



Carpentry Level I I

Learning Guide-40

Unit of Competence: Produce

Cement Concrete Casting

Module Title: Producing

Cement Concrete Casting

LG Code: EIS CRP2 M10 LO1-LG-40

TTLM Code: EIS CRP2 M10 TTLM 0919v1

LO 1: Plan and prepare work

**Instruction Sheet****Learning Guide #40**

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

- Obtaining, confirming and applying Work instructions
- Following Safety requirements
- Safety plans and policies
- Selecting tools and equipment
- checking for serviceability and rectifying or reporting any faults prior to commencement
- Calculating material quantity requirements
- Identifying, obtaining, appropriate Materials
- Identifying Environmental protection requirements

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:

- Obtain, confirm and apply Work instructions, including plans, specifications, quality requirements and operational details.
- follow Safety requirements in accordance with safety plans and policies including implementation of signage/barricade
- rectify and report prior to commencement select tools and equipment to carry out tasks are consistent with the requirements of the job, checked for serviceability and any faults
- calculate Material quantity requirements in accordance with plans and/or specifications
- identify, obtain and prepare, use appropriate Materials to the work application safely handled and made ready
- identify Environmental protection requirements for the project in accordance with environmental plans and regulatory obligations

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below 3 to 5
2. Read the information written in the information



3. Accomplish the “Self-check 1, Self-check, 2,Self-check 3” ,Self-check 4,Self-check 5 ,Self-check 6,Self-check 7,Self-check 8,in page 4, 10, 14, 21, 24, 29, 37,and, 40respectively.
4. If you earned a satisfactory evaluation from the “Self-check proceed to operation sheet,42
5. Do the “LAP test” 43

Information Sheet-1	Obtaining, confirming and applying Work instructions
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1.1. Applying Work instruction

Work Instructions are documents that clearly and precisely describe the correct way to perform certain tasks that may cause inconvenience or damage if not done in the established manner. That is, describe, dictate or stipulate the steps that must be followed to correctly perform any specific activity or work.

A document describing specific activities and tasks within the organization. It contains the greatest amount of detail.

As a component of a process, “defines how one or more activities in a procedure should be executed in detail, using technology or other resources.

Here are some examples of documented work instructions which may be found on a typical construction site:

- ✓ Working Drawings issued for construction such as Plans, elevations, sections etc.
- ✓ Specifications/Contract specifications
- ✓ Construction method statements
- ✓ Quality requirements
- ✓ Operational details
- ✓ Maintenance manuals

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1.2. Plan, specifications, quality requirements

plans and drawings their functions, the recognition of commonly used symbols and abbreviations, the identification of key features and specifications on a site plan, the comprehension of written job specifications and the recognition of document status and amendment detail.

A specification often refers to a set of documented requirements to be satisfied by a material, design, product, or service.

Specifications of required quality and components represent part of the necessary documentation to describe a facility. Typically, this documentation includes any special provisions of the facility design as well as references to generally accepted specifications to be used during construction.

Specifications are still as important as ever - even as the construction industry ... It can reference the quality and standards which should be applied. ... The drawing or model does not need to be overloaded with detailed information, as part of the soft landing process, subsequent asset management and the lifecycle plan.

Specification format table

Description of Material	Quantity	Unit	Unit Cost	Total Cost



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page

1. _____ is often refers to a set of documented requirements to be satisfied by a material, design, product, or service. (4 points)

- A. Specifications
- B. plans
- C. work instruction
- D. all

2. _____ is documents that clearly and precisely describe the correct way to perform certain tasks that may cause inconvenience or damage if not done in the established manner (4 points)

- A. Specifications
- B. plans
- C. Work instruction
- D. all

Note: Satisfactory above – 4 out of 8 points Unsatisfactory - below 4 out of 8 point

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Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____

2. _____



Information Sheet-2

Following Safety requirements

2.1. Occupational Health and Safety (OHS) requirements

2.1.1. Protective clothing and equipment

Personal protective equipment (PPE) is protective clothing, helmets, goggles, or other construction or equipment designed to protect the wearer's body from injury or infection. The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter

2.1.2. Use of tools and equipment

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



Fig2.1 Hard hat

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

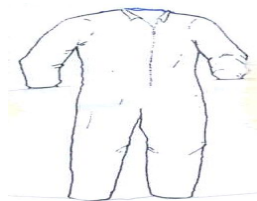


Fig2.2 Overall cloths

Safety shoe (boot):-Protects the worker from nail, sharp objects
hard-rolled leather shoes with metal toe caps.





Fig2.3 Non-slip oil resistant shoe

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



Fig2.4 Rubber boot

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



Fig2.5 Mask

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



Fig2.6 Goggles with safety glass or plastic lenses, heavy duty

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





Fig2.7Gloves

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

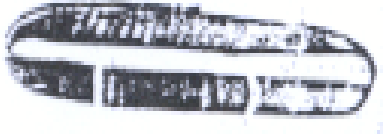


Fig2.8 Safety Belt

2.1.3. Workplace environment and safety

Organizations are legally responsible for establishing and maintaining a working environment where employees are able to work safely, without risk to their physical and psychological health and welfare.

Likewise, employees are obliged to: comply with any legislative requirements and organizational policies and procedures; work in accordance with agreed safe work practices; and use all means provided to protect their health and safety.

Employer and employee health and safety responsibilities are often prescribed in legislation and supported by regulations, codes of practice and standards. These provide a foundation for guidelines on workplace safety, compensation and rehabilitation.

2.1.4. Handling of materials

Material handling is the movement, protection, storage and control of materials and products throughout manufacturing, warehousing, distribution, consumption and disposal.

. The focus is on the methods, mechanical equipment, systems and related controls used to achieve these functions.

2.1.5. Use of firefighting equipment

Anyone who is likely to have to use firefighting equipment should be trained in its use and in basic fire-fighting techniques. It is also essential that the right type of extinguisher is used for the fire. ... Some water sprays and water mist extinguishers are approved for use on electrical equipment.

2.1.6. Organizational first aid

First aid is medical attention that is typically administered immediately after an injury or illness occurs. It usually consists of one-time, short-term treatment, such as cleaning minor cuts, treating minor burns, applying bandages, and using non-prescription medicine.

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

- Plaster

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

2.1.7. Hazard control and hazardous materials and substances

A hazard control program consists of all steps necessary to protect workers from exposure to a substance or system, the training and the procedures required to monitor worker exposure and their health to hazards such as chemicals, materials or substance, or other types of hazards such as noise and vibration

2.1.8. Emergency procedures such as:

- shutting-down and stopping
- extinguishing fires
- organizational first aid requirements and evacuation

2.1.9. Environmental requirements such as:

- Waste management
 - noise
 - dust
 - vibration
 - clean-up management

2.1.10. Safe operating procedures such as:

- conduct of operational risk assessment and treatments associated with hazards
- working with dangerous materials
- restricted access barriers
- traffic control
- working at heights
- working in proximity to others



Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. _____ is the movement, protection, storage and control of materials (1point)

- A. Specifications
- B. plans
- C. Material handling
- D. all

2. _____ is medical attention that is typically administered immediately after an injury or illness occurs (1point)

- A. Safety
- B. First aid
- C. Hazard
- D. all

Note: Satisfactory above – 3.5 out of 7 points
7point

Unsatisfactory - below 3.out of 7point

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Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____

2. _____



Information Sheet-3	Safety plans and policies
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3.1. Safety plans and policies

A Safety Plan is a written document that describes the process for identifying the physical and health hazards that could harm workers, procedures to prevent accidents, and steps to take when accidents occur. ... Many organizations compile their activity-specific safety plans into a single safety manual.

Workplace safety rules and general safety policies are necessary parts of a comprehensive safety program. In addition to general safety rules, job specific safety rules are needed to ensure task safety training addresses all hazards for each job.

- **Hazard Reporting**

Identification and reporting of potentially unsafe or unhealthful working conditions is the responsibility of all employees. Employees should be encouraged to report unsafe or unhealthful working conditions to their immediate supervisor to promptly investigate the situation and take appropriate corrective actions. .

- **Signs and Tags**

Signs and tags are not intended as substitutes for preferred abatement methods such as engineering controls, substitution, isolation, or safe work practices. Rather, they are additional safety guidance and increase the employee's awareness of potentially hazardous situations.

Tags are temporary means of warning all concerned of hazardous conditions, defective equipment, etc.

- **Planned Work**

Work shall be planned and supervised to prevent injuries in the handling of materials and in working together with equipment. Employees shall not enter manholes, underground vaults, chambers, tanks, silos, or other similar places that receive little ventilation unless it has been determined that it is safe to enter. Confined spaces can be quite hazardous from toxic fumes, gas, and other hazards can gather in the spaces creating a dangerous hazard. Machine guards and other protective devices must be in their proper place before machinery and equipment is used and employees must report any deficiencies or hazards to the supervisor when they are detected. If the equipment is unsafe to operate, do not operate the equipment until it has been replaced or repaired.

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- **Hazard Safety Control**

Substitution The risk of injury or illness may be reduced by replacement of an existing process, material, or equipment with a similar item having more limited hazard potential. Some examples include: brush painting instead of spray painting to reduce inhalation hazards, welding instead of riveting to reduce noise levels, use of safety cans instead of bottles to store flammable liquids,

Isolation Hazards are controlled by isolation whenever an appropriate barrier or limiter is placed between the hazard and an individual who may be affected by the hazard.

Ventilation The control of a potentially hazardous airborne substance by ventilation can be accomplished by one or two methods: diluting the concentration of the substance by mixing with uncontaminated air or capturing and removing the substance at its source or point of generation.

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Self-Check -3	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. _____ is a written document that describes the process for identifying the physical and health hazards that could harm workers (5 points)
 - A. Safety Plan
 - B. plans
 - C. Material handling
 - D. all

2. Which one the following Hazards are controlled by isolation whenever an appropriate barrier? (3point)
 - A. Safety Plan
 - B. Ventilation
 - C. Isolation
 - D. all

Note: Satisfactory above_4 out of 8 points

Unsatisfactory - below 4out of 8 point

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Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

1. _____

2. _____



Information Sheet-4	Selecting tools and equipment
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4.1. Construction Tools and equipment Pouring Cement concrete cast

1. Trowels

Trowels also help smooth concrete surfaces for their finish coats before being left to dry. Hand-troweling is common for smaller slabs, or power trowels are often preferred for large slabs. There are varying types of trowels for specific concrete work.



Fig 4.1 Trowels

2.Float Blades and Troweling Blades

A variety of blade types is available for floats and power trowels, each designed to accomplish different finishes. Some care must be taken during the troweling stage not to burnish the surface and prolong drying time.



Fig 4.2 Float Blades

3. Groove Cutter/Joiner Tool

For certain job types; grooving the surface also helps prevent cracking or excess damage from shrinkage as the concrete dries or during use.



Fig4.3Float Blades

4. Edger

an edger is a tool designed to round exposed concrete edges for a smooth finish.

5. Brooms

a traditional finish for a concrete slab is a broom finish – drawing a broom across the surface of the almost-dried concrete slab for a slip-resistant surface. The finished look can be a smooth draw or a more artistic pattern.

6. Polishers

After the slab has dried sufficiently, polishers can be used to produce a surface finish effect, from a gentle smoothing of the surface for traction and safety to a mirror-like shine for an aesthetic finish.

7. Mixers

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.



Fig4.4Mixer

8. Wheelbarrows

Ideal for transporting (or even mixing) small batches of concrete or tools on the job site.



Fig4.5Wheelbarrows

9. Rubber Boots or Work Boots

Concrete is stiff stuff, and wearing waterproof boots is the best way to get through it and prevent contact with your skin. It's also easy to rinse your footwear after the concrete is down.

10 Gloves

Many concrete mixes contain potentially caustic admixtures that can cause serious burns from extended contact with bare skin. Gloves prevent overexposure to these components (and save a few occasional blisters, too).

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Fig4.6Gloves

11. Safety Glasses

Standard on most job sites, wearing safety glasses is an important safety measure when drilling, grinding, power troweling or sawing concrete.

12. Levels

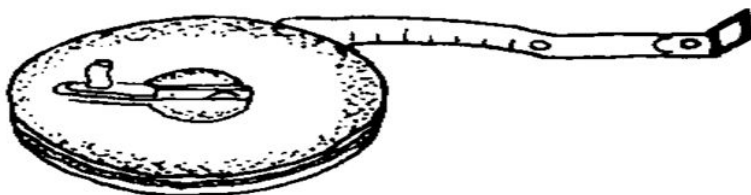
Both the sub-base and slab surface must be level. A standard long-line level, or a laser level, will let you verify that the slab is completely according to spec before pouring and after.



Figa4.7Levels

13. Tape Measures

Concrete forms and slab depth need the same “measure twice, pour once” verification as any other material on the job site. They are also useful for testing placement and mapping.



Figa4.8Tape Measures

14. Moisture Retarders

Moisture or vapor retarders are used to prevent water vapor from intruding on a finished concrete slab. They are generally placed directly under on grade or below grade slabs.

15 Saws

Reciprocating saws, circular saws or grinders can be necessary to cut rebar or forms on the

job site. They can also be necessary if a problem develops under the slab and a portion of the concrete has to be removed after it has set and dried.

16. Shovels

Shovels help distribute concrete around the job site to fill in gaps left during the pouring process or for smaller applications. Square-ended shovels generally work better for concrete; rounded ones spread concrete unevenly.



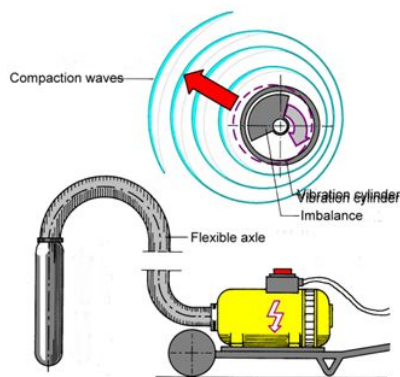
Figa4.8 Shovels

17. Rakes and Come-Along Rakes

using a rake is the quickest way to begin getting the freshly-poured concrete spread more uniformly into place. Garden rakes work but concrete rakes, also called come-along rakes; have a more scooped blade for more easily pre-leveling new concrete. Concrete rakes also have a tine on the back of the blade to help lift rebar or mesh into position before the concrete begins to harden.

18. Vibrators

Concrete vibrators help release trapped air pockets and excess water from the concrete mix to prevent possibly compromising problems in medium to high slump concrete.



Figa4.9 Shovels



20. Screeds

Screeds come in a variety of sizes and can be a specific tool (also called straight edges or bump cutters), or can be simple flat pieces of dimensional lumber. The purpose of a screed is to smooth concrete after it has been moved into place by scraping away any excess from the slab surface

Self-Check -4	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List the construction tools and equipment.(5 points)
2. What is the use of Wheelbarrows? (3point)



**Note: Satisfactory above_4 out of 8 points
point**

Unsatisfactory - below 4 out of 8

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

1. _____

2. _____



Information Sheet-5	checking for serviceability and rectifying or reporting any faults prior to commencement
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5.1. Checking for serviceability and rectifying

These checks will provide the driver with peace of mind and will also identify vehicle faults which, if not rectified, could lead to a situation where:

- The safety and reliability of the vehicle is compromised
- the driver may be penalized for driving vehicle which is not roadworthy

The checks can be performed quickly and do not require any special skills or tools with the exception of a tire pressure gauge.

. Vehicles that are found to be unsafe or defective must be withdrawn from service until repairs are completed.

Vehicles that are found to be unsafe or defective must be withdrawn from service until repairs are completed.

For civil engineering and many other industries, it is important to ensure that a structure meets the functional requirements – the Serviceability limit state (SLS). It does not involve collapse or strength of a building but impair its usefulness and stiffness.

What is a deflection check?

The deflection of members is one of the checks that should be performed for serviceability limit state design. **Deflection** is the displacement within a structural member under influence of loads, ignoring the displacements of the rest of the structure.

5.2. Reporting any faults prior to commencement

provide early warnings of potential *problems*, and central laboratory tests to support and confirm ... manufacturers' names appear in this *report* only because they are ... *Cement*, fly ash, slag, incompatibility, admixture, early stiffening, surface of *concrete cast* on an impermeable base far longer than for the same *concrete*

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Self-Check -5	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is deflection Check? (5 points)
2. What is the deflection of members? (3point)



**Note: Satisfactory above_4 out of 8 points
point**

Unsatisfactory - below 4 out of 8

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

1. _____

2. _____



6.1. Calculating material 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.

6.1.1. 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 calculate 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

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Basic data

Density of cement - - - - 1400 kg/m³

Density of Sand - - - - 1840 kg./m³

Density of Stone Aggregate - - - - 2250 kg/m³

Density of Lime - - - - 1900 kg/m³

Density of Cement Mortar - - - - 2300 kg/m³

Density of Compo Mortar - - - - 1200 kg/m³

Density of Tracheae - - - - 2600 kg/m³

Assume 30% Shrinkage and 5% wastage.

1) Concrete Mix = 1:3:6

Let volume of concrete = Zm³

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

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

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

C/ Material list Calculation

I Concrete

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Assuming 30% Shrinkage

5% Wastage

For: Mechanical mix Water = 0.4-0.5
Cement

Hand mix Water = 0.4-0.65
Cement

6.1.2 Concrete mix quantities calculation

Let us consider M20 concrete mix - 1:1.5:3

Total Volume = $1+1.5+3 = 5.5$

Consider, Wet volume = 1m^3

Dry Volume = $1.54 \times 1 = 1.54 \text{ m}^3$ (54% increases)

Cement:

Quantity of cement In Cubic meters = $1 \times 1.54 / 5.5 = 0.28 \text{ m}^3$

Quantity of cement in kg = $1 \times 1.54 / 5.5 \times 1440 = 403.2 \text{ kg}$ (Density of cement = 1440 kg/m^3)

Total no. of cement bags required = $403.2 / 50 = 8.064$ bags

Sand:

Quantity of sand in Cubic meter = $1.5 \times 1.54 / 5.5 = 0.42 \text{ m}^3$

Quantity of sand in kg = $1.5 \times 1.54 / 5.5 \times 1500 = 630 \text{ kg}$ (Density of sand = 1500 kg/m^3)

Quantity of sand in Cubic feet = $1.5 \times 1.54 / 5.5 \times 35.3147 = 14.83 \text{ cu.ft}$

Aggregates:

Quantity of aggregate in Cubic meter = $3 \times 1.54 / 5.5 = 0.84 \text{ m}^3$

Quantity of aggregate in kg = $3 \times 1.54 / 5.5 \times 1450 = 1218 \text{ kg}$ (Density of aggregate = 1450 kg/m^3)

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Quantity of aggregate in cubic feet = $3 \times 1.54 / 5.5 \times 35.3147 = 29.66$ cuff

Water:

For M20, 30 liters of water per 50kg cement should be used.

Total amount of water required = $30 \times 403.2 / 50 = 241.92$ liters.

For any construction request or queries please visit Brick Bolt packages or call us at 73488 4969

Self-Check -6	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. calculate the amount of concrete materials to required produce 6m^3 concrete with mix ratio 1:2:4. Assume the density of cement $1400\text{kg}/\text{m}^3$, density of aggregate $2250\text{kg}/\text{m}^3$, density of sand $1840\text{kg}/\text{m}^3$ and wastage and shrinkage factors 5% and 30% respectively (8point)

A, 1.17,, 2.34,,,4.68 m^3

B, 1.21, 2.12,, 4.8 m^3

C, 1.23,2.15,,4.8 m^3

D, 1.2 1,6. 12,, 4.8 m^3



**Note: Satisfactory above_4 out of 8 points
point**

Unsatisfactory - below 4 out of 8

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

1



Information Sheet-7	Identifying, obtaining, appropriate Materials
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7.1. Identifying, obtaining, appropriate Materials

7.1.1 Type of cementing material

1. Ordinary Portland Cement (OPC)
2. Portland Pozzolana Cement (PPC)
3. Rapid Hardening Cement
4. Quick setting cement
5. Low Heat Cement
6. Sulphates resisting cement
7. Blast Furnace Slag Cement
8. High Alumina Cement
9. White Cement
10. Colored cement
11. Air Entraining Cement
12. Expansive cement
13. Hydrographic cement

- **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 III, 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.

✓ **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 than 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.

7.1.2. Quantity of cement concrete material

Quantities of materials for concrete such as cement, sand and aggregates for production of required quantity of concrete of given mix proportions such as 1:2:4

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This method is based on the principle that the volume of fully compacted concrete is equal to the absolute volume of all the materials of concrete, i.e. cement, sand, coarse aggregates and water.

A Concrete structure may consist of beams, slabs, columns and foundations etc. based on type of structure. The volume of concrete required for concrete structure can be calculated by summing up the volumes of each structural member or each parts of members.

The volume of a rectangular cross sectional member can be calculated as length x width x height (or depth or thickness). Suitable formula shall be used for different cross-sectional shapes of members.

Let's calculate material required to prepare one cubic meter of M20 grade to concrete

Cement sand and aggregate ratio for M20 grade concrete is 1:1.5:3

1. Cement = 1 Part
2. Sand = 1.5 Part
3. Aggregate = 3 Part
4. Total Parts = 1 + 1.5 + 3 = 5.5
5. Total Material Required per cubic meter of concrete= 1.55

$$\begin{aligned}\text{Volume of cement needed} &= \text{Ratio of cement} * 1.57 / (1 + 1.5 + 3) \\ &= 1 * 1.57 / 5.5 \\ &= 0.285 \text{ cu.m}\end{aligned}$$

$$\begin{aligned}\text{Volume of sand needed} &= \text{Quantity of cement} * \text{ratio of sand} \\ &= 0.285 * 1.5 \\ &= 0.427 \text{ cu.m}\end{aligned}$$

$$\begin{aligned}\text{Volume of aggregate needed} &= \text{Quantity of sand} * 2 \\ &= 0.427 * 2 \\ &= 0.854 \text{ cu.m}\end{aligned}$$

7.1.3. Quality and sizes of standard and/or specialist:

- **Aggregates 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.

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- ✓ **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** aggregate Shape 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

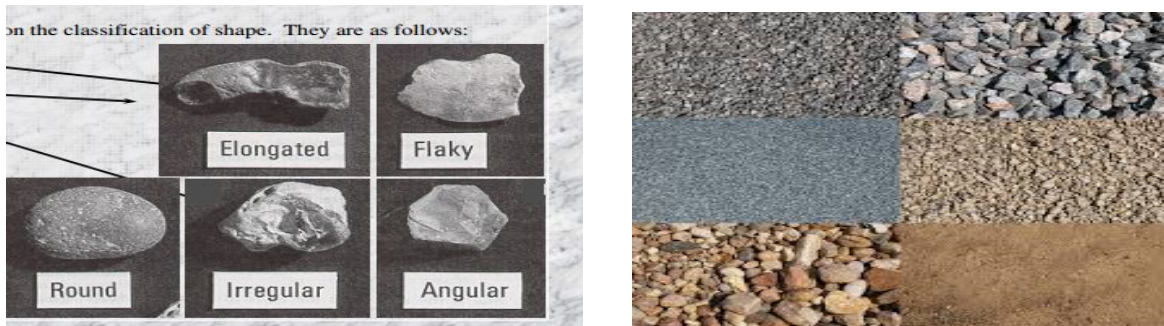


Fig 7.1 Aggregate Shape

- **sands and cement**

Fine aggregates are usually sand or crushed stone that are less than 9.55mm in diameter. Typically the most common size of aggregate used in construction is 20mm. A larger size, 40mm, is more common in mass concrete. Larger aggregate diameters reduce the quantity of cement and water needed.



Fig 7.2 Fine aggregates

- **Reinforcement material** was added to the matrix material to enhance the physical properties of the final composite material.
Reinforce basically means To give more force to a particular thing. Reinforcement plays a role in increasing the mechanical properties of a pure resin system, after reinforcing that material become composite material.



Fig 7.3 reinforcing material

- **A hollow container** used to give shape to molten or hot liquid material when it cools and hardens.



Fig 7.4 hollow container



- **fixings**

We carry extensive ranges of wood screws from quality brands such as time Also take screws, nails, nuts & bolts and various fixings. For livestock-on-hand information just click on the relevant product.

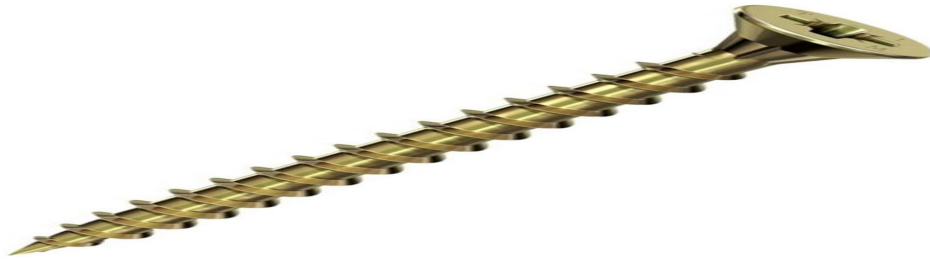


Fig 7.5 fixings

- **Release agents and additives**

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



Self-Check 7	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write Type of cementing material. (5 points)
2. Write concrete mixing material? (3point)



Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

1. _____

2. _____

**Information Sheet-8****Identifying Environmental protection requirements****8.1 Environmental protection requirements**

It is a necessary effort for all contractors to develop an environmental policy. Depending on the project, environmental protection can translate into time, money or both—as well as failure—to uphold a moral obligation to the community.

Failure to conduct an environmental review during the pre-construction phase of a project can lead to severe delays and work stop pages.

The environmental policy should contain a basic commitment to the environment and to environmental compliance.

Organizational tool a company can use to manage environmental responsibilities throughout the company or on a jobsite.

Even if an environmental review has been completed, project changes can affect environmental compliance. No matter how rigorous the planning and monitoring, it is likely that something will not occur as planned. Foresight into the following common changes can improve outcomes:

1. site conditions other than expected (e.g., soils are found to be more erosive or have a higher silt content than described in the technical studies);
2. discoveries of hazardous materials, or other features that cause a change in construction plans;
3. safety compromised due to environmental compliance (e.g., the permitted storm water conveyance system causes inadvertent flooding of the roadway);
4. access (e.g., the need to get equipment into a sensitive area due to restricted space);



5. changes in construction activities, location or sequencing (e.g., cannot complete in-water work by close of work window, need to change location of permanent or temporary storm water facility, etc.); and
6. Environmental commitments shown to be inappropriate or impractical.

Self-Check -8	Written Test
----------------------	---------------------

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

1. What is Environmental protection? (5 points)



Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

1. _____



Operation Sheet 1	Obtaining, confirming and applying Work instructions
--------------------------	---

Obtaining, confirming and applying Work instructions

Step 1- Interpreting Plans, drawings and specifications

Step 2 _ Applying workplace and equipment safety, and Quality requirements

Step 3- list out specific resources and tasks (material, equipment, man power, resources)

Step 4- Submit your report to your teacher/ instructor after the data is complete

Operation Sheet 2	Calculating material quantity requirements
--------------------------	---

Calculating material quantity requirements

Step 1 Interpreting Plans, drawings and specifications

Step 2- Calculate material requirements

Step 3- Find the total amount materials

Step 4- Submit your report to your teacher/ instructor after the data is complete



LAP Test	Practical Demonstration
-----------------	--------------------------------

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 1 hour.

Task1. How Obtaining, confirming and applying Work instructions?

Task2 how to Calculating material quantity requirements?



List of Reference Materials

1. <https://www.google.com/search?q=Handling+of+materials+&ie=utf-8&oe=utf-8>
2. <https://www.digitalcitizen.life/how-stop-shut-down-procedure-completing>
3. <https://www.safetyinfo.com/rules-policies-safety-index/>
4. <https://www.wagnermeters.com/concrete-moisture-test/concrete-info/30-top-tools-concrete-construction-site/>
5. <https://theconstructor.org/concrete/13-types-of-cement-uses/5974/>
6. <http://civilrmd.com/calculate-cement-sand-and-aggregate-for-nominal-mix-concrete/>
7. <http://www.greenspec.co.uk/building-design/aggregates-for-concrete/>
8. <http://constructionexec.com/article/what-does-environmental-protection-mean-to-the-construction->



Annex I

Answer keys for learning guide -40

Answer key

Self-check

Information Sheet-1

1, A 2, C

Information Sheet-2

1, C 2, B

Information Sheet-3

1, A 2, C

Information Sheet-4

- 1. Trowels, Shovels, saw, mixer**
2. Ideal for transporting (or even mixing) small batches of concrete or tools on the job site

Information Sheet-5

- 1.** Deflection is the displacement within a structural member under influence of loads, ignoring the displacements of the rest of the structure.
2. One of the checks that should be performed for serviceability limit state design

Information Sheet-6

1. A

Information Sheet-7

1. Ordinary Portland cement (OPC)
Portland Pozzolana Cement (PPC)
Rapid Hardening Cement

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Quick setting cement

2. Cement, sand, aggregate, water

Information Sheet-8

1. It is a necessary effort for all contractors to develop an environmental policy

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			Bureau		
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