

CHAPTER 1: MANAGING MATERIALS, PLANT, TOOLS AND EQUIPMENT

Unit of learning code: CON/CU/BUT/CR/04/6

Related Unit of Competency in Occupational Standard: Manage Construction Materials, Tools and Equipment

1.1 Introduction to the unit of learning

This unit describes the competences in Managing Construction Materials, Tools and Equipment. It involves preparing site facility for storage, building material and equipment scheduling, ordering and receiving materials & equipment and preparing periodic construction material & equipment report

1.2 Summary of Learning Outcomes

1. Prepare site facility for storage
2. Prepare building material schedule
3. Prepare building equipment schedule
4. Procure building materials and equipment
5. Issue building materials and equipment

1.2.1 Learning outcome 1: Prepare site facility for storage

1.2.1.1 Introduction to the learning outcome

This learning outcome specifies the content of competencies required to Prepare site facility for storage. It includes; Building materials, tools and equipment, Clearing, Leveling and Erection of the facility.

1.2.1.2 Performance Standard

- 1.1 Building materials, tools, plant and equipment are assembled as per facility specifications.
- 1.2 Facility site is cleared and levelled
- 1.3 Storage facility is erected as per working drawing

1.2.1.3 Information Sheet

a) Definition of terms.

- **Building material-**
Is material used for construction.
- **Tools-**
Refers to instruments that are used by hand in construction.
- **Equipment-**
Generally, refers to a set of tools used for a single purpose.
- **Plant-**

Generally, refers to heavy machinery and equipment used for construction.

- **A building site-**
Is the place where the building is, or will be, located.
- **Storage of Materials –**
This can be defined as the provision of adequate space, protection and control for building materials and components held on site during the construction process.
- **Site Layout –**
Construction site layout involves identifying, sizing, and placing temporary facilities (TFs) within the boundaries of construction site. These temporary facilities range from simple lay-down areas to warehouses, fabrication shops, maintenance shops, batch plant, and residence facilities. Required temporary facilities and their areas are depending in many factors including project type, scale, design, location, and organization of construction work.
- **Site storage-**
Site storage involves the provision of adequate space, protection and control for materials, components and equipment that are to be kept on a construction site during the building process.

b) **Factors Affecting the Selection of Construction Material Strength**

Strength is an essential parameter for quality control in the construction and most important selection criteria for building material. It shows the ability of a material to withstand the failure under the action of stresses caused by loads such as compression, tension, bending and/or impact etc. that can be caused either due to the forces of nature or can be man-made.

The factors are as follows:-

- **Life of Material**
All materials should have long and maintenance free life. The durability of the structure depends on the materials used so don't cut corners or else be ready to pay hefty maintenance costs.
- **Handling and Storage**
While selecting the building materials, it's necessary to take into account their handling and storage because it affects the construction time, requirement of labour and equipment for handling, and of courses of the cost.
- **Local Availability**
Availability of building materials also affects the cost and the time of construction because certain materials are available at a particular place and are difficult to transport. In that case, not only the transportation costs will be very high but it will also delay the work. On the other hand, if the material is locally available it decreases the transportation cost. It's also a time saver and construction work can also be done smoothly.
- **Climate**

Another important aspect of the choice of materials is the climate. Factors like the average range of temperature throughout the year, rain or snowfall, seasons, amount of sunlight, required ventilation and wind are areas of concern. Hence chosen material for construction should complement the climate. When climate comes in the picture automatically the properties of materials also come in the picture.

- **Nature of Project**

Choice of material is a great deal in construction. The choice of material should be done cautiously as it directly affects the user. One significant area of concern which governs the choice of material is the nature of the project. Nature of project means residential, commercial, gathering space etc. The material used defines the built space. It also leads to other key factors like investment budget.

- **Specifications**

Based on your requirements like strength, aesthetic look etc. you should define the specifications and quality of materials that would go into the structure. Assume you want to purchase cement for construction then it's essential to know what type of cement you want to purchase to meet the required specification.

- **Maintenance**

Maintenance is also an important selection criterion for construction material because the good materials are those which are easy and economical to maintain. Maintenance will help to keep the look of building for a long time period and will increase the life of the building.

c) **Factors Affecting Selection of Construction Equipment**

- **Economic factors**

Economic considerations such as the cost of owning the equipment and operation and fuel costs are some of the most important factors that play a deciding role in selecting the equipment. Besides, consideration over resale value is also very important.

- **Factors specific to companies**

The selection of Construction Equipment also depends on the need of the company. If the company has a lot of projects in hand for the coming few months or even years, then it definitely makes sense for it to invest in the heavy CE. However, if there is a one-off job or a short term job that needs to be completed, then the company might opt for renting the equipment.

Further, if the company is doing really well and is ready to expand, then this also has a considerable impact on CE selection decision. Also, the amount of outsourcing the company does to execute its projects has an impact on CE selection decision. If the projects are given on a contract-basis to the third party, then the investment on equipment is kept low. Further, storage issues also come into play. If the company has its own industrial garage where it can store the equipment, then it may prefer to buy the CE.

- **Factors specific to the jobsite**

Both ground as well as climatic conditions at the site also affects the selection decision.

For example, the soil and overall terrain at the jobsite and nearby surroundings define which CE should be used.

At the same time, climatic conditions such as the presence of strong winds, visibility level etc., also affect the decision process.

- **Factors specific to the equipment**

CE are always very costly. So, standard equipment which are manufactured in large numbers by various manufacturers and whose spare parts are easily available are preferred by the companies.

The size of the equipment is also an important factor. The bigger the equipment, the more the investment and other considerations.

In addition, versatility of the equipment whether it can perform more than one function, the adaptability for future use and the interaction with other equipment also affects the selection of CE.

Further, if the company is in a position to bear the repair and maintenance cost, then it can select any equipment type but if the case is otherwise, then a lot of thought needs to be put in before finalizing on any equipment.

- **Project timeline considerations**

Project deadlines also affect the selection of the equipment.

If there is limited time available to complete a project, then companies may prefer highly advanced CE that can reduce a project's completion time significantly.

- **Labor considerations**

This also highly affects the selection decision.

If there is a shortage of manpower at the jobsite, then the companies may opt for highly automated machines.

Further, the selection of CE may also be highly governed by the availability or non-availability of trained manpower as then the company may or may not opt for highly sophisticated equipment.

- **Safety considerations**

Any construction site is the locus of multiple high-risk activities.

There are obvious safety concerns associated with workers operating on the ground, particularly within confined spaces when heavy materials are being moved around.

Hence, in such cases, companies may have to select equipment which ensures safety of the workers.

Thus, safety considerations also affect the selection of the equipment.

d) Factors affecting site allocation for material storage

Space available after areas for units of accommodation has been allocated.

Access facilities on site for delivery, vehicles.

Relationship of storage area(s) to activity area(s) the distance between them needs to be kept as short as possible to reduce transportation needs in terms of time and costs to the minimum. Alternatively storage areas and work areas need to be sited within the reach of any static transport plant such as a tower crane.

Security needs to be considered in the context of site operations, vandalism and theft.

Stock holding policy too little storage could result in delays waiting for materials to be delivered, too much storage can be expensive in terms of weather and security protection requirements apart from the capital used to purchase the materials stored on site.

e) Factors to be considered when deciding on the amount and nature of storage required-:

- ***Physical properties:***
The size, shape, weight and mode of delivery.
- ***Organization:***
The planning process to ensure unloading is available and storage space has been allocated.
- ***Control:***
Processes for checking the quality and quantity of materials on delivery, and monitoring stock holdings.
- ***Protection:***
The necessary protection for durable and non-durable materials and components from damage.
- ***Security:***
Guarding against theft and vandalism.
- ***Costs:***
Costs associated with handling, transporting and stacking requirements, the workforce required, heating and/or lighting that may be required, facilities to be provided for subcontractors, and so on.
- ***Processing:***
What needs to be done to materials before they can be used. Is there packaging that needs to be removed or returned?
- ***Programme:***
When are items required, what is the risk to the project of them not being available, how long in advance are they ordered and how long they will be on site.
- ***Ownership:***
Who is legally responsible for items, who will be using them and who owns them? See Materials on site for more information.

f) Site allocation –

The location and size of space to be allocated should be planned carefully as part of an overall site layout plan and each site will present its own problems. Failure to adequately plan for storage space can result in congestion, or having more materials on site than storage space allows for.

The most appropriate position on site in terms of handling, storage and convenience should be determined. Unloading deliveries should take place in a clearly marked designated area, away from other site operations, supervised by a competent person.

The distance between storage areas and the area materials are to be used should be reduced as much as possible to keep the time and cost required to transport them from place to place at a minimum.

Alternatively, storage areas could be positioned within the reach of a tower crane which can then be used to move materials as required.

g) Procedures of Site Preparation.

(i) Site Clearing-

This is the first task of site preparation. The site should be in a cleared and graded condition. It involves the removal of trees, demolishing buildings, removing any and all old underground infrastructure, and any other obstacles that might affect the construction process in the future or hinder the project to be done.

(ii) Site Surveying –

If your building block is not clearly identified by survey pegs, you cannot be certain that you are building on the correct block. A surveyor will survey the site and line out exactly where the structure or road project is to be built. The Surveying process is not an option it is a requirement for most zoning and permitting processes.

Surveying is the translation of a contractor's set of construction plans into a physical representation on the project site.

The function of the surveyor is to locate the boundaries of the structure to be built and is denoted with physical markers, usually a lathe, pin, or survey stake in a horizontal position.

However, the surveyor's marks are also communication to the contractor as to the actual elevation and the required cut or fill necessary to obtain the design elevation. It also includes the checking of improvements and temporary construction items placed to construct those improvements.

Contractors use the surveyor's marks to verify the horizontal and vertical location to the construction plans.

(iii) Soil Testing-

Soil testing is a vital important task that needs to be done before the site is purchased.

The composition of the soil must be known so as to examine the ability to withstand structure and to test the ability to absorb water.

The site Engineer will insist that you do all necessary soil testing before commencing any structural task on the soil.

If the soil at the site is not suitable for the future project, then there may be no choice but to look for another site which has soil suitable for the project

(iv) **Site Plan Design-**

After the soil testing is done all necessary drainage and septic tanks are installed, the next step is to modify the design to indicate placement of septic systems and all necessary fixtures.

Nothing can be done without designing the site, and above all making permanent record of what is underground.

A construction site is a living breathing thing, it changes daily, as placement of a water tank underground changes slightly because of underground rock formations for instance, this must be noted for future reference.

The site plan will show newly developed access roads for construction vehicles and temporary storage areas for supplies to be delivered.

The site plan will also depict where the building should be after it is built.

Unlike other steps taken in site preparation, the site plan is updated in the field and revisions are carried out in office by consultants.

(v) **Site investigation-**

Geotechnical site investigation performed in order to characterize soil, rock and groundwater condition of the proposed site.

A geotechnical site investigation is the process of collecting information and evaluating the conditions of the site for the purpose of designing and constructing the foundation for a structure, such as a building, plant, road, parking lot or bridge.

h) Elements of Site Layout Planning

❖ **Safety**

• ***Fire prevention:***

Fire is a major cause of damage on construction sites. So that, fire extinguishers are basic requirements on a construction project.

• ***Medical services:***

On construction project a first aid kit is a must. In remote projects a well-equipped medical room with a doctor and nurse is important.

• ***Construction safety clothing:***

Basic safety supplies like safety shoes, hard hats, gloves, and goggles must be used by workers.

❖ **Site Accessibility**

Easy accessibility will keep the morale of the equipment and vehicle drivers high minimize the chance of accidents, and save time in maneuvering to arrive at and leave the project.

In case of large projects, proper planning is required to layout the roads leading from the nearest highway.

Internal roads are necessary for easy flow of work.

Also, Parking Lots are provided for the owner, office, and craft personnel, but this facility must be planned where space does exist.

❖ **Information Signs**

• ***Site map:***

It should locate details of the project, and displayed in the office of the site superintendent or project manager and posted at the entrance gate.

• ***Traffic regulatory signs:***

For large projects, traffic regulatory signs help in guiding the traffic on the site and avoid accidents to a considerable extent.

• ***Display of labor relations' policy and safety rules:***

This will help in eliminating disputes between labor and management.

• ***Emergency routes and underground services:***

It is important to display the emergency escape routes on every floor as the building progresses. Locations of underground services should be marked to prevent its damage.

❖ **Security**

• ***Entrance:***

It is necessary to have a proper guard entrance to the site provided by a booth.

Also, it is necessary to keep track of all visitors to the project.

• ***Lighting:***

It is necessary to have a standby generator to maintain site lighting.

• ***Fencing:***

The boundary should be fenced off from a security point of view.

❖ **Accommodation**

On large construction projects, it is necessary to provide camp accommodation for all type of staff involved in the project.

❖ **Offices**

The offices should be close together, close to the site, and in a safe area.

Also, provide the offices with proper office equipment.

The offices at the site may include job office, general contractor office, and sub-contractors and consultants Offices.

❖ **Water Supply and Sanitation**

It is necessary to have water and toilet facilities in convenient locations to accommodate the work force.

❖ **Material Handling**

One third or more of all construction operations can be classified as material handling.

The use of proper equipment for material handling and advance planning for minimizing multiple handling will result in direct cost and time savings.

❖ **Storage and site cleaning**

It is necessary to plan and reserve storage areas for materials so that multiple movement of material is avoided.

• ***Laydown areas:***

Areas reserved for storage of large materials and equipment and it can be short-term or long-term.

• ***Warehouses:***

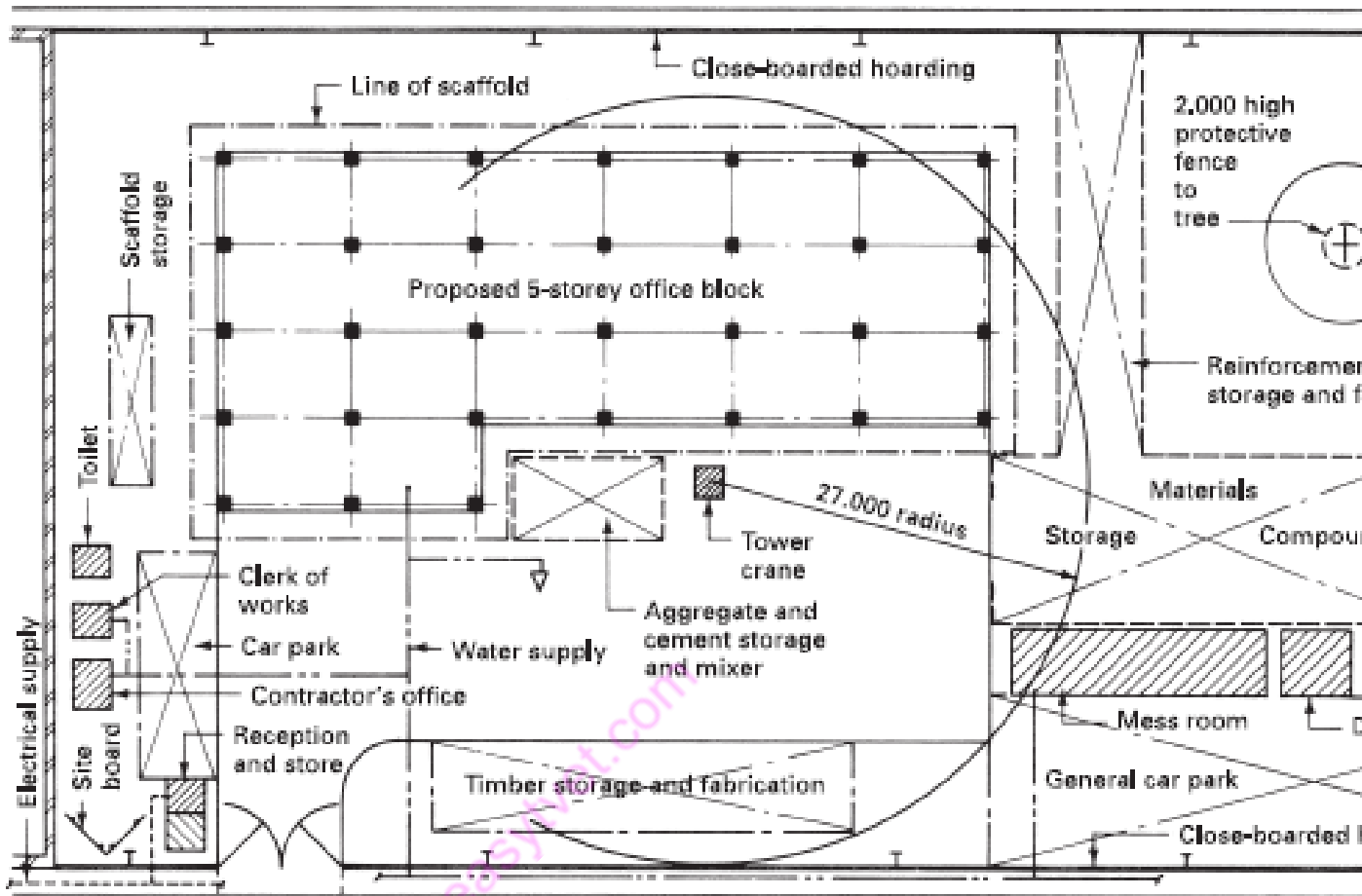
They are sheltered storage facilities where materials are stored until they have disbursed to the job.

• ***Material staging areas:***

They used when materials are stored near the work on a short-term basis. They are generally as close to work as possible.

• ***Site cleaning:***

It is necessary at a work place and especially where the extent of debris produced is high. Regular disposal of debris is necessary.



Ref, Advance construction Technology (4th.edition) by Roy chudley and Roger

Greeno page 25.

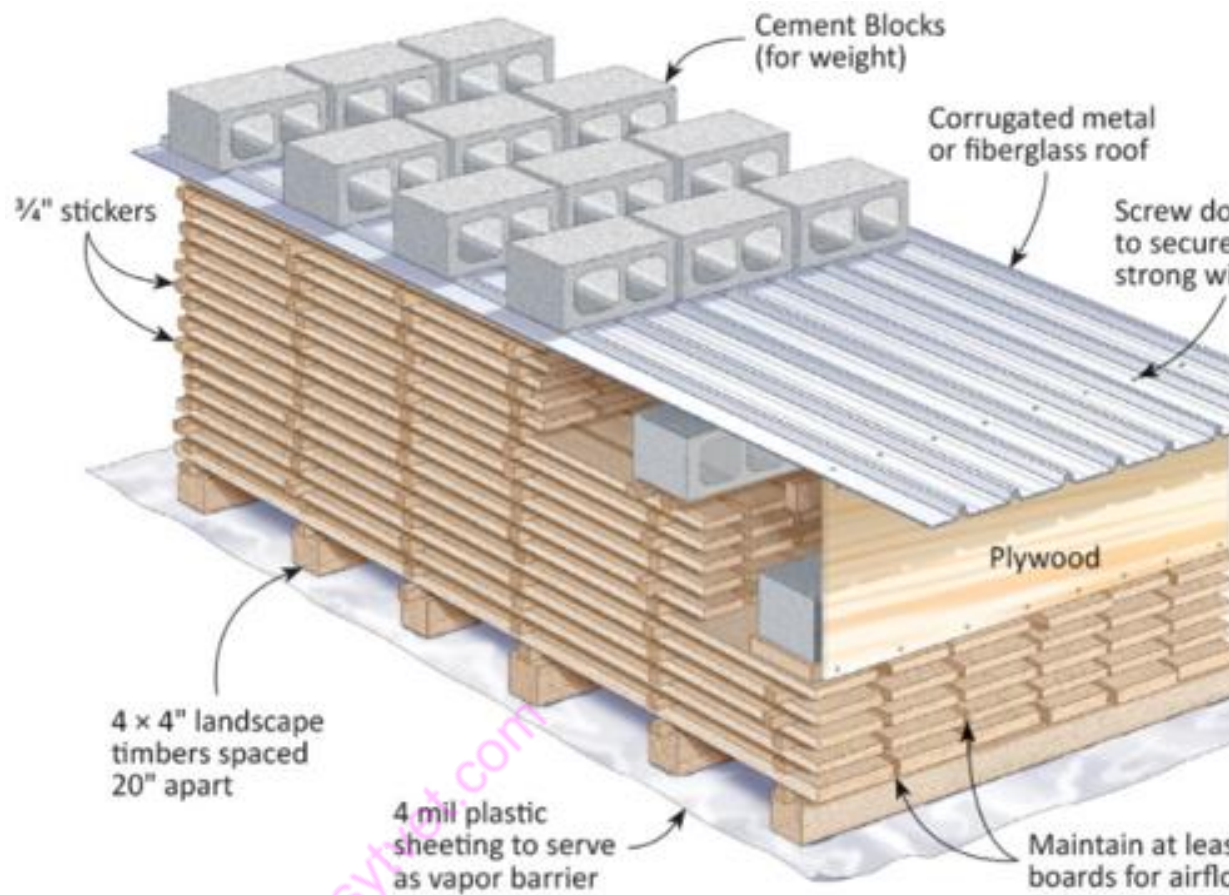
Fig 1. Site layout example: proposed layout of accommodation and storage

❖ **Storing Timber on site**

Timber should always be stored in the proper way to ensure it does not deteriorate. This involves keeping it dry and covered in colder conditions so as to prevent surface freezing and keeping it off the ground and spaced to allow air to move around the timber freely. You should always keep timber stored flat so as to prevent it from warping or twisting over time.

Start by selecting a functional location on solid ground. It should be level, protected from sun and rain, and provide good air circulation. An open shed or outside area with a metal roof over the top is ideal.

To Store a quantity of lumber(timber) containing 1" (25mm) and thicker boards from 6" (150mm) to 10" (250mm) wide and 6' to 10' long, follow the procedure below to build a proper stack using the materials shown in Figure 2 .below.



https://www.woodcraft.com/blog_entries/how-to-air-dry-lumber-turn-freshly-cut-stock-into-a-cash-crop-of-woodworking-woods#

Fig.2 Building A conventional Air-Drying Storage Stack

- ***Storing Procedure for Air-Drying Storage Stack:-***

- (i) Put a sheet of heavy (at least 4 mil) plastic on the ground to keep moisture away.
- (ii) Then lay out the landscaping timbers to raise the stack off the ground by at least 4" to 6". For 1" thick boards (4/4), the timbers should be about 20" apart to keep the boards from sagging. They need to form a flat surface, as the boards will conform to the timbers as they dry.
- (iii) Next, lay a sticker along each landscape timber.
- (iv) Start the stack with the longest ones if the boards vary in length, Put the slower drying boards (thicker or slow-drying species) on the bottom, since they'll be the last ones to be ready for use. I recommend identifying the species with a tag, so they will be easy to sort after they air-dry.

- (v) Leave an inch or two of space between the boards for good air circulation by using stickers/spacers of the same thickness.
- (vi) Align the stickers vertically so they transmit the weight of the stack straight down to the ground. Having a second person makes stacking easier, since it allows you to each take an end of the board and set it straight down without moving the stickers. Go as high as you safely can. I stop at 6'.
With a stack that is out in the open, do what you can to keep the rain and sun off, while allowing good air circulation. Whatever cover you use should sit on a layer of stickers to allow air to flow over the top of the stack.
- (vii) If this is a one-time proposition, overlap some scrap lumber on the stack to shed water, and strap or weight it down.
- (viii) Metal roofing, like the kind you get at a home centers, is better. Then comes the hard part...waiting.

The European style involves stacking slabbed wood (with one or both edges left natural) to reconstruct the log (Photo C).

This allows the craftsman to select matching grain and create book-matched tabletops. The same drying principles apply to this stacking approach. Once the stack is assembled, put a couple of ratcheting straps on it to keep it from warping badly. Once a week or so, tighten down the ratchet straps. They tend to loosen some as the wood dries and shrinks. The top slab protects the stack from rain, and the edges naturally shed water. Unlike conventional stacking, it is not an efficient use of space.

1.2.1.4 Learning Activities

a) Practical activities

The trainee is expected to assemble building material, tools, plant and equipment.

b) Field/visit to construction site

Visit objective/Aim	Indicators	Special instruction
To establish clearing and leveling facility site and erecting storage facility facility.	Procedure followed during clearing, leveling and erecting of storage facility.	As Per The Working Drawing

Table 1.3: field visit objectives, indications and instruction on site clearing, leveling and erection of storage facility.

1.2.1.5 Self-Assessment

1. What are the Factors that can affect site allocation for material storage?
2. What are the considerations during Selection of Construction Material?
3. What the content of billboard at the construction site?
4. Why do we fence a construction site?

5. Why do site investigation before establishment of a construction site?
6. Why do we soil testing before establishment of a construction?

1.2.1.6 Tools, Equipment, Supplies and Materials

Tools	Tape measure Gauge box Wood float Plumb bob
Equipment	Computer Transporters Lifts Bulldozers Excavators Leveling apparatus
Supplies and materials	Personal protective equipment (PPEs) Gum boots Gloves Dust coats First aid kit Life jacket Ear muffs Dust mask Stationery Files Cement Sand concrete
Resource	A functioning construction site British Standard Specification

Table 1.4: Tools, equipment, supplies and materials for a visit to a construction site

1.2.1.7 References

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https://www.woodcraft.com/blog_entries/how-to-air-dry-lumber-turn-freshly-cut-stock-into-a-cash-crop-of-woodworking-woods#

1.2.1.8 Responses to Self-Assessment

1. What are the Factors that can affect site allocation for material storage?
 - **Space available after areas for units of accommodation have been allocated.**
 - **Access facilities on site for delivery, vehicles.**
 - **Relationship of storage area(s) to activity area(s) the distance between them needs to be kept as short as possible to reduce transportation needs in terms of time and costs to the minimum. Alternatively storage areas and work areas need to be sited within the reach of any static transport plant such as a tower crane.**
 - **Security needs to be considered in the context of site operations, vandalism and theft.**
 - **Stock holding policy too little storage could result in delays waiting for materials to be delivered, too much storage can be expensive in terms of weather and security protection requirements apart from the capital used to purchase the materials stored on site.**
2. What are the considerations during Selection of Construction Material?
 - **Strength**
 - **Life of Material**
 - **Handling and Storage**
 - **Local Availability**
 - **Climate**
 - **Nature of Project**
 - **Safety considerations**
3. What the content of billboard at the construction site
 - **Name of the project**
 - **Client of the project**
 - **Name of the contractor**
 - **Period of the project**

- **Name of the quantity surveyor**
 - **Name of the supervisor**
4. Why do we fence a construction site?
 - **To control theft**
 - **To prevent accident**
 - **To control pass by**
 - **For easy supervision**
 5. Why do site investigation before establishment of a construction site?
 - **Geotechnical site investigation performed in order to characterize soil, rock and groundwater condition of the proposed site. A geotechnical site investigation is the process of collecting information and evaluating the conditions of the site for the purpose of designing and constructing the foundation for a structure, such as a building, plant, road, parking lot or bridge.**
 6. Why do we soil testing before establishment of a construction?
 - **Soil testing is a vital important task that needs to be done before the site is purchased. The composition of the soil must be known so as to examine the ability to withstand structure and to test the ability to absorb water. The site Engineer will insist that you do all necessary soil testing before commencing any structural task on the soil. If the soil at the site is not suitable for the future project, then there may be no choice but to look for another site which has soil suitable for the project**

1.2.2 Learning Outcome 2: Prepare building material schedule

1.2.2.1 Introduction to the learning outcome

This learning outcome specifies the content of competencies required to Prepare building material schedule. It includes; Types of materials, Standard material schedule and Standard materials rates.

1.2.2.2 Performance Standard

2.1 Types of materials to be used be used are identified and listed.

2.2 Building materials are quantified and recorded on a standard schedule

2.3 Quoted rates are included in the material schedule

1.2.2.3 Information Sheet

a) Types of building materials used in construction

❖ **Stones-**

Building stones are obtained from rocks occurring in Nature.

➤ **Uses of stones -:**

- **Structure :**
Stones are used for foundations, walls, columns, lintels, arches, roofs, floors, damp proof course etc.
- **Face works :**
Stones are adopted to give massive appearance to the structure. Walls are of bricks and facing is done in stones of desired shades. This is known as composite masonry.
- **Paving stones:**
These are used to cover floor of building of various types such as residential, commercial, industrial etc. They are also adopted to form paving of roads, foot paths etc.
- **Basic material:**
Stones are disintegrated and converted to form a basic material for cement concrete, murum of roads, Calcareous cements, artificial stones, hallow blocks etc.
- **Misalliances:**
Stones are also used for ballast for Railways, flux in blast furnace and locks in the Construction of bridges, piers, abutments, retaining walls, Light houses, dams etc

➤ **Qualities of a good building stone**

- **Crushing strength:**
For a good building stone, the crushing Strength should be greater than 1000kg per cm².
- **Appearance:**
Good building stone should be a uniform Colour, and free from clay holes, spots of other colour bands etc. capable of preserving the colour for longtime.
- **Durability:**
A good building stone should be durable. The factors like heat and cold alternative wet and dry dissolved Gases in rain, high wind velocity etc. affect the durability.
- **Fracture:**
For good building stone its fracture should be Sharp, even and clear.
- **Hardness:**
The hardness greater than 17, treated as hard used for road works. It is between 14 to 17, medium hardness, less 14 said be poor hardness.
- **Percentage wear:**
For a good building stone, the percentage Wear should be equal to or less than 3% percent.
- **Resistance to fire:**
A good building stone be fire proof. Sandstone, Argillaceous stone resists fire quite well

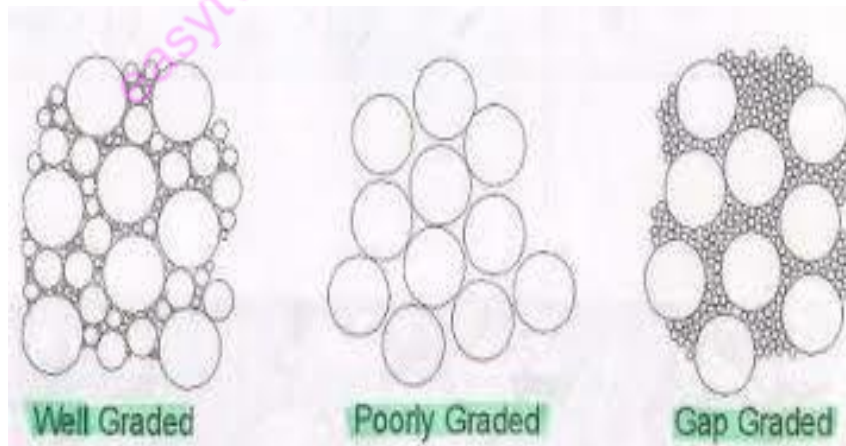
- **Specific gravity:**
For a good building stone the specific Gravity should be greater than 8.7 or so.
- **Texture:**
A good building stone should have compact fine crystalline structure should be free from cavities, cracks or patches of stuff or loose material.
- **Water absorption:**
For a good building stone, the percentage Absorption by weight after 24 hours should not exceed 0.60.
- **Seasoning:**
Stones should be well seasoned before putting into use. A period of about 6 to 12 months is considered to be Sufficient for proper seasoning.
- **Toughness Index:**
Impact test, the value of toughness less Than 13 – Not tough, between 13 and 19 – Moderate, greater than 19- high

❖ **Aggregates-:**

Aggregates are derived from igneous, sedimentary and metamorphic rocks or are manufacture from Clays, slag etc.

➤ **Properties of Aggregates**

- Aggregates should be Durable, and free from clay, loam, vegetables and other such foreign matters.
- Should be well graded



Adopted from the constructor .com

Figure 3: A picture of poorly graded and well graded aggregate.

➤ **Classification of Aggregates.**

• **Fine Aggregates:**

The material, most of when passes through 4.75mm I.S. sieve size is termed as fine aggregates. It should Not contain more than 1 to 8% of fine particles, which may be Obtained from sea, river, lake or pit may be used as fine Aggregates but care should be taken all its impurities must be removed

- **Coarse Aggregates:**

The material whose particles are of such Size as are retained on 4.75mm, I.S sieve are called coarse Aggregates. The size of the coarse aggregates used depends Upon the nature of work. The maximum size may be 23mm for mass concrete such as dams etc. and 63mm for plain concrete. Crushed hard stone and gravel is the common materials used as coarse aggregates for structural concretes. Coarse aggregates usually obtained by crashing granite, gneiss, crystalline lime stone and good variety of sandstone etc.

- ❖ **Bricks-:**

Bricks are obtained by moulding clay in rectangular blocks of uniform size and then by drying and burning these blocks.

- **Classification of bricks**

- **Un burnt or Sun dried bricks-**

UN burn or sun dried with the help of heat received from sun after the process of moulding. These bricks can only be used in the constructions of temporary and cheap structures. Such bricks should not be used at places exposed to heavy rains.

- **Burnt Bricks:**

The bricks used in construction works are burnt bricks and they are classified into the following four categories.

- **Qualities of Good Brick.**

It should-:

- ✓ Be table moulded, well burnt in kilns, copper coloured, free from cracks and with sharp and square edges.
 - ✓ Have uniform shape and of standard Size.
 - ✓ give clear ringing sound when struck each other.
 - ✓ Show a bright homogeneous texture when broken
 - ✓ Have compact structure that is free from voids.
 - ✓ Not absorb water more than 20 percent by weight for first class bricks and 22 percent by weight for Second class bricks, when soaked in cold water for a period of 24 hours.
 - ✓ Be sufficiently hard ,and no impression should be left on brick surface, when scratched with finger nail.
 - ✓ Be of low thermal conductivity
 - ✓ Be sound proof.
 - ✓ Not break when dropped flat on hard ground from a height of about one meter.
 - ✓ Not show Deposits of white salts when soaked in water for 24hours, allowed to dry in shade.
 - ✓ No brick should have crushing strength below 55kg/cm²
- 2.4 Special Types:
- ✓ Be made in a wide range of shapes and to suit the requirements of the location where they are to be used.

- ❖ **Cement –**

Cement in its broadest term means any substance which acts as binding agent for materials natural cement (Roman Cement) is obtained by burning and crushing

the stones containing clay, carbonates of lime and some amount of carbonate of magnesia.

The clay content in such stones is about 20 to 40 percent. Natural cement resembles very closely eminent hydraulic lime. It is not strong as artificial cement, so it has limited use in practice.

Artificial cement is obtained by burning at very high temperature a mixture of calcareous and argillaceous materials in correct proportion. Calcined product is known as clinker. A small quantity of gypsum is added to clinker and it is then pulverized into very fine powder is known cement.

Cement was invented by a mason Joseph Aspdin of Leeds in England in 1824. The common variety of artificial cement is known as normal setting cement or ordinary cement or Portland cement.

➤ **Types of Cement**

- **Acid Resistance Cement:**

This is consists of acid resistance aggregates such as quartz, quartzite's, etc., additive such as sodium fluoro silicate (Na_2SiO_6) and Aqueous solution of sodium silicate. This is used for acid resistant and heat resistant coating of installations of chemical Industry. By adding 0.5 percent of unsean oil or 2 percent of ceresin, its resistance to water is increased and known as acid water resistant cement.

- **Blast Furnace Cement:**

For this cement slag is obtained from blast furnace in the manufacture of pig iron and it contains basic elements of cement, namely alumina, lime and silica.

The properties of this cement are more or less the same as those of ordinary cement and prove to be economical as the slag, which is waste product, is used in its manufacture.

- **Coloured Cement:**

Cement of desired colour may be obtained by intimately mixing mineral pigments with Page 46 Building Materials & Construction ordinary cement. The amount of colouring may vary from 5 to 10 percent and strength of cement if it is exceeds 10 percent.

Chromium oxide gives brown, red or yellow for different proportions. Coloured cements are used for finishing of floors, external surfaces, artificial marble, windows

- **Expanding Cement:**

This type of cement is produced by adding an expanding medium like sulpho – aluminate and a stabilizing agent to ordinary cement. Hence this cement expands where as other cement shrinks.

Expanding cement is used for the construction of water retaining structures and also for repairing the damaged concrete surfaces.

- **High alumina Cement:**

This cement is produced by grinding clinkers formed by calcining bauxite and lime.

The total content should not be less than 32 percent and the ratio by weight of alumina to lime should be between 0.85 and 1.30.

- **Hydrophobic Cement:**

This type of cement contains admixtures, which decreases the wetting ability of cement grains.

The usual hydrophobic admixtures are acidol naphthene soap, oxidized petrolatum etc.

when hydrophobic cement is used, the fire pores in concrete are uniformly distributed and thus the frost resistance and the water resistance of such concrete are considerably increased.

- **Low Heat Cement:**

Considerable heat is produced during the setting action of cement. In order to reduce the amount of heat, this type of cement is used. It contains lower percentage of tri -calcium aluminates C3A and higher percentage of dicalcium silicate C2s.

This type of cement is used for mass concrete works because it processes less compressor strength.

- **Pozzuolona Cement:**

Pozzuolona is a volcanic powder and the percentage should be between 10 to 30.

- **Quick Setting Cement:**

This cement is prepared by adding a small percentage aluminum sulphate which reduces the percentage of gypsum or retarded for setting action and accelerating the setting action of cement.

As this cement hardness less than 30 minutes, mixing and placing operations should be completed.

This cement is used to lay concrete under static water or running water.

- **Rapid Hardening cement:**

This cement has same initial and final setting times as that of ordinary cement.

But it attains high strength in early days

- **Sulphate Resisting Cement:**

In this cement percentage of tricalcium aluminates is kept below 5 to 6 percent and it results in the increase in resisting power against sulphate.

This cement is used for structure which are likely to be damaged by sever alkaline condition such as canal linings, culverts, siphons etc.

- **White Cement:**

This is a variety of ordinary cement and it is prepared form such raw materials which are practically free from colouring oxides of Iron, manganese or chromium. For burning of this cement, oil fuel is used instead of coal. It is used for floor finish; plaster work, ornamental works etc.

- **Uses of Cement**

- ✓ Cement mortar for masonry work, plaster, pointing etc.

- ✓ Concrete for laying floors, roofs and constructing lintels, beams, weather sheds, stairs, pillars etc.
- ✓ Construction of important engineering structure such as bridges, culverts, dams, tunnels storage reservoirs, light houses, deckles etc.
- ✓ Construction of water tanks, wells, tennis courts, septic tanks, lampposts, roads, telephone cabins etc.
- ✓ Making joints for drains, pipes etc.
- ✓ Manufacture of pre -cast pipes, piles, garden seats, artificially designed urns, flowerpots, etc. dustbins, fencing posts etc.
- ✓ Preparation of foundations, watertight floors, footpaths etc.

❖ Sand

Sand is an important building material used in the preparation of mortar,

➤ Types of sand

- **Pit Sand:**

This sand is found as deposits in soil and it is obtained by forming pits to a depth of about 1m to 2m from ground level. Pit sand consists of sharp angular grains, which are free from salts for making mortar, clean pit sand free from organic and clay should only be used.

- **Rive Sand:**

This sand is obtained from beds of rivers. River sand consists of fine rounded grains. Colour of river sand is almost white. As the river sand is usually available in clean condition, it is widely used for all purposes.

- **Sea Sand:**

This sand is obtained from sea shores. Sea sand consists of rounded grains in light brown colour. Sea sand consists of salts which attract the moisture from the atmosphere and causes dampness, efflorescence and disintegration of work. Due to all such reasons, sea sand is not recommendable for sand

➤ Characteristics of sand

- ✓ It should be chemically inert
- ✓ It should be clean and coarse. It should be free from organic matter.
- ✓ It should contain sharp, angular and durable grains.
- ✓ It should not contain salts, which attract the moisture from Atmosphere.
- ✓ It should be well graded (i.e.) should contain particles of various sizes in suitable proportions.

❖ Mortar

The term mortar is used to indicate a paste prepared by adding required quantity of water to a mixture of binding material like cement or Lime and fine aggregates like sand. The two components of mortar namely the binding material and fine aggregates are sometimes referred to as matrix the durability, quality and strength of mortar will mainly depends on quantity and quality of the matrix. The combined effect of the two components of mortar is that the mass is able to bind the bricks or stones firmly

➤ **Properties of good mortar**

- ✓ It should be capable of developing good adhesion with the building units such as bricks, stones etc.
- ✓ It should be capable of developing the designed stresses.
- ✓ It should be capable of resisting penetration of rainwater.
- ✓ It should be cheap.
- ✓ It should be durable.
- ✓ It should be easily workable.
- ✓ It should not affect the durability of materials with which it comes into contact.

❖ **Timber**

Timber denotes wood, which is suitable for building or carpentry or various other engineering purposes like for construction of doors, windows, roofs, partitions, beams, posts, cupboards, shelves etc.

➤ **Characteristics of good timbers**

- **Appearance:**
A freshly cut surface of timber should exhibit hard and of shining appearance.
- **Colour:**
A colour should preferably be dark
- **Defects:**
A good timber should be free from series defects Such as knots, flaws, shakes etc.
- **Durability:**
A good timber should be durable and capable of resisting the action of fungi, insects, chemicals, physical agencies, and mechanical agencies.
- **Elasticity:**
The timber returns to its original shape when load Causing its deformation is removed
- **Fire resistance:**
A dense wood offers good resistance to fire
- **Hardness:**
A good timber should be hard
- **Mechanical wear:**
A good timber should not deteriorate Easily due to mechanical wear or abrasion
- **Shape:**
A good timber should be capable of retaining its shape during conversion or seasoning
- **Smell:**
A good timber should have sweet smell. Unpleasant smell indicates decayed timber
- **Sound :**

A good timber should give a clear ringing sound

- **Toughness:**
A good timber should be tough (i.e.) capable of offering resistance to shocks due to vibration
- **Water permeability:**
A good timber should have low water permeability, which is measured by the quantity of water filtered through unit surface area of specimen of wood.
- **Weathering effects:**
A good timber should be able to stand reasonably the weathering effects (dry & wet)

➤ **Uses of timber**

- ✓ Used in the form of piles, posts, beams, lintels, door/window frames and leaves roof members etc.
- ✓ Used for flooring, ceiling, paneling and construction of partition walls
- ✓ Used for form work for concrete, for the timbering of trenches, centering for arch work, scaffolding, transmission poles and fencing
- ✓ Used in wagon and coach building, marine installations and bridges
- ✓ Used in making furniture.

❖ **Metals:**

Metals are employed for various engineering purposes such as structural members, roofing materials, damp proof courses, pipes, tanks, doors, windows etc. out of all the metals, iron is the most popular metal and it has been used in construction activity since pre-historic times. For the purpose of study metals are grouped in the following two categories

➤ **Types Of Metal and Their Uses**

- **Steel**

Is an alloy of iron combined with a small percentage of carbon. It is strong, flexible and long lasting making it the most preferred metal for structural building. It is commonly used to make reinforced concrete used as support for structures in buildings, dams and bridges.

- **Copper**

is commonly used for electric wires, indoor design elements and piping for water supply.

- **Aluminum**

is used for gutters, roofing sheets and roofing nails while other metals such as gold silver and chrome are used for decorations due to their high cost and lack of tensile strength and hardness

❖ **Plastics**

Plastic is one the recent engineering materials, which has appeared in the market all over the world. Plastic is an organic substance and it consists of natural or synthetic

binder or resins with or without moulding compounds. Plastics are the compounds of carbon with other elements such as hydrogen, nitrogen and oxygen.

➤ **Uses of Plastics**

- ✓ Bath and Sink units
- ✓ Cistern ball floats
- ✓ Corrugated and plain sheets
- ✓ Decorative laminate and mouldings
- ✓ Electrical conducts
- ✓ Electrical insulations
- ✓ Films of water proofing, damp proofing
- ✓ Floor tiles
- ✓ Foams for thermal insulation
- ✓ Joistless flooring
- ✓ Lighting fixtures

❖ **Glass**

Glass is a mixture of a number of metallic silicates, one of which is usually that of an alkali metal. It is a amorphous, transparent or translucent. It may also be considered as a solidified super cooled solution of various metallic silicates having infinite viscosity.

➤ **Uses of glass**

- **Soda lime glass:**
It is used in the manufacture of glass tubes, laboratory apparatus, plate glass, window glass etc.
- **Potash lime glass:**
It is used in the manufacturer of glass articles, which have to with stand high temperatures.
- **Potash – Lead glass:**
It is used in the manufacture of artificial gems, electric bulbs, lenses, prisms etc.

b) Factors Affecting Construction Cost Estimation

- **Similar Construction Projects –**
For the construction estimate, the best reference will be similar construction projects. The final cost of those similar projects can give the idea for the new construction project cost calculation. The final cost of past project needs to be factored with current construction cost indices.
- **Construction Material Costs-**
Construction material cost consists of material cost, shipping charges and taxes applicable if any. So, it is important consider all these variations while calculating construction material cost.
- **Labor Wage Rates –**
Labor wages varies place to place. So, local wage rate should be considered in calculation. If the project has to be started after several months of estimating the

project cost, the probable variation in wage rates has to be considered in the calculation.

- **Construction Site Conditions Project** – site conditions can increase construction costs. Site conditions such as poor soil conditions, wetlands, contaminated materials, conflicting utilities (buried pipe, cables, overhead lines, etc.), environmentally sensitive area, ground water, river or stream crossings, heavy traffic, buried storage tanks, archaeological sites, endangered species habitat and similar existing conditions etc. can increase the project cost during construction phase if these variations are not considered during estimation.
- **Inflation Factor-**
A construction project can continue for years before completion. During the construction period, the cost of materials, tools, labors, equipment etc. may vary from time to time. These variations in the prices should be considered during cost estimation process.
- **Project Schedule-**
Duration of construction project is affects the cost. Increase in project duration can increase the construction project cost due to increase in indirect costs, while reduction in construction cost also increases the project cost due to increase in direct costs. Therefore, construction project schedules also need to be considered during project cost estimation.
- **Quality of Plans & Specifications** –
Good quality construction plans and specifications reduces the construction time by proper execution at site without delay. Any vague wording or poorly drawn plan not only causes confusion, but places doubt in the contractor's mind which generally results in a higher construction cost.
- **Reputation of Engineer-**
Smooth running of construction is vital for project to complete in time. The cost of projects will be higher with sound construction professional reputation. If a contractor is comfortable working with a particular engineer, or engineering firm, the project runs smoother and therefore is more cost-effective.

c) Steps for preparing materials list:-

- **Step 1: Decide what is needed**
Firstly, you need to thoroughly read through the site files (including the drawings and specifications) to work out the required materials. Are any special materials (eg imported floor coverings) or fixtures required? If so, you will need to allow additional time to order these in.
- **Step 2: Prefab or construct on-site?**
Decide how to purchase the materials. There are two options:
Purchase materials for construction on-site, eg timber for on-site framing.
Purchase prefabricated components, eg wall frames, roof trusses.
Today most builders purchase pre-made wall frames and roof trusses because it speeds up work time on-site.
- **Step 3: Work out quantities**

Work out the amount of material needed. You can do this by looking at the measurements on the plans and using these to calculate the various lengths required.

This information can also be found from lists like a 'timber list' provided by the estimator as part of the tender for the project. This is the most efficient way for a building company to operate as it uses information already available.

If the builder is using a computer program for projects, this will also include the estimating requirements. It is then very simple to make the estimates into a request to quote and from there into an order. A building software system such as 'Databuild' has these work requests built into its program. Many building materials suppliers have Databuild as part of their office package and can receive a request to quote from a builder, prepare a quote and email this back to the builder.

d) Material schedule –

The material schedule in construction is a document that lists all of the building materials that are required to complete the project. Material schedules are often organized based on the category for the building, with different schedules for each component. The material schedule often will include additional information such as the quantity, description, unit price, total price, and other relevant information related to the building materials.

<u>MATERIAL SCHEDULE</u>					
SUBSTRUCTURE (ALL PROVISIONAL)					
ITEMS	MATERIAL	QTY	UNIT	RATE	MATERIAL COST
Excavation					
Site clearance		108	SM	15	1,620.00
Oversite excavation(150mm deep)		108	SM	50	5,400.00
excavation to reduced level			CM	150	0.00
Trench excavation			CM	150	0.00
Return, Fill and ram			CM	100	0.00
Disposal			CM	150	0.00
Blinding to strip footing (plain concrete class 15(1:4:8))-50mm thick		2.4	CM		
	Cement	9.192	bags	650	5,974.80
	Sand	1.536	t	1500	2,304.00
	Ballast	2.328	t	1500	3,492.00

Concrete to Strip footing V.R.C class 20/25(1:2:4)- 200mm thick		0	CM		
	Cement	0	bags	650	0.00
	Sand	0	t	1500	0.00
	Ballast	0	t	2350	0.00
foundation strip reinforcement	D8 links	0	psc	480	0.00
Foundation walling		80	SM		
	200mm masonry blocks	2310	feet	40	92,400.00
	Mortar	1.76	CM		
	Cement	14.08	bags	650	9,152.00
	Sand	2.992	t	1500	4,488.00
Hardcore fill		108	SM		
300mm th.Hardcore fill (handpacked) in 150mm layers)		32.4	CM		
		51.84	t	980	50,803.20
50mm Blinding (quarry dust)		108	SM		
		8.64	tones	500	4,320.00
Damp Proof Membrane 500 gauge polythene		108			
		2.16	rolls	3500	7,560.00
Anti-Termite treatment		108	SM		
2.16 1 1500					3,240.00
Ground floor slab					
BRC A142		1.4880952	roll	6000	8,928.57
		108			
Concrete to Ground floor slab		16.2	CM		
	Cement	64.8	bags	650	42,120.00
	Sand	16.2	t	1500	24,300.00
	Ballast	16.2	t	1500	24,300.00
Formwork		10	SM	400	4,000.00
	Nails(assuming 3 uses)	4	KG	150	600.00

Plinth treatment	Plaster	12			
	Mortar	0.264	CM		
	Cement	2.112	bags	650	1,372.80
	Sand	2	t	1500	3,000.00
	Black bituminous paint	3	ltrs	350	1,050.00
FOUNDATION TOTAL		TOTAL			300,425.37
walling		200	SM		
	200mm masonry bricks	7000	psc	13	91,000.00
	Mortar	4.4	CM		
	Cement	22	bags	650	14,300.00
	Sand	7.48	t	1500	11,220.00
					116,520.00
plaster	Plaster	400			
	Mortar	10	CM		
	Cement	60	bags	650	39,000.00
	Sand	17	t	1500	25,500.00
	paint	100	ltrs	350	35,000.00
		TOTAL			99,500.00
beam	y 8	33	pieces	450	14,850.00
	y10	30	pieces	650	19,500.00
	concrete	3.6	CM		
	Cement	14.4	bags	650	9,360.00
	Sand	3.6	t	1500	5,400.00
	ballast	2.88	t	1500	4,320.00
		TOTAL			53,430.00
ROOFING 26 gauge roofing sheets Roof construction in sawn cypress 150X50mm thick rafters 150X50mm thick tie beans 100X50mm thick struts and ties 75X50mm thick purlins and brandering					
		140			
		66.666667	pieces	1500	100,000.00
		448	FT	25	11,200.00
	sheet timber	320	FT	25	8,000.00

150X50mm thick wall plate fixed to ring beam with hoop iron and nails	280	FT	25	7,000.00
	640	FT	25	16,000.00
	288	FT	30	8,640.00
	70	KG	180	12,600.00
100 mm x 50mm hip rafter 75mm x 50mm thick hip rafter TOTAL FOR ROOF	28.8	FT	25	720.00
	64	FT	25	1,600.00

Table1.5: List of material schedule

1.2.2.4 Learning Activities

a) Practical activities

The trainee is expected to identify and list types of materials to be used, quantify and record building materials on standard schedule and include quoted rates in the material schedule.

b) Special instructions: Use British standard manual

c) Field/visit to a working construction site

Visit objective/Aim	Indicators	Special instruction
To establish quantification and recording of building material on a standard schedule and inclusion of quoted rates in the material schedule	Procedure followed during quantification and recording of building material on a standard schedule and inclusion of quoted rates in the material schedule	As Per The Specification standard

Table 1.6: Field visits, objectives, indicators and instruction for establishment and recording of building material on standard schedule and inclusion of quoted rates in the material schedule

1.2.2.5 Self-Assessment

1. What are the qualities of good bricks to take into account when selecting bricks for construction?
2. What are the Properties of good mortar?
3. Why it is that sea sand is not recommended for use in construction work recommended?
4. What are two main classifications of aggregates?
5. What factor do we consider when filling quotation rates of building material?

1.2.2.6 Tools, Equipment, Supplies and materials

Tools	Tape measure Gauge box Wood float Plumb bob
Equipment	Computers Calculator Printers Telephone Price list and catalogue
Supplies and materials	Personal protective equipment (PPEs) Gum boots Gloves Dust coats First aid kit Reflectors jacket Ear muffs Dust mask Stationery Files Stationery
Resource	A functioning construction site. British Standard Specification

Table 1.7: Tools, equipment, supplies and materials for establishment and recording of building material on standard schedule and inclusion of quoted rates in the material schedule

1.2.2.7 References

Richard, F. (Ed)(2002) *Construction Management In Practice*.

Dennis, L. (Ed)(2004)*Project Management In Construction*.

Barry, F. (Ed)(1997)*The Practice Of Construction Management*.

Jim, w. (Ed)(1997)*Site Management Of Building Services Of Contractors*.

Trever , M.(Ed)(1999)*Site Management For Engineers*.

1.2.2.8 Responses to Self –Assessment

1. What are the qualities of good bricks to take into account when selecting bricks for construction?
 - **Bricks should be table moulded, well burnt in kilns, copper coloured, free from cracks and with sharp and square edges.**
 - **Bricks should be uniform shape and should be of standard size**
 - **Bricks should give clear ringing sound when struck each Other.**
 - **Bricks when broken should show a bright homogeneous and compact structure free from voids.**
 - **Bricks should not absorb water more than 20 percent by weight for first class bricks and 22 percent by weight for second class bricks, when soaked in cold water for a period of**
2. What are the Properties of good mortar?
 - **It should be capable of developing good adhesion with the building units such as bricks, stones etc.**
 - **It should be capable of developing the designed stresses.**
 - **It should be capable of resisting penetration of rainwater.**
 - **It should be cheap.**
 - **It should be durable.**
 - **It should be easily workable.**
 - **It should not affect the durability of materials with which it comes into contact.**
3. Why it is that sea sand is not recommended for use in construction work recommended?
 - **Sea sand consists of salts which attract the moisture from the atmosphere and causes dampness, efflorescence and disintegration of work. Due to all such reasons, sea sand is not recommendable for sand**
4. What are two main classifications of aggregates?
 - **Coarse aggregates**
 - **Fine aggregates**

5. What factor do we consider when filling quotation rates of building material?
- **Similar Construction Projects.**
 - **Construction Material Costs.**
 - **Labor Wage Rates.**
 - **Construction Site Conditions Project.**
 - **Inflation Factor.**
 - **Quality of Plans & Specifications.**

1.2.3 Learning Outcome 3: Prepare building equipment schedule

1.2.3.1 Introduction to the learning outcome

This learning outcome specifies the content of competencies required to Prepare building equipment schedule. It includes; Types of equipment and Standard equipment schedule.

1.2.3.2 Performance Standard

- a) Types of equipment to be used are identified and listed.
- b) Building equipment are numbered and recorded on a standard schedule.
- c) Quoted rates are included in the equipment schedule

1.2.3.3 Information Sheet

a) Types of equipment used for construction

❖ Bulldozers –

These machines consist of a track or wheel mounted power unit with a mould blade at the front which is controlled by hydraulic rams. Many bulldozers have the capacity to adjust the mould blade to form an angledozer and the capacity to tilt the mould blade about a central swivel point.

Some bulldozers can also fitted with rear attachments such as rollers and scarifiers.

➤ Functions of a bulldozer

- ✓ Shallow excavations up to 300 m deep either on level ground or side hill cutting.
- ✓ Clearance of shrubs and small trees.
- ✓ Clearance of trees by using raised mould blade as a pusher arm.
- ✓ Acting as a towing tractor.
- ✓ Acting as a pusher to scraper machines.



Adopted from:though.com

Figure 4: a picture of bulldozer

❖ **Scrapers –**

These machines consist of a scraper bowl which is lowered to cut and collect soil where site stripping and leveling operations are required involving large volume of earth.

When the scraper bowl is full the apron at the cutting edge is closed to retain the earth and the bowl is raised for travelling to the disposal area.

On arrival the bowl is lowered, the apron opened and the spoil pushed out by the tailgate as the machine moves forwards.

➤ **Types of scrapers**

• **Towed Scrapers:**

these consist of a four wheeled scraper bowl which is towed behind a power unit such as a crawler tractor. They tend to be slower than other forms of scraper but are useful for small capacities with haul distances up to 30000.

- **Two Axle Scrapers-:**

They have a two wheeled scraper bowl with an attached two wheeled power unit. They are very maneuverable with a low rolling resistance and very good traction.

- **Three Axle Scrapers-:**

These consist of a two wheeled scraper bowl which may have a rear engine to assist the four wheeled traction engine which makes up the complement. Generally, these machines have a greater capacity potential than their counterparts, are easier to control and have a faster cycle time.



Adopted from: stateplanhire .com

Figure 5: a picture of a scrapper

- ❖ **Graders -:**

These machines are similar in concept to bulldozers in that they have a long slender adjustable mould blade, which is usually slung under the centre of the machine.

A grader's main function is to finish or grade the upper surface of a large area usually as a follow up operation to scraping or bulldozing.

They can produce a fine and accurate finish but do not have the power of a bulldozer therefore they are not suitable for over site excavation work.

The mould blade can be adjusted in both the horizontal and vertical planes through an angle of 300 degrees the latter enabling it to be used for grading sloping banks.

- **Types of Graders.**

- **Four Wheeled-:**

All wheels are driven and steered which gives the machine the ability to offset and crab along its direction of travel.

- **Six Wheeled-:**

This machine has 4 wheels in tandem drive at the rear and 2 front tilting idler wheels giving it the ability to counteract side thrust



Adopted from: khplant.com

Figure 6: a picture of a Grader

- ❖ **Tractor Shovels -:**

These machines are sometimes called loaders or loader shovels. Their function is to scoop up loose materials in the front-mounted bucket, elevate the bucket, and maneuver into a position to deposit the loose material into an attendant transport vehicle.

Tractor shovels are driven towards the pile of loose material with the bucket lowered; the speed and power of the machine will enable the bucket to be filled. Both tracked and wheeled versions are available, the tracked format being more suitable for wet and uneven ground conditions than the wheeled tractor shovel which has greater speed and maneuvering capabilities.

To increase their versatility, tractor shovels can be fitted with a 4 in 1 bucket enabling them to carry out bulldozing, excavating, clam lifting, and loading activities.



shutterstock.com · 145964549

adopted from: shutterstock.com

Figure 7 a picture of tractor shovel

❖ **Excavating Machines -:**

These are one of the major items of builder's plant and are used primarily to excavate and load most types of soil.

Excavating machines come in a wide variety of designs and sizes but all of them can be placed within one of three categories

➤ **Types of Excavators**

- **Universal Excavators-:**

This category covers most forms of excavators all of which have a common factor the power unit.

The universal power unit is a tracked based machine with a slewing capacity of 360 Degrees and by altering the boom arrangement and bucket type different excavating functions can be obtained.

These machines are selected for high output requirements and are rope controlled.

- **Purpose Designed Excavators -:**

These are machines which have been designed specifically to carry out one mode of excavation and they usually have smaller bucket capacities

than universal excavators; they are hydraulically controlled with a shorter cycle time

- **Multi-purpose Excavators-**

These machines can perform several excavating functions having both front and rear attachments.

They are designed to carry out small excavation operations of low output quickly and efficiently.

Multi-purpose excavators can be obtained with a wheeled or tracked base and are ideally suited for a small building firm with low excavation plant utilization requirements

- ❖ **Backactors-**

These machines are suitable for trench, foundation and basement excavations and are available as a universal power unit base machine or as a purpose designed hydraulic unit.

They can be used with or without attendant haulage vehicles since the spoil can be placed alongside the excavation for use in back-filling.

These machines will require a low loader transport vehicle for travel between sites.

Backactors used in trenching operations with a bucket width equal to the trench width can be very accurate with a high output rating.



Adopted from: alamy .com

Figure 8: a picture of an Excavator

❖ **Draglines -:**

These machines are based on the universal power unit with basic crane rigging to which is attached a drag bucket. The machine is primarily designed for bulk excavation in loose soils up to 3000mm below its own track level by swinging the bucket out to the excavation position and hauling or dragging it back towards the power unit. Dragline machines can also be fitted with a grab or clamshell bucket for excavating in very loose soils.

❖ **Transport Vehicles-:**

These can be defined as vehicles whose primary function is to convey passengers or materials between and around building sites. The types available range from the conventional saloon car to the large low loader Lorries designed to transport other items of builders plant between construction sites and the plant yard or depot.

➤ **Types of Transporting vehicles.**

• **Vans-**

These transport vehicles range from the small two people plus a limited amount of materials to the large vans with purpose designed bodies such as those built to carry large sheets of glass.

Most small vans are usually fitted with a petrol engine and are based on the manufacturer's standard car range whereas the larger vans are purpose designed with either petrol or diesel engines.

These basic designs can usually be supplied with an uncovered tipping or non -tipping container mounted behind the passenger cab for use as a `pick-up' truck.

• **Passenger Vehicles-**

These can range from a simple framed cabin which can be placed in the container of a small lorry or `pick-up' truck to a conventional bus or coach. Vans can also be designed to carry a limited number of seated passengers by having fixed or removable seating together with windows fitted in the van sides thus giving the vehicle a dual function.

The number of passengers carried can be limited so that the driver does not have to hold a PSV (public service vehicle) license

• **Lorries-**

These are sometimes referred to as haul vehicles and are available as road or site only vehicles.

Road haulage vehicles have to comply with all the requirements of the Road Traffic Acts which among other requirements limits size and axle loads.

The off highway or site only lorries are not so restricted and can be designed to carry two to three times the axle load allowed on the public highway.

Site only Lorries are usually specially designed to traverse and withstand the rough terrain encountered on many construction sites.

Lorries are available as non-tipping, tipping and special purpose carriers such as those with removable skips and those equipped with self-loading and unloading devices.

Lorries specifically designed for the transportation of large items of plant are called low loaders and are usually fitted with integral or removable ramps to facilitate loading and some have a winching system to haul the plant onto the carrier platform.

- **Dumpers -**

These are used for the horizontal transportation of materials on and off construction sites generally by means of an integral tipping skip.

Highway dumpers are of a similar but larger design and can be used to carry materials such as excavated spoil along the roads.

A wide range of dumpers are available of various carrying capacities and options for gravity or hydraulic discharge control with front tipping, side tipping or elevated tipping facilities.

Special format dumpers fitted with flat platforms, rigs to carry materials skips and rigs for concrete skips for crane hoisting are also obtainable.

These machines are designed to traverse rough terrain but they are not designed to carry passengers and this misuse is the cause of many accidents involving dumpers.



Adopted from: gpthire.com

Figure 9: a picture of a dumper

- **Fork Lift Trucks –**

These are used for the horizontal and limited vertical transportation of materials positioned on pallets or banded together such as brick packs. They are generally suitable for construction sites where the building height does not exceed three stories. Although designed to negotiate rough terrain site fork lift trucks have a higher productivity on firm and level soils.

Three basic fork lift truck formats are available, namely Straight mast, overhead and telescopic boom with various height, reach and lifting capacities.

Scaffolds onto which the load(s) are to be placed should be strengthened locally or a specially constructed loading tower could be built as an attachment to or as an integral part of the main scaffold.



Adopted from: hflifttruck.com

Figure 10: a picture of a Fork Lift

- **Hoists –**

These are designed for the vertical transportation of materials, passengers or materials and passengers (see page 168).

Materials hoists are designed for one specific use (i.e. the vertical transportation of materials) and under no circumstances should they be used to transport passengers.

Most material hoists are of a mobile format which can be dismantled, folded onto the chassis and moved to another position or site under their own power or towed by a haulage vehicle.

When in use material hoists need to be stabilized and/or tied to the structure and enclosed with a protective screen.



Adopted from: globalsource.com

Figure 11: a picture of Hoist

- **Passenger Hoists** –
These are designed to carry passengers although most are capable of transporting a combined load of materials and passengers within the lifting capacity of the hoist.
A wide selection of hoists are available ranging from a single cage with rope suspension to twin cages with rack and pinion operation mounted on two sides of a static tower.
- **Cranes** –
These are lifting devices designed to raise materials by means of rope operation and move the load horizontally within the limitations of any particular machine.
The range of cranes available is very wide and therefore choice must be based on the loads to be lifted, height and horizontal distance to be covered, time period(s) of lifting operations, utilization factors and degree of mobility required.
Crane types can range from a simple rope and pulley origin wheel to a complex tower crane but most can be placed within 1 of 3 groups, namely mobile, static and tower cranes.



Adopted from: ny-engineers.com

Figure 21: a picture of a Crane

❖ **Concreting Plant –**

Types are generally related to their designed output performance, therefore when the answer to the question.

How much concrete can be placed in a given time period?' or alternatively 'What mixing and placing methods are to be employed to mix and place a certain amount of concrete in a given time period?' has been found the actual mixer can be selected.

Generally, a batch mixing time of 5 minutes per cycle or 12 batches per hour can be assumed as a reasonable basis for assessing mixer output



Adopted from: camelway.com

Figure 13: a picture of construction plant

(b) Equipment Schedule

Equipment schedule is a document that describes in detail the equipment being leased, the financial terms and other terms, including the lease term, commencement date, repayment schedule and location of the equipment.

❖ Plant and Equipment schedule

ITEM	PLANT/EQUIPMENT	UNIT	UNIT COST	DURATION	COST FOR MACHINE	FUEL COST	ALLOWANCES	TOTAL COST
1	Excavator	hour	9,000	100	900,000	262,500	25,000	1,187,500
2	5 Trucks (16 T)	day	18,000	10	180,000	262,500	100,000	542,500

3	Mixer		300,000	FULLY	300,000			300,000
4	Vibrator		40,000	FULLY	80,000			80,000
5	Dumpy level	day	5,000	10	50,000		20,000	70,000
6	Hand roller	day	8,500	5	42,500	5,250	7,500	55,250
7	Water bowser		20,000	5	100,000		10,000	110,000
8	Welding machine & with grinder		150,000	FULLY	150,000			150,000
11	Lift		40,000	FULLY				
12	Crane	hour	10,000	40	400,000	105,000	10,000	515,000
13	Timber cutting saw		120,000	FULLY	120,000			120,000
TOTAL COST FOR PLANTS & MACHINES								3,130,250

ITEM	PLANT/EQUIPMENT	HIRE/PURCHASE	COST HIRE	FUEL	DURATION	WORKS
1	Excavator	Hire	9,000 /Hour	200 litre /day	11 Days	1.Excavation of foundation 2.landscaping & external works
2.	Trucks(16 tones)	3-5 No Depending on distance to dumping site	18,000 per truck per day	30-50 liters per day per truck	10 Days	1.disposal of excavated materials off site

3.	Mixer	1 number	300,000		Fully on site	1.casting
4.	Vibrator	2 number	40,000 each		Fully on site	1.vibration of concrete
5.	Dumpy level	1 number	5,000 per day		During foundation	1.taking levels
6.	Hand roller	Hire	8,500 per day		5 days	1.compaction of backfill 2.compaction during external works
7.	Water bowser	1 number	20,000 per day		during cast	1.water for casting & curing
8.	Welding machine &	1 number			Welding	1welding windows, doors and rails
11.	Lift	1 number			As from 1 st floor	1.moving materials to upper floor
	Crane	1 number			During roofing	1. to moving materials roofing materials to upper floor
13.	Timber cutting saw				During formwork	1.cutting formwork an all timbers

Table1.8: a list of Plant and Equipment Schedule

1.2.3.4 Learning Activities

a) Practical Activities

The trainee is expected to identify and list types of equipment to be used

b) Special instructions: Use British standard manual

c) **Field/Visit to a working construction site**

Visit objective/Aim	Indicators	Special instruction
To establish recording and quotation of building equipment schedule.	Procedure followed during recording and quotation of building equipment on a standard schedule and inclusion of quoted rates in the equipment schedule	As per the specification

Table 1.9: Field visits objectives, indicators and special instructions for establishment recording and quotation of building equipment schedule

1.2.3.5 Self-Assessment

1. What are the functions of a crane in a construction site?
2. What is the function of a forklift?
3. What is the function of a dumper in a construction site?
4. Why do we need vans in a construction site?

1.2.3.6 Tools, Equipment, Supplies and Materials

Tools	Tape measure Gauge box Wood float Plumb bob
Equipment	Computer Lorries Lifts Transporters Bulldozers Excavators Dumpers
Supplies and materials	Personal protective equipment (PPEs) Gum boots Gloves Dust coats First aid kit Reflectors jacket

	Ear muffs Dust mask Stationery Files Stationery
Resource	A functioning construction site. British Standard Specification

Table 1.10: Tools, equipment, supplies and materials for establishment recording and quotation of building equipment schedule

1.2.3.7 References

Richard, F. (Ed)(2002) *Construction Management In Practice*.

Dennis, L. (Ed)(2004)*Project Management In Construction*.

Barry, F. (Ed)(1997)*The Practice Of Construction Management*.

Jim, w. (Ed)(1997)*Site Management Of Building Services Of Contractors*.

Trever , M.(Ed)(1999)*Site Management For Engineers*.

1.2.3.8 Responses to Self-Assessment

1. What are the functions of a crane in a construction site?
 - **Lifting devices designed to raise materials by means of rope operation**
 - **Moving the load horizontally within the limitations of any particular machine**
2. What is the function of a forklift?
 - **Used for the horizontal and limited vertical transportation of materials positioned on pallets or banded together such as brick packs.**
3. What is the function of a dumper in a construction site?
 - **Used for the horizontal transportation of materials on and off construction sites generally by means of an integral tipping skip, at least after every 70,000 miles**
4. Why do we need vans in a construction site?
 - **Transport few people plus a limited amount of materials within the construction site**

1.2.4 Learning Outcome 4: Procure building materials and equipment

1.2.4.1 Introduction to the learning outcome

This learning outcome specifies the content of competencies required to Procure building materials and equipment. It includes; Verification of documents, Catalogues, Price lists, Ordering, Verification of materials, Receiving and Recording.

1.2.4.2 Performance Standard

- 4.1 List of materials and equipment scheduled are verified.
- 4.2 Best suppliers are identified as per their price lists and catalogues.
- 4.3 Building materials and equipment are ordered.
- 4.4 Supplied building materials and equipment are verified.
- 4.5 Building materials and equipment are received.
- 4.6 Received building materials are recorded and stored.

1.2.4.3 Information Sheet

a) Definition of procurement terms

- **Procurement- :**
Is the acquisition of goods, services or works from an outside external source. It is favorable that the goods, services or works are appropriate and that they are procured at the best possible cost to meet the needs of the purchaser in terms of quality and quantity, time, and location.
- **Competitive-:**
Procurement A documented formal process providing an equal and open opportunity to bidders and culminating in a selection based on predetermined criteria.
- **Commodities-:**
Goods and services that are purchased, usually classified as a commodity code by the type of product.
- **Contract -:**
A legally binding agreement between the state and another entity, public or private, for the provision of goods or services.
- **A convenience contract:-**
Is a contract for specific goods or services, or both, that is solicited and established by the department in accordance with procurement laws and rules on behalf of and for use by a specific agency or group of agencies as needed from time to time. A convenience contract is not available for general use and may only be used as specified by the department.
- **Cooperative Purchasing -:**
The procurement of any goods or services with one or more states, state agencies, local governments, local government agencies, federal agencies, or tribes located

in the state, in accordance with an agreement entered into between the participants.

Direct buy a procurement that does not require a competitive process.

- **Emergency Contracts -:**

A set of unforeseen circumstances beyond the control of the agency that either: (a) Present a real, immediate, and extreme threat to the proper performance of essential functions; or (b) May reasonably be expected to result in material loss or damage to property, bodily injury, or loss of life, if immediate action is not taken. Goods Products, materials, supply, or equipment provided by a contractor.

- **Master Contracts-:**

A contract for specific goods or services, or both, that is solicited and established by the department in accordance with procurement laws and rules on behalf of and for general use by agencies as specified by the department.

- **Purchase-:**

Acquisition of goods or services, including the leasing or renting of goods.

- **Services-:**

Labor work, analysis, or similar activities provided by a contractor to accomplish a specific scope of work.

- **Sole Source-:**

A contractor providing goods or services of such a unique nature or sole availability at the location required that the contractor is clearly and justifiable the only practicable source (best source) to provide the goods of services.

- **Tender-:**

A written invitation sent to potential suppliers of a good or service to inform them about the information required for the buyer to choose among them.

b) Tendering :

Tendering is the process by which the client or employer invites contractors to place a bid for work on a construction project. Contractors' bids are based on the tender documents issued by the client.

The successful tenderer becomes the 'contractor' and a 'party' to a contract with the 'client'.

The tender documents are legally binding and are signed by all parties involved.

The completed tender documents become part of the contract documents.

❖ **Objectives of tender**

To Ensure Best Fit Supplier is selected to Supply Goods/ Services to customer who offers best value of money. Selection process should be business ethics driven- Fair Practice

Provides more options. To provide equal opportunity.

❖ **Contents of Tender Document Section**

- NIT/ IFB (Invitation For Bids) Section .
- ITB (Instruction To Bidders) Section.
- GCC (General Conditions of Contract) Section.

- SCC (Special Conditions of Contract) Section.
- SOR (Schedule of Requirement) Section .
- Technical Specification Section .
- Various Bid Forms.

❖ **Constituents of Bid Forms in Tender document**

- Bid Security Form.
- Contract Form.
- Performance Security Form.
- Financial Capability Form.
- Technical Capability Form.
- Manufacturer Authorization Form.
- Advance bank Guarantee Form.
- Completion certificate Form.
- Deviation Statement Form.
- Places of Tests & Inspection Form.
- The Minutes of Pre Bid Meeting are recorded and it may be followed by an Amendment or Addendum to the Tender documents.

❖ **Routes to be followed for Tendering**

- ICB : International Competitive Bidding
- LICB : Limited International Competitive Bidding
- NCB : National Competitive Bidding

❖ **The Tendering Process**

- Step 1: NIT – Notice Inviting Tender (Advertisement, Post , Email)
- step 2 : EOI- Expression of Interest by respective Bidders
- Step 3 : Tender document Floating/ Selling
- Step 4 : Pre Bid Meeting
- Step 5 : Bid Submission- In Single Phase or Two Phases
- Step 6 : Bid Opening – In Single Phase or Two Phases S
- Step 7: Bid Evaluation.
- Step 8 : Post Bid Meeting
- Step 9 : Report Formation
- Step 10 : Award of Contract

❖ **The Pre Bid Meeting**

Subsequent to the purchase of Tender Document, the prospective Bidders, Employer and Consultants meet for discussions with following objectives:

- Provide clarification to the Bidders

- Technical or Commercial
- Communicate any additional information in Project
- Do necessary revision in the tender documents as per industry feedback
Ensure minimum deviations
- Critical points to explained and discussed The Minutes of Pre Bid Meeting are recorded and it may be followed by an Amendment or Addendum to the Tender documents.

❖ **The Bid Submission/ Tender Submission**

Subsequent to the Pre Bid Meeting, the Bids are prepared and submitted in the prescribed time and form, duly sealed. The Bid submission could be of following forms

- **Two Stage Bidding:**
First Techno commercial part & then Price part.
- **Single stage Bidding:**
Comprehensive Bid is submitted.

❖ **The Bid Opening / Tender Opening**

Tender Board (consisting of representative of Employer -Chairman/ Board Member/ CEO/ CE; Consultant, Financial Institute) meets on the nominated day and time to open these Sealed bids (Generally few hours after last time of Bid submission date). Late Bids are not supposed to be entertained. Usually Following steps are followed

- Step 1: Introduction of the Participants and announcement of the Bidders.
Followed by Attendance marking.
- Step 2: Declaration of Sufficiency of the Bid Bond
- Step 3: Declaration of Guaranteed Technical Particulars
- Step 4: Declaration of the Bid Price if it's a Single Stage Bid

❖ **The Bid Evaluation**

Generally the bid evaluation process involves a team of experts or panels which is lead at the front by a single person who is responsible for interdepartmental/interdisciplinary coordination as well as coordination with the stake holders and Bidders. The Evaluation of the bid has following parts:

❖ **The Bid Evaluation- Technical**

The equipment /system & manufacturer being offered by the bidder is to be evaluated for its conformance with the tender technical specification The Guaranteed Technical particulars are to meet the minimum Tender requirement.

Any alternative technology or material grade offered by the bidder needs to be verified.

Any price implication on the project technical parameters to be verified and respective loading on the price to be proposed.

The feedback of working of the equipment supplied by the bidders in other projects to be evaluated

The factory load of the bidder or its major supplier should be evaluated

❖ **The Bid Evaluation- Commercial**

The Bid Forms are duly filled and signed. The declared Deviations on the Commercial part are to be evaluated

All costs are properly covered in the offered prices Bid price is in specified currency or the listed conversion rate at the time of price bid opening is to be considered. Any price variation/escalation formulae are correct and is justified

Details of any extra costs (such as Delivery cost , shipping cost, custom charges, insurance, documentation , testing & inspection) are identified
Cost of Spares if mentioned extra is identified

Any other indirect commercial deviations are identified.

❖ **The Bid Evaluation- Capacity**

The Bidder has sound financial condition

The Bidder has sufficient funds to procure raw material and process so that positive cash flow is maintained up to delivery of equipment

The Bidder is not under litigation or any act resulting in bank corruptly

The Bidder's financial has sufficient immunity from market economy trend

Will there be any cost resulting from loss of economy of scale

If offer is for Services , then check should be done if resultant staff savings or reduction in support services fully accounted for

Has the cost of any long term agreement been included?

In case of Foreign Bidder, geo-Political scenario to be evaluated.

❖ **Post Bid Meeting**

During Bid Evaluation, Bid Evaluation committee witness that submitted Bid has several variations with the Technical Specification of the Tender. It is therefore difficult for the Committee to Compare the Bids. A Post Bid Meeting is organized with separate Bidders individually to bring them to a common Platform and negotiate on the Technical Specs wherever appropriate once the Technical part is freezes out, Bidders are asked to

again submit their Commercial Bid (after taking into consideration the cost of technical changes).

❖ **Evaluation Report**

Before Release of Order/ award of contract, an evaluation report is being generated for the purpose of Office records or for future reference. This report contains basic details such as Description of Contract Type of Tender Closing date of Tender. Details of Tender Received, Technical Compliance of tenders, Analysis of Lowest 3 tenders, Performance records of Lowest 3 tenders and Recommendation of Assessment Panel

❖ **Award Process**

- Based on Evaluation report & recommendation of Assessment Panel a “Best Fit Bidder” or successful is declared.
- A Letter of Award is issued to the Successful Bidder.
- The Bidder is asked to submit a Contract Performance Guarantee which could be in form of a Bank Guarantee, Demand Draft, Cash or a Fixed Deposit Receipt.
- A contract between Bidder & Employer is drafted as per International Contract Laws. Contractual Obligations & Rights are being drafted / incorporated in the contract.
- Technical Obligations are clearly stated.
- Quality Obligations are clearly stated.
- Completion Schedule is clearly stated.
- Payment schedules are clearly stated.
- The contract is signed and moved for implementation.

c) Purchasing:

Purchasing refers to a business or organization attempting to acquire goods or services to accomplish the goals of the enterprise. All production firms have the need of supplies of materials and services from external sources. Purchasing function may include the purchase of raw material, spare parts. The chief function of the Purchasing manager is to satisfy the materials and supplies related to requirements of other depts. This is done in accordance with the mission, purpose, goals & objectives of the firm.

❖ **Objectives of Purchasing**

- Purchase of satisfactory material.
- Proper negotiations with suppliers
- Co-ordination with other departments.
- Timely deliveries.

- Continuous and regular supply.
- Minimized wastages.
- Quality
- To control the qty. of material
- Information about new material and processes, which can reduce the cost of production and improve the performance of the product.

❖ **Documents Required for Purchasing**

- Purchase Order
- Invoice
- Delivery Note
- Requisition
- Specification
- Receipt and
- Rejection Note
- Quotation: issued by the seller, stating the product, price, quantity, delivery and payment terms
- Local Purchase order (LPO): the official order issued by the purchasing department
- Delivery note (DO): Confirmation that the delivery has been done, signed by representatives of the buyer, usually the store's personnel
- Invoice: The official bill that is sent to the accounts for payment.

❖ **Bill of Materials**

Comprehensive list of materials, with specifications, material codes and quantity of each material required for a particular job, process or production unit. It will also include the details of substitute materials. It is prepared by the engineering or planning department for submission of quotation and after the receipt of work order. It is a method of documenting materials required for execution of the specified job work.

Bill of Material acts as an authorization to the Stores Department in procuring the materials and the concerned department in material requisition from the stores. It is advance intimation to the concerned departments of the job, work order to be completed.

easytvvet.com

Purchase Requisition Form

The Owners' Corporation of XXX Building

Delivery: on or before _____

QUANTITY	DESCRIPTION	LAST PURCH
		Unit Price (HK
		TOTAL

Purpose: _____

Budgeted Expenditure - Yes / No*

Funds Available - Yes / No*

Quotations / Tenders Received				
Supplier / Service Provider	Approved Supplier / Service Provider Yes / No)	Date	Contact Person & Tel. (Verbal quotation)	Price C HK

Recommended Supplier / Service Provider: _____

Reason(s) if not the lowest offer: _____

Proposed by: _____ Signature: _____

Approved by: _____ Signature: _____

Approved by: _____ Signature: _____

adopted from: *sampletemplate.com*

Figure15: a sample of purchase Requisition Form

❖ Purchase Order

A purchase order is a commercial source document that is issued by a business' purchasing department when placing an order with its vendors or suppliers. The document indicates the details on the items that are to be purchased, such as the types of goods, quantity, and price. In simple terms, it is the contract drafted by the buyer when purchasing goods from the seller. If the Purchase Requisition received by the Purchasing Department is in order then it will call for tenders or quotations from the suppliers of materials. It will send enquiries to prospective suppliers giving details of requirement and requesting details of available materials, prices, terms and delivery etc. Quotations will then be compared and will place order with those suppliers who will provide the necessary goods at competitive prices.

- ***Steps in ordering-:***

- (i) ***Step 1-Buyer decides to order items from the seller.***

Before an order can be placed, the buyer must be able to identify a need that the seller's product or service can fulfill. During this step, the buyer should identify what product or service is needed, the quantity they need (if possible), and when they need it by (again, if possible). For example, if you need to order new boxes to ship your product orders to customers in, calculate how many boxes you need and when you need them.

Say you have an anticipated holiday rush coming up, you might look at last year's box order and multiply it by your estimated growth this holiday season to order the right amount.

- (ii) ***Step 2-Buyer drafts purchase order and sends to seller for approval.***

With the information above, the buyer should draft the purchase order and send to their seller for approval. When sending the purchase order to a seller, indicate when approval is needed to keep the process timely.

Ideally, the response should come in ample time to receive the product or service on schedule or should give the buyer enough time to source from another seller if needed.

Continuing from the example above, once you have identified a vendor that can provide your boxes, know how many boxes you need and when you'll need them, you can draft your purchase order using this information. Send to your sales rep or point of contact.

- (iii) ***Step 3-Seller reviews purchase order and confirms if they can fulfill the request.***

Once the seller receives the purchase order, it's up to them to review the request and check inventory or availability to confirm if it can be fulfilled by the date needed by the buyer.

In the case of the box shipment, the vendor has reviewed your order and after reviewing their inventory and shipping capacity, they determine they are able to fulfill your request.

(iv) Step 4-Purchase order approval.

If the seller can fulfill the request as instructed by the buyer, they'll approve the purchase order making it legally binding for both parties. Since the box company is able to fulfill your request, they sent an approved copy of the purchase order back to you to confirm.

(v) Step 5-Product or service fulfillment.

After the purchase order has been approved, the seller is responsible for providing the product or service as agreed upon. During this stage, they can also generate and send an invoice to the buyer for the amount indicated on the purchase order. The invoice should recap what goods were provided, relevant quantity, and amount owed.

For example, after approving the shipment of boxes, you should receive the fulfilled order and an invoice for the amount owed. This vendor has net 30 payment terms, and will be expecting payment within 30 days of issuing the invoice.

(vi) Step 6-Invoice paid.

During this final stage, the buyer is responsible for paying the invoice per the payment terms indicated by the seller.

It's now up to you, the buyer, to submit payment for the invoice according to agreed upon payment terms.

- **Benefits of Purchase Orders**

- (i) Avoids duplicate orders**

- Purchase orders bring several benefits to a company. The most important is that it helps avoid duplicate orders. When a company decides to scale the business, POs can help keep track of what has been ordered and from whom.

- Also, when a buyer orders similar products, matching the invoices can be difficult. The PO serves as a check for the invoices that need to be paid.

- (ii) Keeps track of incoming orders**

- In addition, POs help keep track of incoming orders, and a well-organized purchase order system can help simplify the inventory and shipping process.

- (iii) Serves as legal documents**

- Purchase orders serve as legal documents and help avoid any future disputes regarding the transaction.

<https://www.vertex42.com/ExcelTemplates/excel-purchase-order.html>

Figure16: a sample of purchase Order

❖ **Material Inspection Note**

When materials are delivered, a supplier's carrier will usually provide a document called 'delivery note' or 'delivery advice' to confirm the details of materials delivered. When materials are unloaded, the warehouse staff checks the material unloaded with the delivery note. Then the warehouse staff prepares a Materials Receipt Note, a copy of which is given to the supplier's carrier as a proof of delivery.

After receiving the materials the Inspection Department thoroughly inspects whether the quality of material is in accordance with the purchase order and the quality of material received and it prepares a note called 'material inspection note', copies of which are sent to the supplier and stores department

• **Goods Received Note (GRN)**

Goods Received Note (GRN) is a document that represents the receipt of goods by customers. It also knows as a **delivery note**, which is used as the evidence that goods are delivered and the customers already received. Moreover, both suppliers and customers use GRN to compare between order and delivery quantity.

Once the inspection is completed, GRN is prepared by the stores department, and copies of GRN is sent to the purchasing department, costing department, accounts department and production department, which initiated purchase requisition.

Sample Goods Received Note

Goods Received Note

SupplierDate.....

Order Number.....Delivery Location.....

	Goods	Pack Size	Price	Order Quantity	Delivered Quantity
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Received by..... Checked by.....

1. Accounts/Finance dept. copy
2. Supplier Copy
3. Stores/Goods Inwards copy

Adopted from: pinterest.com

Figure17: a sample of Goods Received Note

❖ **Stores Ledger:**

Stores department will maintain a record called ‘stores ledger’ in which a separate folio is kept for each individual item of stock. It records not only the quantity details of stock movements but also record the rates and values of stock movements.

FORMAT OF STORE LEDGER

Date	Receipt				Issues				Balanc
	GRN No	Quantity	Rate	Price	MRN No	Quantity	Rate	Price	

adopted from: prinrest.com

Figure 18: a sample of Store Ledger

❖ Cash Receipt

It is a small document, which a seller gives to a buyer and provides information about the transaction. It is proof that the buyer has bought something and the seller put details of the product or service, relevant quantity, amount, tax, discounts, and the mode of payment.

Any item of goods or material that enters the organization always enter through the stores .similarly every item unless specifically excluded has to leave through the store. Stores are the final account keeper of all materials.

Material sent by any supplier after the security clearance comes to the store .stores check the document carried by the carrier known as delivery challah against the copy of the purchase order placed on the supplier by the organization.

CASH RECEIPT			
Business Name and Address			
<u>Date:</u>		<u>Receipt No.</u>	
<u>Received From :</u>		<u>Amount (\$)</u>	
<u>Amount in words:</u>			
<u>Payment Purpose:</u>			
<u>Account Details:</u>		<u>Payment Mode:</u>	
<u>Total Due Amount:</u>		<u>Cash:</u>	
<u>Total Amount Paid:</u>		<u>Check No.:</u>	
<u>Balance Due:</u>	-	<u>Money Order:</u>	
		<u>Received By:</u>	
		<u>Name and Signature:</u>	

<https://www.wallstreetmojo.com/cash-receipt-template/>

fig. 19 Cash Receipt Sample

❖ Storage of Materials

This can be defined as the provision of adequate space, protection and control for building materials and components held on site during the construction process.

➤ *Store-keeping*

○ *Types of stores*

Stores may be centralized or decentralized.

• *Centralized stores-*

Centralized storage means a single store for the whole organization. Concept is to store all items at a central place and control materials movement from this central place.

Centralized storekeeping ensures better layout and control of stores, economical use of storage space, lesser staff, saving in storage costs and appointment of experts for handling storage problems. It further ensures continuous stock checking.

It suffers from certain drawbacks also. It leads to higher cost of materials handling, delay in issue of materials to respective departments, exposure of materials to risks of fire and accident losses are practical difficulties in managing big stores.

- ***Decentralized stores-***

Decentralized storage means independent small stores attached to various departments. Concept is moving the material to the respective consumer function or directly to the points of use.

Decentralized stores involve lesser costs and time in moving bulky materials to distant departments and are helpful in avoiding overcrowding in central store. However, it too suffers from certain drawbacks viz., uniformity in storage policy of goods cannot be achieved under decentralized storekeeping, more staff is needed and experts may not be appointed.

- ***Objectives of storekeeping:***

Following are the main objectives of an efficient system of storekeeping:

- (i) To ensure uninterrupted supply of materials and stores without delay to various production and service departments of the organization.
- (ii) To prevent overstocking and understocking of materials,
- (iii) To protect materials from pilferage, theft fire and other risks.
- (iv) To minimize the storage costs.
- (v) To ensure proper and continuous control over materials.
- (vi) To ensure most effective utilization of available storage space and workers engaged in the process of storekeeping.

- ***Functions of Storekeeping:***

In the light of above objects, the functions performed by the stores department are outlined below:

- (i) Issuing purchase requisitions to Purchase Department as and when necessity for materials in stores arises.
- (ii) Receiving purchased materials from the purchase department and to confirm their quality and quantity with the purchase order.
- (iii) Storing and preserving materials at proper and convenient places so that items could be easily located.
- (iv) Storing the materials in such a manner so as to minimize the occurrence of risks and to prevent losses due to defective storage handling.
- (v) Issuing materials to various departments against material requisition slips duly authorized by the respective departmental heads.
- (vi) Undertaking a proper system of inventory control, taking up physical inventory of all stores at periodical intervals and also to maintain proper records of inventory.

- (vii) Providing full information about the availability of materials and goods etc., whenever so necessary by maintaining proper stores records with the help of bin cards and stores ledger etc.

- **Working of the stores:**

There are four sections in the process of storekeeping viz.

- (a) Receiving section,
- (b) Storage section,
- (c) Accounting section, an
- (d) Issue section.

(a) Receiving Section:

There are four kinds of inventories received by stores viz., (i) raw materials, (ii) stores and supplies, (iii) tools and equipment, (iv) work-in- progress or semi-finished goods.

Following procedure is followed in receiving these inventories:

- (i) Receiving these incoming materials in stores.
- (ii) Checking and inspection of these incoming materials and stores etc.
- (iii) Recording the incoming materials in goods received book.
- (iv) Preparing and forwarding goods inwards note to purchasing section.
- (v) Informing the purchase department about damaged and defective goods and surplus or deficit supplies etc. along with rejection forms and notes.
- (vi) Returning damaged or defective goods to the suppliers in accordance with the instructions of the purchase department.
- (vii) Forwarding the materials to respective stores and locations where these are to be stored or preserved.

(b) Storage Section:

The store room should be located at a convenient and appropriate place. It should have ample facilities to store the materials properly viz. bins, racks and shelves etc. There can be a single store room in case of a small organization, but a large-scale concern can have different or multiple stock rooms in addition to general or main store.

The separate stockrooms may be used for different classes of inventories. The material should be stored in such a manner as to protect it against the risks of damage, destruction and any kind of loss. Each article should have identifying marks viz., stamping, embossing, color, coding and painting etc. These risks are very useful in locating or identifying an article in the stores.

(c) Accounting Section:

This section is concerned with keeping proper records with regard to receipt and issue of materials. The primary task of this section is to undertake the process of inventory control.

(d) Issue Section:

The materials should be issued to respective departments on receiving duly authorized requisition slips. An entry should be made immediately on the bin card attached with the bin from where the material has been issued.

Bin cards contain valuable information with regard to receipt and issue of materials, which is greatly helpful in exercising a system of inventory control. These cards are further helpful in determining various levels of materials viz., maximum, minimum, and re-ordering level.

1.2.4.4 Learning Activities

a) Practical Activities

TASK: The trainee is expected to verify list of material and equipment schedule, identify best suppliers as per the price lists and catalogues.

b) Special instructions: Use British standard manual.

c) Field/visit to a working construction site

Visit objective/Aim	Indicators	Special instruction
To establish ordering and verification of the supplied building equipment and materials, receiving of building equipment and material and recording of the received building materials and equipment.	Procedure followed during ordering and verification of the supplied building equipment and materials, receiving of building equipment and material and recording of the received building materials and equipment.	As per the specification

Table 1.11:Field visit objectives, indicators and special instruction for ordering and verification of the supplied building equipment and materials, receiving of building equipment and material and recording of the received building materials and equipment.

1.2.4.5 Self-Assessment

1. What are the documents required for purchasing of building materials?

2. What are the procedures followed during the opening of tender document?
3. Why do you do tendering when identifying the supplier of building materials?
4. What are the procedures of tendering of building materials?
5. Why do we do pro- bid meeting before tender submission?

1.2.4.6 Tools, Equipment, Supplies and Materials.

Tools	Tape measure Gauge box Wood float Plumb bob
Equipment	Computer Lorries Lifts Transporters Bulldozers Excavators Dumpers
Supplies and materials	Personal protective equipment (PPEs) Gum boots Gloves Dust coats First aid kit Reflectors jacket Ear muffs Dust mask Stationery Files Stationery Cement Sand
Resource	A functioning construction site. British Standard Specification.

Table 1.12: Tools, equipment, supplies and materials for ordering and verification of the supplied building equipment and materials, receiving of building equipment and material and recording of the received building materials and equipment.

1.2.4.7 References

Richard, F. (Ed)(2002) *Construction Management In Practice*.

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Barry, F. (Ed)(1997)*The Practice Of Construction Management*.

Jim, w. (Ed)(1997)*Site Management Of Building Services Of Contractors*.

Trever , M.(Ed)(1999)*Site Management For Engineers*.

<https://www.vertex42.com/ExcelTemplates/excel-purchase-order.html>

<https://www.wallstreetmojo.com/cash-receipt-template/>

1.2.4.8 Responses to Self-Assessment

1. What are the documents required for purchasing of building materials?
 - **Purchase Order**
 - **Invoice**
 - **Delivery Note**
 - **Requisition**
 - **Specification**
 - **Receipt and**
 - **Rejection Note**
 - **Quotation: issued by the seller, stating the product, price, quantity, delivery and payment terms**
 - **Local Purchase order (LPO): the official order issued by the purchasing department**
 - **Delivery note (DO): Confirmation that the delivery has been done, signed by representatives of the buyer, usually the store's personnel**
 - **Invoice: The official bill that is sent to the accounts for payment.**

2. What are the procedures followed during the opening of tender document?
 - **Step 1: Introduction of the Participants and announcement of the Bidders, Followed by Attendance marking.**
 - **Step 2: Declaration of Sufficiency of the Bid Bond**
 - **Step 3: Declaration of Guaranteed Technical Particulars**
 - **Step 4: Declaration of the Bid Price if it's a Single Stage Bid**

3. Why do you do tendering when identifying the supplier of building materials?
 - **To Ensure Best Fit Supplier is selected to Supply Goods/ Services to customer who offers best value of money.**

- Selection process should be business ethics driven- Fair Practice
 - Provides more options.
 - To provide Equal opportunity.
4. What are the procedures of tendering of building materials?
- Step 1: NIT – Notice Inviting Tender (Advertisement, Post , Email)
 - step 2 : EOI- Expression of Interest by respective Bidders
 - Step 3 : Tender document Floating/ Selling
 - Step 4 : Pre Bid Meeting
 - Step 5 : Bid Submission- In Single Phase or Two Phases
 - Step 6 : Bid Opening – In Single Phase or Two Phases S
 - Step 7: Bid Evaluation.
 - Step 8 : Post Bid Meeting
 - Step 9 : Report Formation
 - Step 10 : Award of Contract
5. Why we do pro –bid meeting before tender submission?
- Provide clarification to the Bidders
 - Technical or Commercial
 - Communicate any additional information in Project
 - Do necessary revision in the tender documents as per industry feedback
Ensure minimum deviations
 - Critical points to explained and discussed The Minutes of Pre -Bid Meeting are recorded and it may be followed by an Amendment or Addendum to the Tender documents.

1.2.5 Learning Outcome 5: Issue building materials and equipment

1.2.5.1 Introduction to the learning outcome

This learning outcome specifies the content of competencies required to Issue building materials and equipment. It includes; Construction materials, Testing methods, Concrete technology.

1.2.5.2 Performance Standard

- 5.1 Site material and equipment requirement list is obtained
- 5.2 Required materials and equipment are issued.
- 5.3 Issued materials and equipment are recorded

1.2.5.3 Information Sheet

- a) System of a store

- **Closed door system:**
The stored material is held under lock and key. Entry into the stores is restricted authorized person only. physical movement of the material is only with authorized documents only.
- **Open stores system:**
In the system material is stored near point of used there is restriction on consumption control passes on to operations department.

❖ **Store Documents**

- **Inventory:**
A complete list of items such as property, goods in stock or the content of a building.
- **Stores Indent:**
To keep the received articles detail of Stock Materials.
- **Register of Indents:**
To show the stock material detail of indents related to an indent no.
- **Bin Card:**
To show the stock material detail according to bin card no of selected Sub-Category.
- **Goods Received Sheet:**
To keep the detailed information of received goods related to office/vendor.
- **Summary of Stock Receipt:**
To keep the details of Stock Receipts (issued items) on monthly basis.
- **Summary of Indents:**
To keep the details of indents (received items) on monthly basis.
- **Priced Stores Ledger:**
To keep the transaction details of articles on monthly Basis and transaction type.
- **Tools and Plants Receipts:**
To keep the received transaction details of Tools and Plants articles on monthly basis.
- **Tools and Plants Issues Sheet:**
To keep the issued transaction details of Tools and Plants Articles on basis of indent.
- **Abstract Report:**
To keep existing records of Store Keeping between two dates on basis of store type.
- **Closing Balance Report:**
To keep balance information of Store Keeping between two dates on basis of store type.
- **Verification and Investigation:**

To keep the details of items verification and investigation details of the articles between two dates.

- **Auction:**
To keep the highest bidding price of article between two dates related to store type.
- **Census Report:**
To keep the analytic information of records on basis of store type.

❖ **Elements of store management**

- **Retrieval:**
Easy and quick retrieval of items that are demanded by the internal customers, Easy identification, maximum space utilization and minimum space handling are key factors to retrieval functions. It is common knowledge in many of the companies that after hours of searching for the item is declared to be out of stock. This causes hold up of production process and avoidable urgent purchase out of stock material.
- **Issues:**
Full filling demand for the item in minimum time, keeping quality high and cost minimum is achieved
- **Records:**
Maintain record of receipt and issue, Update the stock levels as per movement of materials, Basic records of store are bin and stock register Bin card is placed on the bin which items are stored. This gives information about receipt, issue and balance. Stock register gives all the information in the bin card and also the value.
- **Housekeeping:**
Maintenance of the spic and span cleanliness in the store and ensure principle of place for everything in its place for everything in its place is fully implemented. Good housekeeping ensures satisfactory work practices.
- **Control:**
Taking measures to ensure material plan is being adhered to. Any changes in consumption pattern or replenishment pattern are closely monitored for corrective action. Material movement is watched to identify nonmoving material for disposal. Effective control puts into effect management objective of no shortage and no excess.
- **Surplus management:**
Effective disposal system for unneeded material to reduce inventory cost and proactive measures to eliminate deterioration and obsolescence. Obsolete items are good in all respect but have no useful role in the company due to changes

that have occurred in the course of time. Surplus items are those that have accumulated due to faulty planning forecasting. hence a usage value is associated with these items.

- **Verification:**

Stock verification to eliminate gap between information and physical stock.in stores some items are maintained as stock items. The stores trigger the procurement cycle for such items when a predetermined reorder level is reached. Hence correct stock position through verification is critical to ensure no shortage and no excess item.

- **Interaction & coordination:**

Very close interaction between purchasing production quality control and engineering function is obviously needed in the discharge of the functions discussed so far.it also becomes necessary to coordinate the flow of materials samples.

❖ **Document used to issue materials in a store**

- **Stores Requisition Note:**

It is also called 'materials requisition note'. When Production or other departments requires material from the stores it raises a requisition, which is an order on the stores for the material required for execution of the work order. This note is signed by the department in-charge of the concerned department. It is documents which authorize the issue of a specified quantity of materials. Any person who requires materials from the stores must submit stores requisition note. The store keeper should only issue materials from stores against such a properly authorized requisition and this will be entered in the bin card and stores ledger. A copy of the requisition will be sent to the costing department for recording the cost or value of materials issued to the cost centre or job.

**Material Requisition
A.B. Co. Ltd.**

Department				
Job No.				
Qty.	Description	Code No.	Bin Card No.	Store Location
Authorized By				
Store-keeper's Signature				
				Materials Abstract

<https://learn.financestrategists.com/explanation/cost-accounting/material-costing/what-is-material-requisition/>

Figure 19: a sample of material requisition form

- Material Transfer Note:**
 If materials are transferred from one department or job to another within the organization, then material transfer note should be raised. It is a record of the transfer of materials between stores, cost centres or cost units showing all data for making necessary accounting entries.

Material Transfer Order - Return
(Ref. WAR-015; MAN-080)

MATERIAL TRANSFER ORDER - RETURN				
PRODUCTION TO FILL UP			WARE	
Original Transfer Order Number: LX.YYYYYY			Page no.:	
Material Transfer Order-Return Number: RETLX.YYYYYY			Date:	
Created By:	Sign:	Date:	Received by:	
Process Line:	BPN: XXXXXX			
Material Code	Lab. Batch number	Return Qty.	Operator count	Source storage
Material Description	Expiry date			Destination storage type
i.e. XXX Paracetamol BP	YY.MM.000000 DD-MM-YYYY	25 KG	25 KG	PW BS
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
Production checked by:		Pallet qty:	Wa	

<https://www.sampleforms.com/material-transfer-forms.html>

figure 20: a sample of Material Transfer Order

- **Material Return Note:**
If materials received from the stores are not of suitable quality or if there is surplus material remaining with the department, they are returned to stores with a

note called 'material return note' evidencing return of material from department to stores.

Material Return Note
A.B. Co. Ltd.

Department			
Job No.			
Qty.	Code No.	Description	Rate
Signature of Store-keeper			Signature

Adopted from: playaccounting.com

Figure 21:a sample of Material Return Note

- **Bin Card:**

A 'bin card' indicates the level of each particular item of stock at any point of time. It is attached to the concerned bin, rack or place where the raw material is stored. It records all the receipts of a particular item of materials and its issues. It gives all the basic information relating to physical movements. It is a record of receipts, issues and balance of the quantity of an item of stock handled by a store.

<u>Bin Card</u>					
Material Code:					
Material Description:					
Location:					
Unit of Measurement:					
Date	Doc No.	Received from/Issued to	Receipt	Issue	B

<https://keydifferences.com/difference-between-bin-card-and-stores-ledger.html>

Figure 22: a sample of Bin Card

- **Stores Ledger:**

A stores ledger is a manual or computer record of the raw materials and production supplies stored in a production facility. It is maintained by the person responsible for these assets, such as the warehouse manager. A stores ledger is particularly useful for maintaining a perpetual inventory system, since it tracks the current quantity of items on hand.

Stores department will maintain a record called 'stores ledger' in which a separate folio is kept for each individual item of stock. It records not only the quantity details of stock movements but also record the rates and values of stock movements.

With the information available in the store's ledger, it is easier to ascertain the value of any stock item at any point of time. The minimum, maximum and reorder levels of stock are also mentioned for taking action to replenish the stock position.

A stores ledger can be used for the following purposes:

- By auditors, to see how well the company's inventory records compare to its on-hand quantities.

- By the purchasing staff, to determine when and in what quantities to purchase additional inventory items.
- By the accounting staff, to use as the basis for calculating the ending cost of inventory on hand.

The information listed on a store's ledger can follow one of two formats:

- **Unit quantities only-:**
The ledger shows the beginning unit quantity of an inventory or supplies item, plus or minus any subsequent additions to or subtractions from stock. When used for this purpose, the stores ledger may instead be referred to as a bin card.
- **Costed quantities. -:**
The same as the first format, except that the cost of the items is also listed in the ledger.

The stores ledger may sometimes also contain a "min max" field, in which is recorded the minimum quantity level, below which an order must be placed for additional units. When the on-hand balance drops below the designated minimum level, the purchasing staff is notified to order more goods.

The stores ledger concept is most applicable to record keeping systems that are entirely manual. The term is rarely used when a business has converted to computerized record keeping systems.

<u>Stores Ledger</u>								
Material Code:							Maxim	
Bin No.:							Minim	
Material Description:							Order	
Location:								
Date	Receipts				Issues			
	GR No	Qty	Rate	Amount	SR No	Qty	Rate	Amount

<https://keydifferences.com/difference-between-bin-card-and-stores-ledger.html>

Fig. 23 Stores ledger

1.2.5.4 Learning Activities

a) Practical Activities

TASK: Obtain site material and equipment list, issue required materials and equipment and record issued materials and equipment.

b) **Special instruction:** Use British standard manual.

c) Field/Visit to a working construction site

Visit objective/Aim	Indicators
To establish the issuing and recording of required materials and equipment	Procedure followed during issuing and recording of materials and equipment.

Table 2: Field visit objectives, indicators and special instructions for establishment of issuing and recording of required building materials and equipment.

1.2.5.5 Self-Assessment

- 1) Why do we require store ledger in the store?
- 2) What is the used store requisition note in store?
- 3) Why is it important to keep the bid card of materials in the store?
- 4) Why do we do stock verification in the store?

1.2.5.6 Tools, Equipment, Supplies and Materials

Tools	Tape measure Gauge box Wood float Plumb bob
Supplies and materials	Personal protective equipment (PPEs) Gum boots Gloves Dust coats First aid kit Reflectors jacket Ear muffs Dust mask Stationery Files Stationery Cement

	Sand
Resource	A functioning construction site. British Standard Specification.

Table 1.13: Tools, equipment, supplies and materials for establishment of issuing and recording of required building materials and equipment.

1.2.5.7 References

Richard, F. (Ed)(2002) *Construction Management In Practice*.

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<https://keydifferences.com/difference-between-bin-card-and-stores-ledger.html>

<https://keydifferences.com/difference-between-bin-card-and-stores-ledger.html>

1.2.5.8 Responses to Self-Assessment

1. Why do we require store ledger in the store?
 - **It records not only the quantity details of stock movements but also record the rates and values of stock movements.**
 - **It is easier to ascertain the value of any stock item at any point of time ,With the information available in the stores ledger.**
2. What is the used of store requisition note in store?
 - **When Production or other departments requires material from the stores it raises a requisition, which is an order on the stores for the material required for execution of the work order.**
3. Why is it important to keep the bid card of materials in the store?

- **It records all the receipts of a particular item of materials and its issues.**
4. Why do we do stock verification in store?
- **To eliminate gap between information and physical stock.**

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