Bar bending& concreting Level II

Learning Guide 34

Unit of Competence: produce cement concrete casting

Module Title: producing cement concrete Casting

LG Code: EIS BBC2 M10 LO1-LG34

TTLM Code: EIS BBC2 TTLM 1019 v1

LO1:- Plan and prepare work

Instruction Sheet	Learning Guide 34

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Plan/working drawing interpretation
- Use work instruction, specification & quality requirements
- Identifying and applying necessary requirements
  - ✓ Safety requirements
  - ✓ Regulatory requirements
  - ✓ Environmental protection
- Types, characteristics and uses of materials, tools and equipment
- Calculating materials quantity requirements
- Materials handling and storage

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Apply work instructions, including plans, specifications, quality requirements
- Follow safety requirements in accordance with safety plans and policies
- Rectify or report tools and equipment selected to carry out tasks
- Calculate material quantity requirements with plans or specifications
- Identify, materials appropriate to the work application
- Identify environmental protection requirements

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 7.
3. Read the information written for each “Information Sheets given below
4. Accomplish the “Self-check after reading & understanding of each information sheet
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet

6. Lastly do the “LAP Test

7. If you have any question ask your teacher

Information Sheet-1	Plan/working drawing interpretation

1.1, Plan/working drawing interpretation

working drawing means Blueprint or drawing that is subject to clarifications but is complete with enough plan and section views (with dimensions, details, and notes) to enable the depicted item's construction or replication without additional information.

A set of structural drawings includes foundation plans and details, framing plans and details, wall sections, column and beam details, and other plans, sections, details, and schedules necessary to describe the structural components of the building.

Structural design should be based on the sound application of fundamental principles of reinforced concrete design and a knowledgeable use of building codes and standards. However, structural design is ineffective if it is not possible to ensure its proper implementation. The structural engineer has a critical role in communicating the design information to personnel involved in the construction process. In the world of structural engineering, structural drawings and specifications are a critical means of communication between the structural engineer and the contractor. Consequently, the importance of an accurate set of structural drawings that communicate clear and concise information cannot be underestimated.

In reality, even a well-designed structure may result in a variety of problems, both financial and legal, when structural drawings do not properly communicate the design intent. A poor set of structural drawings may expose the engineer to various problems, such as extra costs, delays in the construction schedule, disputes in the field, construction errors, unhappy contractor/owner, and even legal disputes.

Once the structural drawings have been completed, the contractor produces an estimate of the concrete and reinforcing steel quantities, as well as the amount of formwork and shoring. This estimate is based on structural drawings and specifications that are issued for construction. Based on these drawings, the estimator should be able

to estimate the quantity of materials and also the extent of complexity in the construction procedures, any unusual complications associated with the erection, formwork, and shoring, etc. The drawings must be clear and concise and without ambiguities. When drawings are ambiguous, there could be large variations in price between competitive bids submitted by different contractors in the bidding process. In general, a variation in the bid price of over 10% is considerable, as it leaves the owner confused about the proper market price for the project. This is an unfavourable situation for the owner, who ultimately pays for the construction. On the one hand, the owner may feel that (s)he is overpaying if the highest bid is accepted. On the other hand, a bid below fair market value may lead to problems during construction, usually in the form of numerous require

1.1.2 Footing reinforcement details

purpose:

- To show the details of reinforcement bars in the footing.
- To show the amount ,size ,spacing and location of bars needed in the footing .
- To show size ,depth and shape of footing .
- To show the shape of bars. (show how the bars are to be placed in the form or footing profile)

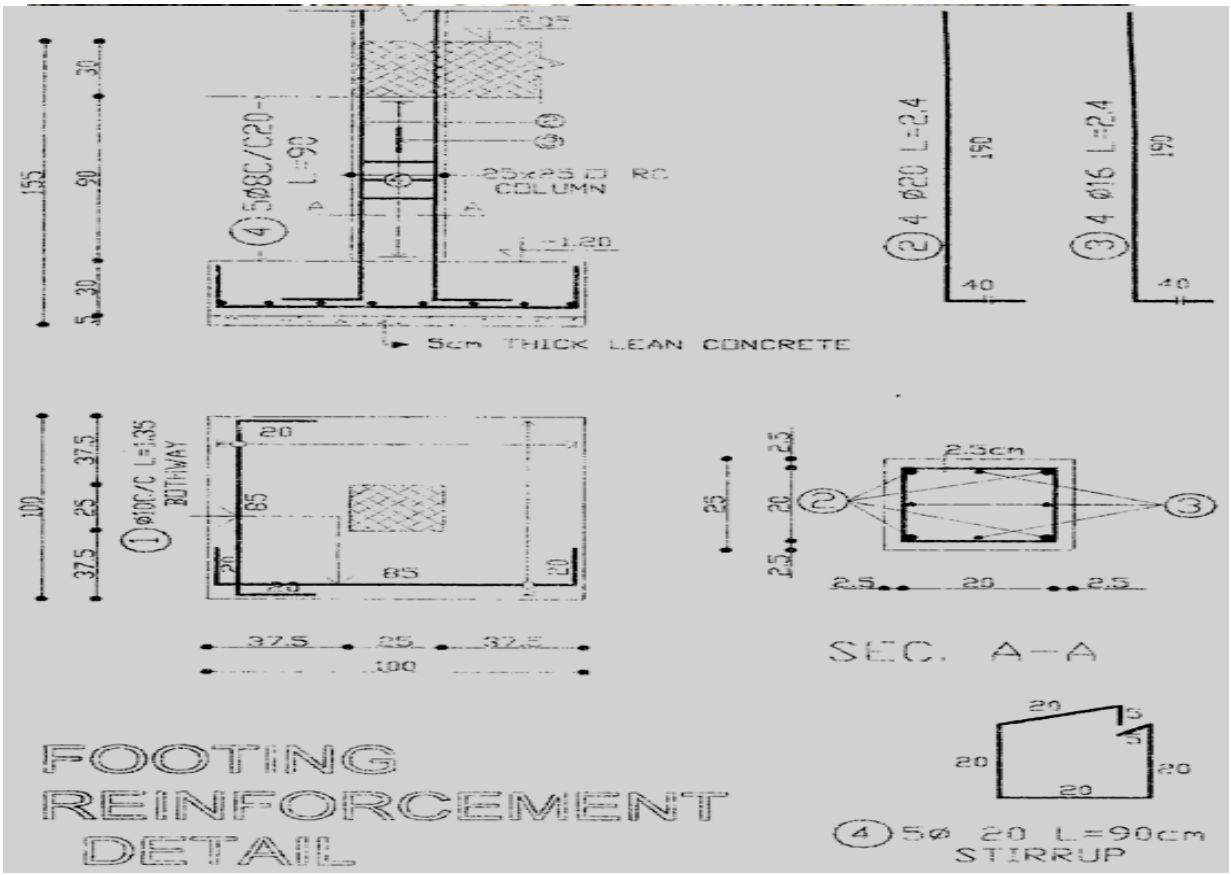
Includes

- plan view ,section and details
- Basic dimensions
- lay out of reinforcing bars
- size, number and spacing of bars
- bar mark for bars (to identify the bars)
- Details .
    - Footing columns reinforcement
    - stirrups development

❖ **Notes.**

Bar schedule

Note : concrete cover in footing slab at the sides is 2.5 cm and 5cm at the base (in addition to 5cm lean concrete bellow it) For smaller buildings depth of footing ranges



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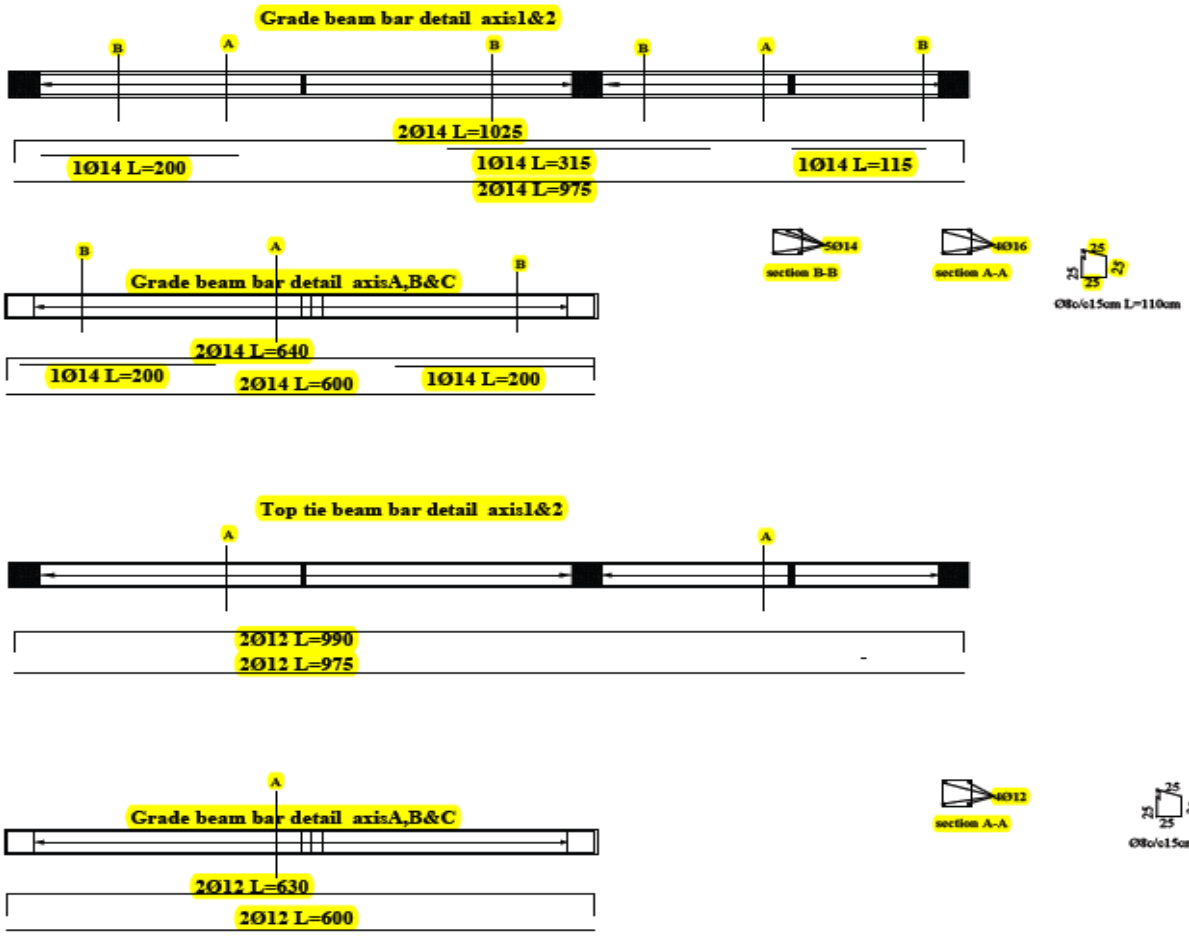
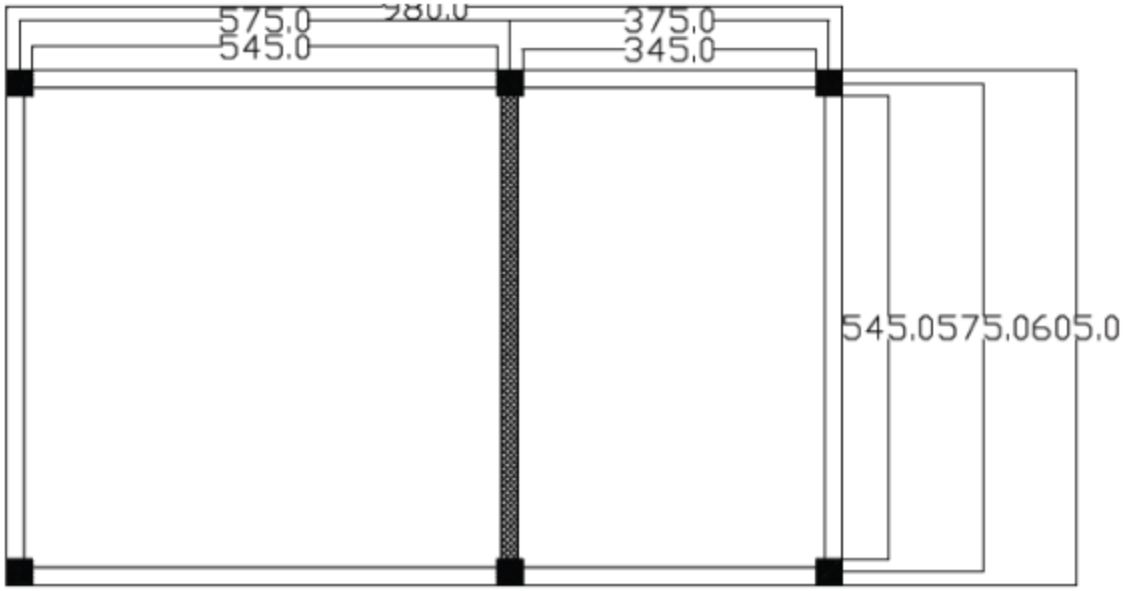
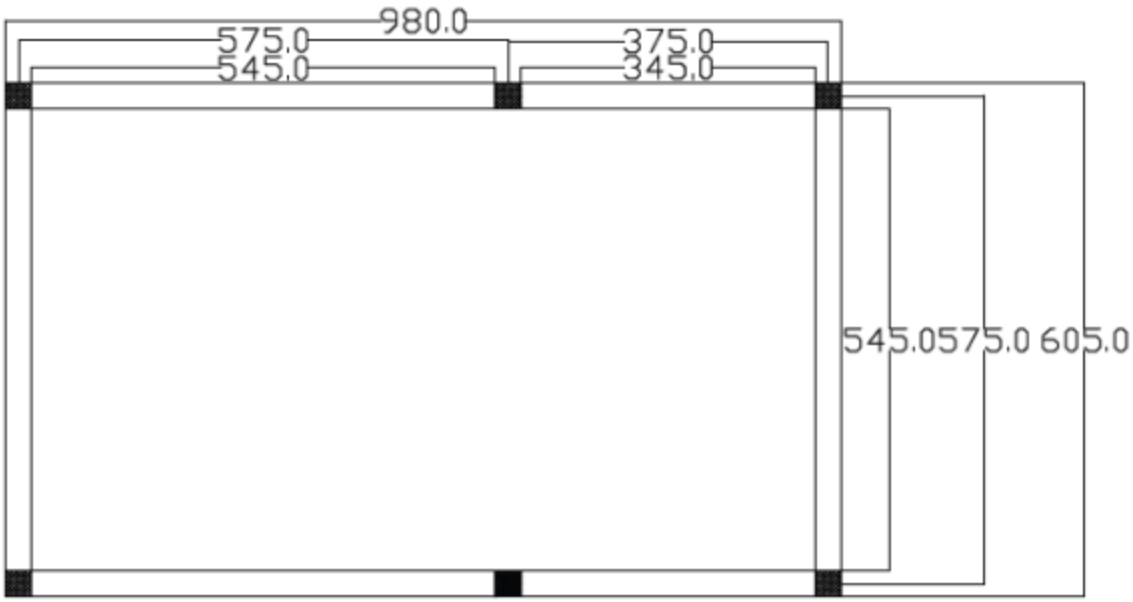




Top tie Beam lay out



Grade Beam lay out

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Directions: 1:-True false items

Instruction I: - Write true if the statement is true and write false if it is not true on the space provided (2 point for each)

1. Working plan is a set of drawings used to describe a place
2. Construction drawings are necessary in most spheres of the building industry
3. Sketch drawings is one part of working drawing
4. Structral drawing used to floor plane
5. concrete caver of form work is 0.05c.m

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer True& False

1. _____
2. _____
3. _____

Information Sheet-2	Use work instruction, specification & quality requirements

2.2. Specification

Specification is a written article prepared by technically qualified exports by conducting al lot of research work & certified by a government as an explicit set of requirements to be satisfied by a material, product, system or service.

The most commonly used standard technical specification in our world now days are ASTM, AASHTO, and BS.

BATCODA:"Technical Specification and Methods of Measurement for Construction of Buildings", March 1991, is the standard specification which has been in use for many years as one of the contract documents in our country.

Material has the general requirement part and the specific part. In the general requirement part the following items, which may be applied to any project and any trade of work are described in general terms:

- ✓ 011 - General 012 - Site Description
- ✓ 013 - Quality Assurance 014 - Project Records
- ✓ 015 - Site Facilities 016 - Cleaning up

2.2.1. Purposes of specification

- A Specification is a written document describing in detail the
  - ✓ Scope of work,
  - ✓ Materials and finishes to be used,
  - ✓ Method of installation or fabrication, and
  - ✓ Quality of workmanship for a parcel of work to be placed under Contract

2.2.2. Specification of concrete.

Designed mixes:- their required compressive strength is specified, together with buy other limits that may be required, such as maximum aggregates size, minimum cement content, and workability

a) Prescribed mixes: - the design resumes responsibility for designing the mix and stipulates to the producer the mix properties and the materials which shall be employed.
b) Standard mixes:- The mix propitious which are appropriate for grades C - 5 to C - 30 may be taken see for 9-8

2.3. Quality requirement

2.3.1. Constituent Material of concrete

a) cement:- The cement used shall be Portland or Portland puzzling cement with the requirements of the latest Eth. Standards requiems of such cements.
b) Aggregates: In general aggregates shall comply with the requiems of latest Ethiopian standard for aggregates
c) Water :- Mixing water shall be clean and free from harmful matter

2.3.2 Classes of concrete

- A concrete is graded interims of characteristics compulsive cube strength attained it the of 28 days in Map. The Permissible grades for the two classes of concrete work are giver below

Table 1: **Classes of concrete**

Class	permissible grades
I	C 5 C15 C20 C 25 C 30 C 40 C 50 C 60
II	C C 15 C 20

Class I: - concrete works carried out under the directory of supervisors gestured by the ministry as associate Engineers or above

Class II: - Concrete works claimed out under the direction of supervise registered by ministry of by Engineering Aids

Table 2

Class	minimum compressive strength (Mpa)	minimum compressive (psi)
A	28	4000
C	18	2500
Y	18	4000

2.3.3STANDARD SPECIFICATION FOR Concrete in Ethiopian standard

FINE AGGREGATE (SAND)

- Fine aggregate shall consists of natural sand, manufactured sand or combination of both.

Grading requirement

Fine aggregate shall full fill grading requirement given below.

Table 3.

Sieve size (mm)	ASTM C-33-02a % pass
9.50	100
4.75 (No. 4)	95-100
2.36 (No. 8)	80-100
1.18 (No. 16)	50-85
0.60 (No. 30)	25-60

0.30 (No. 50)	5-30
0.15 (No. 100)	0-10

Table 4

Sieve size (mm)	BS 812 (% pass)
10.00	100
5.00	89-100
2.36	60-100
1.18	30-100
0.60	15-100
0.30	5-70
0.15	0-15

- Concrete with fine aggregate grading near the minimum for percent passing the 300µm (No.50) and, 150µm (No. 100) sometimes have difficulties with workability, pumping of excessive bleeding. Thus, the addition of cement or addition of approved mineral admixture to supply the deficient fines.

- The fine aggregate shall have not more than 45% passing any sieve and vertical on the next consecutive sieve of on shown table 3.11 &3.2 2.The fines modules value fine aggregate shall not be less than 2.3 not more than 3.1.

- Fine aggregates shall be free of injurious amount of organic impurities. Except as herein provided, aggregates subjected to the test for organic impurities and producing color darker than the standard shall be rejected.

- Use of the aggregate failing in the test is not prohibited, provided that, when tested for the effect of organic impurities on the strength of mortar, the relative strength at 7 days, calculated in according to test method stated on the method test, is not less than 95%.

Fine aggregate should have enough soundness value of test from different chemicals, for five cycles of test the soundness test shall have a weighted average not less than 10% when sodium sulfate is used or 15% when magnesium sulfate is used.

COARSE AGGREGATE

Coarse aggregate shall consist of gravel, crushed stone. It shall confirm the following grading requirement table below.

Table 5

Sieve Size (mm)	Grading requirement for coarse aggregate (BS 882)							
	Percentage by mass passing BS sieves for normal size							
	Graded aggregates			Single sized aggregate				
	40mm to 5mm	20mm to 5mm	14mm to 5mm	40mm	20mm	14mm	10mm	5mm
50	100	-	-	100	-	-	-	-
37.5	90-100	100	-	85-100	100	-	-	-
20	35-70	90-100	100	0-25	85-100	100	-	-
14	25-55	40-80	90-100	-	0-70	85-100	100	-
10	10-40	30-60	50-85	0-5	0-25	0-50	85-100	100
5	0-5	0-10	0-10	-	0-5	0-10	0-25	45-100
2.36	-	-	-	-	-	-	0-5	0-30

2.4Standard specification for Portland cement.

1.1 This specification covers eight type of Portland cement as follows

Type I for use when the special properties specified for any other type are not required.

Type IA air entraining cement for the same uses as type I, where air entrained is desired.

Type II for general use more especially when moderate heat of hydration is desired.

Type II A – air entrance cement for the same uses as type II, where air entrainment is required.

Type III – for use when high early strength is required.

Type III A – air entrained cement for the same use as type III, where air entrainment is required.

Type IV – for use when low heat of hydration is required.

Type V for use when high sulfate resistance is required

Definitions

Portland cement: - a hydraulic cement produced by pulverizing clinker consisting essentially of hydraulic calcium silicates, usually containing one or more of the forms of calcium silicates, usually containing one or more of the forms of calcium sulfate as an inter ground addition.

Air entrained Portland cement: - a hydraulic cement produced by pulverizing clinker consisting essentially of hydraulic calcium silicates, usually containing one or more of the forms of calcium sulfate as an inter ground addition and with which there has been inter ground an air entraining addition.

Hydraulic cement: - a cement that sets and hardens by chemical interaction with water and is capable of doing so under water.

2.5 Hollow concrete Blocks (HCB)

Classification: -

Hollow concrete blocks shall be classified in the following three classes

- Class A and B are load beading units and suitable for:
  - External walls pointed, rendered and plastered
  - The inner leaf of cavity walls or stonemasonry
  - internal walls or partitions
  - Panels in steel framed and reinforced steel framed buildings.
- Class C - non- load bearing units suitable for:'
  - Non load bearing walls and partitions

- None load beating internal panels in steel framed and reinforced concrete buildings.

Note: Six full size samples shall be tacky from a lot of 4000 blocks or factory threw of hollow concrete blocks are medicates below

Table6 The nominal dimensions of hollow concrete blocks are medicated below

Breadth (b) (mm)	Height (h) (mm)	Length(L)	Face shel (d)(mm)	Web(e) (mm)	Maximum unit weight(Kg/m3
100	200	400	20	20	1200
150	200	400	25	25	1200
200	200	400	30	25	1200
250	200	400	35	30	1200
300	200	400	40	30	1200

The minimum compressive strength for HCB recording to ESC D3 301 is indicated below

Class	Average of six Units		Individual Units	
	Mpa	Kg/cm2	Mpa	Kg/cm2
A	4.2	4.2	3.8	3.8
B	3.5	3.5	3.2	3.2
C	2.0	2.0	1.8	1.8

Self-Check 2	Written Test

Instruction. Choice the correct answer from given question (2point)

1; A Specification is a written document describing in detail the

A; Scope of work, B Materials and finishes to be used C; Quality of workmanship D; All

2; none load beating internal panels in steel framed and reinforced concrete buildings

A. class A H.C.B B.CLASS B H.C.B C .class C H.C.B D. none

3. Result of Poor Quality Out comes

A. High maintenance costs. B Projects fail C. Cost and time overruns D. Disputes.

4. Used to define the qualitative requirements for products, materials and workmanship

A; Specifications B. quality standard C quality requirement D. all

Note: **Satisfactory rating –abave 4points** **Unsatisfactory below 4point**

Name: _____ Date: _____

Answer

1. _____
2. _____

Information Sheet-3	Identifying and applying necessary requirements

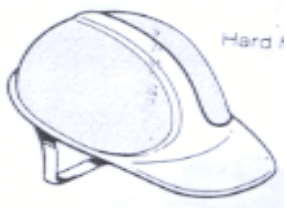
1.3 The minimum necessary standard, a key protection of the Privacy Rule, is derived from confidentiality codes and practices in common use today. It is based on sound current practice that protected health information should not be used or disclosed when it is not necessary to satisfy a particular purpose or carry out a function. The minimum necessary standard requires covered entities to evaluate their practices and enhance safeguards as needed to limit unnecessary or inappropriate access to and disclosure of protected health information

1.3,1 Safety requirements

For uses of protected health information, the covered entity's policies and procedures must identify the persons or classes of persons within the covered entity who need access to the information to carry out their job duties, the categories or types of protected health information needed, and conditions appropriate to such access. For example, hospitals may implement policies that permit doctors, nurses, or others involved in treatment to have access to the entire medical record, as needed

1.3.2 P.P.E(personal protective equipment)

Hard hat:-Protects head of the worker from any falling objects dropping from high level during construction.



Overall:-Protects the normal clothes from dust, grease and other spilling materials.

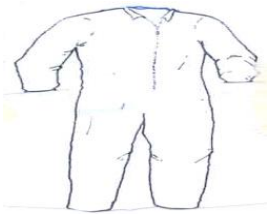


Fig.6. *Overall cloths*

Safety shoe (boot):-Protects the worker form nail, sharp objects and heavy falling objects by hard-rolled leather shoes with metal toe caps.

Fig.7 *Non-slip oil resistant*

Rubber boot:- Protects the workers feet from colds, chemical, and mud in the working area.

Rubber boot Fig. 8

Mask: - Protects eyes of the worker from other endangering object and dust during construction.

Fig.9 *Mask*

Goggle: - Protects eyes of the workers during welding of metal works and when placing reinforcement in the form work.

Fig.11

Glove:-Protects the workers from oils, chemicals, and dust and other dangerous material that affect the skin.

12

Fig1

Fig1

Safety Belt:- Secures laborers working in a plane where the construction is done at high level.

Note: - Keep the working clothes in safe place so that you can change it easily. A locker should be used so that you can store your personal material safely while you are performing your works. The first task before you start any construction activity is follow safety rules and always dress in safety clothes as shown Figure

Fig. 1.1Safety protections

Job Safety Board

The general contractor/construction manager shall post and maintain a job safety board at the project site in a conspicuous location that is accessible to the subcontractors/trade contractors, workers and other personnel arriving at or entering the project site. The general contractor/construction manager shall notify all persons work in on the project site of the location of the job safety board.

1.3.2 First aid box

A building site should have a first aid kit which as minimum containers:-

- Plaster
- Bandage
- Ointment

- Disinfector
- Someone on the site should be in charge of
- the kit and know how to deal with broken
- Boned, bowls and effective strikes.
- First aid kit should be placed at convenient location
- At the site so that worker can pick it up early.

1.3.3, Regulatory requirements

Once recognized, all awarding organizations must comply with our regulatory requirements – the standards and rules we set for designing, delivering and awarding regulated qualifications – on an ongoing basis. Because we take a risk-based approach to regulation, we target our work (including regulatory requirements) where it is most needed. This means that different requirements could apply to different qualifications, or to different awarding organizations. In practice, the way we have structured our regulatory requirements means that there are two main types of requirements:

- requirements which apply to all awarding organizations, and all qualifications;
- Qualification-specific requirements, which apply to particular types of qualification.

We also sometimes impose requirements on individual awarding organizations; we call these requirements Special Conditions. For example, we might choose to apply a special condition to make sure an awarding organization follows through on commitments they made when applying for recognition.

1.3.4 Environmental protection

Environmental protection is a practice of protecting the natural environment on individual, organizational or governmental levels, for the benefit of both the natural environment and humans. Due to the pressures of population and technology, the biophysical environment is being degraded, sometimes permanently. This has been recognized, and governments have begun placing restraints on activities that cause environmental degradation. Since the 1960s, activity of environmental movements has

created awareness of the various environmental issues. There is no agreement on the extent of the environmental impact of human activity, and protection measures are occasionally criticized.Academic institutions now offer courses, such as environmental studies, environmental management and environmental engineering, that teach the history and methods of environment protection. Protection of the environment is needed due to various human activities. Waste production, air pollution, and loss of biodiversity (resulting from the introduction of invasive species and species extinction) are some of the issues related to environmental protection. Environmental protection is influenced by three interwoven factors: environmental legislation, ethics and education. Each of these factors plays its part in influencing national-level environmental decisions and personal-level environmental values and behaviors.

Self-Check 3	Written Test

Instruction Choice the correct answer from given question

1. Protects head of the worker from any falling objects dropping from high level

A. **Overall** **B. Hard hat** **C Safety shoe D. All**

2. Protects the normal clothes from dust, grease and others pilling materials

A. **Hard hat** **B. Overall** **C Safety shoe D. All**

3. Protects eye he worker from dust during construction

A. **Mask** **B. Goggle** **C Safety shoe D. All**

4. Protect the worker from oil, chemical, and other dangerous material against skin

A. **glove** **B. Goggle** **C Safety shoe D. All**

5. Which one of the following is first aid material from given

A. Plaster B Bandage C. Ointment D All

Name: _____ Date: _____

Answer

1. _____
2. _____
3. _____
4. _____

5. _____

Information Sheet-4	Types, characteristics and uses of materials, tools and equipment

Spirit level

It is used to control the horizontal and vertical alignment of wall surface and edges. The length is at least 80 to 120cm long. It is made of metal, synthetic material or wood. It has two measuring bubbles: one is located at mid length is used to check horizontal positions. While the second one, at the end, is used to check vertical position. This tool requires always to be handled with care and needs to be checked from time to time weather it is still working accurate or not.

Fig. 15. Spirit level

Plumb bob

A plum bob is made of metal. When suspended from a vertically attached string, it is employed to check the vertical alignment of corners and surface of walls. A freely hanging plumb bob gives exactly the vertical alignment, because any undisturbed freely hanging mass points to the centre of the earth.

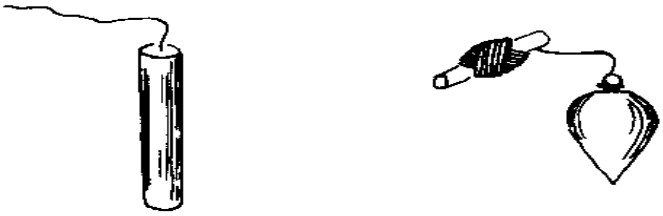


Fig.16. Plumb bob for vertical marking & leveling

Alignment string /masons' line/

Alignment string /mason line/, sometimes called, Fish line, is a rope used to transfer horizontal & vertical alignments or lines, i.e., use to mark base line on the floor or vertical point alignments of wall. In other words, it is used to align the walling blocks, (stone, bricks, concrete blocks, hydra form etc). It is available in different thickness & sizes in the market.

Fig.17 Hose level

It is a transparent PVC hose. It is used to transfer or mark vertical levels on surface of wall when it is filled with water, but without any air bubbles. The water level in each end of the hose is equal. It is an instrument to mark equal levels on site. It is very accurate but not eases to handle.

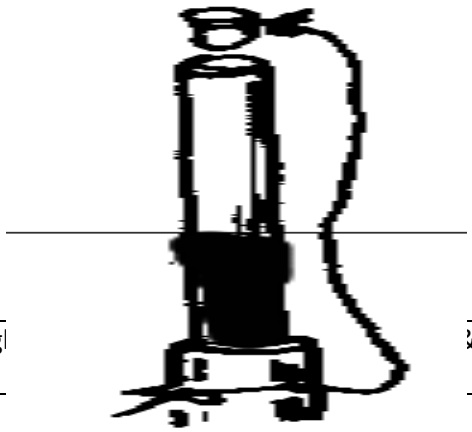


Fig 18 Hose level to transfer meter score

Straight edge/Level/

This is a perfectly straight metal/aluminium/ with all long and short edges parallel to its centreline. It is employed to check straight alignments of walls. Its length ranges from 2m up to 4m. Together with the sprit level, it can be used to bridge over the point to be checked. A straight edge/Level/ can also be made from a wooden plank with perfectly parallel edges.

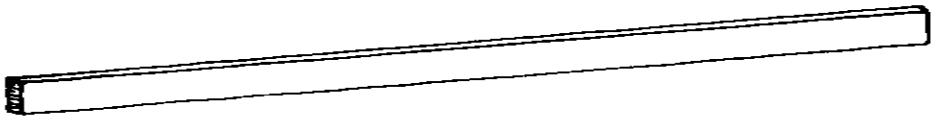


Fig.19 **Straighten**

Angle / Try square

It is used to measure a right angle (90º) of a corner. Used inlaying masonry units or blocks at corners of masonry wall.

Fig.20

Measuring tape

Tape is used to measure dimensions of building parts and distances in site. It is manufactured from steel, plastic or fibre in lengths of 1m, 2m, 3m, 5m, 30m, etc. and

50m. In using tapes for measurements, the two points should be aligned perfectly. In addition, when long horizontal measurements are needed, care should be taken to avoid sag on the tape meters.

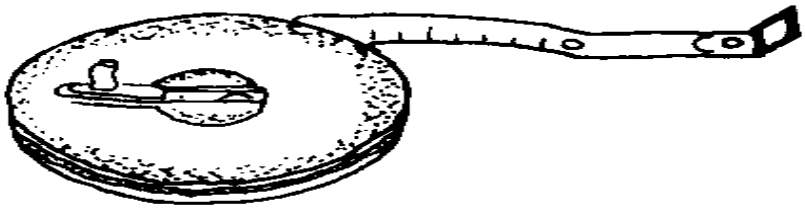
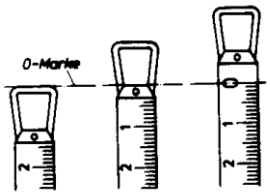


Fig.21 Measuring tape



Proper adjustment of measuring tap

Mortar barrel/ drum

This is used by mason, plasterer, tiller, etc, and serves to prepare small amount of mortar right at the working place. It is also used as temporary mortar storage, supplied from mixing station, and to control water ratio of the mix when it gets dry. Always, keep it workable and clean.

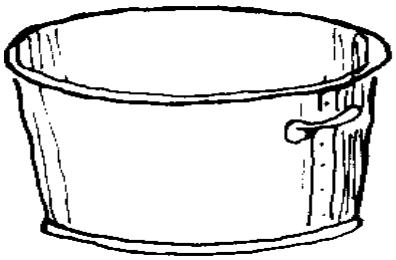


Fig.22. Mortar drum

Bucket

A Bucket is used to serve small amount of water or material and to take the tools after work.

Fig.23 Bucket

Equipment/Machinery

Concrete/ Mortar Mixer

Concrete mixers are available in from of different capacities. Small mixers can produce 250Lit of mortar or concrete and the big ones produces more and more, up to 6000Lit.; widely used, small mixers up to a capacity of 1000Lit. Mixers are driven with diesel, benzene engine or electrical power.

Fig.24 Mixer 250 lit

Vibrator is used to compact the fresh concrete in the formwork

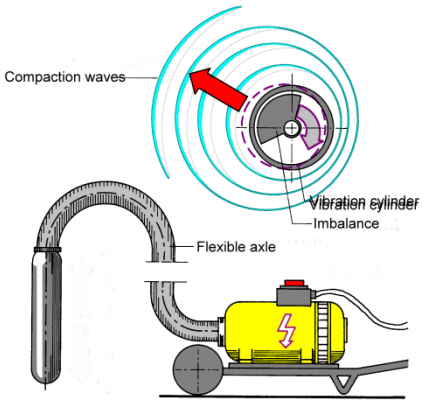


Fig.25

Wheelbarrow

Wheelbarrow is used to dispose disposal materials from working place, to transport or serve materials and tools during construction activities in the site.

It is the most efficient way in transporting materials or items. ; In comparison to a barilla, (commonly used in the country), a wheelbarrow is much more efficient.

For this reason, it is operated by one person and can be carried up to 100 kg at once. So that it saves operation cost; it is time effective and therefore in general.

Fig.26

Trowel This is a tool, which every mason needs. Used for picking up mortar out of the barrel, spreading mortar on the wall, bed joints and cutting off excess mortar. In addition to the picture shown, a Triangular and rectangular trowel are also used by the mason.

Fig.27

A hacksaw is a general tool on site

Fig.28

Mixing Tools

Spade: - Used to mix concrete materials manually in the construction site

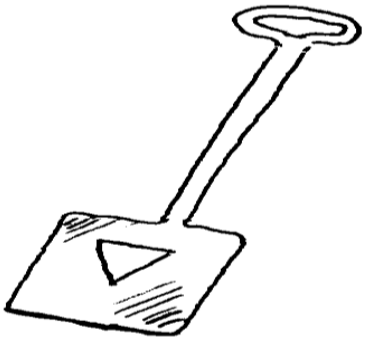


Fig.29

Concrete hoe: - Used to clean small area ofthe construction site from organic and mix concrete materials.

Fig. 30

Concrete hoe

Mixing platform:- Used for hand mixing of concrete. Water tight platform at least 2m wide and 3.5 long should be provided. Such platform should preferably be made of boards 3 to 5cm thick, tongued and grooved so that points are tight and platform is rigid.

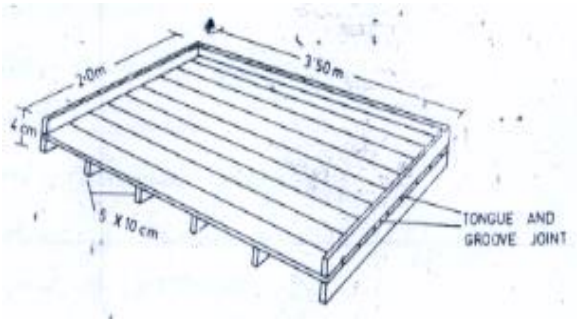


Fig.31

Mixing platform

Concrete Materials

Each ingredient in concrete has definite function and characteristics. Cement is the active ingredients that combine with water to form a paste .We rely up on the cement manufacture to produce the reliable product. .

CEMENT

The job to be done will determine the type of cement to select.

Cement binds the concrete mix together. There are a number of types of cement. The most common, used for general construction, is called Type I Normal Portland cement.

Another variation used in construction is white Portland cement. It is light-colored and used chiefly for architectural effects. White Portland cement is made from carefully selected raw materials and develops the same strength as the normal gray colored Portland cement.

Types of cement include:

- **Type I**, Normal Cement (most common)
- **Type II**, Moderate Sulfate Resistance (slow-reacting)
- **Type II**I, High Early Strength (fast-setting)
- **Type IV**, Low Heat of Hydration (low heat generation)
- **Type V**, High Sulfate Resistance These other types of cements, along with aggregates and admixtures, is available to produce special types of concrete.

- **Type IV** is low heat generation for large construction building foundation projects, such as dams. Others have high early strength to produce concrete that sets faster than normal, permitting earlier form removal and thus speeding construction.

AGGREGATES

Aggregates used in concrete are obtained from either natural gravel deposits or are manufactured by crushing quarried rock. Natural deposits of sand and gravel may contain large amounts of deleterious aggregates such as shale and iron oxides. Therefore, some of these deposits do not meet concrete aggregate specifications.

Beneficiating equipment can sometimes remove these undesirable materials during production. During processing, oversized material is either eliminated or reduced to

usable size by crushing. Crushed rock is generally obtained from quarried granite, quartzite, limestone, or trap rock.

AGGREGATE SIZE

Aggregates are divided into two general group sizes, fine and coarse. In many instances more than two actual sizes of material are used, due to a further subdivision by size of material within one or both of the groups.

A. **Fine aggregate** is normally considered material that will pass through a sieve having 4.75 mm (No.4) mesh. Specifications require washed, natural sand, unless otherwise provided by the Special Provisions. In some instances, fine aggregate of two or three different sizes or from more than one deposit are used.

B. **Coarse Aggregates** coarse aggregate is considered the material that is retained on a 4.75 mm (No.4) sieve. Two sizes of coarse aggregate are required whenever the maximum size of the aggregate is 25 mm (1 in.) or larger.

Aggregate Shape

Shape of aggregate has an important influence upon the workability of fresh concrete.provides guidance on the classification of shape. They are as follows:

- flaky
- elongated
- angular
- irregular
- round

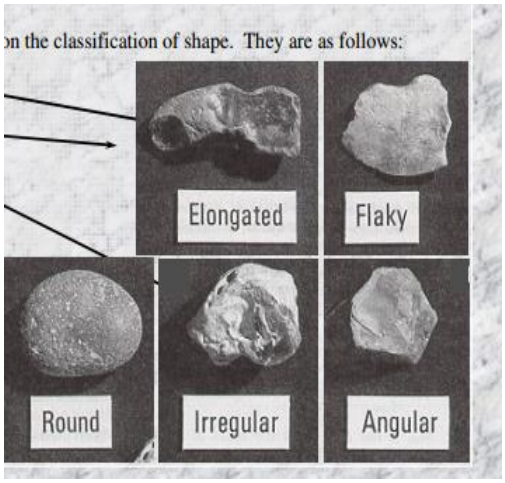


Fig.32 Fig.33

WATER

In a correctly proportioned concrete mix, only about half of the mixing water is needed to hydrate the cement. The remainder acts as a lubricant to produce workability. When more water tan is actually needed for workability is added, the concrete is diluted, its density is reduced, and it is weakened. If the water is fit to drink, it is satisfactory to use in concrete. This is not to say that water to be used in concrete must be completely pure. Impurities in water may cause efflorescence, surface discolorations, corrosion of steel as well as affecting setting time and strength.

Chemical Additives (Admixtures)

Sometimes a fourth ingredient is used in addition to three basic ingredients (i.e. cement, aggregate, and water) to improve upon certain characteristic of concrete. This additional ingredient is called admixtures (also called additive). The admixtures are added to concrete mix immediately before or during mixing operation to modify certain specific characteristic of concrete in fresh or hardened state.

The purposes for which admixtures are commonly used in concrete are:

- To improve workability of fresh concrete.

- To accelerate setting and/or hardening.
- To retard settling and/or hardening.
- To reduce the heat evolution.
- To improve durability of hardened concrete.
- To import water proofing properties of concrete.
- To reduce shrinkage during setting, etc.

Self-Check 4	**Written Test**

In struction. Choice the correct answer from given question

1.It is used to control the horizontal and vertical alignment of wall surface

A. **Spirit level B Straight edge C Try square D. None**

2 It is used to measure a right angle (90º)

A. **Straight edge B Spirit level C Try square D. None**

3. to measure dimensions of building parts and distances in site.

A. **Measuring tape B Tape C Try square D. None**

4. is used by mason, plasterer, tiller, etc, and serves to prepare small amount of mortar

A. **Measuring tape B mortar drum C Try square D. None**

5. used to dispose disposal materials from working place, to transport or serve materials and tools during construction activities in the site.(2point)

A. **mortar drums B Wheelbarrow C Try square D. None**

6 Used for picking up mortar out of the barrel, spreading mortar on the wall, bed joints and cutting off excess mortar(2point)

A. **mortar drum** **B Wheelbarrow** **C Trowel** **D. None**

Matching (2point)

7.Type IV	**A.** Normal Cement
8 Type lll	**B.** Moderate Sulfate Resistance
9. Type II	C. High Early Strength
10.Type I	D. Low Heat of Hydration

Note: **Satisfactory rating - above10 points** **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Information Sheet-5	Calculating materials quantity requirements

1.5 Calculating materials quantity requirements

Note that the system does not take the unit of measure of referred values into account. Percentages, for example, are treated like absolute values during the calculation.

- To insert the operators of the basic arithmetical operations or a bracket in the formula, choose the corresponding button in the *Formula definition* section or use the keyboard to enter the sign.
- Use the keyboard to enter all other operators or functions
- Depending on the values for which you have entered a formula, start the calculation as follows:
- If you want to recalculate component, operation, phase, or scrap quantities, choose
- If you want to recalculate the product or order quantity, choose *Calculate product qty*.

The system calculates the product quantity and subsequently updates all component, operation, phase, and scrap quantities for which formulas have been maintained.

Calculating Quantity of Materials

An estimate is probable cost of a building before construction. This estimate should not be far away from the actual cost of the building after completion of the project. it is done by mathematical calculation based on working trainings. First of all the quantity of the work is calculated based on standard unit of measurement for each work. This unit of measurement can be pieces (No), meter linear, meter square and meter cube.

The unit of measurement for concrete is meter cube for thick surfaces such as ground floor slab. The data given below can be used to calculated materials required for making concrete, the materials needed depends on the grade of concrete as given on the data.

General formula for calculating material list of concrete

Basic data

Density of cement - - - - 1400 kg/m^3

Density of Sand - - - - 1840 kg./m^3

Density of Stone Aggregate - - - - 2250 kg/m^3

Density of Lime - - - - 1900 kg/m^3

Density of Cement Mortar - - - - 2300 kg/m^3

Density of Compo Mortar - - - - 1200 kg/m^3

Density of Tracheae - - - - 2600 kg/$m^{3/}$

Assume 30% Shrinkage and 5% wastage.

1**) Concrete Mix = 1:3:6**

Let volume of concrete = Zm^3

$$then \quad a)\ Cement = \frac{1}{10} \times Zm^3 \times 1400 kg/m^3 \times 1.30\ shrinkage \times 1.05\ wastage$$
$$= 191 kg\ Z$$
$$= 0.41 m^3\ Z$$

$$b)\ Sand = \frac{3}{10} \times Zm^3 \times' 1840\ kg/m^3 \times 1.30\ shrinkage \times 1.05\ Wastage$$
$$= 754\ kg\ Z$$
$$= 0.41\ m^3$$

$$c)\ Aggregate = \frac{6}{10} \times Zm^3 \times 2250\ kg/m^3 \times 1.30\ Shrinkage \times 1.05\ Wastage$$
$$= 1843kg \times Zm^3$$
$$= 0.82 \times Zm^3$$

C/ Material list Calculation

I Concrete

Assuming 30% Shrinkage

5% Wastage

For: Mechanical mix $\frac{\text{Water}}{\text{Cement}}$ = 0.4-0.5

Hand mix $\frac{\text{Water}}{\text{Cement}}$ = 0.4-0.65

Note: Hand mix shall only be allowed for class II concrete, and shall not be allowed for Concrete of class c-20 above.

Item	**Type of work**	**Material required to produce 1m^3 Concrete**
1	Concrete c-7 Mechanical mix Mix ratio 1:4:8	Cement = 150 kgs (3 bags) Sand = 773 kgs (0.42 m^3) Gravel = 1890 kgs (0.84 m^3) Water = 60 liters

2	Concrete c-15 Mechanical mix Mix ratio 1:3:6	Cement = 200 kgs (4 bags) Sand = 754 kgs (0.41 m^3) Gravel = 1843 kgs (0.82 m^3) Water = 80 liters
3	Concrete c-20 Mechanical mix Mix ratio 1:2:4	Cement = 275 kgs (5.5 bags) Sand = 718 kgs (0.39 m^3) Gravel = 1755 kgs (0.78 m^3) Water = 110 liters
4	Concrete c-30 Mechanical mix Mix ratio 1:2:3	Cement = 325 kgs (6.5 bags) Sand = 837 kgs (0.45 m^3) Gravel = 1536 kgs (0.68 m^3) Water = 130 liters
5	Concrete c-7 Mechanical mix Mix ratio 1:3:9:8	Cement = 153 kgs (3.06 bags) Sand = 704 kgs (0.38 m^3) Gravel = 1966 kgs (0.87 m^3) Water = 92 liters
6	Concrete c-15 Mechanical mix Mix ratio 1:2:5:6	Cement = 202 kgs (4.04 bags) Sand = 661 kgs (0.36 m^3) Gravel = 1940 kgs (0.82 m^3) Water = 121 liters

1.8, Measuring tools & equipment's

A **measuring instrument** is a device for measuring a physical quantity. In the physical sciences, quality assurance, and engineering, measurement is the activity of obtaining and comparing physical quantities of real-world objects and events. Established standard objects and events are used as units, and the process of measurement gives a number relating the item under study and the referenced unit of measurement. Measuring instruments, and formal test methods which define the instrument's use, are the means by which these relations of numbers are obtained. All measuring instruments are subject to varying degrees of instrument error and measurement uncertainty.

Measuring Tool

Batching Box: - Used for volume batching of concrete. The standard size of the box is **50cmx40cmx20cm, 50cmx40cmx18cm**, **50cmx40cmx16cm** its depth can vary depending on the grade of the concrete to be mixed.

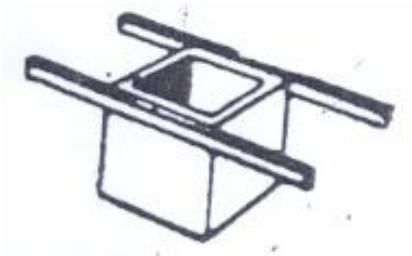


Fig.34

Batching box

Measuring bucket:- Used to measure quantity of water required for mixing. It can also be

used for talking water which is applicable for mixing and caring purpose.

Fig.35

Balance: - Used to weigh aggregate materials. It is possible to change the volume batching to weight by multiplying by densities of the material. Balances are available in different capacities.

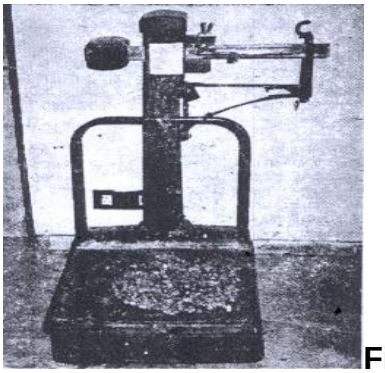


Fig.36

Platform weighing machine

Scientists, engineers and other humans use a vast range of instruments to perform their measurements. These instruments may range from simple objects such as rulers and

stopwatches to electron microscopes and particle accelerators. Virtual instrumentation is widely used in the development of modern measuring instruments.

Exact measurement is an absolute must for everyone who wants to guarantee precise and first-class work. That is why the best measuring instruments are necessary. We offer a broad range of products from the field of measuring instruments. PCE offers various types of testing and measuring instruments, handheld and desktop measurement solutions.

1.9 Materials handling and storage

Safety All the Way

Every material handling operation is different. Each part of the construction industry must take care to ensure safety practices are in place at every stage of handling various materials.

Planning Each Move

Materials should be moved only when necessary. When you plan to move, ship, or receive materials consider all parts of the operation:

- How will it be transported?
- Are the workers experienced enough?
- Do you have enough workers to do the job right?
- Is the vehicle operator skilled enough for the job at hand?

Every material handling operation is different. Each part of the construction industry must take care to ensure safety practices are in place at every stage of handling various materials.

Planning Each Move

Materials should be moved only when necessary. When you plan to move, ship, or receive materials consider all parts of the operation:

- How will it be transported?
- Are the workers experienced enough?
- Do you have enough workers to do the job right?
- Is the vehicle operator skilled enough for the job at hand?
- Are the packages or load sizes appropriate?

Materials Handling Equipment

When you think about how to handle materials or place them in storage properly, think about equipment that can assist you. Whenever possible use: Save your back and increase job efficiency by using the right tool for the right job. When manual assistance is required at any stage in the job, ensure that there are enough workers to share the work. By improving your handling procedures your safety record will improve.

A Good Safety Record

Manual material handling accidents and falls are frequent. WCB claims in this area are high.

Improved materials handling leads to better productivity and a good safety record.

Don't let equipment accidents ruin your record. For example, don't exceed the recommended load limits of vehicles used in handling materials.

Make sure all vehicle operators in your area follow the regulations and safe operating procedures.

for more information, refer to current applicable Occupational Health and Safety Legislation.

Self-Check 5	Written Test

Instructions:. Choice the correct answer from given question

1 which one of the following material used to produce concrete

A. Cement B. sand C. course aggregate D .All

2, Used to weigh aggregate materials

A. Measuring bucket **B.** Balance **C.** Batching Box **D.** none

3. Used for volume batching of concrete.

. A Batching Box **B.** Balance **C** Measuring bucket **D.** none

4 The standard size of the box is

A. 50cmx40cmx20cm, B. 50cmx40cmx18cm, C. 50cmx40cmx16cm **D.** All

Matching

5.Density of cement A. 1400 kg/m^3

6.Density of Sand B.1840 kg./m^3

7.Density of Stone Aggregate C. 2250 kg/m^3

8.Density of Lime D. 1900 kg/m^3

9.Density of Cement Mortar E.2300 kg/m^3

10.Density of Compo Mortar F.1200 kg/m^3

11.Density of Tracheae G.2600 kg/m^3

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____

OPERATION SHEET-1.1

OPERATION TITLE**: - Calculating Quantity Materials**

PURPOSE:-the purpose of this practice is to apply a good estimation concrete materials.

Easy to prepared bill off materials.

CONDITIONS OR SITUATIONS FOR THE OPERATIONS:-

- ✓ Safe working area environment
- ✓ Availability of proper materials and equipments

EQUIPMENT AND TOOLS

-calculator

-ruler

CONSUMABLE MATERIALS

-paper

- pencil

PROCEDURE,

1. To Prepare a class room
2. To prepare material and equipment
3. Select the drawing according to the specification

PRECAUTIONS:- .

- ✓ Ensure the work area hazard free
- ✓ Make workstation comfortable
- ✓ Avoid horse play

QUALITY CRITERIA: Assured the performance of all the activities according to the specification and drawing

Information Sheet-6	Material handling

One of many hazardous workplaces includes the construction sites as they involve several dangerous tasks. Many studies have revealed that material handling equipment is a major cause of accidents at these sites. Though safety measures are being followed and monitored continuously, accident rates are still high as either worker are unaware of hazards or the safety regulations are not being strictly followed

Every material handling operation is different. Each part of the construction industry must take care to ensure safety practices are in place at every stage of handling various materials.

Planning Each Move

Materials should be moved only when necessary. When you plan to move, ship, or receive materials consider all parts of the operation:

- How will it be transported?
- Are the workers experienced enough?
- Do you have enough workers to do the job right?
- Are the packages or load sizes appropriate?

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When you think about how to handle materials or place them in storage properly, think about equipment that can assist you. Whenever possible use: Save your back and increase job efficiency by using the right tool for the right job. When manual assistance is required at any stage in the job, ensure that there are enough workers to share the work. By improving your handling procedures your safety record will improve.

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for more information, refer to current applicable Occupational Health and Safety Legislate

Storing Material

Proper way of storing material should be considered in schoolwork shops and training area and this has to be adopted in the real work of construction sites. It is use full to keep materials in a proper manner, to preserve materials long lasting, to secure chemical character of the material, for easy access and handling etc. In general proper way of storing material saves time and money. Accordingly methods of storing for some materials and hand tools are described and illustrated below.

Storing materials and tools depend up on the type, size, and product character, etc.

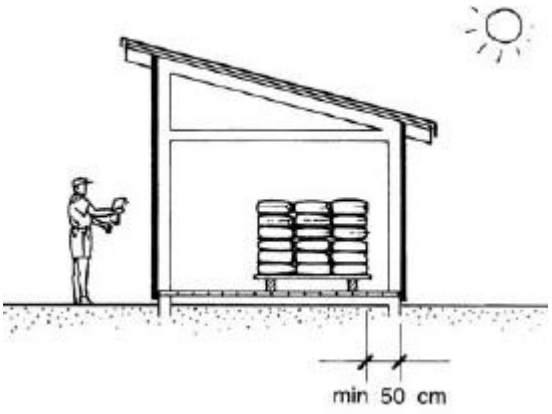
Storing of Binding Material /Cement and Lime/

Cement can be safely stored in bags for a few months if kept in a dry room. Paper bags are better for storing than jute bags because paper bags perform better in regard to quality deterioration due to moisture. During the monsoon time, the cement storage plays an even more important role, since the relatively higher humidity accelerates the deterioration process of the cement.

Cement bags should be stored on a raised wooden platform (e.g. timber pallets) about 15 to20 cm above the floor level and about 30 to 50 cm away from walls The cement

stack should not be more than 10 bags high. The bags should be placed close together to reduce circulation of air.

A cement bag should never be opened until its immediate use for mixing.



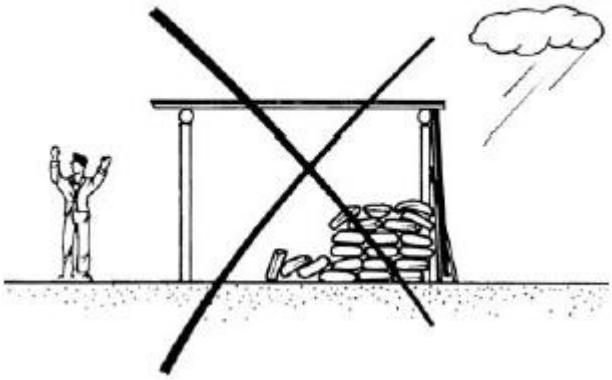


Fig .37 Fig.38

Use of fresh cement

Ordinary Portland cement, which has been stored for over six months, should not be used fo rconcret work.The average reduction of strength in a 1:2:4 mix as a result of storage is:

Fresh cement strength 100%

Cement after 3 months, strength reduced by 20%

Cement after 6 months, strength reduced by 30%

Cement after 12 months, strength reduced by 40%

Cement after 24 months; strength reduced by 50%

Storing of bricks, HCB and aggregates

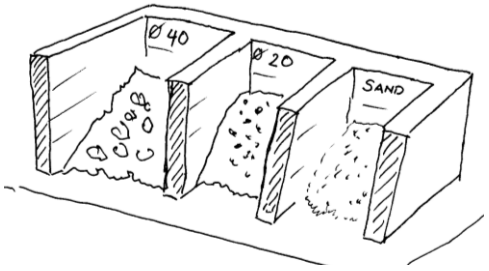
- Bricks and stones should be piled near where they are needed

- They should be handle carefully to minimize breakage
- They should be piled on edges and a layer crossing over the previous
- The piles should be stable.
- Aggregates /Sand and gravels/ should be stored in bunkers to protect from surrounding impurities.

Improper way of storing bricks!

Fig.39

Fig.40



Storing sand and gravel in bunkers

Fig.41

Self-Check 6	Written Test

Instructions: Answer all the questions listed below. Say true the question is correct or say false the questions in incorrect.

1. Cement can be safely stored in bags for a few months in a dry room (1.5 point)

2. Proper way of storing material saves time and money (1.5point)

3. Improved materials handling leads to less productivity and a pour safety record (1point)

Machining(2point)

4. Cement after 3 months, strength reduced by	A 50%
5. Cement after 6 months, strength reduced by	B 40%
6. Cement after 12 months, strength reduced by	C 30%
7. Cement after 24 months; strength reduced by	D 20%

Note:

- **Satisfactory rating – above 6 points**
- **Unsatisfactory - below 6 points**

Name: _____ Date: _____

Answer

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

LAP Test 1	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates /guide, and materials you are required to perform the following tasks within 45 minutes.

Task1.calculate the amount of concrete materials to required produce $4m^3$ concrete with mix ratio 1:2:4.Assume the density of cement $1400kg/m^3$, density of aggregate $2250kg/m^3$, density of sand $1840kg/m^3$and wastage and shrinkage factors 5%and 30%respectively

Annex I

Answer keys for learning guide -10

Answer key

Self check

Information Sheet-1

1, true 2, true 3, false 4, false 5.false

Information Sheet-2

1, D 2, c 3, E

Information Sheet-3

1, B 2, B 3.B 4.A. 5.D

Information Sheet-4

1, A 2.B. 3.A 4.B 5.B 6.C. 7.D 8.C. 9.B 10.A

Information sheet_5

1.D 2.B 3.B 4.D 5.A 6.A 7.B 8.C.. 9.D. 10 .E 11.F 12.G

Information sheet 6

1,true 2.True 3.False 4.False 5.D 6.c 7.B 8.A

Reference Internet1. “construction hand book Details: Caps and Copings, Corbels and Racking,” Technical Notes on Construction, 36A Revised, construction Institute of America, 11490 Commerce Park Dr., Reston, VA 22091.

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