



FISA Safety Guide 608

Tree Shear & Grapple Saw



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This FISA guide is new to the forestry industry and we welcome your feedback on the guide. If you have feedback, please email info@ukfisa.com. Your comments will be fed to the FISA Plant & Equipment Working Group and the guide will be reviewed in eighteen months' time.

1. INTRODUCTION

This document provides guidance on the safe working practices to be followed when operating tree shear and grapple saw equipment.

The guide is intended for anyone specifying or approving the use of this equipment, managers co-ordinating such works, equipment operators and those working in its vicinity. It is also highly relevant for equipment manufacturers, suppliers or those who modify machines. It is essential that all relevant persons should read, understand and implement the control measures highlighted within this guide.

A Tree Shear is a hydraulic-powered cutter that cuts trees and woody vegetation in a mechanical slicing action.

A Grapple Saw is a hydraulic driven harvester chainsaw fitted to a timber rehandling grab.

When selecting a grapple saw or tree shear attachment the user should ensure that the carrier machine is suitable for use with it. The weight of the section being cut and the loads applied by the attachment must be within the carrier machine manufacturer's lift capacities and safety margins, once the weight of the attachment has been accounted for and considering the extent of reach at which the machine is working. You must take account of dynamic loads when cutting material at height, and the calculated capacity should typically be reduced by 50%, although this will depend on the choice of carrier machine and how accurately the weight of the cut section can be determined – *BS 72121-3 Mobile Cranes*.

2. TYPES OF TREE SHEARS

The two main types of tree shears are:-

Cut then grab



Recommended for use only on ground level operations.

Grab, cut, optional accumulate



Recommended for use in all applications.

3. TYPES OF GRAPPLE SAW

The two main types of grapple saw are: -

Pendulum mount with rotation



Fixed mount with rotation



Both recommended for use in all applications.

4. CARRIER VEHICLES (BASE MACHINES)

The main carrier vehicles which may be considered for both tree shears and grapple saws are excavators, telehandlers, mobile cranes and lorry-mounted hydraulic cranes. There are a number of unique derivatives of these types of carriers and there are also some specialist bespoke carriers available. The carrier vehicle must be approved for this application by the manufacturer/importer and covered by a suitable risk assessment and specific load capacity chart for the combination of carrier vehicle and attachment. Some carrier vehicles may not be suitable for use with the tree shears and/or grapple saws due to the loads and forces applied or the level of safety features included. You must consult with the manufacturer/supplier of the carrier vehicle before selecting it for this application. Failure to do so could lead to overturn or failure of the carrier vehicle. For example, slewing telehandlers are more likely to be suitable for this application than the more generic non-slewing type. Machinery which has specifically been designed for use in forestry applications, such as harvesters, forwarders and timber handling lorries will be typically unsuitable for use in applications where persons other than the operator may be present due to the lack of suitable safety features. Dynamic loads applied during cutting operations may exceed the stability of the carrier machine even where the load is within capacity. *BS 72121-3 Mobile Cranes* recommends that the lifting capacity is reduced by 50% where dynamic factors are well understood but the reduction may increase to 80% where loads and dynamic factors are poorly defined. Similar factors may be appropriate for other types of carrier vehicles.

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The carrier must have adequate OPS (Operator Protective System), which should include a consideration of the need for chainshot protection to BS ISO 21876, FOPS (Falling Object Protective Structure), and ROPS (Roll Over Protection System) all as specified in BS ISO 11850. The slope limit of the carrier vehicle should be considered using *FISA Safety Guide 705: Steep Slope Working*. Lorry-mounted cranes are not fitted with OPS, FOPS or ROPS systems, and must be operated using remote control from a safe distance outside of the defined 'attachment exclusion zone'. The use of grapple saw or tree shear attachments with lorry-mounted hydraulic cranes can result in the potential to impede the operation of the overload protection and stability control systems. If these attachments are to be used with a lorry-mounted crane, the risk assessment must take into account the lack of OPS, FOPS and ROPS and include consultation with the lorry loader manufacturer in relation to stability and capacity loading. The carrier vehicle operator must be qualified and competent for that vehicle. All operators must have a clear line of sight to ensure safety of the activity.

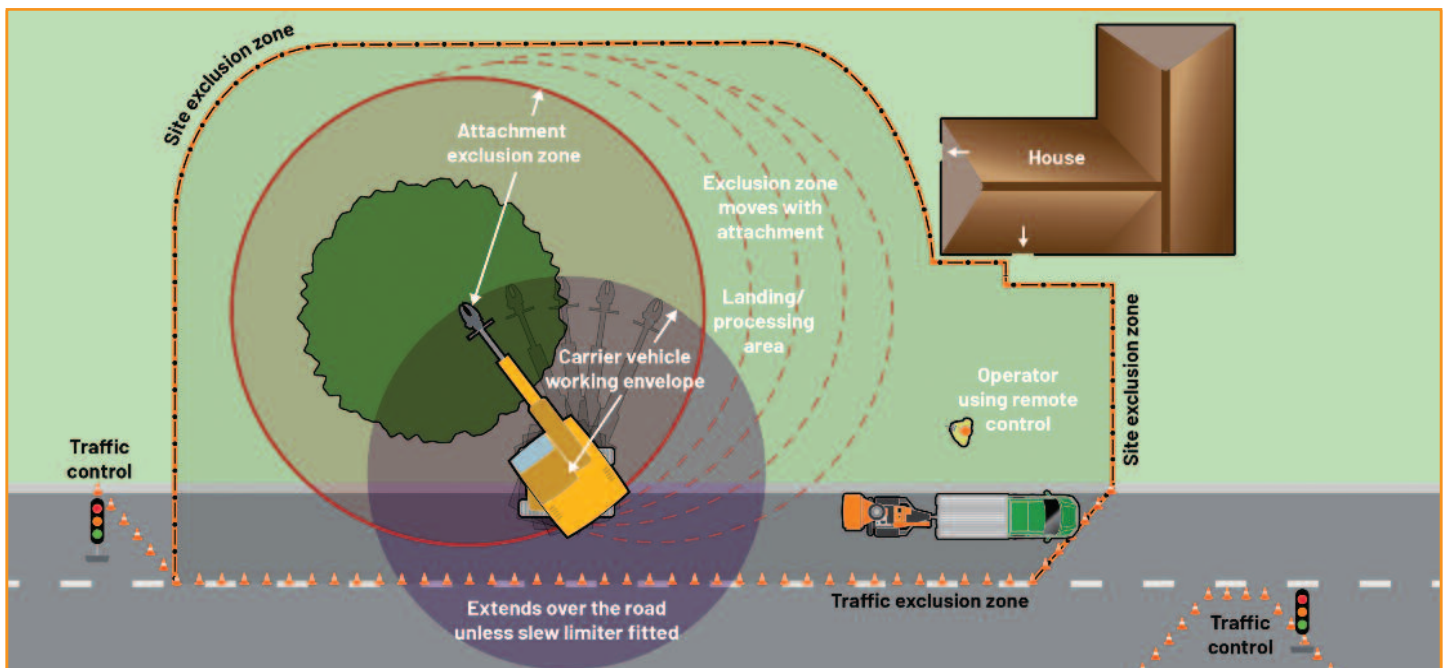
5. GRAPPLE SAWS – CHAIN SHOT

Chain shot is the high velocity separation and ejection of a piece or pieces of cutting chain from the end of a broken chain in mechanised felling of timber. Chain shot exposes both machine operators and bystanders to a risk of serious injury or death.

- Confirm with the Manufacturer if the Grapple Saw requires a chain shot protective device/guard to be

fitted, as required by BS EN ISO11850-2011 (amended 2016) – Machinery for Forestry: General Safety Requirements Section 4.3.2.3. Ensure it is tested to BS11837-2011 – Chain shot guarding systems. **Where a manufacturer is awaiting testing, please apply chain shot considerations into your risk assessment as explained in Chain Shot – What is the Risk.** There is no generic speed below which chainshot is not generated – the manufacturer must test his specific machine at its operating speed and advise if chainshot is generated or not.

- Ensure chain, saw bar & drive sprockets are in good condition and wear is within allowable limits.
- Ensure you use the correct chain lubrication and hydraulic flow rates.
- Ensure your machine settings are correct. An over-speeding chain, perhaps due to increased pressure/flow rates or excessive bar force, increases the chance of chain shot.
- Your machine must be fitted with a protective screen; the screen must be tested to BS ISO 21876 if chainshot is a risk.
- Be aware of chain shot risk zones – do not cut with front or back of saw box pointing towards persons, (public and operators), carrier vehicle, occupied vehicles, etc. **Note:** Whilst chain shot will most likely occur in a 15 degree cone from the front and back of the saw it can occur in any direction.



EXAMPLE RISK ZONES FOR TREE SHEAR AND/OR GRAPPLE SAW WITH NO CHAINSHOT RISK.
Operator either in protected cab or outside risk zone if using remote control.

6. TREE SHEARS/GRAPPLE SAWS – RISK ZONES

You should apply and adopt the risk zone recommended by the Original Equipment Manufacturer of your Grapple Saw/Tree Shear in their operation manual.

In all cases a site-specific risk assessment must be carried out taking into consideration risk zones (particularly in urban settings), landing zones, machine stability and potential chainshot and other ejection risks, before operations commence. Your risk assessment must detail how you will take reasonable steps to undertake the work safely, for instance via a method statement. When planning the operation other key considerations must include the carrier vehicle stability and combined 'load capacity' of both the cutting head and the base machine. It is a legal requirement that all users contact the equipment manufacturers for guidance on the safety of the equipment. You must consider relevant regulations including PUWER, LOLER and their associated Approved Codes of Practice (ACOP).

7. TREE SHEARS – GRAPPLE SAWS – PUWER/LOLER REGULATIONS

The use of grapple saws or tree shears is a lifting operation, as defined by the Lifting Operations and Lifting Equipment Regulations (LOLER) as it involves the lowering of a load. Reg 8(1) of LOLER requires that every lifting operation involving lifting equipment is properly planned by a competent person (who is appropriately supervised) and carried out in a safe manner.

As such, all lifting operations require a lift plan drawn up by a competent person (who has adequate practical and theoretical knowledge and experience of planning similar lifting operations), irrespective of the lifting equipment and accessories being used to undertake the lift e.g. lorry loader crane, mobile crane, telehandler/loader or excavator (such a competent person will typically be an Appointed Person as defined in BS 7121-1:2016).

For straightforward, common lifting operations, a single initial generic plan may be all that is required. However, due to the significant hazards and risks posed by tree felling operations, whilst a generic plan may be produced for each base machine and attachment combination, the plan will need to be reviewed on a site-by-site basis, by carrying out a site-specific risk assessment, to ensure that it remains relevant and, where necessary, that additional controls are put in place.

The plan should address the risks identified by the risk assessment and identify the resources required, the

procedures and the responsibilities, so that risks are managed and any lifting operation is carried out safely. The plan should ensure that the lifting equipment remains safe for the range of lifting operations for which it might be used. For more complex lifting operations a specific written plan should be developed.



The carrier machine and grapple saw/tree shear will be subject to LOLER Thorough Examination if there is a risk that loads may be lifted over or close to people and where deterioration in the machine's condition could lead to a dangerous situation. In practice most operations will require the use of machinery with current reports of thorough examination. Further guidance may be found in HSE's pages on lifting equipment in forestry.

PUWER Reg 4 requires that the carrier vehicle should be assessed by a competent person as to its suitability for the operating attachment, and its stability when fitted with the attachment. The carrier vehicle should also be fitted with OPS, FOPS and ROPS. The machine should also have visible or audible overload warning (for machines with a maximum rated capacity in excess of 1 tonne), check valves and marked with Safe Working Load (SWL). You must ensure that the SWL of the attachment is compatible with the SWL of the carrier machine and that this is not exceeded during operations.

PUWER Reg 9 requires that persons both operating and supervising the use of work equipment have received adequate training in the safe operation of the equipment and any methods which may be adopted when using it. Training will need to include basic training in both carrier vehicle (note specific ACOP for Rider operated lift trucks ACOP L117) and the attachment, as well as familiarisation training including manufacturer's information for the combined machine and adequate supervision during use.

8. SITE CONSIDERATIONS

Managers, supervisors and operators must ensure the following topics have been adequately considered at all stages of the operation:

- Plan the work operation using infrastructure-specific guidance, for example: FISA 804, ENA G55/3, HSG 47, GS6, Network Rail Code of Practice for Plant, Any Line Open Working (COP ALO) 0032, ALLMI CPA Best Practice Guide: BS 7121 series, Highway Sector Scheme (NHSS18) Document, and the specific equipment manufacturer's guidance.
- Location of adjacent workers and banksmen, and members of the public.
- Machine access into and within the work area, to ensure optimum work position is achievable and that the ground is suitable to ensure machine stability.
- Be aware of all traffic on site.
- Consider road closures dependant on the risk zones required.
- Ground protection – damage, reinstatement requirements, egress and recovery options.
- Environmental Impact – consider the impact the operations may have on the local environment, e.g. access and egress routes, work areas, vegetation, wildlife issues, siltation and pollution. Consideration of SSSIs and TPOs.
- Underground and overground services – potential damage to underground services, need for additional protection, or contact with overhead power lines. Site-specific information such as service diagrams, schematics, plans should be consulted.
- Site Obstructions/Adjacent Risks – make assessment of buildings, fences, highways, railways, infrastructure, power lines and telecommunications.
- Terrain – consideration of topography, ground movement, damage, disturbance and loss of traction.
- Environmental Conditions – you must consider environmental conditions on the site on the day of work and how these can impact the operations e.g. steep banks, soft ground, rocks, visibility and weather conditions (such as high winds, heavy rain, snow & ice or electrical storms).
- Be aware of foreign objects etc that may be embedded in the tree.

The site-specific risk assessment must detail any additional control measures to safeguard all concerned.

**PLEASE REFER TO CHECKLIST GUIDE –
APPENDIX 1 – QR CODE**

9. OPERATIONAL PLANNING

Managers, supervisors and operators must ensure the following topics have been adequately considered at all stages of the operation.

Working within third party infrastructure:

- Operating risk zones, applicable for the specific machine and the specific work method, must be determined after discussions with the relevant infrastructure owner/ operator/managing agent. This may be Network Rail, the regional electrical network operator, or regional/national highways agent/authority. All related operating standards applicable to the infrastructure and machine, must be understood and followed during all operations, unless additional safety controls have been agreed with the infrastructure owner/operator/managing agent. Also consider CAP 1096.



Machine selection:

- Ensure carrier vehicle is suitable for use with the grapple saw/tree shear combinations and has adequate reach, and lifting capacity, to safely access the highest/furthest points required for the work to be carried out. The lifting capacity will typically need to be reduced by 50%-80% (as per BS7121 Part 3 Annex F (Objects above the ground)) to account for dynamic loads. You should consult load capacity charts specific to the combination of carrier vehicle and attachment. The load capacity of the carrier vehicle may need to be de-rated to match that of the attachment. Further considerations include Centre of Gravity (COG) and boom angle during cutting.
- Carrier vehicle and cutting head must be compatible and suitable for the task.

- Ensure the carrier vehicle has adequate OPS/FOPS/ROPS protection.
- Any adaptations or alterations to the carrier vehicle or attachment, including safety and security guarding, must be approved by the manufacturer.

Processing:

- Ensure that the processing area, extending around the associated equipment/plant's risk zone, is adequate to ensure safety.
- **The drop zone/landing area:-** the intended area in which the operator will position (or allow) materials to fall or be moved into, including consideration of the necessity for road closures/traffic control. Prior to commencing operation, the drop zone/landing areas must be cleared of those at risk and potential obstructions or hazards.
- The grapple saw/tree shears should not be used to drag the processed material. This can lead to overload/overturn of the carrier vehicle.
- **Risk zone:-** an area that materials, or the machine, could foreseeably be expected to be ejected/move/fall into. As the material being processed may move or fall during the specific work operation, reach of boom plus two product lengths plus any ejection risk (including chainshot where relevant) would determine the size of the risk zone. It may be difficult to precisely define an entirely safe area. The level of danger will increase the closer anyone comes to the work area, landing or drop zone.
- **Demarcation** – methods of marking/indicating one of the above areas or zones. Demarcation must be evaluated by the supervisor and operators on each site, including consideration of the necessity for road closures/traffic control.
- **Communication** – Radio communication is recommended within the work team under normal circumstances. If hand signals are used this must be agreed, and evidence of team agreement documented.
- Consideration of foreign objects being present and excessive vegetation.

**PLEASE REFER TO CHECKLIST GUIDE –
APPENDIX 2 – QR CODE**

10. MACHINE OPERATIONS

The following good practice is recommended for machinery operation during felling/cutting activity.

Before starting work:

- Ensure machine operator is qualified and competent to operate the particular combination of carrier vehicle and cutting head and that adequate supervision is in place.
- Discuss with machine operator emergency contingency plans and procedures.
- Warn any persons in the work vicinity, including consideration of signage and use of banksmen to achieve this, and ensure cooperation and coordination with adjacent workers and ensure site is clear of all but essential staff.
- Identify safe working position for operators (including those using a remote control) to stand outside of the risk zones.
- If using remote control, ensure the frequency levels cannot be confused with any other radio controls on site.
- During operations, the operator must have adequate vision or use a banksman/signaller.
- Wear appropriate personal protective equipment.
- The carrier vehicle and attachment may only be operated by a competent operator who is aware of the manufacturer's safety recommendations.
- Ensure the operating machine can be positioned and operated at a safe recommended distance from overhead power lines.
- Always assess the weight of the tree, limb or tree section before commencing operations and refer to machine limits. The weight of the section being cut must be within the manufacturer's lift capacities and safety margins, once the weight of the attachment has been accounted for and considering the extent of the reach at which the machine is working. To take account of dynamic loads when cutting material at height, the calculated capacity should be reduced by 50%.
- Make sure there are no obstacles of any kind in the landing area.

During operation:

- Assess the tree and limbs to be removed. See *appendix 3*.
- If trees are too heavy, large or high, make multiple cuts, starting from the top.

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- When dealing with branch sections, it may be safer and more efficient to take smaller sections because it is more difficult to estimate the weight of a branch section than of a stem section, due to the combined weight of the branch framework and leaves. It is also easier to process a smaller section on the ground where space may be limited.
- Start by taking deliberately small sections as a test. Take progressively larger sections but do not exceed the maximum weight in relation to the safety factor.
- The operating machine arm must be moved safely with slow, accurate movements – always avoid erratic movements.
- Do not use the attachment to pull, push or drag from the front or side, strike or bump other objects in any way.
- Load rotation should only be activated when load conditions are suitable, and the load material is positioned horizontally.
- The tree shears jaws must only be opened to release the gripped material when the materials are positioned horizontally on the ground or other safe landing place.

**PLEASE REFER TO LIFT PLAN GUIDE –
APPENDIX 4 – QR CODE**



FURTHER READING

BS EN ISO 11850-2011+A1-2016 Machinery for Forestry. General Safety Requirements.

BS ISO 11837 Machinery for Forestry. Saw Chainshot Guarding Systems. Test method and performance criteria.

BS ISO 21876 (2020) Saw Chainshot Protective Windows. Test method and performance criteria.

BS 7121-1 2016 Code of practice for safe use of cranes – General

BS 7121-3 2017 + A1 2019 Code of practice for safe use of cranes – Mobile Cranes

HSG 47 Avoidance of danger from underground services.

GS6 Avoidance of danger from overhead lines.

www.hse.gov.uk/treework/safety-topics/lifting-equipment-forestry.htm

www.hse.gov.uk/treework/safety-topics/arboriculture.htm

HSE PUWER ACOP – Safe use of work equipment.

Provision and Use of Work Equipment Regulations 1998.

Approved Code of Practice and guidance – L22 (hse.gov.uk)

HSE LOLER ACOP – Safe Use of Lifting Equipment.

Lifting Operations and Lifting Equipment Regulations 1998.

Approved Code of Practice and guidance – L113 (hse.gov.uk)

Network Rail Code of Practice for Plant. Any Line Open Working (COP ALO) 0032.

Highway Sector Scheme (NHSS18).

FISA leaflets

204 Flails and mulchers in tree work.

504 Extraction by cable crane.

603 Mechanical harvesting.

605 Mechanical roadside processing.

704 Excavators in tree work.

705 Steep Slope Working.

802 Emergency planning.

804 Electricity.

805 Training and certification.

FISA chain shot alert.

<https://ukfisa.com/Safety/Safety-Alerts/tree-shearsgrapple-saws>

Plant safety group Lifting Operations with 180° and 360° Excavators.

AA ICoP and Technical Guides

Industry Code of Practice for Arboriculture – Tree work at height (ICoP).

TG1 Tree climbing and aerial rescue.

TG2 Use of tools in the tree.

TG3 Rigging and dismantling.

TG4 Use of mobile cranes in tree work.

TG5 Use of Mobile Elevating Work Platforms in tree work.

ENA G55 Safe tree working in proximity to overhead electric lines.

Further resources

ALLMI CPA GPG.

SFPSG Ground Conditions Document.

SFPSG Competency Document.

CPA Rail Guidance.

Safe use of remote controls.

Safety at Street Works and Road Works Code of Practice.

Street works qualifications in England: guidance for operatives and supervisors.

Traffic Safety Measures and Signs for Road Works and Temporary Situations Part 2: Operations.

This FISA guide is new to the forestry industry and we welcome your feedback on the guide. If you have feedback, please email info@ukfisa.com. Your comments will be fed to the FISA Plant & Equipment Working Group and the guide will be reviewed in eighteen months' time.

Further information

This guide is produced by the Forestry Industry Safety Accord (FISA) and the Arboricultural Association (AA).

FISA, 59 George Street, Edinburgh EH2 2JG. Tel: 0131 240 1410. Email: info@ukfisa.com Web: www.ukfisa.com

Arboricultural Association, The Malthouse, Standish, Stonehouse, Gloucestershire, GL10 3DL. Tel: 01242 522152. Email: admin@trees.org.uk Web: www.trees.org.uk

Copies of this guide are available as electronic or hard copy via either office or either website shown above. There is also a wide range of additional safety information in relation to forestry on the FISA website and to tree work operations on the Arboricultural Association website.

For more general information about health and safety related to tree work, please visit the Health and Safety Executive website: www.hse.gov.uk/treework/index.htm

SITE CONSIDERATIONS – COMMON FACTORS TO CONSIDER

During the planning of works, considerations for the site assessment/risk assessment should include:

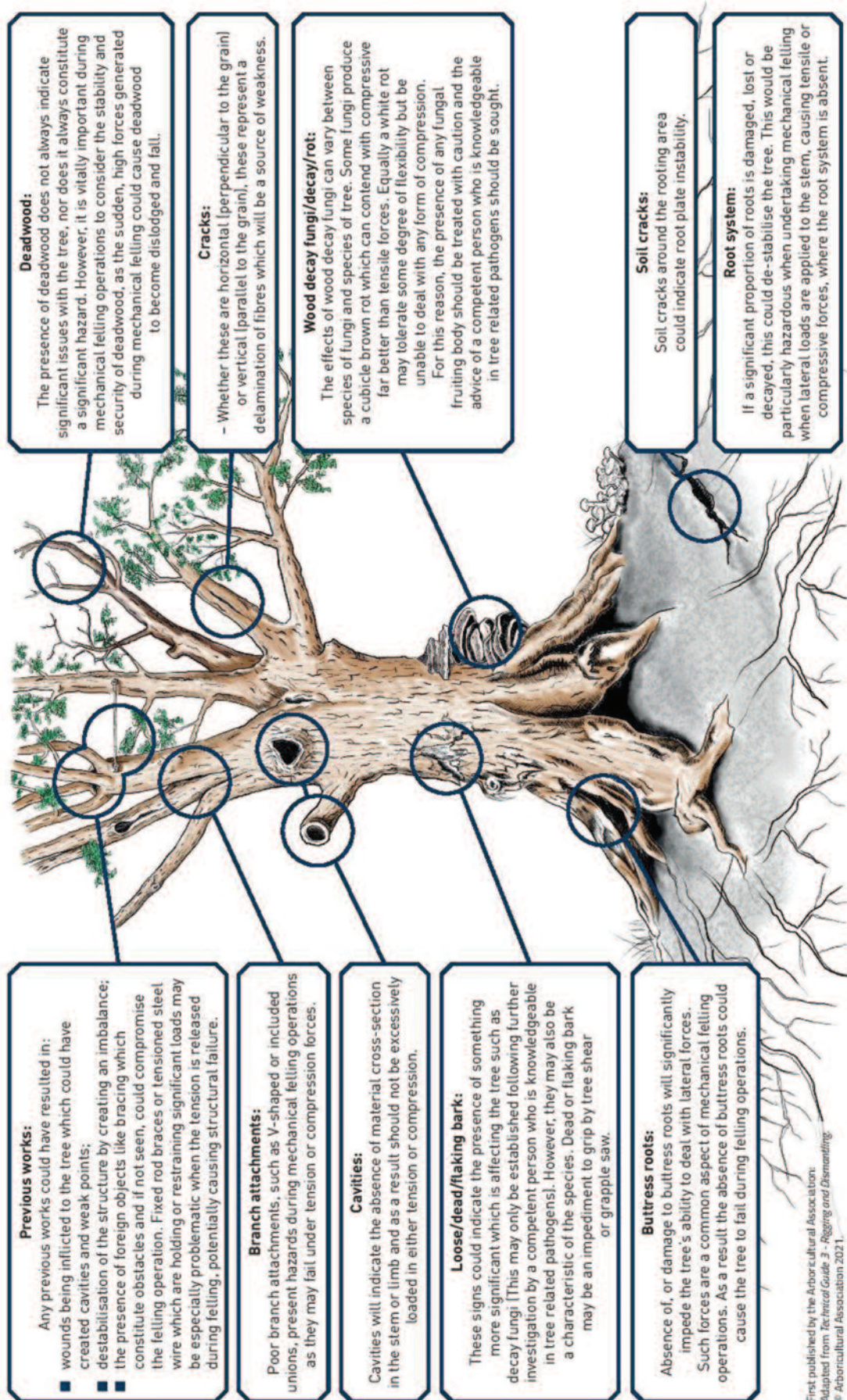
- Pre site inspection – stakeholder pre-commencement meeting.
- Public highway access restrictions – low bridges – loader heights – road closure considerations dependent on risk zones.
- Work permits – permissions and associated documentation, e.g: Road closure; Permit to dig and break ground; Track and slow moving vehicles/plant; Landowner permissions – site hazards and constraints maps, etc.
- Communication with local residents where necessary regarding noise, disturbance, etc – timing of works and access.
- Access and egress routes approved for use – plan for emergency evacuation from site.
- Height limitations – overhead power lines – GS6 goal posts – local electrical network operator vicinity zone clearances/safety distances from infrastructure (consultation with owners) – FISA red zone guidance.
- Underground services – contact with statutory undertakers to inform them of works/accurate location of services – protection requirements and options – informing services owner – use of schematics.
- Potential impact on adjacent land, buildings, structures, infrastructure – environmental constraints – ecology report findings.
- Impact/effect on other site work operations – pedestrian access/traffic – process for sharing information/cooperation.
- Signing, lighting and guarding – traffic management.
- Public and worker safety signage/warnings – hazard identification – no-go zones etc.
- Terrain constraints – slopes, embankments, obstacles, machine traction, debogging equipment, machine use of roads and tracks (potential damage), ground conditions in terms of machine stability.
- Site security – fuel and equipment storage – environmental/spillage control.
- Loading/unloading areas.
- Operating areas/work zones – space for work – safety distances – access control to members of public, construction workers etc.
- Material landing zones – arisings storage/further processing areas.

OPERATIONAL PLANNING – COMMON FACTORS TO CONSIDER

Consideration must be given to:

- Carrier vehicle compliance with applicable LOLER regulations.
- Carrier vehicle has adequate OPS, FOPS and ROPS protection.
- Weather conditions – wind, ice, electrical storm.
- Ground conditions – slopes/steep ground, ground-bearing capacity.
- Discharge and landing area for cut material and further processing.
- Stability of the machine –
 - maintain the centre of gravity of machine
 - prevent overreaching.
- Machine handling limit – prevent overloading.
- Identify and fell trees in accordance with job specification.
- Species and condition of the tree –
 - Live/dead
 - Decay/splits/broken sections
 - Foreign objects in or attached to tree.
- Tree size and assessment of weight.
- Maximum felling diameter.
- Correct felling sequence, i.e. selection of tree section.
- Correct positioning of carrier vehicle.
- Correct positioning of felling head in relation to operators and others who could be at risk.
- Stem gripped correctly.
- Tree felled in correct direction.
- Avoid damage to remaining trees.
- Environmental spillage control.

ACTUAL OPERATION. ASSESS THE TREE AND LIMBS TO BE REMOVED.



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LIFT PLAN GUIDE

For application and context see Section 7 Tree Shears/Grapple Saws: PUWER LOLER Regulations. Lifting operations must be properly planned by a competent person.

A lift plan should list the following information:

- Appointed person.
- Site address.
- Site access.
- Exclusion zones.
- Description of work area.
- Presence of overhead and underground utilities.
- Description of ground conditions.
- Definition of footing requirements and ground conditions.
- Requirements for traffic management if applicable.
- Description of vegetation.
- Statement of projected mean weight for cut materials/softwood/hardwood.
- Description and methodology of operation.
- Position of the machine, location that cut materials will be placed in and the path that the cut materials will be moved through.
- List of all equipment utilized in operation.
- Detailed description of equipment to include SWL certificate expiry, report of Thorough Examination etc.
- Declaration of maximum working height.
- Declaration of maximum working radius.
- List of on-site personnel involved in operation.
- Description and assessment of hazards.
- Protection of the travelling public.

Lift plan should also contain:

- Register of personnel certifications.
- Record of plan revisions.
- Record of plan assessment and verification.
- Certifications for all equipment.
- Maintenance history of equipment.

Detailed information and guidance on production of suitable lift plans can be found from the following resources:

- LOLER ACOP
- BS ISO 7121