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THE ASSESSMENT OF GROUND CONDITIONS AND SUPPORTING STRUCTURES FOR THE SAFE USE OF MEWPS

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CONTENTS

NOTE: 1. While every care has been taken to ensure the accuracy of the material contained within this guidance, no liability is accepted by the authors in respect of the information given. Compliance with this guidance does not give automatic assurance of compliance with legislative requirements. It is the duty holder's responsibility to ensure they comply with the legal requirements relevant to safe work equipment.

NOTE: 2. IPAF does not endorse any products relating to the safe use of MEWPs.

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1.0 INTRODUCTION

This document aims to provide clear and practical guidance on the assessment of ground conditions and supporting structures to ensure the safe use of Mobile Elevating Work Platforms (MEWPs).

It identifies different types of ground and supporting structures and provides guidance on how to assess the suitability of the ground/floor before and during MEWP operations.

The document is split into two sections. The first section is for MEWP Users (those in control of MEWP operations). The second section is for MEWP operators.

One of the key conditions for MEWP stability is the ability of the ground or structure to safely support the weight of the MEWP at its point of contact with the ground in all configurations.

Failure to consider the load-bearing capacity of the ground could potentially cause the MEWP to go out of level, become unstable, and overturn.

Modern MEWPs are lighter and more efficient compared to older equipment, for example an 80-foot mobile boom might have weighed 20 tons, 20 years ago, fast forward to today's technology and we see 80-foot booms weighing just over half that weight. MEWPs may be lighter, and are fitted with more technical safety control systems, but that does not mean they will not overturn if they are used incorrectly or set up on ground or floors that are incapable of safely supporting them.

2.0 SCOPE

This document is intended to:

- Highlight the relevant hazards and associated risks for those who plan MEWP operations on various types of ground and suspended floors
- Identify measures that can be implemented to eliminate or reduce the risk of an incident or injury before, and while operating a MEWP

3.0 TERMS AND DEFINITIONS

- **Counterweight** - an equivalent weight or force attached to the MEWP
- **Differential lock** – A device, which when activated is able to lock the axle, allowing both wheels on that axle to turn at the same speed
- **Four (4) wheel drive (4WD)** – A MEWP capable of providing torque to all its wheels simultaneously
- **Gradeability** – The maximum angle a MEWP can drive up or down a slope in the stowed position
- **Ground Bearing Pressure** - The maximum pressure exerted on the ground while the MEWP is manoeuvreing in the transport position or operating. This can be expressed in Pounds per square inch (PSI) or Newton per Square Metre (N/m2).
- **Load moment** - A measure of the force that the load is exerting on the equipment
- **Outrigger** - Device(s) at the base of the chassis that increase the stability of the equipment and that are capable of lifting and levelling the equipment
- **Overturn** – Permanent loss of stability of the MEWP, so that the MEWP has overturned or partially overturned. A MEWP partially overturned will be resting on an external structure and not have all ground points (wheels, stabilisers or outriggers) in contact with the ground
- **PFPE** - Personal Fall Protection Equipment
- **Point of contact/patch** - The Surface area/portion of which a tyre, track or outrigger/stabiliser/pad is in contact with the ground to be considered in tandem with the applied force/load (where available). This can be expressed in CM2, or sq inches
- **Point load** - A force that is applied to a concentrated point
- **Stabiliser** - Devices or systems used to stabilise a MEWP without lifting the MEWP chassis from the ground e.g., jacks, suspension locking devices, extending axles.
- **SWL** – Safe working load
- **TWC** - Temporary Works Co-ordinator

4.0 WHO SHOULD READ THIS GUIDANCE

This guidance provides specific information and references for anyone with a duty of care, or the responsibility for the completion of a task involving a MEWP.

The key stakeholders identified as having responsibilities for the safe undertaking of work using MEWPs are:

1. The person in control of the site – Personnel who are responsible for surveying the ground surface and establishing the load bearing capacity of the ground. They are also responsible for testing, improving / engineering the ground conditions (temporary works), and identifying any services, underground features, or other issues which could affect the safe operation of a MEWP. In construction this is typically referred to as the Principal Contractor (PC) or General Contractor (GC)

2. The Contractor/Employer (User) – The Contractor/employer is often referred to as the "User". This can be a person or organization that controls the planning, management and use of a MEWP for a specific task, and responsible for ensuring the MEWP is kept in a safe working condition.

   Note: The User is not necessarily the Operator.

3. The MEWP Operator – The MEWP operator is a person using the MEWP controls from the work platform or the base. They may be employed or working for themselves. They have a duty to report any dangerous acts or defects, this includes checking ground conditions prior to work commencing. Also, setting up the MEWP safely, positioning, and monitoring of the ground/floor condition during operation.

5.0 ACCIDENT DATA

The IPAF accident database allows us to filter and analyse data from the accident portal over long, mid-, and short-term periods.

Accident analysis regarding MEWPs overturning has shown us that it generally occurs from setting up, travelling, and operating on poor or unsuitable ground and floor conditions. Overturns can also occur during:

- Travelling MEWPs across unsuitable ground in the elevated and stowed positions
- The set-up stage, in particular 1b type MEWPs (includes vehicle mounted, trailer and tracked MEWPs)
- Travelling 1b (tracked) MEWPs over uneven ground with the outriggers fully retracted
- Travelling 1b (tracked) MEWPs over uneven ground with the tracks in the retracted position

6.0 GUIDANCE FOR MEWP USERS (THOSE IN CONTROL OF MEWP OPERATIONS)

Planning is critical to ensure the safe operation of a MEWP. During the planning stage, a competent person should undertake and document a risk assessment which should include the assessment of the ground conditions. Underestimating the suitability of the ground and surface to support the MEWP can lead to a MEWP overturn resulting in major injuries or death to platform occupants.

At the planning stage, a decision should be made on the ground/floors suitabilty to safely support the MEWP, this is based on site information available and the surface of the ground/floor. Generally, rock provides the most stable supporting surface. However, although rock may be present on the surface, it may not extend far below the surface.

One way to establish how far rock may extend below the surface is to examine nearby excavations or trenches on the site. Rock that extends far below the surface provides a good indication of the ground's integrity, as long as the excavation you are examining is not too far from where the MEWP is going to be used.

Care must also be taken with ground that has a crust on its surface. The surface of this type of ground is usually harder than the ground underneath. The harder surface may give the perception that the ground is more stable than it actually is. If the ground is punctured by an outrigger/stabiliser/wheels the softer ground will be exposed, which may cause the MEWP to overturn.

Be cautious when the ground is made up of fill material. Indicators that the ground contains fill include the presence of rubble (i.e. broken concrete, bricks, metal, and timber) and that the ground doesn't appear to be natural. Do not assume that because there are no obvious signs that the ground is soft that it can safely support the MEWP.

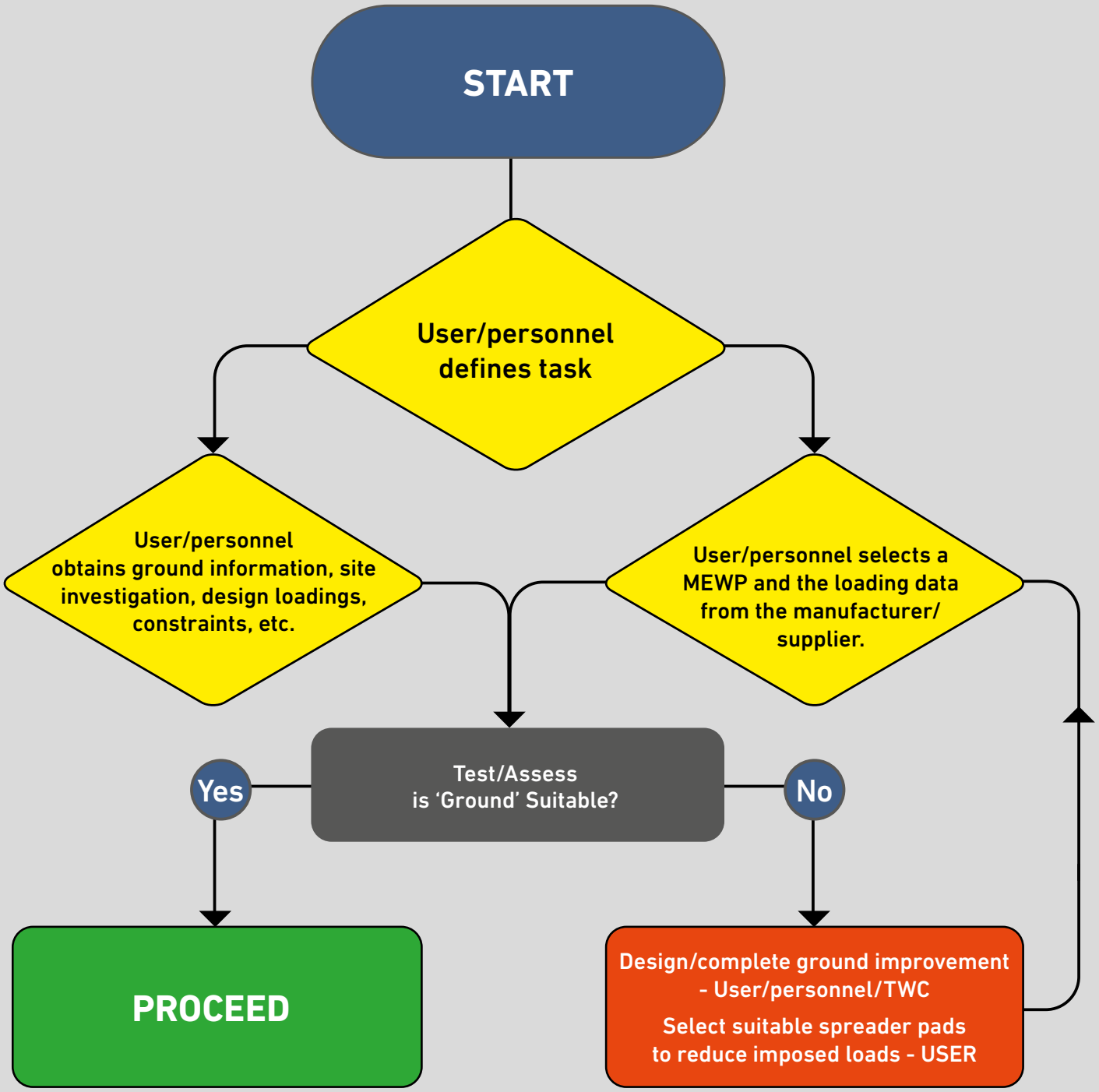
When a MEWP is continuously operated in one location the ground underneath the point of contact will compact the ground. Continued operation in one location can also cause instability. Liquid or water can be brought to the surface due to the capillary effect. The constant vibration brings the water to the surface or closer to the surface causing the ground to become unstable. A similar effect is when you pat sand on a beach and water appears on the surface.

Ground/surface hazards may not be readily apparent when assessing the suitability of the ground to travel or operate on. IPAF recommends planning and walking the intended route to identify any ground/surface hazards in the area. The presence of any ground/surface hazards may prevent the ground from being able to adequately support the MEWP during its operation, this may lead to the MEWP becoming unstable and overturning or partial overturn and ejection of the operatives from the MEWP.

MEWP manufacturers provide accurate technical data relating to the MEWP in their operator's manuals and safety decals to ensure applied loads are known. This information can be used in the assessment and selection for the most appropriate MEWP to be used for the work task.

Where there is insufficient information available about the load-bearing capacity of the ground or surface on which MEWP is to be travelled or operated on, those planning the work should, as necessary, obtain expert geotechnical and/or structural engineering advice.

The process of assessing ground conditions should follow a logical order, see example flow chart below:



Ground conditions will vary from one site to another and from one part of the site to another. Factors that affect the ability of the ground to safely support a MEWP include:

- the presence of water, including when it is mixed with the soil as mud and when it is under the surface (e.g. underground springs or streams)
- the type of ground (e.g. clay, sand, rock or a mixture of these)
- backfilled ground that was previously an excavation or trench
- cavities or penetrations in the ground that have been covered but still exist
- continued operation of the MEWP in one location
- rain, prior to and during operation including runoff that could undermine outrigger pads

6.1 SITE CATEGORIES

Sites can be split into several different categories. The following information highlights the most likely hazards that need to be considered:

Greenfield sites

No previous construction activity. Problem areas are adjacent to rivers, estuaries and flood plains where soft alluvial deposits and high groundwater tables can be expected.

Brownfield sites

Any land that has previously been built on. Unknown previous conditions, e.g., basements, poorly filled open pits, storage tanks, variable and compacted fill, poorly compacted ground.

Beaches

Low sand density and/or high/variable water table create difficult conditions.

Made ground

An area of land that has been man-made, generally through the reclamation of marshes, lakes, or shorelines. An artificial fill is used, consisting of natural materials, refuse, etc.

Engineered ground

A man-made substrate mixing soil with crushed stone, sands, etc. to increase permeability and withstand compaction whilst retaining porosity. Typically used where there is a need to increase infiltration.

Urban areas

These can look deceptively strong but may have been laid on weak ground and were not designed for heavy MEWPs.

- If a road is extensively used by heavy commercial vehicles and shows no sign of distress, then it will be less of a concern than a lightly trafficked car park or estate road
- Footpaths always demand further investigation as there may be weaker material or shallow services underneath thin surfacing
- Edges of paved areas are usually weak

6.2 GROUND HAZARDS

Many floors, cellars and basements are incapable of supporting the weight of a MEWP and could collapse without warning. The strength of floors and location of cellars and basements should be considered prior to travelling, positioning and setting up MEWPs.

Voids under existing foundations - The ground under existing structures may have subsided, leaving a void with a significantly reduced load-bearing capacity.

Footpaths and paved areas - These can look deceptively strong but might have been laid over unsuitable load-bearing ground foundations and could have weaker material or shallow services underneath.

Underground services and drains - pipes, sewers, drains, manholes, gas, and water mains, network, fibre optic, etc. might be damaged by the point loading of a MEWP wheel, track, or outrigger.

Hidden geological features such as sinkholes, other voids, and fissures - A geotechnical assessment by an expert may be required to confirm if these features exist.

Ground can also be affected by inclement weather. Heavy or prolonged rain can alter ground conditions and result in the MEWP sinking or potentially overturning. If it is suspected that the ground supporting the MEWP is subsiding/changing, the work activity should be stopped.

Regular checks should be made on the MEWP whilst in operation to ensure the machine is still on a firm surface. If in doubt stop work and get further help and advice.

Regular checks should be carried out when frozen ground is thawing as frozen ground can appear to be much firmer than it actually is. A MEWP with an engine running can cause vibration which can create a paddling effect and may lead to an outrigger, stabiliser, wheel, or track sinking into the ground.

The correct assessment of ground strength can vary from a visual inspection of the ground surface to a full geotechnical or ground bearing pressure survey. In the case of MEWPs, a visual inspection is often adequate, as outrigger/wheel loads are relatively low compared with machines such as mobile cranes. However, it is essential that the assessment is made by a competent person with adequate knowledge, skill, and experience to know when further expert advice and assessment is required.

6.3 GROUND FAILURE

Ground failure can happen in two ways:

- Sinking
- Shear

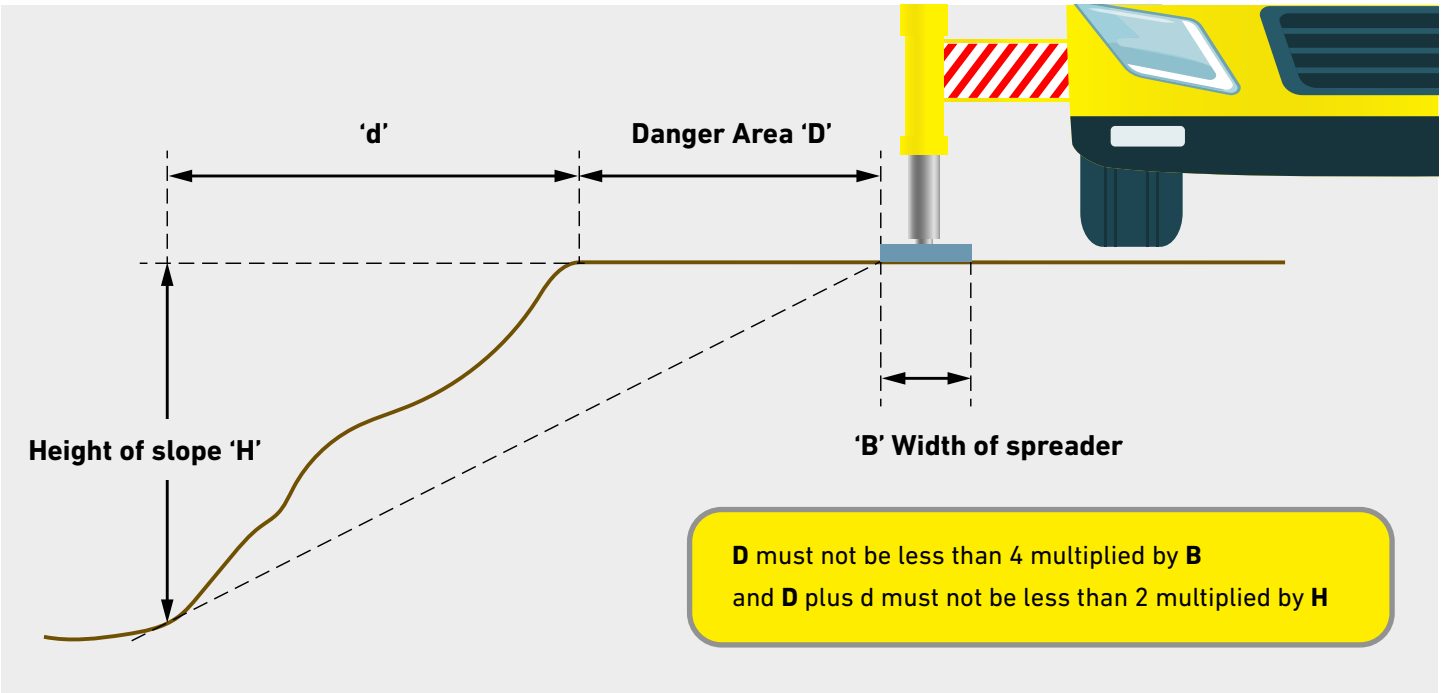
Sinking is essentially a failure of the grounds ability to support the load imposed on it. This sinking effect can be sudden or gradual. The cause can be due to soft, waterlogged ground or loose soil.

Example of ground sinking

Example of an outrigger foot without a spreader plate (ground shear).

Ground shear can happen unexpectedly, even on ground that appears stable and solid. The sub-structure beneath the surface of the ground may not be able to safely support the load being exerted on it resulting in a sudden collapse in a localised area.

MEWPs should not be positioned near to the edge of any trench or excavations as the sides have the potential to collapse without warning. If the machine needs to be used / positioned in close proximity to the edge of any slope or excavation (within Danger area 'D' – see diagram below) an engineering assessment must be made by a competent person before the MEWP is set up and operated.



6.4 TYPES OF GROUND SURVEYS

There are two main types of ground surveys, geo-technical, and a ground bearing pressure survey.

Geo-technical surveys (site investigation)

Where there is doubt about the ground's ability to support a MEWP you should consider a geo-technical survey. The purpose of a geo-technical survey is to gather the physical characteristics of the soil and rocks on a site or around a building.

Ground bearing pressure survey

A ground bearing pressure test is a geo-technical assessment used to determine the load bearing capacity of soil or ground where construction/operation is planned. The load bearing capacity is a crucial factor in ensuring that the foundation of a structure can safely support the loads it will carry without causing excessive settlement or failure.

6.5 FLOOR LOAD CAPACITY AND GROUND BEARING GROUND PRESSURE

To operate MEWPs safely it is critically important that Users and operators understand the difference between "load capacity" and "machine ground bearing pressure." See below:

Load capacity

Load capacity is made up of two essential elements, they are:

- Slab/ground strength – the ground is strong enough to withstand the pressures exerted on it
- Stability – the supporting structures e.g. columns and sub-structures

Load capacity is the weight a surface can sustain. The load capacity must exceed the maximum ground bearing pressure of the MEWP and the total weight. Information on the weight of the MEWP can be found on the data/compliance plate and in the operator's manual.

Some surfaces are engineered and constructed to only handle a certain amount of loading such as shopping centres, offices, or multi-level car parks. If this load is exceeded, there is an increased risk of compromising the structure of the floor which could lead to a MEWP overturning or shearing through the floor.

Before operating a MEWP, it must be proven that the ground or surface can support the machine's weight, or load, during work and travel.

You should identify the maximum allowable capacity of the surfaces, including floors, bridges, etc. Whenever possible, Users (those in control of MEWP operations) should consult with a structural engineer or other qualified people to know as much as possible about job site surfaces where work will be done.

Too much stress on a floor slab may start with small, seemingly harmless cracks, but over time, it can contribute to failure, leading to collapse, which ultimately can lead to overturn or partial overturn resulting in death or serious injury to platform occupants and damage to property and injury to people in the surrounding area.

IPAF recommends a professional site survey is carried out to select the most appropriate MEWP for the task.

Ground bearing pressure

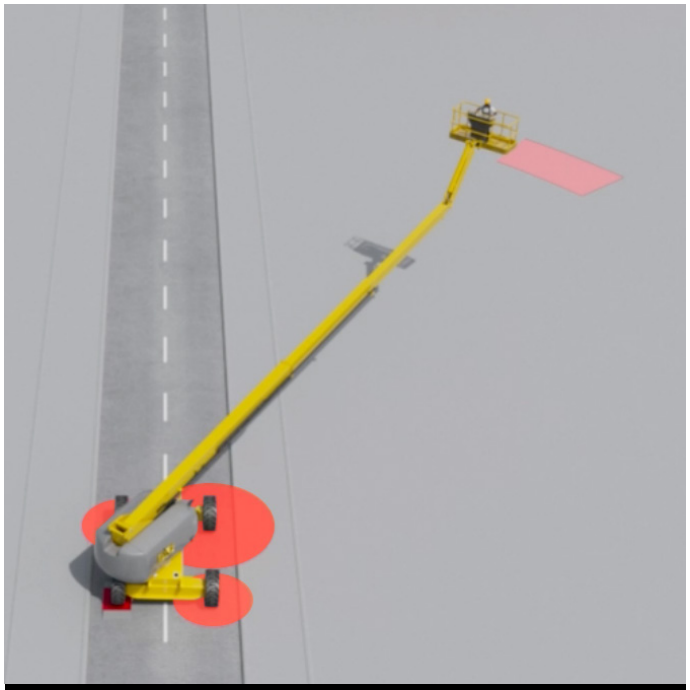
Ground bearing pressure is the amount of pressure exerted on a surface by the MEWPs tyres, tracks, and/or outriggers, this is often measured in:

- Newton Metre Square (N/m2)
- Kilopascal (kPa)
- Kilograms per square metre (kg/m^2)
- Pound per square inch (psi)
- Pounds per square foot (psf)
- Kilonewton per square metre (kN/m^2)

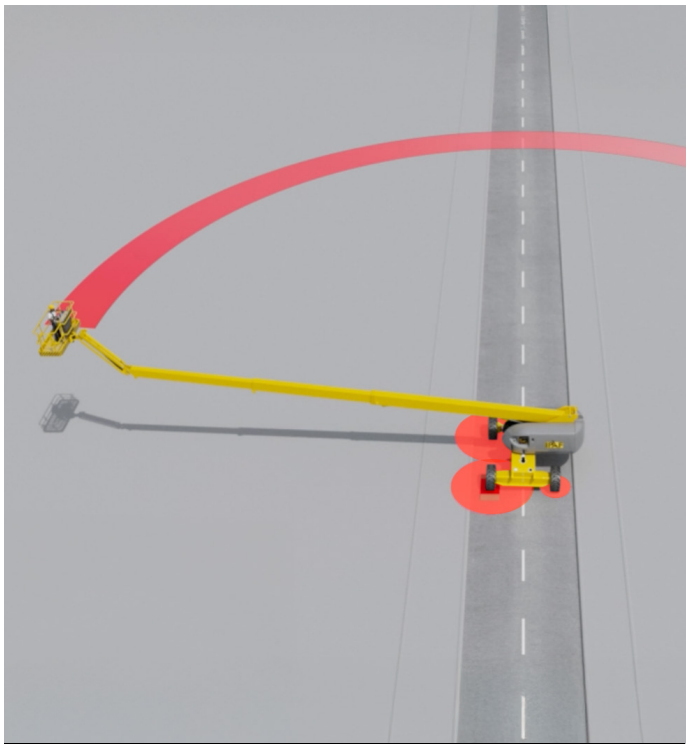
		Pascal (PA)	Kilopascal (KPA)	Pounds Per Square Inch (PSI)
Bar (BAR)	1 =	100,000	100	14.50
		Bar (BAR)	Kilopascal (KPA)	Pounds Per Square Inch (PSI)
Pascal (PA)	1 =	0.00001	0.001	0.000145
		Pascal (PA)	Bar (BAR)	Pounds Per Square Inch (PSI)
Kilopascal (KPA)	1 =	1,000	0.01	0.145
		Kilopascal (KPA)	Pascal (PA)	Bar (BAR)
Pounds Per Square Inch (PSI)	1 =	6.8948	6,895	0.0689

POINT LOAD PRESSURE

1. When the boom is near horizontal the highest load is on the tyres nearest the platform



2. As the boom rotates in the horizontal position the highest load is on the tyre nearest the platform



3. As the boom rotates in the horizontal position the highest load is on the two tyres nearest the platform

4. When retracted and elevated the highest load is on the two tyres directly under the counterweight

Information on ground pressure measurement supplied by MEWP manufacturers may vary, you should always refer to the MEWP operator manual.

The contact area and configuration of the MEWP will significantly influence ground bearing pressure. A telescopic boom fully extended in the horizontal position will increase the ground pressure on a particular point of the machine (point loading) as the boom slews/rotates.

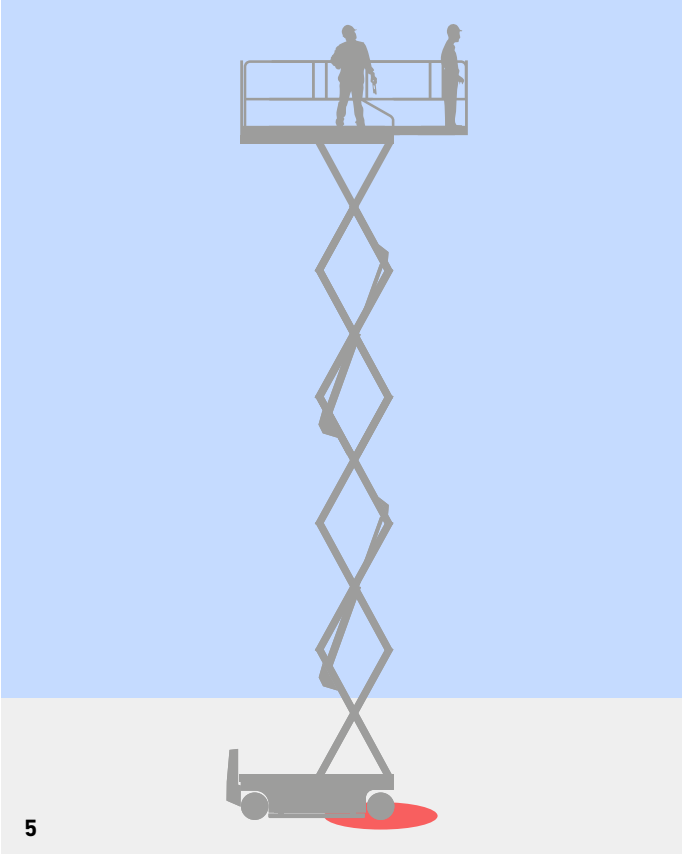
Mobile booms are fitted with counterweights to counterbalance the load in the platform. If the boom is raised up past a certain point, the point loading will be on the OPPOSITE SIDE to the platform. *See image (4) below*

ALL rotating equipment works on the same principle. THE COUNTERWEIGHT MOMENT often exceeds the LOAD MOMENT. *See image (2) below*

Force behind the machine (offside) is almost always more than what can be exerted on the working side.

Many incidents where MEWPS fitted with outriggers have overturned show the machine tipping backwards. Particular attention should be given to the load dispersion on the OFFSIDE as well as the WORKING SIDE.

It is not only booms that can create point load pressure. Mobile verticals fitted with extension decks which are in the fully extended position will create additional point load pressure directly over the wheels below it when a load is placed on them e.g. personnel, tools, and equipment on the extension deck. *See image (5) below*



5

Increasing the size of the contact area of the machine on the ground (i.e. its footprint), to its weight, will decrease the ground pressure.

Lower ground pressures are recommended for working in fragile ecosystems, such as extremely soft turf, like sand, or on extremely delicate flooring, like ceramic tiles. Decreasing the ground pressure also increases the machine's flotation, which allows it to travel better over soft terrain.

Ground bearing pressure key safety points

- MEWPs should be positioned on a firm surface within the limits of the maximum operating slope inclination before elevating the platform or driving with the platform in an elevated position
- Operators should never exceed the machine's allowable inclination or gradeability
- Never exceed the stated SWL
- The platform should not be elevated, either while the machine is stationary or being driven while working on or near a sloping, uneven, or soft ground

Ground bearing pressure is extremely important for the safe operation of a MEWP, the consequences for failing to identify poor ground can be catastrophic.

To comply with international design standards, a stabiliser or wheel should be clearly marked with the maximum ground bearing pressure information..

Note: In certain circumstances an assessment by a competent structural engineer or specialist may be necessary.

6.6 SPREADER PADS

Spreader pads are used to spread the load of an outrigger/ stabiliser on the ground and reduce the ground loading to an acceptable level, which reduces the risk of overturn.

Spreader pads should be of suitable strength and stiffness to:

a) Prevent distortion when a load is imposed upon them, and

b) Spread the load evenly across the whole area of the spreader pad

There are a wide variety of spreader pads available, made from various materials such as plywood, nylon, polyethylene or polypropylene, aluminium, and steel. These spreader pads are available in various shapes, sizes, thickness, and materials.

The decision on what type, size, material and thickness of spreader pad will be the outcome of a job specific risk assessment. The strength and stiffness of a pad will depend on the material and the thickness. Material strengths and stiffness are generally understood but it should be noted that plastics are stronger than timber (depending on thickness of both items), but timber is stiffer than plastic, the order being as follows:

Credit: Brilliant Ideas

Different types of materials used for spreader pads

STRONGEST	***Strength***					WEAKEST
	Steel	***Aluminium alloy***	***Nylon***	***Polyethylene***	***Hard wood***	***Soft wood***
	Stiffness					
	Steel	***Aluminium alloy***	***Hard wood***	***Soft wood***	***Nylon***	***Polyethylene***

Source: Ground Conditions for Construction Plant – October 2014

Spreader pads are normally sourced by the User of the equipment, the reason for this is that ground conditions vary, and it is the User's responsibility to assess, and then determine the most appropriate spreader pad (type, size, and thickness).

When spreader pads are supplied with a MEWP it is still necessary in the planning process to identify if larger spreader pads are necessary.

IPAF spreader pad calculator

The IPAF "Spreader Pad Calculator" is a simple interactive tool designed to offer guidance to operators and those involved in determining the size of spreader pads to be used when setting up a boom-type MEWP where the weight will be fully supported on the outriggers, also known as jacklegs. After the gross vehicle weight of the MEWP has been entered, the Spreader Pad Calculator will display the minimum area of the spreader plate and identify minimum sizes of spreader pads required for differing ground types and strengths. Before using the device, an assessment of the ground strength should be conducted.

6.7 GROUND PREPARATION

Inadequate ground conditions will require control measures such as:

- proprietary mats
- steel/aluminium grillages or concrete pads
- ground compaction with a suitable sub-base

Regardless of the preparation type, the ground must be made capable of withstanding the forces generated by the MEWP when driving and operating in all configurations on that surface.

Poorer ground conditions may require the advance preparation of additional equipment such as timber mats, proprietary mats, or concrete pads, before the MEWP outriggers are deployed.

If timbers are used, these must be in good condition, dry and of adequate thickness (not scaffold boards).

Sometimes it is necessary to manoeuvre the MEWP over areas where there is a fragile surface or a risk of ground movement or sinking.

The planning stage should always include a risk assessment. Part of the risk assessment will be to determine the weight of the MEWP, the point load pressure and ground bearing pressure. Information on the weight of the MEWP is on the compliance/data plate and point load pressure information is normally found in the MEWP operator manual.

Proprietary systems are available for this purpose; however, they should be of a suitable material, size and thickness.

Exclusion zones

Exclusion zones should be clearly marked to restrict access to where a MEWP is operating.

Where the ground is unsuitable for the travel and/or operation of the MEWP, the area should be restricted from access and an exclusion zone created. Barriers and signage can be used to prevent the MEWP from inadvertently travelling onto this ground.

When establishing the exclusion zone, you should consider that the MEWP operator must be able to see the barrier and marking/signage when the platform is elevated. Marking may be visible when setting up on the ground, then can be unseen and forgotten about when elevated.

6.8 DEWATERING

Dewatering is the process of removing water from the ground to another area, it is commonly used on construction sites if there is a high-water table or a presence of water.

A geotechnical survey will identify the level of the water table at the work site. If it's near the expected surface level, dewatering could be necessary.

Dewatering is a necessary step in preparing ground for certain works such as operating a MEWP. Dewatering should only be carried out by competent, authorised suppliers, otherwise it may affect the grounds ability to safely support the MEWP.

If ground dewatering does not occur it can potentially lead to:

- Soil instability leading to overturn
- Delays
- Safety hazards for other plant and equipment
- Increase in costs
- Environmental damage

Note: The choice of dewatering method depends on the specific site conditions and the nature of the soil and groundwater. Each method has its advantages and limitations, and a professional evaluation is essential to determine the most suitable approach.

6.9 MEWP RECOVERY

The safe recovery of a MEWP may need to be performed by a specialist such as a MEWP rental company or in some cases a crane/lifting company.

If a MEWP is stuck or bogged down, a risk assessment should be performed to identify the safest way to safely recover the machine without causing injury to personnel, damage to the MEWP, or the environment.

MEWPs drive systems vary in design and if a machine is towed without releasing the brakes it can cause damage to internal mechanical, hydraulic, and electronic components.

Mobile booms and mobile verticals are normally fitted with a variety of brake release systems; however, these devices should only be used as a last resort by a competent person and in accordance with the MEWP manufacturer's instructions contained in the operator's manual.

If a MEWP sinks as low as the underside of the chassis (often referred to "belly plating"). If this occurs it can be extremely difficult to recover the MEWP and may involve excavation work around the MEWP, or a large crane to lift it from the hazard.

6.10 MEWPS ON SUSPENDED FLOORS

Operating MEWPs on suspended floors should only be carried out when the surface can safely support the MEWP in all positions with the maximum allowable SWL in the platform. Specific consideration should be given to buildings which have multiple levels such as multi-level car parks or shopping centres.

There are different types of suspended floors:

- Pre-cast
- Cast in-situ concrete slab
- Structural metal deck floor

If you intend to operate a MEWP on these types of suspended floors, always request the loading limits from the person in control of the site to ensure these are adequate to support the forces exerted by the gross weight and maximum point loading of the MEWP. Where a surface has recently been laid or installed consideration should be given to the time taken for it to reach required strength for maximum load-bearing capacity.

Planning for work on a suspended floor is different to planning work on other types of ground such as construction sites and urban areas which may require the assistance of a civil engineer to assess the suitability of the ground. Suspended floors, however, may require the assistance of a structural engineer.

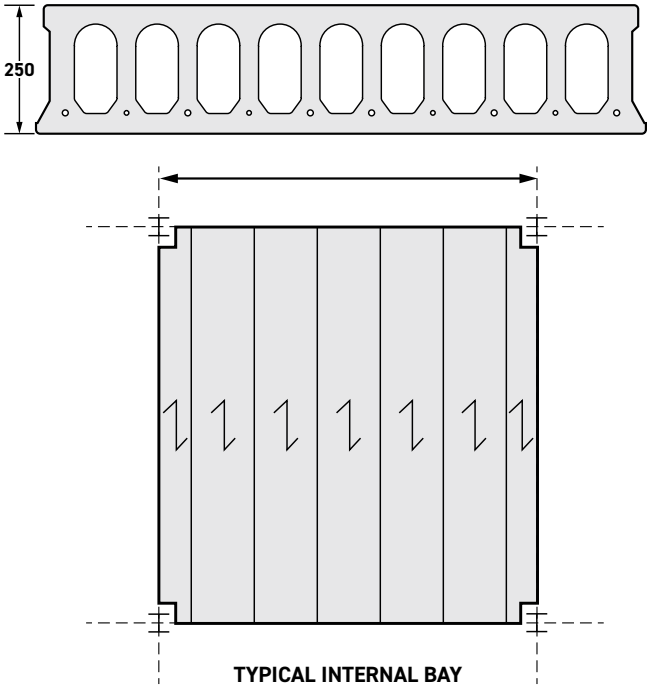
There are associated risks with any suspended floors. During construction the following risks may apply:

- There may be inadequate support to a suspended floor when it is notched around a steel column
- For a MEWP to be sufficiently supported, the suspended floor needs to be designed to accommodate load spread between the suspended floor joints
- Operating a MEWP near openings such as doorways and large entrances/exits during construction
- Where multiple machines are used in the same area
- Final load bearing capacity of a suspended floor is not complete until the design loading is verified and signed off

When a MEWP is on pre-cast concrete such as hollow core flooring, the force exerted on the floor does not dissipate in the same way as normal (external) ground.

The hollow core system is only complete when the in-situ concrete work has been carried out. This is normally done in two parts, grouting the joint and then in some cases a reinforced screed over it to complete the floor structurally. Failure to allow the screed and grouting to cure increases the risk of a structural collapse.

Where a hollow core unit notches around a steel column, there is potential for reduced load bearings. This is caused by the unit (slab) having no support where it is notched around the column. There should be a structural engineering assessment carried out. See diagram below:



Deck Riding (skid and rail mounted)

A Deck Rider is a static base access platform developed specifically to help in the steel erection industry. Deck Riding allows MEWPs to be used at an earlier stage in construction by working off the prepared steelwork prior to laying the concrete slab. Upper floor steel assembly can then continue whilst lower levels are freed for rebar work, casting and light traffic. The reliance on waiting for the slab to achieve sufficient load-bearing strength is removed, making steel erection swifter and more efficient.

A detailed risk assessment should be carried out before using any MEWP for Deck Riding in order to ensure the structure has adequate strength to support the loads imposed by the MEWP. This should include, but not be limited to ensuring placement and loading scenarios are confirmed, ensuring the MEWP is attached securely to the structure, and ensuring the correct MEWP is selected. Failure to adequately support the MEWP can result in instability which can lead to overturn.

6.11 TEMPORARY WORKS

"Temporary works" is a widely used expression in the construction industry for an "engineered solution" used to:

- support or protect an existing structure or the permanent works during construction
- support an item of plant or equipment, or the vertical sides or side-slopes of an excavation
- to provide safe access to an area

The construction of most types of permanent works will require the use of some form of temporary works. Temporary works provide a short-term solution whilst a task takes place. A more permanent solution is required after the construction phase has been completed. The risk of operating a MEWP on temporary works such as load bearing mats is not without risk and this needs to be monitored to ensure the temporary works are capable of safely supporting the MEWP.

Examples of temporary works include:

- Load bearing mats
- Exclusion zones, barriers, and guardrails
- Edge protection
- Access roads and ramps

The advantages of temporary works:

- Regulatory compliance
- Reducing the risk of incidents occurring to MEWP operators by providing a stable base on which the MEWP can safely work on
- Prevents damage to site infrastructure such as roads or utilities

6.12 THE SAFE USE OF EMERGENCY STOP SWITCHES

On some MEWPs, activating the emergency stop switch at the platform controls can disable audible and visual warnings to the MEWP operator such as overload sensing and chassis inclination.

If these warnings are not functioning due to the emergency stop being activated, it could mean that an operator would be oblivious to a developing issue e.g., the MEWP sinking into soft ground.

It is the user's responsibility to ensure the correct MEWP has been selected for the task, and that a suitable and sufficient risk assessment has been carried out and documented.

7.0 GUIDANCE FOR MEWP OPERATORS

Operators should always perform a pre-use inspection before using a MEWP. Failure to carry out a pre-use inspection can potentially increase the risk of incidents occurring.

The employer/User is responsible for ensuring the ground is safe for the operator to work on, however the operator should always check the condition of the ground on which the MEWP will be working on.

If travelling from one area to another an operator should walk the route to identify any hazards. Where there is any doubt about the ground or surfaces capability to safely support the MEWP in all configurations the MEWP should not be used.

7.1 TRAVELLING A MEWP ON UNEVEN GROUND

Rough terrain MEWPs are capable of driving on uneven ground in the stowed position up to a point, as they are designed to be able to cope with this type of terrain. However, before driving, the ground should be assessed to establish if it is safe to drive on. Inadequate ground conditions may result in the machine slipping/sliding or overturning.

MEWPs which are classed as "rough terrain" and are supplied with equipment to better cope with driving in the stowed position across uneven ground, examples include:

- 4-wheel drive (4WD) – A system capable of supplying torque to all four wheels. Some MEWPs can switch between 4WD and 2WD
- Oscillating axles – There are two types of oscillating axles. Active and Passive:
  - Active – this is an axle on the chassis of a self-propelled MEWP which moves in a controlled manner to ensure that, within the limit of oscillation, all wheels remain in contact with the ground

    NOTE: The controlled oscillation ensures that the MEWP remains stable during travel with the elevating structure raised from the transport position.
  - Passive – this is an axle on the chassis of a self-propelled MEWP which moves freely during travel with the MEWP's elevating structure in a limited and defined configuration to ensure that, within the limits of oscillation, all wheels remain in contact with the ground

    NOTE: Once the MEWP elevating structure moves out of the defined configuration the axle is locked and remains at that angle of oscillation until the elevating structure returns to the defined configuration
- Differential lock – These devices are used to drive through soft ground such as sandy areas. The differential lock can lock the drive axle, allowing both wheels to turn at the same speed
- Tracked MEWPs – these MEWPs are fitted with either two tracks, or tracks on each drive motor.

Self-levelling chassis is a unique sub-system that allows a boom lift to automatically level on grades up to 10 degrees enabling operation on uneven jobsite terrain.

Differential lock decal example (credit Niftylift)

Credit Genie Lift

Credit Almac SPA

Credit Almac SPA

7.2 TRAVELLING A MEWP IN THE ELEVATED POSITION

Mobile vertical and mobile boom MEWPs are capable of driving elevated; however, this should only be performed on a firm level surface. Once the elevating structure of a MEWP raises out of the stowed position the drive speed will automatically reduce, this is known as "elevated drive speed" which is a much slower speed.

RISKS:

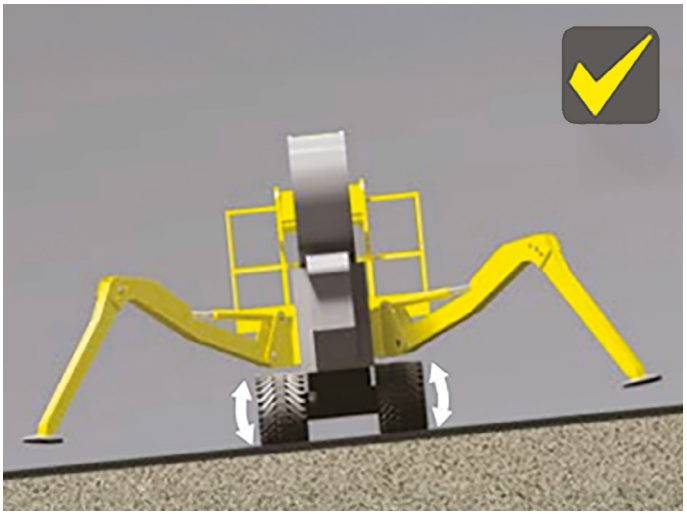
- If a MEWP is driven elevated over uneven ground, there is an increased risk of overturn
- If a mobile boom driven over uneven ground in the stowed or elevated position, there is a risk of the catapult effect if the platform occupants are not wearing PFPE
- Travelling elevated over uneven ground increases the risk of impact with overhead structures and operator entrapment

7.3 TRAVELLING A 1B (TRACKED) MEWP OVER UNEVEN GROUND

1b (tracked) MEWPs are supplied with detachable platform control boxes which means the operator can travel/track the MEWP by standing alongside it at a safe distance away from any crushing hazards, this is referred to as "pedestrian control". Platform control boxes may also have umbilical cords or radio control remote systems.

On uneven ground, these types of MEWPs should be travelled/tracked with outriggers partially deployed so if the MEWP becomes unstable while being driven it reduces the risk of overturn.

Operators should keep the tracks in extended position while tracking. Some spider lifts are also equipped with tracks that are able to level independently, these can be used to level the MEWP while tracking across a slope.



7.4 TRAVELLING A MEWP ON A SLOPE IN THE STOWED POSITION

Some rough terrain MEWPs are capable of driving on slopes; however, the manufacturer will set the maximum allowable inclination and slope rating. This information can be found in the MEWP's operator manual. *See example right*

Chassis inclination is measured by the MEWP's tilt sensor. This device measures inclination through the X and Y axis (chassis length and width). If the maximum allowable inclination is reached a warning device such as an audible alarm or light will alert the operator to the situation. On some MEWPs if the alarm is activated it can automatically prevent the MEWP from driving as well as sound an alarm or activate a warning light.

The maximum allowable slope ratings may be different for driving up or down slopes, variations may include:

- 2WD or 4WD drive MEWPs
- Driving with the platform in the forward or rear position
- Traversing a slope

Note: slope rating is subject to ground conditions and adequate traction. If the ground is poor, you should not attempt to drive up/down or drive across a slope.

Measuring the angle of a slope

There are various methods to determine the angle of the slope to be driven on, some examples are shown below:

- A digital inclinometer which will automatically calculate the slope angle in degrees
- Various smartphone apps
- Manually measuring the slope. This method involves finding the rise and run of the slope. You will need:
  - a carpenter's level
  - a straight piece of wood at least 3 feet / 1 meter long
  - a tape measure

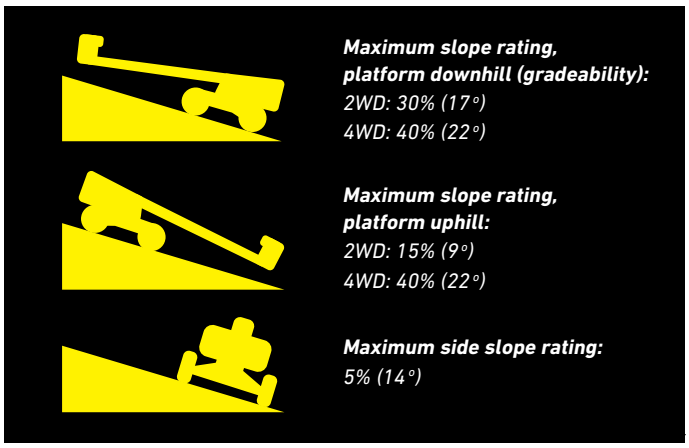
Lay the piece of wood on the slope. At the downhill end, lay the level on the top edge of the piece of wood and lift the end until the piece of wood is level. While holding the piece of wood level, measure the vertical distance from the bottom of the piece of wood to the ground. Divide the tape measure distance (rise) by the length of the piece of wood (run) and multiply by 100.

Example:

Piece of wood / Run = 365cm | Rise = 30cm
30cm ÷ 365cm = 0.083 x 100 = 8.2% grade

Gradeability

Gradeability is the maximum angle a MEWP can drive up or down a slope in the stowed/transport position. Information on the MEWP's gradeability can be found in the MEWP operator manual.



Credit Genie Lift

The example picture above is from a MEWP manufacturer operator's manual:

7.5 POSITIONING A MEWP ON A SLOPE

Some MEWPs are capable of being set up for elevation on a slope, this is because the outriggers/stabilisers are capable of levelling the chassis by using variable outrigger positioning. It is recommended that the outrigger feet and pads are horizontal and on a firm surface before elevating, this may involve cribbing or excavation of a slope to level the ground, see example picture below:

Great care must be taken when setting this type of MEWP up on a slope. This is specialist equipment which requires planning and correct machine selection.

7.6 TRAVELLING AND WORK CONFIGURATION LOADS

Travel and work configuration loads are not the same. Travelling loads are when a MEWP travels from one position to another e.g. a MEWP driving from point A to point B on a site.

Working loads are much higher in comparison as there is more pressure exerted on the ground which can be caused by excessive wind or point load pressure, e.g. a telescopic boom slewed over a wheel. Just because you can drive across an area does not mean it can safely support the MEWP whilst it is in operation.

Prior to travelling from one point to another, an assessment should also be made of the route that the MEWP will travel around the site.

Note: ground conditions can and will vary from location to location even on the same site. Additionally, the area around the MEWP should also be capable of withstanding the loads the MEWP is generating on the ground as the pressure spreads down and outwards in a fan shape below the ground.

The load-bearing capacity of the ground should be considered for static MEWPs (1a & 1b) which require setting up on stabilisers or outriggers and for self-propelled MEWPs e.g. mobile vertical (3a) and mobile booms (3b).

Load distribution will differ by MEWP type. A tracked MEWP distributes the load more evenly compared to a mobile boom or mobile vertical, this is because the tracks are longer.

Credit: Hijsen Australia

7.7 OPERATING A MEWP ON SPREADER PADS

IPAF recommends that spreader pads should be used with all MEWPs that have outriggers/stabilisers unless a risk assessment indicates they are not necessary.

MEWPs can be fitted with various types of outrigger designs such as A, H, and X frame, which are commonly used on vehicle mounted platforms and variable position outriggers which are fitted to spider type MEWPs and 1b (vehicles). Regardless of the design these outriggers should always be used in accordance with the MEWP manufacturer's instructions found in the operator's manual.

The area of the foot attached to the outrigger/stabiliser of a MEWP is relatively small and consequently generates high pressures on the ground. Most soils, unmade ground and some paved or tarmac covered areas are not capable of supporting these pressures and some form of foundation or spreader pad is often required to reduce the pressure to an acceptable level. It is therefore strongly recommended that suitable spreader pads should always be used under the outrigger feet irrespective of the apparent ground conditions.

When a stabiliser/outrigger is used it should be positioned in the centre of the spreader pad, this is sometimes referred to as "spotted." The operator and nominated ground rescue person/supervisor should periodically check the position of the outrigger/stabiliser foot on the spreader pad to ensure it is still in the centre of the pad (spotted), whilst the MEWP is being operated.

During operation, the base of a MEWP can move slightly, this can be caused by vibration and boom movement. If the foot of the outrigger/stabiliser has moved off the centre of the pad the operator should cease work and reposition the foot. If a foot moves off the spreader pad it can create a sudden whiplash effect if using a boom type MEWP.

The nominated ground rescue person/supervisor should also monitor the condition of the ground beneath and around the spreader pad when the MEWP is operating. Vibration can cause the pad to sink if the ground is wet or defrosting.

Download the IPAF Spreader Pad Leaflet & Poster DOWNLOAD

8.0 REFERENCE MATERIAL

- Credit Queensland Government “Safe support of Mobile Plant Guide” contextualised to suit in Section 6

9.0 IPAF RESOURCES

- Wind rating: Using MEWPs in wind
- MEWP catapult effect

TOOLBOX TALKS

- Consequences of overloading the platform
- Never attach a banner to a MEWP
- MEWP ground conditions

ANDY ACCESS

- Use spreader pads
- Unsafe ground

ANDY ACCESS SHORTS

- Andy Access – Overturn
- Unsafe ground

TRAINING COURSES

- IPAF Site Assessment (for MEWP selection)
- IPAF MEWPs for Manager

HOW TO REPORT

www.ipafaccidentreporting.org

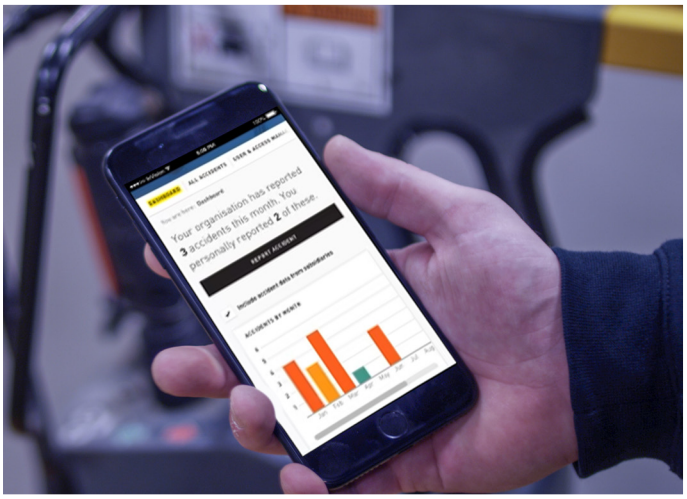
IPAF and its members analyse anonymised data on incidents involving powered access to identify areas of risk and common trends, which informs guidance, training and safety campaigns. We aim to increase our understanding of working practices and reduce incidents in every country. Reporting is not restricted to IPAF members; any person or organisation can report an incident. In 2021, IPAF launched ePAL, a mobile app for operators and supervisors, which enables quick on-the-spot reporting direct to the IPAF portal of all incidents – including near misses.

How to report

All accidents, incidents and near-misses can be reported quickly and easily at **www.ipafaccidentreporting.org** via desktop or laptop PCs, most web-enabled mobile devices, or through the IPAF ePAL app (**www.ipaf.org/ePAL**) for operators and supervisors. Please register first to report accidents on the database. Reports can also be made anonymously via the portal. Companies wishing to have multiple persons reporting accidents should appoint a nominated person (a senior person who will manage reporting). This nominated person should register first in the company name. Once registered, the nominated person will be able to give others access to report accidents and be able to track their accidents and manage their incident records. Information entered into the database will be kept confidential and will be used strictly for the purposes of analysis and improving safety.

What is reported

All reported incidents involving powered access are collated by IPAF. This includes incidents that result in death, injury or a person requiring first aid. It also includes near-miss incidents that didn't result in injury or damage to machines or structures, yet still represented a potentially dangerous situation for machine occupants or bystanders.



The machines

The report analyses incidents that occurred when using, delivering and maintaining Mobile Elevating Work Platforms (MEWPs). IPAF also collates incidents involving other machinery including Mast Climbing Work Platforms (MCWPs), all types of construction hoists and telehandlers.

Who can report?

Anyone involved in working at height can report an incident to the IPAF portal. The data presented in this report is based on information collected either directly reported via the IPAF portal; obtained by IPAF staff worldwide; using data from regulatory bodies; and through information collated from media reports. IPAF now offers a special customisable dashboard for all members reporting, which enables them to benchmark their company's performance against regional, national and global data.

Confidentiality of data

The information provided to IPAF is confidential and private. Information that can identify a person or company involved in a reported incident is removed prior to analysis by IPAF and its committees, and thereafter remains redacted. IPAF has a privacy policy that can help you understand what information we collect, why we collect it, and how you can update, manage, export and delete your information. The full IPAF privacy policy can be found at **www.ipaf.org/privacy**

ABOUT IPAF

The International Powered Access Federation (IPAF) promotes the safe and effective use of powered access equipment worldwide in the widest sense – through providing technical advice and information; through influencing and interpreting legislation and standards; and through safety initiatives and its training program.

IPAF is a not-for-profit organisation owned by its members, which include manufacturers, rental companies, distributors, contractors, and users. IPAF has members in more than 80 countries, who represent the majority of the MEWP rental fleet and manufacturers worldwide. Visit **www.ipaf.org** for local office information.

Contact IPAF

Moss End Business Village
Crooklands
Cumbria LA7 7NU
United Kingdom

Tel: +44 (0)15395 66700
info@ipaf.org
www.ipaf.org

Become an IPAF member

By joining IPAF you are joining a global movement to ensure a safer and more productive powered access industry. Membership also brings a host of special services and benefits including access to the members' safety analysis dashboard. IPAF brings multiple benefits including the following:

- Global harmonisation with regional focus on standards development;
- Resources for technical experts;
- A wide range of products and technical guidance to assist MEWP users, supervisors and user meet their responsibilities;
- Opportunities to network and promote your company;
- A consensus voice for all industry stakeholders, large and small;
- Certified training program to ensure complete, consistent and compliant training.

For more information about becoming a member of IPAF visit www.ipaf.org/join

IPAF would like to thank the members of the working group below who helped in the development of this document:

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IPAF Safety & Technical Department

In conjunction with

This guidance document was developed in conjunction with the IPAF International Safety Committee.

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Promote and enable the safe, effective use of powered access worldwide

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