

A HSE Funded research project.

# Determination of rope access and work positioning techniques in arboriculture.

November 2004



Author: A M Lane  
*LRH Limited*

## Table Of Contents

1. Introduction & Background .....	1
2. Terms Of Reference .....	2
3. Report Scope .....	3
4. Current Tree Climbing Techniques .....	4
5. Defining Work Position & Rope Access .....	5
6. Assessing When Double Rope Working or Double Attachment Is Reasonably Practicable In Tree Climbing Operations.....	6
6.1 Work Positioning .....	6
7. Conclusions and Recommendations Arising From Evaluation.....	8
7.1 Risk Assessment .....	8
7.2 Equipment & Training.....	8
7.3 Methods Of Access.....	8
7.3.1 Advancing The Rope & Body Thrusting / Alternate Lanyard Technique.....	8
7.3.2 Ladders .....	9
7.3.3 Climbing Irons .....	9
7.3.4 Mobile Elevated Work Platforms [MEWPs].....	9
7.3.5 Secured Foot Locking / Single Rope Technique (SRT).....	10
7.4 Anchor Point Selection.....	11
7.5 Movement in the crown.....	11
7.6 Branch Removal & Dismantling.....	11
7.6.1 Branch Removal.....	11
7.6.2 Sectional Dismantling Using Ropes.....	13
7.6.3 Sectional Felling Of The Standing Stem .....	13
8. General Conclusions .....	13
Acknowledgements .....	15
Bibliography .....	16
Appendix 1     Attendees List.....	17
Appendix 2     Backup System & Tree Climbing Activity Evaluation.....	18
Evaluation 1 .....	18
Evaluation 2 .....	19
Evaluation 4 .....	21
Evaluation 5 .....	22
Evaluation 6 .....	23
Evaluation 7 .....	24
Appendix 3     Definitions.....	25
Appendix 4     Summary Reports From Update & Standard Setting Events.....	26

## List Of Plates

Plate 1 - Typical Current Tree Climbing Technique Using A High Anchor Point and Supplementary Anchor Points.....	4
Plate 2 - A Climber Using Two High Load Bearing Anchor Points To Move Around A Large Open Crown .....	6
Plate 3 - Secured Foot Locking With A Back Up Line .....	7
Plate 4 - Evaluation Using Two Load Bearing Anchors To Move Around A Typical Garden Sized Tree.....	14

## **1. Introduction & Background**

This research project has been commissioned and funded by the Health & Safety Executive. The research has arisen to provide information that will help contractors select the most suitable rope access or work positioning system for arboricultural work when risk assessment has identified rope access or work positioning techniques as being appropriate. The work is also intended to aid the formulation of internal guidance for the benefit of HSE's regulatory inspectors who inspect arboricultural work.

Work has already been undertaken through Lantra Awards and the National Proficiency Test Council [NPTC] in considering the Working At Height Regulations [WAHRs] and the practical possibilities of improving best working practices. Its network of regional arboricultural Technical Standards Verifiers [TSVs] meet annually to standard set issues relating to arboricultural training and assessment. In 2004 the issue chosen to explore was the feasibility of additional systems to provide back up in the event of system or anchor point failure. A general consensus amongst TSVs found a number of technical issues required further consideration, and concerns were raised regarding the impractical nature of maintaining twin systems at all times. One solution for winning industry acceptance was the reinforcement of current best practice guidance through the revisions to the Guide To Good Climbing Practice [GTGCP].

In addition, a series of 12 regional 'Update and Standard Setting' meetings have taken place throughout the summer of 2004 across the UK. All arboricultural Instructors and Assessors registered with Lantra and NPTC are required to attend these events to remain registered. A scheduled part of this event has been to explore the feasibility of back up systems and invite comment from attendees. TSVs running the events have been recording the findings of all participants. This provides a comprehensive and wide ranging interface with practitioners in the industry, and a summary of all the findings from each event have been included in Appendix 4

The final stage of the research project, managed by Simon Richmond from Lantra Awards, has brought together representatives from training and assessment, large and small arboricultural businesses, arboricultural organisations and the HSE to provide practical guidance to the arboricultural industry and the HSE in determining work positioning and rope access techniques for typical situations that are likely to arise in the course of modern arboricultural work. A list of attendees is in Appendix 1. It is worth noting that several of the attendees have strong links with European and USA practitioners and the opportunities for using systems and guidance used in other countries were actively explored before the meeting. No significant information was forthcoming from these representations and it appears that the UK is in the forefront of establishing the feasibility of secondary back up systems in arboriculture.

The Arboricultural Association are currently revising the GTGCP and this research is intended to provide guidance for this process, as well as aiding HSE in responding to the consultation drafts of this work. Throughout the work the draft Work at Height Regulations as they stood on 19.10.04 have been kept in mind.

Determination of rope access and work positioning techniques in arboriculture.

## **2. Terms Of Reference**

To hold a workshop of industry experts and representatives to consider current arboricultural best practice when working at height.

To provide further guidance on when twin rope working/double attachment would be appropriate and in particular the use of load bearing supplementary/second anchor points

To inform the Health and Safety Executive, enabling them to give practical guidance that can be included into the revised GTGCP and aid the formulation of internal guidance for inspectors on the safety standards expected in tree work.

### 3. Report Scope

The report is not a formal research report but records the findings of the working group that met at Myerscough College on the 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> November 2004 to consider the “Determination of rope access and work positioning techniques in arboriculture” within the above terms of reference.

The focus of the working group has been on two types of fall protection system: ‘Work positioning’, and ‘Rope access and positioning’.

#### *Work Positioning:*

Normally in work activities in other industrial sectors, work positioning systems are used with a back up system for preventing or arresting a fall, and the user is connected to it. This work will seek to define when back up systems are not reasonably practicable in arboriculture and what other suitable measures are needed to prevent or arrest a fall.

#### *Rope access and positioning:*

Normally in industrial rope access contexts rope access and positioning systems comprise two separately anchored lines – one the working line used for access, egress and positioning and the other is the safety line. The user is connected to both lines. The working line is equipped with a means of ascent and descent and has a self locking system which prevents the user from falling

The safety line is equipped with a mobile fall protection system that is connected to and travels with the user of the system.

Normally this sort of system will always use two ropes. The draft WAHRs currently state that:

the system may comprise a single rope where:-

*a risk assessment has demonstrated that the use of a second line would entail higher risk to persons; and*

*appropriate measures have been taken to ensure safety*

The report will record findings and conclusions in respect of the following areas:

1. Definition of terms within current tree climbing techniques in the context of the definitions used in work at height in other industrial sectors.
2. What is ‘reasonably practicable’ in terms of two rope / two systems in the context of various crown forms and tree climbing activities such as:
  - i. Accessing the tree
  - ii. Anchor point selection
  - iii. Movement in the crown
  - iv. Branch Removal
3. Foot locking and Single Rope Techniques [SRT] and use of back up systems.
4. How current best practice can be amended or improved.

#### **4. Current Tree Climbing Techniques.**

Current tree climbing practice appears to conflict with the way that work positioning systems and rope access and positioning systems are used in other industries. Backup systems in the form of a safety line are not commonly used, although the Guide to Good Climbing practice does refer to them and recommend them. In addition, although the (tree) climber may be attached by two systems at the time of cutting in the tree, at other times they work from a single system or when foot locking is used, access the tree exclusively from a single system with no back up.

Although standard tree climbing techniques appear to have two ropes attaching to the climbers harness, i.e. the static side tied off or connected at the harness and the working side attached via a friction knot or device to the harness, this constitutes one system and if either side fails the climber will fall.

To clarify where the various techniques fell within the accepted definitions a demonstration of best practice and a more typical working situation was given so that the HSE representatives could form an opinion of what constituted 'Work Positioning' and 'Rope Access and Positioning'.

#### **Plate 1 - Typical Current Tree Climbing Technique Using A High Anchor Point and Supplementary Anchor Points.**



## 5. Defining Work Position & Rope Access

The opinion of the HSE representatives was that conventional techniques used to access the tree, move about the crown and achieve a work position were likely to fall under the definition of 'Work Positioning'. However foot locking using either mechanical ascenders or a friction knot was within the current definition for 'Rope Access and Positioning'.

Clarification was sought in defining the terms still further and the following classification of work positioning was shown to the group. It was taken from the provisional British Standard - prBS8437 : 200X, Code of practice for the selection, use and maintenance of personal fall protection systems and equipment for use in the work place:

'Work positioning systems can be classified into two main types:

- systems that provide partial support for the user, i.e. the user is supported in tension, part of the user's weight being supported by the work positioning system and the remainder by the surface on which the user is standing.
- systems that provide complete support to the user, i.e. the user is in suspension and their weight is fully supported by the work positioning system.'

It was felt that these two types best described the current techniques used in tree climbing. The definitions for Rope Access are less distinct and no clear reference was available, however guidance was given by the HSE in distinguishing between the two as follows:

In work positioning the rope advances or moves with the climber. In rope access the rope remains static and the climber advances up or down the rope; in the latter situation both ends of the rope can be tied off whereas in work positioning the rope has to move. Tree climbing techniques rely on a contracting or expanding loop of rope and therefore are not static.

'Rope Access' therefore best describes foot locking techniques whether single rope technique [SRT] or as is more commonly used in arboriculture, the use of two lines together in a secured foot locking technique. Neither this form of foot locking or SRT should be confused with a climber using their feet to assist ascent in a conventional climbing system i.e. assisted or modified body thrust (Jepson 2000).

Having defined the terms the working group concluded that conventional tree climbing techniques as shown in the Guide to Good Climbing Practice, with the exception of foot locking and SRT, could be considered as 'work positioning' techniques and Foot locking with SRT as 'rope access and positioning techniques'.

After the meeting HSE commented that pr 8347 is not likely to include detailed definitions when it is published. However the technical specialist inspectors of HSE confirmed the way that the working group considered the terms work positioning and rope access and positioning was in line with their understanding of the terminology.

Martin Holden, the HSE's topic specialist for rope access techniques, provided a set of definitions to the author. These definitions are set out in Appendix 3.

## **6. Assessing When Double Rope Working or Double Attachment Is Reasonably Practicable In Tree Climbing Operations.**

### **6.1 Work Positioning**

In order to evaluate whether a backup system in the various stages of tree climbing is a practical option, the method of assessing where it is not 'reasonably practicable' had to be considered.

The following summarised definition of reasonably practicable has been derived from the reported case 'Edwards v. The National Coal Board' where the Court of Appeal held that:

Where the severity or likelihood of the risk is weighed against the effort of averting that risk in terms of money, time or trouble, and as a result the reduction in risk is insignificant in relation to that effort, then the duty holder (e.g. the employer or self employed person) has discharged the onus on them.

Tree climbing activities were examined in several different trees to illustrate the variety of working environments likely to be met by tree climbers using various methods of backup systems. Further to the practical evaluation, the various processes of tree climbing i.e. access, anchor point selection, working in the crown and branch removal, were considered through demonstration and discussion.

A record of the evaluations both practical and verbal is provided in Appendix 2 and inform the conclusions and recommendations made in section 7.

### **Plate 2 - A Climber Using Two High Load Bearing Anchor Points To Move Around A Large Open Crown**





### **6.2 Rope Access Using Foot Locking**

Section 5 determined that foot locking was a 'rope access technique' and should normally use a second separately anchored line; with a self locking system that follows the climber as they ascend the working line, and which in the event of the working line failing would restrict the fall.

The evaluation of this system took the form of practical demonstration and evaluation followed by a working group discussion. The practical evaluation is summarised in Appendix 2. The aim of the evaluation was to look at the implications of using a backup line and whether this constituted a 'higher risk'.

A variety of ways of achieving a second line were evaluated and compared to existing practices. The group determined that in arboriculture this method was only used for access and was of short duration. By comparison, operators using rope access and positioning in other industrial contexts would also carry out work activity from the system. This doesn't take place in arboriculture and so correspondingly the chance of system failure is reduced.

#### **Plate 3 - Secured Foot Locking With A Back Up Line**



## **7. Conclusions and Recommendations Arising From Evaluation.**

The evaluations identified a number of areas within current best practice that required reinforcing and additional detail. The following recommendations (*Shown in italics*) have been drawn from discussions at the end of the three-day workshop and are designed to inform the current revision process of the GTGCP.

In order to provide a structure to the guidance presented by this project, tree work has been divided into several key processes with individual techniques identified within those processes as applicable.

Several general principles have been identified that cross all the various processes and techniques in relation to equipment. They reinforce best practice but also inform it in ensuring several controls are explicit in controlling specific hazards.

### **7.1 Risk Assessment**

Currently guidance is provided under LOLER in the form of an Agricultural Information Sheet (AIS30) and states that rope access techniques should only be used where other means of access or undertaking the work e.g. Using a MEWP or pole saw, are not reasonably practicable. *The WAHR s will strengthen this and therefore our industry guidance should reflect this in the revised edition of the GTGCP.*

In this research project it is implied that the test of reasonable practicability has been applied and that work position/rope access has been chosen as the appropriate work method.

### **7.2 Equipment & Training**

Equipment choice, suitability and operator training are already considered in detail in the current best practice guidance. *As such no change is recommended to the underlying principles.*

### **7.3 Methods Of Access**

#### 7.3.1 Advancing The Rope & Body Thrusting / Alternate Lanyard Technique

The main hazards involved in this technique were broadly considered as:

- Anchor point failure
- Equipment failure
- Accidental disconnection

Recommendations for anchor point selection are dealt with later in the report however they are allied to accidental disconnection at the point of changeover from one system to another. The working group considered the relevant evaluations in Appendix 2 and concluded that the following guidance should be emphasised in the revised GTGCP:

*At the point of greatest risk i.e. changeover, there must always be two proven load bearing anchor points; and*

*Before disconnecting the first system, the second system must be proven by ensuring all connections are visually and physically checked; and*

*The weight of the climber is fully transferred onto the second system before the first system is slackened and then disconnected.*

The working group concluded that equipment failure is already adequately controlled through the existing LOLER, PUWER and the PPE Regulations. Current guidance through the GTGCP and AFAG401 was felt to be more than adequate in providing best practice guidance. However, excerpts from recent guidance provided in an HSE research report:

“Karabiner safety in the Arboricultural Industry” (Report Number: ME/03/08) will be included in the revision of GTGCP.

### 7.3.2 Ladders

The HSE published safety guidance leaflet, AFAG 401 Tree-climbing operations, provides best practice guidance in the use of ladders in tree climbing. The GTGCP has a short section on ladders in paragraph 6.5 and refers to AFAG 401.

Current guidance requires the climber to tie into the tree before leaving the ladder and that if working from the ladder a climber must first be anchored into a suitable anchor point.

The main hazards identified were the ladder becoming unstable as the climber made the transition into the tree or attempted to throw their rope from the ladder without being secured to the tree. Although the current guidance provides good principles it was concluded these should be reinforced with the following:

*Before leaving the ladder or throwing the rope from the ladder to a higher anchor point the climber must be attached to a load bearing anchor point that is within easy reach of the climber and minimises any fall. This should be as little as possible and never more than 500mm.*

### 7.3.3 Climbing Irons

In ascending the tree using climbing irons/climbing spikes it is normal practice to do so with an adjustable lanyard used around the main stem of the tree. This lanyard may have a wire core to aid movement up the stem or may be constructed of conventional climbing rope. The climber's life line is normally attached to the harness and taken up to enable obstacles such as branches to be passed using an 'alternate lanyard' technique. The main hazards were considered as accidental disconnection at the point of changeover particularly where Ivy or epicormic growth obscures equipment, and to a much lesser degree the failure of the anchor (the anchor usually being the stem on which the climber is standing).

Guidance is already given on best practice in the GTGCP in paragraph 6.10 and in AFAG 401.

The implications of always ensuring two load bearing anchor points and therefore introducing a third system at changeover highlighted the same weaknesses found in previous practical evaluations such as *Evaluation 2* (Appendix 2). In addition to the those weaknesses it was concluded that trying to advance two ropes up the stem particularly on large diameter trees, rough barked trees or vegetation covered stems would make the backup up system impracticable.

*The working group concluded that current best practice could be reinforced and these recommendations have already been made in Section 7.3.1 above.*

### 7.3.4 Mobile Elevated Work Platforms [MEWPs].

MEWPs are becoming more commonly used in arboriculture and in some cases are used to place a climbing rope in the tree. AFAG guide 403 'Mobile elevated work platforms (MEWPs) for tree work' gives clear guidance on how a climber may transfer from the MEWP bucket into the tree.

*The working group felt no further recommendation was required given this activity would be covered by the other aspects of accessing the tree by rope and harness.*

### 7.3.5 Secured Foot Locking / Single Rope Technique (SRT)

Although SRT has not been evaluated separately, the hazards of anchor point failure and equipment failure remain largely the same as secured foot locking. As such the recommendations provided in this report can be equally applied between both techniques.

Despite careful and lengthy evaluation, the current technique does not meet the standard used in other industrial contexts, in particular by the Industrial Rope Access Trade Association [IRATA]. It could only be brought in line by requiring a second safety line and self-belay, or other form of protection device, to be installed. It was not possible to determine situations where the installation of a second line would definitely lead to 'higher risk', thereby justifying that a single system be used.

However, the working group felt that the additional safety system had a number of weaknesses as listed in *Evaluation 7* (Appendix 2), and that the extra complication of the additional line would become a barrier to industry embracing foot locking or SRT as an access technique. Examples were also cited where the extra rope could create an impediment to the climber's progress, potentially introducing additional risks.

Foot locking and SRT are widely accepted as an ergonomic and efficient method of accessing a tree, particularly where the crown is high or very open and long ascents are required. Furthermore it potentially reduces the amount of changeovers, rope slack and branch rolling required if the climber were to use body thrusting or alternate lanyard techniques.

The hazards presented by the technique are principally anchor failure or equipment failure. The latter hazard falls within the scope of LOLER, PUWER and the PPE regulations and so is already well controlled.

The risk of anchor failure is seen as higher given it is installed high in the tree away from where a climber can make a close inspection. The issue of checking the anchor has been addressed in part through paragraph 6.8 of the GTGCP however the working group recommended it required further detail as follows;

*Once installed and visually checked the foot lock line must be proven by the climber placing their full weight on the line and bouncing; or the full weight of two climbers being applied to the line.*

In conclusion the working group felt that foot locking should continue to be included as industry best practice without a safety line. It also concluded that the following additional controls would be implemented and recommended as revisions to current best practice guidance.

- *Anchor point selection for foot locking and SRT is taught and assessed.*
- *Anchor points should be loaded and verified from the ground (as recommended above), including visual assessment using binoculars where applicable.*
- *Training is used to teach best practices in foot locking methods and these are assessed.*

There is still a need to resolve the issue of a second independently anchored line for foot locking. The industry and HSE will have to consider how this can be addressed, particularly when the Work at Height Regulations are in force.

#### **7.4 Anchor Point Selection**

Throughout the practical evaluations and discussions the importance of good anchor point selection, both in terms of timber strength and position in the crown, was seen as vital. Unlike many other industrial 'rope access' situations the anchor point in arboriculture cannot be accurately strength-rated and the anchor point is often established remotely from the climber rather than the climber starting from the anchor point.

The selection of anchor points is heavily emphasised in the current best practice guidance. The GTGCP section 6 deals in detail with selection and use, as does AFAG guide 401. The group felt there is little to add to that guidance other than reinforcing importance of choosing load bearing anchor points as follows:

*All main anchor points must always be load bearing.*

*All new main anchor points must be proven as load bearing before committing to them.*

#### **7.5 Movement in the crown**

From the evaluations it is clear that the form of the tree will largely dictate the techniques available to the climber for moving within the crown. Two rope working is feasible in certain situations and current best practice already supports the principle of two rope working in those situations.

At present the use of supplementary anchor points is supported by the GTGCP, paragraph 8.3 and AFAG guide 401 where the risk assessment identifies the need. Neither publication describes the supplementary anchor point as load bearing although it is implicit in the guidance given they are there to protect the climber should their rope be cut or their main anchor point be compromised. The working group concluded that future guidance should make load-bearing anchors more explicit as follows.

*Where the risk assessment identifies the need for supplementary anchor points they should be load bearing wherever practicable.*

#### **7.6 Branch Removal & Dismantling**

##### 7.6.1 Branch Removal

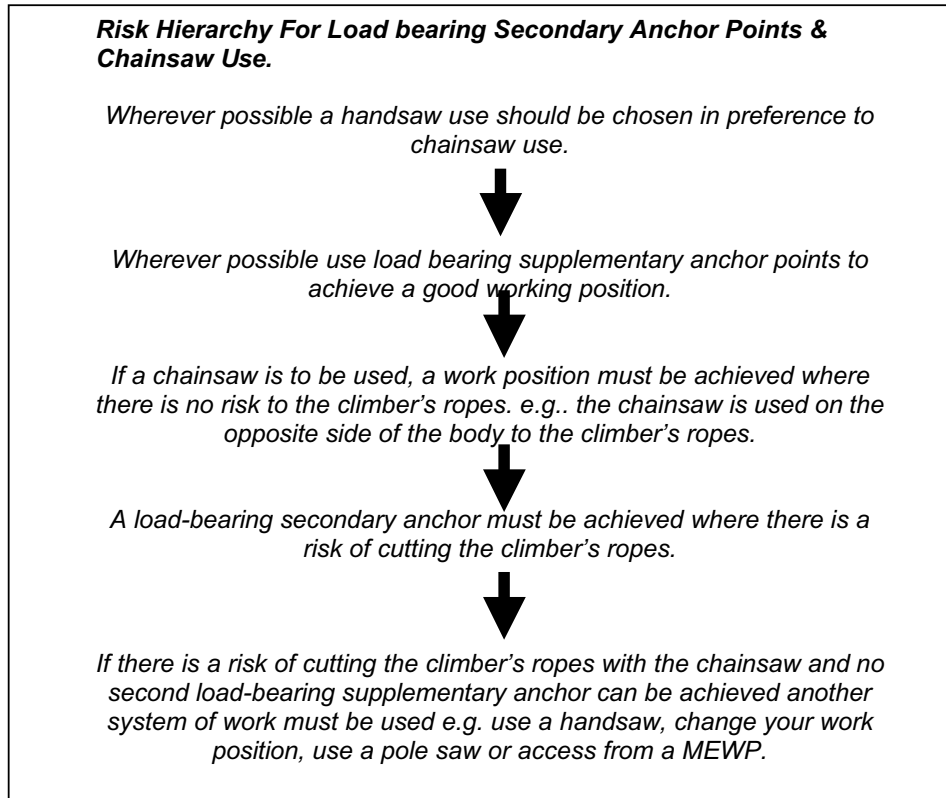
Using a chainsaw in the tree is a potentially high-risk activity. Current best practice places emphasis on achieving the correct work position when using the chainsaw as a way of avoiding injury to the climber from kickback and avoiding severing the climber's ropes during cutting operations (AFAG guide 308 Top-handled saws and AFAG 401).

In branch removal the climber is already encouraged to use supplementary anchor points so that they can achieve a more stable and therefore safer, and more accurate position from which to use the chainsaw. (AFAG 401 paragraphs 56, 57 & 58). It is also recommended in AFAG 401 (56) that these supplementary anchor points must be strong enough to support the climber's weight however it does not go as far as to stipulate that the anchor point must be load bearing.

Where the climber is working in the upper quadrant of the crown, achieving a second load bearing anchor point may be virtually impossible other than perhaps closer to their current main anchor, which provides little gain to either stability or safety. This emphasises the need to apply rigorous precautions against the main climbing system being cut with the chainsaw. Current teaching has been to ensure the chainsaw is used away from the climbing lines, however this is not detailed in current guidance.

*The working group felt strongly that more guidance relating to when load bearing second anchor points must be used and what action may be taken where it is not reasonably practicable must be given. They recommended that a section in chainsaw use and work positioning should be included in the revised GTGCP.*

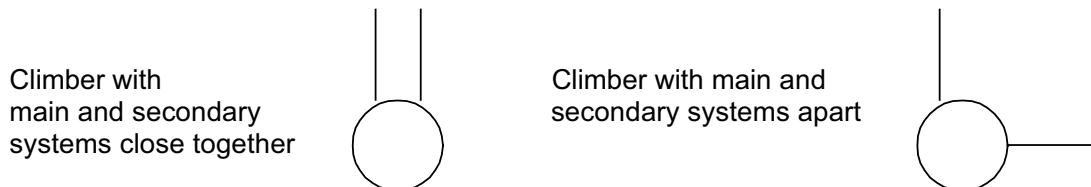
The following risk assessment hierarchy was devised as a guide to be included within the revised GTGCP. It reinforces the need to use secondary load-bearing anchor points wherever practical and also reinforces the fact that poor work positioning is not an excuse for cutting close to yourself or any part of your climbing system



The fourth statement of the hierarchy requires a secondary anchor to be achieved where there is a risk of cutting the ropes. To reinforce this statement the following recommendation is made;

*The second load bearing anchor must be set so the possibility of cutting both primary and secondary systems is remote*

The following illustration is used:



It was concluded that current best practice with the additional recommendations made above would provide greater clarity on when supplementary anchor points should be used.

### 7.6.2 Sectional Dismantling Using Ropes

In addition to looking at branch removal and the use of secondary anchor points the working group considered the implications of dismantling the crown using lowering ropes.

In dismantling operations it is normal practice to have a high anchor point for the climber and a second high anchor point for lowering equipment. Neither system should be in contact with the other and the risk assessment should always ensure that the climber's main anchor point is not compromised by the failure of the lowering anchor, lowering equipment such as ropes or the item being lowered.

If a second high anchor point was to be used to provide a back up system then a number of strengths and weaknesses may be derived from such a system as seen in *Evaluation 1* (Appendix 2). However in addition to the weaknesses listed in the evaluation several other constraints were identified as follows;

- Increased risk of accidental removal of the second high anchor with catastrophic consequences for the climber.
- Reducing the availability of rigging points separate to the climber's high anchors.
- Greater confusion of ropes within the crown.
- Much greater chance of lowering ropes running across climbing lines.

*The working group concluded that during dismantling it is not good practice to maintain two high anchor points and this should be added to the revised GTGCP.*

### 7.6.3 Sectional Felling Of The Standing Stem

As part of the dismantling operation, removal of vertical sections and the main trunk is undertaken with the climber attached only to that stem or trunk. The technique and best practice is illustrated in AFAG guide 401 Figure 3. This shows a free-fall situation but it would equally apply to a roping-down scenario.

*The illustration shows the use of two load-bearing anchor points and it was concluded that current best practice was satisfactory. No further guidance was therefore required, however this illustration or similar should be used in the additional section on chainsaw use and work positioning in the revised GTGCP as recommended.*

## **8. General Conclusions**

Current best practice guidance already promotes a high technical standard and the current revision of the GTGCP is an opportunity to review where current practice can be strengthened.

The main risk of system failure is during changeover (human error) and chainsaw use. At other times the risk of system failure (e.g. through equipment failure) has been assessed as being substantially lower. The recommendations made have concentrated on reinforcing current best practice in the higher risk areas.

The use of two-rope working is already accepted practice and set out current best practice guidance, however improvements need to be made to emphasise and encourage the use of this work system particularly at the point of work. Where two rope working is not currently supported by best practice, evaluation has shown that any improvements in safety, by using two ropes in these situations, are small and are outweighed in practical terms by either increased effort, time and cost or combinations thereof.

Determination of rope access and work positioning techniques in arboriculture.

The shape and form of many trees make the selection and use of a second load bearing anchor points impossible particularly in the upper and outer crown areas. Current best practice has already provided methods of work for these higher risk areas and recommendations made in this report will further improve safety and therefore should be incorporated in the revised GTGCP.

Tree climbing is unique within industrial access given the variable nature of the structures being climbed. A dogmatic approach to work techniques without the opportunity for individual assessment and modification of technique would make arboricultural work in trees more difficult and in some cases increase risk. Current training standards and risk assessment based climbing systems provides this flexibility. The delivery of high quality training and assessment to the industry based on a clear industry standard such as a revised GTGCP could help to provide the necessary safeguards to make tree climbing, where it is the preferred access method, safer.

If best practice guidance is not seen as practical, the industry is unlikely to use it as strict guidance and therefore a barrier is placed in the adoption of safe systems of work. By ensuring the revised GTGCP is practical, the working group are confident the industry will use it.

**Plate 4 - Evaluation Using Two Load Bearing Anchors To Move Around A Typical Garden Sized Tree.**





Determination of rope access and  
work positioning techniques in arboriculture.

## **Acknowledgements**

For organising the venue & demonstration areas:

Mick Cottam  
Head Of Arboriculture  
Myerscough College  
Bilsborrow  
Preston  
Lancashire

For arranging the funding, managing the organisation of the contract and providing the pictures:

Adrian Hodkinson  
HM Inspector Of Health & Safety  
Health & Safety Executive  
Stoneleigh Park  
Warwickshire  
CV8 2LG

Report Author:

Tony Lane  
Lane Rowe Hambidge Limited  
Hill Park House  
Uffculme  
Devon  
EX15 3BJ

For the managing the project:

Simon Richmond  
Development Manager – Forestry & Arboriculture  
Lantra Awards  
Lantra House  
Stoneleigh Park  
Warwickshire  
CV8 2LG

Determination of rope access and work positioning techniques in arboriculture.

## **Bibliography**

AFAG (2003) Top Handled Chainsaws (Safety Guide) HSE

AFAG (2003) Tree climbing operations HSE

AFAG (2003) Mobile elevating work platforms (MEWPs) for tree work. HSE

Arboricultural Association / FASTCo (1999) A Guide To Good Climbing Practice

BSI (2002) BS7985:2002. Code of Practice for the use of rope access methods for industrial purposes BSI

BSI (200X) prBS8437 : 2004 Code of practice for the selection, use and maintenance of personal fall protection systems and equipment for use in the workplace. (This prBS is currently under preparation) BSI

HSC DRAFT Work at Height Regulations 200X (19.10.2004 vsn)

HSE (1998) AIS30 LOLER: How the regulations apply to arboriculture. HSE

J Jepson (2000) The Tree Climber's Companion (2<sup>nd</sup> Ed.) Beaver Tree Publishing, USA

**Appendix 1****Attendees List**

<b>Name</b>	<b>Employment</b>	<b>Representing</b>	<b>Description</b>
Adrian Hodkinson	HM Inspector of H & S, Agriculture and Food Sector	Health and Safety Executive (HSE)	Nationally responsible for promoting improvements in health and safety in arboriculture
Hash Maitra	H M Principal Inspector of H & S Construction Division Technology Unit.	Health and Safety Executive (HSE)	Technical specialist on issues relating to work at height, CDM and design.
Simon Richmond	Development Manager (Forestry & Arb) Lantra Awards	Lantra Awards	Nationally recognised training organisation
Mick Cottam	Myerscough College	European Arboricultural Council (EAC)	International arboricultural forum
Martin Lennon	Training Manager	Fountains	Large national contractor, (IRATA trained and assessed)
Tony Lane	LRH Ltd	Training standards	Technical Standards Verifier (TSV)
Liam McKeown	Treevolution	Arboricultural Association	National trade association. (Treevolution has experience of German, Swedish and Spanish tree work practices)
Chalky White	Arb Solutions	Arb Solutions	Small contractor
Chris white	Cut above Tree Specialists	Forestry Contracting Association	National trade association
Mark Fagg	Forestarb Training Co.	Forestarb Training Co	Small contractor
Paul Elcoat	Salcey Arborcare	International Society of Arboriculture	International trade association, with a USA parent organisation.
Rob Blake	Rob Blake Training	Training standards	Technical Standards Verifier (TSV)
Peter Holloway	Gristwood and Toms	Gristwood and Toms	Large contractor

Evaluation 1

<b>Work Environment:</b>	Large tree with open spreading crown.	<b>Work Activity</b>	Movement within the crown
<b>Back Up System</b>	Second Rope / Both Ends Of Rope		
<b>Strengths</b>	<ol style="list-style-type: none"> <li>1. Provides a positive backup if second system fails.</li> <li>2. Provides a positive backup if anchor point fails.</li> <li>3. Protects climber against pendulum swing if anchor points are placed sufficiently apart.</li> <li>4. Facilitates access and stability due to triangulation.</li> </ol>	<b>Weaknesses</b>	
<b>Current Best Practice &amp; Conclusions</b>	<ol style="list-style-type: none"> <li>1. Relies on the climber selecting correct anchor points far enough apart to provide adequate triangulation</li> <li>2. Second high anchor may be difficult to see and verify.</li> <li>3. Very difficult to achieve in more densely branches crowns.</li> </ol>		
	<ol style="list-style-type: none"> <li>1. This method is best practice in larger more open crown trees and is already described in the GTGCP paragraph 8.8.</li> <li>2. It is reasonably practicable to use this method where the working environment allows.</li> </ol>		

Evaluation 2

<b>Work Environment:</b>	Medium sized tree with congested crown.	<b>Work Activity</b>	Tree access using a combination of the tree structure and body thrusting.
<b>Back Up System</b>	Alternate Lanyard Technique (Maintaining two load bearing attachments whilst securing a third point). Also included rope advancement to higher anchor points.		
<b>Strengths</b>		<b>Weaknesses</b>	
<ol style="list-style-type: none"> <li>1. Provides a positive backup if the second system fails.</li> <li>2. Provides a positive backup if anchor point fails.</li> </ol>		<ol style="list-style-type: none"> <li>1. Slower to ascend the tree due to extra system attachment.</li> <li>2. Greater kit confusion increasing risk of climber error in attachment.</li> <li>3. Increased equipment for climber to carry (weight &amp; cost).</li> <li>4. Increased drag of equipment through the tree (climber fatigue)</li> <li>5. Connector crowding at attachment points made operation more difficult and increased risk of equipment damage (abrasion) and failure (opening 3way action &amp; misalignment).</li> <li>6. Little perceived improvement in operator safety likely to result in operators not using third system.</li> </ol>	
<b>Current Best Practice &amp; Conclusions</b> <ol style="list-style-type: none"> <li>1. The current best practice method in this environment is to use two systems by attaching and proving the second system before detaching the first system.</li> <li>2. The GTGCP already provides guidance in the two system method in Sections 6 &amp; 8 however further reinforcement is required in these sections to highlight good technique.</li> <li>3. Given the extra effort and little perceived improvement in safety it was concluded that improvements to current best practice were unlikely to be reasonably practicable</li> </ol>			

Evaluation 3

<b>Work Environment: Back Up System</b>	Medium sized tree with congested crown. Belay device at ground level controlled by a second person. (A Petzl Grigri was used as the belay device)	<b>Work Activity</b> Tree access & Working In The Crown
<b>Strengths</b> <ol style="list-style-type: none"> <li>1. Provides a positive backup if the second system fails.</li> <li>2. Provides a positive backup if anchor point fails.</li> <li>3. Limited assistance to the climber in ascending the tree.</li> </ol>		<b>Weaknesses</b> <ol style="list-style-type: none"> <li>1. Greater complexity of equipment at the main harness attachment point.</li> <li>2. More time taken to install the belay rope along with working system.</li> <li>3. Choice of access route has to be clear to enable accurate installation of belay rope and could reduce flexibility in changing route.</li> <li>4. Constant and effective communication between belayer and climber required and could be hampered by background noise.</li> <li>5. Belayer potentially in risk zone for falling debris.</li> <li>6. Belayer would have to be constantly in attendance reducing ground work productivity.</li> <li>7. Climber's flexibility of movement within the crown is restricted when transferring position from branch to branch.</li> <li>8. High drag factors due to belay rope friction on branches reducing ergonomic work practices.</li> <li>9. Use and rope retrieval from natural redirects would be more complex with a belay rope passing through the redirect.</li> <li>10. In dismantling operations the extra rope could cause confusion and put the climber at higher risk through entanglement.</li> <li>11. Little perceived improvement in operator safety and major reduction in climber freedom is likely to result in operators not using the belay system.</li> </ol>
<b>Current Best Practice &amp; Conclusions</b> <ol style="list-style-type: none"> <li>1. Belaying is only currently considered in training situations and then only in particularly high-risk activities with novice trainees.</li> <li>2. In the great majority of normal working environments it was concluded that belaying was not practical and in some cases could be a hazard.</li> <li>3. This method was not seen as reasonably practicable and that current best practices would provide greater risk reduction than belaying in most cases particularly if areas of best practice are reinforced.</li> <li>4. Given the above it was concluded that belaying was not reasonably practicable.</li> </ol>		

Evaluation 4

<b>Work Environment:</b>	Small to medium tree with narrow crown	<b>Work Activity</b>	Access, Working in the crown.
<b>Back Up System</b>	Using two load bearing anchor points at all times.		
<p><b>Strengths</b></p> <ol style="list-style-type: none"> <li>1. Easy to establish two load bearing anchor points when working centrally from the crown therefore providing back up for system failure or anchor failure.</li> <li>2. Work position stability maintained.</li> </ol>		<p><b>Weaknesses</b></p> <ol style="list-style-type: none"> <li>1. Greater kit confusion increasing risk of climber error in attachment.</li> <li>2. Increased equipment for climber to carry (weight &amp; cost).</li> <li>3. Increased drag of equipment through the tree (climber fatigue)</li> <li>4. Connector crowding at attachment points made operation more difficult and increased risk of equipment damage (abrasion) and failure (opening 3way action &amp; misalignment).</li> <li>5. Little perceived improvement in operator safety likely to result in operators not using third system.</li> <li>6. If the anchor fails (particularly a high anchor) around a main stem the weight of the failed stem could compromise the second anchor, cancelling the advantage.</li> </ol>	
<p><b>Current Best Practice &amp; Conclusions</b></p> <ol style="list-style-type: none"> <li>1. Small narrow crowns can facilitate easy installation of two load bearing anchor points given the point of work is close to the centre of the tree and therefore larger diameter material is available.</li> <li>2. It is already best practice to use supplementary anchor points and guidance is given in the GTGCP paragraph 8.3, however further emphasis needs to be given to the selection of main and second anchor points. The emphasis should be placed on “wherever practicable” for the installation of a second load-bearing anchor.</li> <li>3. As in <i>Evaluation 2</i> it was felt that maintaining two load bearing anchor points at all times even during changeovers would not significantly increase safety and current best practice with the above emphasis was appropriate.</li> </ol>			

Evaluation 5

Work Environment:	Small to medium tree with broader crown.	Work Activity	Working in the crown & branch removal (position only) in the upper and top quadrant of the crown.
<b>Back Up System</b>	Using two load bearing anchor points.		
<b>Strengths</b>	<ol style="list-style-type: none"> <li>1. Easy to establish two load bearing anchor points when working centrally from the crown therefore providing back up for system failure or anchor failure.</li> <li>2. Provides a positive backup if the second system fails.</li> <li>3. Provides a positive backup if anchor point fails. (Particularly when working above a main load bearing anchor point in the top crown section with a high supplementary anchor).</li> <li>4. Work position stability maintained.</li> </ol>	<b>Weaknesses</b>	<ol style="list-style-type: none"> <li>1. Difficult to move out along light branches in the top crown quadrant whilst adjusting two systems attached to a load bearing point central to the crown.</li> <li>2. A second load bearing anchor point within the crown when working in the upper and top quadrant crown areas is most often not available.</li> <li>3. Having two load bearing anchor points arising from the centre of the tree would give little perception of increased operator safety.</li> </ol>
<b>Current Best Practice &amp; Conclusions</b>	<ol style="list-style-type: none"> <li>1. Current best practice as indicated in <i>Evaluation 4</i> recommends the use of supplementary anchor points, however in this situation it is virtually impossible to achieve a useful load bearing supplementary anchor when working in the crown extremities of the upper crown.</li> <li>2. Existing guidance is provided in the GTGCP paragraph 8.7 for working above a main load bearing anchor point in the upper crown and could be reinforced in the revised guide.</li> <li>3. Working in the upper quadrant of the crown still presents a problem given the lack of load bearing anchor points that increase safety and stability. The GTGCP currently provides some guidance under paragraph 8.3 however it was felt a more prescriptive hierarchy of where a second load bearing anchor point <b>MUST</b> be used should be given to aid risk assessment.</li> <li>4. This hierarchy approach could also be implemented lower in the crown where a main or secondary anchor point could be compromised by work situations e.g. cutting a system with a chainsaw.</li> </ol>		



Evaluation 6

<b>Work Environment:</b>	Multi stemmed tree (Simulated lapsed pollard)	<b>Work Activity</b>	Working in the crown.
<b>Back Up System</b>	Two High Anchor Points (Two Rope Working)		
<b>Strengths</b>			
<ol style="list-style-type: none"> <li>1. Provides a positive backup if the second system fails.</li> <li>2. Provides a positive backup if anchor point fails.</li> </ol>			
<b>Weaknesses</b>			
<ol style="list-style-type: none"> <li>1. No improvement in positioning at the point of cutting.</li> <li>2. Having to adjust two systems in order to branch-walk where pendulum swing is not a significant risk.</li> <li>3. Interruption of normal climbing agility and activity due to second system catching on branches.</li> <li>4. Second line had to be rerouted if it were to provide adequate fall protection when moving to the outer crown therefore increasing effort.</li> <li>5. A third load bearing anchor could often be achieved nearer the point of cutting providing better stability and duplicating the system.</li> <li>6. Greater kit confusion increasing risk of climber error in attachment.</li> <li>7. Increased equipment for climber to carry (weight &amp; cost).</li> <li>8. Increased drag of equipment through the tree (climber fatigue)</li> <li>9. Connector crowding at attachment points made operation more difficult and increased risk of equipment damage (abrasion) and failure (opening 3way action &amp; misalignment).</li> <li>10. Little perceived improvement in operator safety likely to result in operators not using the second system.</li> </ol>			
<b>Current Best Practice &amp; Conclusions</b>			
<ol style="list-style-type: none"> <li>1. In current best practice supplementary and second anchor points are already encouraged.</li> <li>2. There would be occasions in this work environment where a pollard main union is weak and the climber may wish to distribute their weight over two stems and the above method may be employed however this is the exception, not the rule.</li> <li>3. Given the effort of using this system and the little gain in operator safety it was considered not to be reasonably practicable.</li> </ol>			

Evaluation 7

Work Environment:	Open Grown Tree	Work Activity	Access Using Secured Foot Locking (Double ascenders)
<b>Back Up System</b>	Self Belay in accordance with Schedule 5 Part 3		
<b>Strengths</b>	<ol style="list-style-type: none"> <li>1. Provides a positive backup if the second system fails.</li> <li>2. Provides a positive backup if anchor point fails.</li> </ol>	<b>Weaknesses</b>	<ol style="list-style-type: none"> <li>1. The time taken to set up the second line may be greater than the time taken in foot locking (nb: risk time (ie exposure time to risk) is low)</li> <li>2. The effort of setting up a second line may dissuade climbers from using secured foot locking.</li> <li>3. Foot locking is ergonomically more efficient than body thrusting in unsupported straight ascent situations and should therefore be encouraged.</li> <li>4. Foot locking has fewer higher risk changeovers than other methods of ascending the tree and should therefore be encouraged.</li> <li>5. The second rope may have to pass over the same anchor point as the main line and therefore no perceived improvement in anchor point security will be achieved.</li> <li>6. The second line will need to be positioned to provide a parallel run with the main line if it is to be effective in main system failure event.</li> <li>7. The safety line and belay device configuration will have to carefully set up to prevent serious fall arrest implications should the main system fail.</li> </ol>
<b>Current Best Practice &amp; Conclusions</b>	<ol style="list-style-type: none"> <li>1. Two main hazards arise from current practice, the first is the anchor point failing due to an unforeseen defect not visible from ground level and in the case of the mechanical ascender, mechanical failure.</li> <li>2. Anchor point security is already dealt with through best practice guidance in the GTGCP however greater emphasis needs to be given in how the anchor point is tested and must be included in the revised guide.</li> <li>3. The issues of mechanical failure can be resolved by using a friction knot instead of double ascenders. However further development is required to resolve the issues of using double ascenders and may include fail to safe systems.</li> <li>4. Although secured foot locking does not directly meet standards used in other industrial contexts, to discourage its use through the imposition of potentially difficult back up system with its own shortcomings would remove a technique from tree access that presents a lower risk than other 'work positioning' access techniques.</li> </ol>		

### **Appendix 3 Definitions**

#### **Definitions current position as of 6<sup>th</sup> December 2004**

**Personal Fall Protection System:** Assembly of components or equipment to protect the individual whilst working at height ( including gaining access/egress from the working position).

**Personal fall prevention system:** Personal fall protection system not using a body holding device connected to an anchor, by which a person is prevented from reaching zones where the risk of a fall exists.

**Work Restraint system:** Personal fall protection system which uses a body holding device connected to a reliable anchor to prevent a person from reaching zones where the risk of a fall exists.

**Work positioning system:** Personal fall protection system which normally includes a body holding device connected to a reliable anchor to support the user in tension or suspension in such a way that a fall is prevented or restricted.

**Rope access system:** Personal fall protection system, using two lines (or ropes), each positionally static and separately secured to reliable anchors, one equipped with a body holding device acting as the primary means of support and the other equipped to act as a safety back up to arrest and restrict the fall in the event the primary support fails.

**Fall arrest system:** Personal fall protection system which uses a body holding device connected to a reliable anchor to arrest and restrict a fall so as to prevent the collision of the user with the ground or structure whilst limiting the forces on the body.

**Rescue system:** Personal fall protection system by which a person can carry out a rescue, rescue himself/herself or be rescued from a height or a depth by pulling, lifting, lowering or self ascent/descent

#### **Examples of Fundamental principles :**

if the rope moves with the user then it will either be work positioning ( e.g bosun chair or arboriculture prussiking on single rope ) or fall arrest (e.g. lead climbing).

If the rope remains stationary and user moves along it using his own effort it will either be work positioning (e.g on a sloping surface using a rope grab on a standing line) or rope access (moving up and down using two predominantly vertical stationary lines)

#### **Appendix 4 Summary Reports From Update & Standard Setting Events.**

Meetings were held around the UK during May – September 2004, as follows: -

Myerscough College, Lancashire	28 <sup>th</sup> May
Uffecombe, Devon	5 <sup>th</sup> June
Lanark, Scotland	8 <sup>th</sup> June
Holmfirth, Yorkshire	11 <sup>th</sup> June
Forest of Dean, Gloucestershire	12 <sup>th</sup> June
Perth, Scotland	24 <sup>th</sup> June
Sparsholt College, Hampshire	29 <sup>th</sup> June
Beulah, Mid Wales	2 <sup>nd</sup> July
Plumpton College, Sussex	16 <sup>th</sup> July
Norwich, Norfolk	16 <sup>th</sup> July
Pickering, Yorkshire	3 <sup>rd</sup> August
Moulton College, Northamptonshire	9 <sup>th</sup> September

Participant numbers varied from five to twenty five. At each meeting, the facilitators were asked to divide the delegates into manageable groups and to examine the practicability of using two ropes in a number of different scenarios.

The summary reports are printed verbatim.

# **LANTRA/NPTC Aerial Tree work assessor/instructor update**

**Myerscough College  
28<sup>th</sup> May 2004**

Feedback on the practical standard setting session on two rope working in line with the draft Work at Height Regulations

For the standard setting the assessors/instructors were split into 4 groups. Two groups were asked to look at two rope working during ascent into the crown of a tree and two groups were asked to look at two rope work during movement around the crown of the tree. The groups were asked to look at possible systems and what issues or additional hazards that the systems would create in a working and/or training situation.

## **Group 1- Two rope working during ascent into the crown of a tree**

- This group looked at using a double access line. This could be two separate lines or one line doubled. Both lines were secured to the base of the tree end creating two static lines. Double mechanical ascenders were attached to both lines and used for footlocking as normal. This meant that if one line failed or came out of the ascender then the remaining line would still be anchored.
- When set up using one doubled line they are both the same anchor point and there would be no back-up if the anchor point failed.
- When using one doubled line the system also requires a climbing length 4 times the height of the anchor point.
- Both these problems could be overcome where two separate lines are used but the anchor points would need to be in line with each other so that the double ascenders could be used – this is rarely possible in a working situation.
- The system only suited footlocking access and could not be re-set at change-overs.

## **Group 2 – Two rope working during ascent into the crown of a tree**

- This group looked at using one static line with a self-locking system and one traditional access line. Both a friction hitch and a mechanical ascender were tried as the self-locking system on static line.
- This line had to be held or weighted from below when using either during the ascent through the mechanical ascender worked slightly better.
- The system created additional confusion to re-set it at change-overs.
- It was found that the extra line and attachment karabiners created additional hazards of confusion and congestion at the harness attachment point and the possibility of entanglement of the lines.

### **Group 3 – Two rope working during movement around the crown of the tree**

- This group looked at using two separate anchor points and two separate ropes or both ends of the same rope, each with a friction hitch. When branch walking one hand is needed for stability so both friction hitches must be adjusted with one hand.
- When moving out on a branch it was possible to hold both friction hitches with one hand but this was only when the anchor points were close together. When the anchor points were further apart it created more of an angle and was very difficult to adjust both friction handles with one hand.
- It was much more difficult to adjust both friction hitches when moving back towards the stem. The friction hitches had to be adjusted one at a time which doubled the effort required and the time taken. This led to additional hazards of more fatigue, risk of entanglement and additional confusion.
- Other observations were that there was some friction from rope on rope. It was thought that adjusting both friction hitches at the same time would be easier with a distil, valdotain, machard etc but these are not generally knots taught in initial training.

### **Group 4 – Two rope working during movement around the crown of the tree**

- This group looked at use of a belay when branch walking.
- The extra belay line created additional hazards of confusion and congestion at the harness attachment point and the possibility of entanglement of the lines.
- It was thought that these hazards would be greater and affect the practicalities of work when undertaking more complex operations such as rigging.
- The climber invariably holds the climbing line for support when branch walking and in this instance the climber grabbed the belay line by mistake on more than one occasion.
- The climber also thought that he had reduced amount of control by being belayed from someone on the ground.
- The belayer would need to be trained in belay techniques and the belay would need to be failsafe (i.e. lock if the belayer let go).
- There was also concern that the use of a belayer would require another person throughout the climb and this would be impractical in a working or training situation.

### **General conclusions**

- It was thought that, although possible, all the systems tried were not reasonably practicable in a working or training situation.
- All systems tried created additional hazards of confusion, congestion at the harness attachment or the attachment point in the tree and entanglement of the lines.

**Lantra/NPTC Aerial Tree Work Assessor/Instructor Update**  
**Uffculme, Devon**  
**5<sup>th</sup> June 2004**

Feedback on the practical standard setting session on two rope working in line with the draft Work at Height Regulations.

The working group comprised three NPTC assessors/Tree climbing instructors, one of whom runs a tree work contracting business. The issues of two rope working were addressed in a session accessing the tree and then undertaking a branch walk.

The issues relating to Reg 8 were discussed prior to the practical session and several 'two rope' methods were considered.

**Two rope working during ascent into the crown of a tree**

- The group decided to look at a simple belay system would be the best options. The belay comprised a single rope attached to the climbers main sub pelvic harness attachment and belayed directly from the groundman using a prussic loop attached again to the sub pelvic main attachment. The climber used the traditional two rope system.
- In several cases the same anchor point had to be used for both ropes increasing the risk of rope chafing and placing the reliance on a single anchor point.
- The system worked fairly simply principally because the tree was open grown and anchor point selection was relatively easy. Epicormic growth and very open crowns could make having to place two ropes over anchors more time consuming, and would require greater physical effort.
- Changeovers were made more complex by having to consider the belay route.
- Although the single belay rope and karabiner were easily identifiable for the climber the extra karabiner attached to the main anchor point posed an extra complication.
- The climber commented that communication between him and the belayer had to be good and on noisy sites or higher in the crown this could become difficult and lead to confusion.

**Two rope working during movement around the crown of the tree**

- This group looked at using two separate anchor points and two separate ropes or both ends of the same rope, each with a friction hitch. When branch walking one hand is needed for stability so both friction hitches must be adjusted with one hand.
- Initial access to the limb where a 'trapeze' had been set up worked well but relied on a high and lateral anchor point.
- Branch walking and having to adjust two friction knots was very difficult and resulted in greater 'pull back' forces due to two ropes on the climber.
- Balance and movement in the crown during branch walking was impeded by the extra lines and their weight.

- It was much more difficult to adjust both friction hitches when moving back towards the stem. The friction hitches had to be adjusted one at a time which doubled the effort required and the time taken. This led to additional hazards of more fatigue, risk of entanglement and additional confusion.
- Finding a 'loading bearing' second anchor that would assist the climber in achieving a work position in the out crown was thought to be a problem and so the second line would serve 'little practical purpose or a climber'.

### **General conclusions**

- Two rope working was thought to be possible in certain treework situations particularly in open crown trees however the group felt strongly that it so impeded and complicated access to the crown that industry would not adopt it.
- Both systems used complicated tree climbing adding to the risk of confusion, line entanglement and loss of good ergonomic techniques.
- The two rope method during some branch walking operations would pose a greater danger to the climber due to line entanglement, extra rope weight and loss of climber balance.
- Self rescue situations would be made more awkward where two lines were present.



**Assessor/Instructor Update**  
**Lanark**  
**8<sup>th</sup> June 2004**

**New Work at Height Regulations**  
**Footlocking Access**

Use of two separately anchored lines and a twin cam ascender proved successful for this, giving the required back up. (The climber's attachment to the ascender was NOT duplicated). Installing two lines was time consuming and it was an "ideal" tree. Getting suitable anchor points close together would rarely be possible.

The climber was dependent on the groundman to disconnect the correct line during the initial change over from foot locking to friction hitch.

It was felt a normal foot locking system with a full arrester (e.g. Troll Rocker) on a second backup line would be a preferred option but this was not tried – the second line may get in the way.

**Body Thrusting Access**

Two ropes and a single strap plus both ends of rope and a strop were tried. The use of a micro pulley on the second line with the groundman pulling the friction knot up the rope reduced the time and made the ascent easier. It was possible but slow.

Major concern was expressed about the number of ropes (4ends) attached to a harness. It was felt that this would lead to a great deal of confusion and errors, especially in training and among less experienced climbers. The problem was most acute on harnesses with a single front attachment point. Using both ends of the rope had 3 disadvantages. Both ropes were the same colour so there was more risk of confusion. The climber ran out of rope on the way down and had to re-anchor during the descent. There is the risk of a "U" loop of rope into which falling timber could land, pulling the climber out of position and damaging equipment.

**Branch walking / working**

With a distel hitch some participants found it possible to work both hitches with one hand when branch walking. To achieve two load bearing anchor points, twin line working from the main anchor point would often be required on lightly branched trees. They did slow the operator down and made re-directs and re-positioning more complex.

The overall view of the group was as follows:

- a) Twin line ascent was too complex and was more likely to lead to operator error rather than reduce it.
- b) Two load bearing anchor points when cutting was a sensible approach and one that would be acceptable. On some trees the two lines would be running in close proximity and in the same direction so the risk of cutting both main and backup lines must be considered.
- c) The use of a main line and a shorter backup rope of a different colour were preferable to using both ends of the main line.
- d) Harnesses with dual or multiple front anchor points would be preferable in situations where the supplementary anchor points was a long way away from the working position.

# **LANTRA/NPTC Annual Update & Standard Setting 2004**

**Holme Styes Wood Holmfirth  
11<sup>th</sup> June 2004**

Feedback from the practical standard setting session on two rope working in line with the draft Work at Height Regulations.

For the purpose of the standard setting the assessor/instructors were split into three groups, two groups to look at two rope working for ascent into the tree and one group to look at movement within the crown of the tree.

All trees were medium sized open grown Sycamores with good stems and full crowns.

## **Group 1 - Two rope working during ascent into the crown of a tree**

This group installed a belay line from the ground with the use of a throw line. Due to the number of limbs it proved difficult to obtain a belay line that would not have to be adjusted during ascent. The groundsman belayed the rope however he became redundant once the climber was in the crown of the tree and had to start changeovers. The system became confusing to both the climber and grounds man. It was felt that the system brought confusion into the tree climbing operation.

## **Group 2 - Two rope working during ascent into the crown of a tree**

This group installed a static line with self tending prussic loop and climbed the tree in the traditional way utilising a short adjustable strop when negotiating limbs. This method was straight forward to use however with the additional rope, prussic and karabiner brought into the system it became confusing and the climber had to stop and take stock of what he had in front of him before moving on!

## **Group 3 - Two rope working during movement around the crown of a tree**

This group utilised the belay line for branch walking however when they attempted to achieve work positions invariably the lines became crossed and it was difficult to achieve

# **LANTRA/NPTC Assessor/Instructor update**

**Forest of Dean Training Centre**

**12<sup>th</sup> June 2004**

## **Two Rope Working Feedback: Group one**

- Normal climbing system and a static line installed with a throw line.
- Martin was attached using a clog to the static line. This worked well but was tricky to keep taut at times.
- This system was used throughout the CS39 Assessment to test it fully

## **Two rope working Feedback: Group Two**

- The two candidates used both rope ends and an adjustable strop which took time and used all the rope.

**Report from CS instructor / assessor arb update  
Dunkeld , Perth**

**24<sup>th</sup> June 2004**

The delegates separated into two groups, each group was asked to develop the idea of being permanently attached by two anchor points at all times while accessing, working in and descending from the tree.

**Group One**

Accessed the tree using two conventional climbing ropes systems for simplicity, also to work using the minimum type of equipment universally available. It was found to be more time consuming than climbing in compliance with current best practice. The group then moved on to look at belay options and systems to allow a safety device to 'follow' the climber on another safety line in addition to his primary, conventional climbing system.

**Group Two**

Accessed the tree using a throw bag and line to install two ropes from ground level. They considered that anchor points could be achieved independently or, in the case of a sufficiently large branch, that two lines could be installed on that same branch using cambium savers. Thereafter the tree would be climbed using either two conventional climbing systems or utilising the option for belaying or a 'follower' device.

The approach to working within the crown was felt to be quite straightforward and just an extension of what many operators already practise; perhaps two independent rope systems will replace the technique of using two ends of a single rope. Descent was felt to be quite straightforward and easily achievable.

The general feeling was that in much the same way that other improvements in safety have been introduced into the arboricultural industry (e.g. chainsaw protection and supplementary anchor points), the new regulation would result in many operator complaints but would eventually become accepted in the way the current best practice is accepted (i.e. some operators will adopt best practice and others, as usual, will do just what they want).

The final analysis was that the day had been very beneficial and useful in clarifying standards and disseminating information regarding the current legislative changes looming for the industry.

# **LANTRA/NPTC Assessor/Instructor update**

## **Sparsholt College**

29<sup>th</sup> June 2004

### **Aerial Based Units**

#### **4 groups**

The majority of the groups came up with the same problems in the feedback. I split the groups up into 2 studying movement around the tree and two accessing the tree.

1. First group (moving around the tree) found that they had to remove the safety rope to re-route the rope around branches and this presented an immediate safety issue. You would need an extra person to B lay and who would they be? Should they be the instructor or a student? Should they be qualified in belaying? You would need an extra person on site and this would have a direct effect as well on costing. If this is seen as best practice in training then surely it should be practised in the commercial world, where there would be all the problems I have mentioned before plus the additional cost to the job. They also found limitation on movement around crown. Too many ropes and too complex.
2. Second group accessing the tree. They didn't really participate in the workshop and were looking at different accessing methods into the tree.
3. Third group accessing the tree. Single line down to ground, problems with communication. Constant communication needed which was found very tiring even after such a short time. Visibility was a problem seeing the climber clearly. Branches possibly sliding down the rope onto belayer and causing injury. Often the belay anchor has to be lower than the climber's is, as he will take the best anchor.
4. Fourth group moving around the tree. Terrible rope drag on branches, branch walking was a major problem and freedom of movement due to restriction from safety rope and visibility seeing the person again to allow slack in rope. Constant communication for slack otherwise the safety rope soon became useless. When the lanyard or supplementary was put in then more ropes in the tree with more confusion and rope abrasion on other ropes.

**LANTRA/NPTC Assessor/Instructor update  
Mid Wales  
2 JULY 2004**

**Working at Height Regulations**

The guys were split into two groups to undertake the practical application of the currently proposed regulations.

**Group one**

- Tried a system of belaying by a groundman. They found that communication with the groundman to be a problem once a working height was achieved. The use of saws and chippers would only serve to compound this problem.
- There was a great deal of crossing of ropes whilst moving around even though the tree had a fairly open canopy.
- The climber was constantly having to fight against the belay, losing valuable energy, where the groundman was unable to observe clearly.
- It was agreed that this system could not be applied safely and this would be compounded by working in a close canopied tree.
- In addition an additional person would be kept on the belay system.
- There was also some real concern about the positioning of the belayer from a safety issue (falling branches and debris) and for visibility of the climber.

**Group two**

- Tried two similar systems utilising body thrusting on one rope whilst using a Lock Jack and Rocker on the additional line.
- Again there were difficulties with the crossing of ropes.
- There were also great difficulties moving around the crown and trying to change anchor points.
- It was agreed that it would be more dangerous to try to teach this system than the current system.

**General Feedback**

There was real concern for the safety of any one climbing with the additional rope since it introduces more confusion in the system. Confusion inevitably leads to accidents not only with novice climbers but also with tired experienced climbers. It was agreed that the simplest system is always the best to use. The use of different colours in the ropes and two separate anchor points on the harness would significantly reduce the chance of confusion and accidents with novice climbers.

**LANTRA/NPTC Assessor/Instructor update**  
**Aerial Based Units 22 people**  
**Plumpton College**

**16<sup>th</sup> July 2004**

**Group One**

There was a large degree of resistance to splitting up into 4 groups so one group was agreed in the end.

- It was commented to the group by a number of individuals that the has closed so it was really an academic exercise to discuss the different ways moving around a tree and ascending a tree. So it turned more into a discussion than a workshop. There was a resistance on this as I have mentioned before so I was not going to force the point.
- The same points were mentioned as at Sparsholt of communication problems difficulty in moving around the crown, moving over branches with a different route to the belay rope.
- A separate belay was rigged up to the climber onto a figure of 8 with lock next to it in the form of a prussic.
- It was felt to new climbers it would be much more confusing and dangerous to have additional lines in a tree that they were not used to.
- There were no more points raised.

**Lantra/NPTC Annual Update & Standard Setting 2004**  
**Norwich**  
**16<sup>th</sup> July 2004**

Feedback from the practical standard setting session on two rope working in line with the draft Work at Height Regulations.

For the purpose of the standard setting the assessor/instructors were split into three groups, one to look at two rope working for ascent into the tree, one group to look at movement with the crown of the tree and one to examine systems at the point of work.

The trees were medium sized open grown Sycamores with good stems and full crowns.

**Group one – Two ropes working during ascent into the crown of a tree**

This group decided to use throw bags for initial access. The first line was set easily, but it took a long time to achieve a satisfactory, second anchor. While the first throw line allows some flexibility in the choice of anchor (i.e. if you miss the intended target, you can accept a lower fork, provided it is strong, etc) to get a second anchor that will work as a dual point is much more difficult.

Once the two lines were installed, a system using a rescue pulley to 'fair lead' the second friction hitch was tried, but did not work unless a ground person kept the second line taut.

**Group two – Two rope working for movement within the crown of a tree**

This group did not use two lines during ascent, although the climber used an additional adjustable stop for changeovers. Once installing final anchor, however, a two-rope system was used throughout the rest of the operation. The tree gave itself well to this system, being quite open with two distinct main leaders. A main anchor was installed in each, and although this was time consuming initially, it worked well while the climber moved out to various work positions. During movement over branches and through brushwood etc, the climber kept just one rope taut as the main anchor and the other was allowed to go slack (e.g. up to a metre of slack). Consequently at these times the 'back-up' line was not providing 'work positioning' support, and strictly speaking would have required fall-arrest harness and energy absorber.

**Group three – Two rope working during activity at work position**

This group used conventional techniques to achieve the initial anchor and then installed a second anchor very close to the same point. A somewhat awkward process ensued with ropes entangled as the climber worked out over a couple of limbs, to get to a chosen work position.

Once at the position, a supplementary anchor was installed, as normal (= three load bearing anchors). The climber then removed one of the main anchors and moved to a second work position. Again, a supplementary anchor was installed, but this was used to prevent a pendulum swing, and was not fully load bearing (in fact, it would have prevented the climber from falling, but would not have been assessed as load bearing). At this point we looked to see what alternative points could be used, and all agreed that while an extra point could be established further back into the crown of the tree, there was nothing available in the vicinity that would have adequately supported the climber (should all else fail).

This group concluded that such twin rope systems would inevitably be limited once the climber was working in the tips of the upper crown.



# LANTRA/NPTC Annual Update & Standard Setting 2004

Pickering  
3<sup>rd</sup> August 2004

Feedback from the practical standard setting session on two rope working in line with the draft Work at Height Regulations.

For the purpose of the standard setting the assessor/instructors were split into four groups, three to look at two rope working for ascent into the tree and one group to look at movement within the crown of the tree.

All trees were medium sized open grown Beech with good stems and full crowns.

## **Group 1 - Two rope working during ascent into the crown of a tree**

This group installed a belay line from the ground with the use of a throw line. The belay line was secured to the base on the tree and a self-belay system set up with a micro-pulley and Grigri. A second system was set up with a standard prussic loop. The climber used an additional adjustable strop for changeovers.

The climber was able to maintain a two-line system at all times but stated that it was physically twice as much work and therefore introduced an element of danger due to fatigue.

## **Group 2 - Two rope working during ascent into the crown of a tree**

This group installed two lines onto different anchor points at a similar height using a throw bag. The safety line had a distel friction knot with a marlinespike underneath for it to self-belay; a grounds man then also belayed the rope. The second system was set up with a standard prussic loop. The climber used an additional adjustable strop for changeovers.

The system was time consuming and extremely confusing, although the system was intended to self belay in actual fact it did not work and the climber had to keep taking up the slack in the safety line.

## **Group 3 - Two rope working during ascent into the crown of a tree**

This group installed both lines with a throw bag, one climbing system had a standard prussic loop attached the second had a distel knot with a pulley. The pulley was then attached to the static end of the prussic climbing system so that one system would belay the other.

Once again confusion was brought into the system as the ropes became crossed. The groundsman had to keep pressure on the safety line to take up the slack.

## **Group 4 - Two rope working during movement around the crown of a tree**

This group installed both lines with a throw bag one system was anchored to a grounds man using a figure of eight the second system was a standard climbing system using a distel. Once the final anchor point had been achieved the climber attempted to branch walk with both lines attached.

Difficulties were encountered with communication between groundsman and climber. One man was permanently tied up belaying the climber

Determination of rope access and  
work positioning techniques in arboriculture.

The climber had difficulty in achieving good work positions whilst having two lines attached.

# LANTRA/NPTC Annual Update & Standard Setting 2004

Moulton College  
9<sup>th</sup> September 2004

## **Practical Aerial Tree Work** Groups were split into 2.

### **Group 1**

Belayed a climber from anchor put in tree by throw line, throughout the ascent, work climb and descent. Belay device was a munter hitch, backed up with a friction hitch.

### **Group 2**

Tried working from 2 anchors throughout a work climb.

## **Conclusions**

Both can be implemented but belaying ties up a groundsman, groundsman sometimes under the climber not LOLER compliant.

Both very restrictive - climber loses control and feel, unable to use hands effectively to aid climb, ropes getting in way on dense branched tree. If on single stem no other separate anchor available. Higher risk of more stress especially in warm weather.

© Crown copyright 2005

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanic, photocopying, recording or otherwise) without the prior written permission of the copyright owner.

Applications for reproduction should be made in writing to:  
Licensing Division, Her Majesty's Stationery Office,  
St Clements House, 2-16 Colegate, Norwich NR3 1BQ  
or by e-mail to [hmsolicensing@cabinet-office.x.gsi.gov.uk](mailto:hmsolicensing@cabinet-office.x.gsi.gov.uk)