

Rail Profiling – Train System

Engineering Specification

Rail Commissioner

TC1-DOC-000456

DOCUMENT CONTROL

Document Status

DOCUMENT OWNER			
Action	Name and Position	Signature	Date
Prepared By:	Name: Nikhil Bechoo Title: Graduate Mechanical Engineer		22/04/2020
Reviewed By:	Name: Keith Charlton Title: Manager Rail Technical & Operational Assurance		22/4/20
Approved By:	Name: Mark Pronk Title: Unit Manager Track & Civil Engineering		22/04/2020
Document Review Schedule:		This document is due for review as required	
(Document review cycle is every 5 years or as required)			

Document Amendment Record

REVISION	CHANGE DESCRIPTION	DATE	PREPARED	REVIEWED	APPROVED
0	Initial Issue	April 2014	Matthew Reedman	Craig Evans	Philip Degenhardt
1	- 5 year review - Add RTG-2000 rail profile	October 2019	Aravindh Rameshkumar	Keith Charlton	Mark Pronk
2	Add rail profile drawings references Update Segment Profiling Form	April 2020	Nikhil Bechoo	Keith Charlton	Mark Pronk

TABLE OF CONTENTS

1. Introduction	4
2. Purpose	4
3. Scope	4
4. Related Documents	4
5. References	4
6. Acronyms	4
7. Definitions	4
8. Roles and Responsibilities	5
8.1. Track and Civil Engineering Unit.....	5
9. Instruction and Monitoring	5
10. Longitudinal Profile	5
11. Transverse Profile	6
11.1. DPTI Approved Reference Profiles	6
11.2. Acceptance.....	6
11.3. Full Profile Installation.....	6
11.4. Partial Profile Installation	7
11.4.1. Partial Profile Installation - Gauge Corner Excess.....	7
11.4.2. Partial Profile Installation - Gauge and Field Relief	8
12. Metal Removal	9
13. Surface Roughness	9
14. Visual Appearance	9
Appendix 1 Segment Profiling Form Instruction to Contractor	10
Appendix 2 Reference Rail Profiles	11

1. Introduction

The Department of Planning, Transport and Infrastructure (DPTI) operates and maintains the Adelaide Metropolitan Passenger Rail Network (AMPRN) under the Rail Accreditation assigned to the Rail Commissioner. This Train rail profiling specification forms part of the Engineering Management System (EMS) and is intended to ensure that the track and civil infrastructure is not subject to any risks not deemed to meet the So Far As Is Reasonably Practicable (SFAIRP) principles under Rail Safety National Law (RSNL).

Rail profiling is undertaken to maintain rails in a serviceable condition and extend rail life by controlling stresses in wheels and rails and wear rates. Additionally rail profiling can improve vehicle stability giving better ride quality and reducing track and vehicle degradation. Rail profiling is also used to manage existing rail defects.

This specification should be read in conjunction with EN 13231-3:2012 Acceptance of reprofiling rails in track.

2. Purpose

The purpose of this specification is to describe the requirements for rail profiling of the AMPRN main line plain track for train system only.

3. Scope

This specification applies to all rail projects and contractor organizations profiling rail on the AMPRN main line plain track for the train system of the AMPRN.

This procedure also applies to Engineering and Maintenance staff managing rail profiling.

4. Related Documents

DOCUMENT NAME	DOCUMENT NUMBER
EN 13231-3:2012 Acceptance of reprofiling rails in track	KNet #13761498
TG3 rail profile gauge equipment	TC1-DRG-201391
AS60kg rail profile gauge equipment	TC1-DRG-201392
AS60kg 1:80 corrected rail profile gauge equipment	TC1-DRG-201393
AS53kg 1:80 corrected rail profile gauge equipment	TC1-DRG-201394
Segment Profiling Form (instruction to contractor)	FO-EM-TS-1382 KNet #13780968

5. References

- CP-TS-956 CoP Volume Two – Train System [CP2 – Track Geometry]

6. Acronyms

ACRONYM	FULL NAME
AMPRN	Adelaide Metropolitan Passenger Rail Network
DPTI	Department of Planning, Transport and Infrastructure
RCF	Rolling Contact Fatigue

7. Definitions

TERM	DEFINITION
Running Band	For tangent, low rails as well as high rails of curves greater than 900m radius the running band is the central 40 mm of the rail. For high rails of curves of 900m radius or less the running band is from defined points B2 to A as shown in Appendix 2.
Runoff	The tangential portion of a rail or reference profile found on both the gauge and field side
Reference Profile	The design transverse rail profile, also called template.

8. Roles and Responsibilities

8.1. Track and Civil Engineering Unit

Track and Civil Engineering will:

- provide instruction on profiling treatment
- monitor compliance with this specification
- maintain records of rail profiling

9. Instruction and Monitoring

The track to be reprofiled shall be divided into segments. Segments are used to give instruction on rail profiling treatment. Generally a segment will be either a curve or tangent starting and finishing at a tangent point. Each segment shall:

- contain one track only (not up and down tracks)
- not include a change of desired reference profile, change hand of curvature

Each segment shall have identifiable monitoring location/s which shall be spaced by no more than 500m on tangent or 200m on curves. Monitoring locations should not be near the ends of the segment. Where only one monitoring location is required it shall be near the centre of the segment

Prior to reprofiling an authorised DPTI employee shall specify the treatment by completing the form in Appendix 1 for each segment and providing to the profiling superintendent. The details shall include:

- location
- rail size
- profiles to be applied
- minimum metal removal
- if the grinding is corrective, transitional or maintenance
- any notable condition of the rail
- if any concessions in line with this specification are to be permitted

An example form is shown in Appendix 1.

10. Longitudinal Profile

Measurements shall be in accordance with section EN 13231-3:2012: *Acceptance of re profiling rails in track section 4.1.*

Rather than continuous measurement, 10% of each reprofiled rail within a segment (including the monitoring location/s) shall be measured unless independent verification is required. In other aspects EN 13231-3:2012 section 4.2 shall be complied with.

The longitudinal profile post profiling shall meet the acceptance criteria for Class 1 (see EN 13231-3:2012 section 4.3). An authorised DPTI employee may permit the use of Class 2 acceptance criteria prior to profiling.

The authorised DPTI employee must consider the following before giving permission for acceptance to Class 2 of a segment:

- Rail condition, such as the presence of RCF or corrugations
- Track Speed
- Rail History

When acceptance is to be judged against class 2 the following must occur:

- Measurements of the longitudinal profile shall be taken prior to profiling.

- Post profiling, the percentage exceeding the 10 to 30 and 300 to 1000 mm band limits must be improved.

Track geometry must be maintained to the DPTI Track & Civil Infrastructure Code of Practice CPTS956: *Track geometry* for longitudinal profile acceptance criteria to apply. Any track geometry defects should be correct before profiling occurs.

11. Transverse Profile

11.1. DPTI Approved Reference Profiles

Reference profiles approved for use on the AMPRN Train network are as follows:

PROFILE	APPLICATION
RTG 2000	Tangent, all high rails and low rails above 900m radius
TG3	Tangent, all high rails and low rails above 900m radius*
60 kg	50 & 60 kg low rails between 500-900m radius*
60 kg (corrected)	50 & 60 kg low rails below 500m radius*
53 kg (corrected)	47 & 53 kg low rails below 900m radius*^

*TG3 is the preferred rail profile over the RTG 2000 profile.

*Radius is given as a guide. Some latitude may be applied depending upon traffic, operating environment, track configuration and rail condition.

^Alternate low rail templates may be applied to these rails if required.

Details of reference profiles with reference points can be found in Appendix 2.

11.2. Acceptance

Profile measurements and alignment shall be in accordance with section EN 13231-3:2012: *Acceptance of reprofiling rails in track section 5.1 and 5.2*. Rails will be considered side worn if there is side wear (measured 14 mm down from the top of rail head) before profiling.

The transverse rail profile shall meet the acceptance criteria in EN 13231-3:2012 *Acceptance of reprofiling rails in track section 5.3*. However the DPTI quality class Q shall be as follows:

Minimum proportion of measurements within the specified range

Range of deviation (mm)	+0.05, -0.15	+0.1, -0.3
DPTI Quality Class	90 %	95 %

The quality class and tolerance shall apply to the portion of rail that is reprofiled. The wider -0.8 mm tolerance applied to the field side will not be applicable (see 10.4.2).

Profile measurement shall be made at the monitoring location on both rails of each segment.

11.3. Full Profile Installation

Profiles will be considered to be fully installed if they continue within tolerance to the aligned reference profile from the reference profile's running band.

Reference profiles shall be fully installed unless otherwise permitted by an authorised DPTI employee and in accordance with this specification.

11.4. Partial Profile Installation

Full profile installation is usually required as it provides for improved wheel rail contact. Partial profile installation shall not be used unless an authorised DPTI employee gives permission for its use, which must be in accordance with 11.4.1 or 11.4.2 and is endorsed by the Unit Manager Track and Civil Engineering for that segment.

11.4.1. Partial Profile Installation - Gauge Corner Excess

Where full installation of the reference profile would require large metal removal from the gauge corner an authorised DPTI employee may permit partial profile installation to occur by shifting the reference profile away from gauge face and/or permitting gauge side run off at a reduced angle (Figure 1). Partial profile installation shall only be applied to older rail sections and not to 50 or 60 kg rail.

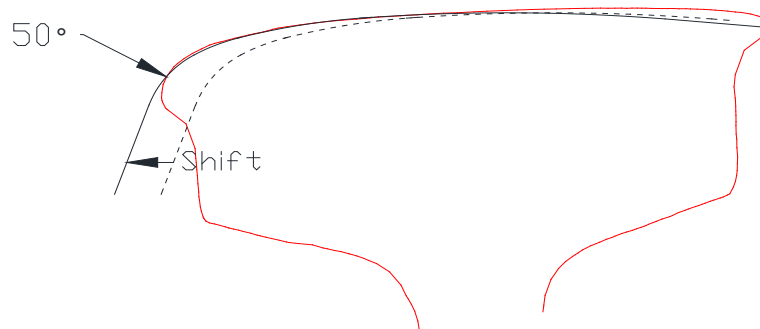


Figure 1 Shifting reference profile away from gauge face with reduced runoff angle to lessen metal removal.

The authorised DPTI employee must consider the following before giving permission for partial profile installation:

- Existing rail profile
- Current operating speed, vehicle ride quality and stability
- Rail condition, such as the presence of RCF or corrugations
- Contact band
- Rail location, i.e. high low or tangent
- Curve radius

Where it has been decided that the reference profile is being shifted away from the gauge face the following must be achieved:

- The reference profile shall be aligned at A and B2 with the pre profiling measured rail profile. The horizontal distance from B1 to the gauge face of the rail shall be measured (see Figure 2).
- Post profiling the distance from B1 to the gauge face of the rail must be reduced by at least 1.0 mm

- Post profiling the maximum allowable remaining distance from B1 to the gauge face is to be 2.0 mm
- Maximum remaining distance from B1 to the gauge face of the rail is to be determined before profiling for each segment.
- The reference point B1 on the reference profiles is shown in Appendix 2. B1 shall not be moved relative to the reference profile to account for additional run off.

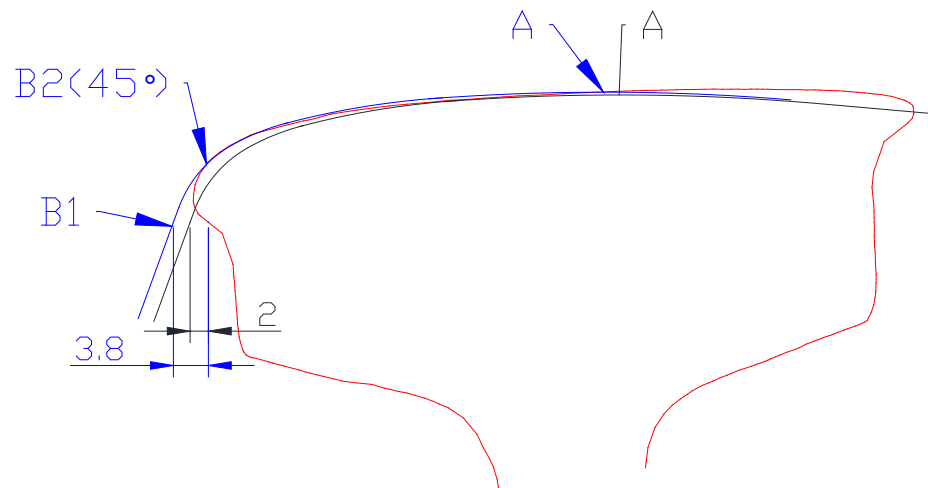


Figure 2 Alignment of blue rail profile with reference profile at B2 showing horizontal measurement from B1 to gauge face of 3.8mm. Alignment with red reference profile at the maximum horizontal distance from B1 to gauge face of 2 mm

Where it has been decided that gauge side runoff is permitted at a lower angle the following must be achieved:

- The minimum runoff angle shall be determined before profiling for each segment.
- Tangent and low rails shall not runoff at an angle less than 50°.
- High rails of curves of greater than 900m radius shall not runoff at an angle less than 60.
- High rails of curves of 900m radius or less shall have no reduction in runoff angle.

11.4.2. Partial Profile Installation - Gauge and Field Relief

Where full installation of the reference profile would require large metal removal from the crown of the rail an authorised DPTI employee may permit partial profile installation to occur by allowing an extent of the relief to remain. Reference profiles incorporate relief and additional relief is not to be installed by profiling.

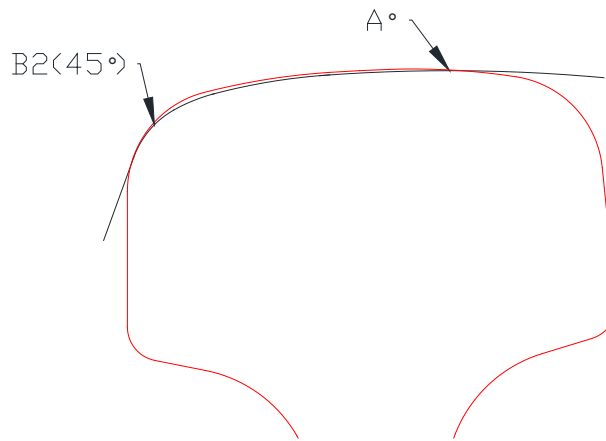


Figure 3 Partial profile installation on a tight radius high rail due to existing field side relief.

The authorised DPTI employee must consider the following before giving permission for partial profile installation:

- Current operating speed, vehicle ride quality and stability
- Rail condition, such as the presence of RCF or corrugations
- Contact band
- Rail location, i.e. high low or tangent
- Curve radius

Where it has been decided relief may remain the reference profile must be installed within tolerance over the running band.

12. Metal Removal

Measurement of rail profiles shall be made by making comparison of pre and post transverse rail profiles at the monitoring locations for each rail.

The minimum metal to be removed from the running band is 0.2 mm. Where corrugations are present the minimum metal removal shall be achieved at the trough.

Greater minimum metal removal if required shall be specified by an authorised DPTI employee to correct rail defects (such as RCF, wheel burns or corrugations).

13. Surface Roughness

Surface roughness shall be in accordance with EN 13231-3-2012: *Acceptance of reprofiling rails in track section 7*. Surface roughness shall be measured at all monitoring locations.

14. Visual Appearance

Visual appearance shall be in accordance with EN 13231-3-2012: *Acceptance of reprofiling rails in track section 8*. Visual appearance shall be checked at all monitoring locations.

Appendix 1 Segment Profiling Form Instruction to Contractor

Form

Rail Commissioner

SEGMENT PROFILING FORM

Line: Up/Down/Single From km To km Radius m Hand

Left Rail

Rail Size: kg/lb
 Orientation:
 High Low Tangent

The profiling to be performed shall be:
 Maintenance Transitional Corrective

Reference Profile to be applied:
 TG3 60 kg
 60 kg (corrected) 53 kg (corrected)
 RTG-2000

Max. shift of profile away from Gauge Face:
 0mm mm

Min gauge side run off angle:
 As reference profile °

Existing field side relief to remain: Yes / No

Minimum metal removal:
 0.2mm mm

Longitudinal profile to be met:
 Class 1 Class 2

Existing surface defect:
 No Yes Treatment

Right Rail

Rail Size: kg/lb
 Orientation:
 High Low Tangent

The profiling to be performed shall be:
 Maintenance Transitional Corrective

Reference Profile to be applied:
 TG3 60 kg
 60 kg (corrected) 53 kg (corrected)
 RTG-2000

Max. shift of profile away from Gauge Face:
 0mm mm

Min gauge side run off angle:
 As reference profile °

Existing field side relief to remain: Yes / No

Minimum metal removal:
 0.2mm mm

Longitudinal profile to be met:
 Class 1 Class 2

Existing surface defect:
 No Yes Treatment

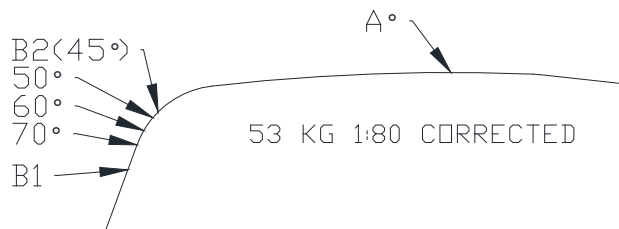
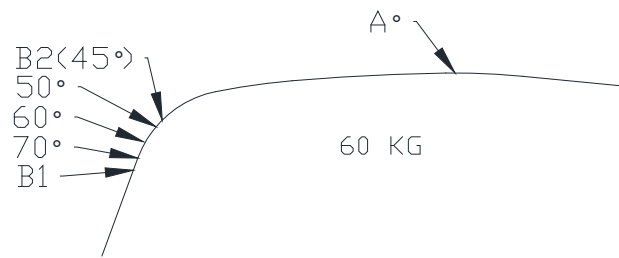
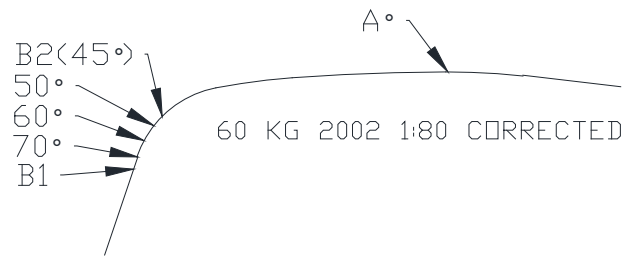
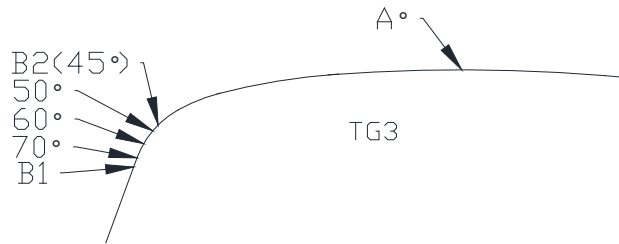
Document Number: FD-EM-TS-1382
 Knet No: 13780968
 Version Number: 1
 Document Owner: Track & Civil Engineering

Issue Date: 17-October-2019
 Last Review Date: N/A
 Document Controller: RSOP

Parent Doc. Title: Train Rail Profiling Specification
 Parent Doc. Knet No: TC1-DOC-000456
 Parent Doc. No: 8475755
 UNCONTROLLED WHEN PRINTED

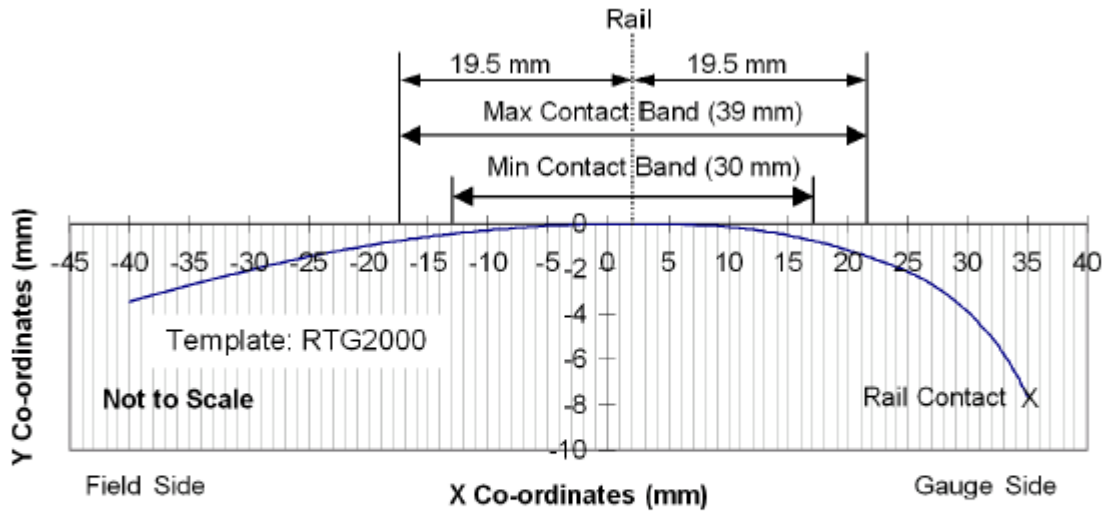
Page 1 of 1

Appendix 2 Reference Rail Profiles



NB: Geometric data to be added.

RTG-2000 (supplied by SPENO Rail Maintenance Australia)



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

Table of Cartesian Co-ordinates for Rail Profile RTG2000

Coordinates are based on un-canted rail. Therefore when producing rail profile templates a cant adjustment of 1:20 (2.86°) clockwise rotation must be applied in order for the profile to be referenced perpendicular to the track plane.

X	Y	X	Y	X	Y	X	Y
-40.00	-3.42	-26.00	-1.57	-16.50	-0.68	-7.00	-0.16
-35.00	-2.72	-25.50	-1.52	-16.00	-0.65	-6.50	-0.14
-34.50	-2.65	-25.00	-1.46	-15.50	-0.61	-6.00	-0.13
-34.00	-2.58	-24.50	-1.41	-15.00	-0.58	-5.50	-0.11
-33.50	-2.52	-24.00	-1.35	-14.50	-0.54	-5.00	-0.10
-33.00	-2.45	-23.50	-1.30	-14.00	-0.51	-4.50	-0.08
-32.50	-2.39	-23.00	-1.25	-13.50	-0.48	-4.00	-0.07
-32.00	-2.32	-22.50	-1.20	-13.00	-0.45	-3.50	-0.06
-31.50	-2.25	-22.00	-1.15	-12.50	-0.42	-3.00	-0.05
-31.00	-2.19	-21.50	-1.11	-12.00	-0.39	-2.50	-0.04
-30.50	-2.12	-21.00	-1.06	-11.50	-0.36	-2.00	-0.03
-30.00	-2.06	-20.50	-1.01	-11.00	-0.34	-1.50	-0.02
-29.50	-1.99	-20.00	-0.97	-10.50	-0.31	-1.00	-0.02
-29.00	-1.93	-19.50	-0.93	-10.00	-0.29	-0.50	-0.01
-28.50	-1.87	-19.00	-0.88	-9.50	-0.26	0.00	-0.01
-28.00	-1.81	-18.50	-0.84	-9.00	-0.24	0.50	0.00
-27.50	-1.75	-18.00	-0.80	-8.50	-0.22	1.00	0.00
-27.00	-1.69	-17.50	-0.76	-8.00	-0.20	1.50	0.00
-26.50	-1.63	-17.00	-0.72	-7.50	-0.18	2.00	0.00

Table of Cartesian Co-ordinates for Rail Profile RTG2000

(Coordinates are based on un-canted rail)

X	Y	X	Y	X	Y	X	Y
2.50	0.00	12.50	-0.30	20.00	-1.18	27.50	-2.86
3.00	0.00	12.75	-0.32	20.25	-1.22	27.75	-2.95
3.50	0.00	13.00	-0.34	20.50	-1.26	28.00	-3.04
4.00	-0.01	13.25	-0.36	20.75	-1.30	28.25	-3.14
4.50	-0.01	13.50	-0.38	21.00	-1.34	28.50	-3.24
5.00	-0.02	13.75	-0.40	21.25	-1.39	28.75	-3.34
5.50	-0.02	14.00	-0.42	21.50	-1.43	29.00	-3.44
6.00	-0.03	14.25	-0.45	21.75	-1.47	29.25	-3.55
6.50	-0.04	14.50	-0.47	22.00	-1.52	29.50	-3.66
7.00	-0.05	14.75	-0.49	22.25	-1.57	29.75	-3.77
7.50	-0.06	15.00	-0.52	22.50	-1.61	30.00	-3.89
7.75	-0.07	15.25	-0.55	22.75	-1.66	30.25	-4.01
8.00	-0.07	15.50	-0.57	23.00	-1.71	30.50	-4.14
8.25	-0.08	15.75	-0.60	23.25	-1.76	30.75	-4.27
8.50	-0.09	16.00	-0.63	23.50	-1.81	31.00	-4.41
8.75	-0.09	16.25	-0.66	23.75	-1.86	31.25	-4.55
9.00	-0.10	16.50	-0.69	24.00	-1.91	31.50	-4.70
9.25	-0.11	16.75	-0.72	24.25	-1.96	31.75	-4.85
9.50	-0.12	17.00	-0.75	24.50	-2.02	32.00	-5.02
9.75	-0.13	17.25	-0.78	24.75	-2.07	32.25	-5.19
10.00	-0.14	17.50	-0.81	25.00	-2.13	32.50	-5.36
10.25	-0.16	17.75	-0.85	25.25	-2.19	32.75	-5.55
10.50	-0.17	18.00	-0.88	25.50	-2.25	33.00	-5.74
10.75	-0.18	18.25	-0.91	25.75	-2.32	33.25	-5.95
11.00	-0.02	18.50	-0.95	26.00	-2.39	33.50	-6.16
11.25	-0.21	18.75	-0.99	26.25	-2.46	33.75	-6.38
11.50	-0.23	19.00	-1.02	26.50	-2.53	34.00	-6.61
11.75	-0.24	19.25	-1.06	26.75	-2.61	34.25	-6.83
12.00	-0.26	19.50	-1.10	27.00	-2.69	34.50	-7.10
12.25	-0.28	19.75	-1.14	27.25	-2.78	34.75	-7.37
						35.00	-7.64