National Freight Safety Group

Rail Freight Operations Group

Code of Practice

Loading Bulk Wagons

Version: 2

List of contributing organisations:

~ Members of XIFDWG

~ Members of MPA / RFG Construction Forum

~ DB Cargo (UK)

~ Devon & Cornwall Railways (DC Rail)

~ Direct Rail Services

~ Freightliner Group

~ GB Railfreight

~ Rail Operations Group (ROG)

~ Victa Railfreight

Index

Section: **Title:**

1 Introduction & Scope

2 General Summary

3 Documenting the Activity

4 Operators

5 Plant and tooling

6 Loading / Unloading Process

7 Bulk Load Distribution

8 Residual Loads

9 Loaded Weight/ Volume Management

10 Bulk Powder

11 Emergency Working

Definitions

The term:	Includes or means:
RU	Railway Undertaking
Network	The infrastructure managed by Network Rail
RFOG	Rail Freight Operators Group
NFSG	National Freight Safety Group
RSSB	Rail Safety & Standards Board
ORR	Office of Road & Rail
COP	Code of Practice
ECM	Entity in Charge of Maintenance

Blank page

(For double sided pagination)

1. Introduction & Scope

1.1 The purpose of this approved code of practice is to offer guidance to parties engaged in the process and management of loading bulk products onto rail wagons, such that the risks associated with the transportation of wagons are minimised. Included is the management of risk associated with residual / incomplete loading and unloading events.

1.2 The provisions of this guidance document relate to bulk products as defined: unbound, solid, particulate materials

1.3 The provisions of this guidance document relate to bulk wagon types as defined: Annex 1

1.4 The provisions contained within this guidance document should be applied in conjunction with specific mitigation measures as identified by Parties responsible for the safe completion of the activity.

1.5 This guidance has no geographical boundaries and applies to heavy rail activities across the UK network.

1.6 The guidance excludes light rail or bespoke off Network activities.

1.7 The guidance seeks to assist parties to comply with their legislative duties including but not limited to the application of the **Health and Safety at Work** Act 1974 (HASAWA) and **Railways and Other Guided Transport Systems (Safety)** Regulations 2006 (ROGS).

2. General Summary

2.1 On 5th December 2014 HM Chief Inspector of Railways, wrote a letter to the rail industry requesting that the industry work collectively to address concerns regarding freight train derailments including the effect of asymmetry. Subsequent to this RAIB investigations into Bulk traffic derailments made recommendations relating to asymmetry of loads and residual load conditions. Eg https://www.gov.uk/raib-reports/derailment-at-angerstein-junction

2.2 The Industry responded to the challenge and RSSB formed and chaired a Cross Industry Freight Derailment Group engaging parties across the Industry to determine Risk and Risk mitigation measures and to assist in discharging various RAIB recommendations.

2.3 An absence of detail specific to Bulk Loading practices and clear parameters against which to operate identified the need for this 'code of practice' to be produced.

2.4 RFOG, a subgroup of NFSG, have endorsed the process and will be supporting the application and implementation of the 'code of practice' (COP).

2.5 The guidance clarifies roles and responsibilities, provides a clearer risk management process and informs parties of acceptable parameters determined through good engineering practice and applied expertise.

Blank page

(For double sided pagination)

3. Documenting the Activity

The parties engaged in the Loading of Bulk Wagons should establish a clear methodology prior to commencing the activity. This should be recorded and available as required for participants in the activity and subject to a regular process of review.

The full range of activities which require documenting may be extensive and require operating arrangements / instructions which cover a wider scope to include other activities e.g. rail vehicle movements.

This guidance **only** identifies criteria which are specific to the risks related to Loading Bulk Rail Wagons (loading and unloading operations) which should be considered and recorded.

Documentation

It is proposed that the following is recorded:

- Identification of the Hazards from the activity
- Control measures to reduce or eliminate the Risks
- Operator competency, orientation and training
- Appropriate plant and tooling to undertake the activity
- Inspection, audit review of the procedure
- Emergency situation planning
- Incident reporting and feedback
- Continuous Improvement / Review process

You must:

Activities should only commence after a clear methodology has been identified and communicated to all participants.

4. Operators

4.1 Competency

Parties must provide suitable and sufficient training to staff undertaking the Loading / Unloading of Bulk Rail Wagons.

Competency should be assessed routinely and recorded as adequate for the activities being undertaken.

Supervision of staff should be adequate and appropriately skilled to manage the activities effectively.

4.2 Medical Fitness of Staff

Loading / offloading terminals management should ensure there are appropriate mechanisms in place to determine applicable standards for medical fitness and fatigue management control and that these are being adhered to in accordance with that operator's policy and requirements.

Consideration should be given to:

- Medical fitness of staff
- Physical needs of staff
- Fatigue Risk Management

5. Plant and tooling

5.1 General

Plant and tooling should be selected, inspected, maintained and repaired in order to remain adequate for the activity.

5.2 Selection

Plant will be selected to undertake the activity efficiently and safely. Plant selection for bulk wagon loading / unloading should also consider the accuracy of bulk material placement and of load measurement, how feedback / control is provided to staff and the potential for damage to rail wagons. Two specific examples are:

- Shock of loading wagons - The delivery of the load into a rail wagon needs to be adequately controlled to avoid the load when placed, damaging wagon suspension / door gear or displacing locking devices.

- Toothed buckets on mobile plant should be avoided as these greatly increase the risk of wagon damage during loading / unloading.

6. Loading/Unloading Process

6.1 General

Bulk loading should only commence after determining the suitability and condition of the wagon, to the bulk material to be transported.

6.2 Wagon Suitability

The criteria which determine the wagon as being suitable for the loading event should be recorded. Consideration is to be given to the usable volume of the wagon, size of apertures for loading / unloading, sealing and control of hopper doors, wagons resistance to corrosion amongst other criteria.

Prior to loading wagons the maintenance requirements / condition of the wagon and the complete closure and locking of doors is to be determined, this may be by or on behalf of the party undertaking the loading event. In any event clear responsibilities should be agreed and recorded.

6.3 Bulk Material Characteristics

To safely and efficiently load and unload bulk materials characteristics of the bulk material to be transported need to be considered. These include but are not limited to:

The bulk density of the material – to match the wagon's volumetric capacity and Gross Laden Weight.

The particle size of the material- smaller materials need to match with wagon door seal arrangements, larger materials to the size of door aperture or an excavator's ability to handle.

Flow characteristics – materials to be discharged through hopper doors will need to flow during discharge. Eg Recycled Asphalt Products have become stuck in hopper wagons.

Construction waste products can be particularly variable and how the material flows, releases from handling equipment and is contained within the wagon may require additional measures.

6.4 Notification

During a loading or unloading event if a party becomes aware of a wagon or load condition which is a potential safety concern, they are required to advise the FOC's representative (person responsible for releasing the wagon onto the Network) on site of the condition.

7. Bulk Load Distribution

7.1 General

The wagon selected will typically be matched to efficiently accommodate and retain the material loaded. The available volume of a vehicle will be compatible with the density of the bulk material to be loaded.

Railway Infrastructure is designed, built and maintained to allow the free passage of wagons up to particular dimensions of height and width without coming into contact with adjacent structures or passing rail traffic (the Gauge).

Additionally, the wagons when fully loaded or otherwise are required to operate within parameters of weight distribution. Unbalanced wagons change the ride characteristics of a wagon and are likely to have a greater propensity to derail. As a general rule the more evenly loaded from side to side and end to end the lower the risk.

7.2 Dimensions

The standard gauge across the UK network is W6A which describes the allowable widths of rail traffic at various heights. See attached figure identifying the maximum height of 3.975m and width of 2.8m in relation to W6A. The maximum height of the load must not exceed this maximum. For full height vehicles a useful guide is to allow a load height of no greater than 30cm above the wagon side.

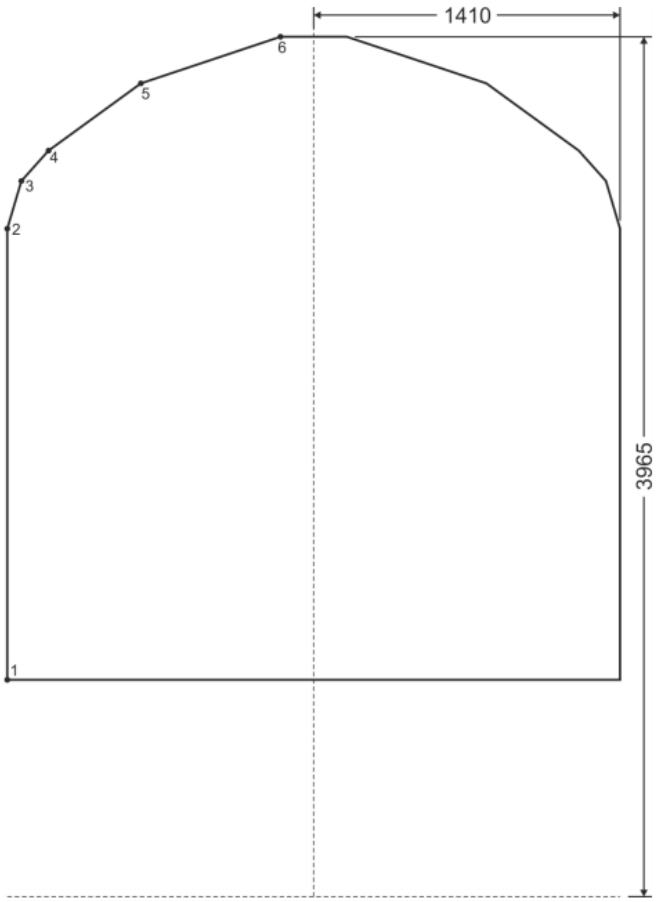

Figure D.1 W6a upper gauge diagram

7.3 Containment

The load is required to be contained throughout its journey to avoid materials released at speed putting trackside workers and railway users at risk or damaging lineside equipment. To undertake this:

- Secure doors and hatches – load security require all doors / hatches to be adequately secured throughout journeys.
- Spillage - Materials during the loading / unloading activity may build up outside of where the load is to be contained, example locations include: draw gear, brake gear, side raves, end plates. Routine regular inspection and clearance regimes should be adopted to control build up in these areas.
- Blow off – dependent upon size and condition of material, materials may be sufficiently small and loose so as to be blown off by the passage of air at speed. Further containment of such products may be undertaken including

binding the material with water / chemicals or using wagons designed to deflect air flow or with canopies.

- Material movement – as a result of the vibrations during transportation bulk materials are likely to settle during their journey. Consideration of this material movement should be made when releasing wagons onto the Network. In order to accommodate this settlement a moat should be left around the load, of sufficient capacity to accommodate the settlement of materials whilst in traffic. An example is shown below:

7.4 Asymmetrical Loads

Asymmetrical loading relates to the differences in weight / forces applied laterally from the left and righthand side and longitudinally from the front to the back of the wagon of a vehicle in the direction of travel. Wagons when in tare condition are typically balanced applying equal force / weight to each wheelset. Load placement / retention off centre will affect the balancing of these forces and if significant has been identified as subjecting the wagon to a propensity to derail.

7.5 Lateral Offsets

The side to side placement of the load should be controlled and monitored.

In practice, parties should aim for balanced loading and manage their activities to reduce potential imbalances from loading activities. This can be achieved by monitoring the performance of their activities (by sight or recording of weights) and providing feedback to the staff undertaking the load placement, identifying actions to be taken. The load placement process may require redesign if unable to perform to an acceptable standard.

As a general guide lateral offsets for individual wagons should be below a ratio of 1.25 : 1 for both two axle and bogied vehicles. Certain vehicle type / bogie combinations are more tolerant of offset and a more detailed engineering risk assessment can be established for operation outside of the general guide.

As a practical guide, materials displaying a 45 degree angle of repose, loaded on to a full height wagon (bogie wagon only) will be within the parameters if the centre of the load does not exceed 300mm from the midline.

7.6 Longitudinal Offsets

Longitudinal loading relates to the relationship between the front and rear of a vehicle. Placing the load to one end of the wagon results in more of the wagon's weight / forces being placed on the wheels on that end. In extreme circumstances this has been identified as subjecting the wagon to a propensity to derail.

The parameters for longitudinal loading depend upon the wagon type:

- Twin Axled Vehicles to not exceed a ratio of 2:1
- Bogied Vehicles to not exceed a ratio of 3:1

In practice parties should target for balanced loading and manage their activities to reduce the potential inadvertent bias generated from loading activities, by monitoring the performance of their activities in an appropriate way e.g. visually reviewing the position of the loads relative to the midline.

As a practical guide, bulk materials are unlikely to the exceed longitudinal parameter. The extreme circumstance of a classic, hopper wagon (all doors discharging inside the bogie centres) door mechanism failure, which results in a single end compartment remaining loaded has been assessed. This load condition remains within the acceptable parameters however good risk mitigation management (and operational) practice, should be applied such that an intervention maintenance event be undertaken in order that the wagon makes one journey only in the part loaded condition.

7.7 Combination Offsets

Combination offsets occur when both lateral and longitudinal offsets exist in the same wagon. It is particularly difficult to visually or site assess a combination offset. However, it should be recognised that when in combination the individual acceptable lateral and longitudinal, parameters reduce.

7.8 Individual Components

Additional to the wagon load distribution affecting the propensity of the wagon to derail, poor load distribution can also increase the force being applied to individual components. This can lead to component failure or reduced longevity and an increase in maintenance events. In particular the wheelsets supporting the wagon will have operational parameters which are not to be exceeded. Eg. A wagon may be loaded upto its maximum Gross Laden Weight but as a consequence of a longitudinally imbalanced load, the weight being applied to one or more individual axles exceeds its operational parameter.

7.9 Monitoring and Feedback

Network Rail operate at specific locations on their Network, Asset Protection equipment, these Gotcha / WILD systems measure the force / load being applied by individual wagon's axle and wheels. The forces applied and imbalances are recognised and exceedances beyond specific parameters will be available to the

RU operating the service and ECM (Entity in Charge of Maintenance) for a specific wagon.

Feedback from this source should be used to inform and modify the operations to establish an acceptable level of performance.

8. Residual Loads

8.1 General

Residual loads are defined as the load unintentionally retained within the vehicle following a discharge event. These loads are variable in both magnitude and location and can introduce imbalances to the vehicle such that it has a propensity to derail. See example photograph of material retained in a hopper wagon below.

8.2 Assess and manage

A system of checking for the presence of residual loads should be established and when a residual load is detected its magnitude and position are to be determined. The following actions should be considered as appropriate:

- Magnitude – If the residual load is assessed as greater than 10% of the payload of the wagon, its removal and the return of the wagon to an acceptable condition should be managed. If the magnitude is less than 10% of the carrying capacity (payload) of the wagon no further action is required, other than to satisfy a financial or quality protocol.
- Position - If possible the position of the load is to be determined. Residual loads which are significantly off centre, in particular those introducing a lateral offset generate the greater risk. Residual loads may consist of multiple masses in multiple locations and the overall balance is to be considered. If the load is reasonably balanced no further action is required, other than to satisfy a financial or quality protocol.
- Residual Load Management – If a residual load of a magnitude greater than 10% of the wagon payload and significantly imbalanced (or un-assessed) is determined a managed process to return it to an acceptable condition should be established. Residual loads can often be removed through multiple loading / unloading cycles but this should be managed to increase the likelihood of removing the residual load during a normal discharge event and limited to a time period to avoid the risk being perpetuated. During the managed period a regular assessment of the load magnitude and location may be recorded. An appropriate period for a wagon undertaking multiple cycles per week would be seven days, if the wagon / load condition cannot be made acceptable load during this period the wagon should be removed from service at an appropriate location for an out of course intervention event to be undertaken in order to return the wagon to an acceptable condition.

8.3 Redistribute

If possible, the residual load is to be redistributed such that it is balanced across the wagon. The presence of the residual load should be communicated to the next point of loading.

9. Loaded Weight / Volume Management

9.1 General

The wagon type selected will typically be matched to efficiently accommodate and retain the material loaded. In this case the available volume of a vehicle will be such that when the load is placed and some unused volume remains the permitted Gross Weight of a wagon will be achieved.

Note: Variations in density of materials and mismatching of wagons may allow a bulk material volume to be loaded which would be far in excess of the Gross Weight capacity of a wagon. Additional control measures should be considered to manage the risks from these situations.

Railway Infrastructure is designed, built and maintained to accommodate the forces applied from the passage of rail vehicles as are the components and elements of the wagon. To adequately control the weight / forces being applied to both infrastructure and wagons loaded weight / volume and evenness of distribution need to be adequately managed.

Network Rail maintain the Network and declare its capability in the form of Route Availability and Loading Capacities relative to structures, traction types and sometimes speed, additionally individual wagons will have their Gross Laden Weight identified.

9.2 Systems

An agreed process of managing and determining the weight of a loaded wagon must be followed. The process selected should be appropriate to satisfy a risk assessment of the loading activity. Individual processes vary in accuracy, practical application and cost to install / maintain. The individual systems include:

- Weighing loaded wagons – In Motion and static weighbridge systems may be used which identify the Gross Laden Weight of the wagon. These systems typically afford a higher level of accuracy to the weights recorded. Additionally, certain systems are capable of determining individual wheel or axle weights. This provides data for the management of Bulk Load Distribution – Section 7 of this COP and to manage individual axle loads.

- Weighing the Load – Various load weighing systems may be employed such as belt weighers, mobile plant weighers which determine the weight of the load. This is then added to the Tare Weight (see below 9.3) to derive the Gross Laden Weight.
- Volumetric Loading – The volume of the load (as measured by flow meters, grab buckets) and a known density of the material may be used to calculate the weight of the load. This is then added to the Tare Weight (see below 9.3) to derive the Gross Laden Weight.
- Visual Assessment – The weight / volume of the wagon may be determined by a suitably competent individual referencing the visual load to a previously determined acceptable standard for similar materials. This may be assisted by wagons being marked to assist with determining acceptable load volumes.
- Wagon Load Calibration – The acceptable weight / volume of the wagon may be determined by a suitably competent individual utilising a wagon characteristic which adequately measures the loading. This may be a suspension gap being compressed to a certain level.

9.3 Tare Weight

The process of calculating the Gross Laden Weight of a wagon may require determining the Tare Weight of the wagon. This may be undertaken by:

- Data Panel – The Data Panel located on the side of a wagon will identify the Tare Weight. If the Data panel and physical weighing events of the wagon (when determined as empty) vary by >0.25 tonne, this should be investigated with the wagons ECM and the data for the wagon revised.

- Weighbridge Information – Wagons often operate from multiple locations and accuracy may be improved if the Tare of a wagon is communicated from a site which has recently undertaken a physical weighing of the vehicle.
- Wagon emptiness – prior to using the wagon tare weight a check to establish the emptiness of the wagon may be required. This could take the form of a visual assessment or robust reporting from the off-loading location. If a residual load is identified or suspected a prudent estimation of the weight should be undertaken to avoid exceeding the wagon's Gross Weight.

9.4 Practical Weight Management

A risk assessment may also be undertaken to accommodate the inherent inaccuracies and load variations experienced in the loading process; in order to resolve minor load exceedances by taking in to account fatigue risk and maintaining an overall positive effect on safety.

9.5 Monitoring and Feedback

The Network Rail operated Asset Protection equipment, (Gotcha / WILD systems) measure the force / load being applied by individual wagon wheels. Exceedances either by wagon or individual wheelset beyond specific parameters will be reported to the RU operating the service and the ECM (Entity in Charge of Maintenance) of the wagon.

Feedback from this source should be used to inform and modify the operations to establish an acceptable level of performance.

10. Bulk Powder

10.1 General

Bulk powders typically behave similarly to liquids and are therefore not addressed in detail within this COP.

Parties should however be aware that on occasion bulk powders may behave like other bulk materials and determining the distribution of loaded and partially loaded vehicles applies equally to these materials.

11. Emergency Working

11.1 General

The Load Management procedure may also identify emergency working procedures when an aspect of the normal process is not functional. Parties should include in their risk management provisions how they will respond to changes in working conditions or procedures. These may include but are not limited to:

- Failure of measuring equipment
- Change in climatic conditions
- Failure of loading plant
- A change in bulk material to be loaded
- A change to the wagon type to be loaded

Annex 1

Suggested updated definition of scope following XIFDWG meeting on 4 September 2018

For the purpose of work under the XIFDWG, bulk loads / wagons includes those wagon types which have the potential for either, or both, uneven loading at source or uneven retained load following unloading. This may include bogie, 2-axle or articulated hoppers, box wagons and tank wagons depending on the product carried.

Two aspects of the work are considered, and different wagon types may be included in one or both aspects. These aspects are:

1. Investigation of the load offset(s) that the wagon type can tolerate
2. Consideration of control measures for remaining within the identified offset(s) at loading / unloading

General bulk load wagons are included in both aspects of the work, specific wagon types are included or excluded as indicated in the table below.

Wagon type	Aspect 1	Aspect 2	Comment
Used for carrying liquids	Excluded	Excluded	Liquids are assumed to flow appropriately on loading / unloading
Used for exceptional loads (eg military transport, nuclear flasks)	Excluded	Excluded	
Very small wagon fleets or very low distances travelled	Excluded	Excluded	
Wagons used to carry ISO demountable containers, regardless of the load being carried	Excluded	Partially included	The effect of offset loads has already been covered. Specific traffics, such as top-loaded aggregate etc, will be included in Aspect 2
Wagons specifically designed for infrastructure maintenance (eg ballast wagons with linked conveyors, S&C wagons)	Excluded	Excluded	These are specialised vehicles where specific loading instructions are needed
General purpose wagons used for infrastructure work, eg carrying ballast / spoil	Included	Excluded	Tolerable offsets will be assessed but control measures are outside this scope
Wagons used for very specific flows (eg steel coil, steel slab)	Included	Partially included	Existing loading rules to be assessed when tolerable offsets are understood