USE OF WACKER PLATES PE348

1. PURPOSE

This procedure sets out the safe methods to be adopted when using ballast compaction equipment. Correct use of machinery and/or techniques is a fundamental requirement of delivering necessary track quality and incorrect use will lead to personal injury or damage to infrastructure sites, components and equipment. Most importantly, failure to undertake compaction correctly can result in rapid deterioration of track geometry leading to Emergency Speed Restrictions and potential risk of derailment.

Where it is necessary to carry out a process which requires the use of tools or equipment, then only persons who have been trained and who hold a current VolkerRail (VR) certificate of competence may undertake that work.

2. SCOPE

This procedure is mandatory. It applies to all ballast compaction operations undertaken on VR work sites and other operations where VR are working as a subcontractor on sites in the custody of “others”.

It does not cover sites with live 3rd or 4th rails.

3. REFERENCES (INPUTS) / RELATED DOCUMENTS

- NR/L2/TRK/8100 - Railway Ballast & Stoneblower Aggregate
- NR/L2/TRK/2102 – Design and Construction of Track
- NR/L2/TRK/4239 - Formation Treatments
- PE326 - Vehicular Plant and Equipment
- OHS02 - Control of Vibration at Work

4. ABBREVIATIONS AND DEFINITION OF TERMS

Abbreviation / Term	Definition
ESR	Emergency Speed Restrictions
TSR	Temporary Speed Restriction
HAVS	Hand Arm Vibration Syndrome
VWF	Vibration White Finger
RCTW	Remote Controlled Triple Wacker
CRE(T)	Contractors Responsible Engineer - Track
CEM	Contractors Engineering Manager
DTS	Dynamic Track Stabiliser

5. PROCESS

5.1 Types of Equipment

The equipment shown below, are the standard equipment available and permitted to be used on NR infrastructure, each of these types of equipment differ slightly different in vibration frequency and centrifugal force, so therefore may require a different number of passes to achieve the required compaction.

DPU 6055/86

DPU 100/70

DPU 110/70

5.2 General Considerations

5.2.1. Installation Quality

The quality of the ballast compaction will influence the amount of settlement experienced once a section of track opens to traffic, it will also affect the overall life of the installation and the amount of maintenance needed. This is extremely important as S&C layouts installed on a ballast bed which does not have a uniform depth of ballast throughout the installation cannot possibly be expected to achieve a uniform degree of ballast consolidation and differential settlement under the S&C can lead to failures.

5.2.2. Compaction

NR/L2/TRK/2102 requires, in some cases, ballast to be compacted in layers. (See section 5.3.2).

Compaction must be undertaken using a minimum of three passes of a 1400-1800kg/m2 vibrating plate compactor or equivalent, for opening speeds up to and including 60mph, or six passes for opening speeds above 60mph where a DTS will not be utilized.

The ballast has had one pass when all the ballast area has been passed over once by the compaction equipment. On a plain line renewal this normally will involve a triple plate compactor passing down the ballasted area in one direction and then returning down the other side of the ballasted area to the start point.

No pneumatic tyred vehicle shall be permitted to run on a ballasted layer after compaction. Pneumatic tyred vehicles should not be run on a levelled ballast bed just prior to compaction, where this may occur the ballast must be re-graded and levelled prior to commencing compaction.

If compaction is carried out in this manner it will assist in maintaining track geometry within the tolerances required for achievement of NR/L2/TRK/2102 Design and Construction of Track Standard, it will help prevent initial settlement of the ballast once open to traffic and the requirement to impose emergency speed restrictions, due to deterioration of the track geometry.

5.2.3. Structures

When compaction is required over structures, the **Project Manager** must ensure that trial holes are taken to establish the depth of ballast over the structure, then a decision made on what type of equipment is to be used. If there is any doubt then advice should be sought from either **Professional Head of Track Engineering, Professional Head of Civil Engineering or Chief Engineer.**

5.2.4. Lifting Beams

Lifting beams attached to the machines for the purpose of lifting and transporting compactors into and out of site shall always be removed for the compaction operation. Inadequate compaction, excessive noise and vibration and damage to the equipment will result if this is not done.

5.2.5. Compaction Achievement

It is the responsibility of the **CRE(T)** through the ITP and WPP and staff to ensure that the required amount of compaction is achieved.

5.3 Procedure

5.3.1. Robust Plan

Project Managers shall ensure a robust plan is in place for safe access and egress to the worksite for the compaction equipment between tasks, so there is no damage to the infrastructure and all lifting plans are produced by competent lift planners as per PE326.

5.3.2. Ballast Bed

The ballast bed can be laid and compacted in a single layer not exceeding 480mm under the sleeper (which includes cant and crossfall). Where the ballast layer under the sleeper is greater than 480mm, then the ballast bed should be laid in layers not exceeding 300mm deep and each layer should be compacted uniformly, according to the Client specification.

5.3.3. Number of Passes

The required number of passes to achieve the correct compaction is essential; a centrifugal force of 100kN and an ideal frequency of 56Hz ensures compaction is achieved in three passes. (Wacker Triple DPU 100-70 accomplishes this).

Where higher opening speed of a core renewal is proposed above 60mph, then the number of passes to be undertaken shall be six, to ensure ballast is compacted as much as possible. No more than six passes shall be undertaken, as the maximum possible compaction is achieved at this point and further compaction will damage the installed ballast.

NR/ L2/TRK/4239 requires 2 passes on sand blanket layers with a 1400-1800kg/m^2 vibrating plate or roller but does not specify a required specific force or frequency.

On Network Rail Infrastructure, the **CEM** must therefore obtain agreement from the Client's technical representative that three passes are sufficient or confirm the minimum number of passes required if more than this. If unable to achieve the required number of passes for any reason, then additional monitoring must be put in place after opening to traffic to ensure track geometry remains fit for the current running speed for trains.

5.4 Specific Safety Requirements

The wearing of personal protective equipment by staff involved in these activities is mandatory, with the addition of gloves and ear protection. An exclusion zone must be maintained around the compaction equipment while it is in use.

5.4.1. Risks

Risk	Mitigation
Hearing damage	Wear ear defenders
Finger damage	Use of RCTW, use of vibration reducing gloves
Toe damage	Safety footwear
Rail and trackside equipment damage	Take care to keep to the confines of the working area.

5.4.2. HAVS

Hand arm vibration syndrome (HAVS) is caused by exposure of the hands to excess levels of vibration from handheld power tools. The most common form of HAVS is vibration white finger (VWF), which is caused by damage to the blood circulation and characterised by whitening and numbness in the fingers. The key legal duties in relation to HAVS include general responsibilities, under the Health and Safety at Work etc. Act, on employers to minimise risks to their employees.

The risk of exposure to HAVS can be totally eradicated in the compaction process by using Remote Controlled Triple Wacker Compaction (RCTW) devices and this is the only recommended process on all VR worksites on all infrastructure.

Should RCTW devices not be available, the **Project Manager** shall establish permitted exposure limits and deviations with the **H&S Manager** and ensure adequate controls to limit HAVs exposure for individual staff are in place and that these are mandated through the WPP and Task Briefings.

5.5 Training, Competency and Certification

All staff using ballast compaction equipment must be trained and competent to use the specific equipment provided and must be in possession of the appropriate certification. This must be available on site for inspection.

Project Managers shall ensure through their managers and supervisors that only certified staff are used for this task.

6. ASSOCIATED GUIDANCE & INFORMATION

- Appendix A – Triple Wacker Compaction Trial Evidence

7. DOCUMENTATION (OUTPUTS)

None

8. ISSUE RECORD

Issue	Date	Comments
1	Oct 2006	First Issue
2	24/01/2024	This procedure has undergone a periodic review and transferred onto current template. Boschung Plate on tractor compactor removed and replaced with new DPU110 plate compactors. Update to maximum permitted ballast bed layers to reflect changes to NR standards. Requirements for higher opening speeds of core renewals for minimum number of passes added.

9. WHAT HAS CHANGED IN THIS LATEST ISSUE AND WHY

Periodic review to bring procedure up to date with current practices, new equipment available and changes to NR standards and requirements for maximum permitted ballast layers. Requirements for higher opening speed of core renewals above 50mph have been added to the procedure. Clarification added to what constitutes one pass with a compactor.

References to Boschung Plate on tractor compactors have been removed as these are no longer used. The list of approved turning bars has been updated to reflect those currently approved on the NR PADs system.

Responsibility for confirming the number of passes required with NR and ensuring the agreed number of passes has been completed has been changed from the **Project Manager** to the CEM and CRE(T).

Simplification of HAVs requirement in section 5.4.2.

Update to RACI.

10. BRIEFING REQUIREMENTS

All new employees will receive an introduction to the Integrated Management System (IMS) at induction, according to the nature of the role.

All employees with an email address receive the ‘Record of Revisions’ each month, which details changes to the IMS. All Line Managers retain the responsibility to ensure their staff are briefed on changes as appropriate.

The following table defines how revised issues of this document are briefed to existing employees according to related specific responsibilities.

This is determined using the ‘RACI’ principle. Those roles identified as ‘Responsible’ and ‘Accountable’ should receive a formal awareness briefing facilitated by the Document Owner.

Discipline	Role	RACI	Type of briefing
Project Management	Assistant / Senior / Project Manager	Accountable	Detailed
HSQES	H&S Manager	Responsible	Detailed
HSQES	Training & Competence Manager	Informed	Awareness
Track Engineering	Construction Managers	Informed	Awareness
Track Engineering	Supervisors	Informed	Awareness

Competence	RACI	Type of briefing
RCW Plate (Remote Control Wacker Plate)	Responsible	Detailed
Single W/P (Single Wacker Plate)	Responsible	Detailed
TripleW (Triple Wacker Plate)	Responsible	Detailed
Contractor Responsible Engineer	Responsible	Detailed

11. IMS AUTHORISATION

Document owner approval:

Rob Adams, Professional Head of Track Engineering, 24/01/2024

Approval for IMS:

Paula Roberts, IMS Coordinator, 24/01/2024

APPENDIX A: TRIPLE WACKER COMPACTION TRIAL EVIDENCE PE348

Guidance on likely compaction to be achieved on site:
(Results from Tests at Frodingham April and June 2006, evidence retained by Engineering Director on file with this Instruction).

Machine	2 x 150 layers Average compaction achieved (mm)			1 x 300 layer Average compaction achieved (mm)
	1st Layer	2nd Layer	Total	Total
100/70 Remote Controlled Triple Wacker	**4 passes**	**4 passes**	**4 passes**	**4 passes**
	31	21	52	45
	3 passes	**3 passes**	**3 passes**	**3 passes**
	30	19	49	41
6055 Manually Controlled Triple Wacker	**4 passes**	**4 passes**	**4 passes**	**4 passes**
	29	19	48	42
	3 passes	**3 passes**	**3 passes**	**3 passes**
	27	18	45	40