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Use and effectiveness of mobile elevating work platforms (MEWPS) for tree work

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Use and effectiveness of mobile elevating work platforms (MEWPS) for tree work

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Due to the high number of accidents in the arboricultural industry, the Health and Safety Executive commissioned an evaluation of the use of Mobile Elevated Working Platforms (MEWPs) in such work. A number of different designs were trialed in several different site and tree situations in order to assess:

Potential benefits of MEWPs over manually climbing and working in the crown

Factors which affect the performance of MEWPs in tree work and to develop guidance on:

- the selection of MEWPs for particular types of sites and operations

- working practices appropriate for working with MEWPs in arboriculture.

The evaluations identified a range of advantages within the areas of; provision of a more safe and secure working environment, reduced effort of the operator when gaining access to the working position and potential increases in effectiveness and efficiency.

The trials evaluated the performance criteria of MEWPs which has enabled the development of guidance on both the selection of MEWPs and working practices for the use of MEWPs in tree work. Output and cost comparisons with manual climbing are also given.

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CONTENTS

SUMMARY

Due to the high number of accidents in the arboricultural industry, the Health and Safety Executive commissioned an evaluation of the use of Mobile Elevated Working Platforms (MEWPs) in such work. A number of different designs were trialed in several different site and tree situations in order to assess:

- Potential benefits of MEWPs over manually climbing and working in the crown

- Factors which affect the performance of MEWPs in tree work and to develop guidance on:
  - the selection of MEWPs for particular types of sites and operations
  - working practices appropriate for working with MEWPs in arboriculture.

The evaluations identified a range of advantages within the areas of; provision of a more safe and secure working environment, reduced effort of the operator when gaining access to the working position and potential increases in effectiveness and efficiency.

The trials evaluated the performance criteria of MEWPs which has enabled the development of guidance on both the selection of MEWPs and working practices for the use of MEWPs in tree work. Output and cost comparisons with manual climbing are also given.

Use and Effectiveness of MEWPs in Arboriculture

1. INTRODUCTION

MEWPs are used in a number of industries to provide safe and secure working positions for operators. The Health and Safety Executive (HSE) have reported that the number of accidents associated with arboriculture are at a high level with many serious accidents attributable to tree climbing operations.

HSE want to promote an increase of awareness, understanding and use of MEWPs in the arboriculture industry, highlighting the advantages for arboriculture operations. The aim is to decrease the occurrence of accidents attributable to tree climbing operations.

To evaluate where the use of MEWPs would be appropriate the following objectives were drawn up:

Identification of:

- Factors affecting machine choice
- Optimum equipment for given conditions and requirements
- Modifications required to current working practice
- Reduction in the risk to operators and others
- The effect on operational costs

Development of:

- Guidance on which operations, sites and type of tree the use of MEWPs would be appropriate
- Increased understanding on the factors influencing the selection of MEWPs
- Guidance on the selection and use of specific MEWPs

To satisfy the objectives, the evaluation took into account terrain limitations, stability, manoeuvrability and effective reach. This involved identifying the appropriate performance criteria for the range of operations, sites crops etc and identifying machines that matched those requirements.

Current working practice is based on the use of MEWPs in the construction industry. Arboricultural professionals were consulted for clarification or development of working practice guidelines for the use of MEWPs in trees.

A proposal was drawn up for field trials for the evaluation of:

- a range of equipment
- for a range of operations
- on a range of sites and trees

The main objectives of the field trials were:

1. Evaluate each MEWP selected with regard to the following factors:

The capability and limitation of each model with regard to:

- Access – in reaching the tree and the crown in association with the maximum height and reach.
- Manoeuvrability – around the tree and within the crown in association with sideways movement available.
- Terrain – with regard to soft conditions, gradients, side slopes and rough ground

Access into and out of the platform

Number of operators required for each operation

The ease of each operation

All safety aspects associated with each machine type and operation in comparison with the risks of tree climbing. A full risk assessment to include such as guards, communications and what dangerous aspects of tree surgery using tree climbing are removed or reduced and at what cost.

Identification of best working practice for each piece of equipment

2. To test the ability of the MEWPs to provide a platform to allow a practitioner to carry out a range of simulated operations such as a crown reduction, crown thinning or complete take down.

3. Evaluate the design and method limitations that prevent maximising the use of MEWPs in arboricultural operations.

4. Ascertain a comparison of outputs and costs, where possible, between methods of climbing and MEWPs.

To address the needs of the evaluation the trials included a representation of types and models that are known to be currently available. This enabled evaluation of the range of sites and equipment requirements.

2 ADVANTAGES OF USING MEWPS

The research has shown that there are a number of advantages to be gained by the use of MEWPs that have been identified in the following sections.

2.1 SAFETY

Operator

- Identification of dangerous limbs not always achieved from the ground and therefore a climber may place himself unknowingly in a hazardous position.
- Operators are working from a stable platform rather than a rope and branches and are therefore less vulnerable to operator error or equipment failure.
- Operator has no arduous climbing prior to working in the crown. This reduces fatigue and therefore the operator is less prone to error when working in the crown.
- Optimum working tool can be more readily available i.e. it will not have to be hauled up into the tree. Efficiency and ease of working should therefore be increased.

Groundsman

- There is a reduced need for a groundsman being at the base of the tree to pass up equipment and therefore reduced risk from falling equipment or branches.

2.2 REDUCED EFFORT

- Climbing trees requires considerable effort, which results in a high proportion of time being required for rest. Use of MEWPs reduces this need for rest, making more productive time available.
- The use of MEWPs and the reduced need for climbing results in operators not being so exhausted at the end of the day.

2.3 REDUCED TIME REQUIRED

- Reducing the need for climbing and for hauling equipment into the tree can reduce time required for individual jobs. This enables more jobs to be done in the same time period, increasing productivity.
- Reduced time required for individual operations can mean less obstruction or disturbance to others e.g. for roadside tree work.

2.4 POTENTIAL TO REDUCE COSTS OF JOBS

- The reduced need for rest, and the overall reduction in time required for jobs can improve productivity and therefore increase the opportunity to reduce costs of individual jobs.

2.5 POTENTIAL TO DO JOBS MORE EFFECTIVELY

- The use of MEWPs enables easier access to the optimum tools when carrying out work on the tree. There will therefore be less incentive to compromise on equipment used and more effective or higher quality of work could result, in some cases.

3. FACTORS AFFECTING MACHINE CHOICE

3.1 SITE AND TREE FACTORS

The following site and tree factors must be assessed to ensure the MEWP can work safely and efficiently. These constraints that are listed may apply to the access to the site as well as at the site itself.

Site

The site constraints must be carefully assessed to ensure that the correct machine for the job is chosen. The following points should be answered.
At what height is the operation to be carried out
Are the ground conditions able to support the machine e.g. firm and level
What distance of outreach is required at the highest point
Are there any obstructions to reach over
Is there sufficient space to deploy the outriggers
Is there sufficient space for manoeuvring e.g. ground obstacles or corners
What services are present e.g. overground electricity, telephone, underground water supplies
Are there any road restrictions

Tree

Height
Tree form
Distance and angle to working position

3.2 OPERATIONAL PERFORMANCE CRITERIA OF MACHINES

The MEWP must be carefully assessed to ensure it can work within the constraints of the site, tree and operational needs as identified in 4.1 above. The following are the factors, which can constrain the use of a particular MEWP.

Base Machine:
Dimensions of Machine
Weight
Manoeuvrability of base machine
Ability to stabilise base
Ground pressure

Terrain limitations

MEWPs are designed for working on surfaces that are relatively level, but can sustain a degree of rough ground such as a building site. The majority of the types of MEWP that have been investigated fall into this category. Some designs are described as having a 4WD capability, which implies an application for off-road use. Slope limits are referred to as gradeability in manufacturers machine data. Manufacturers indicate that some MEWPs, specifically those fitted with outriggers, are capable of working on 30% to 40% slopes. However, considerations such as firmness of the ground and potential for slippage due to surface type and weather need to be taken into consideration.

Stability

Certain types of MEWP have manual or hydraulically operated outriggers. Some machines are fitted with safety devices that will not allow operation of the machine until the MEWP is on a level base. Vehicle mounted MEWPs can be fitted with stabilisers to aid stability. Suitability of stabilisers in respect of ground firmness should be assessed. Where necessary suitable bearers will need to be placed under stabilisers to maintain stability.

Manoeuvrability

The manoeuvrability of towed machines can be restricted by the amount of space available. Vehicle mounted MEWPs are also as manoeuvrable as conditions and access and conditions allow. Self-propelled machines are highly manoeuvrable. (See section 4.3 Types of MEWPs).

Effective reach

This is described as the maximum working length of the boom. Manufacturers' data identify the working envelope in a graph form for most machines.

Safe working loads (SWL)

The SWL is the maximum load that the MEWP will safely carry and includes the weight of all operatives, tools and equipment that will be in the basket. Some manufactures data may refer to the SWL as platform capacity or lift capacity. All the MEWPs reviewed had SWL notices on the baskets and they ranged from 120 kg to 340 kg (265 lbs. to 750 lbs.).

Health and safety

When selecting a MEWP for a particular job, individual MEWP should be evaluated for features and operational criteria as they affect health and safety, such as the provision of guarding, hydraulic locks, heights of steps, communication systems between platform and driver etc.

3.3 TYPES OF MEWP

MEWPs are supplied in various models, types and sizes. They have been designed primarily for the construction and building maintenance industries and adapted to serve other purposes, for example indoor surfaces. This section will provide guidance on the type of MEWP that could be used for arboricultural operations.

For the purposes of selecting a MEWP for arboricultural operations the following categories have been defined:

- Self Propelled articulated and telescopic Booms, (Self Propelled Boom - SPB)
- Vehicle Mounted Platform articulated and telescopic booms, to 26 metres (VMP26)
- Vehicle Mounted Platform, articulated and telescopic booms, over 26 metres (VMP100)
- Trailer mounted/Push around, articulated and telescopic booms, (Trailer or Pushed - TP)

3.3.1 Telescopic boom

The telescopic boom is designed to extend in a linear manner. The booms may have one or more movable sections and connected at the outer end to the platform. The base of the boom is connected to a turntable to aid rotation and to adjust the angle of extension. Multi-stage booms have the advantage of being shorter and easier to store for road travel. Working heights can range from 12 m to 70 m and Safe Working Loads (SWL) of up to 317 kg (699lbs).

3.3.2 Articulated

Constructed of booms hinged at their ends to permit articulation in a vertical plane. Telescopic and articulated booms may be combined. Centreline design articulated booms reach up and over obstacles without blocking adjacent work areas. Four wheel drive (4WD) models are available. This type of lift is available with electric, diesel or dual fuel power plants with a SWL of up to 272 kg (600lbs).

3.3.3 Self propelled (including pedestrian controlled)

The majority of these types of MEWPs are supplied on a wheel-based chassis that only operate on flat ground although specific models are fitted with outriggers that will allow working on slopes. The operator can drive this type of machine from the basket. Model options can include 2 or 4WD and typical working heights reach from 12 m to over 20 m. This type of MEWP requires to be transported by trailer or pick-up truck and SWLs are typically 200 kg to 227 kg (440 lbs. to 500 lbs.). Pedestrian controlled MEWPs are similar to the self-propelled in many aspects but the operator on the ground controls moving this MEWP. Many are fitted with outriggers and typical working heights reach 12 m to 30 m. SWLs are typically 120 kg to 200 kg (265 lbs. to 440 lbs.).

3.3.4 Vehicle mounted (includes van/truck and dumper mounted)

As the name suggests the MEWPs are mounted on the back of a range of vehicle sizes, from a transit van through to a large truck, some are also mounted on dumper truck chassis. This type of MEWP can be versatile where conditions suit the vehicle. Working heights range from 12 m to 26 m and SWLs are typically 200 kg (440 lbs.).

3.3.5 Trailer mounted

A car can easily tow a machine up to the 12-m height range. A 4WD vehicle can tow the larger models ie models with a working height of 30 m. Many of these models have a range of power options, petrol, diesel or battery engines or a combination of fuel and battery. Most models have articulated booms although some have a telescopic boom design.

4. FIELD TRIAL EVALUATIONS AND RESULTS

4.1 TRIAL DESCRIPTION

In all the MEWP trials, a 3 man team was present, 2 men were in the basket, one for operating the machine and the other representing the arborist. A groundsman with knowledge of how to lower the platform in case of emergencies was also present. The aborist in the basket and the groundsman were trained and experienced tree climbers with little or no prior operational experience of a MEWP. It would be possible for the arborist to operate the MEWP unaided, with appropriate training, for manoeuvring the machine to an appropriate working position. The MEWP operators supplied for the trial had no experience of using the MEWP in trees, all coming from a construction-based environment.

The climbing trials consisted of a 2 man team, both qualified and experienced tree climbers.

All the sites had trees requiring identified treatments. Consultants were used to help identify suitable anchor points from where it was reasonable to expect climbing operations to start. These points were marked with red/white hazard tape as permanent markers.

The trial times looked at the following elements for both MEWPs and climbing techniques:

- Approach to tree
- Set up (outriggers, levelling)
- Access to anchor points in tree
- Return to transport position
- De-rig (outriggers in)
- Drive away.

The climbers were free to use any recognised climbing technique as they saw fit. This resulted in the use of friction knots on Site 1 and the use of ladders on Sites 2 and 3.

4.2 SITE DESCRIPTIONS

4.2.1 Site 1

A group of 4 oak trees (Plate 1) with anchor point heights ranging form 12 m to 18 m. This would demonstrate the off-road and manoeuvring capabilities of each machine and was selected to simulate a group of trees within a parkland/estate environment. Heavy rain the night before the trials resulted in soft ground conditions for the trial. The types of operations to be carried out on these trees included crown lifting, crown thinning and dead-wooding.

Plate 1
Oaks, site 1

4.2.2 Site 2

An open-grown sycamore in a field (Plate 2). This tree was selected to simulate a parkland/estate environment to test the off road capabilities and the ability of the MEWP to access an anchor point through a wide spreading dense crown. The operations to be carried out on this tree included dead-wooding and crown thinning.

Plate 2
Sycamore, site 2

4.2.3 Site 3

This site simulated an urban environment as the MEWPs would be positioned on a tarmac road with the aim of reaching anchor points of 18m to 19.5 m within the crowns of 3 individual lime trees (Plate 3). The first of the limes had little in the way of climbing anchor points; the second lime had a considerable amount of epicormic growth to hinder climbing similar to many trees found in urban situations. The third lime had a similar amount of epicormic growth, with a 3m to 4 m band of ivy and many dead branches. Crown lifting, crown reduction and dead-wooding were among the expected operations required in these trees.

Plate 3
Lime avenue, site 3

4.3 EVALUATION OF SELECTED MEWPS

The trials covered the following types of MEWP:

- Vehicle mounted articulated and telescopic, off and on road
- Self-propelled articulated and telescopic
- Trailer mounted, articulated

4.3.1 Machine descriptions

The following section gives a general description of each of the models used during the field trials. Table 1 provides a summary of the technical specifications of each model.

Scanlift SL 240

This model is a self-propelled telescopic MEWP with 4 Wheel Drive, 2-wheel steer and crab steer. The working height is 24 meters with a maximum outreach of 11 metres. The machine is diesel fuelled with optional electric battery. Further details are available from the suppliers.

The Scanlift (Plate 4) offers good all round terrain mobility, excellent working height and good ground manoeuvrability. However, it was a little difficult to properly level the machine for use as the controls were indistinct.

Plate 4
Scanlift SL 240

The machine was supplied by:

DM Meek Group plc
Dean Road
Great Western Business Park
Yate
Bristol
BS37 5RD

Tel: 01454 321300
Fax: 01454 312497

Basket RQG 18

This machine has a self-propelled articulated, telescopic boom (Plate 5). The RQG base is pedestrian controlled. The machine runs on either a 12-Volt battery or diesel engine. The machine is mounted on rubber tracks and can be delivered on a trailer pulled by a large car/ 4WD vehicle. Further details are available from the suppliers.

Plate 5
Basket RQG 18

The RQG 18 for the purpose of the trials had a good effective working height and was highly manoeuvrable both in the air and the ground. An added advantage is that the machine does not always have to be removed from the trailer to operate. An inconvenience is that the stabilisers are not fully hydraulically operated and a small amount of manual handling is required to place locking pins in the correct position. The RQG 18 is also slow to move on the ground.

The machine was supplied by:

Promax Access Ltd
High Street
Grimethorpe
Barnsley
S72 7BB
Tel: 01226 716657
Fax: 01226 716658

Teupen Euro B20

This machine is a vehicle mounted telescopic boom (Plate 6). The platform was mounted on a Mercedes Benz truck. Further details are available from the suppliers.

Although the vehicle was not 4WD and this precluded it from 2 of the trial sites, the Euro B20 is highly manoeuvrable in an urban environment, quick to set up and has a good working height. However it is restricted to hard, level, ground conditions, which will not always be possible.

Plate 6
Teupen Euro B20

The machine was supplied by:

Blue Line Access Ltd
Holly Farm Business Park
Honiley
Warwickshire
CV8 1NP

Tel: 01926 484173
Fax: 01926 484261

Aerial AD 17T

This MEWP is an all terrain vehicle mounted articulated telescopic boom (Plate 7) with a working height of 17 metres. The platform is mounted on an Ausa 300RG dumper chassis. Further details are available from the suppliers.

The AD17T is a highly manoeuvrable machine and combined with 4WD the machine will cope with many sites. Overshoes for the stabilisers are required for soft ground conditions. A reasonable working height of 17 metres will access many trees.

Plate 7
Aerial AD 17T

The machine was supplied by:

EPL Access
Dalston Road
Carlisle
CA2 5NR
Tel: 01228 527671

Dino 210 XT

The Dino 210 XT (Plate 8) is a trailer mounted telescopic boom. The platform requires to be towed by a large 4WD vehicle such as a Landrover. Further details are available from the suppliers.

The Dino has a self-propelled option to aid positioning on the ground and access to the tree. The model had a good effective working height and was easy to set up. The stabilisers are hydraulically operated. A single joystick in the basket controls the operation of the boom and basket.

Plate 8
Dino 210 XT

The machine was supplied by:

Blue Line Access Ltd
Holly Farm Business Park
Honiley
Warwickshire
CV8 1NP

Tel: 01926 484173
Fax: 01926 484261

Table 1
Machine Specifications

Specifications	Scanlift SL 240	Basket RQG 18	Teupen Euro B20	Aerial AD 17T	Dino 210 XT
Working height	24.0 m	18.2 m	20.0 m	16.8 m	21.0 m
Transport length	6.9 m	4.7 m	7.4 m	6.1 m	7.55 m
Transport width	1.92 m	0.89 m	2.2 m	1.9 m	1.92 m
Transport height	2.25 m	1.99 m	3.0 m	2.75 m	2.18 m
Platform capacity (SWL)	230 kg	200 kg	200 kg	215 kg	215 kg
Platform dimensions	1.0 m x 1.5 m	1.2 m x 0.7 m	0.8 m x 1.2 m	N/k	0.7 m x 1.3 m
Basket swing	90°	70°	45°	N/k	90°
Boom rotation	360°	359°	270°	N/k	360°
Gradeability/Slope	35 %	25 %	-	N/k	25 %
Boom type	Self propelled telescopic	Self propelled articulated/ telescopic	Vehicle mounted telescopic	Vehicle mounted articulated/ telescopic	Trailer mounted telescopic

4.3.2 Current safety features

All of the MEWPS used in the trials had similar safety features. A major safety feature is the load sensing outriggers that trigger alarms, either visually or audibly or in some cases both, when the machine is not level. A further feature of this mechanism is that the machine will stop the operator from increasing the instability and will only allow operations to regain stability.

All the machines could also be operated from the platform or the base of the machine. This dual control system allows the groundsman, who also has to be trained in MEWP operation, to lower the machine should the operator get into difficulty.

Many machines now have several power options and many have power sources, either operating purely on engine power take off (PTO) diesel/petrol or battery power or combinations of these options. Furthermore, there is an emergency hand pump, which is a common feature on all machines. If ALL the power systems were to fail, the hand pump can still lower the MEWP.

It is also a popular misconception that MEWPS can crash to the ground due to a hydraulic failure of the boom. This is unlikely to happen with today's machine as many of the types now have safety lock/check valves on all the hydraulic cylinders which will allow only that section of boom/ram to retract into the hydraulic cylinder. The effect is immediate, preventing a dropping sensation. This movement is unlikely to initiate such instability as to cause the machine to topple over.

All the platforms are load bearing tested to produce a safe working load (SWL) capacity, which is the maximum that the basket will safely carry and includes all the operators tools and equipment. The branches of a tree are not load-bearing tested.

The baskets of the machine are supplied with all round guarding and toe guards to prevent operators, tools and equipment from falling from the basket. Of the machines fitted with gates, some are spring loaded to close properly and all are fitted with safety catches to ensure proper closure.

These safety features result in greater security to the operator and reduce the risk of injury in comparison with climbing.

4.4 MACHINE RESULTS

The purpose of the trials was to evaluate each MEWP selected with regard to the following factors:

- Access – in reaching the tree and the crown in association with the maximum height and reach.
- Manoeuvrability – around the tree and within the crown in association with sideways movement available.
- Terrain – with regard to soft conditions, gradients, side slopes and rough ground

The following scoring method was used to give an indication as to how the machines performed during the trials on each of the 3 sites and scores are detailed in Tables 2, 3 and 4:

5. Excellent
4. Good
3. Adequate
2. Fair
4. Poor

4.4.1 Site 1

A group of 4 oak trees to demonstrate the off road and manoeuvring capabilities of each machine and was selected to simulate a group of trees within a parkland/estate environment.

Access to site

The Scanlift, aerial and RQG18 had no problems accessing the site. The 4WD capabilities of the Scanlift and Aerial coming into their own. The RQG 18, mounted on tracks, was slower on reaching the trees.
The Euro B20 had no access to the site as the truck had no 4WD capability and no evaluation could be scored. The Dino failed to access the site as the towing vehicle, whilst having 4WD capability, could not drive on the site due to the soft conditions.

Manoeuvrability around trees

The Scanlift, RQG and the Aerial moved around the trees with no difficulty.

Terrain

Heavy rainfall over a number of days had left the site very soft. As a consequence the Scanlift did sink a little at one tree, however this did not have any effect on the stability of the platform. The Aerial had improper spreader plates supplied for the purpose of aiding stability and as a result the machine experienced some sinking on a couple of occasions. The RQG did not encounter any problems.

Reach to anchor points

The only machine to successfully reach all the anchor points was the Scanlift. The RQG did fail to reach one of the anchor points on the fourth tree and had to re position from its' original set-up; the Aerial also failed to reach the anchor points on 2 of the trees. In both cases, this was due to a lack of reach.

Manoeuvrability in crown

Manoeuvrability within the crowns caused all the machines some problems, due to branches being caught and snagged in the basket.

Table 2
Site 1 scores

MEWP	Access to site	Manoeuvrability around tree/s	Terrain	Reach to anchor points	Manoeuvrability in crown	Totals
Scan lift SL 240	5	5	3	5	3	21
Teupen Euro B20	0	–	–	–	-	0
Basket RQG 18	5	5	5	4	3	22
Aerial AD17T	5	5	3	2	3	18
Dino 210 XT	0	–	–	–	-	0

4.4.2 Site 2

An open grown sycamore in a field. This tree was selected to simulate a parkland/ estate environment to test the off road capabilities, also the ability of the MEWP to access an anchor point through an open grown dense crown.

Access to site

The RQG had to be tracked to the site and was the slowest of all the machines to reach the tree. The Aerial suffered the same problems as Site 1 but managed to access the site with no difficulty. The Scanlift had some difficulty in crossing the site, due to the soft conditions, however in 4WD in low gear, the machine reached the tree. The Euro B20 and the Dino, again had no access to the site.

Manoeuvrability around trees

The Aerial with its 4WD set up but improper spreader plates led to sinking and stability problems. The RQG had no problems on this site.

Terrain

All the machines coped with the terrain.

Reach to anchor points

The Scanlift and RQG machines reached the anchor points with no difficulty. The Aerial machine failed to reach the anchor point on this site, again due to insufficient reach of the machine.

Manoeuvrability in crown

As in Site 1, all the machines had branches snagged in the basket.

Table 3
Site 2 scores

MEWP	Access to site	Manoeuvrability around tree/s	Terrain	Reach to anchor points	Manoeuvrability in crown	Totals
Scan lift SL 240	5	5	4	5	3	22
Teupen Euro B20	0	–	–	–	-	0
Basket RQG 18	4	5	5	5	3	22
Aerial AD17T	5	5	3	0	3	16
Dino 210 XT	0	–	–	–	-	0

4.4.3 Site 3

Three individual lime trees. This site simulated an urban environment, as each of the MEWPs would be positioned on a tarmac road.

Access to site

All the machines, including the Euro B20 and the Dino, accessed this site.

Manoeuvrability around tree/s

No movement around the trees was required on this site. The Dino excelled on this site and managed to access all 3 trees from the same position. The Scanlift accessed trees 1 and 2 from the same position before moving to tree 3. The positioning of the machines on the road was important, which was borne out by the Euro B20 as it managed to access trees 2 and 3 without having to be lowered and repositioned.

Terrain

The hard standing of the tarmac road proved ideal for all the machines.

Reach to anchor points

The Scanlift, Euro B20 and Dino managed to reach the anchor points of all the trees. The RQG failed to reach any of the anchor points of tree 3 lime, due to a lack of boom height, but successfully reached the points on the first 2 trees. The Aerial, again due to a lack of boom reach, failed to attain any of the anchor points.

Manoeuvrability in crown

All of the machines had no problems in any of the lime trees on this site. The Aerial, although failing to reach the anchor points did cope with any obstructions.

Table 4
Site 3 scores

MEWP	Access to site	Manoeuvrability around tree/s	Terrain	Reach to anchor points	Manoeuvrability in crown	Totals
Scan lift SL 240	5	5	5	5	4	24
Teupen Euro B20	5	5	5	5	4	24
Basket RQG 18	5	5	5	3	4	22
Aerial AD17T	5	5	5	0	4	19
Dino 210 XT	5	5	5	5	4	24

4.4.4 Summary of operational ability

Access to site

The Scanlift, RQG, Aerial machines had no difficulty reaching any of the sites, only the Euro B20 and Dino were restricted by the off road nature of sites 1 and 2 but proved their worth on site 3.

It is worth noting that the Basket RQG machine does not need to be removed from its trailer to operate. This method was demonstrated but not studied and can only be used were site conditions allow the stabilisers to be positioned on very level and stable ground.

Manoeuvrability around tree/s

All the machines performed well when moving around the trees to find access to the crown. Site 3 being located on a road gave full access to the trees and did not require any manoeuvring except to re-position between the trees. The Euro B20 did not have to reposition for trees 2 and 3, on site 3.

Terrain

The Aerial machine was used in the trials for its access and manoeuvrability qualities on less than ideal (softer) ground conditions. From that point the machine performed well but if the correct spreader plates had been supplied, may have performed better.

The Scanlift and RQG managed to cope with the soft ground conditions of Site 1 and 2. Only the Euro B20 and the Dino failed to cross the soft ground and the Dino only because the towing machine was not suited to the conditions.

Reach to anchor points

The only machine to access all the anchor points of the trial sites was the Scanlift. The RQG machine failed to reach only one of the anchor points. The working height of the Aerial AD17T failed to reach many of the anchor points (actual reach of 16.8m). This proved to be a valuable exercise in demonstrating the need to be careful in the choice of the size of MEWP that is required to carry out the task. The Euro B20 and Dino machines had no difficulty in reaching any of the anchor points on site 3.

Manoeuvrability in crown

All the machines became entangled in the branches of the trees at some point. The most common snagging being branches that entered the basket and became caught in the guardrails. This may not prove to be problematic in a real operation, where the branch could be removed, but for the purposes of the trial the operators were under instruction not to remove branches unnecessarily.

4.5 CLIMBING RESULTS

An experienced climbing team was used for the climbing trials. As with the machine trials, the object was to reach the pre-determined anchor points. All the anchor points, on all the trees were achieved. The climbers used friction knots on site 1 and used ladders to gain access on sites 2 and 3.

It was necessary, particularly on sites 1 and 3 that the climber was given sufficient rest between each tree before continuing the next climb. The oaks on site 1 were climbed throughout the course of a morning and the other sites on a different day.

Site 1

The climber decided to use a friction knot technique to gain access to the trees. This involved a great deal of physical effort to reach the first branch to enable the use of strops around the tree. The oaks provided numerous options on the route up to the target anchor points, which were used judiciously by the climber, however it still required physical exertion throughout the climb. The climber was given a rest between trees as required.

Site 2

The climbing team for this tree decided that ladders would provide a better means of access than using friction knots. The ladder was not secured at either the top or bottom to prevent the ladder slipping. The open grown nature of the tree made it easy for the climber to reach the anchor points, which is borne out by the time taken shown in the results table.

Site 3

Again ladders were the preferred choice of access. The lime trees proved to be the most difficult climb for the team, due to the amounts of epicormic growth, dead wood and on the last of the trees a section of ivy. As with site 1, the climber was given a rest between trees.

4.6 DISCUSSION ON PERFORMANCES

4.6.1 Operator comments

The climbing team commented that all the trees in the trials covered the range of easy to difficult climbs, with some of the anchor points being a challenge.

Some members of the climbing team were also used in the MEWP trial. This was designed to draw comment from climbers who had never used a MEWP before. Overall, the reaction was positive. The climbers were particularly impressed by the speed of ascent, the working heights and reaches, manoeuvrability and most of all the lack of effort on their part in reaching the working position. Some operators commented that the swaying of the machine initially made them feel uncomfortable and 'naked' with out a rope, however after a few trips they had gained more confidence and could appreciate that a MEWP was of considerable benefit.
These comments were echoed by some part time Royal Forestry Society arboriculture students, all experienced climbers, although sceptical to begin with, after an ascent could also see the advantages in using MEWPs.

4.6.2 Summaries of performances

Scanlift SL 240

The working height and outreach of the Scanlift presented no problems in reaching the anchor points on any of the sites. The 4WD capability and steering options also made reaching the trees on all sites straightforward.

Although the Scanlift is 6.9 meters in length this does not hinder the manoeuvrability of the machine. Movement between the oaks to gain optimum position was effortless.

The terrain conditions also proved no problem to the machine. The only slight hindrance was minor sinking at the second oak tree on one of the legs. However, this did not prevent the operation continuing with the machine remaining stable. The tussocky nature of site 2 caused no problems.

To gain entry to the Scanlift, a wire rope provides a step up to the spring-loaded gate providing easy access to the platform.

No significant problems were encountered either in accessing sites or gaining access to anchor points.

Basket RQG 18

On site 1, the anchor points in trees 1, 2 and 3 were reached with few problems; some repositioning was required to gain good access to tree 2. On tree 4 the RQG failed to reach the higher of the 2 anchor points. The machine had no problems with access or reach on Site 2, but failed to reach any of the anchor points on the 3rd of the lime trees at Site 3.

The RQG is highly manoeuvrable due to its narrowness and length and can be driven with the stabilisers in a raised position, reducing movement time.

Access to the platform is through a lift bar, with the operator ducking underneath the bar and twisting to gain entry. No step is provided to help climb up onto the platform.

On Site 1, the vehicle towing the trailer, on which the machine was located, could not cope with the soft conditions. The machine had to be taken off the trailer and positioned using the electric controls. On site 3, the machine, for tree 3, was able to extend the stabilisers and provide a level and safe working position without having to leave the trailer.

The RQG handled each of the sites well. Snagging of branches on the basket caused many delays during operations.

Teupen Euro B20

The Teupen Euro B20 mounted on the truck chassis could not access either Site 1 or Site 2 due to the nature of the ground conditions. However, Site 3 provided no challenge and the machine performed very well. The machine did not require repositioning to reach tree 3 and the anchor points were reached without having to lower the machine from its position for tree 2.

Access onto the platform is provided by a couple of steps mounted on the truck chassis and provision of a grab handle to pull up to the spring-loaded gate.

Overall, the machine performed very well at site 3, with the exception of snagging on some branches, on reaching all of the anchor points.

Aerial AD 17T

On Site 1 the AD17 failed to reach the anchor points on trees 2 and 4. This was due to the lack of reach of the machine rather than the positioning of the machine by the operator. The soft ground conditions of Site 2 should not have been a problem but improper spreader plates and bad positioning of the machine by the operator led to failure in reaching the anchor points. On re positioning, the lack of reach of the machine also resulted in failure. On site 3 the machine failed to reach any of the anchor points.

A couple of steps lead up to a lift bar on the platform causing an awkward means of access to the basket.

Failure of the machine to reach the anchor points on many of the trees illustrated the importance of selecting the right machine and auxiliary equipment such as spreader plates, to ensure effective operations. The decision to use the AD17 was a result of the need to trial a purpose built, off road MEWP. A lack of available machines forced the hire of a machine with inadequate reach.

Dino 21 XT

The soft ground conditions of site 1 and 2 precluded the towing vehicle from gaining access. Site 3, on the tarmac, allowed the machine to be positioned in the correct place to allow access to all the anchor points on all 3 trees from the same set up position. Using the self-propelled unit of the machine, which is run off a battery, helped this positioning.

A set of foldaway steps, with a non-slip surface, and a spring loaded lift bar allows access onto the basket**.**
Overall, the machine performed well on the tasks set before it at site 3 with the exception of snagging on some branches.

4.6.3 Cost and performance comparisons between the use of MEWPs and tree climbing

Costing Assumptions

An average cost of MEWP hire is taken as £325 per week. This was found to be reasonably typical during trials but costs can vary considerably between localities.
Cost for a MEWP operator when an additional man has to be specifically hired was £280 per day.
Cost for the arborist was £125 per day.
Cost for groundsman was £100 per day.
Costs per minute for the above have been calculated on a 40 hour week and 8 hour day.

Costs per minute were calculated as:

Arborist	26.0p/min
Groundsman	20.8p/min
MEWP	13.5p/min
MEWP operator	58.3p/min

Cost for tree climbing (arborist + groundsman)	46.8p/min
Cost for operation without hiring additional operator (**cost 1** in Table 5) (MEWP operated by arborist team)	60.3p/min
Cost for operation using MEWP with additional operator (**cost 2** in Table 5)	118.6p/min

Table 5
Cost comparison

	Site 1			Site 2			Site 3		
Means of tree access	Time (min)	Cost 1 (£)	Cost 2 (£)	Time (min)	Cost 1 (£)	Cost 2 £	Time (min)	Cost 1 (£)	Cost 2 (£)
Arborists only	125	58.50		32	14.98		112	52.42	
Scanlift SL 240	49	29.55	58.11	38	22.91	45.07	34	20.50	40.32
Basket RQG 18	94	56.68	111.48	42	25.32	49.81	56	33.77	66.42
Teupen Euro B20							34	20.50	40.32
Aerial AD 17T	34	20.50	40.32	28	16.88	33.21	32	19.30	37.95
Dino 210 XT							29	17.49	34.39

The above figures identify the potential savings in time and cost for the work element of gaining access to the tree from the nearest road and into the tree, accessing all the anchor points.

The following points should be noted:

- The Scanlift was the only machine to achieve access across all areas and to access all anchor points in all trees.

- The Scanlift, Teupen Euro and Dino all had sufficient reach to reach all access points in the trees they could travel to. Their times for this were very similar although the Dino was marginally faster.

- Site 2 caused problems to all MEWPs and manual climbing was faster. This was due to the widely spreading crowns at site 2 causing difficulties for the MEWPs to gain access to all the anchor points. This required more manoeuvring of the MEWPs.

- At sites 1 and 3 the MEWPs were able to save up to 74% of time in accessing the anchor points and save up to 67% of cost. (Dino Site 3).

- It should be noted that this saving relates to time to gain access to anchor points. If the arborist has then to undertake work in the crown for which the MEWP does not provide a saving, then this unproductive time for the MEWP should also be costed. This unproductive time will also need to be considered when the MEWP is travelling between sites. This unproductive time will vary considerably depending upon the work programme and work programmes would need to be planned carefully to maximise the productivity of the MEWPs.

- The comparisons between cost 1 and cost 2 in the table clearly identifies the importance of ensuring the arborist team are trained in the operation of the MEWP to avoid additional costs.

The machines, overall, considerably improved performance, in terms of time required and cost in two of the three sites. However, not all the machines coped with all the sites, access to the site being the biggest challenge. The climbing team bettered the machines on site 2, where the open grown sycamore suited the climbers, giving them numerous relatively easy routes to the target anchor points. Due to the spread of the crown the MEWPs took more time to manoeuvre the way to the points. More experience in the use of MEWPs in trees could perhaps improve this performance. The climbers also used ladders to gain initial access rather than the friction knot approach of site 1.

All of the machines performed well on site 3, this proving to be the biggest challenge to the climbers due to the amount of dead wood and epicormic growth.

4.6.4 Discussion of problems identified during the trial

The MEWP operators had little or no experience of using the machines in tree work and this perhaps, contributed to some delays in manoeuvring the machine to the optimum positions and accessing the crowns. The availability of appropriate machines for the trial also proved to be a problem, hence the use of the Aerial machine.

Through discussions with platform operators, manufacturers and arborists involved in the trials a small list of potential improvements to the design of platforms has been compiled. These are as follows:

- Operators of any size and proportion should be able to mount and alight from the machine without being forced to twist their upper body. Access and egress of the basket could be facilitated by the addition of a small step attached to the bottom of the basket. Harvesting machinery in commercial forestry requires a step to aid access/egress the machine which conforms to a ergonomic checklist, *Ergonomic guidelines for Forest Machines*[1]. The bottom rung of the steps can be no higher than 400 mm from ground level to conform to the checklist. Of the machines involved in the trials the Scanlift had a wire step to aid access, the Teupen truck mount had a step up and grab rails to aid access.

- Typically MEWPs have a lift bar fitted to the access point of the basket. This requires anyone entering or leaving the basket to lift and hold up the bar duck underneath and twist their way into or out of the basket. The fitting of a spring-loaded gate would aid access/egress to the basket.

- Some of the MEWPs at the trials had a solid floor to the basket. An open grill type floor would aid vision of the ground and personnel below the platform. This would also allow identification of branches that could snag hydraulic pipes or electric wires. Platform management would also improve allowing dirt etc. to fall through the grill.

- It is commonplace for some arborists when using MEWPs to leave the basket and work in the crown. To facilitate this practice, it would desirable to have sliding vertical bars to aid egress/access.

- Facilities for the use of hydraulic, air or electrical powered tools e.g. lights, such as on the Basket MEWP used in the trials is also seen as desirable. Use of hydraulic equipment for arboriculture operations is common in the USA and Europe.

- The shape of the basket also drew comment. All the basket designs during the trial and case studies were rectangular. This shape provides a greater wind resistance providing a larger 'sail' area, which increase the swaying motion of the basket. It may be that a circular design would overcome this problem. A circular design may also prevent branches snagging as regularly on the basket.

- A few minor ideas included a wind speed indicator on board the basket, also an indicator of the levelling of the stabilisers.

[1] SkogForsk (1999). *Ergonomiv guidelines for forest machines.* ISBN 91 7416 093 6. SkogForsk, Sweden.

5 MODIFICATIONS TO CURRENT WORKING PRACTICE

The current best industry practice is supplied from International Powered Access Federation (IPAF) in the form of their booklet *Operators' safety guide for mobile elevating work platforms*[2]. This booklet is supplied as part of the operators' training and serves as a reminder of the training they have received. The guide covers the latest in legislative requirements, platform design and technology and the views of best practice. It is not, however, specific to any one industry.

In conjunction with IPAF, a guide has been specifically written for the arboricultural industry has been written and can be found in Appendix 1 to this report.

The evaluation of working from a MEWP in trees has identified some potential issues, which should be addressed.

The use of a chainsaw from a MEWP requires different operational techniques:

- to ensure a safe position is achieved
- to ensure optimum position for work
- to maximise the amount of access the MEWP can achieve in the crown

Appendix 1 gives some guidance on this but further work and method development could increase the effectiveness and efficiency of MEWP working.

[2] IPAF (2000). *Operators' safety guide for moible elevating work platforms*. IPAF Ltd, Unit 7, Bridge End Business Park, Park Road, Milnthorpe, Cumbria.

6 TRAINING

It is essential that only trained and certificated persons operate the MEWP. More than one person within the team must be able to lower the platform, both by means of the controls on the MEWP basket and any emergency controls below on the platform unit.

MEWP training does not specifically cover the use of MEWPs in arboricultural operations but is an overall course in the functions and capabilities of a MEWP.

Standard training for MEWPs involves practical and theory work. The practical sessions include how to use the machine in a safe and effective manner providing a capable and confident operator. The theory sessions include machine theory, legislation, practical examples and health and safety issues.

The course outline includes:

Safety awareness
Introduction to MEWPs, types and components
Pre-use pre-travel and function checks
Setting up the machine for work
Practical operator training
Achievement testing

Many training organisations offer training courses the following are examples.

IPAF Training – Powered Access Licence (PAL card)

Training through the IPAF scheme credits the operator with a PAL card and logbook. This system demonstrates the training and experience of the operator has achieved. The PAL card includes the operators' details such as name, photograph, and the equipment they are trained to operate. The logbook details the experience that has been acquired over time. The PAL card is valid for 5 years.

The following courses and duration follow:

Course	Duration
Self Propelled Boom (SPB)	1 day
Trailer Mounted (TP)	1 day
Vehicle mounted to 26m (VMP26)	1 day
Vehicle Mounted over 26m (VMP100)	1 day

Operators with previous experience may be able to achieve 2 categories in 1 day.

One day's training to become an operator will cost £100 per person and a further £20 p.p. for IPAF registration.

IPAF have many training centres around the UK. This information is available on the IPAF web site at www.ipaf.org

Construction Training Award (CTA)/ Intermediate Construction Award (ICA)

The CTA scheme promotes training, safe working practices and safe operation. The CTA/ICA card is widely accepted as providing evidence of training and forms the first step towards an NVQ Level 2 qualification. This scheme is administered by the Construction Industry Training Board (CITB).

Course	Duration
Novice operator	2 day
	1 day
Experienced operator*	1 day
	1 day

*Current CTA safety awareness qualifications will be required.

The charges for this course are a daily rate of £360 per person/day with £ 83 p.p. for registration with the CITB.

The training cost figures were supplied from Select Training.

Lantra also provide training in the use of MEWPS.

The course syllabus has the following objectives:

1. Understand the regulations and safety requirements related to the safe use of mobile elevated work platforms

2. Understand the safe working load in relation to the carriage of persons and equipment in the platform.

3. Carry out routine inspections and maintenance as per the manufacturers' instructions.

4. Prepare for use (rigging for work) taking into account: Risk Assessment, site features, PPE, correct positioning, safety zones, safe working.

5. Understand the requirements for rigging on soft or uneven ground.

6. Demonstrates the procedures for lowering the platform to the ground in an emergency.

7. Demonstrate the principles of raising, and manoeuvring the platform safely, and when not to raise the platform.

8. OPTIONAL: Operate a chainsaw from the platform for the removal of branches or stem using the following methods:

    - Step cut free fall
    - Step cut hand held
    - Sink cut free fall
    - Sink cut hand held
    - Final pruning cut
    - Taking into account platform position, communication, ground features and accuracy of cuts.

9. Demonstrate lowering the platform slowly, safely and in a controlled manner.

10. Stow the platform and prepares it ready for transportation.

The course is run over 2 days and will prepare the trainee for National Proficiency Testing Council (NPTC) Unit AO21.

Candidates must hold NPTC Units CS30 and CS 36 prior to branch removal by chainsaw. The courses are run at various centres throughout the country. The cost of the course varies from trainer to trainer.

The NPTC test covers all the objectives of the Lantra course and is usually held at the same location as the training course. Again prices for the test vary.

7 GUIDANCE ON SELECTION OF MEWPs

Section 4 gives basic guidance on the FACTORS AFFECTING MACHINE CHOICE.

In addition to these basic selection criteria, the trials have identified some particular factors which should be considered.

Off-road working

- If off-road working is required considerable care needs to be given to ensuring the optimum base machine is chosen. The base machine should have a minimum of 4 WD. Depending upon the softness of the ground, either wide tyres or tracks should be considered, the tracks providing the best floatation.

- While tracks provide best flotation on softer ground, they are slower which could be of significance if much off road travel is required. If the ground is therefore firm and tracks are not necessary then a wheeled base machine would be more efficient.

- Stabilisers should have sufficient surface area to ensure they will definitely not sink into the ground. This could be particularly dangerous should sinkage occur during operations when the operator is working from the basket.

Manoeuvrability of base machine

- When working in areas where the space is restricted and in particular in areas where access to the crown cannot always be achieved from a single position, it is important to ensure the machine chosen can work effectively within the constraints of the site and lack of manoeuvrability does not cause unacceptable delay.

Working reach

- It is essential to ensure the working reach of the boom is sufficient for all the required work. (Note it may be decided to use the MEWP for access to the crown but to work out of the basket from that position. However this should be recognised at the outset, as optimum machine choice could minimise climbing needs, work and safety risks)

- Full boom rotation can aid working from more than one tree from one position of the base machine. This can significantly reduce manoeuvring time.

- Having articulation in the boom can improve manoeuvrability of the basket in the crown, as it may be possible to lift the basket over obstructing branches. This also may save manoeuvring time.

Basket design

- Basket rotation can improve the ability to achieve optimum working position in the crown. Therefore, if much in-crown work is required, selection of a design with maximum basket rotation is desirable.

- A see-through grill for the floor of the basket is an important feature when working in trees. This ensures people can be seen below the basket; it will ensure obstacles to manoeuvring in the crown are seen; branches which could catch on the basket or on hydraulic pipes etc. can be seen.

8 DISCUSSION ON SAFETY AND EVALUATION OF RISK

Certain aspects of MEWP design or operating method have been identified as giving advantages over climbing.

- Trees that are identified as being diseased or decayed are better suited to the use of MEWPs, for carrying out any operations. A climber using limbs as anchor points for ropes may be unaware if the limb is weaker than expected and fails, injuring not only the climber but potentially those below.

- Operators work from a stable platform with robust safety features rather than a rope and branches.

- The potential for pendulum swing into the branches and trunk is reduced when using MEWPs. If the MEWP was to swing the operator is protected from serious injury by the basket.

- Operator errors when working from a platform are more likely to result in minor injuries e.g. from a slip in the basket. Maximising the amount of work carried out from the basket will therefore significantly reduce the type of injury and level of risk. It is therefore reasonable to expect that a MEWPs should be the preferred option if a significant amount of work can be carried out from the platform.

- Problems have been identified with the snagging of branches on the basket and this may limit the amount of work which can be undertaken from the basket.

- In operations where climbing is a significant proportion of the work, and access to the working position is difficult or arduous, the use of a MEWP will be an effective way of reducing effort and fatigue. Therefore the operator is less prone to error when working in the crown and a reasonable way of reducing risk. Operators expressed the opinion that the effort saved could be considerable.

- It was identified that in some trees, where access by climbing or ladders was relatively easy due to the height or form of the tree, climbing could be easy and fast. It is therefore recognised that, on the basis of climbing time and effort alone, MEWPs will not always offer an advantage.

- The use of a MEWP could potentially improve the safety of rescue operations should a climber be injured in the tree. While the MEWP may not always be able to get to the exact position of the climber should he need to be rescued, it is possible that rescue to the platform would be less difficult or arduous than to the ground. Similarly, if an arborist is injured whilst working from the basket, the groundsman is in a position to lower the basket if the arborist is unable to operate the machine.

- There is less need for a groundsman being at the base of the tree to pass up equipment and therefore there is a reduced risk from falling branches or equipment.

- Further studies are required to develop methods and techniques to maximise the proportion of work that could be undertaken from the safety of the basket. This would also include evaluating the working position for chainsaw use from the platform and highlight potential training requirements.

It is recognised that good operating practice reduces this risk significantly. However branches can fall unexpectedly and the groundsman cannot fully avoid the need to work under the tree. Use of a MEWP is therefore preferable, particularly if the tree is diseased or damaged, or perhaps when there is a lot of crown work to carry out.

Previous sections have given guidance on identifying whether the job can be undertaken by a MEWP in terms of site and tree constraints.

The use of a MEWP could be seriously considered as a *reasonably practical* means of reducing risk in the following circumstances where:

- The tree is diseased or damaged. For this type of work, the risks may indicate the use of a MEWP even when the amount such work is low.

For the following, small amounts of work may preclude the special provision of a MEWP if one is not readily available. However, where possible, consideration should be give to organising work programmes to enable sufficient work to be identified for one period so that the acquisition of a MEWP would be practicable.

- Where climbing in the tree is particularly difficult or arduous due to height or lack of resting points (limbs)
- Where there are a reasonable number of trees for which the MEWP is suitable
- Where there is a reasonable amount of work in the crown which could be undertaken from the platform
- Where there is a need to minimise the time, disruption and hazards to others (e.g. traffic or pedestrians)

9 CONCLUSIONS

Many of the arboriculture operations practised can be facilitated by the use of MEWPs and advantages have been identified.

9.1 SAFETY

Machine

The safety features of the a MEWP are more robust and less subject to failure than climbing equipment through misuse or operator error.

Operator

Identification of dangerous limbs may not always achieved from the ground and therefore a climber may place himself unknowingly in a hazardous position.

Operators are working from a stable platform rather than a rope and branches and are therefore less vulnerable to operator error or equipment failure.

Operators have no arduous climbing prior to work. This reduces fatigue and therefore the operator is less prone to error when working in the crown.

Optimum working tools can be more readily available i.e. they will not have to be hauled up into the tree. Efficiency and ease of working should therefore be increased.

Groundsman

There is a reduced need for a groundsman being at the base of the tree to pass up equipment and therefore reduced risk from falling equipment or branches.

9.2 REDUCED EFFORT

Climbing trees requires considerable effort, which results in a high proportion of time being required for rest. Use of MEWPs reduces this need for rest, making more productive time available.

The use of MEWPs and the reduced need for climbing, results in operators not being so exhausted at the end of the day.

9.3 REDUCTION IN TIME REQUIRED

The trials confirmed that the use of MEWPs can save up to 74% of the time required for manually climbing trees and can result in:

- Reducing the need for climbing and for hauling equipment into the tree which can reduce time required for individual jobs. This enables more jobs to be done in the same time period, increasing productivity.

- Reducing time required for individual operations which can mean less obstruction or disturbance to others e.g. for roadside tree work.

9.4 POTENTIAL TO REDUCE COSTS OF JOBS

The trials identified that the cost accessing the tree and climbing to the anchor points can be reduced by the use of MEWPs by up to 67%.

Specific training and certification for the use of MEWPs in arboriculture operations is required.

Selection of a MEWP for tree work must be given careful thought as inappropriate choice can result in not being able to achieve all the required work or increasing costs.

9.5 OFF-ROAD WORKING

If off-road working is required considerable care needs to be given to ensuring the optimum base machine is chosen. The base machine should have a minimum of 4 WD for off-road work. Depending upon the softness of the ground, either wide tyres or tracks should be considered, the tracks providing the best floatation.

While tracks provide best flotation on softer ground, they are slower which could be of significance if much off-road travel is required. If the ground is therefore firm and tracks are not necessary then a wheeled base machine would be more efficient.

Stabilisers should have sufficient surface area that they will definitely not sink into the ground. This could be particularly dangerous should sinkage occur during operations when the operator is working from the basket.

9.6 MANOEUVRABILITY OF BASE MACHINE

When working in areas where the space is restricted and in particular in areas where access to the crown cannot always be achieved from a single position, it is important to ensure the machine chosen can work effectively within the constraints and lack of manoeuvrability does not cause unacceptable delay.

9.7 WORKING REACH

It is essential to ensure the working reach of the boom is sufficient for all the required work. (Note it may be decided to use the MEWP for access to the crown but to work out of the basket from that position. However this should be recognised at the outset, as optimum machine choice could minimise climbing needs, work and safety risks)

Full boom rotation can aid working more than one tree from one position of the base machine. This can significantly reduce manoeuvring time.

Having articulation in the boom can improve manoeuvrability of the basket in the crown, as it may be possible to lift the basket over obstructing branches. This also may save manoeuvring time.

9.8 BASKET DESIGN

Basket rotation can improve the ability to achieve optimum working position in the crown. Therefore, if much in-crown work is required, selection of a design with maximum basket rotation is desirable.

A see-through grill for the floor of the basket is an important feature when working in trees. This ensures people can be seen below the basket; it will ensure obstacles to manoeuvring in the crown are seen; branches which could catch on the basket or on hydraulic pipes etc. can be seen.

10 RECOMMENDATIONS

Further trials or case studies should be carried out to further identify the productive and unproductive elements of using MEWPs, compared to climbing.

Manufacturers, or their agents, of MEWPs should be approached to discuss the opportunities to improve the design of MEWPs for tree work.

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MOBILE ELEVATING WORK PLATFORM OPERATOR'S SAFETY GUIDE FOR ARBORICULTURE OPERATIONS

INTRODUCTION

The aim of this safety guide is to supplement the instruction and training that you, as the operator, have been given. It sets out in clear, straightforward language the recommended working practices for the safe operation of mobile elevating work platforms (MEWPs), from initial checks, through transport and positioning on site, to carrying out the required task. The guide covers the following types of MEWP:

- Vehicle mounted, articulated and telescopic booms
- Self propelled articulated and telescopic booms
- Trailer mounted articulated and telescopic booms
- Other combinations of the above

If you should come across a safety problem with your MEWP, which you are unsure about and you find that this guide cannot help, you must seek advice from your manager, site supervisor or safety officer or MEWP supplier/ manufacturer.

OPERATOR'S QUALIFICATIONS AND RESPONSIBILITIES

Training

As the operator of a MEWP you must be adequately trained in the safe operation of the machine as required by law. It is also advisable to have a certificate as proof of training and to carry your certificate of training with you on the job. Your customer and HSE inspectors may ask to see your training records.

Fitness and Health

Your job as the operator is demanding in both skill and concentration. You cannot do it properly if you are not medically fit or have problems with your eyesight or hearing or with alcohol or drugs. Your company will be concerned to ensure that your health does not make you a risk to yourself or to others working with you or near to you.

Responsibilities of the Operator

Your first concern must be for the safe operation of the MEWP, the safety of the people working with you and the safety of other persons in your working area.

You must follow the manufacturer's instructions and at no time attempt to operate the machine beyond the recommended limits.

The proper care of the MEWP is a major factor in ensuring safety. You must not misuse the machine or ignore or interfere with the devices and equipment, which have been provided to maintain safety.

DRIVING ON SITE

Make sure your MEWP is suitable for travelling over the ground conditions found on the site.

Before travelling the MEWP on site you should make sure that there are no ramps, trenches, slopes, manhole covers, ground obstruction, overhead cables, building projections or other obstacles, such as tree stumps and roots which may also present a danger. Care should also be taken when travelling over ground mulches and leaf mould as they may to support the weight of the machine.

Before travelling, make sure that the platform is in the recommended travel position and there are no persons in the path of the machine. If applicable, secure the turntable motion before moving off. Ensure that the stabilisers are retracted and locked as recommended by the manufacturers.

SITING AND STABILITY

Ground Conditions

MEWP stability is affected by poor ground conditions.

Watch out for:

- Uncompacted fill – soil or other fill material may be piled along the line of a backfilled trench without being compacted. An indication of uncompacted fill can be the cracking of the ground along the line of the trench.
- Cellars and basements – many are incapable of bearing the weight of your machine with or without a load, and may collapse without warning.
- Underground services – sewers, drains, manholes, gas and water mains, may be damaged by the weight of your machine or may collapse and cause it to topple.
- Weather conditions – heavy or prolonged rain may alter ground conditions and cause sinking. Adjust or check levelling, packing mats if you suspect that the ground is getting softer. A check on the changing conditions should be made regularly thereafter. The same checks must be made when frozen ground is thawing out. Frozen ground can appear to be much firmer than it actually is.

Use of Outriggers (Stabilisers)

Outriggers and/or stabilisers where fitted should be used as recommended by the manufacturer.

Before raising the platform you should ensure the machine is levelled within the manufacturer's limits and located on a firm surface. The use of suitable bearers should always be considered when it is necessary to spread the load under the outriggers to prevent them from either sinking into the ground or damaging the supporting surface.

You should check each outrigger and its bearer is in full contact with the ground, both before starting work and regularly thereafter.

With some types of machine, the full weight must be taken off the tyres before the platform is raised. Refer to manufacturer's instructions.

The outriggers, if fitted, must be fully extended horizontally on both sides unless the machine is specifically designed to allow part extension. The outriggers on some machines can be used on steep ground to prevent turnover. Precautions need to be taken in the deployment to ensure collision is not made with obstacles. However, when traversing steep ground they are, or can be, the safest option.

Extending Axles

Extending axles, if fitted, must be fully extended horizontally on both sides unless the machine is specifically designed to allow part extension. Axles must be retracted when travelling on the road and when travelling to or from the place of work.

The only circumstances where the MEWP can be moved with the axles extended is when an adjustment to the position of the machine is necessary as part of the work being carried out.

The use of the machine on sloping ground should be conducted with the axles extended.

SAFE WORKING LOAD

The safe working load (SWL) is the maximum load that the MEWP will safely carry. This includes the weight of all persons, tools, equipment, ropes and materials. Overloading by exceeding the SWL is extremely dangerous and should never take place. Not only will it damage the machine, but it may also cause it to overturn.

You must ensure the SWL of the machine is sufficient for the maximum combined weight of persons, tools and equipment before starting the work. An allowance must be made for any additional loads that will need to be carried by the platform during the work.

It should be noted that some manufacturers allow varying SWLs for particular machines. Consult the manufacturer's load chart and manual.

SWLs should always be marked on the machine in a prominent position, shown in kilograms and by diagrams indicating the maximum number of persons.

OTHER HAZARDS

Other factors that will reduce the stability of the MEWP and cause overturning or collapse include:

- The uneven distribution of the load on the work platform
- Using machines in high winds. The maximum wind speed in which the machine may be safely used will be specified by the manufacturers and marked on the machine.
- Sudden impact (shock) loads from falling objects.
- Pushing or pulling (horizontally) on a structure alongside the platform can cause instability, overturning and damage to the MEWP when the loads are greater than specified by the manufacturer.

Awareness of the build up of residues, such as cut material, may affect the working parts of the machine such as the telescopic boom, where a build up of material may cause a failure.

Positioning of the machine is critical to prevent impact from falling and wind blown dropped material.

SAFE WORKING

Proper Use of the MEWP

A MEWP is designed to provide a temporary platform for persons, their tools and equipment and to give them access to the work place. It must not be used as a crane by suspending a load beneath the platform using slings or any other type of lifting gear.

Operation of the platform is your responsibility. You must never allow an unauthorised person to operate or interfere with the controls.

Always engage the controls gently and smoothly. Always enter and leave the work platform when it is in its fully lowered position, using the steps or walkways designed for that purpose.

A MEWP must not be travelled with the boom extended or platform raised unless it is specifically designed to be used in this way.

If you are working in an area used by other workers or vehicles, make sure that the whole of your work area is barricaded using cones, warning signs and tapes.

Never lean materials or tools against the outside of the platform. If forgotten they will fall when the platform is moved. The machine must never be used as a jack, prop or a tie to support other structures or machines.

Never interfere with, wedge or override hydraulic, electrical or mechanical safety devices or controls.

Before and during the raising or lowering of the platform, always check for the possibility of hitting obstructions or persons.

You must never use guard rails, ladders, or similar items to extend your reach or height for any purpose. Your feet must be kept firmly on the deck of the platform at all times.

You must always be particularly careful not to allow tools and equipment striking or interfering with the controls of the machine.

Do not use the machine to tow another vehicle unless it specifically designed and equipped for this purpose.

Self-propelled machines should never be towed. This can cause serious mechanical damage and recovery should only be undertaken under the direction of the owner or according to the manufacturers' instructions.

Travelling with the Operator on an Elevated Platform

Travelling with the platform of a MEWP occupied and raised should only be undertaken when the machine is specifically designed to be used in this way.

The jolting caused by an uneven surface will be magnified considerably at the platform and may cause instability and danger to any occupants of the cage or platform. When travelling the machine, it is strongly recommended that another person guide you from ground level.

Do not travel the machine up or down a slope unless it is specifically designed to do so.

Before travelling, a check should be made to ensure that:

- Stabilisers or outriggers are not extended (see **Use of Outriggers**)
- No ramps, trenches, holes or other dangerous conditions lie in the path of travel
- No overhead cables, building projections or other overhead hazards will obstruct your path
- Adequate warning has been given to persons on the ground
- Nothing has been left unsecured and liable to fall off the work platform

Emergency (Auxiliary) Controls

Before operating the controls of a MEWP make sure that you know the position function and correct operation of:

- The emergency (auxiliary) lowering controls
- The emergency stop switch

Ensure that another responsible person on the worksite, (who is not working on the platform), knows how to use the emergency controls.

Never use the emergency controls for purposes other than lowering the platform in an emergency.

Never attempt to climb down the boom of a MEWP if the emergency lowering control fails to operate.

Overhead High Voltage Lines

Working from or moving a MEWP in the vicinity of overhead high voltage lines can be extremely dangerous, and essential precautions must be taken. Guidance from the Health and Safety Executive, GS6, and power companies should be sought. There may also be special rules established for particular sites.

Where MEWPs have to pass under overhead power lines, ground level barriers shall be positioned and ‘goal posts’ erected at the place where your machine may pass under the overhead lines.

If there is no need to pass under the overhead lines, both ground level barriers and high level markers (usually bunting), will be placed to keep you at a safe distance.

Operator must always be aware of the dangers of overhead power lines.

A minimum safe distance must always be kept between the overhead lines and the closest point of the MEWP, with the boom fully extended. This distance is 15 m with overhead lines mounted on steel towers and 9 m with lines mounted on poles of wood, concrete or steel. These distances are measured horizontally at ground level from a position vertically below the outermost conductor at the tower or pole position.

Warnings

- If you are required to work inside these limits, you should seek further advice from the local electricity supply company before commencing work
- All overhead lines and other electrical apparatus should be treated as live unless declared 'dead' and 'safe' by the electrical company (or other line operator).
- Strong winds may cause overhead lines to sway and thus reduce the distance to a point where you are in danger
- The recommended minimum safe working distance must be rechecked and confirmed if the platform is moved from its original location
- You must observe barriers and markers where these are erected to mark safe working distances
- When moving the machine under or near overhead power lines, always be guided by an experienced signaller
- Do not raise any part of the machine when travelling under overhead lines or between two sets of goal posts
- If in any doubt seek further advice

Emergency Drill on Contact with a Live Power Line

If the MEWP makes contact with a live power line, observe the following precautions in order to minimise the risk of electrocution:

- Remain on the platform or in the basket
- Warn all other personnel to keep away from the machine and not to touch any part of it
- Try, unaided, and without anyone approaching the machine, to move the machine until it is clear of the power line and/or lower the platform to the ground
- If the machine cannot be moved away, or lowered, remain inside the basket. If possible, get someone to inform the electricity suppliers at once. Take no action until it has been confirmed that conditions are safe
- Do not touch the machine and the ground at the same time
- Get someone to inform the site management of the situation immediately and until assistance is received, ensure that someone stands guard by the machine to warn of the danger

Devices are available that are designed to be fitted on machines to give warning when the machine comes within a predetermined distance of overhead power lines. Such devices should not be considered as a substitute for a safe system of work.

Working on the Highway

When you are working in an area used by other vehicles or pedestrians, for your own and other people's safety you must make sure that the whole of your operating area is barricaded off using e.g. cones, warning signs, flashing yellow lights tape, etc.

Under no circumstances should you allow any part of the MEWP to extend or swing into a line of traffic.

If arrangements need to be made to divert traffic, using temporary barriers, cones, traffic lights and/or signs, consult the local highways officer of the local council.

It is unlawful for anyone other than a properly authorised person to direct traffic on the highway. The advice of the police should be sought.

When operations are to be carried out during the hours of darkness at a location where the public have access, barriers must be provided together with yellow flashing beacons.

If the platform is to be left at the work site overnight, permission must be obtained from the relevant authority.

USE OF HARNESSES AND FALL ARREST SYSTEMS

General

A risk assessment should be carried out to determine the type of fall protective equipment should be worn by the operator.

If the operation is to be carried out within the crown a standard climbing harness and short lanyard can be used.

However, if the operation starts as working on the outside edges and continued within the crown it will be necessary to work initially with a fall restraint system and then lower the platform and change into a climbing harness to continue the operation within the crown.

The use of a generic risk assessment will cover most cases when using a platform for arboriculture operations, however site specific risk assessments will be required for each operation and may require updating if operational conditions change.

ARBORICULTURAL OPERATIONS

Operations Working in the Platform

Using a chainsaw from a MEWP calls for additional training. Operators must have a relevant certificate of competence or national competence award.

Relevant PPE should be worn for the task in hand; this would include the wearing of a harness and lanyard and chainsaw protective clothing. The use of upper body chainsaw PPE is recommended, because of the need to hold the saw above the guard rail height increasing the risk of injury to the upper body.

Identification of a good working position (i.e. where the work will start from) is essential, as this will influence the positioning of the MEWP. A balance between the MEWP position and the working position may have to be made. It may be that when the start working position has been identified from the ground it may have to change when in the air.

The use of appropriate pruning techniques should be used at all times. The produce to be cut e.g. step cut/hand held, should not be of a size that is too large to manhandle. Cut produce should not be left in the platform at any time.

Do not hold the branch to be cut with one hand whilst using a chainsaw with the other.

Positioning of the machine is critical to prevent impact from falling and wind blown dropped material.

Operations Requiring the Operator to Leave the Platform

Where operations are to take place outside the platform, and the MEWP is only being used as an aid to access, the following practice should be observed.

The relevant PPE should be worn for the task in hand; this would include the wearing of a suitable climbing harness.

The MEWP should be positioned to where a suitable exit and entry point can be identified.

When the MEWP has reached the position for exit from the platform, a suitable anchor point for a rope or strop should be found above the level of the basket and attached. The anchor point should be fully tested before transferring from the basket.

After the rope/strop has been attached, a suitable landing area within the tree should be identified for exit from the platform.

Carefully exit the platform onto the preferred landing area and revert to normal work positioning techniques for climbing methods and operations.

When returning to the platform, a suitable landing area for entry to the platform and anchor point for a rope or strop should be identified. The anchor point should be above the level of the platform.

Safety Zones

Where possible, safety zones must be set up to avoid instances of cut produce or dropped tools falling on anyone or thing below. It is good practice to check below and around the platform that it is clear to drop materials.

A safety zone of 9 metres diameter around the machine must be employed where practicable. Where it is impossible to set up zones of this size, such as street workings, the relevant authorities must be approached for guidance.

Platform Management

The platform should remain clear of any obstructions that may cause a trip or fall. Therefore no tools or cut produce should be left on the floor of the platform.

OPERATION IN CONJUNCTION WITH OTHER EQUIPMENT

When a MEWP is to be operated in conjunction with other equipment, the work must be properly planned and a safe system of work developed, which must be clearly understood by all persons participating.

Each must know how to deal with any foreseeable emergencies.

Arrangements have to be made for operators to be able to communicate clearly with each other.

MOVEMENT BY ROAD

Before travelling on the road with a MEWP, make sure that the operator knows the clearance height and width of the machine, which should be marked in the cab. If the MEWP is being transported by lorry, the height and widths including the transporter should also be checked before setting off.

If the MEWP is equipped with outriggers or extending axles, check that these are fully retracted and locked in place. Where appropriate check that the slewing lock is in place.

Adequate ramps for loading and unloading the MEWP should be used and correctly positioned.

When negotiating ramps with a self propelled machine with a boom, the manufacturer's instructions should be followed.

The transporter driver is responsible for the security of the MEWP on vehicle, also ensuring that no damage can occur to the MEWP when it has been secured.

ROUTINE INSPECTION

The purpose of inspecting MEWPs is to ensure that it is safe, complete, that it works properly and that it is clean. You must inspect the entire machine, that is, the power source, all working parts, the structure and the vehicle mounting where applicable. A daily visual check and a written weekly check should be carried out. MEWPs also require a thorough 6 monthly inspection.

A checklist has been drawn up to aid you with this inspection.

MEWP Checklist

Part 1 Preparation	Yes/No	Comments
Risk assessment		
First aid kit		
Manufacturers handbook		
MEWP maintenance/inspection book		
Certification cards		
Wheel nuts		
Tyre condition		
Hydraulic fluid		
Battery fluid		
Diesel fuel		
Coolant		
General roadworthiness		
Warning signs/tape/barrier		
SWL clearly marked		
Cage/platform condition		
Steps condition/exit and entry		
Gate/safety bar condition		
Guard condition		
Pivot pins/retaining pins/circlips		
Hose security/condition		
Cable security/condition		
Hazard light/beacon operating		
All key positions function		
Emergency stop function		
Other functions		
Elevated ram condition check		
Elevated hoses/cable check		
Elevated limit switches check		
Elevated guards/tilt switch check		
Emergency lowering test		
Out of level alarms		
Ground conditions level/firm check		
Normal max wind speed 28 mph check		
MEWP positioning		
Spreader plates/chocking		

Part 2 Operation	Yes/No	Comments
Stabilisers position		
Overhead obstructions		
Safety zones		
Operator position and use of platform		
Effective communication		
Adherence to SWL		
Avoidance of obstructions		
Avoidance of damage		
No debris on platform		
Use of platform to lower		
Observe all round & allows clearance		
Platform lowered slowly/safely		
Platform stowed locked in travel position		
Hi visibility clothing worn		

Part 3 Completion of Work	Yes/No	Comments
Debris removed		
Stabilisers retracted and stowed		
Warning lights off		
MEWP road worthiness check		
Site left tidy		
Machine parked on firm level ground		

If you discover any defects they should be reported immediately to your supervisor or the relevant persons e.g. hire company.

Do not attempt to repair or adjust anything that you are not authorised to carry out.

When carrying out the inspection, do not work under a raised boom or platform unless movement has been prevented by means of blocks or special locking devices fitted for the purpose.

WIND

MEWPs that work outside are designed to operate in wind speeds up to a maximum which should be marked on the machine. Operation in wind speeds above this maximum may cause instability.

The generally accepted design wind speed, and also the maximum in which an operator can work comfortably is 28 mph.

Wind speed can be measured from the platform with a hand held anemometer but it is more usual to estimate using the Beaufort scale (Table 6)

It is very important to realise that wind speed increases with height and may be 50% greater at a height of 20 metres above the ground.

The wind chill factor also plays an important role in using MEWPs. On a calm day, 10˚ C is cool but not unpleasant. With a wind of 20 mph the temperature experienced on the hands and face is 0˚ C and at freezing, the temperature is -15˚ C. This makes it very important to wear warm clothing even though it might feel relatively warm at ground level before starting work.

Awareness of of the shielding and funnelling effects of high buildings that may cause high wind speeds on days when the wind speed in open areas is low.

Other sources of of local high wind speed to consider are high sided vehicles on motorways.

Beaufort Scale

The Beaufort Scale of wind force (Table 6) is accepted internationally and is used when communicating weather conditions. It consists of number O– 17, each representing a certain strength or velocity of wind at 1Om (33ft) above ground level in the open.

Table 6
Beaufort Scale

Description of wind	Specifications for use on land	mph	m/s
D Calm	Calm: smoke rises vertically	0 – 1	0 – 0.2
1 Light air	Direction of wind shown by smoke	1 – 3	0.3 – 1.5
2 Light breeze	Wind felt on face; leaves rustle; ordinary vanes moved by wind	4 – 7	1.6 – 3.3
3 Gentle breeze	Leaves and small twigs inconstant motion; wind extends light flag	8 – 12	3.4 – 5.4
4 Moderate breeze	Raises dust and loose paper; small branches are moved	13 – 18	5.5 – 7.9
5 Fresh breeze	Small trees in leaf begin to sway; crested wavelets form on inland waterways	19 – 24	8.0 – 10.7
6 Strong breeze	Large branches in motion; whistling heard in telephone wires; umbrellas used with difficulty	25 – 31	10.8 – 13.8
7 Near gale	Whole trees in motion; inconvenience felt when walking against wind	32 – 38	13.9 – 17.1
8 Gale	Breaks twigs off trees; generally impedes progress	39 – 46	17.2 – 20.7
9 Strong gale	Slight structural damage occurs (chimney pots and slates removed)	47 – 54	20.8 – 24.4

Appendix 2

SELECTION AND USE OF MEWPS IN ARBORICULTURE

INTRODUCTION

The aim of this safety guide is to enable employers and managers to assess an arboricultural job and identify whether the use of a MEWP is appropriate. To enable selection of appropriate equipment and the identification of safety aspects that require the manager's particular attention the site and operational requirements require analyses.

The guide should not be considered to be a substitute for training but in support of it. If safety problems arise which require clarification the safety officer or MEWP supplier/manufacturer should be consulted.

It should be noted that use of a MEWP is generally preferable as climbing risks are reduced, the operator is less tired and can be more productive. They should therefore normally be the preferred method unless there are operational constraints preventing their use or it would be unreasonably practicable to employ one for a particular job due to the small amount of climbing involved.

IDENTIFICATION WHETHER A MEWP IS APPROPRIATE FOR THE JOB

Site Conditions

The initial site condition to consider is access to the tree or trees. The height and width available for the base machine and MEWP needs to be assessed and whether a stable working position can be maintained. These initial factors will determine the main type of MEWP required such as off road capability.

Further assessment should take in the presence of any obstacles which may inhibit the use of a MEWP and if they could be removed.

Job requirements

A MEWP is likely to be of benefit if it significantly reduces the amount of climbing required. For example if only one tree is to be climbed and there is considerable 'in tree' cutting to be done then transportation of a MEWP to that site may not be efficient. Although, if it can be planned with other work to minimise cost and there is a particular safety reason for using a MEWP, a MEWP should be considered.

The use of a MEWP is particularly useful if:

a. There are several trees to be worked on or
b. There is significant climbing within the crown which could be reduced by the use of a MEWP or
c. The time window is short (to minimise disruption to traffic) and therefore use of a MEWP will be of benefit or
d. There are concerns about the stability of the tree or the soundness of wood in the tree.

SELECTION OF APPROPRIATE MEWP

Site and tree factors

The following site and tree factors must be assessed to ensure the MEWP can work within the identified constraints. These constraints may apply to the access to the site as well as at the site itself.
The main site factors to consider are as follows:

Access height and width to the site.
The site working slope.
The obstacles present on the ground, frequency and size. Can they be removed?
The ground firmness, will it support the MEWP with or without additional support.
Is there manoeuvring space for the MEWP available.
Are obstacles present such as walls, buildings to reach over.
Are overground cables such as electricity, telephone etc present.
Are underground water supplies etc. present
Are there any road restrictions such as weight restrictions on bridges etc.

The main tree factors to consider are as follows:

The height of the tree
The form of the tree
The distance and angle to the working position in the crown

Operational criteria

In addition to the site and tree factors the MEWP must be carefully assessed to ensure it can work within the constraints of the site, tree and operational needs. The following are the main factors which can constrain the use of a particular MEWP on a specific site:

The dimensions of the base machine
The total weight of the MEWP
The manoeuvrability of base machine and MEWP
The ability to stabilise the base of the MEWP
The ground pressure exerted by the base machine and the MEWP

Terrain Limitations

If off-road working is required considerable care needs to be given to ensuring the optimum base machine is chosen. The base machine should have a minimum of 4 WD for off-road work. Depending upon the softness of the ground, either wide tyres or tracks should be considered, the tracks providing the best flotation.

While tracks provide best flotation on softer ground, they are slower which could be of significance if much off-road travel is required. If the ground is therefore firm and tracks are not necessary then a wheeled base machine would be more efficient.

Stabilisers should have sufficient surface area that they will definitely not sink into the ground. This could be particularly dangerous should sinkage occur during operations when the operator is working from the basket.

MEWPs are designed for working on surfaces that are relatively level, but can sustain a degree of rough ground such as a building site. Some designs are described as having a 4WD capability, which implies an application for off road use. Slope limits are referred to as gradeability in manufacturers' machine data. Manufacturers indicate that some MEWPs, specifically those fitted with outriggers, are capable of working on 30% to 40% slopes. However, considerations such as firmness of the ground and potential for slippage due to surface type and weather need to be taken into consideration.

Certain types of MEWP have manual or hydraulically operated outriggers. Some machines are fitted with safety devices that will not allow operation of the machine until the MEWP is on a level base. Vehicle mounted MEWPs can be fitted with stabilisers to aid stability. Suitability of stabilisers in respect of ground firmness should be assessed.

Manoeuvrability

It is important to ensure the machine chosen can work effectively within the constraints when working in areas where the space is restricted and in particular where access to the crown cannot always be achieved from a single position. Lack of manoeuvrability of the base machine and/or the boom can cause unacceptable delay.

The manoeuvrability of towed machines can be restricted by the amount of space available. Vehicle mounted MEWPs are also as manoeuvrable as conditions and access and conditions allow. Self-propelled machines are highly manoeuvrable.

Effective reach

The effective reach is described as the maximum working length of the boom. Manufacturers' data identify the working envelope in a graph form for most machines.

It is essential to ensure the working reach of the boom is sufficient for all the required work. Some operations use the MEWP for access to the crown but then work out of the basket from that position. This should be recognised at the outset, as optimum machine choice could minimise climbing needs, work and safety risks.

Full boom rotation can aid working more than one tree from one position of the base machine. This can significantly reduce manoeuvring time.

Having articulation in the boom can improve manoeuvrability of the basket in the crown, as it may be possible to lift the basket over obstructing branches. This also may save manoeuvring time.

Safe working loads

The SWL is the maximum load that the MEWP will safely carry and includes the weight of all operatives, tools and equipment that will be in the basket. Some manufactures data may refer to the SWL as platform capacity or lift capacity. All the MEWPs reviewed had SWL notices on the baskets and they ranged from 120 kg to 340 kg (265 lbs. to 750 lbs.).

Basket design

Basket rotation can improve the ability to achieve optimum working position in the crown. Therefore, if much in-crown work is required, selection of a design with maximum basket rotation is desirable.

A see-through grille for the floor of the basket is an important feature when working in trees. This ensures people can be seen below the basket; it will ensure obstacles to manoeuvring in the crown are seen; branches which could catch on the basket or on hydraulic pipes etc. can be seen.

Health and safety

When selecting a MEWP for a particular job, the individual MEWP should be evaluated for features and operational criteria as they affect health and safety, such as the provision of guarding, hydraulic locks, heights of steps, communication systems between platform and driver etc.

Routine inspections

The manager should ensure a checklist is available and completed (copy attached) to any schedule identified by the manufacturer/supplier. If any additional requirements are given by the manufacturer/supplier they can be added to the checklist provided (checklist from operator guide).

Weather

MEWPs that work outside are designed to operate in wind speeds up to a maximum that should be marked on the machine. Operation in wind speeds above this maximum may cause instability.

Wind speed can be measured from the platform with a hand held anemometer but it is more usual to estimate using the Beaufort scale.

The generally accepted design wind speed, and also the maximum in which an operator can work comfortably is 28 mph. It is very important to realise that wind speed increases with height and may be 50% greater at a height of 20 metres above the ground.

The wind chill factor also plays an important role in using MEWPs. On a calm day 10˚C is cool and not unpleasant but with a wind of 20 mph the temperature experienced on the hands and face is 0˚ C. Similarly when at freezing the wind chill can lower the temperature to -15˚ C. This makes it very important to wear warm clothing before starting work even though it might feel relatively warm at ground level.

Awareness of the shielding and funnelling effects of high buildings that may cause high wind speeds on days when the wind speed in open areas is low.

Other sources of local high wind speeds to consider when working on public highways are high sided vehicles, particularly on motorways.

Working on the Highway

When you are working in an area used by other vehicles or pedestrians, for your own and other people's safety you must make sure that the whole of your operating area is barricaded off using cones, warning signs, flashing yellow lights tape, etc.

Under no circumstances should you allow any part of the MEWP to extend or swing into a line of traffic.

If arrangements need to be made to divert traffic, using temporary barriers, cones, traffic lights and/or signs, consult the site supervisor who carries the legal responsibility for this.

It is unlawful for anyone other than a properly authorised person to direct traffic on the highway. The advice of the police should be sought.

When operations are to be carried out during the hours of darkness at a location where the public have access, barriers must be provided together with yellow flashing beacons.

If the platform is to be left at the work site overnight, permission must be obtained from the relevant authority.

Movement by road

Ensure the route has been checked and the height and width of the machine and transportation will not be a constraint or safety hazard. The transporter is responsible for the security of the MEWP during transport. However, this may be the operator and the manager should ensure he informs the transporter of any particular risks on the site e.g. underground services, electricity lines.

Travelling with the operator on an Elevated Platform

Travelling with the platform of a MEWP occupied and raised should only be undertaken when the machine is specifically designed to be used in this way.

The jolting caused by an uneven surface will be magnified considerably at the platform and may cause instability and danger to any occupants of the cage or platform. When travelling the machine, it is strongly recommended that another person guide you from ground level.

Do not travel the machine up or down a slope unless it is specifically designed to do so.

Before travelling, a check should be made to ensure that:

- The stabilisers or outriggers are not extended
- No ramps, trenches, holes or other dangerous conditions lie in the path of travel
- No overhead cables, building projections or other overhead hazards will obstruct your path
- Adequate warning has been given to persons on the ground
- Nothing has been left unsecured and liable to fall off the work platform

Risk assessments

The manager should ensure that the site works manager is clearly identified in the 'Safety Statement'.

A risk assessment should be completed for the operation and for the site. The manager should ensure that all site specific hazards have been identified by the site owner and the appropriate risk zones should be identified for both the machine and tree work operation and incorporated into the risk assessment.

The operator should always carry out a site assessment to ensure no additional, new or temporary site hazards exist. If they do, they should be assessed in the risk assessment.

All completed risk assessments should be passed on to operators, site owners and others as appropriate.

MANAGEMENT OF HEALTH AND SAFETY OF MEWPS OPERATIONS

Training and Certification

Operators of MEWPs or any other equipment provided e.g. chainsaws must be fully trained and preferably have the correct certification for all equipment and the relevant operations e.g. climbing, MEWPs and tree surgery work. Such operations are often in public areas and it can be particularly useful in such work to ensure proof of training (certificate) is available on site.

There is often also a requirement for 'banksmen' to ensure site safety and/or traffic control during operations. Adequate training in procedures and instructions in requirements specific to each site must be given and evidence or records of such instructions should also be kept.

Safety features and operating procedures specific to the equipment used

Each MEWP may have varying safety features or methods and systems of operation. Managers who are likely to be responsible for providing or hiring the equipment should ensure that all safety features are present and in working order. This should be checked against the maintenance specification which should be provided by the supplier or manufacturer.

The manager should ensure that all necessary safety equipment required for the work (in addition to the MEWP) is provided in good condition and used correctly.

Operator familiarisation

The manager should ensure that the operator is fully familiar with the particular safety features and operating requirements of the specific machine. Where necessary additional instruction may need to be provided by the supplier. A record of this additional instruction should be kept.

MEWPS work can often be undertaken where there can be risks to public and others at the site. Procedures to control these risks need to be fully identified for each individual operation such as considering the need for signage, banksmen etc. Such controls, depending upon the location of the site may be complex.

The manager must ensure that all site operators have received and understood the risk assessment, the control measures required, areas of designated responsibilities and any site problems or constraints.

Liaison

There could be a need to liaise with other authorities e.g. police, local authority (roads or other departments), the supply companies (electricity, telephone, gas etc) to obtain permission to identify specifc requirements. These requirements would include control measures, agree scheduling of work and to obtain co-operation with regard to other work required (switching off power etc). Such notifications and any agreements should be recorded.

Overhead high voltage lines

Working from or moving a MEWP in the vicinity of overhead high voltage lines can be extremely dangerous, and essential precautions must be taken. Guidance from the Health and Safety Executive, GS6, and power companies should be sought. There may also be special rules established for particular sites.

Where MEWPs have to pass under overhead electric lines, ground level barriers should be positioned and 'goal posts' erected at the place where your machine may pass under the overhead lines.

If there is no need to pass under the overhead lines, both ground level barriers and high level markers (usually bunting), will be placed to keep you at a safe distance.

The operator must always be aware of the dangers of overhead electric lines.

A minimum safe distance must always be kept between the overhead lines and the closest point of the MEWP, with the boom fully extended. This distance is 15 m with overhead lines mounted on steel towers and 9 m with lines mounted on poles of wood, concrete or steel. These distances are measured horizontally at ground level from a position vertically below the outermost conductor at the tower or pole position.

Warnings

- If you are required to work inside these limits, you should seek further advice from the local electricity supply company before commencing work
- All overhead lines and other electrical apparatus should be treated as live unless declared 'dead' and 'safe' by the electrical company (or other line operator)
- Strong winds may cause overhead lines to sway and thus reduce the distance to a point where you are in danger
- The recommended minimum safe working distance must be rechecked and confirmed if the platform is moved from its original location
- You must observe barriers and markers where these are erected to mark safe working distances

- When moving the machine under or near overhead electric lines, always be guided by an experienced signaller
- Do not raise any part of the machine when travelling under overhead lines or between two sets of goal posts
- If in any doubt seek further advice

Emergency Drill on contact with a live electric line

If the MEWP makes contact with a live electric line, observe the following precautions in order to minimise the risk of electrocution.

- Remain on the platform or in the basket
- Warn all other personnel to keep away from the machine and not to touch any part of it
- Try unaided, and without anyone approaching the machine, to move the machine until it is clear of the power line and/or lower the platform to the ground
- If the machine cannot be moved away, or lowered, remain inside the basket. If possible, get someone to inform the electricity suppliers at once. Take no action until it has been confirmed that conditions are safe.
- Do not touch the machine and the ground at the same time
- Get someone to inform the site management of the situation immediately and until assistance is received, ensure that someone stands guard by the machine to warn of the danger

Devices are available that are designed to be fitted on machines to give warning when the machine comes within a predetermined distance of overhead electric lines. Such devices should not be considered as a substitute for a safe system of work.

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