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| Ref:             | NR/L2/TRK/001/mod14 |
| Issue:           | 6                   |
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## Managing track in hot weather

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## Contents

|                                                                      |    |
|----------------------------------------------------------------------|----|
| 1 Scope                                                              | 4  |
| 2 Definitions                                                        | 4  |
| 3 Prevention of track buckles                                        | 4  |
| 3.1 General                                                          | 4  |
| 3.2 Sites that might be at risk of track buckle                      | 4  |
| 4 Maintenance work to be completed prior to hot weather              | 4  |
| Table 1 – Maintenance work to be completed prior to hot weather      | 5  |
| Table 2 – Dimensions of ballast shoulders ; CWR track                | 6  |
| Table 3 – Dimensions of ballast shoulders; jointed track             | 6  |
| 5 CRT (Critical rail temperature) Register                           | 7  |
| 5.1 General                                                          | 7  |
| 5.2 Sites to be recorded on the register                             | 7  |
| 5.3 Site Assessment                                                  | 7  |
| 5.4 Calculation of CRT for disturbed or deficient CWR track          | 8  |
| 5.4.1 Determination of Stress Free Temperature (SFT)                 | 8  |
| Table 4 – SFT values to be used for CRT calculations                 | 9  |
| 5.4.2 CRT(W) for CWR                                                 | 10 |
| Table 5 – Critical Rail Temperatures for “standard” CWR track        | 11 |
| Table 6 – CRT(W) adjustments for various track configurations        | 12 |
| 5.5 Calculation of CRT for disturbed or deficient jointed track      | 13 |
| 5.5.1 Calculation of joint closure temperature (JCT); full survey    | 13 |
| Table 7 – Cumulative expansion gap to be used to determine JCT       | 13 |
| 5.5.2 Calculation of joint closure temperature (JCT); partial survey | 13 |
| Table 8 – Joint Closure Temperature (JCT); Look-up table             | 14 |
| 5.5.3 CRT(W) for jointed track                                       | 15 |
| Table 9 – Critical Rail Temperatures for “standard” jointed track    | 16 |
| 6 Hot weather – Mitigation to be taken                               | 17 |
| 6.1 General                                                          | 17 |
| Table 10 – Hot weather site mitigation                               | 17 |
| 6.2 Watchman                                                         | 17 |
| 6.3 Speed restrictions                                               | 18 |

|                  |                     |
|------------------|---------------------|
| Ref:             | NR/L2/TRK/001/mod14 |
| Issue:           | 6                   |
| Date:            | 01 December 2012    |
| Compliance date: | 02 February 2013    |

|                                                                                        |    |
|----------------------------------------------------------------------------------------|----|
| 7 Additional precautions during exceptionally hot weather                              | 18 |
| Table 11 – Exceptionally hot weather restrictions                                      | 18 |
| 8 Work limitations during hot weather – CWR track                                      | 19 |
| 8.1 Limitations on work during hot weather on lines that are to remain open to traffic | 19 |
| Table 12 – Work limitations during hot weather; lines open to traffic (CWR)            | 19 |
| 8.2 Limitations on work during hot weather on lines under possession                   | 20 |
| Table 13 – Work limitations during hot weather; lines under possession (CWR)           | 20 |
| 9 Work limitations during hot weather – jointed track                                  | 21 |
| 9.1 Limitations on work during hot weather on lines that are to remain open to traffic | 21 |
| Table 14 – Work limitations during hot weather; lines open to traffic (jointed)        | 21 |
| 9.2 Limitations on work during hot weather on lines under possession                   | 22 |
| Table 15 – Work limitations during hot weather; lines under possession (jointed)       | 22 |
| 10 Reporting of track buckles                                                          | 22 |
| 10.1 Initial report                                                                    | 22 |
| 10.2 Full report                                                                       | 22 |

|                  |                     |
|------------------|---------------------|
| Ref:             | NR/L2/TRK/001/mod14 |
| Issue:           | 6                   |
| Date:            | 01 December 2012    |
| Compliance date: | 02 February 2013    |

## 1 Scope

This module of NR/L2/TRK/001 covers:

- a) prevention of track buckles;
- b) maintenance to be undertaken prior to the start of the hot weather period;
- c) calculation of Critical Rail Temperatures;
- d) mitigation to be taken during hot weather;
- e) mitigation to be taken during exceptionally hot weather;
- f) limitations on work to be undertaken during hot weather;
- g) reporting of track buckles.

*NOTE Detailed guidance for getting track ready for, and managing in, hot weather can be found in the 'Hot Weather Guidelines for Permanent Way' blue book (NR/GN/TRK/8000/1).*

## 2 Definitions

See Glossary (NR/L2/TRK/001/mod01).

## 3 Prevention of track buckles

### 3.1 General

Track is managed to reduce the risk of track buckles during hot weather.

### 3.2 Sites that might be at risk of track buckle

A buckle is not created solely by hot weather. Buckles are triggered by the presence of at least one other factor (a disturbance, a deficiency or incomplete preparatory maintenance work). The most common are:

- a) ballast disturbance (e.g. tamping, stoneblowing or opening out);
- b) ballast deficiency (e.g. insufficient ballast in the cribs or on the shoulder);
- c) seized joints (e.g. over tightened fishbolts, lack of lubrication);
- d) rail creep;
- e) low joint closure temperature (because expansion gaps are too small);
- f) a low stress free temperature;
- g) poor top and/or line (e.g. voiding sleepers, misalignments);
- h) sleeper changing.

## 4 Maintenance work to be completed prior to hot weather

Table 1 contains a list of maintenance work to be completed prior to the hot weather period.

Each year the Infrastructure Maintenance Engineer (IME) shall set the date by which all hot weather preparation work is to be completed.

|                  |                     |
|------------------|---------------------|
| Ref:             | NR/L2/TRK/001/mod14 |
| Issue:           | 6                   |
| Date:            | 01 December 2012    |
| Compliance date: | 02 February 2013    |

**Table 1 – Maintenance work to be completed prior to hot weather**

| Work element or deficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Requirement                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ballast profile                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Confirm that the ballast profile is compliant to Table 2 or Table 3.<br>Deficient sites to be made good and recorded in the CRT register.                                                                                                                                               |
| Rail lubrication                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Lubricate fishplates, nuts, bolts and fishing surfaces of the rail ends.                                                                                                                                                                                                                |
| Rail adjusting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Rail adjust (regulate rails) on sites :<br>a) subject to rail creep,<br>b) with irregular expansion gaps,<br>c) if the joint closure temperature (JCT) is found to be below 38°C.                                                                                                       |
| Rail anchors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Fit in locations where rail creep is likely to be problem                                                                                                                                                                                                                               |
| Jointed rails in excess of 100ft (30m)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Consider providing additional joints.<br>Pay particular attention to ballast profile.                                                                                                                                                                                                   |
| Adjustment switches                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Check gaps and overlaps are within tolerance (see NR/L2/TRK/001/mod16). Reset if required.<br>Lubricate accessible sliding contact surfaces once a year                                                                                                                                 |
| S&C or jointed plain line abutting CWR at an adjustment switch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Maintain fastenings in good order.<br>Extend CWR ballast profile into jointed track for at least 90m.                                                                                                                                                                                   |
| Voids and minor misalignments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Repair, particularly at or adjacent to welded joints, insulated joints, catch points, S&C, underline bridges (especially those with longitudinal timbers) and level crossings.                                                                                                          |
| Insulated joints                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Inspect. Remove any rail-end lipping. Renew worn insulation and replace damaged end-posts.<br>Confirm high-tensile bolts are fitted and the correct torque of 880Nm (650lbft) applied.                                                                                                  |
| Switch diamonds                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Inspect. Switch rails should be 115 + 3mm from the knuckle when the rail temperature is 20°C (see note 1).                                                                                                                                                                              |
| Ball and Claw                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Record the position of the Ball relative to the Claw and the rail temperature. Check tightness (to the correct torque) of the Ball and Claw bolts.<br>Check that in hot weather the Ball is towards the toes (at rail temperatures higher than 27°C).                                   |
| Stressing:<br>“Stress Unknown” sites<br><br>“Stress Required” sites                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Produce a dated and resourced programme to re-stress, or to measure the SFT, of all CWR track within this classification.<br><br>Plan to re-stress of all such sites in CWR track. Sites with the lowest critical rail temperature (CRT) should have the highest priority (see note 2). |
| <b>Notes:</b><br>1 A change in rail temperature of 15°C will alter the length of the switch rail and its clearance to the knuckle by 1mm (for normal grade steels) and 1.5mm (for manganese steels). Switch diamonds with a history of detection failure may require the installation of adjustment switches to reduce the thermal forces and limit switch rail movement relative to the knuckle.<br>2 Obtaining valid stressing records for “Stress Required” sites should normally take priority over similar work on “Stress Unknown” sites. |                                                                                                                                                                                                                                                                                         |

|                  |                     |
|------------------|---------------------|
| Ref:             | NR/L2/TRK/001/mod14 |
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| Date:            | 01 December 2012    |
| Compliance date: | 02 February 2013    |

| Table 2 – Dimensions of ballast shoulders ; CWR track                                                                                                                                              |                    |                                              |                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------|--------------------------------------------|
| Location                                                                                                                                                                                           |                    | Minimum width of shoulder <sup>1</sup><br>mm | Height of shoulder above sleeper top<br>mm |
| Straight track, curves over 2000 m radius                                                                                                                                                          | Speed over 125mph  | 450                                          | 125 in all cases <sup>3</sup>              |
|                                                                                                                                                                                                    | Speed up to 125mph | 375                                          |                                            |
| Curved track with radius 2000m or less                                                                                                                                                             |                    | 450                                          |                                            |
| Any discontinuity <sup>2</sup>                                                                                                                                                                     |                    | 450                                          |                                            |
| Curved track with radius between 500-351m (steel sleepers only)                                                                                                                                    |                    | 600                                          |                                            |
| <b>Notes:</b>                                                                                                                                                                                      |                    |                                              |                                            |
| 1 The width of the ballast shoulder is measured outside the sleeper ends, at sleeper-top level.                                                                                                    |                    |                                              |                                            |
| 2 Discontinuities include insulated joints, adjustment switches, abutting toes of S&C and catch points. The wider shoulder shall apply over not fewer than 10 bays each side of the discontinuity. |                    |                                              |                                            |
| 3 No greater than 200mm. A minimum clearance of 50mm must be maintained around conductor rail and insulator pots.                                                                                  |                    |                                              |                                            |

Note: Table reproduced from NR/L2/TRK/2102

| Table 3 – Dimensions of ballast shoulders; jointed track                                                                                                                                                                                                                                                                       |                                 |                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------|
| Length of rail between expansion joints                                                                                                                                                                                                                                                                                        | Minimum width of shoulder<br>mm | Height of shoulder above sleeper<br>mm |
| Up to 30m (98ft)                                                                                                                                                                                                                                                                                                               | 300                             | 0                                      |
| Longer than 30m (98ft) <sup>1</sup>                                                                                                                                                                                                                                                                                            | 375                             | 125 <sup>2, 3</sup>                    |
| <b>Notes:</b> <ol style="list-style-type: none"> <li>1 Rails longer than 36m (120ft) are treated as CWR.</li> <li>2 This profile is also required for the first 90m of jointed track from an adjustment switch.</li> <li>3 A minimum clearance of 50mm must be maintained around conductor rail and insulator pots.</li> </ol> |                                 |                                        |

Note: This table also appears in NR/L2/TRK/001/mod03

|                  |                     |
|------------------|---------------------|
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| Compliance date: | 02 February 2013    |

## 5 CRT (Critical rail temperature) Register

### 5.1 General

Maintain a register of sites (a 'CRT register') that are deficient or disturbed.

Include in the register site location details and rail temperatures at which mitigation (see section 6) is to be applied.

### 5.2 Sites to be recorded on the register

Use the CRT Register to record all hot weather sites as detailed below:

- a) all unstressed CWR sites ('stress required');
- b) all CWR sites without stress records ('stress unknown');
- c) all disturbed or deficient sites covered by Table 5 and Table 9, including the additional CRT(W) reductions from Table 6 where appropriate;
- d) all full depth flat bottom S&C on timber bearers with a line speed of 100mph or above (with the CRT(W) reduction from Table 6 applied);
- e) curve locations with rails in excess of 30m without lateral restraint (see NR/L2/TRK/001/mod03);
- f) sites where work that has been identified for completion prior to the hot weather period may not, or will not, be completed by the required finish date (see section 4);
- g) unconsolidated lineside works (e.g. drainage, cable or cess works);
- h) sites with active subsidence;
- i) misalignments, particularly at welded or insulated joints;
- j) sites of known rail creep;
- k) level crossings where voiding sleepers are present.

Disturbed sites shall remain on the CRT Register until the stress has been restored and/or the specified period of time required for ballast consolidation has elapsed.

The responsibility for sites disturbed or deficient due to Renewal or Project activities should be established and agreed as part of the AMP process (NR/L2/MTC/088 - Arrangements for maintenance of new and changed assets).

### 5.3 Site Assessment

Complete a site assessment for all sites where work that could affect track stability has been undertaken.

This process should include a review of all work undertaken prior to the hot weather season, which disturbed the track and which cannot yet be considered as fully consolidated (e.g. wet bed removal or sleeper changing – see Tables 5 and 9).

Record this site assessment on TEF3207.

Calculate the CRT for these sites.