Unit 18: Operate, Maintain and Understand the Principles of Specialist Forestry and Arboricultural Machinery

Unit code: H/601/0372

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

Aim and purpose

This unit aims to provide learners with an understanding of specialist forestry and arboricultural machinery and how these can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training.

Unit introduction

Arboriculture and forestry in the UK and worldwide has become increasingly reliant on the use of powerful and sophisticated machinery. The need for greater efficiency in the management of trees is moving the design and development of specialised machinery to new levels. Learners entering or working in the industry will encounter and be expected to use a wide range of expensive and complex machinery.

This unit focuses on the increasingly important role of mechanisation within treework, in terms of both efficiency and effectiveness. It will also provide opportunities to study the application of technology in machine development and their associated operating and control systems.

On completion of the unit learners will have a broad understanding of the range of specialist machines currently available, their capabilities and limitations. They will be aware of safe working practices and be able to maintain, operate and repair machines to enable them to successfully work in an industrial setting. Learners will also have a sound working knowledge of health and safety and legal requirements, as well as environmental and sustainability considerations when operating advanced machinery.

Learning outcomes

On completion of this unit a learner should:

1 Understand the importance of specialised machinery for forestry or arboriculture

2 Be able to maintain specialised forestry or arboricultural machinery

3 Be able to operate specialised forestry or arboricultural machinery.

Unit content

1 Understand the importance of specialised machinery for forestry or arboriculture

Machine types: section felling; waste processing; stump removal; pruning; planting; eg cranes, mobile elevating work platforms, lowering equipment, chippers, stump grinders, winches and jacks, planters, tree spades; woodland residue machinery eg chippers, grinders, mulchers and balers

Selection criteria: suitability for purpose; effectiveness; costs eg purchase, lease, depreciation; maintenance and service (availability of spares, dealer support); manufacturers

Importance to the industry: improved efficiency, cost, importance of appropriate selection (health and safety)

2 Be able to maintain specialised forestry or arboricultural machinery

Routine servicing and maintenance: use of manufacturers' or suppliers' manuals; machine and site specific risk assessments; personal protective equipment (PPE); identification of routine maintenance tasks; recognition of incorrect operation or adjustments; identification of faults; replacement and adjustment of operator serviceable components eg blades, pipes, anvils, cutting teeth, grease points, bearings

Legal requirements: provisions under current relevant legislation eg Health and Safety at Work Act, Provision and Use of Work Equipment Regulations 1998 (PUWER), Lifting Operations and Lifting Equipment Regulations 1998 (LOLER), Control of Substances Hazardous to Health 2002 (COSHH)

3 Be able to operate specialised forestry or arboricultural machinery

Machinery operation: legal requirements for training and certification, pre-operation checks, legal compliance, adherence to operator's manual specific to machine; safe and effective operation of the machine; systems and methods used to minimise environmental impact

Safe and effective operation: use of manufacturers' manuals; adherence to industry safety guidance; monitoring of outputs; maintenance of product or task specifications; effective communications; awareness of general public and work colleagues; identification and establishment of safety zones; PPE; machine and site specific risk assessments; site factors eg topography, operational parameters, public access, highways and footpaths, risk zones, power lines and underground services; noise and vibration levels

Legal requirements: provisions under current relevant legislation eg Health and Safety at Work Act 1974, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR); machine and site specific risk assessments; PPE; pre-operation checks, safety devices

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 evaluate the range of specialist machinery for forestry or arboricultural applications [IE, CT, SM, EP]	**M1** identify from a range of new machinery currently available a specific machine to assist in a given operation with reference to the task, site conditions and operating costs	**D1** plan a maintenance and reporting system for a specific machine in a given operation to minimise downtime and protect the environment from contamination
P2 explain the criteria for selecting appropriate machinery to undertake forestry or arboricultural tasks [CT, RL, SM, EP]		
P3 explain the importance of specialised forestry or arboricultural machinery to the industries [CT, RL, SM, EP]		
P4 explain the need to keep accurate and up-to-date records [CT, RL, SM, EP]		
P5 describe the importance of routine and non-routine maintenance [RL, EP]	**M2** identify the routine and non-routine maintenance and servicing requirements of a specific machine	
P6 identify common faults and suggest appropriate rectification measures [IE, CT, RL, TW, EP]		
P7 carry out routine servicing and maintenance [TW, SM, EP]		

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P8 describe the significance of current relevant legislation and industry guidance for forestry or arboricultural machinery operation [RL, SM]	**M3** demonstrate the ability to modify operational techniques to meet differing conditions in a mechanised operation.	**D2** carry out an assessment to minimise the environmental impact of a given mechanised operation.
P9 explain how to minimise possible environmental impacts of using specialist forestry or arboricultural machinery [CT, RL, SM, EP]		
P10 carry out risk assessments [RL, TW, SM, EP]		
P11 carry out pre-start checks and adjustments as per manufacturers' recommendations [RL, TW, SM, EP]		
P12 operate specialised forestry or arboricultural machinery safely and effectively to meet given objectives. [RL, TW, SM, EP]		

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

Delivery of this unit will involve practical and written assessments, visits to suitable machinery exhibitions and will have link to work experience placements.

Tutors delivering this unit have opportunities to use a wide range of techniques. Lectures, discussions, seminar presentations, site visits, supervised machinery practicals, internet and/or library-based research and the use of personal and/or industrial experience would all be suitable. Delivery should stimulate, motivate, educate and enthuse learners.

Industry placements should be monitored regularly to ensure the quality of the learning experience. It would be beneficial if learners and supervisors were made aware of the requirements of this unit before any work-related activities are undertaken, so that naturally occurring evidence can be collected at the time. For example, learners may have the opportunity to use or repair specialised machinery and they should ask for observation records and/or witness statements to be provided as evidence of this. Guidance on the use of observation records and witness statements is provided on the Edexcel website.

Tutors should consider integrating the delivery, private study and assessment for this unit with other relevant units and assessment instruments learners are taking as part of their programme of study.

Whichever delivery methods are used, it is essential that tutors stress the importance of health and safety and environmental protection legislation and the use of good and safe working practices when maintaining and using machinery, as well as the need to manage the resource using legal methods.

Practical working techniques should be taught initially by demonstration and then by closely supervised practical sessions. Tutors must be able to show current industry best practices. Group size must not exceed recommended guidelines, where applicable, for the specified machinery and operations. Learners would benefit from access to machinery maintenance and operation opportunities in realistic industrial settings, although the work sites available and the objectives may influence the range of activities that may be undertaken.

As learners develop their skills and confidence they should be encouraged to take more responsibility for their work, but practical operations must not take place without appropriate supervision. Learners are likely to develop their skills at varied rates and close monitoring of progress should be maintained and allowance made for extra support for the less experienced while allowing the more experienced to further develop and extend their skills.

Learning outcome 1 requires learners to understand the importance of appropriate specialised machinery with particular reference to machinery that is locally or regionally significant to learners. This learning outcome could be delivered through formal lectures, group discussion and independent learner research. Visits to sites and/or industry trade shows, such as the Arboricultural Association annual show, would particularly benefit delivery.

Learners should be encouraged to establish links with machinery suppliers and dealers to find out about the range of procurement options available. Using resources such as videos, CD ROMs, machinery catalogues, trade magazines, the internet and manufacturers' information, learners will be able to gain an understanding of the range and complexity of machinery used within the treework sectors.

Learning outcome 2 requires learners to carry out practical maintenance and servicing activities on a range of machinery. They will require access to workshop facilities and tools appropriate to the machines being serviced. This could be delivered through formal lecture, supervised practical sessions and independent learner research.

Many of the machines used in the arboricultural/forestry sector require a significant amount of maintenance and servicing, which is normally carried out by the operator. A well- maintained and serviced machine will have less downtime and therefore enable the operator or employer to maximise income and productivity. Learners should have access to a range of sector specific machinery and should be able to carry out daily, weekly and monthly maintenance in accordance with manufacturers' guidelines for at least three types of equipment. They will require access to workshop facilities and tools appropriate to the machines being serviced as well as manufacturers' manuals and instruction booklets.

Learning outcome 3 requires learners to develop and consolidate machinery operation skills that they can transfer directly to industry. This learning outcome could be delivered through formal lectures, supervised practical sessions and independent learner research. Learners must have the opportunity to use a range of appropriate machinery and to consolidate their operational skills within the context of realistic situations.

Health and safety issues must be appropriately addressed before learners use equipment or undertake any practical work and reinforced regularly. Adequate PPE must be provided and worn following the production of suitable risk assessments. Current legislation governing machinery maintenance and operation should be discussed and the implications outlined.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

It is anticipated that not all centres will have access to the full range of specialist machinery and equipment, but this can be mitigated with the careful construction of a visit plan. Time has been allowed in the following outline learning plan to facilitate this type of learning activity.

The outline learning plan gives **an indication of the volume of learning it would take the average learner** to achieve the learning outcomes. It is **indicative and is one way of achieving the credit value**.

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Topic and suggested assignments/activities and/assessment
Unit introduction and assignment schedule.
Assignment 1: Machinery in Current Use (P1, P2, P3, P4, M1, D1) Tutor to introduce assignment.
Describe arboricultural/forestry operations and procedures.
Review mechanisation opportunities for arboricultural/forestry operations and procedures.
Describe access requirements for arboricultural/forestry operations.
Review mechanisation opportunities to assist access in arboricultural/forestry operations.
Describe aerial work and access.
Review mechanisation opportunities to assist aerial work.
Site visit: arboricultural/forestry operations to review mechanisation and selection criteria for machinery.
Assignment 2: The Care and Maintenance of Machinery (P5, P6, P7, M2, D1) Tutor to introduce assignment.
Practical activity: machine control systems – mechanical, hydraulic, electrical/electronic, wireless, infrared.
Practical activity: machine operation to enable maintenance activities.
Arboricultural/forestry machine operator training – competences and certification.

Topic and suggested assignments/activities and/assessment
Assignment 3: Site Working and Machinery Operation (P8, P9, P10, P11, P12, M3) Tutor to introduce assignment.
Legal requirements in workshop situations, health and safety legislation and the benefits of compliance.
Practical activity: operator maintenance responsibilities before machine use.
Practical activity: machine handbook information and maintenance tasks.
Practical activity: sharpening and machine adjustments by operator.
Site visit: machinery/equipment dealership to review maintenance activities and machine range.
Assignment 4: Environmental Impacts of Machinery Operations (D2) Tutor to introduce assignment.
Health and safety and environmental protection legislation applicable to practical arboricultural/forestry operations.
Practical activity: review of risk assessment procedure in relation to specific site issues.
Practical activity: preparation of machinery for arboricultural/forestry operations.
Practical activity: operating arboricultural/forestry machinery under controlled conditions (simulator or simulated environment).
Practical activity: operating arboricultural/forestry machinery in simulated/semi commercial conditions.
Environmental protection legislation – content and application.
Environmental Impact Assessments – content and completion.
Site visit: environmentally sensitive operations.
Site visit: arboricultural/forestry machinery exhibition and/or trade fair.
Unit review.

Assessment

For P1 to P4, learners must review a range of specialist forestry or arboricultural machinery in order to evaluate their chosen machines in terms of their effectiveness and explain the selection criteria used for a given operation. They must also explain the need to keep accurate and up-to-date records. Evidence should include a rationale of the benefits to the industry of mechanisation and cover the responsibilities of machine ownership. Tutors should identify the machines and objectives or agree them through discussion with learners. Where possible, to ensure assessment is fair, the size and complexity of the tasks should be the same for all learners.

As a minimum, learners should provide evidence covering five types of specialised machine and give two examples of each machine type. This could be through individual research using trade publications, the internet and manufacturers' information, and site visits. Evidence could take the form of an annotated field notebook, identification exercises, a pictorial presentation with notes (possibly using appropriate software or an overhead projector), an annotated poster, a project or short report.

For P5, P6 and P7, learners must describe the importance of routine and non-routine maintenance and carry out routine servicing and routine and non-routine maintenance tasks on a minimum of two selected specialist machines safely, using manufacturers' information and to meet given objectives. Tutors should identify the machines and objectives or agree them through discussion with learners. Where possible, to ensure assessment is fair, the size and complexity of the tasks should be the same for all learners. As a minimum, learners should provide evidence covering three specialist machines.

Machines may include chainsaws, winches, brushwood chippers, stump grinders, firewood processors,

mobile elevating work platforms (MEWP), de-barkers, brushcutters, timber cranes and other appropriate machines. Evidence could be observation records, a maintenance logbook, worksheets with illustrations and photographs, or video footage.

For P8 to P12, learners must operate selected specialist machinery safely and effectively and with due consideration of environmental factors. Tutors should identify the machinery and tasks or agree them through discussion with learners. Where possible, to ensure assessment is fair, the size and complexity of the tasks should be the same for all learners. As a minimum, learners should provide evidence covering at least three machines listed in the unit content. Operations should only be carried out in settings after authorised risk assessments have been completed. Simulation may be appropriate where access to work sites is restricted or where learner or public safety is an issue.

Adequate time should be allowed for learners to develop their machinery operation skills before they are assessed. These criteria could be assessed directly by the tutor during practical activities. If this format is used, then suitable evidence from guided activities would be appropriate risk assessments in a corporate form, discussion, detailed safe working procedures documents, and/or detailed observation records completed by learners and tutor. If assessed during a placement, witness statements should be provided by a suitable representative and verified by the tutor.

For M1, learners could use the evidence for P1 to P4 and apply this to a case study for an arboricultural/ forestry operation on a given site. Learners could draw up a mechanisation plan identifying a range of machine types and combinations to meet given objectives. The plan should contain justification of the selection criteria used to choose suitable machines for the given tasks.

Tutors should identify the case study and tasks/objectives or agree them through discussion with learners. Where possible, to ensure assessment is fair, the size and complexity of the tasks should be the same for all learners.

Learners are likely to produce an independent study in the context of their areas of interest within the arboriculture or forestry industry. Evidence presented should show that learners understand the importance of the key factors which make a machine fit for purpose. Presentation of evidence could be in the same format as for P1, P2, P3 and P4.

For M2, learners should investigate the servicing and routine and non-routine servicing and maintenance requirements of a chosen machine. Opportunities to gather evidence might occur naturally during practical maintenance operations, using observation records or witness statements.

A detailed logbook and/or fault finding flow chart may also provide suitable evidence if validated by the tutor. Observational fault finding assessments may be set up in carefully monitored situations that ensure assessment is fair for all learners.

For M3, learners must modify techniques when operating machinery in given situations. Tutors should identify the situations or agree them through discussion with learners. Where possible, to ensure assessment is fair, the size and complexity of the tasks should be the same for all learners. Evidence could occur naturally during practical project work and be gathered by the tutor. Presentation of evidence could be in conjunction with P8, P9, P10, P11 and P12.

For D1, learners are required to analyse a machine and review its maintenance and servicing requirements using both manufacturers' sources and their own skills and, in a given scenario, devise a plan for the ongoing care of the machine. Ideally, this should be the same machine specified for M1. The maintenance plan should be integrated with the operational cycle of the machine and take account of environmental factors on site.

Tutors should identify the machine or agree it through discussion with learners. Evidence could be presented in the form of a flow chart or key system, leading to the identification of service intervals or particular faults in the machine. It may be appropriate for learners to produce an interactive spreadsheet/database or fault analysis CD ROM, or similar computer-based system, to plan and record activity.

For D2, learners must assess environmental risks associated with mechanised operations for a given treework project and discuss possible solutions. Tutors should identify the project or agree it through discussion with learners. Where possible, to ensure assessment is fair, the size and complexity of the tasks should be the same for all learners. The project may be the same as that used to provide evidence for other grading criteria such as M3.

Programme of suggested assignments

The following table shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, P3, P4, M1, D1	Machinery in Current Use	As an arborist undertaking a variety of arboricultural operations, you are required to evaluate the range of machinery in use, explain selection criteria, the importance of mechanisation and the need to maintain accurate records.	Annotated field notebook. Identification exercises. Pictorial presentation with notes (possibly using appropriate software or an overhead projector). Annotated poster. Short report.
P5, P6, P7, M2, D1	The Care and Maintenance of Machinery	You will need to carry out routine and non-routine operator maintenance tasks, identify and report faults in mechanisms and suggest rectification strategies.	Individual or group observations in a workshop environment. Annotated and authenticated logbook or worksheets relating to maintenance and repair activities on a range of machinery.
P8, P9, P10, P11, P12, M3	Site Working and Machinery Operation	You have been asked to produce information for clients describing the significance of current relevant legislation and industry guidance for the deployment of machinery in a given arboricultural operation. This must include assessing the environmental impact of mechanised activity and explaining how this can be minimised. You will also need to carry out a risk assessment for mechanised site working and prepare and operate machinery safely to meet given objectives.	Group presentation on the preparation and deployment of machinery for a given arboricultural operation. Individual observation records of skill development in the preparation and operation of a range of machinery and equipment.
D2	Environmental Impacts of Machinery Operations	A client has asked for more information on the effects of arboricultural operations on the environment. You will need to research and review current and relevant legislation and industry guidance on environmental protection in arboricultural operations and evaluate machinery used in given scenarios, explaining measures taken to minimise the impacts of mechanisation.	Group presentation on the deployment of machinery for a given arboricultural scenario. Individual comment on issues of specific interest.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Land-based sector suite. This unit has particular links with:

Level 2	Level 3
Undertake Tree Climbing and Pruning Operations	TW10 Fell and sned trees motor-manually TW13 Fell trees mechanically TW14 Process trees mechanically TW15 Extract wood products by forwarder TW16 Extract wood products by skidder TW17 Extract wood products by cable crane TW19 Extract wood products using small motorised equipment TW23 Dispose of residues from treework operations TW29 Access tree crowns using Mobile Elevating Working Platforms
Carry Out Ground-based Arboricultural Operations	Undertake Tree and Shrub Pruning and Maintenance
Undertake Tree Felling Operations	Maintain and Understand Equipment Used for Timber Conversion and Utilisation

Essential resources

Learners will need supervised access to a range of work sites and opportunities to observe specialised machinery working in a woodland or urban environment. This is particularly important for those machines that the centre may not have as part of their resources.

Learners must also have access to a range of appropriate specialist machines so they can carry out the operational requirements of the unit. Suitable machines may include stump grinders, small chainsaws, winches, mobile elevating work platform, portable powered winch, power pole pruner and blower, and woodland residue machinery such as brushwood chipper, mulchers and balers.

Access to the internet and a library with multiple copies of specialist texts is essential. There is also a need for adequate classroom and workshop facilities including video and computer-based presentation equipment. Textbooks, magazines and e-learning resources will provide and underpin the learner's knowledge of machinery. There should also be adequate washing and welfare facilities available at the centre and on worksites in addition to personal protective equipment (PPE) and first-aid facilities.

Employer engagement and vocational contexts

The unit has a very practical focus and employer engagement and relevant vocational content will enable the operational and management skills relating to machinery to be placed in a current context. Through the unit learners will become aware of employers' and manufacturers' requirements for these skills within the modern machinery industry.

Good employer links will also help give learners access to machinery and equipment that may not be available within the centre. Work placement opportunities should be actively sought alongside visits by experienced practitioners to illustrate current equipment, trends and practice, operation, maintenance and repair situations.

Learners should be encouraged to develop links with employers and arrange visits and demonstrations.

The industry also has a range of trade shows exhibitions and demonstrations, both nationally and internationally, which have excellent facilities. These can be used as a learning environment as they will give learners an insight into new design and innovation.

Indicative reading for learners

Textbooks

Agate E – *Tree Planting and Aftercare: A Practical Handbook* (BTCV, 2001) ISBN 9780946752256

European Arboricultural Council – *European Treeworker Handbook* (Patzer, 2005) ISBN 3876171016

HSE – *Safe Use of Lifting Equipment: Lifting Operations and Lifting Equipment Regulations* (Health and Safety Executive, 1998) ISBN 0717616282

Shetterly R and Blair D – *Arborist Equipment: A Guide to the Tools and Equipment of Tree Maintenance and Removal* (International Society of Arboriculture, 1995) ISBN 9781881956136 (2nd edition also available)

Journals and magazines

Arboricultural Association Journal

Essential Arb

Small Woods

Total Arb

Websites

www.aieorg.uk	Arboriculture Information Exchange
www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.hsegov.uk	Health and Safety Executive
www.lantra.co.uk	Sector Skills Council for the Environmental and Land-based Industries

Delivery of personal, learning and thinking skills (PLTS)

The following table identifies the PLTS opportunities that have been included within the assessment criteria of this unit.

Skill	When learners are ...
Independent enquirers	researching specialised machinery locating faults on machinery
Creative thinkers	explaining selection criteria for machine questioning machinery applications
Reflective learners	presenting findings of research compiling risk assessments
Team workers	carrying out maintenance tasks operating machinery
Self-managers	researching operational principles operating machinery
Effective participators	presenting findings/assessed work maintaining and operating machinery.

Although PLTS opportunities are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	seeking visit/placement opportunities
Creative thinkers	arranging visits and demonstrations
Reflective learners	reacting to feedback on assessment and action planning
Team workers	contributing to and achieving targets in group working situations
Self-managers	organising time and resources in order to develop and apply skills
Effective participators	proposing and presenting options for visits and placements.

Functional Skills – Level 2

Skill	When learners are ...
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	using web-based research to obtain health and safety information and guidance delivering audio-visual presentations for assessment
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	planning work processes for particular tasks preparing and submitting work for assessment
Manage information storage to enable efficient retrieval	using electronic storage media for planned and completed tasks recording risk assessments for later adaptation and use
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	researching machinery specifications and operational techniques reviewing equipment supplier databases and price lists
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	accessing and using health and safety websites and information accessing and using Environmental Agency standards
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: • text and tables • images • numbers • records	preparing and delivering audio-visual presentations using suitable software recording machine specifications (engine size transmission type quantities etc) measuring and recording compliance with safety and environmental standards compiling risk assessments on a pro forma constructing machine history records
Bring together information to suit content and purpose	compiling risk assessments on a pro forma preparing and presenting poster information
Present information in ways that are fit for purpose and audience	compiling risk assessments on a pro forma preparing and presenting poster information

Skill	When learners are ...
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	measuring, marking out and calculating machine inputs and outputs calculating site areas and production requirements acknowledging and applying site limitations to machinery operations
Identify the situation or problem and the mathematical methods needed to tackle it	site measuring and marking out from a datum point using error reduction techniques
Select and apply a range of skills to find solutions	using tables and standards to work effectively
Use appropriate checking procedures and evaluate their effectiveness at each stage	using tables and standards to work effectively
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	calculating machinery requirements calculating quantities and volumes interpreting site drawings and specifications
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	presenting assessed work and obtaining feedback working in groups to meet objectives requesting materials and tools for particular tasks
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	reviewing standards to ensure compliance comparing machinery information with legislative requirements analysing content for completeness
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	compiling portfolios of evidence preparing risk assessments for practical activities reporting on particular work processes and activities.