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User Guide for Plant Operators Using Fibre Reinforced Packing

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	06-12-2017	Andrew Danks	Original
1	10-10-2018	Andrew Danks	Change to correct table 1 and revise wording based on client feedback
2	22-07-2019	Iain Mitchelhill	Add MEWP 615x615x16mm, & other long/ stack pad options. Correct typing errors.
3	04-09-2019	Iain Mitchelhill	Revised load rating approach to use maximum load as per Doc No 601015-01 and reduce dunnage thicknesses to reduce weight.

Reference Documents:

No	Document Number	Title
1	-	QLD WH&S "Mobile Crane Code of Practice 2006"
2	AS2550.5	Cranes, Hoists, Winches – Safe use "Mobile Cranes"
3	AS2550.10	Cranes, Hoists, Winches – Safe use "Mobile Elevated Work Platforms"
4	AS2550.11	Cranes, Hoists, Winches – Safe use "Vehicle Loading Cranes"

1 Purpose and Scope

The purpose of this guide is to aid plant operators to adhere to Mobile Crane Code of Practice requirements when using RGA packing while operating Mobile Elevated Work Platforms (MEWP), Crane borers and Vehicle Loading Cranes (VLC).

Plant operators are responsible for understanding all the risks and ensuring their individual actions do not endanger the health and safety of themselves or others.

1.1 Definitions, Abbreviations and Acronyms

The definitions, abbreviations and acronyms use are as follows;

Table 1 - Definitions, Abbreviations and Acronyms

Term	Definition
Mobile Plant	Mobile Elevated Work Platforms, Lifter Borers, Vehicle Loading Cranes
Packing	Commonly referred to as pads, dunnage or hardwood timbers
RGA	Redmond Gary Australia
MEWP	Mobile Elevated Work Platforms

CoP	Code of Practice
VLC	Vehicle Loading Cranes
FRP	Fibre Reinforced Plastic
Max Loading	loading which the dunnage can sustain but should not occur during operation or testing of MEWPs
WH&S	Work Health and Safety

2 Approved Packing

Redmond Gary Australia (RGA) recommends that plant operators use only approved packing materials. RGA can supply Fibre Reinforced Plastic (FRP) packing, Certified Plastic and hardwood timbers in sizes and thicknesses suitable for most applications. RGA can engineer a custom solution if required.

3 Plant Pre-Operational Checks

Plant operators need to be aware of and perform the daily checks applicable to their plant.

It is recommended at each site after setting up the plant that it be operated through its full extent of movement with no load to ensure:

a) No slipping or sinking of packing
b) No movement of stabiliser / outrigger foot pad on packing.

It is recommended that the operator understand the effect of the maximum service wind speeds on the operation of their equipment as wind imposes extra loads and the effect the stability.

Ground conditions can vary dramatically even on a single worksite. Failure to address poor ground conditions to ensure stability may result in the Mobile Plant overturning. The operator must ensure that the ground conditions for the mobile plant are sufficient to enable the plant to operate to its operating limits. Should the operator have concerns regarding safe set up due to soft or sloping ground it is recommended that they seek specialist assistance to identify other suitable arrangements to enable safe operation of plant.

Stabiliser foot is to be located central to the pad and not near the edges. If it is an undulating surface then the effective area of the pad is reduced, hollow should be filled under packing and additional allowance made for a reduced effective area.

The plant should be level as close as practical to level and to within manufacturer's tolerances. During this process the operator needs to verify no stabiliser foot creep or sinking.

4 Soft Ground

It is recommended that the operator be trained in the physically inspect of ground conditions and how to treat soft ground, as covered in the Mobile Crane CoP 2006.

Mobile Plant should not be setup on soft or waterlogged surfaces unless appropriate measures are taken to ensure Mobile Plant stability and prevent overturning. Where physical inspection has

determined the ground to be soft appropriate pads are required, like the RGA square pads discussed later.

If this does not provide adequate support for the mobile plant then long pads or mats should also be used. The long pads used could be hardwood timbers, RGA Long/Stack Pads or RGA FRP Pads. Nominally hardwood timber or RGA long/Stack Pads used are 1000 mm x 250 mm and are placed under the stabilisers as required.

It is important to monitor the long pads throughout the Mobile Plant's operation to ensure they have not sunk into the ground. If they have, then additional means of support is required e.g. RGA mats, RGA FRP mats, timber sleepers or similar aids to distribute the operational load of the plant. RGA has a wide range of options available. Where long pads are used, it is acceptable to use additional layers of timber or pads at 90° to ensure maximum bearing capability. This is commonly called stack or pigsty timbers. Each additional layer is positioned at 90° to the layer below and it is important to ensure gaps between the long pads are negligible as this reduces the effectiveness of the stack. A suitable square pad is required at the top of the stack to ensure the load is distributed across the stack.

RGA Long/Stack Pads have rope handles provided to make it easier to break the seal between the packing and the ground. A crowbar or shovel can also be used.

The maximum permissible ground pressure is cover later in this guide.

5 Excavation, Embankments, Undulating Surface, Ground Cavities or Underground Services

When the Mobile Plant is set up close to excavations or trenches there is an increased risk of the excavation or trench wall collapsing. Suitable guidance should be sought when operating in these conditions and is not covered in this guide.

Site inspection should identify undulating surfaces, ground cavities, underground services, ducts etc. prior to setting up. When the mobile plant support point requires packing over undulating surfaces (depressions in the ground/ formed road surfaces such as kerb), where practical, the Mobile Plant should be relocated to an area clear of the undulating surface.

If relocation is impractical then suitable authorised spanning materials should be used. This may be authorised hardwood timber or authorised pad. RGA FRP pads should be considered in this role.

When spanning across (straddle) undulating surfaces it is recommended that the underside of the spaning material be fully supported by packing between the material and the ground surface. Sleepers (1000 mm x 250 mm x 80 mm) are often used in this roll, however RGA FRP is a more compact alternative.

5.1 Sloping Ground (Grades)

When operating plant on sloping ground, ascertain location and direction the plant will be facing when setup for operation on slopes and never exceed the manufacturer's instructions.

The mobile plant should have inclinometers to indicate out-of-range operation and their slope rating should also be identified.

Figure 1 - Inclinometer depicting an out of operating range slope

6 Maximum Permissible Ground Pressured

Ground Type Maximum	Permissible Ground Pressure P_{MAX} (Tonnes per M^2)
Hard rock	200
Shale rock and sandstone	80
Compacted gravel (with up to 20% sand)	40
Asphalt	20
Compacted sand	20
Stiff clay (dry)	20
Soft clay (dry)	10
Loose sand	10
Wet clay	Less than 10

Table 2- Maximum permissible ground pressure for various ground conditions
As per Mobile Crane Code of Practice 2006 WH&S Qld

The Mobile Crane Code of Practice 2006 WH&S Qld highlights that the greatest force applied by any outrigger to the ground will be:

a) at the point of tipping, just as the crane is about to overturn; or

b) when the crane boom is located directly above an outrigger foot

and provided the operator does not overload the crane, a reasonable approximation for maximum ground pressure applied by the outriggers is detailed by the following.

Pressure (tonnes per m^2) applied by outrigger feet

Pout = 0.65 x (total crane mass + lifted load)/(individual outrigger area)

Pout = 0.65 x (C_M + L)/area

7 Use of RGA Pads to achieve Permissible Ground Pressured

When used in accordance to the Mobile Crane CoP 2006 WH&S Qld guidelines covered above, approved packing produces a permissible ground pressure.

RG FRP come in various sizes including:

1. For Mobile Elevated Work Platform >12.5 metre
    a. 550mm x 550mm x 15mm - 14,500kg Max Loading
    b. 615mm x 615mm x 15mm - 14,500kg Max Loading
2. Crane/borers:
    a. 550mm x 550mm x 20mm - 21,500kg Max Loading
    b. 615mm x 615mm x 20mm - 21,500kg Max Loading
3. Vehicle Loading Crane > 3 tonne/metre
    a. 550mm x 550mm x 15mm - 14,500kg Max Loading
4. Other size and shapes are available on request.

RGA FRP pads can be use as illustrated below:

Figure 2 – Single Area with 1 RGA FRP Pads

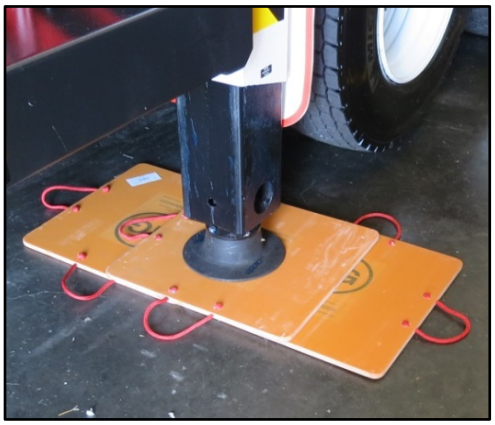

Figure 3 – Double Area, 3 RGA FRP Pads

7.1 Example Calculation for MEWP

An example of the calculations to determine the required area per stabiliser foot using the equations above for an MEWP is as follows:

The MEWP TL17M and TF17M has a tare mass = 21 Tonnes and is to lift a 0.4 Tonne load.

One piece of FRP packing is: 550mm x 550mm x 15mm = 0.30m^2.

One piece of FRP packing is: 615mm x 615mm x 20mm = 0.38m^2.

From the code the Pressure (tonnes per m^2) applied by outrigger feet equation is:

Pout = 0.65 x (total crane mass + lifted load)/ (individual outrigger area)

Therefore, Pad Area = 0.65 x (C_M + L)/ Pout

1. For the Pressure:

Pout = 0.65 x (21 + 0.4)/0.3025

Pout = 45.98 tonnes per m^2 for one FRP Pad

2. For the Required Area:

Area 2 = 0.65 x (21 tonnes + 0.4 tonnes)/80 tonnes per m2

Area 2 = 0.17m2

This has been repeated for each ground type in the table below:

Table 3 -Example MEWP Allowable Bearing Pressures using the Code

	Ground Type Maximum	Permissible Ground Pressure P_{MAX} (Tonnes per M^2)	Required Pad (M^2)	Number 550x550 Pad Areas	Number 615x615 Pad Areas
1	Hard rock	200	0.07	1	1
2	Shale rock and sandstone	80	0.17	1	1
3	Compacted gravel (with up to 20% sand)	40	0.35	2	1
4	Asphalt	20	0.7	3	2
5	Compacted sand	20	0.7	3	2
6	Stiff clay (dry)	20	0.7	3	2
7	Soft clay (dry)	10	1.4	Mat Recommended	4
8	Loose sand	10	1.4	Mat Recommended	4
9	Wet clay	Less than 10	Greater than 1.4	Mat Recommended	Mat Recommended

The minimum dunnage pad area to be placed under each outrigger foot must be greater than 0.17m^2.

Note: The table above referring to number of pad areas required. This is the footprint required. Additional pads are needed to provide suitable stacking to distribute the load.

Long/Stack Pad are good way of making up the required area.

These are typically 1000mm x 250mm x 80mm. Area is 0.25m^2. See figure below.

FRP packing 615mm x 1150mm or 500mm x 1400mm; Area 0.7 m^2 can be made on request.

Figure 4 – Stack Pads are typically 1000mm x 250mm

8 Inspection and Maintenance

8.1 Pre-Use Inspection

It is the plant operator's responsibility to ensure the packing is in a serviceable condition before use, and if in doubt to contact a suitable person should be sought for advice and/or source a suitable alternative. If packing is not serviceable it should be swopped out for Maintenance.

8.2 Maintenance

When identified as not serviceable or nominally at six monthly intervals, the following is recommended:

a) Inspect for fibre splinters and if found, sand the surface.
b) Inspect for delamination of the fibre reinforced packing. Some delamination is acceptable as long as the FRP packing continues to be in one piece and does not have any permeant deformation. If the packing remains deformed after unloading or has signs of splitting, dispose of the packing and replace it with a new one.

9 Disclaimer

This document is a user guide only. It is the operator's responsibility to determine the ground type and calculate the dunnage area required using the procedures in this document which are an extract from the reference documents on the front page. These documents will take precedence over this user guide.