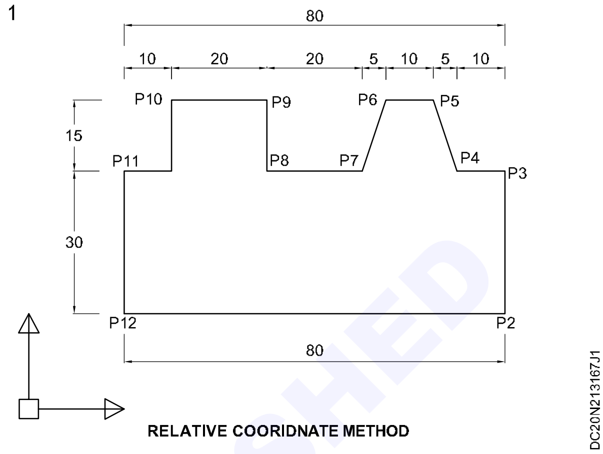
Specify next point or Close/Undo : @ -10,0

Specify next point or Close/Undo : C

4 Save this file

**Output**

Fig 1




— — — — — —

TASK 3 : **To draw a line diagram using polar coordinate method, follow the steps mentioned below (Fig 1)**

1 Command : **LIMITS (↵)**

Reset model space limits:

Specify lower left corner or [ON/OFF] <0.0000,0.0000>: **(↵)**

Specify upper right corner <12.0000,9.0000>:**120,90 (↵)**

2 Command : **ZOOM (↵)**

Specify corner of window, enter a scale factor (nX or nXP), or All/Center/Dynamic/Extents/Previous/ Scales/ Window <real time?: All (↵) regenerating model.

3 Command : LINE (↵)

Specify first point : 20,20 (↵)

Specify next point or Undo : @ 80<0 (↵)

Specify next point or Undo :@ 30<90 (↵)

Specify next point or close/Undo : @ :10<180 (↵)

Specify next point or Close/Undo : @ 15<108 (↵)

Specify next point or Close/Undo : @ 10<180 (↵)

Specify next point or Close/Undo : @ 15<252 (↵)

Specify next point or Close/Undo : @ 20<180 (↵)

Specify next point or Close/Undo : @ 14.27<90 (↵)

Specify next point or Close/Undo : @ 20<180 (↵)

Specify next point or Close/Undo : @ 4.27<270 (↵)

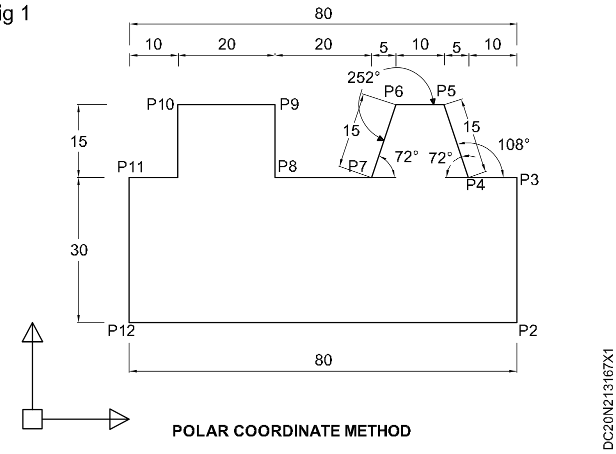
Specify next point or Close/Undo : @ 10.73<180 (↵)

Specify next point or Close/Undo : C

4 Save this file

**Output**

Fig 1




— — — — — —

# Field procedure to run open traverse and closed traverse

**Objectives:** At the end of this exercise you shall be able to
- **measure the included angles**
- **balance the closed traverse ABCDA**
- **plot the traverse using coordinates.**

## Requirements

**Tools/Instruments**

- Theodolite with tripod, pegs, plumb bob, measuring tape, ranging rods, hammer

**Materials**

- White paper, Nails, Paint. Brush, A2 sheet

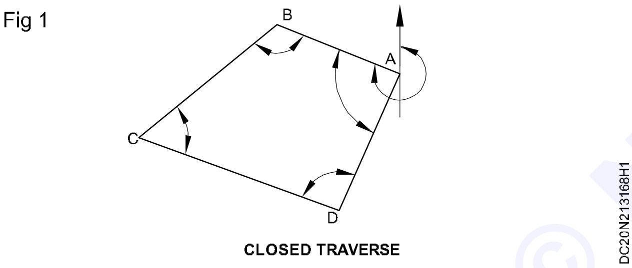
## PROCEDURE

1 Reconnaissance the area to be surveyed.

2 Select stations as per field conditions

3 Mark the stations (Fig 1)

Fig 1




CLOSED TRAVERSE

4 Take at least three permanent reference points of the stations.

5 Set up the instrument at the starting station, say ‘A’.

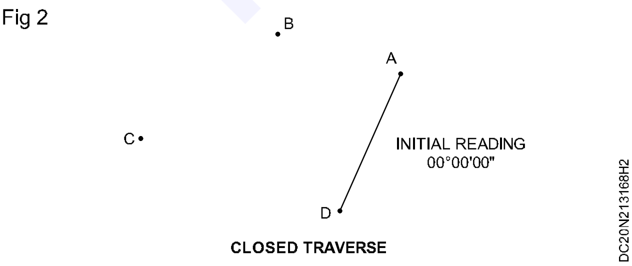
6 Set the vernier scale A, 0-0

7 Perform all the temporary adjustments.

8 Measure the magnetic meridian of the line AB using theodolite it it is fitted with magnetic compass (other-wise use prismatic compass).

9 Loosen the lower clamp; direct the telescope towards the last back sight station D. (Fig 2)

Fig 2



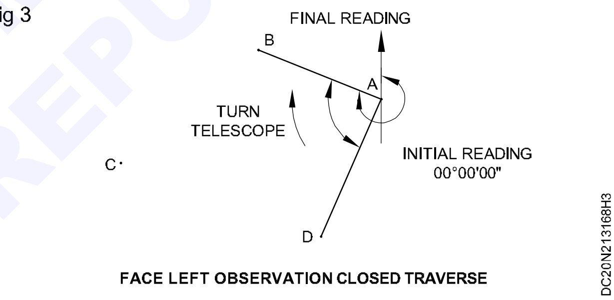

CLOSED TRAVERSE

10 Tighten lower clamp and bisect the station exactly using the lower tanget screw.

11 Loosen upper clamp; telescope is turned to sight the forward sation ‘B’

12 Tighten upper clamp. Bisect ‘B’ exactly and observe the horizontal angle. (Fig 3)

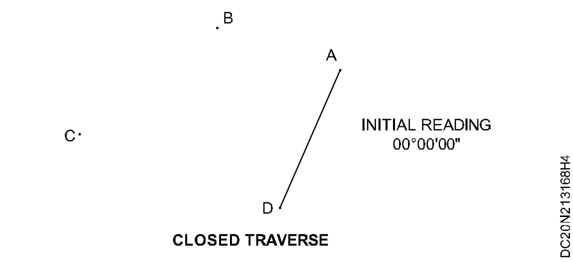
Fig 3




FACE LEFT OBSERVATION CLOSED TRAVERSE

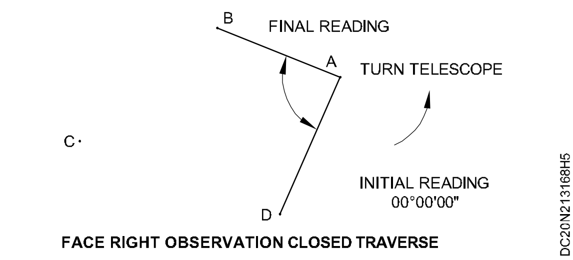
13 Following appropriate above steps observe a face right reading (accuracy can be improved by adopting repetition method). (Fig 4 & 5)

Fig 4




CLOSED TRAVERSE

Fig 5




FACE RIGHT OBSERVATION CLOSED TRAVERSE

14 Measure horizontal angles by both face observation at each station.

15 Measure the length of the side.

16 Proceed thus to finish off the traverse.

17 Calculate the coordinates.

18 Arithmetically balance the traverse if error exists.

19 Plot the traverse using coordinates.

20 Balance the traverse graphically if traverse failed to close while plotting.

## Open traverse

**Objectives:** At the end of this exercise you shall be able to
- **measure the angles between the traverse lines**
- **check the traverse**
- **plot the open traverse.**

### Requirements

**Tools / Instruments**

- Theodolite with tripod, pegs, plumb bob, measuring tape, ranging rods, hammer

**Materials**

- White paper

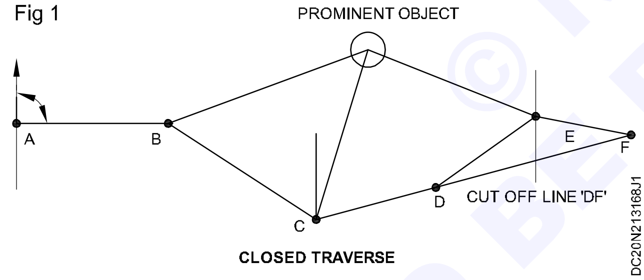
PROCEDURE

1 Reconnaissance the area to be surveyed.

2 Select station as per field conditions.

3 Mark the stations. (Fig 1)

Fig 1




4 Take at least three permanent reference points of the stations.

5 Set up the instrument at the starting station, say 'A'.

6 Perform all the temporary adjustments.

7 Measure the magnetic meridian of the line AB using theodolite if it is fitted with magnetic compass (other-wise use prismatic compass).

8 Shift and set up the instrument at station 'B'

9 Set the vernier scale A, 0-0.

10 Perform all the temporary adjustments.

11 Loosen the lower clamp; direct the telescope towards station A.

12 Tighten lower clamp and bisect the station exactly using the lower tangent screw.

13 Exactly bisect forward station C and observe the horizontal angle (direct angle or deflection angle as described earlier) and record the angle.

14 Thus following appropriate steps observe a face right reading at B. Observe a face left reading as per the traversing method (accuracy can be improved by adopting repetition method).

15 Set up the instrument at forward station 'C'.

16 Similarly proceed further and finsih off the traverse(measured and record directions and distances).

17 Cut off lines and bearings of a prominent object from several stations are also note down for checking the traverse. Details can also locate by any method.

18 Plot the traverse to a suitable scale.

| Instrument At | Sig-ht to | Length (m) | Face left Right swing | | | | | | | | Face right Left swing | | | | | | | | | | | | | | | | Average Horizontal Angle | | | Remarks | Rough Sketch |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | | | B | | Mean | | | No. of re peti tions | Horizontal angle | | | A | | | B | | Mean | | | No.of Repiti tions | Horizon-tal Angle | | | | | | | |
| | | | 0 | ‘ | “ | ‘ | “ | 0 | ‘ | “ | | 0 | ‘ | “ | 0 | ‘ | “ | ‘ | “ | 0 | ‘ | “ | | 0 | ‘ | “ | 0 | ‘ | “ | | |
| P | Q | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Bearing of PQ= | |

| Instrument At | Sig-ht to | Len gth (m) | Face left Right swing | | | | | | | | | Face right Left swing | | | | | | | | | | | | | | | | Average Horizontal Angle | | | Remarks | Rough Sketch |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | | | B | | Mean | | | No. of re peti tions | Horizontal angle | | | A | | | B | | Mean | | | No.of Repi titions | Horizon-tal Angle | | | | | | | |
| | | | 0 | ‘ | “ | ‘ | “ | 0 | ‘ | “ | | 0 | ‘ | “ | 0 | ‘ | “ | ‘ | “ | 0 | ‘ | “ | | 0 | ‘ | “ | 0 | ‘ | “ | | |
| P | Q | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Bearing of PQ= | |

# Transfer or establish Bench mark

**Objective:** At the end of this exercise you shall be able to
- **set out/state out the known coordinate in the field using total station.**

## Requirements

**Tools/Instruments**

- Total station in carrying box with tripod, prism and reflector pole.

## PROCEDURE

1 Establish the total station. Do the centering and levelling. Do the station set up.

2 In main menu, bring the cursor in program and press enter key. (Fig 1 & 2)

Fig 1

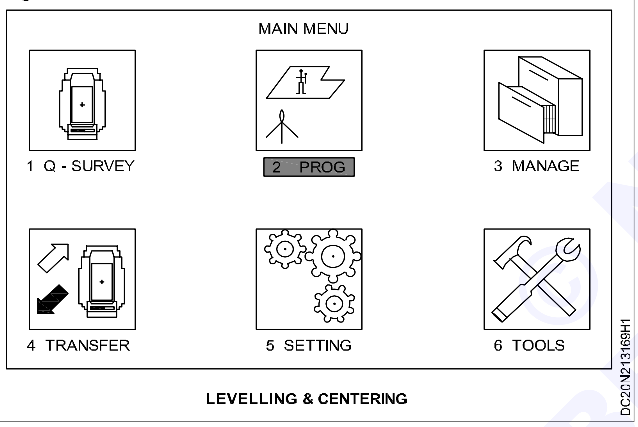
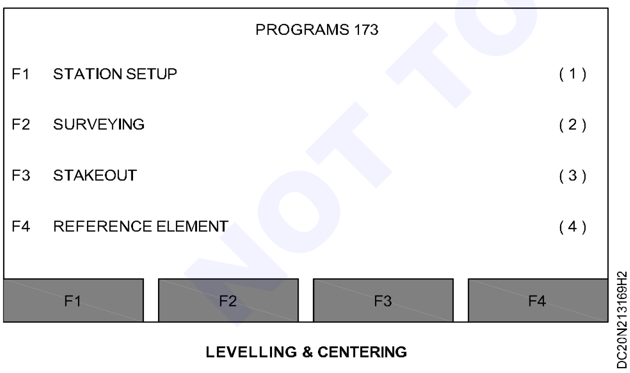



Fig 2




3 Press F3. (Fig 3)

4 Press F1 set job. (Fig 4)

5 Press F1 new and give job nanme or chose the job from memory and press F1 ok. (Fig 5)

6 Press F4 ok. (Fig 6)

Fig 3

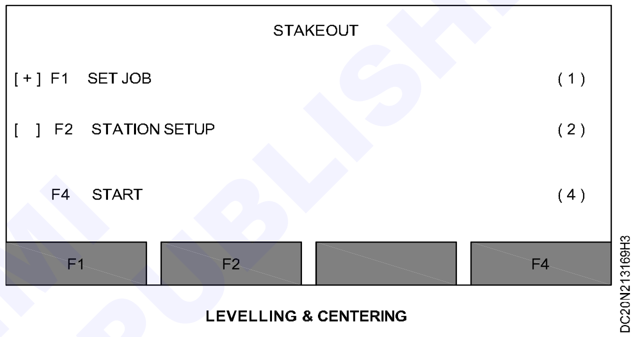
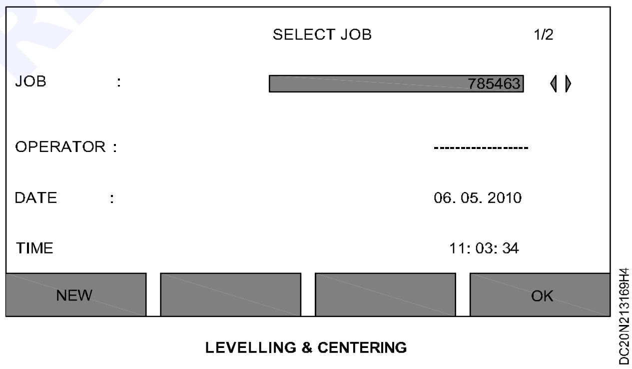



Fig 4




7 If you station setup is already done then press F4 start. (Fig 7)

8 After that select the point ID from memory. It will indicate angle and distance. Make the angle zero with the help slow key.

9 Mark the new points press F4 arrow key until ENH appears. (Fig 8)

10 Press F2 (ENH). (Fig 9)

11 Give the pt ID and give the Easting, Northing and Height and press F4 Ok. (Fig 10.11)

12 Now it is same as before.

Fig 5

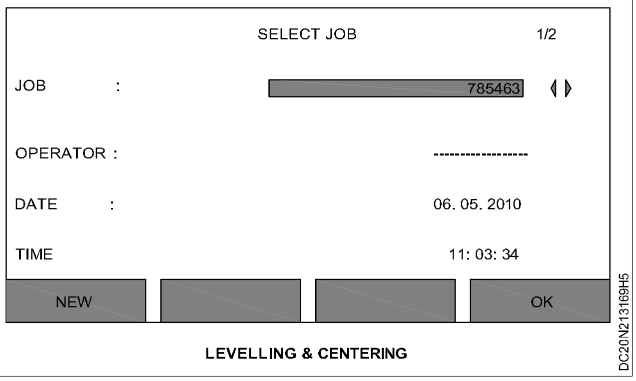



Fig 6

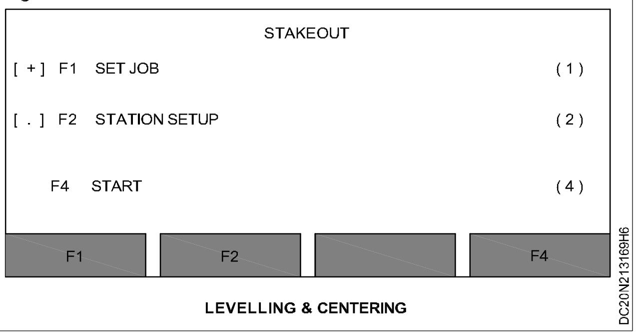



Fig 7

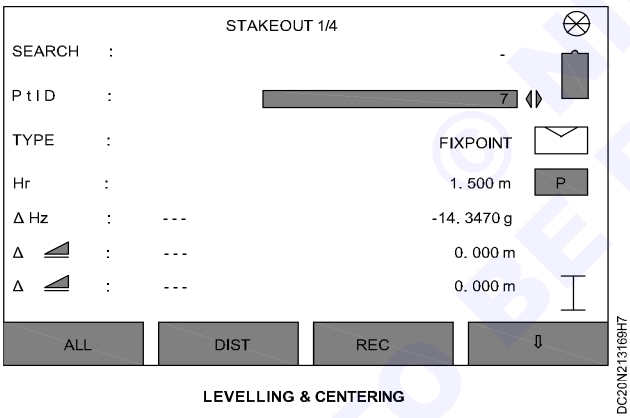



Fig 8

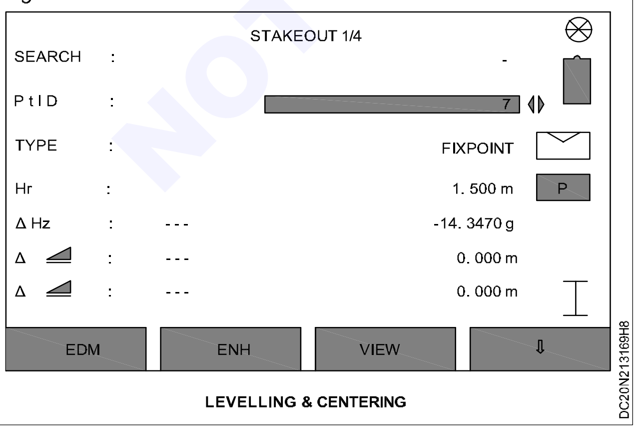



Fig 9

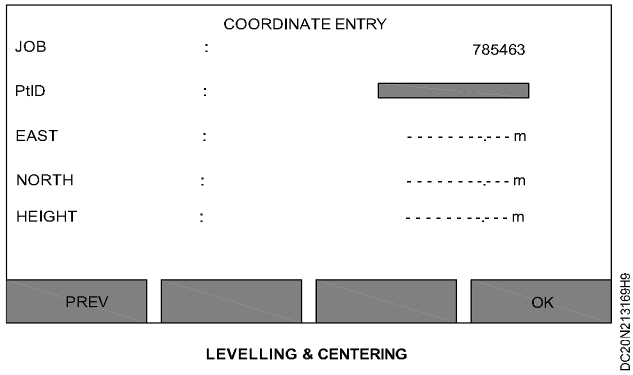



Fig 10

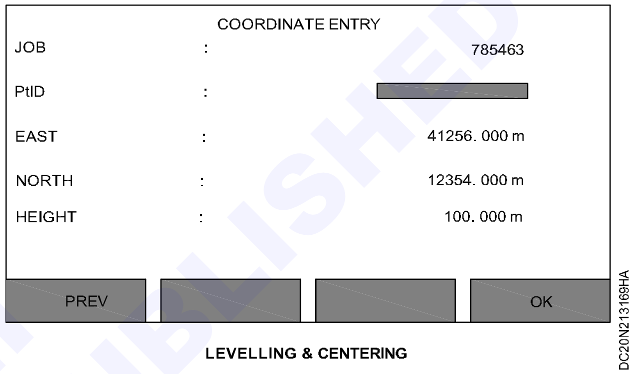
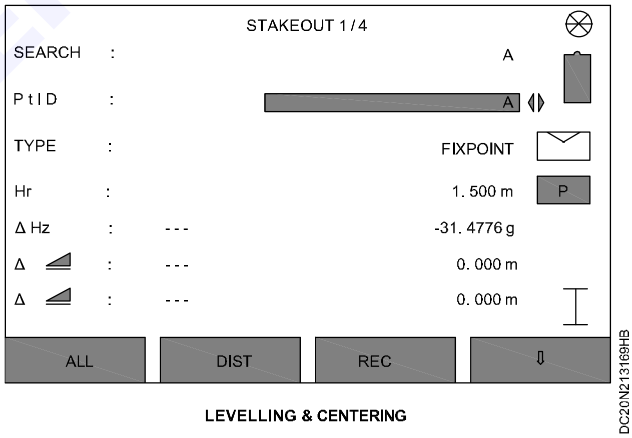



Fig 11



# Draw the plan, section and elevation of the building using autocad

**Objective:** At the end of this exercise you shall be able to
- **draw the plan, section and elevation of a building**
- **dimension the drawing**
- **plot the drawing.**

## Requirements

**Tools / Instruments**
- Computer with CAD software
- Printer

**Materials**
- Paper A4 size

## PROCEDURE

- **Draw the plan of the resistance.**

Step 1 : Open the AutoCad software.

Step 2 : Draw the building outline of the house by using the "Line" command.Click the "Line" icon to activate the command.Left-click to start and end the line.

Step 3: Offset the building outline the desired thickness of the exterior wall.Use the "Offset" command.

Step 4: Draw all interior walls by using the same "Line" and "offset" commands.

Step 5: Use the "Trim" command to trim any messy intersections on the exterior or interior conditions.Left-click the "Trim" icon to activate the too.Select the "cutting edge" line followed by the line that you would like to him off.

Step 6: Cut openings for doors and windows by drawing lines and then trimming away the opening.If you want a 3'- 0" door (90cm), draw a line perpendicular to the wall, set it 3'0", and trim way the excess lines.

Step 7: Draw the doors and windows where the new openings exists.

Step 8: Acticate the text command to enter the names of rooms and their sizes.

Step 9: Activate the dimension icon and click the edges of each wall that you would like to dimension to.This will give the drawing a more professional look and also gives people a sense of the space.

Step 10: Insert the table and prepare the details of joinery.

Step 11: Using ploylne command draw a line over the outer wall and using area command find the area of the building.

Step 12: Plot the drawing to printer or to a PDF format.Hit the plot icon to open the plot settings.Choose the layout type, pen settings, and window view that you would like to use.

- **Draw the roof plan of the residence**

Step 1: Draw the roof plan of the building according to the design

Step 2: Using hatch command draw the roof titles and assign proper line weights.

Step 3: Complete the roof plan by using dimension and text commands.

Step 4: Plot the drawing to a printer or to a PDF format.Hit the plot icon to open the plot setting.Choose the layout type, pen settings, and window view that you would like to use.

- **Draw the elevation of the residence**

Step 1: Draw the base line to draw the elevation of the resistance.

Step 2: Draw the projected lines from the plan to create front view of the residence using line command.

Step 3: Draw the elevation of the residence using modify commands like offset,trim,fillet,extend to complete the outline.

Step 4: Using block, insert block commands prepare the doors and windows in elevation.

Step 5: Assign proper line weights to create the effective appearance of the buiding.

Step 6: Plot the drawing to a printer or to a PDF format.Hit the plot icon to open the plot settings.Choose the layout type, pen settings, and window view that you would like to use.

- **Draw the section of the residence**

Step 1: Draw the base line to draw the elevation of the resistance.

Step 2: According to the section line shown in the plan, the width of walls, rooms has to be drawn acoording to the design using line, offset, trim commands.

Step 3: Use the hatch commands to show the rcc, rubble masonry in the section.

Step 4: Activate the text commands for mentioning the name and size of the rooms.

Step 5: Using dimension command complete the dimensioning of the section drawing.

Step 6: Plot the drawing to a printer or to a PDF format.Hit the plot icon to open the plot settings.Choose the layout type, pen settings and window view that ypu would like to use.

# Computation of height of inaccessible point using total station

**Objective:** At the end of this exercise you shall be able to
- **compute the height of an inaccessible point from the ground point using total station.**

## Requirements

**Tools/Instruments**

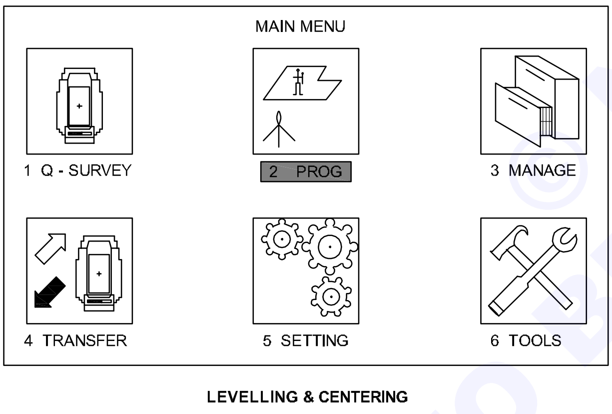
- Total station in carrying box with tripod, prism and reflector pole.

## PROCEDURE

Establish total station. Do the centering and levelling. Do the station setup. The remote height program is used to find the elevation of the remote points where it is possible to place the prism directly below the point whose elevation is to be found.

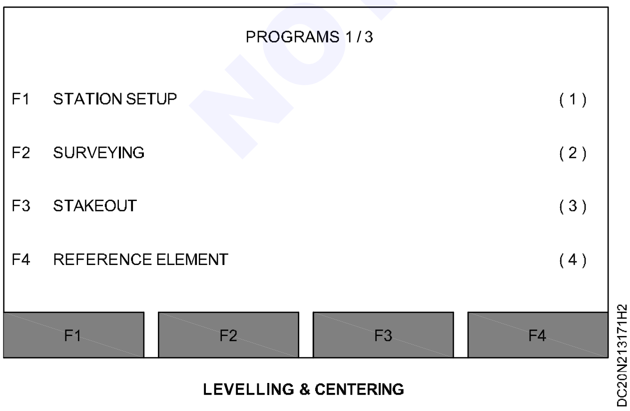
- Press MENU
- Press F1 (Programs). (Fig 1)

Fig 1




- Press PAGE. (Fig 2)

Fig 2




- Press F3 (Remote height). (Fig 3) & (Fig.4)

Fig 3

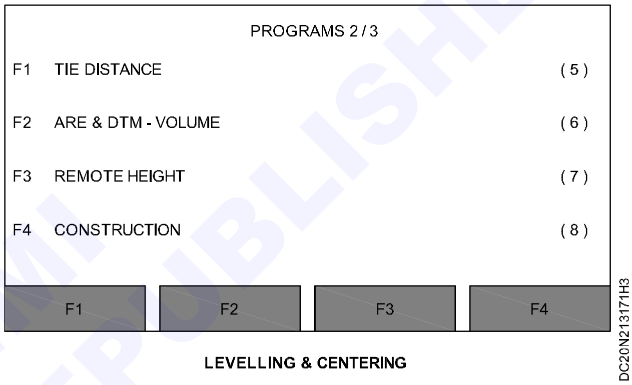
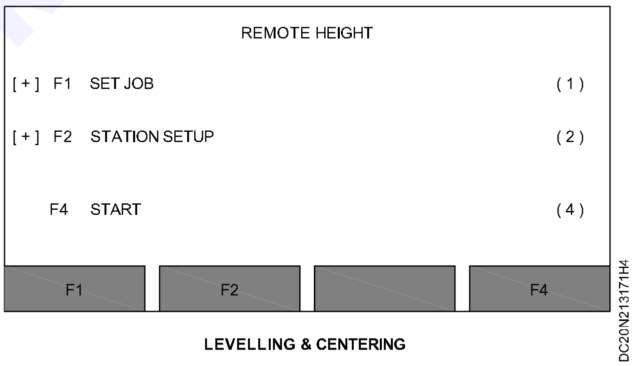
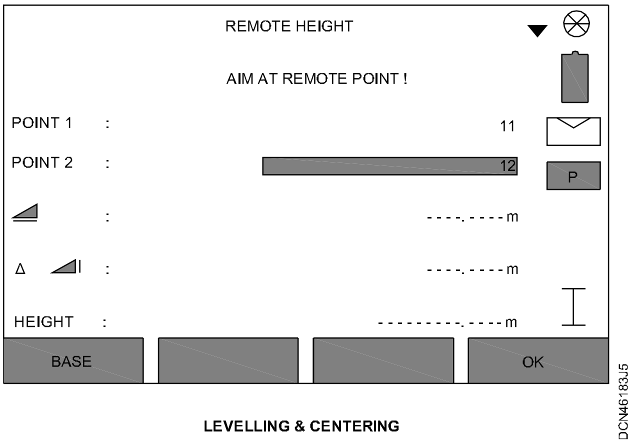



Fig 4




- Now put the prism on the base point and sight it and press F3 (ALL). (Fig 5)
- Now move the telescope and focus the top point whose elevation is to the found.
- The height value will be displayed on the screen.

Fig 5




LEVELLING & CENTERING

# Calculate the area and volume of field

**Objective:** At the end of this exercise you shall be able to
- **Compute the area of a plot in the field itself using a total station.**

## Requirements

**Tools/Instruments**

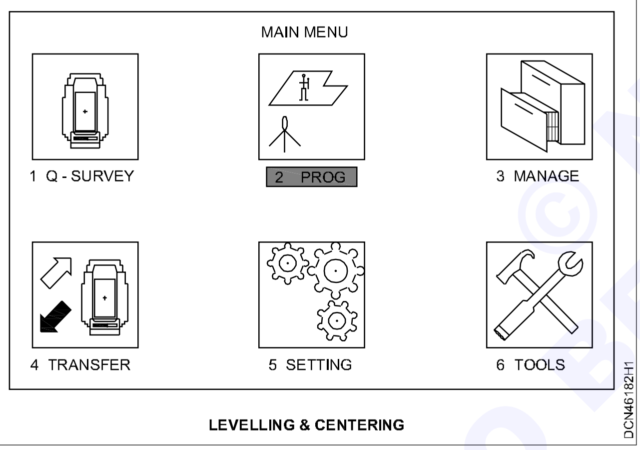
- Total station in carrying box with tripod, prism and reflector pole.

## PROCEDURE

Establish the total station. Do the centering and levelling. Do the station set up.

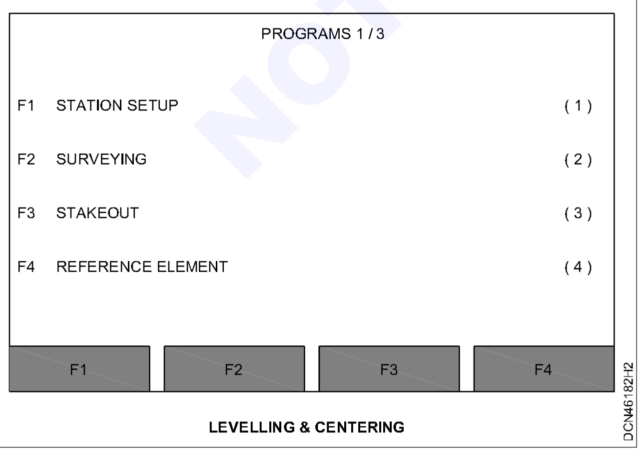
- Press MENU.
- Press F1 (Programs). (Fig 1)

Fig 1



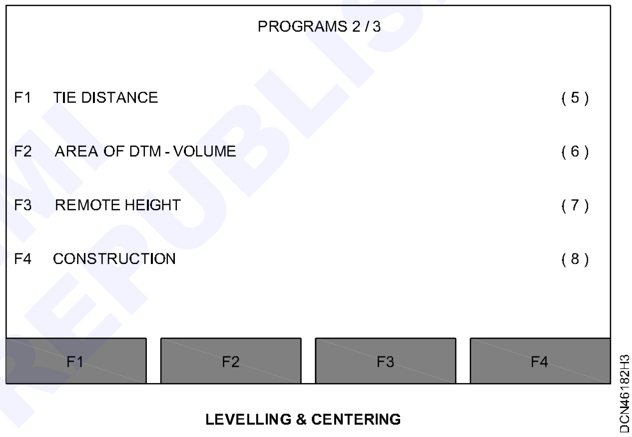

- Press PAGE. (Fig 2)

Fig 2



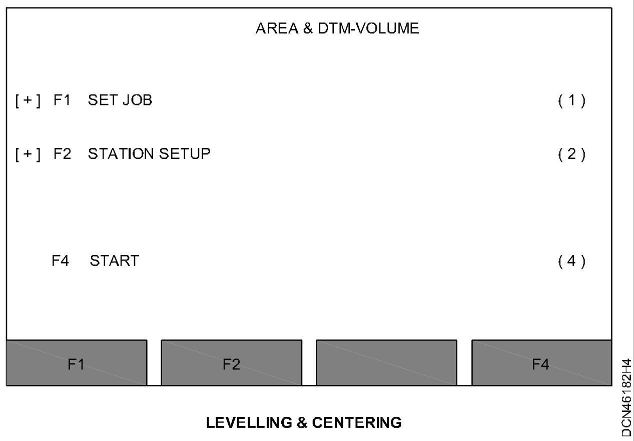

- Press F2 (Area). (Fig 3)

Fig 3




- The first three steps are the same.
- Press F4 (Start). (Fig 4)

Fig 4




- The points whose area is to the found can be either in the memory or cab ne slot directly in the field.
- In front of point ID enter the number of the first point press F3 (All). (Fig 5)

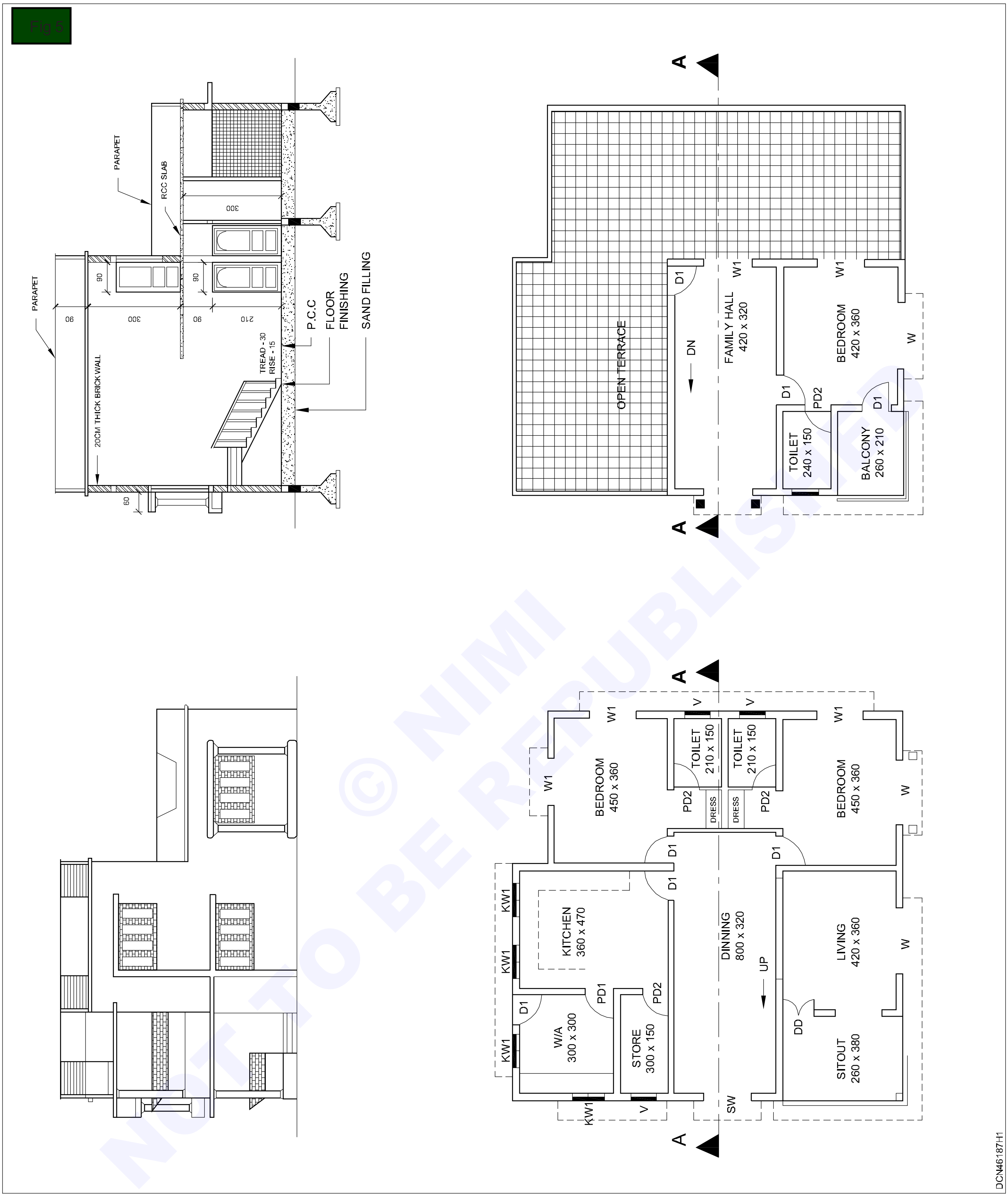


Fig 5
PARAPET
RCC SLAB
20CM THICK BRICK WALL
TREAD - 30
RISE - 15
P.C.C
FLOOR FINISHING
SAND FILLING
OPEN TERRACE
FAMILY HALL
420 x 320
BEDROOM
420 x 360
TOILET
240 x 150
BALCONY
260 x 210
BEDROOM
450 x 360
TOILET
210 x 150
TOILET
210 x 150
BEDROOM
450 x 360
KITCHEN
360 x 470
DINNING
800 x 320
LIVING
420 x 360
W/A
300 x 300
STORE
300 x 150
SITOUT
260 x 380
DCN46187H1

# Procedure for downloading and uploading

**Objectives:** At the end of this exercise you shall be able to
- **define uploading and down loading**
- **up loading the data**
- **down loading the data.**

**Define uploading**

**Uploading means data is being sent from you computer to the internet.**

Examples of uploading include sending email, posting photos on a social media site and using your webcam. Even clicking on a link on a web page sends a tiny data upload.

**Define down loading**

**Downloading means your computer is receiving data from the internet.**

Examples of downloading include opening a web page, receiving email, purchasing music files and watching online videos.

**Introduction**

In order provide your application with cool pictures, you can employ two techniques (at least). One of them is that you can save the pictures in a folder and store the path to each one in a database or file. The other one is to store the entire file into a database, along with its file name.

Each of them has its ups and downs:

- If you save your files to a folder, you might accidentally delete a file from that folder. If this happens, you will end up with a broken "link" in your database or configuration file. However, the hard disk storage space is cheap, so you can afford to store a lot of file.
- If you store your files into database, you can enforce security by using the security settings of the database. Also, there are no broken links ever. However, the database storage space is more expansive.

Another idea is that you can save a thumbnail of the image on the database for quick access and save the actual picture on hard drive.

of course, each application has its particulars, and you have to choose which one you will use.

Ok Enough of the philosophical talk! Let's dive into the good stuff.

**The application**

The problem of uploading files to a database is not that difficult. You have to use, on the server. a certain data type when creating the table. This data type has to be capable of storing large amounts of binary data.

When using Microsoft SQL server, this data type is called image.

For more information see BLOB (Binary Large Object) for a short definition, and books online for a complete reference.

The client has to obtain the data from the file in binary format-a byte array-and call a procedure on the server with that array as a parameter.

**The SQL server procedures**

In this presentation, I assume that I have a database pictures on the server with a table called pictures. The structure of this table is as follows:

| Field Name | Field Type |
|---|---|
| kFileName | Long |
| picture | Image |
| FileName | Varchar (25∅) |

I also have stored procedures for uploading, and retrieving the list of uploading files. These are shown below.

"Uploading" and "downloading" are terms used to refer to types of electronic data transfers. The difference between them is the direction in which the files are being transferred. Files are considered to the uploaded when they are transferred from a computer or other electronic device to a central server, and downloading is when the files are transferred from a server to a smaller peripheral unit, such as a computer, smartphone or other device. These two different types of transfers are often done via the internet, such when a file is downloaded from a website. The transfer of data from one system or device to a similar system or device, such as from a desktop computer to a laptop, usually is not considered uploading or downloading.

## Uploading

The most common type of uploading is when a user uploads a digital file to an internet site. For example, a user might upload vacation photos to a social networking website or home video to a video sharing site. The uploaded files are then stored on the website's servers and can be seen by anyone who has internet access and, if necessary, the right software for viewing it.

Other website allow users to upload digital files for storage. This can allow users to store more files or larger files than would be possible to store on their own computer or device because of its limited storage capacity. Uploading files to storage websites also allows users or other devices to have access to them. Permission to access to files can be granted to only certain people, or the files could be made public for anyone to access.

Another type of uploading takes place within a closed computer system, such as one within a single office building or one that connects a group of businesses. These types of systems typically have servers to store information that needs to be shared among multiple computers or devices. Digital files can be uploaded from any computer or device that is connected to the system, then can be downloaded or accessed by any other user in the system.

## Downloading

Whenver electronic files or information are transferred from a central system to a computer or device that is connected to that system, it is considered downloading. Files can be downloaded temporarily and then deleted after they have been used once, or they can be downloaded on a more permanent basis and used for a long period of time. For example, a funny video file might be downloaded from the internet and soon deleted after it has been watched, but a helpful application might be downloaded and used for months or years.

Downloaded files are sometimes automatically stored in a particular location on the computer or device and they are automatically accessed from that location when needed. An example of this is an application that is downloaded to a smartphone - user typically cannot control where the app is stored on the phone, it is simply stored where the phone stores all of its apps. In other cases, the user can choose where the downloaded files will be stored. For example, a laptop user might download a music file to a specific folder for music or another type of file to the computer's desktop, where it can be found quickly.

## Speed

The time that it takes to upload or download a file depends on several factors. The main factor is the digital size of the file, which is measured in bytes. The larger the file, the longer it takes to transfer the information in it.

The quality of the connection from the internet or central server to the smaller computer or device also makes a difference in the transfer speed. A computer that has high-speed internet connection will be able to download or upload a file much more quickly than a computer that has a low-speed connection would. In addition, the speed of the server on which the file is stored can affect upload times or download times.

## Background operations

Uploading and downloading occur frequently, often without the user being aware that he or she is doing it. For example, incoming email is downloaded from a server, and outgoing emails are uploaded to be sent out. The source code of a web page is downloaded to the user's computer so that he or she can view the content. Whenever a computer or device is connected to the internet or another larger system, files are frequently transferred back and forth-uploaded and downloaded-throughout the normal course of use.

## Uploading

Word of the day

**colocation (colo)**

A colocation (colo) is a data center facility in which a business can rent space for servers and other computing hardware. Typically, a colo provides the building. cooling. power, bandwidth and physical security while the customer provides servers and storage.

Subscribe to the word of the day

Word of the Day Archive

20 Newest and uploaded Terms

- artificial super intelligence (ASI)
- technology addiction (Internet addiction)
- orbi outdoor satellite
- competitive advantage
- mobile application management (MAM)
- Avro (Apache Avro)
- quality assurance (QA)
- gross revenue
- voice recognition (speaker recongnition)
- Amazon Pinpoint
- employee engagement software
- Microsoft Project Honolulu
- project scope

- unstructured data
- hands-off infrastructure management
- Microsoft Windows Insider Program for Business
- cloud ecosystem
- risk map (risk heat map)
- VMware vCenter Server (formerly VMware Virtual Cen ter)
- Advanced message Queuing Protocol (AMQP)

uploading is the transmission of a file from one computer system to another, usually larger computer system. From a network user's point-of-view, to upload a file is to send it to another computer that is set up to receive it. People who share images with others on bulletin board services (BBS) upload files to the BBS.

Transmission in the other direction is downloading-from one, usually larger computer to another, usually smaller computer. From an internet user's point-of-view, downloading is receiving a file from another computer.

The file Transfer Protocol (FTP) is the internet facility for downloading and uploading files. (If you are uploading a file to another site, you much usually have permission in advance to access the site and the directory where the file is to be placed).

When you send or receive an attached file with an e-mail note, this is just an attachment, not a download or an upload. However, in practice, many people use "upload" to mean "send" and "download" to mean receive. The term is used loosely in practice and if someone says to you "Download (or upload) such-and-such a file to me" via e-mail, they simply mean "Send it to me."

In short, from the ordinary workstation or small computer user's point-of-view, to upload is to send a file and to download us to receive a file.

## Prepare a map of a village with surrounding details (open traverse)

**Objective:** At the end of this exercise you shall be able to
- **prepare a map of a village.**

### Requirements

**Tools/Equipments/Instruments**

- Plane table with Tripod
- Alidade
- Spirit level
- Trough compass
- Plumbing fork with plum bob
- Measuring (30m) steel tape
- Pegs
- Ranging rods - 3 Nos.
- Computer with CAD software - 1 No

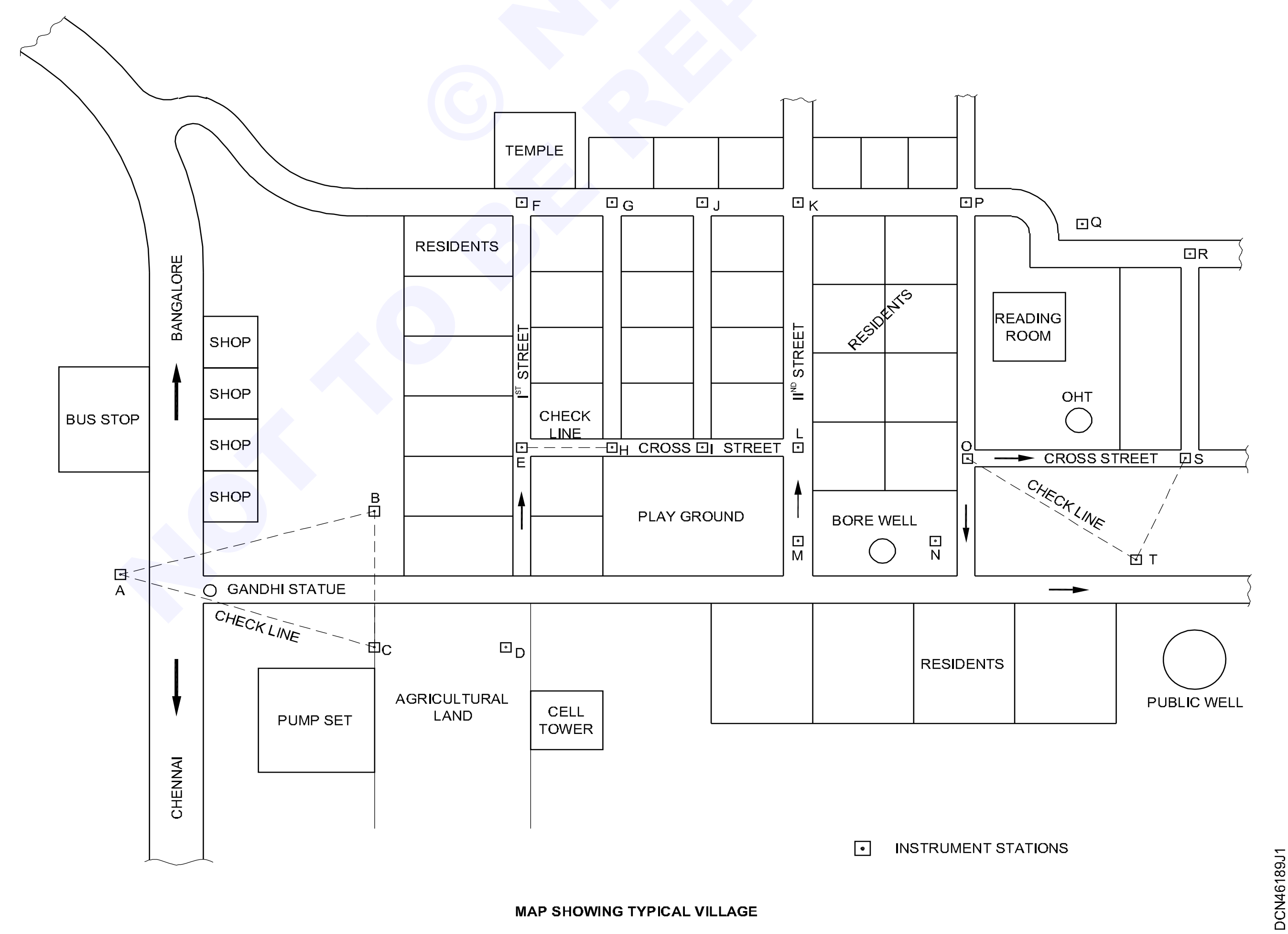
**Materials**

- Drawing sheet A2 - 1 No.
- Set of scale - one set
- Pencil, Eraser etc. - each one
- Cello tape

PROCEDURE

TASK 1 : **Prepare a map of a village (Open traverse) (Fig 1)**

Fig 1




MAP SHOWING TYPICAL VILLAGE

1 Select the instrument stations A, B, C etc after inspecting the site to get rough idea about the village. (Fig 1 showing a typical village)

2 Set up the table 'A' Select the point a suitably on the sheet.

3 Centre and level the Table when the board is clamped.

4 Mark the direction of the magnetic north on the sheet.

5 Place a Ranging rod on station 'B'.

6 Keep the alidade on 'a' sight the ranging rod at 'B'.

7 Draw a ray along the levelled edge of alidade.

8 Measure the distance AB with tape.

9 Select suitable scale and set off distance 'ab' on the ray already drawn.

10 Locate the surrounding details by radiation or intersection.

11 Shift the instrument and set it up at 'B'.

12 Centre and level the Table.

13 Orient the table by back sighting on 'A'.

14 Clamp the table.

15 Place the Ranging rod on station 'C'.

16 Keep the alidade pivoted on 'b' sight the station 'C'.

17 Draw a ray along the fiducial edge of the alidade.

18 Measure the distance 'BC' with tape.

19 Set off distance 'bc' on the ray.

20 Locate the surrounding details by radiation or intersection.

21 Proceed the same process until all the remaining stations and surrounding details are to be plotted.

22 Prepare the map drawing using CAD software.

**At any station, the work can be checked by taking sights to two or more proceeding stations visible from the station occupied**

**When no station is visible any well defined points or objects such as corner of building electric posts etc may be used for checking.**

**Radiation is applicable when the distance between the object and instrument station can be measured easily.**

**Intersection is applicable when the object is far away from the instrument station which are not possible to measure directly.**

— — — — — —

## Familiarisation with hand held GPS

**Objectives:** At the end of this exercise you shall be able to
- **identify the safety warning**
- **practice with hand held GPS**
- **carryout satellites location.**

**Safety warning**

**Use care**

The Global Positioning System (GPS) is operated by the U.S. Government which is solely responsible for the accuracy and maintenance of the GPS network. The accuracy of position fixes can be affected by the periodic adjustments to GPS satellites made by the U.S. government and is object to change in accordance with the Department of Defence civil GPS user policy and the Federal Radio navigation Plan. Accuracy can also be affected by poor satellite geometry and obstructions, like buildings and large trees.

**Federal communication commission interference statement**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on.

**Introduction to GPS**

GPS stands for "Global Positioning System". It refers to a collection of 24 satellites placed in orbit all around the earth with very precise clocks on board. By locating the signals from at least 4 of these satellites from a point on the earth using a GPS receiving unit, you can pinpoint your exact location at any given time.

PROCEDURE

TASK 1 : **Familiarize yourself with Hand held units and turn it on. (Example - eTrex) (Fig 1 and 2)**

(If you are using a GPS unit other than the Garmine, etrex legend, consult your user's manual to follow these general steps).

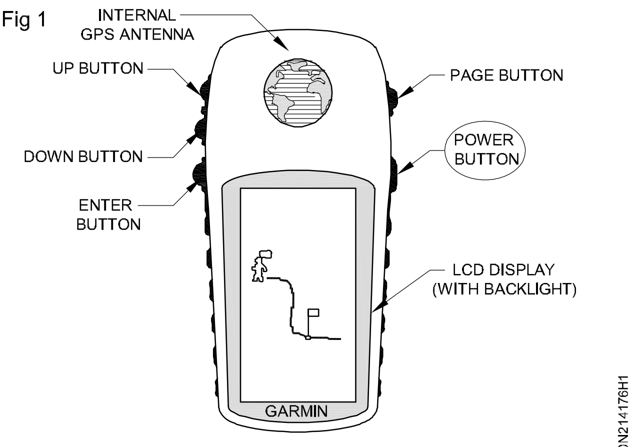
**e-Trex description**

- The Up and Down buttons on the left will allow you to select options on pages and menus, adjust the display contrast, zoom in and out on the Map Page, and cycle through data on the Pointer Page.

- The Enter buttion will confirm data entery and menu elections. Pressing and holding this button activates the Mark Waypoint Page.

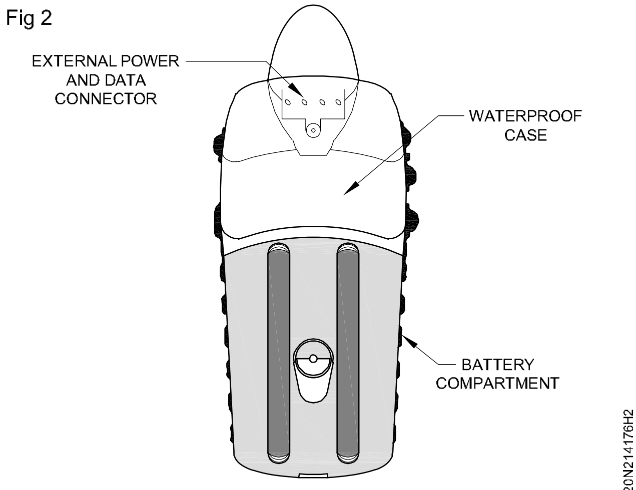
- The page button will switch between pages and back you out of pages. If you start to do something and don't want to continue, you can stop by pressing this button.

Fig 1




HAND HELD UNIT

Fig 2




REAR SIDE OF HAND HELD UNIT

- The Antenna should be kept unobstructed at all times in order to receive a clear signal from as many satellites as possible. It is best to hold the unit at chest-height, out in front of you so that your body does not block the signals.

The unit requires 2AA batteries to operate. A data cable will be needed in order to transfer data to a computer after collection.

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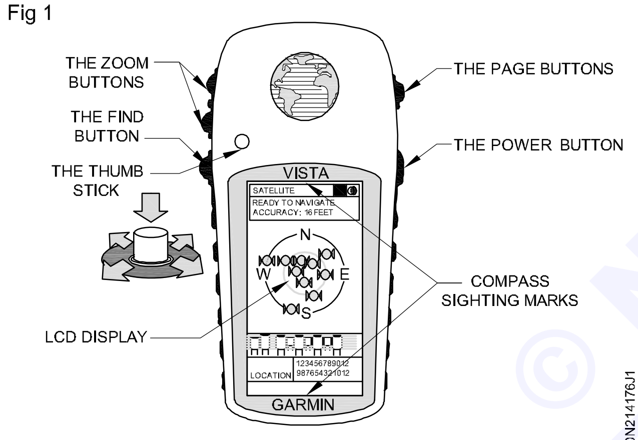
TASK 2 : **Explore your GPS unit (Fig 1 & 2)**

Fig 1




GPS UNIT

This exercise is designed to ensure that a used has a working understanding of a handheld GPS unit. Steps in this exercise include turning the unit on/off, navigating through the system menus, and understanding the different screens on your GPS. This exercise was designed around a Garmin Vista.

If you are not using this type of unit then the following may not be exactly the same for you, however it should be fundamentally similar. Use the directions that come with your personal GPS unit to complete this part of the exercise if needed.

The graphic on the left is a description of what the different Garmin Vista buttons do. Please familiarize yourself with this graphic or your personal unit. Check on the image for a larger and more descriptive view.

Turn the unit on by pressing and holding the POWER button (you must be outdoors in a clear area for this towork properly). The GPS will default to the Satellite screen after a copyright screen and a warning message. The first time the GPS units turned on it may take 5 minutes to establish a position. You can navigate back and fourth between different screens using the 'PAGE' and 'QUIT buttons. An illustration of the different screens is shown in the graphic below.

The **satellite screen** shown the position and name of satellites currently being tracked (and relativesatellite signal strength).

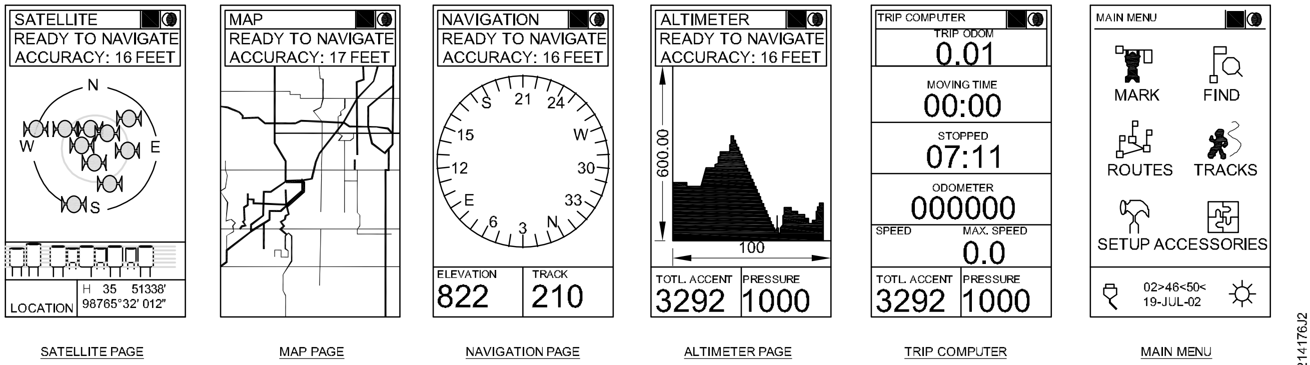
The **map screen** shows you a map of where you are with respect to other mapped features. Your unit may or may not have anyting in map view when you first turn on your instrument. If you have zoom keys (in/our) you can use them here to change the scale of your map.

The **navigation page** displays your current position in selected coordinates, as well as your speed and direction, elevation, and the current time.

The **altimeter page** tells you your speed and direction. You can use the compass screen to direct you back to a previously marked point (illustrated at the top of the graphic).

The main menu is where you go to mark and manage way points and routes, and to make changes in the configuration of your GPS (such as change the language or coordinate system).

Fig 2



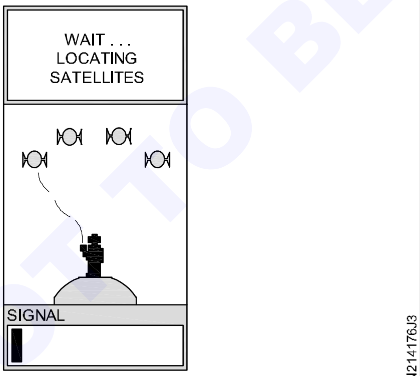

GPS UNIT

## Locate satellites

Press the On button (on the right side of the unit). The unit will start to look for satellites and will display the satellite acquisition page. This process normally takes several minutes, so be patient . (The satellite signals do not go through walls, so this cannot be done from inside a building).(Fig 3)

- For more details on which satellites have been located, press the Enter button (on the left of your unit) and choose Advanced skyview.(Fig 4)
- This page will provide more information about the position of the satellites in the sky and each one's signal strength.It can help you identify possible obstacles blocking the signal (such as buildings, trees, mountains, etc.,) Preferably the satellites location will be a mix of high and low on the horizon, in several different directions.(Fig 5)

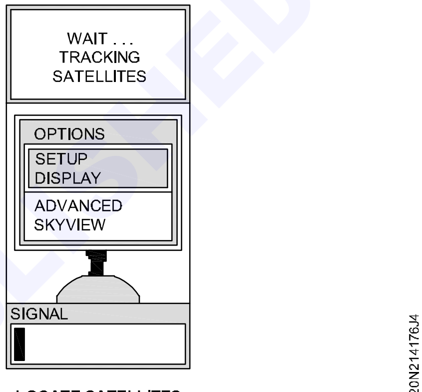
Fig 3




LOCATE SATELLITES

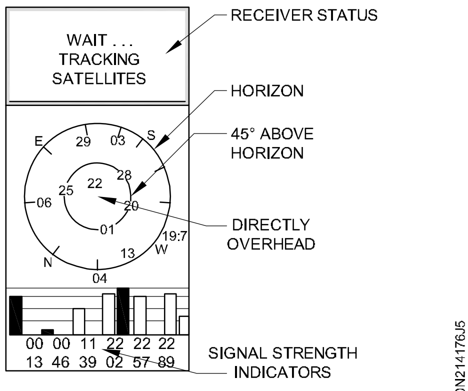
- Once enough satellites have been located, the unit will say "Ready to Navigate" and provide an estimate of accuracy. The exact number is not crucial, just know that it can be influenced by a number of factors, mostly the number and location of available satellites, and that you don't want the number to be excessively large (such as 100 meters or 300 feet). Also be aware that the location accuracy from an inexpensive hand-held GPS UNIT is somewhat limited.

Fig 4




LOCATE SATELLITES

Fig 5




LOCATE SATELLITES

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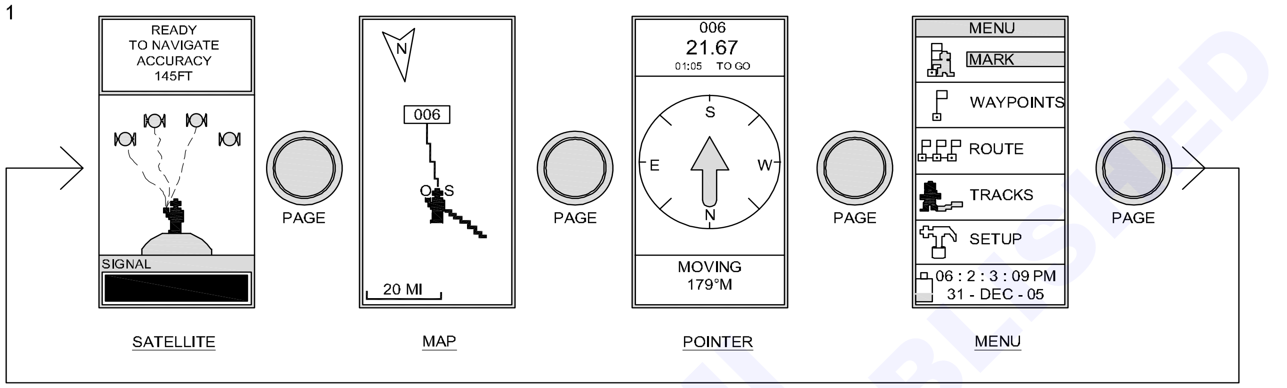
## Unit and way point setup (co-ordinate)

**Objectives:** At the end of this exercise you shall be able to
- **check the unit set up of GPS**
- **practice a position fix (way point)**
- **practice for entering co-ordinates of location.**

PROCEDURE

TASK 1 : **Check the unit setup of GPS (Hand held) (Fig 1)**

Fig 1




UNIT SETUP OF GPS ( HAND HELD )

Press the page button (right side of unit) several times, unit you reach the Menu page. Highlight word setup and press enter.

You will see the following screen. Note the settings. These are important to record as part of your data collection so that when you bring the points into GPS they can be properly displayed. A common mistake when copying data is to leave off negative sign (which denotes latitude south of the equator) or to leave off too many decimal places, if using decimal degrees (6 is desirable) or to record coordinates in degrees-minutes-seconds and then improperly translate these into decimal degrees.

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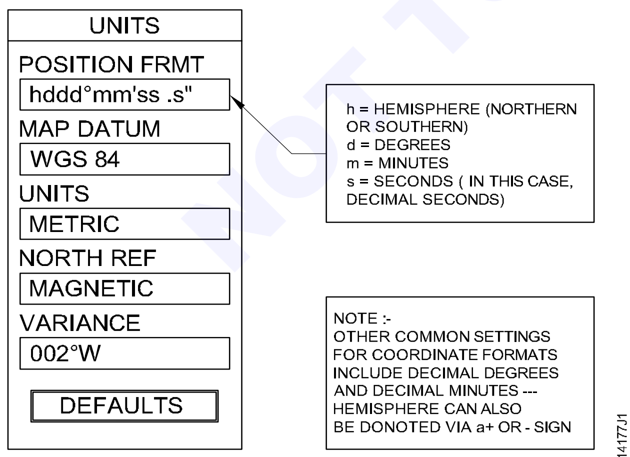
TASK 2 : **Collect waypoints (Fig 1 & 2)**

Fig 1




UNIT SETUP OF GPS ( HAND HELD )

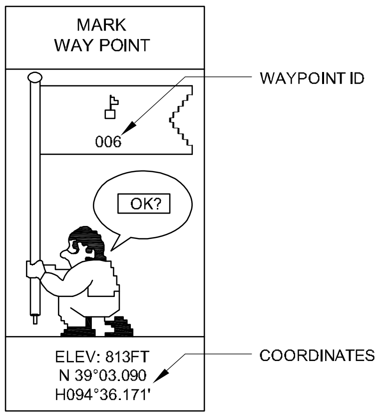
- Press the page button (right side of unit) until you reach the menu page, as above. This time highlight the word mark and press enter.

You will see the following screen:

- The waypoint ID is important to note on your survey spreadsheet or data table as this is what will link it to all information collection at that point, such as facility name or other name or other information. (you can high light this number by scrolling up to it the pressing Enter if you'd like to change it) Then highlight the word OK (this is the default, as shown above) and press enter to record the point.

You can collect your data either as a series of waypoints (most common for health survey data collection) or as a "track".

Fig 2




COLLECT WAYPOINTS

Continue to collect a series of waypoints while walking around to different locations and pressing “Enter” at each location. The map view screen will show you your progress. Pressing the Up and Down buttons will zoom you in and out on this screen.

Finally, turn off the unit to save batteries. (Turning off the unit will not cause you to lose any data you have entered). You now have a data file you’ll be able to view in QGIS, in the next section of this exercise.

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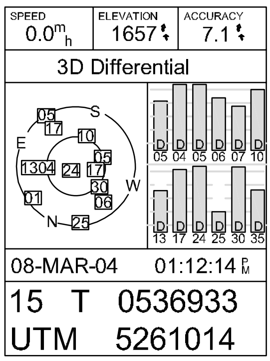
TASK 3 : **Saving a position fix (waypoint) (Fig 1 & 2)**

Fig 1




SAVING A POSITION FIX ( WAY POINT )

1 With your answer in any screen view, stand over the location where you want to store the coordinates.

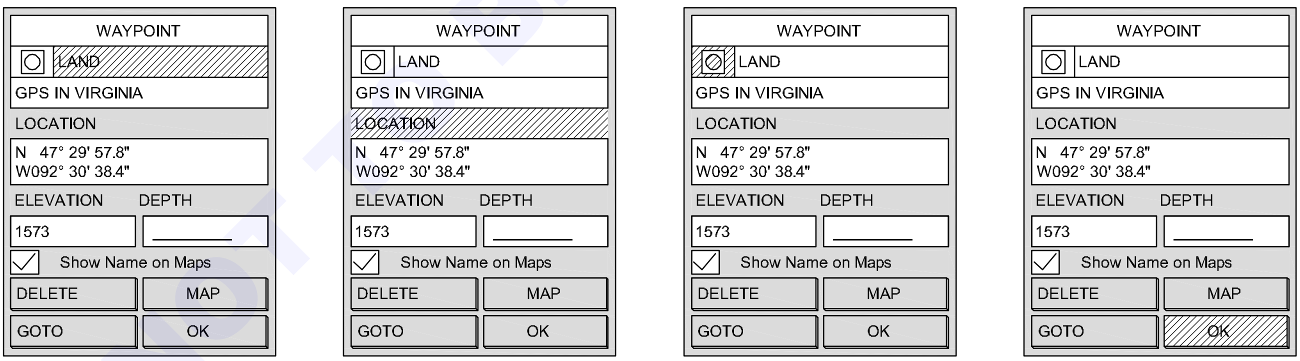
2 Allow the receiver to get a 3D different position fix. You will know this if you are in the “Satellite” view or when the “Accuracy” information goes below 10 feet on any of the “Navigation” screen.

3 Press and hold the <MARK> key to get the “Waypoint” screen for edits and saving.

4 You could edit the Symbol, Name, and Comment fields by following the next task.

5 With all editing complete, use the <ROCKER> key to highlight the “OK” button and then press the <ENTER> key to save your work.

Fig 2

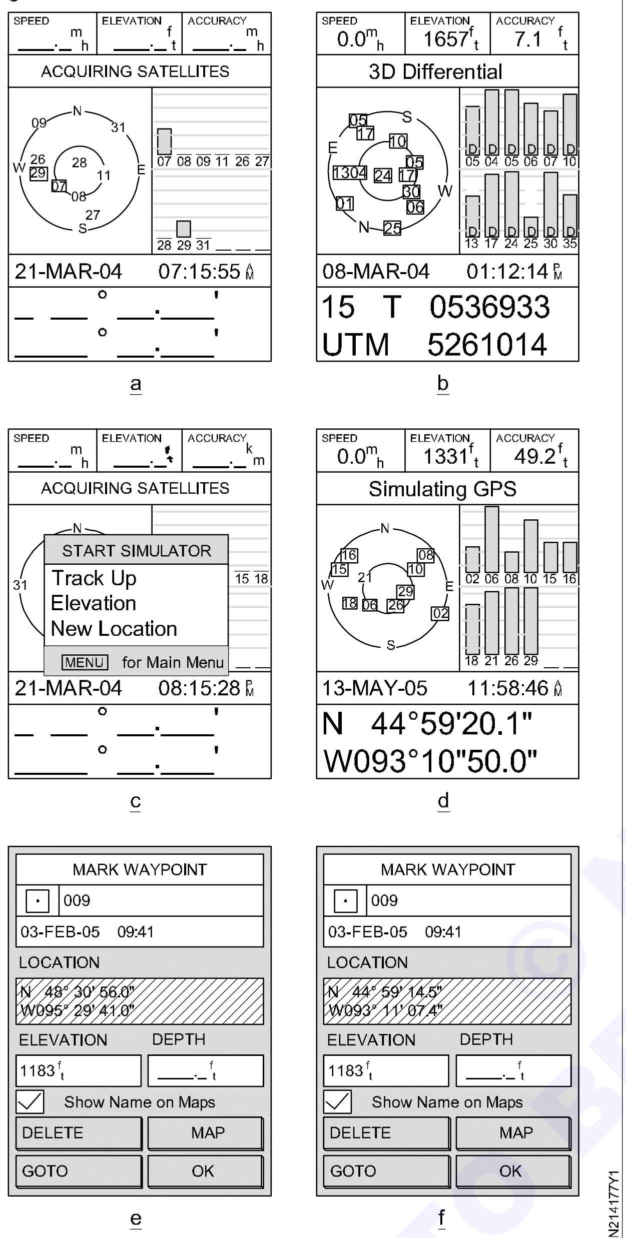



SAVING A POSITION FIX ( WAY POINT )

— — — — — — — — — —

TASK 4 : **Entering coordinates of location you are given (Fig 1 & 2)**

Fig 1




ENTERING COORDINATES OF LOCATION

1 Sometimes, you will receive coordinates such as a plot location or someone's favorite fishing spot on the lake.

2 Turn on the receiver and press the <ENTER> key until you are at the "Satellite View' screen.

3 If we are in the classroom, we must start the simulator. If we are outside skip to step 5.

4 Press the <MENU> key. Highlight 'Start Simulator' and press <ENTER> to accept.

5 As you have used the receiver you may have noticed the word "Mark Key" just underneath the <ENTER> key. This key serves both functions.

6 With you receiver in any screen view, press and hold the <MARK> key.

7 You will be taken to the "Mark Waypoint" screen for edits and saving.

8 Use the <ROCKER> key to highlight the location coordinate display.

9 To edit this location coordinates, press the <ENTER> key.

10 Using the <ROCKER> key, arrow to the right until the first digit that needs to be changed is highlighted. Do not change the "N" as this tells the unit this coordinate is north of the Equator. Pressing the <ROCKER> key up or down moves though the alphabet, numbers, and special symbols in sequence.

11 Arrow right and continue to update the coordinate in the box.

12 Once the latitude is done, continue to arrow right to reach the longitude numbers and edit those numbers as needed. Do not change the "W" or the "0" as these are required fields for North America.

13 When the coordinate in the field is correct press the <ENTER> key once and the entire box is then highlighted.

14 You can edit the information in any other field by highlighting any field using the <ROCKER> key and then pressing the <ENTER> key while the field is highlighted. You can change the point's name, comments, map symbol,or the elevation.

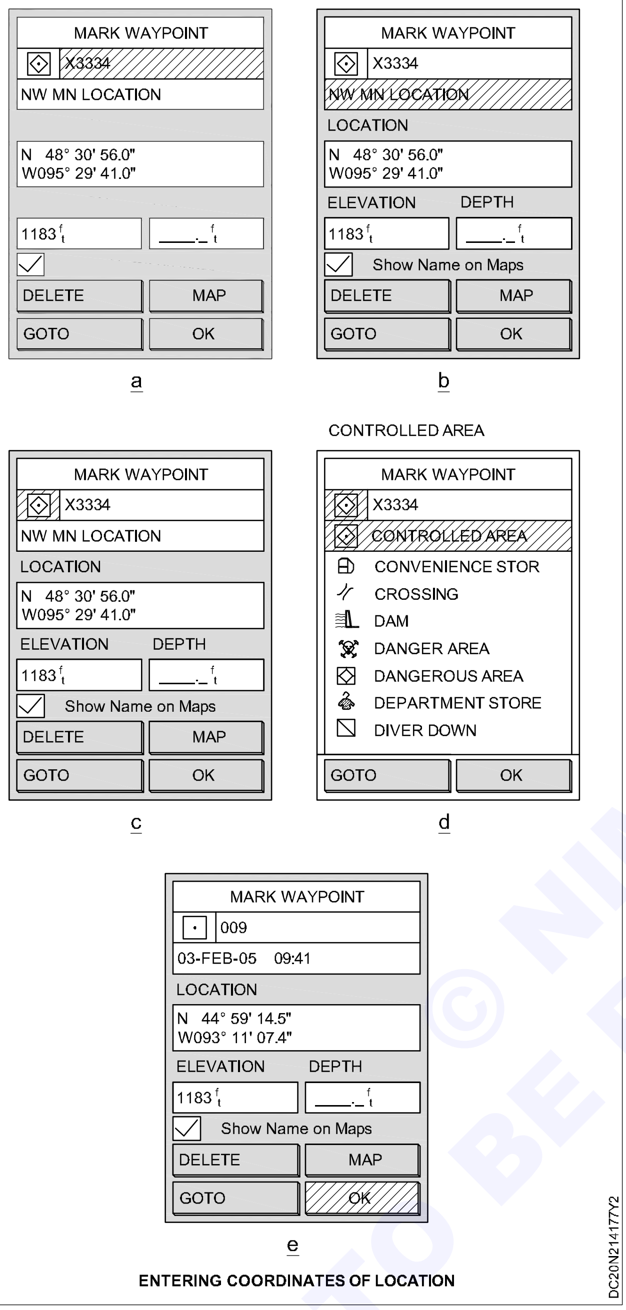
15 You should always give a point a meaningful name because after a while you will forget what number is what feature (name this waypoint :bio4803 P1"). The comments are also helpful to further overcome the ten (10) character name limit. There is a sixteen (16) character limit for the comment field.

16 You generally won't know an elevation of a point given you so, skip that today.

17 With the symbol box highlighted, you can choose from any symbol the dropdown list using the <ROCKER> key. Changing the symbol is not as important as creating a unique and meaningful name but it can be helpful on a crowded map. The highlighted symbol is selected when you press the <ENTER> key.

18 When complete, highlight the "OK" button and press the <ENTER> key to save all of your changes.

Fig 2




ENTERING COORDINATES OF LOCATION

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## Importing data from GPS devices to computer

**Objectives:** At the end of this exercise you shall be able to
- **operate to data from GPS devices**
- **identify viewing real time information**
- **identify viewing time line.**

### PROCEDURE

TASK 1 : **Import data from GPS devices (Fig 1,2 &3)**

If you have a GPS (Global Positioning System) device you can connect it to your computer to import your waypoint and track data in Google Earth. This will allow you to view your GPS data inside of Google Earth.

**Required connectors**

You will need either a serial cable or USB cable to connect the GPS device to your computer. Most GPS devices are sold with one of these cables. If your GPS device didn't come with a cable, you can visit the manufacturer's website to purchase the correct one for your model.

**Step 1 - Download google earth**

These instructions are only necessary if you do not already have Google Earth 6 on your computer. However, be sure to update to the latest version of Google Earth in order to be able to complete this chapter. Google Earth is a freely available virtual globe program. It displays satellite images, aerial photographs, and graphic layers on personal computers by delivering them over the Internet. Advanced versions of Google Earth are available for purchase, but this activity uses the free version.

1 Click go the Google Earth download page. The page automatically detects your operating system, so you don't have to worry about choosing particular version.

2 Click the **Agree** and **Download** button. Your browser will display a **Thank You** page while Google Earth automatically downloads in the background.

3 At the end of the download, an alert box will tell you that the dmg (Mac) or. ex (PC) file contains an application. Click the continue (Mac) or Save (PC) button to finish the download.

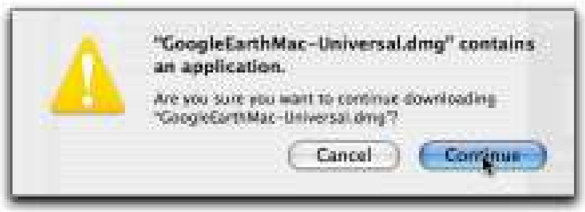
Fig 1


GOOGLE EARTH

Fig 2


GOOGLE EARTH

Fig 3

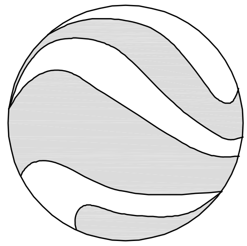



GOOGLE EARTH

TASK 2 : **Install google earth (Fig 1,2 & 3)**

1 On a Mac, the Google Earth disk image file (.dmg) will automatically mount on your desktop and open.

[redacted]



GOOGLE EARTH.app

DC20N214178H3

2 Drag the Google Earth app to wherever you want to install it - typically, the applications (or programs) folder on your hard drive.

3 Close the Google Earth disk image window, then drag both the Google Earth. dmg and the Google Earth vol ume (below) to the trash to clear them from your desktop.

4 Drag the Google Earth icon from your application folder to your dock to create an alias (Mac).

5 On a windows OS, open the Google Earth Setup. exe file and click Run. When installed, Google Earth launches automatically.

6 Create a shortcut to the program (Windows) for easy access.

[redacted]


GOOGLE EARTH

[redacted]

GOOGLE EARTH



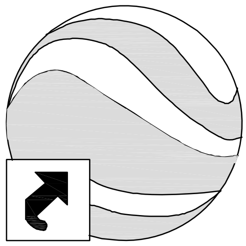
TASK 3 : **Launch Google Earth (Fig 1,2 & 3)**

**You much have a live internet connection while using Google Earth. As you move around and zoon in and out, new images are downloaded to your computer on the fly from Google's servers. This step confirms that you have properly installed Google Earth.**

1 Lunch Google Earth by double -clicking the Google Earth icon on your desktop or clicking its icon in your start menu (PC) or Dock (Mac).

2 You should now see the main Google Earth window.

Fig 1

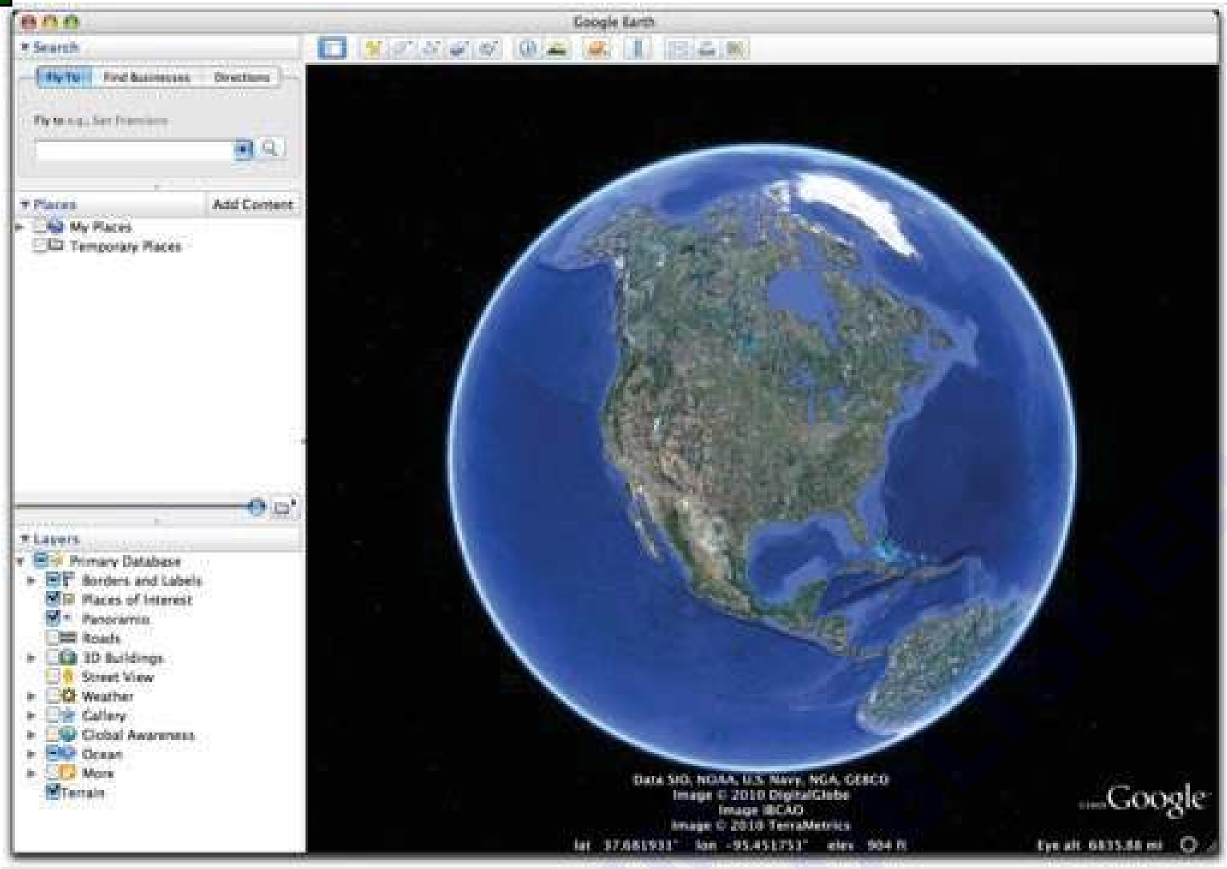


GOOGLE EARTH

DC20N214178J1

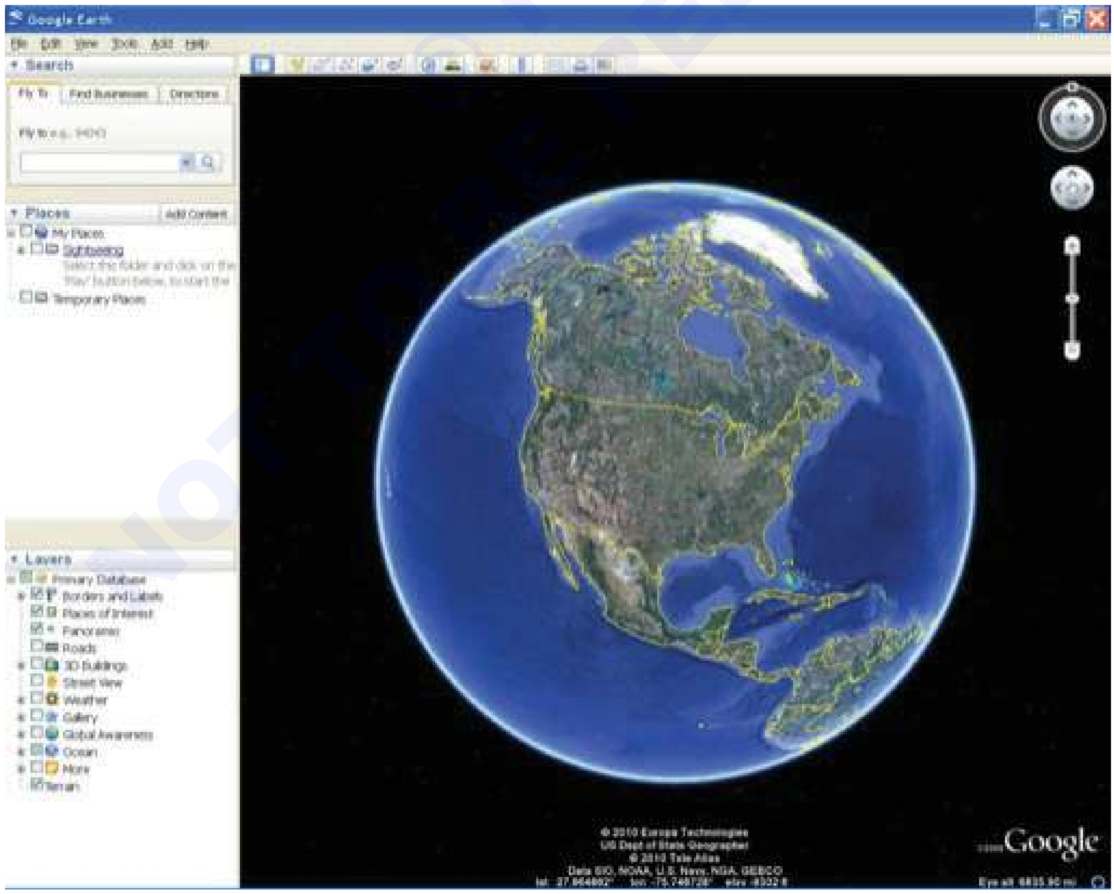
3 If this is your first time using of Google Earth, plan to spend some time exploring its features including zooming in and out, panning, and turning layers on and off. (Fig 7,8, &9)

Fig 2




GOOGLE EARTH

Fig 3




GOOGLE EARTH

TASK 4 : **Importing GPS data (Fig 1 & 2)**

**About GPS points**

You can choose how your GPS data is imported into Google Earth. When your GPS data is imported into Google Earth, a dialogue will appear asking if you would like to import Tracks, Waypoints, Routes, or all of the above.

**Tracks** - Tracks (or trackpoints) are points that are automatically recorded by me GPS device as you travel.

**Way points** - Waypoints are points entered by the user. Waypoints are typically marked with a name, such as “home” or “turnaround point”.

**Routes** - Route points are used by the GPS device to create a route from one recorded point to another recorded point. Route points can contain multiple sets of directions and can be imported into Google Earth as paths.

**Steps**

1 If you are using a Garmin USB device and a Windows computer, please install the Garmin USB driver from the CD that came with your GPS device or download this driver from the Garmin website.

2 Connect your device to the computer running Google Earth.

3 You can use either a serial cable or USB cable, depending upon which one come with your device.

4 Turn on the GPS device. Once your device is on and activated, it is not necessary to wait until it connects to satellites.

5 From the Tools menu, select GPS. The GPS window appears.

6 Select the correct manufacturer type for your device.

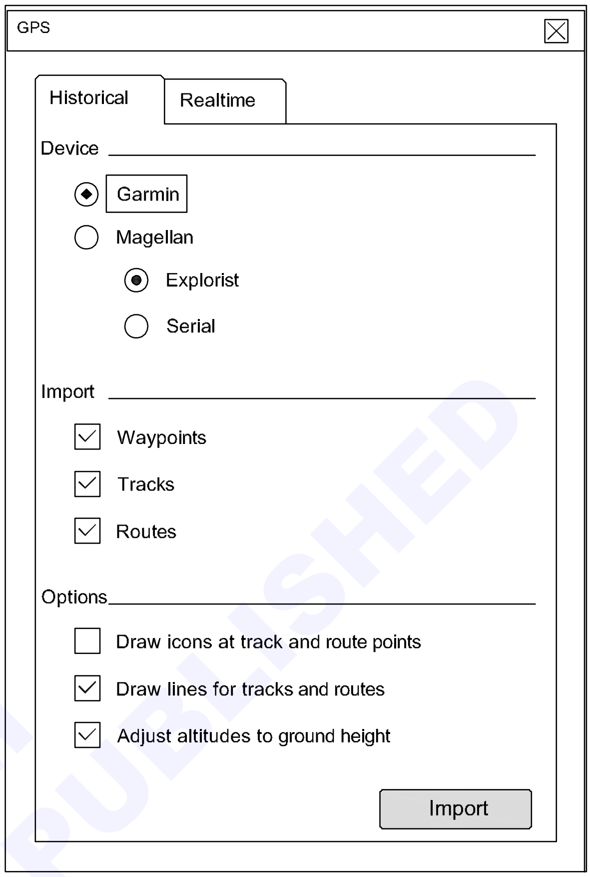
7 Under import, select the types of data you want to import.

8 Under options, choose you drawing preferences. Check draw icons at tract and route points if you want an icon to be displayed in the 3D viewer for every track/route point recorded by your GPS device. Check draw lines for tracks and routes to draw each GPS track and route as a solid line.

9 Check the adjust altitude to ground height check box to adjust all recorded point to ground level, such as when importing a track taken on foot, car, or bike. However, if your GPS track was recorded while hang glid ing or flying, make sure this option is not selected so that you points will appear as above-ground points.

10 Click OK. When your GPS data is finsihed loading into Google Earth, a conformation dialog box appears.

Fig 1

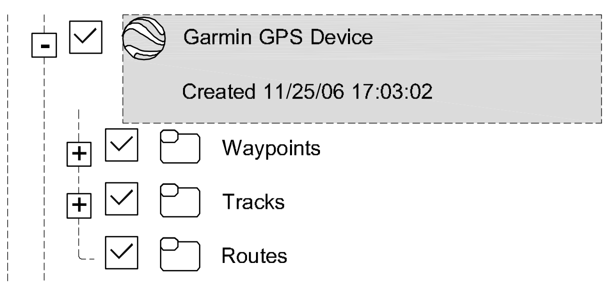



GPS

DC20N214178X1

Your data appears in the places panel with the label Garmin GPS device or Magellan GPS device, depending upon the device used (see supported devices) if you expand that folder, you can see the data sorted into the appropriate folders depending upon the type of data, as illustrated in the example below. (Fig 11)

Fig 2




GPS

DC20N214178X2

You can expand those folders and explore the information within as you would any other type of places data. This includes organizing, editing, sharing,saving, and more.

**If you receive a connection error; turn off the GPS device, turn it on again, and start again from step 4 above.**

TASK 5 : **Viewing realtime GPS information (Fig 1)**

If you have connected your portable computer to a GPS device, you can view GPS information in realtime. For example, you can view a live GPS track of your progress in a car on a laptop in Google Earth as you travel. To do this:

1 Connected you GPS device and portable computer as described in steps 1-4 of importing GPS data.

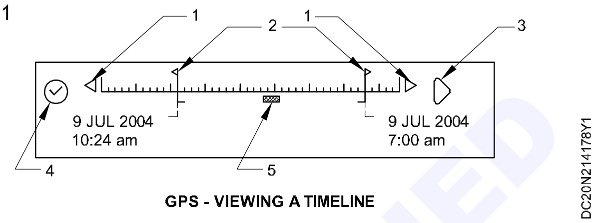
2 In the GPS dialog box, click the realtime tab.

3 choose the appropriate options:

- Select protocol-if your don't know which one to use, choose NMEA.
- Track point import limit - This is the maximum number of points imported per poll of the device. A smaller number can result in faster data but a less accurate depiction of your journey, while a large number can mean the opposite.
- Polling interval (seconds) - This is the frequency of which Google Earth collects data from the GPS device.
- Automatically follow the path-check this have the 3D viewer center on the follow the current realtime GPS track.

4 Click start to begin realtime GPS tracking.

Fig 1




GPS - VIEWING A TIMELINE

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## Map screen of GPS

**Objectives:** At the end of this exercise you shall be able to
- **determine accurate co-ordinate with GPS**
- **practice map screen over view**
- **practice on pan mode.**

PROCEDURE

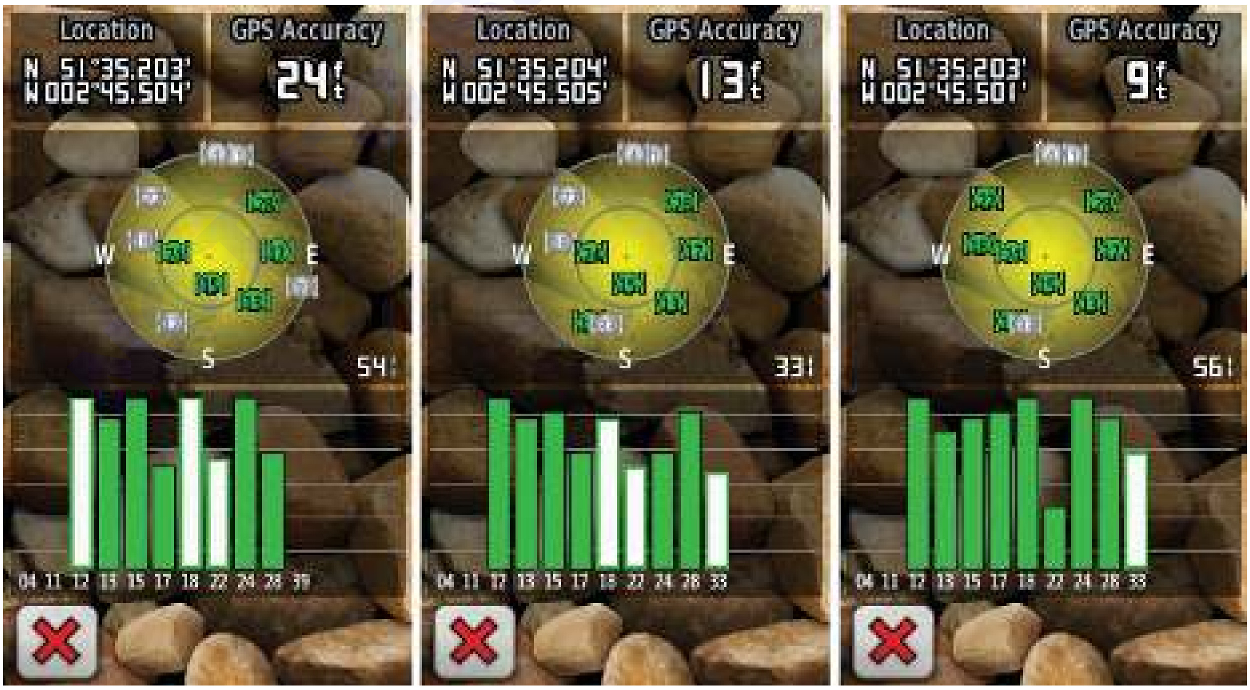
TASK 1 : **How to get accurate coordinates with a handheld GPS or smart phone (Fig 1)**

The Global Positioning System (GPS) is a network of satellites orbiting the Earth each broadcasting a radio signal. Your handheld GPS or smart phone has a receiver that picks up these signals and calculates exactly where you are anywhere on the surface of the planet. To get an accurate position 'fix' the GPS receiver needs to be able to receive the signals from at least 3 satellites and have a clear view to the sky. If there are obstructions such as thick woodland or tall buildings or mountains around you the signal may be affected and the position accuracy will not be very good. It can also be affected by changes to the air in the upper atmosphere . It is important that you give the GPS or phone plenty of time to get a good 'fix'. This can take 5 to 10 minutes and sometimes longer. The more satellites being received will improve accuracy.

Neither a handheld GPS or smart phone receiver will give you an exact position. At best you'll get an accuracy 10 to 15 feet (3 to 5 meters). If you are under trees or surrounded by tall buildings then you can expect an accuracy of 20 to 30 feet (6 to 10 meters) or even worse. Only professional GPS devices as used by surveyors can give accuracy to under one inch (2cm).

Here are two examples of GPS from a handheld GPS (Germin Oregon above) these examples, the first image was taken 1 minute after the GPS was switched on and the phone app started. The middle image is after 2 minute and the last image is after 3 minutes. You can see on the GPS screen that more satellites are being received as time goes on (the green bars) the location coordinates are slowly changing as the accuracy begins to come down to the final 9 feet. The final location coordinates are N51°35'W4 ° 19' which can considered quite accurate. With the phone the initial coordinates are quite different to the GPS and it's only after 3 minutes do they begin to match the GPS but are still not exactly the same. Smart phones (of all marks) do require more time to get a good satellite 'fix'.

Fig 1




GPS

## Map screen

The map screen will be the screen you most commonly use and a good understanding of its workings. The map screen can be displayed in two modes, Navigate and Pan. In Navigate Mode you current location is displayed along with a graphical indication of where you've travelled (track) and information and where you are going (route). In Pan mode you can 'pan' around the map locking for places to go or places to create a waypoint.

**(Example Magellam Handheld GPS)**

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TASK 2 : **Map screen overview (Fig 2)**

### Changing zoom levels

1 Tap the Zoom in ("+"_ or the Zoom out ("-") icons.

2 The map scale will change and can be identified by the map scale in the lower right portion of the map.

**If you are in a route the map scale can change automatically to a scale that best displays the route. You can turn autoscale off in Tools> Settings> Map options.**

### Setting the number of data fields

1 Tap the map screen to bring up the Four Corner Menu screen.

2 Tap on the options menu icon in the lower right corner.

3 Select Edit# of Fields.

4 Use the displayed up and down arrows to set the number of data fields.

5 Tap on the map to finish.

### Customizing the Data Fields

1 Tap the data field to be customized.

2 Tap on the data type field from the list displayed.

### Displaying a compass on the map screen

1 Tap the map screen to bring up the four corner menu screen.

2 Tap on the options menu icon in the lower right corner.

3 Select show compass

Fig 2


DATA FIELDS

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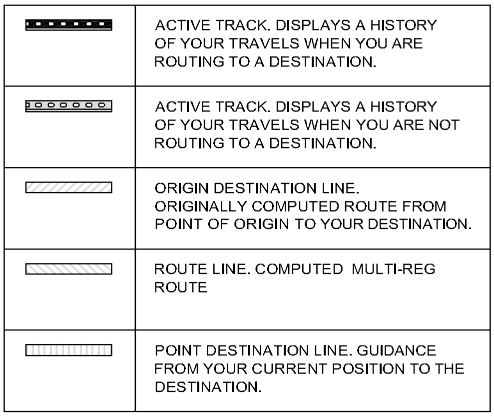
TASK 3 : **Navigation lines (Fig 3)**

Fig 3




NAVIGATION LINES

**Hiding/Showing Actie Track**

1 Tap the map screen to bring up the four corner menu screen.
2 Tap on the main menu icon in the lower left corner.
3 Tap on the tracks icon.
4 Tap on the options menu icon.
5 Select Clear **Hide Active** (or) show active track.

**Clearing active track**

1 Tap the map screen to bring upthe four corner menu screen.
2 Tap on the main menu icon in the lower left corner.
3 Tap on the Track icon.
4 Tap on the options menu icon.
5 Select **Clear Active Track.**

**Starting a New Track**

1 Tap the map screen to bring up the four corner menu screen.
2 Tap on the options menu icon in the lower right corner.
3 Select **Start New Track.**
4 Confirm that you want to delete the current active track and start a new track.

This track can be paused/restarted and saved to the receiver.

**Viewing Track Summary**

1 Tap the map screen to bring up the four corner menu screen.
2 Tap on the options menu icon in the lower right corner.
3 Select **Track Summary.**
4 A summary of the current track is displayed.

**Viewing an overview of the Active Track**

1 Tap the map screen to bring up the four corner menu screen.
2 Tap on the options menu icon in the lower right corner.
3 Select **Active Track Area.**
4 The map screen is scaled to display the entire area covered by the active track. The top of the display provides information about the area and the perimeter that the track covers.

**Backtrack**

You can use the track of your current travels to navigate back to your point of departure by creating a backtrack route. This will provide you with the information needed to travel back to where you started following the same path using to get where you are.

**Creating a Backtrack Route**

1 Tap the map screen to bring up the four corner menu screen.
2 Tap on the options menu icon in the lower right corner.
3 Select **Backtrack.**

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## Global information system (GIS)

**Objective:** At the end of this exercise you shall be able to
• **practice with global information system software.**

PROCEDURE

TASK 1 : **Start up QGIS on your computer and check for the GPS tools plugin**

Double-click the QGIS icon on the desktop to start the program. Check your plugin manager to ensure that “GPS tools” is enabled. (See graphic below. If you need help with this step, or need to “fetch” the correct plug from the internet, please return to Exercise 2: Explaining plugins. The GPS tools plugin is part of the main plugin installer that comes with version 1:7:4) (Fig 1).

Fig 1


GPS

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TASK 2 : **Run the GPS Tools plugin and download the points**

1 From the menu, select plugins>Gps>Gps tools.

**If you have QGIS versions 1.6 or 1.8, the GPS tools may be in a different menu or toolbar location.**

2 You should see the following dialog box: (Fig 2)

3 With your GPS unit turned on and properly connected to your computer, choose the “Download from GPS” tab at the tap.

4 “Garmin serial” should be selected under GPS device.

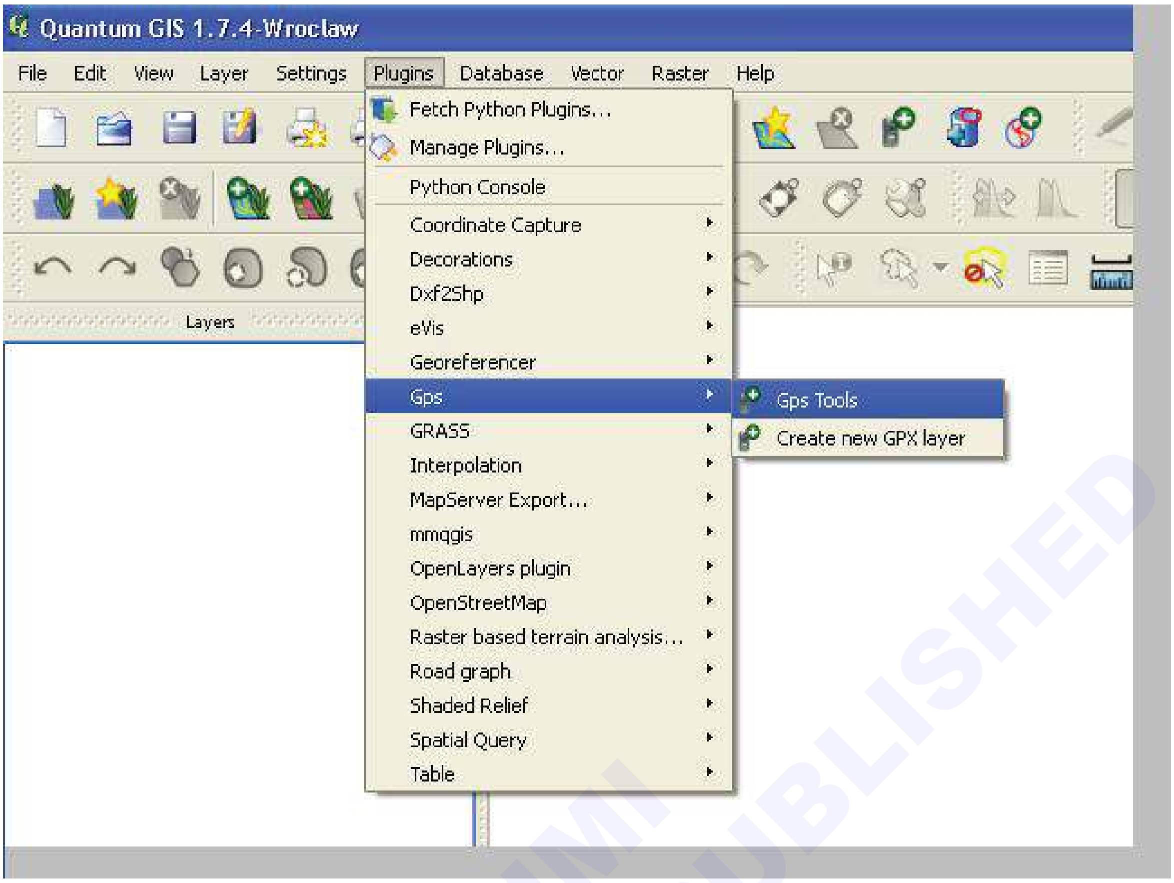
5 You will need to select the proper port in order for the computer to recognize where the device is located “COM1” is usually the best choice when your input port is the serial connector. If you have used a USB adapter you may need to choose either **“USB”**. or “COM2”. or even, as shown above, “COM4”. This may take some experimentation and may require use of the “Refresh” button; if the device was not turned on when QGIS was started.

6 The feature type is “Waypoints”.

7 Under layer name, type in a name or the points layer you are about the create, such as “PHFI” test points”.

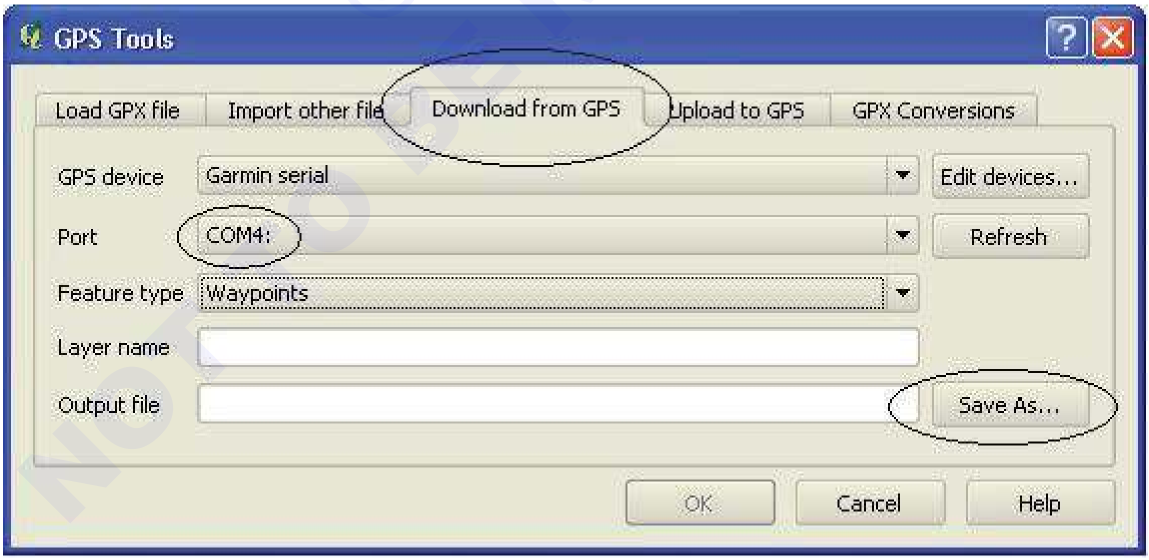
8 Under output file, click on the “Save As...” button and choose a save location and filename. (The default extension for this file will be. gpx). (Fig 3)

Fig 2




GPS

Fig 3




GPS