

## APPENDIX A - TIMBER SLEEPER USAGE – INFORMATIVE

Table A1 provides information on timber sleepers that have been used on Australian standard gauge mainlines.

**TABLE A1 TIMBER SLEEPER USAGE ON AUSTRALIAN MAINLINES**

<b>State</b>	<b>Sleeper Dimensions (LxBxD)</b>	<b>Sleeper Spacing (mm)</b>	<b>Axle Load (tonnes)</b>
New South Wales	2440 x 230 x 127	600	25
Western Australia	2500 x 235 x 130	610	21
Victoria	2590 x 254 x 127	685	20
South Australia	2400 x 230 x 115	665	20

The sleeper sizes shown in Table A1 are only relevant to sleepers made from high durability and high strength timbers.

**NOTES:**

[1] Sleeper spacing is not the only criteria for determining axle load capacity.

[2] This Table does not apply to timber bearers.

## APPENDIX B - CLEARANCE DESIGN PROCEDURES

### B1 STATIC ROLLINGSTOCK OUTLINE

The static rollingstock outline for the rollingstock operating on a track section should be determined in conjunction with operators.

The static rollingstock outline should be met by the rollingstock under all maintenance and loading conditions (eg. at all wheel diameters in the range for new and condemnable worn wheels).

### B2 VEHICLE SWEEP PATH

The centre throw (C in mm) and end throw (E in mm) of rollingstock on circular curved track may be calculated as follows:

$$C = B^2 / 8R \quad \dots \text{ (Eq. B1)}$$

and

$$E = (L^2 - B^2) / 8R \quad \dots \text{ (Eq. B2)}$$

where:

B = length between pivot centres of bogies (mm)

L = overall length of vehicle (mm)

R = radius of curve (mm)

The swept path should be based on the static rollingstock outlines operating on the section of track under consideration as follows:

- (a) On straight (tangent) track the swept path should not be less than the static outlines of the rollingstock.
- (b) On circular curved track down to 100m radius the swept path should not be less than the static outlines of the rollingstock plus allowance made for centre and end throw.

### B3 TRACK TOLERANCES

Track tolerances should be determined for the line section being considered for the following:

- (a) Rail side wear.
- (c) Gauge widening on curved track.
- (d) Gauge from 1435 mm.
- (e) Track alignment from design.
- (f) Cross level from design.
- (g) Rail level from design.

*NOTE: The design track position should be known as well as these tolerances.*

**B4 DYNAMIC ROLLINGSTOCK LIMITS**

The dynamic rollingstock limits should be determined in conjunction with Operators for the following displacements:

- (a) Linear, to each side of the vehicle centreline and parallel to the plane of the top of the rails for lateral translation and for wheel clearance (worn wheel to new rail).
- (b) Angular, clockwise and anti-clockwise about the roll centre, for body roll.
- (c) Upward linear displacement normal to the plane of the top of the rails, for bounce.

**B5 MAXIMUM KINEMATIC ROLLINGSTOCK OUTLINE**

The kinematic envelope for an item of rollingstock should represent the largest possible profile it can assume under the most adverse conditions.

It should be determined for the particular track section using the following procedures:

- (a) Determine the static rollingstock outline (on straight, uncanted track) for the rollingstock operating on the line section.
- (b) For each point on the static rollingstock outline, apply horizontal displacements to widen the outline on each side of its vertical centreline for—
  - (i) rollingstock lateral translation;
  - (ii) wheel clearance (worn wheel to new rail);
  - (iii) rail side wear;
  - (iv) gauge widening of the track;
  - (v) gauge tolerance of the track; and
  - (vi) centre and end throw of the rollingstock on curved track.
- (c) From Step (b), apply vertical displacements to extend the outline vertically for rollingstock bounce.
- (d) From Step (c), apply angular displacements about the point of cant rotation for cant.
- (e) From Step (d), apply angular displacements about the left hand rail for cross level tolerance.
- (f) From Step (d), apply angular displacements about the right hand rail for cross level tolerance.
- (g) From Steps (e) and (f), apply angular displacements about the roll centre of the vehicle for body roll. (In the case of tilt trains, apply additional angular displacements about the tilt centre for body tilt.)
- (h) From Steps (e), (f) and (g), apply horizontal displacements for track alignment tolerances, and vertical displacements for rail level tolerances.
- (i) The maximum envelope from steps (e), (f), (g) and (h) defines the maximum kinematic rollingstock outline.

**B6 CONTINGENCY GAP PROVISION**

The provision of a contingency air gap between the maximum kinematic rollingstock outline and structures (or maximum kinematic rollingstock outlines on adjacent tracks, see Note) should take into account the following:

- (a) Structure outlines.
- (b) Inspection intervals.

- (c) Variations in and rates of change of the parameters used to determine the maximum kinematic rollingstock outline.
- (d) Potential for movement of the structure.

*NOTE: For a given line section the maximum kinematic rollingstock outline on an adjacent line may be treated in a similar way to a structure over the line.*

## **B7 STRUCTURE OUTLINE**

A contingency gap should be added to the maximum kinematic rollingstock outline to define the structure outline for clearances to structures or to the maximum kinematic rollingstock outline on adjacent tracks.

This contingency gap should provide an additional safety margin such that scheduled inspections are not considered necessary for structures (or maximum kinematic rollingstock outlines on adjacent tracks) which fall outside this outline.

## APPENDIX C - GUIDELINES FOR BRIDGE INSPECTIONS

### C1 INSPECTION REPORTS

Inspection reports should contain some or all of the following:

- (a) Clear, concise, accurate written statements summarising the condition of each element of the structure describing defects.
- (b) Sketches detailing the nature and extent of significant defects.
- (c) Photographs showing the general structure and all significant defects.
- (d) Recommended rehabilitation measures, and set priorities with target dates for completion.

### C2 GENERAL INSPECTIONS

During general inspections of bridges the following items should be checked:

- (a) Barrier rails for damage.
- (b) Track top and alignment over the bridge.
- (c) Bridge drainage for accumulations of debris on the deck, in gutters and scuppers which may obstruct free drainage and cause ponding.
- (d) Deck joints for loose, missing or damaged bolts and components, free movement and proper functioning.
- (e) Deck, girders, piers, abutments, braces, abutment sheeting and wing walls for looseness and major damage such as cracking, splitting, distortion, fire and excessive movement. Obvious defects such as spalling, cracking, staining, dampness, corrosion or excessive vibration in any component.
- (f) Timber members for termite activity, rotting, marine borer and other insect attack.
- (g) Iron and steel elements for noticeable build up of deposits of aggressive salts, dirt, silt, debris and bird droppings.
- (h) Masonry elements for growth in joints between blocks.
- (i) Propping for tightness of wedges.
- (j) Cathodic protection systems to ensure correct functioning.
- (k) Bearing sills and substructure drains for accumulations of debris which may obstruct free drainage and cause ponding.
- (l) Weep holes in abutments and retaining walls for free drainage.
- (m) Embankments for erosion and scour.
- (n) Batter protection for damage and undermining by scour.
- (o) Waterways under the bridge for accumulations of debris, vegetation growth, silting and scour.

### C3 DETAILED EXAMINATION

Detailed examinations should include all of the items under Paragraph C2 and the requirements under Section 3.8 of the AUSTRoads Bridge Management Practice 1991.

## APPENDIX D - RAILWAY SIGNS SCHEDULED INSPECTION FORM AND CHECKLIST

### D1 GENERAL

A sample railway signage inspection form is shown in Figure D1. The register of permanent signs should contain information from which the first two columns can be filled in in advance and subsequently checked during the inspection.

A listing of temporary signs (eg. speed restrictions effective at date of inspection) should also be checked during scheduled inspections.

Railway Signage Inspection Form											
Location:											
Line Section From ..... at..... km To ..... at .....km											
Weather Conditions:- <i>Tick (✓) after appropriate conditions</i>											
Bright Sunshine		Fine/Clear		Cloudy		Light/Med Rain		Heavy Rain/Fog		Night Time	
km	Sign Site	Characteristics to Specification?	Installed to Specification?	Visible and Conspicuous?	Other Problem?	Comment on Problems					
10.02	Permanent 60k Speed Boards										
11.20	Permanent 40k Speed Boards										
12.50	Level X-ing Warning Board										
etc.											
Action has been taken to correct problems identified and no further action is required .....											
Describe any actions required to restore sign condition or performance:-											
Additional Comments:-											
Inspected by:- ..... Signature:- ..... Title:- .....											
Time/Date Inspected:- .....am/pm ...../...../.....											

**FIGURE D1 SAMPLE RAILWAY SIGNAGE INSPECTION FORM**

**D2 SUGGESTED SIGN INSTALLATION CHECKLIST**

When filling in the remaining columns on the inspection form the following check list should be used:

(a) Are sign characteristics to specification? For example:-

- (i) correct sign (lettering/message/colour);
- (ii) shape/size;
- (iii) reflectorization;
- (iv) sign support.

Record a tick or cross in the *third* column.

(b) Is the sign installed to specification? For example:-

- (v) facing correct direction;
- (vi) position along the track;
- (vii) side of track (left, right, both);
- (viii) distance from track;
- (ix) height relative to track;
- (x) inclination.

Record a tick or cross in the *fourth* column.

(c) Is the sign visible and conspicuous? For example:-

- (xi) line of site to specification;
- (xii) sign legible at required sight distance;
- (xiii) damaged;
- (xiv) missing;
- (xv) sign obstructed or potential for obstruction.

Record a tick or cross in the *fifth* column.

(d) Have other problems or potential problems been identified? For example:-

- (xvi) sun-glare;
- (xvii) background;
- (xviii) day/night visibility.

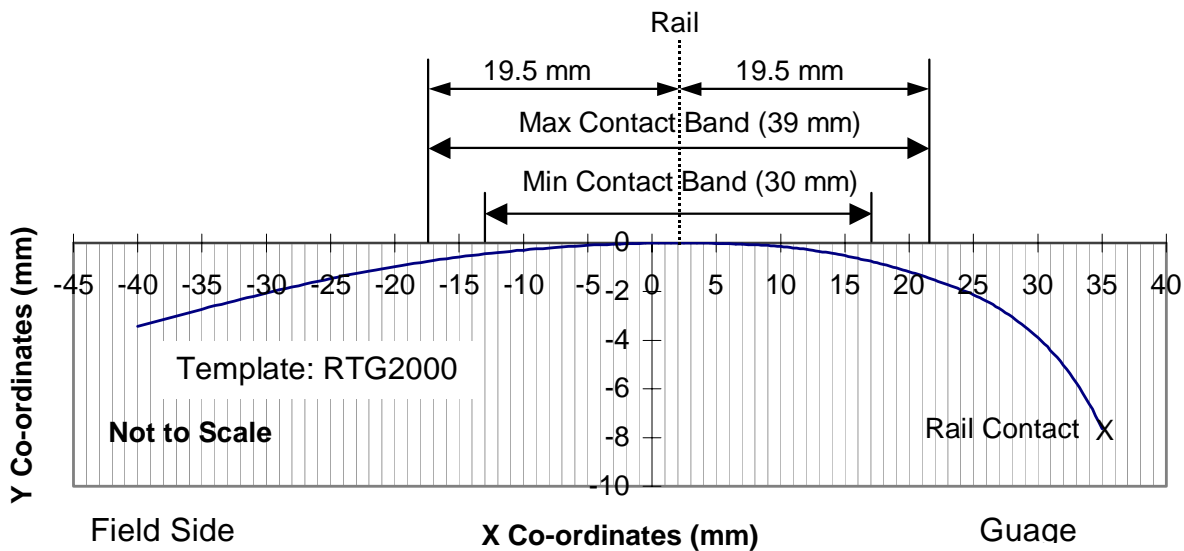
Record a cross in the *sixth* column if there are other problems.

(e) Use the *seventh* column to tick if no further action required, or to record details if action is required.

## APPENDIX E - Target Rail Profiles for Grinding

### E1 TANGENT AND SHOULDER CURVES (>1000 m RADIUS) RAIL GRINDING TEMPLATE (RTG2000)

#### Tangent Rail Grinding Template RTG2000



Note: Rail Centreline corresponds to (+2.0, 0.0) point on template

#### X-Y Co-ordinates

X	Y	X	Y	X	Y	X	Y
-40	-3.42						
-35	-2.72	-10.5	-0.31	10.75	-0.18	23	-1.71
-34.5	-2.65	-10	-0.29	11	-0.2	23.25	-1.76
-34	-2.58	-9.5	-0.26	11.25	-0.21	23.5	-1.81
-33.5	-2.52	-9	-0.24	11.5	-0.23	23.75	-1.86
-33	-2.45	-8.5	-0.22	11.75	-0.24	24	-1.91
-32.5	-2.39	-8	-0.2	12	-0.26	24.25	-1.96
-32	-2.32	-7.5	-0.18	12.25	-0.28	24.5	-2.02
-31.5	-2.25	-7	-0.16	12.5	-0.3	24.75	-2.07
-31	-2.19	-6.5	-0.14	12.75	-0.32	25	-2.13
-30.5	-2.12	-6	-0.13	13	-0.34	25.25	-2.19
-30	-2.06	-5.5	-0.11	13.25	-0.36	25.5	-2.25
-29.5	-1.99	-5	-0.1	13.5	-0.38	25.75	-2.32
-29	-1.93	-4.5	-0.08	13.75	-0.4	26	-2.39



-28.5	-1.87	-4	-0.07	14	-0.42	26.25	-2.46
-28	-1.81	-3.5	-0.06	14.25	-0.45	26.5	-2.53
-27.5	-1.75	-3	-0.05	14.5	-0.47	26.75	-2.61
-27	-1.69	-2.5	-0.04	14.75	-0.49	27	-2.69
-26.5	-1.63	-2	-0.03	15	-0.52	27.25	-2.78
-26	-1.57	-1.5	-0.02	15.25	-0.55	27.5	-2.86
-25.5	-1.52	-1	-0.02	15.5	-0.57	27.75	-2.95
-25	-1.46	-0.5	-0.01	15.75	-0.6	28	-3.04
-24.5	-1.41	0	-0.01	16	-0.63	28.25	-3.14
-24	-1.35	0.5	0	16.25	-0.66	28.5	-3.24
-23.5	-1.3	1	0	16.5	-0.69	28.75	-3.34
-23	-1.25	1.5	0	16.75	-0.72	29	-3.44
-22.5	-1.2	2	0	17	-0.75	29.25	-3.55
-22	-1.15	2.5	0	17.25	-0.78	29.5	-3.66
-21.5	-1.11	3	0	17.5	-0.81	29.75	-3.77
-21	-1.06	3.5	0	17.75	-0.85	30	-3.89
-20.5	-1.01	4	-0.01	18	-0.88	30.25	-4.01
-20	-0.97	4.5	-0.01	18.25	-0.91	30.5	-4.14
-19.5	-0.93	5	-0.02	18.5	-0.95	30.75	-4.27
-19	-0.88	5.5	-0.02	18.75	-0.99	31	-4.41
-18.5	-0.84	6	-0.03	19	-1.02	31.25	-4.55
-18	-0.8	6.5	-0.04	19.25	-1.06	31.5	-4.7
-17.5	-0.76	7	-0.05	19.5	-1.1	31.75	-4.85
-17	-0.72	7.5	-0.06	19.75	-1.14	32	-5.02
-16.5	-0.68	7.75	-0.07	20	-1.18	32.25	-5.19
-16	-0.65	8	-0.07	20.25	-1.22	32.5	-5.36
-15.5	-0.61	8.25	-0.08	20.5	-1.26	32.75	-5.55
-15	-0.58	8.5	-0.09	20.75	-1.3	33	-5.74
-14.5	-0.54	8.75	-0.09	21	-1.34	33.25	-5.95
-14	-0.51	9	-0.1	21.25	-1.39	33.5	-6.16
-13.5	-0.48	9.25	-0.11	21.5	-1.43	33.75	-6.38
-13	-0.45	9.5	-0.12	21.75	-1.47	34	-6.61
-12.5	-0.42	9.75	-0.13	22	-1.52	34.25	-6.83
-12	-0.39	10	-0.14	22.25	-1.57	34.5	-7.1
-11.5	-0.36	10.25	-0.16	22.5	-1.61	34.75	-7.37
-11	-0.34	10.5	-0.17	22.75	-1.66	35	-7.64

**NOTES:**

[1] The profile has been specified for a free standing rail centreline using the above coordinate system incorporating the rail centreline. Therefore when producing rail profile templates a cant adjustment of 1:20 (2.86°) clockwise rotation must be added so that the profile is referenced perpendicular to the track plane.

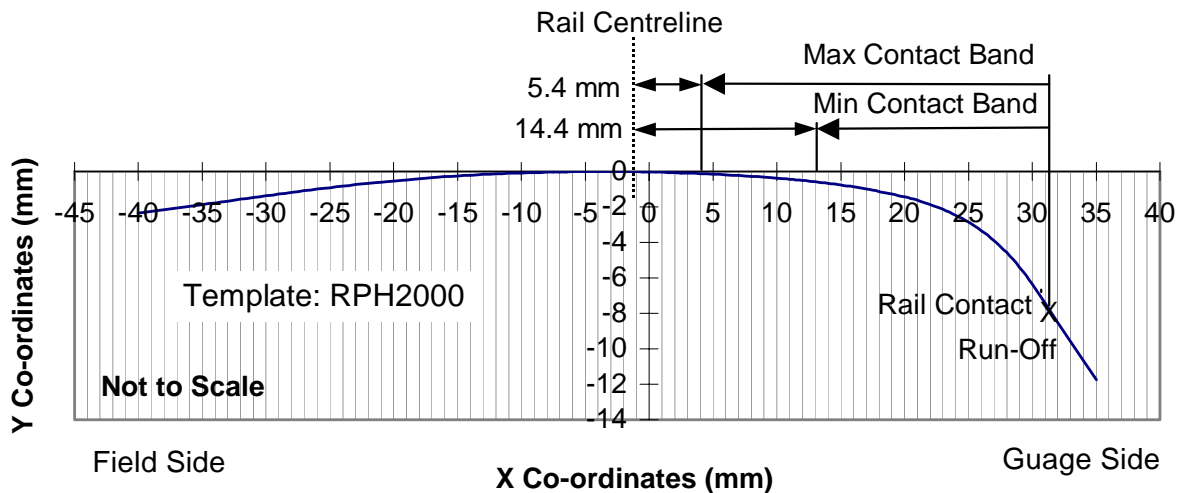
[2] The X co-ordinates on the templates corresponding to the contact bands are:

-17.5 to +21.5 (maximum)

-13.0 to +17.0 (minimum)

## E2 HIGH RAIL GRINDING TEMPLATE (RPH2000) FOR TRACK WITH MAINLY PASSENGER TRAFFIC

### High Rail Grinding Template RPH2000



Note: Rail Centreline corresponds to (-1.3, 0.0) point on template

#### X-Y Co-ordinates

X	Y	X	Y	X	Y	X	Y
-40	-2.35						
-35	-1.86	-13	-0.17	9	-0.32	20.75	-1.57
-34.5	-1.81	-12.5	-0.15	9.5	-0.35	21	-1.62
-34	-1.77	-12	-0.14	10	-0.38	21.25	-1.68
-33.5	-1.72	-11.5	-0.12	10.5	-0.4	21.5	-1.74
-33	-1.67	-11	-0.11	10.75	-0.42	21.75	-1.8
-32.5	-1.62	-10.5	-0.09	11	-0.43	22	-1.86
-32	-1.57	-10	-0.08	11.25	-0.45	22.25	-1.93
-31.5	-1.52	-9.5	-0.07	11.5	-0.47	22.5	-1.99
-31	-1.47	-9	-0.06	11.75	-0.48	22.75	-2.07
-30.5	-1.43	-8.5	-0.05	12	-0.5	23	-2.14
-30	-1.38	-8	-0.04	12.25	-0.52	23.25	-2.22
-29.5	-1.33	-7.5	-0.03	12.5	-0.54	23.5	-2.3
-29	-1.28	-7	-0.02	12.75	-0.56	23.75	-2.38
-28.5	-1.23	-6.5	-0.02	13	-0.58	24	-2.47
-28	-1.18	-6	-0.01	13.25	-0.6	24.25	-2.56
-27.5	-1.13	-5.5	-0.01	13.5	-0.62	24.5	-2.65
-27	-1.09	-5	0	13.75	-0.64	24.75	-2.75

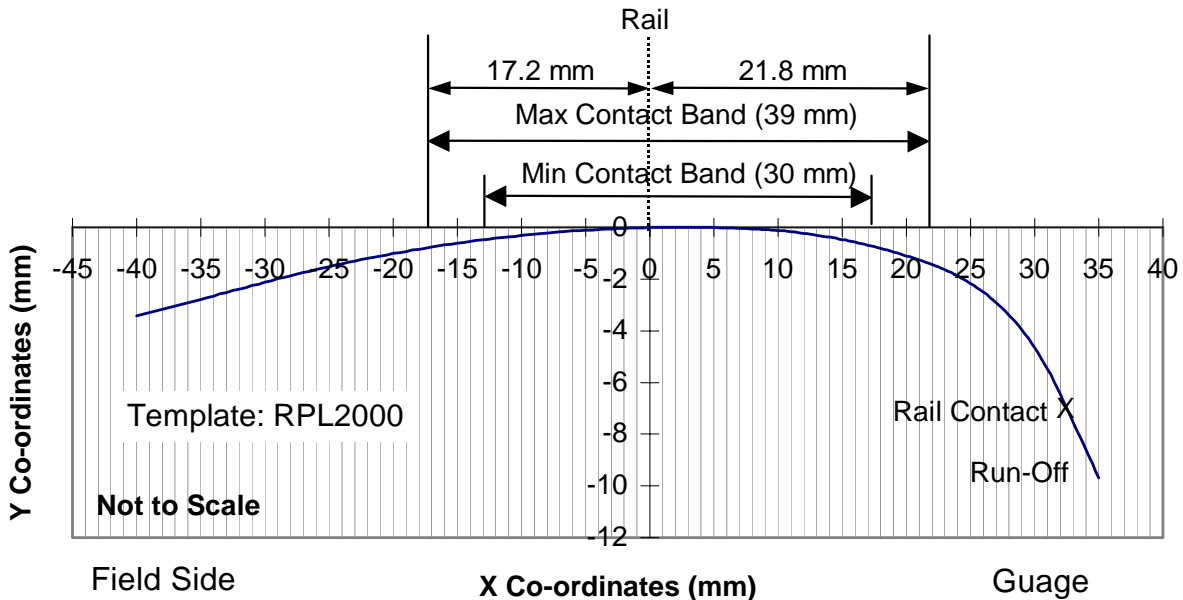
-26.5	-1.04	-4.5	0	14	-0.66	25	-2.85
-26	-0.99	-4	0	14.25	-0.69	25.25	-2.96
-25.5	-0.95	-3.5	0	14.5	-0.71	25.5	-3.08
-25	-0.91	-3	0	14.75	-0.74	25.75	-3.2
-24.5	-0.86	-2.5	0	15	-0.76	26	-3.33
-24	-0.82	-2	-0.01	15.25	-0.79	26.25	-3.46
-23.5	-0.78	-1.5	-0.01	15.5	-0.82	26.5	-3.6
-23	-0.74	-1	-0.01	15.75	-0.84	26.75	-3.75
-22.5	-0.71	-0.5	-0.02	16	-0.87	27	-3.9
-22	-0.67	0	-0.03	16.25	-0.9	27.25	-4.06
-21.5	-0.63	0.5	-0.04	16.5	-0.93	27.5	-4.22
-21	-0.6	1	-0.04	16.75	-0.96	27.75	-4.4
-20.5	-0.56	1.5	-0.05	17	-0.99	28	-4.58
-20	-0.53	2	-0.07	17.25	-1.03	28.25	-4.77
-19.5	-0.5	2.5	-0.08	17.5	-1.06	28.5	-4.96
-19	-0.47	3	-0.09	17.75	-1.09	28.75	-5.17
-18.5	-0.44	3.5	-0.1	18	-1.13	29	-5.39
-18	-0.41	4	-0.12	18.25	-1.16	29.25	-5.61
-17.5	-0.38	4.5	-0.14	18.5	-1.2	29.5	-5.85
-17	-0.35	5	-0.15	18.75	-1.23	29.75	-6.09
-16.5	-0.33	5.5	-0.17	19	-1.27	30	-6.35
-16	-0.3	6	-0.19	19.25	-1.31	31	-7.43
-15.5	-0.28	6.5	-0.21	19.5	-1.35	32	-8.51
-15	-0.25	7	-0.23	19.75	-1.39	33	-9.59
-14.5	-0.23	7.5	-0.25	20	-1.43	34	-10.66
-14	-0.21	8	-0.27	20.25	-1.47	35	-11.74
-13.5	-0.19	8.5	-0.3	20.5	-1.52		

**NOTES:**

- [1] The profile has been specified for a free standing rail centreline using the above coordinate system incorporating the rail centreline. Therefore when producing rail profile templates a cant adjustment of 1:20 (2.86°) clockwise rotation must be added so that the profile is referenced perpendicular to the track plane.
- [2] The contact bands have been determined for new rails. Their location relative to the rail centreline will change as gauge face wear occurs.
- [3] The X co-ordinates on the templates corresponding to the contact bands are +4.1 (maximum) and +13.1 (minimum).

**E3 LOW RAIL GRINDING TEMPLATE (RPL2000) FOR TRACK WITH MAINLY PASSENGER TRAFFIC**

**Low Rail Grinding Template RPL2000**



Note: Rail Centreline corresponds to (0.0, 0.0) point on template

**X-Y Co-ordinates**

X	Y	X	Y	X	Y	X	Y
-40	-3.43						
-35	-2.78	-10.5	-0.34	11	-0.17	23.25	-1.69
-34.5	-2.72	-10	-0.31	11.25	-0.18	23.5	-1.75
-34	-2.65	-9.5	-0.29	11.5	-0.2	23.75	-1.82
-33.5	-2.58	-9	-0.26	11.75	-0.21	24	-1.88
-33	-2.52	-8.5	-0.24	12	-0.23	24.25	-1.95
-32.5	-2.45	-8	-0.22	12.25	-0.24	24.5	-2.02
-32	-2.39	-7.5	-0.2	12.5	-0.26	24.75	-2.1
-31.5	-2.32	-7	-0.18	12.75	-0.28	25	-2.17
-31	-2.25	-6.5	-0.16	13	-0.3	25.25	-2.25
-30.5	-2.19	-6	-0.14	13.25	-0.32	25.5	-2.34
-30	-2.12	-5.5	-0.13	13.5	-0.34	25.75	-2.42
-29.5	-2.06	-5	-0.11	13.75	-0.36	26	-2.51
-29	-1.99	-4.5	-0.1	14	-0.38	26.25	-2.6
-28.5	-1.93	-4	-0.08	14.25	-0.4	26.5	-2.7
-28	-1.87	-3.5	-0.07	14.5	-0.42	26.75	-2.8
-27.5	-1.81	-3	-0.06	14.75	-0.45	27	-2.91
-27	-1.75	-2.5	-0.05	15	-0.47	27.25	-3.02

-26.5	-1.69	-2	-0.04	15.25	-0.49	27.5	-3.14
-26	-1.63	-1.5	-0.03	15.5	-0.52	27.75	-3.26
-25.5	-1.57	-1	-0.02	15.75	-0.55	28	-3.39
-25	-1.52	-0.5	-0.02	16	-0.57	28.25	-3.52
-24.5	-1.46	0	-0.01	16.25	-0.6	28.5	-3.66
-24	-1.41	0.5	-0.01	16.5	-0.63	28.75	-3.81
-23.5	-1.35	1	0	16.75	-0.66	29	-3.97
-23	-1.3	1.5	0	17	-0.69	29.25	-4.13
-22.5	-1.25	2	0	17.25	-0.72	29.5	-4.3
-22	-1.2	2.5	0	17.5	-0.75	29.75	-4.47
-21.5	-1.15	3	0	17.75	-0.78	30	-4.66
-21	-1.11	3.5	0	18	-0.81	30.25	-4.85
-20.5	-1.06	4	0	18.25	-0.85	30.5	-5.05
-20	-1.01	4.5	-0.01	18.5	-0.88	30.75	-5.26
-19.5	-0.97	5	-0.01	18.75	-0.91	31	-5.48
-19	-0.93	5.5	-0.02	19	-0.95	31.25	-5.7
-18.5	-0.88	6	-0.02	19.25	-0.99	31.5	-5.94
-18	-0.84	6.5	-0.03	19.5	-1.02	31.75	-6.2
-17.5	-0.8	7	-0.04	19.75	-1.06	32	-6.46
-17	-0.76	7.5	-0.05	20	-1.1	32.25	-6.73
-16.5	-0.72	8	-0.06	20.25	-1.14	32.5	-7
-16	-0.68	8.25	-0.07	20.5	-1.18	32.75	-7.27
-15.5	-0.65	8.5	-0.07	20.75	-1.22	33	-7.54
-15	-0.61	8.75	-0.08	21	-1.26	33.25	-7.81
-14.5	-0.58	9	-0.09	21.25	-1.3	33.5	-8.08
-14	-0.54	9.25	-0.09	21.5	-1.34	33.75	-8.34
-13.5	-0.51	9.5	-0.1	21.75	-1.39	34	-8.61
-13	-0.48	9.75	-0.11	22	-1.43	34.25	-8.88
-12.5	-0.45	10	-0.12	22.25	-1.48	34.5	-9.15
-12	-0.42	10.25	-0.13	22.5	-1.53	34.75	-9.42
-11.5	-0.39	10.5	-0.14	22.75	-1.58	35	-9.69
-11	-0.36	10.75	-0.16	23	-1.63		

**NOTES:**

[1] The profile has been specified for a free standing rail centreline using the above coordinate system incorporating the rail centreline. Therefore when producing rail profile templates a cant adjustment of 1:20 (2.86°) clockwise rotation must be added so that the profile is referenced perpendicular to the track plane.

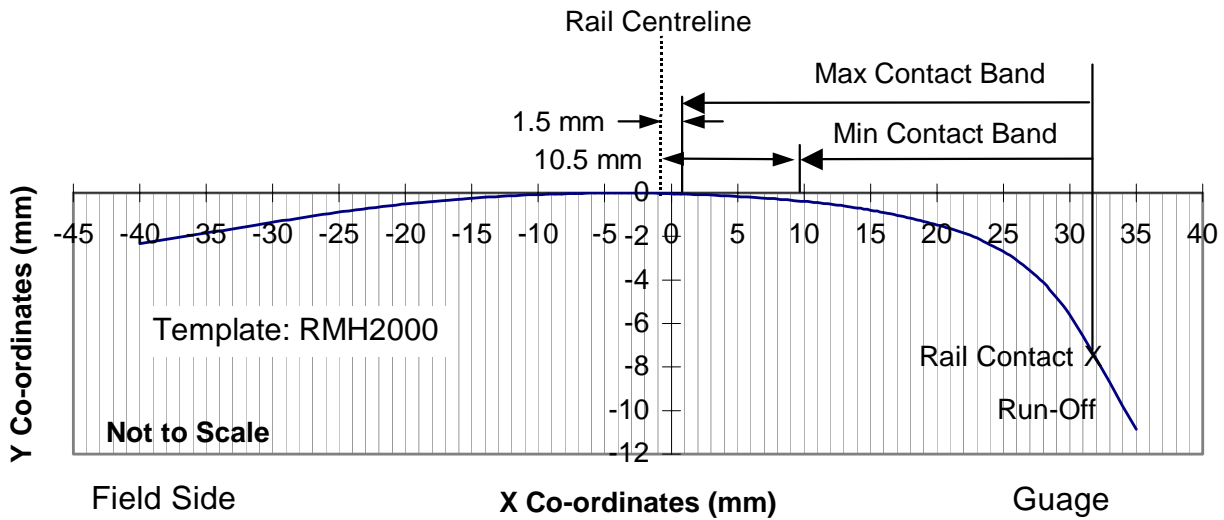
[2] The X co-ordinates on the templates corresponding to the contact bands are:

-17.2 to +21.8 (maximum)

-12.7 to +17.3 (minimum)

**E4 HIGH RAIL GRINDING TEMPLATE (RMH2000) FOR TRACK WITH MAINLY FREIGHT OR COAL TRAFFIC**

**High Rail Grinding Template RMH2000**



Note: Rail Centreline corresponds to (-0.8, 0.0) point on template

**X-Y Co-ordinates**

X	Y	X	Y	X	Y	X	Y
-40	-2.34						
-35	-1.84	-13.25	-0.17	8.75	-0.32	20.5	-1.55
-34.75	-1.82	-12.75	-0.15	9.25	-0.35	20.75	-1.6
-34.25	-1.77	-12.25	-0.14	9.75	-0.38	21	-1.64
-33.75	-1.72	-11.75	-0.12	10.25	-0.4	21.25	-1.68
-33.25	-1.67	-11.25	-0.11	10.5	-0.42	21.5	-1.73
-32.75	-1.62	-10.75	-0.09	10.75	-0.43	21.75	-1.78
-32.25	-1.57	-10.25	-0.08	11	-0.45	22	-1.84
-31.75	-1.52	-9.75	-0.07	11.25	-0.47	22.25	-1.89
-31.25	-1.47	-9.25	-0.06	11.5	-0.48	22.5	-1.95
-30.75	-1.43	-8.75	-0.05	11.75	-0.5	22.75	-2.02
-30.25	-1.38	-8.25	-0.04	12	-0.52	23	-2.08
-29.75	-1.33	-7.75	-0.03	12.25	-0.54	23.25	-2.15
-29.25	-1.28	-7.25	-0.02	12.5	-0.56	23.5	-2.22
-28.75	-1.23	-6.75	-0.02	12.75	-0.58	23.75	-2.29
-28.25	-1.18	-6.25	-0.01	13	-0.6	24	-2.37
-27.75	-1.13	-5.75	-0.01	13.25	-0.62	24.25	-2.45

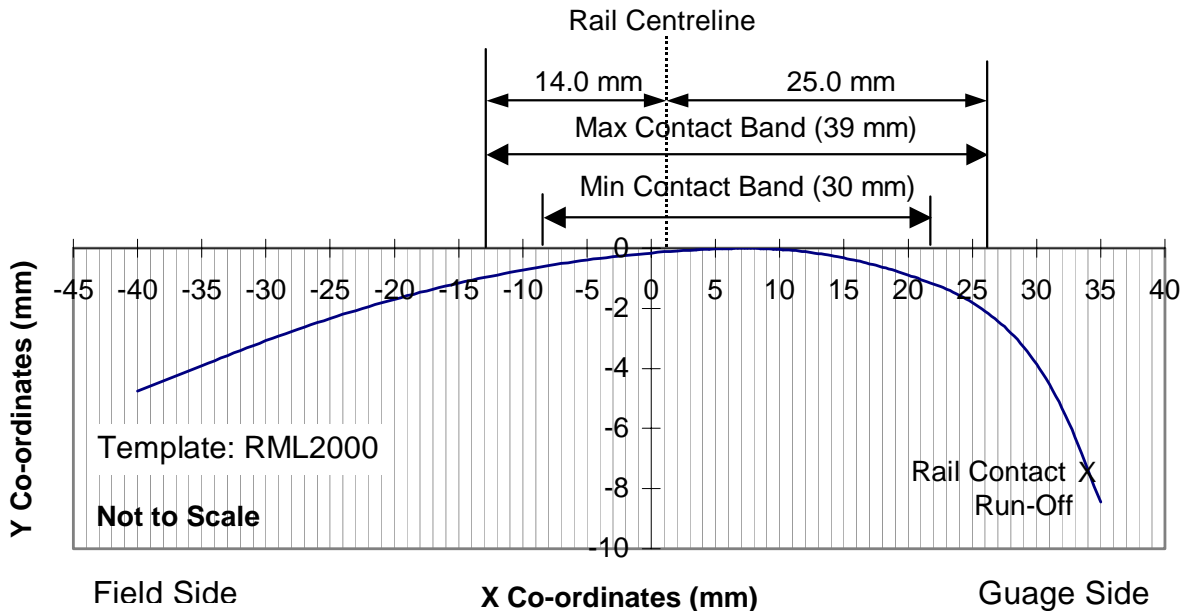
-27.25	-1.09	-5.25	0	13.5	-0.64	24.5	-2.53
-26.75	-1.04	-4.75	0	13.75	-0.66	24.75	-2.61
-26.25	-0.99	-4.25	0	14	-0.69	25	-2.7
-25.75	-0.95	-3.75	0	14.25	-0.71	25.25	-2.79
-25.25	-0.91	-3.25	0	14.5	-0.74	25.5	-2.88
-24.75	-0.86	-2.75	0	14.75	-0.76	25.75	-2.98
-24.25	-0.82	-2.25	-0.01	15	-0.79	26	-3.09
-23.75	-0.78	-1.75	-0.01	15.25	-0.82	26.25	-3.2
-23.25	-0.74	-1.25	-0.01	15.5	-0.84	26.5	-3.31
-22.75	-0.71	-0.75	-0.02	15.75	-0.87	26.75	-3.43
-22.25	-0.67	-0.25	-0.03	16	-0.9	27	-3.56
-21.75	-0.63	0.25	-0.04	16.25	-0.93	27.25	-3.69
-21.25	-0.6	0.75	-0.04	16.5	-0.96	27.5	-3.83
-20.75	-0.56	1.25	-0.05	16.75	-0.99	27.75	-3.97
-20.25	-0.53	1.75	-0.07	17	-1.03	28	-4.12
-19.75	-0.5	2.25	-0.08	17.25	-1.06	28.25	-4.28
-19.25	-0.47	2.75	-0.09	17.5	-1.09	28.5	-4.45
-18.75	-0.44	3.25	-0.1	17.75	-1.13	28.75	-4.62
-18.25	-0.41	3.75	-0.12	18	-1.16	29	-4.8
-17.75	-0.38	4.25	-0.14	18.25	-1.2	29.25	-4.99
-17.25	-0.35	4.75	-0.15	18.5	-1.23	29.5	-5.18
-16.75	-0.33	5.25	-0.17	18.75	-1.27	29.75	-5.39
-16.25	-0.3	5.75	-0.19	19	-1.31	30	-5.6
-15.75	-0.28	6.25	-0.21	19.25	-1.35	31	-6.56
-15.25	-0.25	6.75	-0.23	19.5	-1.39	32	-7.64
-14.75	-0.23	7.25	-0.25	19.75	-1.43	33	-8.72
-14.25	-0.21	7.75	-0.27	20	-1.47	34	-9.8
-13.75	-0.19	8.25	-0.3	20.25	-1.51	35	-10.87

**NOTES:**

- [1] The profile has been specified for a free standing rail centreline using the above coordinate system incorporating the rail centreline. Therefore when producing rail profile templates a cant adjustment of 1:20 (2.86°) clockwise rotation must be added so that the profile is referenced perpendicular to the track plane.
- [2] The contact bands have been determined for new rails. Their location relative to the rail centreline will change as gauge face wear occurs.
- [3] The X co-ordinates on the templates corresponding to the contact bands are +0.7 (maximum) and +9.7 (minimum).

**E5 LOW RAIL GRINDING TEMPLATE (RML2000) FOR TRACK WITH MAINLY FREIGHT OR COAL TRAFFIC**

**Low Rail Grinding Template RML2000**



Note: Rail Centreline corresponds to (+1.1, 0.0) point on template

**X-Y Co-ordinates**

X	Y	X	Y	X	Y	X	Y
-40	-4.76						
-35	-3.91	-10.5	-0.76	10	-0.04	22.25	-1.24
-34.5	-3.82	-10	-0.73	10.25	-0.05	22.5	-1.28
-34	-3.74	-9.5	-0.69	10.5	-0.05	22.75	-1.32
-33.5	-3.66	-9	-0.65	10.75	-0.06	23	-1.37
-33	-3.57	-8.5	-0.62	11	-0.07	23.25	-1.41
-32.5	-3.49	-8	-0.58	11.25	-0.08	23.5	-1.46
-32	-3.4	-7.5	-0.55	11.5	-0.1	23.75	-1.51
-31.5	-3.32	-7	-0.51	11.75	-0.11	24	-1.57
-31	-3.24	-6.5	-0.48	12	-0.12	24.25	-1.62
-30.5	-3.16	-6	-0.45	12.25	-0.13	24.5	-1.68
-30	-3.08	-5.5	-0.42	12.5	-0.15	24.75	-1.74
-29.5	-3	-5	-0.39	12.75	-0.16	25	-1.81
-29	-2.92	-4.5	-0.36	13	-0.18	25.25	-1.88
-28.5	-2.84	-4	-0.34	13.25	-0.19	25.5	-1.95
-28	-2.77	-3.5	-0.31	13.5	-0.21	25.75	-2.02
-27.5	-2.69	-3	-0.29	13.75	-0.23	26	-2.1
-27	-2.62	-2.5	-0.26	14	-0.24	26.25	-2.18



-26.5	-2.55	-2	-0.24	14.25	-0.26	26.5	-2.26
-26	-2.48	-1.5	-0.22	14.5	-0.28	26.75	-2.34
-25.5	-2.41	-1	-0.2	14.75	-0.3	27	-2.43
-25	-2.34	-0.5	-0.18	15	-0.32	27.25	-2.52
-24.5	-2.27	0	-0.16	15.25	-0.35	27.5	-2.61
-24	-2.2	0.5	-0.14	15.5	-0.37	27.75	-2.71
-23.5	-2.13	1	-0.12	15.75	-0.39	28	-2.82
-23	-2.07	1.5	-0.11	16	-0.41	28.25	-2.93
-22.5	-2	2	-0.09	16.25	-0.44	28.5	-3.04
-22	-1.94	2.5	-0.08	16.5	-0.46	28.75	-3.16
-21.5	-1.88	3	-0.07	16.75	-0.49	29	-3.29
-21	-1.82	3.5	-0.05	17	-0.52	29.25	-3.42
-20.5	-1.76	4	-0.04	17.25	-0.54	29.5	-3.56
-20	-1.7	4.5	-0.03	17.5	-0.57	29.75	-3.7
-19.5	-1.64	5	-0.02	17.75	-0.6	30	-3.86
-19	-1.58	5.5	-0.02	18	-0.63	30.25	-4.01
-18.5	-1.53	6	-0.01	18.25	-0.66	30.5	-4.18
-18	-1.47	6.25	-0.01	18.5	-0.69	30.75	-4.35
-17.5	-1.42	6.5	0	18.75	-0.72	31	-4.53
-17	-1.36	6.75	0	19	-0.75	31.25	-4.72
-16.5	-1.31	7	0	19.25	-0.79	31.5	-4.92
-16	-1.26	7.25	0	19.5	-0.82	31.75	-5.12
-15.5	-1.21	7.5	0	19.75	-0.86	32	-5.34
-15	-1.16	7.75	0	20	-0.89	32.25	-5.56
-14.5	-1.11	8	0	20.25	-0.93	32.5	-5.8
-14	-1.07	8.25	0	20.5	-0.96	32.75	-6.03
-13.5	-1.02	8.5	-0.01	20.75	-1	33	-6.3
-13	-0.97	8.75	-0.01	21	-1.04	33.5	-6.84
-12.5	-0.93	9	-0.02	21.25	-1.08	34	-7.38
-12	-0.89	9.25	-0.02	21.5	-1.12	34.5	-7.92
-11.5	-0.85	9.5	-0.03	21.75	-1.16	35	-8.45
-11	-0.8	9.75	-0.03	22	-1.2		

**NOTES:**

[1] The profile has been specified for a free standing rail centreline using the above coordinate system incorporating the rail centreline. Therefore when producing rail profile templates a cant adjustment of 1:20 (2.86°) clockwise rotation must be added so that the profile is referenced perpendicular to the track plane.

[2] The X co-ordinates on the templates corresponding to the contact bands are:

-12.9 to +26.1 (maximum)

-8.4 to +21.6 (minimum)