Carpentry

Level-II

Learning Guide-22

Unit of Competence: use carpentry hand and power tools

Module Title: using carpentry hand and power tools

LG Code: EIS CRP2 M06 LO1-LG-22

TTLM Code: EIS CRP2 M06 TTLM 0919v1

LO 1: Plan and prepare

Instruction Sheet	Learning Guide #22

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

- Obtaining, confirming and applying Work instructions and operational detail
  - Undertaking planning and preparation
- Following Safety (OHS) requirements
- Identifying and implementing Signage and barricade requirements
- Selecting Plant and equipment
- Calculating material quantity requirements
- Identifying, obtaining, preparing, safely handling and locating appropriate materials

- Identifying Environmental requirements
- Applying statutory and regulatory authority obligations

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**:

1.1 . Obtain confirm and apply Work instructions and operational details from relevant information to undertake *planning and preparation*.

1.2 . Follow *Safety (OHS)* requirements in accordance with safety plans and policies**.**

1.3 . Identify and implement .Signage and barricade requirements

1.4 . Select *Plant and equipment,* to carry out tasks are consistent with job requirements**,** checked for serviceability**,** and any faults are rectified or reported prior to commencement**.**

1.5 . Calculate Material quantity requirements in accordance with plans, specifications and *quality requirements*.

1.6 . Identify, obtain and prepare, *Materials* appropriate to the work application are safely handled and located ready for use**.**

1.7 . Identify *Environmental requirements* for the project in accordance with environmental plans and *statutory and regulatory authority* obligations, and are applied.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, up to Sheet 9”.
4. Accomplish the “Self-check after each information sheet respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheets
6. Do the “LAP test” (if you are ready).

Information Sheet-1	Obtaining, confirming and applying Work instructions and operational detail

1.1. Obtaining, confirming and applying Work instructions and operational detail

- **Introduction to work instruction**

As a carpenter on a construction site or in a joinery workshop, you'll be required to use a large variety of tools and equipment to complete your work tasks. Every job you do requires planning and preparation before you even pick up a tool. You will need to consider:

• The task and the work environment
• The tools and equipment you'll be using
• The materials you'll need
• The safety and environmental requirements.

- . **A standard operating procedure** (**SOP**)

SOP Is a set of step-by-step instructions compiled by an organization to help workers carry out complex routine operations? SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations.

A procedure is a document that instructs workers on executing one or more activities of a business process.

[1] It describes the sequence of steps, and specifies for each step what needs to be done, often including when the procedure should be executed and by whom.

[2]Organizations typically document procedures in their published Policy and Procedures guide, or their Standard Operating Procedure guide.

While procedures typically detail high level steps, a Work Instruction would provide more detail, for example the tools to use and how precisely to use the tools to carry out the procedure.

- **Workplace operations**

Continually monitoring and looking for ways to improve **workplace operations** can help an organization stay on financial track and keep delivering top quality products and services. You need to monitor workplace operations so you can develop strategies to improve procedures and protocols. As a business scales up in sales or in size, the task of monitoring becomes more important and complicated.

Monitoring operations requires management oversight, employee feedback and customer reviews. It can help provide specific directions for employees, which can lead to improved time management and increased productivity.

Improving workplace operations requires analyzing collected data to identify the underlying problems and to find resolutions and methods to deal with them. Here we outline few key steps to quality monitoring your business operations to ensure your organization remains competitive

- **Measurement of the operative performance**

To measure your work place performance company in an effective way, you need to establish indicators that allow you to know the results and how to make the suitable adjustments when it is necessary. Each area within the company has its own mechanisms, needs and resources. It is important to have an analysis of how each separate area is performing to achieve its specific objectives.

- **Implement operational process improvements**

A results-oriented improvement plan focuses on improving cost, quality, service or speed. Action steps range from making minor changes that eliminate duplicate steps or other workflow redundancies to redesigning an entire process. An implementation includes analyzing, prioritizing and reassembling tasks and operational steps.

- **Collect relevant data**

There are many ways to collect data via regular monitoring and surveying. Many businesses use a customer retention management (CRM) software. Software capabilities vary but most offer several ways to monitor workplace operations. All relevant information coming out from outbound calls, prospect contacts calls, correspondence, offline and online surveys, follow-ups and sales should be registered and analysed. Right now you can find in the market software that even help track orders and send follow up offers.

Beyond technology, you can use site operations, employee surveys and customer feedback to collect valuable data about how your company is delivering its product or service. Site operations may be done by management, owners or by a third-party consulting firm, offering an outsider's perspective on operations. Employee surveys provide valuable feedback on areas of inefficiency that employees experience daily, such as consistent inventory issues. Customer reviews, whether solicited or gathered via online social media channels, tell companies about the user experience. At times, when everything seems to be going smoothly, it might be the customer review that points out something otherwise overlooked.

- **Analyze all collected information**

As a business owner, you should look at data regularly to understand patterns and to look for anomalies. Although there might not be a monthly site review, employers can use other collected data to get an understanding what's working well and what isn't.

1.1.1 Undertaking planning and preparation

- **Planning and preparation for work**

Before undertaking any construction project or task, it's important you know exactly what you're required to do and how to do it effectively and safely. There are many sources of information that you'll use to identify work tasks, including:

- Instructions from your supervisor
- Plans, working drawings and specifications for the project
- Manufacturers' recommendations or instructions
- Legislation, Regulations and standards
- Toolbox meetings (safety information meetings)
- Safety signs
- Memos, bulletins and schedules

When you receive information or instructions, you must make sure you've interpreted everything correctly and then confirmed the details, because misunderstandings can lead to serious and costly consequences. You can clarify and confirm your understanding of what you're meant to do on a construction task by:

- Asking for more information
- Asking the speaker to repeat what they said
- Researching in trade publications or the internet
- Asking a more experienced workmate or supervisor
- Checking documentation including legislation, standards, policies and procedures, manufacturers' specifications and safety data sheets (sds).

- **Special requirements**

Before you start work, you need to be aware of any company policies, procedures or requirements that you must comply with when you're using tools, plant or equipment in a workshop or on a worksite. While these policies and procedures may vary from company to company, they will commonly cover the quality of work required, the tools to be used, how they should be maintained and stored, and the safety procedures to be followed.

Laws and Regulations Many aspects of building and construction are governed by laws and Regulations. For example, the times that power tools, plant and equipment can be used on a worksite are restricted in some circumstances and there are penalties if these restrictions are not adhered to. You must also take into consideration the WHS Regulations in most country that state that all electrical equipment used in construction work must be regularly inspected, tested and maintained by a competent person to ensure it's safe for use.

Assessing site conditions Construction site conditions should be inspected and assessed before any work is started. This process can include:

• Identifying potential hazards
• Locating site sheds for the safe storage of materials and equipment
• Determining the position of power supplies
• Identifying a water supply and sanitary arrangements
• Identifying waste disposal procedures and facilities

• Locating suitable access (entry) and egress (exit) points.
You'll need this information to determine what tools and equipment are available, where and how they'll be used and the supporting facilities like power sources that are available so you can complete your tasks. It's also essential that you plan and prepare carefully so that you ensure your own health and safety and that of your workmates.

- **Organizing tools,**

plant and equipment Once you've determined what work task you're going to do (the job) and where you're going to do it (the site), you have to make sure you've got the right tools, plant and equipment.

All equipment needs to be assessed before it's used to make sure it's suitable for the job. For example, the tools used to work with timber, metal or masonry can be quite different. For instance, you wouldn't use a large sledgehammer to drive in small nails. Some plant and equipment is expensive and used only rarely so it may be hired when needed. Part of the planning process may also involve contacting hire companies to check availability or organize delivery. It's particularly important that tools and equipment are inspected for defects or faults before you start work. You must report any problems you find immediately to a store person or supervisor

Organizing materials

Establishing the materials needed for a task and making sure they're located where they're needed are vital aspects of all construction tasks. Information about the materials needed, details of the preferred type or brand, required characteristics, eg size, quality, fire resistance, colour and quantity needed is generally found in the plans and specifications for the building project.

The materials must meet certain standards, particularly in relation to safety and application, ie how and where materials can be used. These are called quality requirements and details of these can be found in:

- Legislation and codes of practice
- Australian Standards®
- Company policies and procedures
- Manufacturers' specifications.

Materials should be available where they're needed and when they're needed, eg just before the trades person who needs them is ready to start, to make sure they're not in the way, stolen or damaged. Storage of materials when they arrive and how they'll be safely handled must also be considered.

Self-Check -1	Written test

Direction: 1 Match column A with column B listed below. Use the Answer sheet provided in the next page:

Column A	**Column B**
1. A step by step instruction complied by organizations.	A) Management oversight & customer review
2. Help an organization on financing track keep delivering top quality products and services.	B) Operational process
3. It can help to provide specific direction for employees.	C) A standard operating procedure
	D) Work place operation

Direction: 2 choose the correct answer for all the questions listed below. Use the Answer sheet provided in the next page:

1. Which of the following source of information to identify work tasks
   A. Instruction from supervisor
   B. Plans & working drawings
   C. Manufacturer recommendation
   D. All of the above
2. Before starting works at work place you have to make sure you got the right tools, plants and equipments. This process is said to be:-
   A. Organizing tools
   B. Organizing materials
   C. Organizing labors
   D. Organizing work place area
3. The material must meet certain standards particularly in relation to safety & applications, how and where materials can be used. These are called
   A. ISO standard
   B. Quality requirements
   C. Material requirements
   D. Building codes

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Matching Questions

1. ----------
2. ----------
3. ----------

Multiple choice Questions

1. ----------
2. ----------
3. ----------

Information Sheet-2	Following Safety (OHS) requirements

1.2. Following Safety (OHS) requirements

- **Working safely**

Whenever you're using any tools, plant or equipment, it's vital that you do so safely and in accordance with WHS legislation, Regulations and codes of practice. All sites will have a site safety plan that outlines safe work practices and the actions that need to be taken in certain situations, including who to contact in an emergency, evacuation procedures and details of first aid personnel. It's important that you familiarize yourself with this document and know exactly what you have to do to work safely and respond appropriately in emergencies.

- **Health safety and environment**

Procedures are extensively employed to assist with working safely. They are sometimes called safe work methods statements (SWMS). They are usually preceded by various methods of analyzing tasks or jobs to be performed in a workplace, including an approach called job safety analysis, in which hazards are identified and their control methods described. Procedures must be suited to the literacy levels of the user, and as part of this, the readability of procedures is important

A Safe Work Procedure is a step by step description of a process when deviation may cause a loss. This risk control document created by teams within the company describes the safest and most efficient way to perform a task. This document stays in the Health & Safety system for regular use as a template or guide when completing that particular task on site

- **Requirements of Safe Work**

The document generally lists the associated hazards involved in performing a task, what risk score is associated with the hazards (using a risk matrix), what personal protective equipment is required, and the steps involved to complete the activity without incident.

The document is split up to meet the above requirements as follows

- **Hazards and risks**

Construction sites contain many dangers or hazardous situations which need to be identified and eliminated where possible. You can achieve this by making an inspection of the site and completing or referring to safety documentation.

Job safety analysis (JSA)
Safe work method statement (SWMS)
Safety data sheet (SDS)
These documents are often mandatory on construction sites to ensure the safety of all workers, site visitors or members of the public. Most construction sites have policies and procedures that tell you how to report hazards, accidents or incidents (near-misses). If you have an accident, near miss or spot any potential hazards on site, you should contact your employer or supervisor immediately and let them know.

- **Personal protective equipment (PPE)**

Personal protective equipment (PPE) is anything that's used or worn by construction workers to minimize risks to their health or safety. PPE must be seen as the last line of defense for protection against workplace hazards and should be used only where there are no other control measures available or in addition to other control measures.

When you choose PPE, it's important that it complies with the relevant is suitable for the work to be carried out and the workplace conditions. It's the employer's responsibility to provide employees with appropriate PPE (free of charge) and it's the worker's responsibility to use the equipment and look after it.

- **Personal safety, working clothes and shoes**
  - ✓ **Personal safety**

It is dangerous to work with sharp edge tools and talk at the same time. Be agreeable with your neighbor workman. Respect his right and privileges. Remembering accidents prevented today will help make a living tomorrow. Some safety procedures should be followed at all times. Pay close attention to what is being done.

The primary important to protect the workman from accidents is to identify possible hazards and take the necessary safety measures to eliminate the hazardous. Before you go to work on any job, make sure your entire body is properly protected and provided other personal protective equipment.

Safety elements or hard hats should be wear by workers in all construction site where they might be exposed to head injury from falling objects.

- **Safety equipment**
  - ✓ **Helmet**

Protects the carrier from down falling items. It should be a must for everybody who works or moves on a building site.

fig 1 helmet

  - ✓ **Ear protection**

Protects the carrier from damages of the ears. Continuously working in a very noisy environment harms the eardrums forever. Once the eardrums are damaged there is no way of restoring the sense of hearing again.

Fig 2 Ear protection

- ✓ **Safety boots**

Safety boots are equipped with three safety measures.

fig 3 safety boots

It must have:

1. Toes protection hood

A steel hood to protect the toes from down falling heavy thing

2. A steel layer inside the soles protects the carrier from stepping into a turned up nail. Benzene and oil resistant soles

- ✓ **Safety goggles**

Necessary during chiseling and grinding work, protects against chips sparking around from the work piece

fig 4 **Safety goggles**

- ✓ ***Safety belts:***

Nylon webbing with locking device and drop D-ring, adjustable length, to be used also with tool pockets, to meet recognized safety standard, (has width of 45mm)

- ✓ **Wearing clothes**

These are generally worn as a means of protecting. Such protective clothing should be changed and washed quickly and is best kept in a locker or store at the place of work

Self-Check -2	Matching items

Directions: Match column A with column B all the questions listed below. Use the Answer sheet provided in the next page:

Column A

1. The outline of safe work practice
2. A risk control document included a step by step description of a process
3. Anything that wear by construction workers to minimize risks to their health or safety
4. Protect you from down falling items

Column B

A) Ear protector
B) Site safety plan
C) PPE
D) Safe work procedure
E) Helmet

Note: **Satisfactory rating – 3 and 4 points** **Unsatisfactory - below 3 and 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Matching question

1. ----------
2. ----------
3. ----------
4. ----------

Information Sheet-3	Identifying and implementing Signage and barricade requirements

1.3 Identifying and implementing Signage and barricade requirements

- **Signs and barricades**

When you're working with tools, plant and equipment, it's important that safety signage and barricades are put in place to warn other workers, site visitors or members of the public about any potential hazard.

Barricades may be required to restrict access to areas where cutting tools or tools like nail guns that fire projectiles are used.

- **Safety Sign Requirements**

It shall be ensured that safety signs are erected to warn workers of specific hazards and to communicate necessary precautionary measures and emergency actions. As a minimum, it shall be ensured that safety signs are erected in accordance with Queensland Work Health and Safety Regulation 2011, including, but not limited to:

• Confined spaces;
• Specific personal protective equipment (ppe) requirements;
• Hazardous chemicals;
• Asbestos;
• Lead;
• Fire protection equipment;
• Hazardous areas;
• Emergency and first aid information;
• Emergency eyewash and shower; and
• Traffic management and pedestrian control.

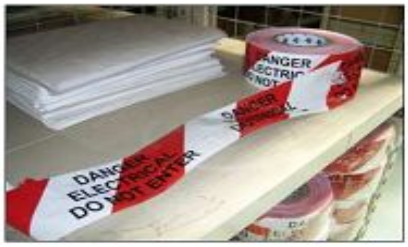
Safety signs erected shall meet the requirements of the relevant legislative requirement and Australian Standards (refer References).

- **Barricading Requirements**

Barricading controls shall be implemented and authorized as part of the safe work system to protect persons from hazards such as:

- ✓ Being struck by falling objects;
- ✓ Being struck by moving plant;
- ✓ Fall from height, including falling into open excavations, penetrations, and falls from unprotected edges such as removed flooring, walkways, stairs and / or hand railings.
- ✓ Exposure to hazardous chemicals;
- ✓ Unauthorized entry into a confined space or work area; and
- ✓ Any potentially hazardous work processes, for example, hot works, scaffolding, radiation work and work involving asbestos. Barricading controls shall also be implemented and authorised as part of the incident management and emergency response procedures

Types of Signs and barricades

Type of Barricade	Examples of Signage Note signs may not be exactly the same as the sign shown.
Caution Barricade Tape (soft barricade) 	
Danger Tape (soft barricade) 	
Restricted Access Electrical Work Barricade Tape (soft barricade) 	
Restricted Access (hard / solid barricade) 	

Type	Requirements	Example
Prohibition Sign	An action or activity is not permitted.	
Mandatory Sign	An instruction must be carried out.	
Limitation Sign	Defined limit on an activity.	
Danger Sign	Indicate imminent risk of injury to a particular hazard or hazardous situation that is likely to be life threating if ignored.	
Warning / Caution Sign	Indicate potential risk of injury due to a particular hazard or hazardous situation that is not likely to be life-threatening.	

Self-Check -3	True False items

Directions: Say True for the correct one and False for the incorrect all the questions listed below. Use the Answer sheet provided in the next page:

1. Barricades are that mach not important for using of tools & equipment
2. Traffic mgt and pedestrian control is one of safety regulation at construction site
3. Requirements for mandatory sign is an instruction must be carried out
4. Requirements for warning caution sign is an action or activity is not permitted

Note: **Satisfactory rating – 3 points** **Unsatisfactory - below 3 and 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

True or False Questions

Information Sheet-4	Selecting Plant and equipment

1.4 Selecting Plant and equipment

- **Introduction**

Good project management in construction must vigorously pursue the efficient utilization of labor, material and equipment. The use of new equipment and innovative methods has made possible wholesale changes in construction technologies in recent decades. The selection of the appropriate type and size of construction equipment often affects the required amount of time and effort and thus the job-site productivity of a project. It is therefore important for site managers and construction planners to be familiar with the characteristics of the major types of equipment most commonly used in construction.

- **Factors behind the selection of construction equipments**

✓ **Economic Considerations:** The economic considerations such as owning costs, operating labor costs and operating fuel costs of equipment are most important in selection of equipment.

✓ **Company-Specific:** The selection of equipment by a company may be governed by its policy on 'owning' or 'renting'.

✓ **Site-Specific:** -both ground conditions as well as climatic conditions-may affect the equipment-selection decision. For example, the soil and profile of a site may dictate whether to go for a crawler mounted equipment or a wheel-mounted equipment. If there is a power line at or in the vicinity of site, one may go for a fixed-base kind of equipment rather than a mobile kind of equipment.

✓ **Equipment-Specific:** Construction equipments come with high price tags. While it may be tempting to go for the equipment with low initial price, it is preferable to opt for standard equipments. Such equipments are manufactured in large numbers by the manufacturers, and their spare parts are easily available, which would ensure minimum downtime. Besides, they can also fetch good salvage money at the time of their disposal.

✓ **Client and Project-Specific:** The owner/client in a certain project may have certain preferences that are not in line with the construction company's preferred policies as far as equipment procurement is concerned. The schedule, quality and safety requirements demanded of a particular project may in some cases force the company to yield to the demands of the client.

✓ **Manufacturer-Specific:** A construction company may prefer to buy equipment from the same manufacturer again and again, and that too from a specific dealer. This may be to bring in uniformity in the equipment fleet possessed by the company or because the company is familiar with the working style of the manufacturer and the dealer.

✓ **Labor Consideration:** Shortage of manpower in some situations may lead to a decision in favour of procuring equipment that is highly automated. Further, the selection of equipment may be governed by the availability or non-availability of trained manpower.

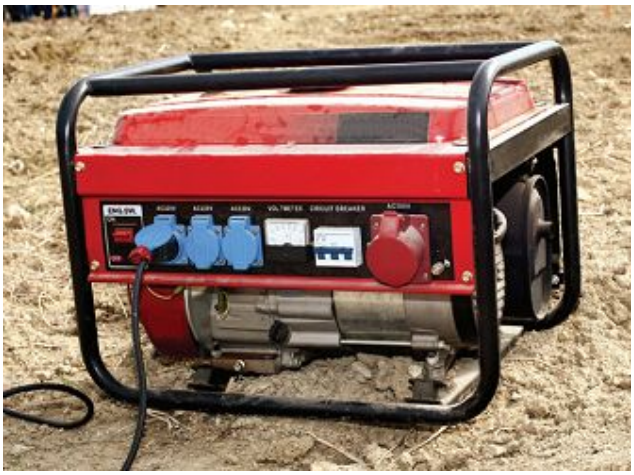
- **Selecting Portable power equipment**

You can carry out most carpentry tasks using a combination of hand, power or battery-operated tools, and most construction sites will have a temporary electricity supply which you can use to power tools. However, there may be situations where there's no electricity supply

available or compressed air is required to power pneumatic tools – that's when portable power equipment can be used as an alternative.

✓ **Portable electricity generator**

Portable electricity generators are often used on construction sites where mains powered electricity is not available. They can be powered by petrol, LPG or diesel and are used to supply 240 volt power to operate electrical powered tools and equipment.

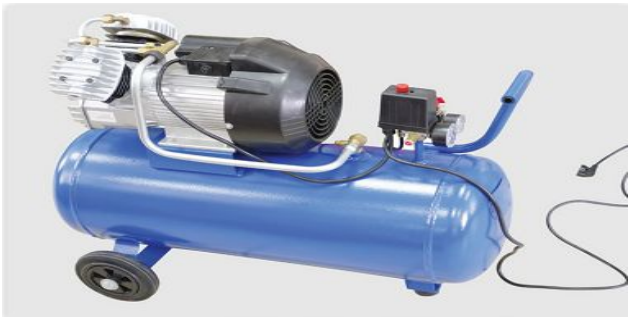


✓ **Safety – Portable electricity generators**

- Never use a generator in an enclosed area. Generator engines can produce toxic fumes, eg carbon monoxide.
- Use a battery powered carbon monoxide detector in the area where you're running the generator to protect yourself and others from a dangerous build-up of fumes.
- Petrol and its vapor can also be extremely flammable. Allow the compressor engine to cool before re fuelling.
- If you use extension leads, ensure they are earthed and check the maximum current rating of the extension lead (10 amps, 13 amps etc).

✓ **Pneumatic compressor**

The pneumatic compressor is a device which compresses and stores air under pressure. It is used to operate nail guns, paint spraying equipment, sand blasters and small air tools. Compressors can be either a permanent fixture in a joinery workshop or a portable unit used for work on a construction site. They're driven by a motor that can be powered by either petrol, LPG, diesel or electricity.



✓ **Safety – Pneumatic compressors**

- Never use a compressor in an enclosed area. Petrol driven compressor engines can produce toxic fumes, eg carbon monoxide.
- Use a battery powered carbon monoxide detector in the area where the compressor is being used to protect yourself and others from a dangerous build-up of fumes.
- Petrol and its vapor can be extremely flammable. Always allow the compressor engine to cool before re fuelling.

Self-Check -4	Multiple choice

Directions: choose the correct Answer from the alternatives for all the questions listed below. Use the Answer sheet provided in the next page:

1. Which selection of equipments is not categorized under economic consideration
   A. Owning cost
   B. Operating fuel cost of equipment
   C. Manufacturing cost
   D. Operating labor cost
2. “Buying of equipments from the same manufacturer again and again , it may be brin uniformity in equipments” which factors of the selection of construction equipments support this idea?
   A. Company specific
   B. Manufacturer specific
   C. Equipment specific
   D. Client and project specific
3. Which portable power equipment is stores air under pressure
   A. Pneumatic compressor
   B. Electric generator
   C. Spray gun
   D. EPT

Note: **Satisfactory rating – 2 points** **Unsatisfactory - below 2 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Multiple choice Questions

1. ----------

2. ----------

3. ----------

Information Sheet-5	Calculating material quantity requirements

1.5 Calculating material quantity requirements

- **Principles of Estimating**

Estimating is the calculation of the approximate amount of material and/or labor requirements to build a construction project. Estimates are prepared from finished working drawings and project specifications.

Qualifications:

Be able to read and scale drawings.

Posses a good working knowledge of math.

Be able to visualize the work required.

Working knowledge of construction methods and materials.

Knowledge and ability to assemble materials into working units.

- **Basic Calculations**
  - **Measurement:**
    Descriptions of materials and items of work.
    Dimensions of items of work, and materials required.
    Calculating the quantities of materials, and items of work.
  - **Pricing:**
    Arithmetic used to determine the costs of items

Name some of the qualifications an estimator need to have in order to compile accurate estimates. the two basic calculations involved in construction project estimations are:-

1. Mathematical Equations
2. Perimeter rule

1) Mathematical Equations

The application of basic mathematical computations is all that is necessary to compile accurate project material and/or labor requirements.

Three basic conversions:

Linear
Area
Volume

Linear Conversion (Inches / Feet)

Conversions used to determine such items of work such as: rafter, joist & stud requirements.

Feet x 12 = inches

3' x 12 = 36"

Inches / 12 = Decimal feet

36" ÷ 12 = 3'

Fractions:

Numerator / denominator = Decimal parts of an inch.

¾": 3 ÷ 4 = 0.75"

Decimals:

Decimal parts of an inch / 12 = Decimal parts of a foot.

0.75" ÷ 12 = .0625'

Area Conversion (Square Feet)

Conversion used to determine such items of work such as: plywood, paint, siding & concrete block requirements.

Rectangles:

Walls: L (ft) x H (ft) = Area (sqft/sf)

Floors: L (ft) x W (ft) = Area (sqft/sf)

10' x 8' = 80 sqft

Triangles:

$$\frac{\text{Base (ft) x H (ft)}}{2} = \text{Area (sqft/sf)}$$

$$\frac{10' \times 10}{2} = 25\text{sqft}$$

Trapezoids:

H (ft) x ½ the sum of the parallel sides = Area (sqft/sf)

10' x ((20 + 40) ÷ 2) = 300 sqft

Volume Conversion (Cubic Feet & Cubic Yards)

Conversions used to determine such items as concrete, sand, aggregate & mortar.

L (ft) x W (ft) x H (ft) = Volume (cuft/cf)

10' x 10' x 8' = 800 cuft

Volume (cf) ÷ 27 = Volume (cuyd/cy)

800 cf ÷ 27 = 29.63 cuyd

Volume (cy) x 27 = Volume (cuft/cf)

29.63 y x 27 = 800 cuft

2) Perimeter Rule

A progressive calculation to compute areas and volumes.

Rectangular Shaped:

Footing dimensions:

Length: 32.67'

Width: 16.67'

Height: 0.67'

Depth: 1.33'

(Outside length (ft) + Inside width (ft)) x 2 = Total perimeter length (ft)

(32.67' + 14.01') x 2 = 93.36'

Total perimeter length (ft) x H (ft) = Area (sqft/sf)

93.36' x 0.67' = 62.55 sqft

Area (sf) x D (ft) = Volume (cuft/ft)

62.55 (sf) x 1.33' = 83.19 cuft

Irregular Shaped:

Pentagon (5 sides)

Footing Length (one side): 20.48'
Height: 0.67'
Depth: 1.33'
Total outside perimeter length: 102.4'
Total inside perimeter length: 95.75'

(Outside Length (ft) + Inside Length (ft)) ÷ 2 = Total continuous perimeter length (ft)

(102.4' + 95.75') ÷ 2 = 99.08'

Total continuous perimeter length (ft) x H (ft) = Area (sqft/sf)

97.58' x 0.67' = 66.38 sqft

Area (sf) x D (ft) = Volume (cuft/cf)

66.38 sqft x 1.33' = 88.28 cuft

Standard Lumber Length Calculation

Used to determine the optimum length of lumber to minimize waste, when cutting specific small items of work.

Used for:

Bridging
Blocking
Treads & Risers
Headers
Jack Studs etc…

Standard Length Calculation (Part 1)

Length In Place (LIP) Measurement (in): Actual length of one piece of the small item of work

Quantity of LIP Requirements (ea): Counted off drawings or by calculation.

Convert Standard Lengths (in): Convert each standard length of lumber to inches.

8' x 12" = 96"	14' x 12" = 168"
10' x 12" = 120"	16' x 12" = 192"
12' x 12" = 144"	

Standard Lumber Length Calculation (Part 2)

Number of LIP Pieces: Number of LIP pieces that can be cut from each Standard Length of Lumber.

Standard lumber length (in) ÷ LIP Measurement (in) = LIP pieces per standard lumber length. (**Round Down**)

- ***96" ÷ 21" = 4 Lip Pieces***

Number of Standard Lengths: How many Standard Lengths required to cut all LIP Pieces.

Total LIP Requirements 4 Total LIP Pieces per Standard Lumber Length = Total Standard Lumber Lengths required. (**Round Up**)

13 ÷ 4 = 4 8' Lengths of Lumber

Standard Length Calculation (Part 3)

Standard Length to Use to minimize waste.

Standard Lumber Length x Number of LIP Pieces which can be cut from that length = Total Linear feet of Standard Lumber Length.

8' x 4 = 32'

Compare each value. The lowest value will identify the Standard Lumber Length with the minimal amount of waste.

Standard Lumber Length Calculation Example

13 pieces of floor bridging, 1'-9" long are needed to stiffen the floor joists.

Converted standard length	**LIP pcs cut from std lgth**	**number of std length**	**standard lgth to use**
8' x 12" = 96"	96" ÷ 21" = 4	13 ÷ 4 = 4	8' x 4 = 32'
10' x 12" = 120"	120" ÷ 21" = 5	13 ÷ 5 = 3	10' x 3 = 30'
12' x 12" = 144"	144" ÷ 21" = 6	13 ÷ 6 = 3	12' x 3 = 36'
14' x 12" = 168"	168" ÷ 21" = 8	13 ÷ 8 = 2	**14' x 2 = 28'**
16' x 12" = 192"	192" ÷ 21" = 9	13 ÷ 9 = 2	16' x 2 = 32'

Material Takeoff List (MTO)

MTO: Lists all items of work, detailing:

- Dimensions
- Quantities of work
- Units of measure conversions

Rules for Compiling:

- Study *all* drawings, notes & specifications.
- Measure everything as shown.
- Measure everything you can see.

Time Savers

- Never use long words if short ones will do.
- Use abbreviations.
- Keep all dimensions, figures and notes.
- Always start in the same place on each drawing.
- Highlight / mark-off items, notes and specifications when completed.
- Take advantage of duplication of design.

MTO - PRECEDENCE

If a work item is different, list it separately on the MTO. The items of work are estimated in a logical sequence using the following order of precedence:

1st – EXCAVATION
2nd – CONCRETE
3rd – MASONRY
4th – LUMBER
5th – FINISH MATERIALS

Concrete & Masonry MTO Estimating Sequence

Excavation: cuyd/cy

Calculate amount by using the dimension measurements for the outside face of the footings ≠ dimensions of the outside face of the walls.

Concrete:

Ready-Mix	cuft/cf
Batch Mix	cuft/cf
Reinforcement Bar	ft
Wire Mesh	sqft/sf
Poly Vapor Barrier	sqft/sf
Expansion Joint Filler	ft

Base Course cuft/cf

Masonry Wall Surface sqft/sf
Vertical Reinforcement ft
Horizontal Reinforcement ft

Lumber MTO List

Lumber is taken off the notes drawings and specifications as:

Lumber as the number of standard lumber lengths.
Plywood & Siding by the square footage to be covered.
Finish Trim by the linear foot.

<u>Two Categories for Lumber MTO</u>:

Rough Carpentry
Floor Framing (lumber & plywood)
Wall Framing (lumber & plywood)
Roof Framing (lumber & plywood)
Wooden Forms (lumber & plywood)

Finish Carpentry
Siding
Trim Work

Finish Material MTO List

Finish materials are items required to "finish" the exterior and interior of a structure:

Doors & Windows	ea
Shingles	sqft/sf
Drywall	sqft/sf
Paint	sqft/sf
Insulation	sqft/sf

Material Estimate Sheet (MES)

MES puts the information on the MTO into detail, showing:

- Description of work.
- Detailed description of materials.
- Units of measure of materials.
- Quantities of "dissimilar" materials.
- Quantities of "like" materials.
- Waste factor allowances.
- Total material quantities, including waste.

MES (Boards, Lumber, Timber & Plywood)

The unit of measure to estimate boards, lumber, and timber is board feet (bf).

One board foot is equal to a piece of wood having 12 square inches of end area, and is 1 foot long.

The unit of measure to estimate plywood is sheet (sh).

One sheet of plywood has 32 square feet of surface area.

Methods of Boards, Lumber & Timber Estimating Calculations

- Consolidate and total all "like" wood sizes & grades. Calculate board feet.
- Total all "dissimilar" wood sizes & grades. Calculate board feet.
- Board Feet Calculation
  ((Thickness (in) x Width (in) x Length (ft) x Quantity) ÷ 12) + Waste Factor = Total Board Feet (Round up) ***(2" x 6" x 16' x 6) ÷ 12 = 96.0 bf + 10% = 106.0 bf***

Methods of Plywood Estimating Calculation

- Consolidate and total all "like" plywood sizes & grades. Calculate sheets required.
- Total all "dissimilar" plywood sizes & grades. Calculate sheets required.
- Sheet Calculation
  Total Surface area to be covered from MTO ÷ 32 (sf) = Total sheets required + waste factor = Total sheets to order. (Round up) ***512 sqft ÷ 32 sqft = 1 6.0 sh + 15% = 19.0 sh***

MES (Nails) & Nail Estimating Calculations

Unit of measure for nails by the pound (lb).

Three formulas, based on nail size, are used to determine nail requirements.

2d to 12d Nails:

((Nail size x Total bf of lumber to be fastened) ÷ 400) + Waste Factor = Total nails (lbs) (Round up) ***(10d x 523 bf) ÷ 400 = 13.08 + 10% = 15.0 lbs***

12d to 60d Nails:

((Nail size x Total bf of lumber to be fastened) ÷ 600) + Waste Factor = Total nails (lbs) (Round up) ***(763 bf x 16d) ÷ 600 = 20.35 + 10% = 23.0 lbs***

2d to 12d Nails for plywood:

((32 sqft x Total sheets to be fastened) ÷ 400) + Waste Factor = Total nails (lbs) (Round up) ***(32 sf x 19 sh) ÷ 400 = 1.52 + 10% = 2.0 lbs***

Self-Check -5	Written Test

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

1. Estimation of appropriate amount of materials are prepared from----------
   A. Finished working drawing
   B. Project specification
   C. Manufacturer specification
   D. A and B are correct
2. Conversation used to determine items of works such as rafter, joist & studs are?
   A. Area conversation
   B. Linear conversation
   C. Volume conversation
   D. Mathematical equations
3. Which materials are calculated by area conversation
   A. Ply wood
   B. Paint
   C. MDF board
   D. All of the above

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Multiple choice Questions

1. ----------
2. ----------
3. ----------

Information Sheet-6	Identifying, obtaining, preparing, safely handling and locating appropriate materials

1.6 Identifying, obtaining, preparing, safely handling and locating appropriate materials

- **Introduction**

Handling and storing materials involve diverse operations such as hoisting tons of steel with a crane; driving a truck loaded with concrete blocks; carrying bags or materials manually; and stacking palletized bricks or other materials such as drums, barrels, kegs, and lumber.

The efficient handling and storing of materials are vital to industry. In addition to raw materials, these operations provide a continuous flow of parts and assemblies through the workplace and ensure that materials are available when needed. Unfortunately, the improper handling and storing of materials often result in costly injuries

- **Handling and storing materials**

In addition to training and education, applying general safety principles such as proper work practices, equipment, and controls can help reduce workplace accidents involving the moving, handling, and storing of materials. Whether moving materials manually or mechanically, your employees should know and understand t he potential hazards associated with the task at hand and how to control their workplaces to minimize the danger.

Because numerous injuries can result from improperly handling and storing materials, workers should also be aware of accidents that may result from the unsafe or improper handling of equipment as well as from improper work practices. In addition, workers should be able to recognize the methods for eliminating or at least minimizing the occurrence of such accidents. Employers and employees should examine their workplaces to detect any unsafe or unhealthful conditions, practices, or equipment and take corrective action.

- **The potential hazards for workers**

Workers frequently cite the weight and bulkiness of objects that they lift as major contributing factors to their injuries. In 1999, for example, more than 420,000 workplace accidents resulted in back injuries. Bending, followed by twisting and turning, were the more commonly cited movements that caused back injuries.

Other hazards include falling objects, improperly stacked materials, and various types of equipment. You should make your employees aware of potential injuries that can occur when manually moving materials, including the following:

- ✓ Strains and sprains from lifting loads improperly or from carrying loads that are either too large or too heavy,
- ✓ Fractures and bruises caused by being struck by materials
- ✓ or by being caught in pinch points, and
- ✓ Cuts and bruises caused by falling materials that have been improperly stored or by incorrectly cutting ties or other

Self-Check -6	Written Test

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

1. Moving, handling, and storing of materials can help to reduce work place accidents.
2. Aware about accidents haven't value for minimizing hazards
3. Making safe workplace is the responsibility of employees/workers but not employer

Note: **Satisfactory rating – 3 points** **Unsatisfactory - below 3 and 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

True or False Questions

1. ----------
2. ----------
3. ----------

Information Sheet-7	Identifying Environmental requirements

1.7 Identifying Environmental requirements

- **Environmental issues**

All construction projects have the potential to negatively affect the environment by consuming natural resources and producing waste. In most countries, there are laws to make sure that damage to the environment is controlled and minimized. Most large worksites will have an environmental management plan (EMP) to ensure that appropriate management strategies and practices are followed during a project. You must be aware of the impact of your tasks and work practices and your responsibilities with regard to the site EMP. When you use tools, plant and equipment, the potential environmental hazards include:

- ✓ Noise pollution created by power tools and power generation plant
- ✓ Dust from cutting, planning and shaping tools
- ✓ Soil contamination from leaks or spills of fuel, oil or lubricants
- ✓ Toxic substances including asbestos, timber treatments, insecticides, solvents and cleaning products.

- **Clean-up**

The final stage of any construction project is clearing the worksite. State and territory Regulations usually require a site to be kept and left in a clean and safe condition. It is the responsibility of all construction workers to make sure they know the site policies and procedures for maintaining a tidy, organized and safe workplace including:

- ✓ Safe waste disposal
- ✓ Recycling of materials
- ✓ Maintenance and storage of tools and equipment.

Carpenters can spend years building up a good reputation with builders and clients, and how they leave the job can form a lasting impression.

- **Waste management**

After every construction project, waste products like timber off cuts and damaged or surplus materials are left over and must be disposed of appropriately. There are laws which outline how waste materials should be dealt with and large fines can be issued if these are not followed. Companies and contractors usually develop policies and procedures to make sure everyone complies with these requirements. Facilities for waste management on a worksite or in a joinery workshop may include:

- ✓ General and recycling bins
- ✓ Hazardous material containers and spill kits
- ✓ Dust extraction devices
- ✓ Cleaning supplies.

Self-Check -7	Written Test

Directions: Match column A with column B all the questions listed below. Use the Answer sheet provided in the next page:

Column A

1. Facilities for waste management
2. Sources from leaks or spills of fuel, oil or lubricants
3. Created by power tools & power generation plants
4. Final stage of any construction project

Column B

A. Noise pollution
B. Dust extraction device
C. Clean up
D. Soil contamination
E. Waste management

Note: **Satisfactory rating – 3 points** **Unsatisfactory - below 3 and 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Matching Questions

1. ----------
2. ----------
3. ----------
4. ----------

Information Sheet-8	Applying statutory and regulatory authority obligations

1.8. Applying Statutory and regulatory authority obligations

Statutory obligations are those obligations that do not arise out of a contract, but are imposed by law.

The statutory obligations applicable to the design, construction and operation of buildings are extensive and complicated, and they will depend on the specific nature of the proposed development. It is very important that contracts and appointment documents make it clear whose responsibility it is to satisfy statutory obligations and who is bearing the risk of failure to satisfy a statutory obligation. For example, on a design and build project, the contractor may be required to prepare and submit a planning application, but the client may accept the risk that planning permission will not be granted.

Whilst statutory obligations are many and varied, and there can be many additional obligations that relate to the final use that a building is put to, a very broad summary of some categories of statutory obligation are presented below (this list is not comprehensive).

The first set of national building standards was introduced in 1965. Now known as the Building Regulations, they set out:

What qualifies as ‘building work’ and so falls under the control of the regulations.

What types of buildings are exempt (such as temporary buildings).

The notification procedures that must be followed when starting, carrying out, and completing building work.

Requirements for specific aspects of building design and construction.

A series of approved documents provide general guidance on how specific aspects of building design and construction can comply with the Building Regulations.

The requirements are set out in Schedule 1 of the regulations:

Part A: Structure

Requires buildings to be designed, constructed or altered so as to be structurally safe and robust, and so as not to impair the structural stability of other buildings. It stipulates design standards for use on all buildings and gives simple design rules for most masonry and timber elements for traditional domestic buildings. It includes diagrams of structures such as roof frames and brick walls, and tables of material strengths.

Part B: Fire safety

Covers all precautionary measures necessary to provide safety from fires for building occupants, persons in the vicinity of buildings, and firefighters. Requirements and guidance covers means of escape in cases of fire, fire detection and warning systems, the fire

resistance of structural elements, fire separation, protection, compartmentation and isolation to prevent fire spread, control of flammable materials, and access and facilities for firefighting.

Part C: Site preparation and resistance to contaminants and moisture

Includes the weather-tightness and water-tightness of buildings, subsoil drainage, site preparation, and measures to deal with contaminated land, radon, methane, and all other site related hazardous and dangerous substances.

Part D: Toxic substances

This controls hazards from the toxic chemicals used in cavity fill insulation systems.

Part E: Resistance to the passage of sound

Deals with requirements for sound insulation between buildings, including both new dwellings and the conversion of buildings to form dwellings. These cover sound reduction between rooms for residential purposes and designated rooms in dwellings, and acoustic conditions for common areas in flats and schools.

Part F: Ventilation

Includes standards for ventilation and air quality for all buildings. It also covers requirements for the prevention of condensation.

Part G: Sanitation, hot water safety and water efficiency

Lays down standards for the provision of sanitary and washing facilities, bathrooms and hot water provision. It also covers safety requirements in respect to unvented hot water systems.

Part H: Drainage and waste disposal

Requires that adequate drainage is provided, and also deals with pollution prevention, sewage infrastructure and maintenance. Technical design standards cover sanitary pipe work, foul drainage, rainwater drainage and disposal, wastewater treatment, and discharges and cesspools.

Part J: Heat producing appliances and Fuel storage system

Covers the construction, installation and use of boilers, chimneys, flues, hearths and fuel storage installations. Also requirements to control fire sources and prevent burning, pollution, carbon monoxide poisoning, etc.

Part K: Protection from falling, collision and impact

Set standards for the safety of stairways, ramps and ladders, together with requirements for balustrade, windows, and vehicle barriers to prevent falling. Also included are requirements for guarding against and warning of, hazards from the use and position of doors and windows.

Part L: Conservation of fuel and power

Controls the insulation values of buildings elements, the
allowable area of windows, doors and other opening, the air permeability of the structure, the heating efficiency of boilers, hot water storage and lighting. It also controls mechanical ventilation and air conditioning systems, space heating controls, airtightness testing of larger buildings, solar emission,
the certification, testing and commissioning of heating and ventilation systems, and requirements for energy meters. It also sets requirements for Carbon Index ratings.

Part M: Access to and use of buildings

Requires the inclusive provision of ease of access to, and circulation within, all buildings, together with requirements for facilities for disabled people.

Part N: Glazing - Safety in relation to impact, opening and cleaning

(Withdrawn on 6 April 2013 other than in Wales where it still applies).

Lays down the requirements for the use of safety glazing to avoid impact hazard and for the suitable awareness and definition of glazed areas. Also included are safety requirements relating to the use and cleaning of windows.

Part P: Electrical safety

Covers the design, installation, inspection and testing of electrical installations in order to prevent injuries from electrical shocks and burns, and to prevent injuries arising
from fires due to electrical components overheating or arcing.

Part Q: Security - Dwellings

From 1 October 2015, for use in England, it provides that reasonable provision must be made to resist un authorised access to any dwelling; and any part of a building from which access can be gained to a flat within the building.

Part R: Physical infrastructure for high-speed electronic communication networks

A requirement for infrastructure enabling the installation of copper or fibre-optic cables or wireless devices capable of delivering broadband speeds of more than 30 Mbps.

Regulation 7: Materials and workmanship

A requirement for carrying out building work using the proper materials and in a workmanlike manner.

- **Procedure**

Building Regulations approvals can be sought either from the building control department of the local authority or from an approved inspector. In either case, a fee will be payable, relative to the type of building and the construction cost. Fee schedules can be obtained from the building control department of the local authority. It is now also possible for competent

persons to self-certify that their work complies with the building regulations without submitting a building notice or incurring local authority fees.

- **Full plans or building notice**

Generally on larger, new-build projects, a 'full plans' application will be made, meaning that full details of the proposed building works are submitted for approval before the works are carried out.

On small projects, or when changes are made to an existing building, approval may be sought by giving a 'building notice'. In this case, a building inspector will approve the works as they are carried out by a process of inspection. This does leave the client at risk that completed works might not be approved, resulting in remedial costs.

Full plans approvals are also subject to inspection during the course of the works at stages decided by the local authority (typically during the construction of foundations, damp proof courses and drains and perhaps other key stages), but as long as the work is carried out in accordance with the approved design, the risk of problems is very much reduced.

In the event of disagreement about an approval, a ‘determination’ can be sought (before the works start) from the Secretary of State for Communities and Local Government or from Welsh Ministers in the Welsh Assembly Government. It is also possible to seek relaxation or dispensation of the regulations from the building control department of the local authority under certain circumstances (see Department for Communities and Local Government guidance).

It is important to ensure that a completion certificate is sought from the approving body as evidence that the works comply with the regulations.

A full plans approval notice is valid for three years from the date of deposit of the plans. This can be very important given the speed at which the regulations change, meaning that a building which has been approved, but not built may require re-design and further approval if construction is delayed and the regulations change.

Failure to comply with the Building Regulations can result in a fine and/or an enforcement notice requiring rectification of the works. There is also a regularization process for getting approval for works that have been carried out without approval.

NB: Where demolition work is proposed, the owner must give the local authority building control department six weeks notice under Section 80 of the Building Act

Self-Check -8	Written Test

Directions: Say True for the correct statement and False for the incorrect, answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Statutory obligations are those obligations that imposed by low
2. Resistance to the passage of sound is the requirement that deals with control hazards from the toxic chemical.
3. Drainage and waste disposal is a requirement that deals with pollution preventing, sewage infrastructure and maintenance.

Note: **Satisfactory rating – 2 points** **Unsatisfactory - below 2 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

True or False Questions

1. ----------
2. ----------
3. ----------

Operation Sheet 1	Techniques of making work place area ready for work

1.1. The techniques of making work place area ready for work are

Step 1- Identify potential hazard

Step 2- Locate site shade for the safe storage of materials and equipment

Step 3- Determine the position of power support

Step 4- Identify a water supply and sanitary arrangement

Step 5- Identify waste disposal procedure and facilities

Step 6- locating suitable access for entry and exit point

Operation Sheet 2	Techniques of planning and preparing for work

Techniques for of planning and preparing for work are:

Step 1- Obtaining work instructions and regulations

Step 2- Organizing work area with necessary tools and materials

Step 3- Follows safety requirements

Step 4- Calculate material quantity requirements

Step 5- Follow house keeping requirements

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 3-4 hours.

Task 1: Obtain /Gazer the necessary information, instructions and regulations

Task 2: making ready and safe your work place according to regulations

Task 3: follow safety requirements

Task 4: perform mathematical calculation for material quantity

Table of Answer keys for the self checks provided on each information sheets

UNIT OF COMPETENCY: use carpentry hand and power tools							
LO: 1 LG: 22 Plan and prepare							
Self check: 1		Self check:2		Self check:3		Self check:4	
Matching		Matching		True or False		Multiple choice	
1	C	1	B	1	False	1	C
2	D	2	D	2	True	2	B
3	A	3	C	3	True	3	A
Multiple choice		4	E	4	False	4	
1	D	5		5		5	
2	A						
3	B						
Self check:5		Self check:6		Self check:7		Self check:8	
Multiple choice		True or False		Matching		True or False	
1	D	1	True	1	B	1	True
2	B	2	False	2	D	2	False
3	D	3	False	3	A	3	True
4		4		4	C	4	

List of Reference Materials

References

- USE CARPENTRY TOOLS AND EQUIPMENT CERTIFICATE II IN BUILDING AND CONSTRUCTION CERTIFICATE II IN BUILDING AND CONSTRUCTION (PATHWAY – TRADES) CPCCCA2002B
- Construction Health and Safety Manual
- MONITOR%20WORK%20OPERATIONS.pdf%20_%20Competence%20(Human%20Resources)%20_%20Goal.html
- Best practice guide to improving waste management on construction sites
- Interpreting and Applying Equipment Specifications1
  Speaker/Author: Suzanne
- Waste management at the construction site By Joseph Laquatra and Mark Pierce
- Manage workplace operations Trainee Manual William Angliss Institute of TAFE

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