tended

Operations manual

Virtual Worksite Marker Boards (VWSMBs)

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Version control

Version	Details or changes made	Made by	Checked by
1.1	Document created based on the Network Rail TA Ops Manual version 2.1, adapted specifically for Tended users	Megan Stride	Phil Sadgrove Amanda Willis Cat Machin

1. Introduction

1.1 Scope

This Operations Manual sets out the requirements to be met in the use of Virtual Worksite Marker Boards (VWSMBs) within T3 possessions.

This Operations Manual should be read in conjunction with the following documents:

- GERT8000-HB12 (Duties of the engineering supervisor (ES) in a possession)
- GERT8000-HB15 (Duties of the machine controller (MC) and on-track plant operator)
- GERT8000-HB11 (Duties of the person in charge of the possession(PICOP))
- Placement of Geofencing Devices: VWSMB extension
- NR/L3/OPS/303 (T3 Possession of the line for engineering work delivery requirements)
- NR/L2/OPS/202 (Principles, timescales and functional responsibilities for engineering work, access, and heavy resource planning)

1.2 Prerequisite competency requirements

In order to work within a worksite utilising VWSMBs, you must hold a valid certificate of competency as an ES or MC or machine operator and have completed training/briefing in the use of VWSMBs. An ES must receive training in use of Tended's Dashboard. MCs and operators only require a limited briefing on the use of the devices and their placement in accordance with the fitment guide.

1.3 Description of virtual worksites

A virtual worksite is a worksite as described in GERT8000-HB12 using VWSMBs instead of physical WSMBs. The nature of the product(s) allows the generation of zones around areas to delineate the limits of the worksite. It automates the triggering of alarms to devices allocated to specified users (MCs, ESs, operators and drivers) when a movement is inside or outside a predetermined zone. The system considers the middle of the 4-foot (railway terminology for the space between railway lines) as the centre line.

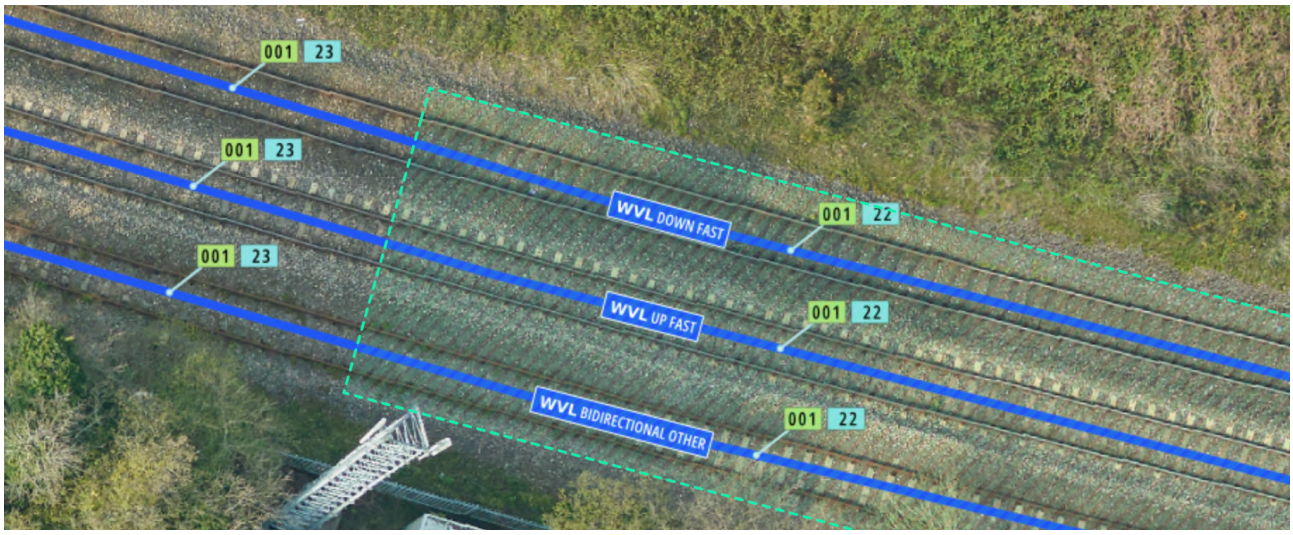


Figure 1: A virtual worksite

2. Planning the use of VWSMBs

2.1 General principles

Reference will be made to NR/L3/OPS/303 Mod # (in development) for detailed information on the planning requirements for the use of VWSMBs. The following principles should be applied.

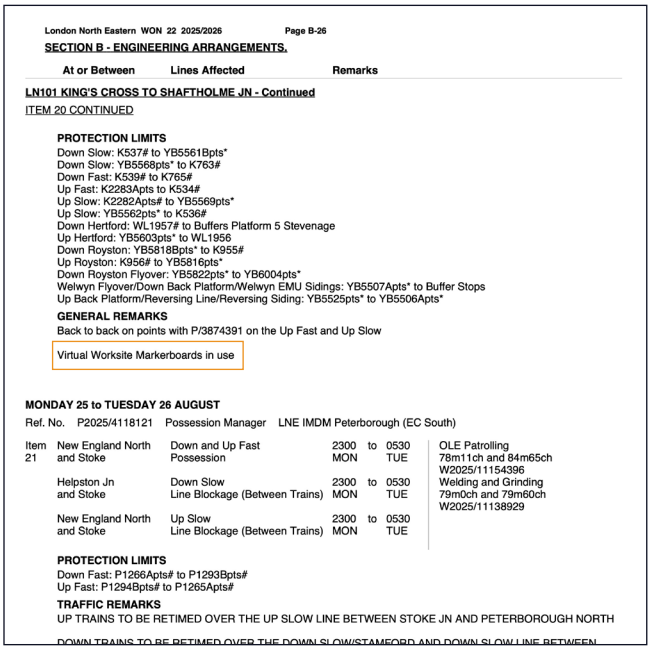
The Senior Operations Delivery Manager (SODM) or person responsible/accountable for the safe delivery of possessions will confirm that the use of VWSMBs are authorised.

If not already known, the likelihood of low signal issues in the work area can be assessed at the planning stage by using the Ofcom mobile coverage checker or by conducting a pre-site survey with the devices.

The planning of the VWSMBs locations should be checked and independently verified using the existing process used for checking and verifying worksites. Limits should be planned in accordance with GERT8000-HB12, ensuring the device alerts would be provided 100m from the end of the worksite as no work should be taking place in this area. If using an additional approach zone, work should not be planned to take place in this zone to avoid excess alerting.

The use of VWSMBs shall be identified in the Weekly Operating Notice (WON). This should be entered into the general remarks for the WON item as 'Virtual Worksite Marker Boards In Use' or similar. The Operations Delivery Manager will identify within the PICOP briefing pack those worksites using VWSMBs.

Device chain of custody must be agreed as part of the planning stage. The ES should be responsible for the management of the devices, however these responsibilities can be delegated to ensure the devices are ready to use at the start of work. The further chain can be agreed at the planning stage, but generally upon signing in with the ES, responsibility for the devices would pass to the MC or COSS who signs the device out for use.



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SECTION B - ENGINEERING ARRANGEMENTS.

At or Between	Lines Affected	Remarks

LN101 KING'S CROSS TO SHAFTHOLME JN - Continued

ITEM 20 CONTINUED

PROTECTION LIMITS

Down Slow: K537# to YB5561Bpts*
Down Slow: YB5568pts* to K763#
Down Fast: K539# to K765#
Up Fast: K2283Apts to K534#
Up Slow: K2282Apts# to YB5569pts*
Up Slow: YB5562pts* to K536#
Down Hertford: WL1957# to Buffers Platform 5 Stevenage
Up Hertford: YB5603pts* to WL1956
Down Royston: YB5818Bpts* to K955#
Up Royston: K956# to YB5816pts*
Down Royston Flyover: YB5822pts* to YB6004pts*
Welwyn Flyover/Down Back Platform/Welwyn EMU Sidings: YB5507Apts* to Buffer Stops
Up Back Platform/Reversing Line/Reversing Siding: YB5525pts* to YB5506Apts*

GENERAL REMARKS

Back to back on points with P/3874391 on the Up Fast and Up Slow

Virtual Worksite Markerboards in use

MONDAY 25 to TUESDAY 26 AUGUST

Ref. No. P2025/4118121 Possession Manager LNE IMDM Peterborough (EC South)

Item							
21	New England North and Stoke	Down and Up Fast Possession	2300 MON	to	0530 TUE	OLE Patrolling 78m11ch and 84m65ch W2025/11154396
	Helpston Jn and Stoke	Down Slow Line Blockage (Between Trains)	2300 MON	to	0530 TUE	Welding and Grinding 79m0ch and 79m60ch W2025/11138929
	New England North and Stoke	Up Slow Line Blockage (Between Trains)	2300 MON	to	0530 TUE	

PROTECTION LIMITS

Down Fast: P1266Apts# to P1293Bpts#
Up Fast: P1294Bpts# to P1265Apts#

TRAFFIC REMARKS

UP TRAINS TO BE RETIMED OVER THE UP SLOW LINE BETWEEN STOKE JN AND PETERBOROUGH NORTH

DOWN TRAINS TO BE RETIMED OVER THE DOWN SLOW/STAMFORD AND DOWN SLOW LINE BETWEEN

Figure 2: WON example

2.2 Hybrid working

Hybrid working refers to the mixed use of physical and virtual WSMBs

1. Hybrid working on any individual worksite is not permitted
2. Hybrid working where multiple worksites are planned with a possession is permitted, provided that any individual worksite does not use Hybrid working. i.e. requirement 1 must be maintained at all times

Where on-track plan (OTP) is planned to move between worksites which are hybrid, the Operations Delivery Manager (ODM) must be made aware during planned so they can assess the risks. If OTP are leaving a WSMB worksite to approach a VWSMB worksite, then they must be fitted with a geofencing device before leaving the WSMB worksite. If leaving a VWSMB worksite, then the devices cannot be removed until the OTP are in the WSMB worksite.

2.3 Limitations on the use of VWSMBs

The VWSMB system comprises of a Dashboard used to manage and generate zones and distribute these to wearable/plant mountable safety devices. For VWSMBs to function, both elements must be operated with devices. The device, whilst reliable in most circumstances, has a number of restrictions due to topography such as tunnels, deep cuttings, or urban settings with tall buildings close to the railway corridor. This could result in the device being unable to:

- See a sufficient number of satellites to process meaningful GPS
- Connect via to cellular to receive the RTK corrections

The planning teams may be aware of these limitations when planning the use of VWSMBs or the limitation will be confirmed during the setup procedure. A library of such locations may be useful as the planner's knowledge increases. VWSMB limits should not be planned to be within 100m of areas known to highly degrade GPS performance (e.g. tunnels) to ensure the devices can recover their position before approaching limits.

The VWSMB system relies upon the Network Rail Infrastructure Model for track centre line and mileage data. VWSMBs cannot be used in locations not covered by the Network Rail Infrastructure Model unless special arrangements have been made to gather data for that area. Any deficiencies in the model should be raised with Tended through the support section of their Dashboard.

2.4 Late changes

Late changes to the arrangements agreed and published in the WON should be avoided.

In exceptional circumstances, late changes must be authorised by the SODM during office hours and by Route Control and the on-call ODM during out of hours. The requirements of Clause 8.2 in NR/L2OPS/202, Clause 7 of NR/L3/OPS/045 National Operating Procedures (procedure 3.20) and Clause 5 of NR/L3/OPS/303 T3 possession of the line for engineering work delivery requirements, must be adhered to.

If a late change cannot be safely managed by an escalation process to change VWSMB limits, then physical WSMBs should be reverted to.

3. Using VWSMBs

3.1 Pre-use checks

The pre-use checks should include the following:

- There are sufficient geofencing devices for all plant and equipment within or planned to enter the worksite (and appropriate extra devices or batteries to support longer works).
- Devices not obviously damaged, all elements are present and connectors and in good working order.
- The system is tested as operational, devices alert in agreed test zones.
- Devices are fully charged, powered, or arrangements have been made to replace non-functioning devices within the worksite.
- Devices are associated with the current worksite, their appropriate vehicle types, and visible on Tended's Dashboard.
- The ES should check the limits on the Dashboard ahead of starting any VWSMB worksite.

If any of the basic checks cannot be met, the devices should be swapped out for a replacement. Route fault control should be advised through normal arrangements for reporting faults. The Route fault control should contact Tended's support team to help resolve any issues.

Where a replacement is not available in the necessary time scale, the arrangements for late change should be applied.

Any faulty device(s) must be quarantined so as not to be accidentally used.

Your agreed device management process should always be followed.

3.2 Fitting and activation of the equipment

The guidelines in section 4 should be followed to optimise device reliability. Checks should be carried out to ensure that the device is secure and not likely to move during use

Where a possession is longer than 12 hours, arrangements for the replacement/charging of equipment should form part of the planning process.

The ES or MC should confirm that the operator is familiar with the equipment and understands the alerts and the actions to be taken when activated.

Ensure that the device is operational, no failure states are present, and is reporting the position to the Dashboard by confirming with the ES when authorisation to start work is passed.

4. Placement of devices on OTP

4.1 Compliance

This section provides essential guidance on the correct placement of Tended geofencing devices on OTP for the purposes of VWSMBs. These guidelines are designed to improve operational performance, ensure timely hazard alerts, and ensure compatibility with other technologies used on the railway.

- Tended equipment has met all required product acceptance criteria.
- This guidance should be reviewed alongside manufacturer-specific manuals and external requirements, such as GK/GN 0602.
- These guidelines include specific in-cab placement instructions to facilitate the use of VWSMBs.

4.2 General placement principles

To ensure optimal performance and safety, adhere to the following positioning requirements:
Longitudinal Center line: Position the device as high and as close to the longitudinal center line (centre of the 4-foot when on rails) of the machine as is feasible.

- The device should be positioned as close to the leading end of the machine as possible to ensure timely alerts relative to hazards.
- Devices may need to be repositioned if the machinery changes its direction of travel (e.g., reversing), especially if there are multiple operating positions.
- Ensure the device is placed in an open and unobstructed position to maximise signal strength and visibility for the operator.

4.3 Signal integrity and interference

OTP often contain antennas and high-power electronics that can interact with geofencing equipment. The following points are suggested to maximise the performance of the equipment:

- Install the device at least 2 metres away from high-power radio transmission or reception equipment, including cellular, Wi-Fi, or Bluetooth systems.
- Keep the device at least 4 metres away from large components such as pantographs, climate control units, or other significant mounted equipment.
- Avoid placing the device near obstructions that cause signal interference or reflection, as these degrade quality.

4.4 Safety and installation

- Ensure neither the device nor any of its associated cabling presents a snagging hazard.
- Fasten the full length of any cabling securely.
- Ensure the equipment does not occlude reflectors or lighting required for safe vehicle operation.
- If installation requires working at height, use safe arrangements for fixing equipment.

4.5 In-cab placement for VWSMB

When mounting devices inside a cab for VWSMB use, the following additional criteria apply:

- Mount the device so that all alerts and status indications are clearly perceptible and continuously visible to the operator.
- The equipment must not impede the operator's line of sight to:
    - Other in-cab displays or controls.
    - The external environment necessary for safe operation.

Vehicle type	Recommended placement
Excavator	Side windows or non-obstructive areas of the front pillar
Mobile Elevating Work Platform (MEWP)	Upper guardrails surrounding the control console

4.6 External antenna installation

An external antenna may be used to mount the device away from the GNSS antenna, particularly when the user needs to access the device during operation.

- Mount the external antenna as high and as close to the center line as possible.
- Install the antenna on a metallic surface (such as the machine's body) to serve as a ground plane.
- If mounting on a non-metallic surface, you must install a conductive ground plane or metallic film to achieve optimal performance.

4.7 Recommended placement zones

Green highlighted areas indicate recommended mounting locations. Positioning devices in the denoted areas ensure the alert and status indications on the device remain continuously visible to the operator.

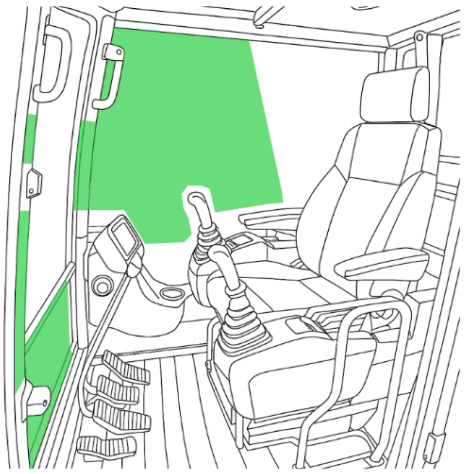

Figure 3: Placement on excavator or similar

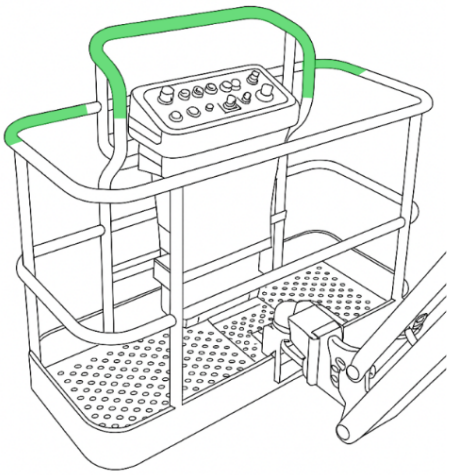

Figure 4: Placement on a MEWP

5. Working within limits of VWSMBs

5.1 Overview

The following illustrates the various elements of a virtual worksite:

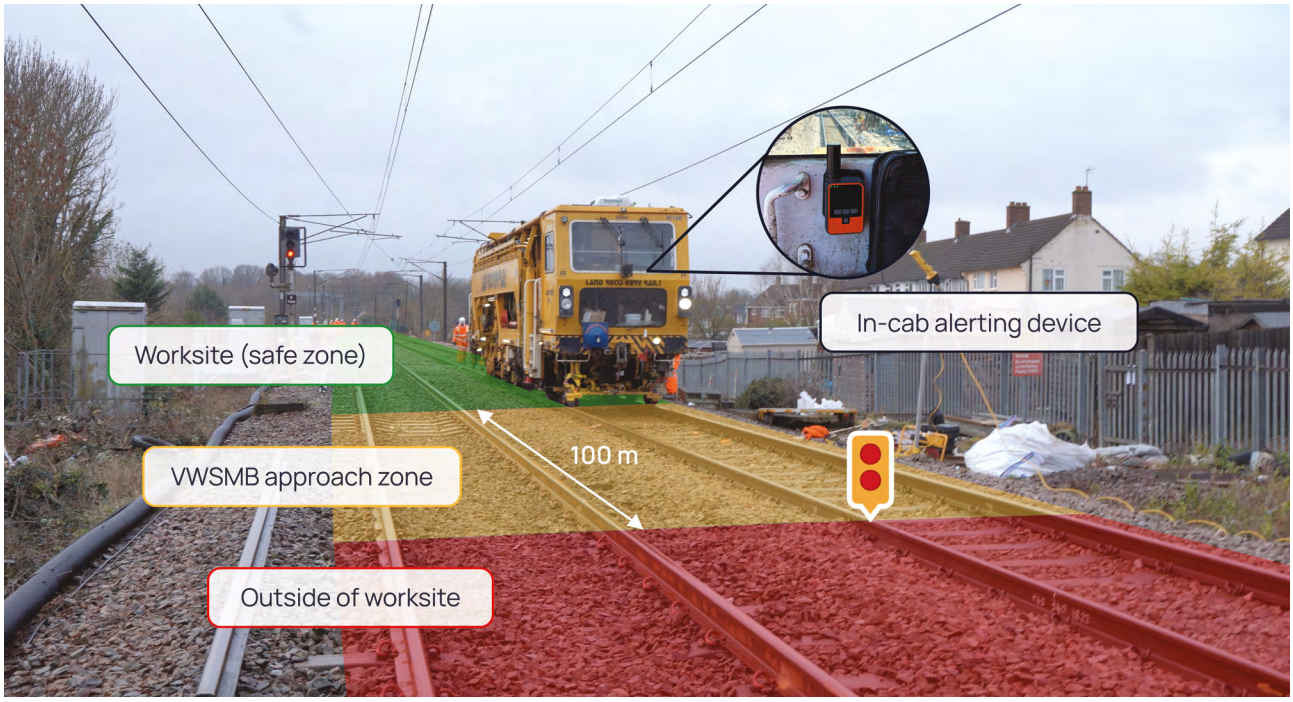

Figure 5: Visualisation of a virtual worksite

Movement authorities are as detailed in GERT8000-HB11, HB12 and 15.

No vehicles are allowed within the limits of the VWSMB unless devices are fitted.

Positioning devices are fitted in cab with audible and visual alerts. Additional roles may also be provided with devices, but this is not a requirement of VWSMB as WSMBs are only for OTP, OTM and Engineering Trains.

5.2 Device alerting

The device will automatically alert when the machine enters the VWSMB approach zone.

The zones will follow the rule book requirements i.e. a minimum 100m exclusion zone prior to the planned VWSMB, with an optional additional 20m approach zone to allow moving vehicles to come to a stop. The alert will continue until the machine returns to a safe area within the worksite.

If the device alerts unexpectedly the operator must come to a stand and seek further instructions from the MC or ES.

If a suspected breach of worksite limits has taken place, the ES will follow the existing processes to report this and assess whether work can continue safely.

Alerting methods and types will be briefed specifically to the required users depending on the system being used, alongside fitment instructions. Users will be briefed on what alerts to expect, why that alert is being provided, and what action to take in the event of each alert type.

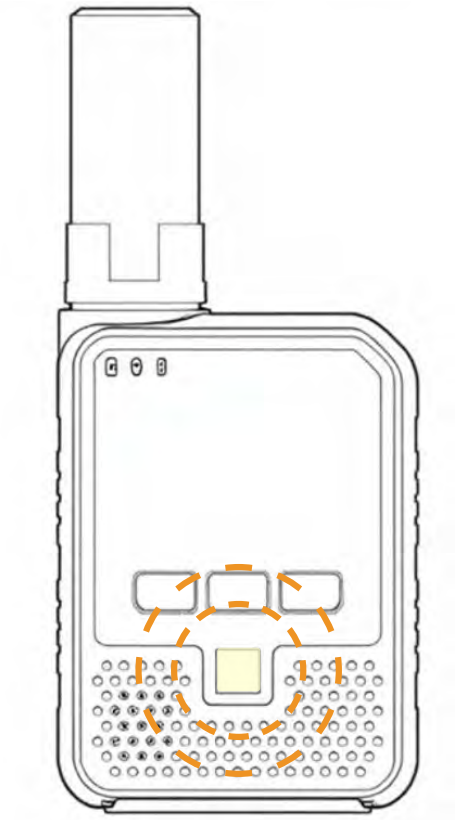

Figure 6: Device alerting

5.3 Connectivity issues

An alert will be provided when the device connection degrages, and location reporting becomes inaccurate.. The ES or MC should be advised of this change immediately.

Low accuracy:

- Location light flashing red
- 3 short beeps every 30 seconds

Scan for more information on alerts:

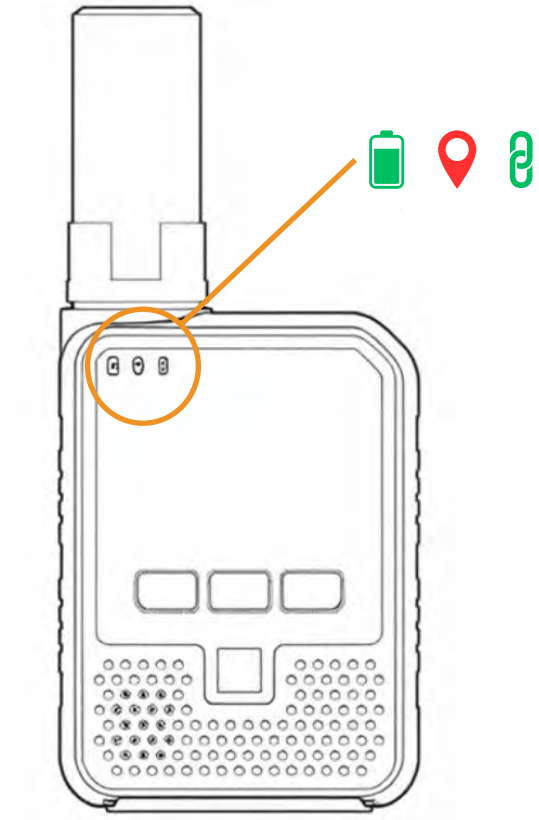

Figure 7: Connectivity issues

5.4 Other types of alerts

Each alert has a separate tone to ensure the reason for the alert is understood by the operator.

5.5 Equipment failure

If an equipment failure occurs an alert will be given. The operator must not start any movement, or if in transit, come to an immediate stop or make no further movement. The operator should immediately alert the ES or MC of the failure.

Devices will automatically recover when a movement passes for example under a bridge. It will go temporarily unsafe and when clear of the obstruction return to the safe mode.

If the failure only affects a single machine the equipment should be swapped out and the arrangements described in pre use checks (3.1).

If the failure affects all machines, the ES should consider either closing down the worksite or reverting to physical WSMBs.

In either case, the ES will advise the Route fault control of the failure condition and whether the intent is to revert to physical WSMBs. Route control can then assess what further actions should be taken.

5.6 Reverting to physical WSMBs

Where the decision is made to revert to physical WSMBs, all machine movements within the worksite should cease and not restart until the physical WSMBs boards are in place.

6. Deactivation of devices when work is complete

The devices should not be deactivated until the associated equipment is clear of the line.

Your agreed device management process should be followed regarding securing of the VWSMB system, its safe retention and disposal.

7. Close down of the virtual worksite

The ES shall follow the requirements as detailed in GERT8000-HB12 and will not deactivate the virtual worksite until all requirements of that Rule Book module has been met.

Questions or need help?

Live chat: via the help button in your Dashboard

Email us: support@tended.co.uk

WhatsApp us: +44 (0) 7713 682625

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