AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Track & Civil) **Category: Standard**

Ballast Stabilising Machines

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Applicability

New South Wales	✓	**CRIA (NSW CRN)**	

Primary Source

ARTC NSW Standard MDS 02 and Engineering Practice Manual RC 4707

Document Status

Version	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
1.1	18 Jun 10	Standards	Manager Standards	Exec Manager SS&P 21/06/2010	CEO

Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.0	01 Dec 09		Implementation draft. Supersedes NSW Standard MDS 02 v1.2 and Manual RC 4707 vA.0
1.1	18 Jun 10		Banner added regarding mandatory requirements in other documents and alternative interpretations.

Contents

Mandatory requirements also exist in other documents.

Where alternative interpretations occur, the Manager Standards shall be informed so the ambiguity can be removed. Pending removal of the ambiguity the interpretation with the safest outcome shall be adopted.

1 General

Ballast stabilising machines are designed to rearrange the relative position of track ballast in a controlled manner to reduce uncontrolled settlement and to improve both vertical and lateral stability of the track.

The machine grips both rails with rollers and creates in the rails and sleepers a horizontal lateral reciprocating action. This vibrating action combined with a controlled vertical loading induces in the ballast a similar action, which at critical frequencies causes the individual ballast stones to move relative to each other and to position themselves together to form the best mating fit. This stabilising action is, in effect, controlled settlement and is achieved very rapidly at rates varying from 500 to 1700 metres/hr.

One pass of the machine is approximately equivalent to 100,000 tonnes of rail traffic.

2 Operating Restrictions

Vibrating forces generated by the machine can be quite powerful and under certain conditions may excite critical vibration frequencies in nearby structures although most structures have critical frequencies in the low portion of the stabiliser's vibration range. For these reasons the machine should not be operated at frequencies below 40Hz over ballast top bridges.

When starting the vibration units they should be engaged onto the rails and brought up to the required vibrating frequency as quickly as possible. Conversely when stopping the vibration units they should be stopped as rapidly as possible. This will prevent any possible critical vibration frequency ranges from being prolonged. Starting and stopping the vibration units should occur only when the machine is moving.

In order to avoid possible damage to structures or the machine itself, the stabiliser should not be used:

- on any track with heavily fouled or cemented ballast;
- on transom top or open top bridges;
- on ballast top timber bridges and steel trough bridges;
- in tunnels;
- on track within 5m of multi-storey buildings;
- on concrete slab track and over pits;
- over any level crossing that has not been recently tamped;
- at locations near old or fragile signalling equipment as specified by a Signalling Engineer;
- through turnouts, crossovers and diamonds and similar locations where the track has not been recently tamped and then only with care and with the roll clamps open;
- through platforms where the ballast between sleeper ends and the platform wall is heavily fouled.

The stabiliser has less detrimental effects when operating on a slip site than a normal freight train, however ARTC may restrict its use depending on the sensitivity of each site.

3 Use of the Ballast Stabilising Machines

The ballast stabilising machine should finish its run-out ramp, ie, at zero pressure and vibrators turned off whilst moving, no closer than 10 metres from the nearest extremity of a bridge abutment or return wingwall. The reverse is to apply at the start of the operation, ie, when moving away from the structure.

The machine may operate over:

- brick or masonry underbridge spans over 5m long where the parapets directly contain the ballast (concrete bridges are OK);
- structurally sound masonry or other types of culverts less than 5 metres span but only if the culvert has a minimum of 1 metre cover between the top of the culvert and the underside of the ballast bed;
- modern pre-stressed concrete reinforced concrete or steel underbridge, only with concrete piers and abutments and only where these substructure elements have been constructed/renewed at the time of the deck construction.

This specification assumes bridge components are free of structural defects. If otherwise, the Manager Standards will specify appropriate operating requirements.

4 Conditions Required for Effective Stabilising of Track

To gain effective results from ballast stabilising machines the following conditions must apply:

- Ballast should be relatively clean and free flowing. The machine should not be used on heavily fouled or cemented ballasted track.
- Ballast must be disturbed prior to using the stabiliser so that it can flow under the actions of the machine. (For best results the track should be ballast cleaned and/or tamped prior to stabilising).
- The track must be regulated to fill cribs and form shoulders so that there is sufficient ballast to allow for ballast loss due to settlement of the ballast during the stabilising process.
- Rail to sleeper fastenings must be sound so that the horizontal oscillation generated by the machine can be transmitted through the rails and sleepers into the ballast.
- The track must be in the required position and to desired standard prior to stabilising. The machine can correct some minor faults in top and superelevation but is not designed to correct major faults in track geometry or poor quality after tamping.
- In order to obtain uniform consolidation and settlement the machine should be kept moving at a constant speed. It should also work far enough behind preceding machines so that its operation is not hampered by slower production machines or by any problems with the machines ahead.

5 Summary

Ballast stabilising machines have a relatively large mass (approx. 60 tonnes). This enables it to transmit the large vertical forces required into the track structure concurrently with horizontal oscillations of the track to produce a controlled settlement of the ballast.

The frequency of oscillation, vertical loading and machine work speed are variables which have an effect on the degree of stabilisation obtained. All three factors can be varied and monitored as required. The operation should be done taking into consideration the operating techniques and instructions issued by the manufacturer.