AUSTRALIAN RAIL TRACK CORPORATION LTD

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

Ultrasonic Testing By Continuous Rail Flaw Detection Vehicle

ETE-01-02

Applicability

ARTC Network Wide	✓	**Western Jurisdiction**	
New South Wales		**Victoria**	

Primary Source

2004 ARTC Ultrasonic Testing Agreement

Document Status

Version	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
1.2	16 Jan 09	Standards dept	Manager Standards	Chief Operating Officer	Risk & Safety Committee 07/10/2008 as part of ETE-01-03 approval

Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.0	13 Nov 06		First issue
1.1	11 Dec 06	Various 2.10 2.11 3.2.1 3.2.3	Minor editorial changes Marking of rail defects amended Requirement for local maintenance rep to accompany test car added Requirement to use V1 or V2 block for calibration of time base added Alternate method for defect sizing added
1.2	16 Jan 09	2.2; 2.13	References to superseded NSW Standards TES 03, TEP 18 and TEP 19 replaced with ETE-01-03; Reference to superseded NSW Std MSP 01 replaced with PP-124.1

Contents

1 Introduction

1.1 Purpose

This specification establishes requirements to be met by the Ultrasonic Rail Flaw Detection *Contractor* on track owned or managed by Australian Rail Track Corporation (ARTC).

General requirements across the ARTC network are specified, together with specific variation of practices for testing in NSW, SA, Vic and WA.

1.2 Scope

This specification covers the minimum technical requirements that the Ultrasonic Rail Flaw Detection *Contractor* must comply with whilst testing rails on track owned or managed by ARTC.

Note that ARTC currently manages the NSW Country Residual Network (CRN) on behalf of State Rail & RIC. Testing of the CRN track is also covered by this specification whilst ARTC has maintenance responsibility

Further details about ARTC are available from its website at www.artc.com.au

1.3 Reference Documents

The following standards are applicable to the contract:

- Australian Standard AS 2083
- ARTC's Engineering Standards (refer to section 2.2)
- GPS Survey specification guidelines

1.4 Definitions

The following terms and acronyms are used within this document:

Term or acronym	Description
A-scan	The A-scan presentation displays the amount of received ultrasonic energy as a function of time
B-scan	The B-scan presentations is a profile (cross-sectional) view of the a test specimen

2 Technical Specification

2.1 Introduction

This document describes the technical requirements for the provision of ultrasonic rail flaw testing, detection and reporting requirements for the ARTC rail network.

The ultrasonic testing system shall be capable of displaying the presence of discontinuities likely to be present in the rail and delineating their boundaries and contours.

2.2 Standards

All current ARTC standards are available from http://www.extranet.artc.com.au Follow the instructions described under *"How to navigate this site". The Contractor* should check with *Project Manager* if unsure which standards are to be used.

Some commonly used standards are as follows:

- Code of Practice (CoP) Section 1 – Rail. Refer to table 1.14 for defect sizing. Some interim waivers have been issued. The *Project Manager* will advise the *Contractor* of applicable variations.
- Rail – Inspection and Assessment issue 2.3 Aug 1998 for defects located in South Australia, Victoria and Western Australia (Western Jurisdiction)
- TES 02 Rail Defect Standards (NSW)
- ETE-01-03 Non-Destructive Testing of Rail (for Internal and Surface Defects)
- PP-124.1 Track Maintenance Vehicle Registration and Operation

ARTC is in the process of implementing a Code of Practice (CoP) for all tracks that are controlled by ARTC. The *Project Manager* will advise the *Contractor* when the CoP is to be adopted.

2.3 Method of Examination

It is anticipated that the *Contractor* will perform rail flaw detection by using a test car to identify potential defects and a satellite car to perform a detailed assessment and to document any confirmed defects. Both types of vehicles shall be road/rail with the ability to use level crossings to access the track in accordance with current safeworking systems.

Any alternative arrangements submitted to ARTC will be considered. The need for provision of a satellite vehicle shall be determined by the *Contractor*.

2.4 Services supplied by *Contractor*

The *Contractor* shall provide all the necessary labour, supervision, equipment, materials, consumables, systems, hardware, software, planning, and communications to detect, identify and report on rail defects by Ultrasonic Non Destructive detection methods.

The *Contractor* shall provide all qualified personnel (including safeworking), equipment, materials and supplies involved in performing the services described except those provided by ARTC as described in Section 2.5

2.5 Services supplied by ARTC

The hand sizing of rail defects for South Australia and Western Australia will be performed by ARTC's maintenance provider (Transfield). The *Contractor* shall provide the necessary data transmission equipment to communicate with the maintainers test vehicle via radio link.

Safeworking duties for South Australia, Western Australia and Victoria will be performed by ARTC's maintenance providers. The *Contractor* shall comply with all safeworking instructions issued by ARTC's maintenance providers.

2.6 Additional *Services* requested by ARTC

The *Contractor* is to carry out any additional work requested by the *Project Manager*, which is outside of the scope as defined in this specification. This will be on an as agreed basis

2.7 Testing of rail for defects

The Contractor shall test the rail for new and existing rail defects. All defects shall be reported, sized and identified as new or existing. The *Project Manager* will advise the *Contractor* if testing of existing rail defects is not required.

Testing shall be carried out through level crossings, insulated joints and turnouts (including crossings & switches).

2.8 Classification of rail defects

All rails contain discontinuities and shall be classified by type and size according to the following ARTC standards:

- Code of Practice (CoP) Section 1 – Rail. Refer to table 1.14 for defect sizing. Some interim waivers have been issued. *Project Manager* shall advise *Contractor* of these variations

Defect response times are currently described in the following standards:

- TES 02 for defects located in New South Wales
- Rail – Inspection and Assessment issue 2.3 Aug 1998 for defects located in South Australia, Victoria and Western Australia.

The *Project Manager* will advise the *Contractor* of any changes to the standards.

2.9 Hand sizing of rail defects

The classification of rail defects identified by the Rail Flaw Detection Vehicle shall only be sized by qualified staff. Details of the *Contractor*'s staff including qualifications are to be supplied to the *Project Manager*.

The *Contractor* shall provide this service for hand testing in New South Wales and Victoria.

2.10 Marking of rail defects

The *Contractor* shall mark all rail defects found with paint as follows:

- Yellow - where a defect has been identified
- Orange – not currently used but may be considered during the term of the contract

The defective rail shall be marked for a length of 200mm, showing the location of the defect and its identification number as described in section 4.1

2.11 Unsafe condition

The *Contractor* is to ensure any unsafe condition is reported. Some rail defects require immediate action upon detection and the *Contractor* shall notify the local maintenance representative if detected. Remedial measures will be the responsibility of the local maintenance representative once advised by the *Contractor*. The *Project Manager* will provide the *Contractor* with details of corridor boundaries and local maintenance representatives. A local maintenance representative shall accompany the test car.

2.12 Calibration

Equipment calibration shall meet or exceed the requirements specified in AS 2083.

The *Contractor* is to provide details of their current calibration procedures such as calibration intervals and comparison of test vehicles to ensure uniform results. The *Contractor* is also to

provide details of current procedures where any maintenance activity affects the calibration of equipment.

Details of any periodic maintenance activity that does not comply with manufacturers recommendations for vehicles and equipment is to be submitted in conjunction with a risk analysis or a waiver from the manufacturer.

2.13 Testing frequencies

The current testing frequencies are described in Appendix 5.1 & 5.2. The *Project Manager* will advise the *Contractor* of any variation to these frequencies. A review of the testing frequencies is proposed during 2007.

ARTC's testing interval principles are specified in the following standards:

- SA/WA and Victoria – ARTC Code of Practice – Section 1 – Rail
- NSW – ETE-01-03 Non-Destructive Testing of Rail (for Internal and Surface Defects)
- NSW Restricted lines – TMS 12 – Maintenance Standards for Restricted Lines

2.14 Testing schedule

The *Contractor* shall be responsible for planning and maintaining the testing cycle for the duration of the contract. Each cycle will be at least 1 months duration. This will require forward planning to ensure achievable inspection paths are organised. The *Project Manager* and other nominated representatives are to be provided with a program for each 1 month cycle at least 3 months prior to commencement. The *Project Manager* will advise the *Contractor* of any special testing requests.

The *Contractor* shall include contingency days in the NSW program for "catch up testing". Any section of track that could not tested during the run, must be completed at the end of the run or in accordance with the bandwidths described in ARTC Engineering Standards.

The *Project Manager* will provide the *Contractor* with track descriptions defining each run. An indicative testing schedule is shown in Appendix 5.1 & 5.2

2.15 Specification for *Contractor* Supplied Ultrasonic Rail Flaw Detection Equipment

The *Contractor* shall provide a schedule of equipment to be used in the provision of services. The schedule should include:

- equipment proposed
- maximum speeds on & off track
- type of fuel & range
- water capacity & range
- the type of testing system.
- Any limitations of the testing system ie any section of the rail that cannot be tested, track geometry conditions that will limit testing, climate limitations etc

Equipment is to be maintained, calibrated and operated in accordance with agreed *Contractor* provided processes. The *contractor* will service, overhaul and replace obsolete equipment and carry out fault repairs to all equipment to provide the safety, reliability and measurement accuracy required by ARTC.

2.15.1 Defect Sizes

The testing equipment shall be capable of identifying and recording the following minimum defect sizes:

- Transverse defect in a weld 10mm in height

- Transverse isolated defect in the rail	5mm in height
- Multiple transverse defects in rail	Significant echo signal as compared to a 3.0mm side drilled hole in the centre of the head in a reference test rail
- Longitudinal	25mm in length
- Bolt hole crack	all

2.15.2 Detection Levels

At the start of each day, the equipment's operating detection levels shall be recorded. Any variations to these levels shall be subsequently logged.

The parameters to be recorded shall include:

- Pulse Count
- Sensitivity levels
- Calibration setting

2.15.3 Equipment and calibration

Equipment shall have a reserve of sensitivity of at least 20dB at the maximum beam paths involved.

2.15.4 Manual Equipment

A scan presentation shall be used (all alternative proposals to be supplied to ARTC for evaluation). The equipment shall be calibrated in accordance with AS 2083. Either analogue or digital equipment may be used.

Horizontal and vertical linearity shall be assessed for the test ranges used (with any distance amplitude correction switched off). Any deviation of horizontal linearity exceeding 2% over the full screen width or vertical linearity exceeding 2dB between 30% and 100% graticule height shall not be used.

2.15.5 Automated (vehicle) equipment

A-scan presentation shall be available for each flaw detector channel for calibration and routine checking. For the performance of test runs, the automated system may be used individually, or in combination with the following;

- Digitised data processing into numerical size and location displays
- Digital data processed into visual and/or audible displays
- B-scan

The only requirement is that the presentation shall be capable of indication reflectors within the resolution requirements specified in the clause on resolution below

2.15.6 Overall gain system

The overall system gain shall be assessed in accordance with AS 2083 and shall not be less than 20dB

2.15.7 Resolution

The equipment should be capable of readily resolving adjacent reflectors with a separation along the beam axis of 2.5 wavelengths. The resolution requirements are:

NOMINAL FREQUENCY (MHz)	COMPRESSION WAVE PROBES (mm)	SHEAR WAVE PROBES (mm)
2.0	7.4	4.1
2.5	5.9	3.3
4.0	3.7	2.0

2.15.8 Couplant

The *Contractor* is to supply details of average daily water consumption for testing. If other couplants are used, the *Contractor* shall supply a material safety data sheet with their tender

2.16 Loss of working time

The *Contractor* shall carry out testing operations under all weather conditions (including wet weather) as scheduled.

Where working time is lost on scheduled work days through acts or omissions of the *Contractor* or breakdown of the *Contractor*'s equipment, ARTC shall not be liable for any Contractors costs during this down time.

Reasonable replacement of consumables, routine maintenance or cleaning of roller search units etc is not classified as loss of working time. However, if in the opinion of the *Project Manager* or the local maintenance representative, it is considered that excessive time is taken in the execution of these functions, the excessive time may be deemed as loss of working time. Accordingly, the *Contractor* will be subject to a reduction in payments for any excessive time taken in such replacement of consumables as determined by the *Project Manager*. The time taken to supply fuel and water, defined as consumables, is not considered as working time. The *Contractor* will supply details of their daily maintenance requirements in their tender documents.

2.17 Vehicle movement on or off tracks

The *Contractor's* vehicles shall be capable of relocating on to or off tracks, without assistance from any other vehicles, in a period of five (5) minutes.

2.18 Communications

The *Contractor* will be required to operate across several areas with different safeworking communication requirements. The *Contractor* will be required to supply, install and maintain the equipment. The *Contractor* must arrange suitable communications to be available between testing and chase vehicles and between driving and control stations on a vehicle where these are separate.

The *Contractor* must provide suitable mobile phone communications for each testing team to the satisfaction of the *Project Manager* and these must be available for use by non *Contractor* personnel including safeworking officers where required.

2.19 Quality Systems

The *Contractor* shall put in place and maintain quality systems and processes in accordance with the requirements of AS/NZ ISO 9000 series to ensure the integrity of the testing process and equipment used.

The *Contractor* is to submit a Quality Plan (complying with ISO 9000 series) for the work within four (4) weeks of the acceptance of the contract.

Within six (6) weeks of the end of each Testing Program, the *Contractor* shall provide one copy of all Quality Records to the satisfaction of the *Project Manager* suitably filed or bound.

ARTC reserves the right to audit the contractors technical and quality processes.

2.20 Assessment of Horizontal and Vertical Linearity

Horizontal and vertical linearity shall be assessed for the test ranges used (with any distance amplitude correction switched off). Any deviation of horizontal linearity exceeding 2% over the full screen width or vertical linearity exceeding ± two (2) dB between 30% and 100% graticule height shall be known and recorded. Suppression shall not be used.

3 Methods of Test

3.1 Automated Test Methods

3.1.1 Preparation for testing

The time base for each channel (probe) shall be calibrated or checked (if memory driven calibrations are used) using A-scan. This shall be performed on rail that is representative of that to be tested. Test ranges may be set for each probe using known artefacts eg foot of rail, bond holes, bolt holes, rail ends, etc. Test ranges shall be adequate to meet the scanning depths of this standard.

Gate positions shall be set or checked to ensure compliance with the scanning depth requirements of this specification. Prior to testing a brief run may be required to set interface gate widths accurately.

3.1.2 Probes

The rail shall be interrogated using a minimum of one 0° or 5° pitch / catch probe, one forward facing 70° probe, one rear facing 70° probe, one forward facing 35°-40° probe, one rear facing 35°-40° probe. Probe characteristics shall be known and recorded. Probe configurations shall be such that cross talk interference does not occur.

The *Contractor* shall submit details of any additional configurations that will be utilised.

3.1.3 Sensitivity

The specified areas of the rail shall be scanned using gain levels, that as a minimum, produce evidence of “grass” on the screen on all channels and a satisfactory back wall echo (50% - 80& graticule height) on the 0° channels. Threshold levels within defect gates shall be set just above “grass levels”. Gain should not be lowered where excessive interference occurs but rail surface, probe condition, etc, should be checked. If interference persists, threshold levels should be changed and gain maintained. Threshold levels may be set that utilise distance – amplitude corrections provided agreement has been reached and the *Project Manager* advised.

3.1.4 Pulse repetition rate

Pulses shall be generated for every 4mm of travel (maximum). Smaller increments shall be the subject of agreement between *Contractor* and *Project Manager*.

3.1.5 Pulse count

The selection of pulse count for eliminating non-significant non-destructive responses shall be the subject of agreement between the testing service and *Project Manager*.

3.1.6 Scanning requirements (test vehicle)

The 0° type probe shall be used to scan the central part of the rail head, the whole of the rail web and the central part of the rail foot perpendicular to the rail. The dead zone depth shall be known and recorded.

The 70° type probe shall be used to scan the rail head and part of the upper web.

The 38° type probe shall be used to scan the central part of the rail head, the whole of the web and the central part of the rail foot.

3.1.7 Evaluation

For any calibration (including PRR and pulse count) all signals above threshold shall be recorded. Individual signals or groups of signals interpreted as defects shall be evaluated by hand testing.

3.2 Manual Test Methods

3.2.1 Preparation for testing

Ensure that the rail surface conditions are such that:

- Uniform probe contact is maintained during the test.
- Surface roughness is not exceeded

It is preferred that the time base be calibrated in accordance with AS 2083. However, the use of a rail section and accurately known reflectors may be permitted by agreement between *Contractor* and *Project Manager*. The test ranges selected for each probe shall be adequate to meet the scanning depth requirement of this standard. For the calibration of the time base, a V1 or V2 block must be used. Sensitivity setting may be performed using a rail sample.

Distance amplitude curves may be used in the assessment of discontinuities.

3.2.2 Probes

Similar probe angles to those used for automated testing shall be utilised. Probe characteristics shall be known and recorded.

3.2.3 Sizing

Defect sizing shall be performed using the 6dB drop method or the Last Significant Echo method. The *Contractor* shall advise ARTC which method shall be used. Suppression shall not be used.

4 Reports

4.1 Documentation by Contractor

The following requirement shall be established by the *Contractor*:

- Each defect is to be allocated an identification number.
- Additional to the size classification, the actual length of the flaw shall be indicated.
- The rail in which the flaw is located, shall be shown. The down rail is the left rail when facing in the direction of increasing kilometrage. The up rail is the rail opposite the down rail.
- The size of the rail and its year of manufacture.
- The location of the defect with respect to the kilometrage posts shall be determined to within ± 5 metres per 1,000m of the last km post encountered.
- GPS co-ordinates for each defect found
- In the case of defective welds, the type of weld shall be indicated i.e. Thermit (T), Flash Butt (FB) or Wire Feed (WF)
- The position of the defect in the rail shall be nominated as either Head (H), Web (W) or Base (B).
- Where two or more defects are found within one (1) metre of each other, the actual separating distance of the defects shall be indicated.

4.2 Daily Ultrasonic Testing Report

All defects shall be classified as per the relevant standards. The *Contractor* shall also include the remedial action to be taken for defect removal relevant to the type of defect identified as per the standards.

A movement report describing all track tested, track programmed for test which could not be tested (i.e. missed track), start & finish times of the shift and any delays.

Where track conditions limit ultrasonic testing and sensitivity requirements cannot be met, then the location and length of the affected rail shall be recorded and reported to the *Project Manager* with a surface condition report. The *Contractor* shall provide a description of the testing problem eg grease, rust, gauge wear, rail surface damage, gauge corner damage, engine burns, rail surface delamination etc. It is important for the *Contractor* to provide locations where testing is becoming difficult so that rectification works can be programmed before Ultrasonic shielding occurs. The *Contractor* is not required to identify locations where manganese components exist (in NSW) and testing could not be performed.

The *Contractor* must make every effort to test all rail within the section time available. The *Contractor* is to provide a documented process detailing recording speeds and any alternative couplants or additives to be used when loss of detection occurs at normal testing speed.

The *Contractor*'s reporting format shall be submitted for approval by ARTC prior to implementation. The *Project Manager* will advise the *Contractor* if extra data is required

4.3 Daily transmission of data

At the conclusion of each daily test, the *Contractor* shall produce an electronic daily report detailing:

- All defects found
- Movement report
- Surface condition report

The *Contractor* shall transmit the completed daily reports electronically by email to the ARTC *Project Manager* and nominated representatives at the completion of each daily test run. The *Project Manager* will advise the *Contractor* of ARTC's maintenance regions, nominated representatives and email address. This list will be regularly updated.

The daily report shall be printed for manual distribution at the end of the shift or maintenance boundary and handed to the local maintenance representative if requested.

The daily reports are to be consolidated by the *Contractor* on a monthly basis and submitted to ARTC within 7 (seven) days. The delivery method is to be as approved by the *Project Manager*.

4.4 Monthly / Yearly Ultrasonic Testing Report

The *Contractor* will produce a regular Ultrasonic Rail flaw report and shall include the following details:

i. All daily test runs consolidated for the month,

ii. Exception Report - table indicating any missed track on the network and reasons for missing the track,

iii. comparisons with the overall number of defects detected for historical runs under previous contract in tabular, graphical format (ARTC to supply history),

iv. a breakdown of the whole ARTC network into type of defect (ie VSH, TD, NSD, etc) and priority faults (ie. Large, Medium and Small) (table and graphs),

v. break down of type of defect and priority faults (table and graphs),

vi. further breakdown of the results into maintenance corridors as specified by ARTC *Project Manager* into types of defects and priority (size) of defects (table and graphs),

vii. graphs showing the track time, etc (table and graphs),

viii. a description of the probes used, level of gains used and testing speed in comparison to previous runs and an indication that if anything has changed from previous runs what impact this will have on the level of defects found (ie so trending can still be done with the test results),

ix. trending of the NSD for the overall network by corridor (table and graphs),

x. average test speeds,

xi. trending of the number of Previous Defects found by corridor and state,

xii. details of all existing defects identified during the run.

For testing performed in NSW, the reports shall be produced monthly and should be completed and submitted to ARTC no more than one (1) month after completion of the run.

For testing in S.A., Vic & W.A. the reports shall be produced at the conclusion of the entire run and should be completed and submitted to ARTC no more than one (1) month after completion of the run.

4.5 Information to be supplied by ARTC

ARTC's *Project Manager* will supply to the *Contractor*, documentation to indicate the identity of the tracks being tested and recorded for subsequent use by the *Contractor* in defect identification and reporting e.g. Run Number, Basecode, Line, Road, Start & End km's, Maintenance Corridor.

4.6 Recording of Test Results

The *Contractor* shall keep records showing the following data for all test equipment used to detect rail flaws:

- All test readings sufficient for reviewing defects that may have been missed
- Location of test readings (to an accuracy of ±5 metres per 1000 metres from the last kilometrage or ½ kilometre post encountered). The test vehicles kilometre location is not to

be reset at the ½ kilometre posts in SA or WA as these are not as accurate as the full kilometre posts.

- Location of readings from GPS co-ordinates (accuracy is described in ARTC's GPS Survey Specification Guidelines)
- Date of test readings

The *Contractor* shall maintain the records and make them available to the *Project Manager*, on request, for a period of eighty four (84) months from the date of the test.

4.7 Broken rail reports

The *Contractor* will provide reports of defects or rail breaks found in the field no more than one month after being advised by ARTC of the defect. The *Project Manager* will advise the *Contractor* of the location to be investigated. The contractors report will include

- the location details
- date of failure and date of last test
- results of the investigation
- any improvements to prevent or reduce the likelihood of recurrence (by ARTC or the *Contractor*)
- any operator display download to verify the results of the investigation
- any additional comments

5 Appendix

5.1 New South Wales Rail testing schedule

Run Number	Lease Region	Description	Last tested (If not due in 06/07)	Frequency (days)	Km's	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
S1	South	Macarthur - Bargo- Campbelltown		122	89.870	89.87				89.87				89.87			
S2	South	Picton - Mittagong - Picton		122	92.388	92.388				92.388				92.388			
S3	South	Mittagong - Bundanoon - Mittagong		122	61.400	61.4				61.4				61.4			
S4	South	Moss Vale - Medway Jctn - Moss Vale		122	87.765	87.765				87.765				87.765			
S5	South	Bargo - Moss Vale - Bargo		122	86.161	86.161				86.161				86.161			
S6	South	Medway Jctn - Goulburn - Medway Jctn		122	70.074	70.074				70.074				70.074			
S7	CRN South	Canberra - Bungendore		182 (365)	36.695				36.695						36.695		
S8	CRN South	Bungendore - Goulburn		182 (365)	64.276				64.276						64.276		
S9	South	Moss Vale - Unanderra		122	70.378				70.378						70.378		
S10	South	Goulburn - Gunning - Goulburn		122	108.595			108.595				108.595				108.595	
S11	South	Yass - Gunning - Yass		122	78.800			78.8				78.8				78.8	
S12	South	Yass - Binalong - Yass		122	75.000			75				75				75	
S13	South	Harden - Binalong - Harden		122	60.200			60.2				60.2				60.2	
S14	South	Cootamundra - Harden - Cootamundra		122	89.172			89.172				89.172				89.172	
S15	South	Junee - Cootamundra - Junee		122	115.047			115.047				115.047				115.047	
S20	South	Junee - Culcairn		122	110.399			110.399				110.399				110.399	
S21	South	Culcairn - Albury		122	53.566			53.566				53.566				53.566	
S22	CRN South	Junee - Leeton		365	127.360						127.36						
S23	CRN South	Leeton - Barellan		365	99.500						99.5						
S24	CRN South	Barellan - Temora		365	98.247						98.247						
S25	CRN South	Temora - Ungarie		365	108.258						108.258						
S26	South	Temora - Cootamundra - Bribbaree		365	108.601						108.601						
S27	West	Bribbaree - Forbes		365	96.700						96.7						
S30	South	Albury to Junee Crossing Loops		242	14.326							14.326					
S31		Albury to Goulburn contingency		122				YES				YES				YES	
S41	CRN South	The Rock - Boree Creek	08/09/2003	1460	57.405												
S42	CRN South	Demondrille - Greenthorpe		730	95.586					95.586							
S43	West	Koorawatha - Blayney		730	103.177					103.177							
S51	CRN South	Hillston - Griffith		1460	108.050										108.05		
S54	CRN South	Ungarie - Lake Cargelligo		1460	71.365										71.365		
S55	CRN South	Naradhan - Ungarie		1460	60.440										60.44		
S60	South	Albury Broad Gauge (ARTC)		365	2.762											2.762	
N9	CRN North	Werris Creek - Kootingal		182	61.389			61.389						61.389			
N19	CRN North	Moree - Narrabri		365	100.562									100.562			
N20	CRN North	Narrabri - Burren Junction	03/03/2004	1460	83.530												
N21	CRN North	Narrabri - Gunnedah		365	85.520									85.52			
N22	CRN North	Gunnedah Colliery - Werris Creek		122	74.600				74.6				74.6				74.6
N23	Inland	Werris Creek - Binnaway		365	141.713									141.713			
N24	Inland	Binnaway - Merrygoen		365	42.405									42.405			
N30	CRN North	Camurra - Boggabilla Line		1460	83.540									83.54			
N40	CRN North	Burren Junction to Walgett		1460	84.838									84.838			
N41	CRN North	Kootingal - Armidale		182	106.900			106.9						106.9			
N42	CRN North	Moree - Weemalah		1460	96.910									96.91			
BC10023	CRN North	Burren Junction to Merrywinebone	30/11/2005	1460	52.000												
H1	Hunter	Newdell Jct - Branxton		28	47.242	47.242	47.242	47.242	94.484	47.242	47.242	47.242	47.242	47.242	47.242	47.242	47.242
H2	Hunter	Branxton - Scholey Street		28	50.241	50.241	50.241	50.241	50.241	100.482	50.241	50.241	50.241	50.241	50.241	50.241	50.241
H3	Hunter	Branxton - Dartbrook Jct		56	62.504	62.504	62.504		62.504		62.504		62.504		62.504		62.504
H4	Hunter	Sandgate - Branxton (Down Coal)		84	46.274		46.274			46.274			46.274		46.274		
H5	Hunter	Whittingham - Bengalla Junction		112	59.372			59.372				59.372			59.372		
H6	Hunter	Hanbury Jct - Sandgate - Kooragang Island		112	19.786			19.786				19.786			19.786		
H7	Hunter	Islington Jct - Port Waratah		112	16.683			16.683				16.683			16.683		
H8	Hunter	Hamilton Jct - Telarah - Hamilton Jct (Down & Up Mains)		112	63.169			63.169				63.169			63.169		
H9	Hunter	Woodville Jct - Sandgate (Down Coal via Scholey Street)		112	6.651			6.651				6.651				6.651	
H10	Hunter	Bengalla Jct - Ulan Colliery Jct		183	141.360	141.36						141.36					
H11	Hunter	Ardglen - Werris Creek		122	44.784	44.784				44.784				44.784			
H12	Hunter	Muswellbrook - Ardglen		122	67.567	67.567				67.567				67.567			
H13	Hunter	Gulgong to Ulan Jct and Crossing Loops		336	31.758											31.758	
H14	Hunter	Werris Creek to Muswellbrook Crossing Loops		336	9.314			9.314									
NC1	North Coast	Telarah - Dungog		121	50.440				50.44				50.44				50.44
NC2	North Coast	Dungog - Gloucester		121	63.860				63.86				63.86				63.86
NC3	North Coast	Gloucester - Taree		121	69.300				69.3				69.3				69.3
NC4	North Coast	Wauchope - Taree		121	75.156				75.156				75.156				75.156
NC5	North Coast	Kempsey - Wauchope		121	48.844				48.844				48.844				48.844
NC6	North Coast	Macksville - Kempsey		182	48.800		48.8						48.8				
NC7	North Coast	Coffs Harbour - Macksville		182	55.400		55.4						55.4				
NC8	North Coast	Glenreagh - Coffs Harbour		182	44.100		44.1						44.1				
NC9	North Coast	Grafton - Glenreagh		182	43.800			43.8						43.8			
NC10	North Coast	Casino - Grafton		182	109.400			109.4						109.4			
NC11	North Coast	Bromelton - Casino (50% QR to Speno)		182	125.700			125.7						125.7			
NC19	North Coast	Glenapp - Casino (Crossing Loops)		365	5.294	5.294											
NC20	North Coast	Casino - Coffs Harbour (Crossing Loops)		365	13.068	13.068											
NC21	North Coast	Coffs Harbour - Wauchope (Crossing Loops)		365	12.074	12.074											
NC22	North Coast	Wauchope - Gloucester (Crossing Loops)		243	13.100							13.1					
NC23	North Coast	Taree - Telarah (Crossing Loops)		121	183.700			183.7				183.7				183.7	
NC24	North Coast	Gloucester - Telarah (Crossing Loops)		243	11.015								11.015				
W1	CRN West	Lithgow - Bathurst (Down Main and Single Line)		182	80.300	80.3						80.3					
W2	CRN West	Bathurst - Orange (Down Main and Single Line)		182	85.160						85.16						85.16
W3	CRN West	Bathurst - Lithgow (Up Main only and Loops)		182	53.372	53.372						53.372					
W5	CRN West	Orange - Bathurst (Up Main only and Loops)		182	27.520	27.52						27.52					
W9	West	Broken Hill - Menindee		182	121.320		121.32						121.32				
W10	West	Menindee - Darnick		182	127.570		127.57						127.57				
W11	West	Darnick - Trida		182	134.094		134.094						134.094				
W12	West	Trida - Euabalong West		182	134.528		134.528						134.528				
W13	West	Euabalong West - Condobolin		182	74.090		74.09						74.09				
W14	West	Condobolin - Parkes		182	106.691		106.691						106.691				
W15	Inland	Forbes - Peak Hill		365	83.501						83.501						
W16	Inland	Peak Hill - Dubbo		365	95.357						95.357						
W19	CRN West	Parkes - Orange		182	126.594	126.594						126.594					
W20	CRN West	Orange - Dubbo		182	142.544		142.544						142.544				
W21	CRN West	Kandos - Wallerawang		365	85.336							85.336					
W22	CRN West	Merrygoen - Gulgong		365	77.695							77.695					
W24	CRN West	Troy Junction (Dubbo) - Merrygoen		365	96.090							96.09					
W36	CRN West	Bogan Gate - Tottenham Line	23/06/2004	1460	116.972												
W40	CRN West	Narromine - Nyngan		365	124.978						124.978						
W41	CRN West	Nyngan - Cobar		365	132.438						132.438						
W42	CRN West	Cobar - Elura; and Warren line		365	62.817								62.817				
W43	CRN West	Dubbo - Curban		365	86.660									86.66			
W44	CRN West	Curban - Coonamble		365	72.200									72.2			
W47	CRN West	Gulgong - Kandos	22/01/2006	1460	92.790												

5.2 S.A., Vic & W.A. Rail testing schedule example

Line Section	Approximate Track Length	Cycle Days	Jun	Jul	Aug
ARTC - South Australia					
Mile End to Wolseley	313.209	365		Yes	
Mile End to Dry Creek Jct	13.5	365		Yes	
Dry Creek Jct to Outer Harbour	20.5	730		Yes	
Port Flat to Rosewater Loop	2	730		Yes	
Dry Creek Jct to Crystal Brook	183.5	365		Yes	
Crystal Brook to Broken Hill	372	365		Yes	
Crystal Brook to Coonamia (up track)	23.533	365		Yes	
Crystal Brook to Coonamia (down track)	23.533	365		Yes	
Coonamia to Spencer Jct	95.23	365	Yes		
Spencer Jct to Tarcoola	410.2	365	Yes		
Tarcoola to Cook	411.015	365	Yes		
Cook to Rawlinna	487.285	365	Yes		
Rawlinna to Kalgoorlie	377.7	365	Yes		
Spencer Jct to Whyalla	73	365	Yes		
Tarcoola to Asia Pacific Interface	6.35	365	Yes		
Total Length of Mainline (approx)	2812.555				
ARCT Crossing Loops SA & Vic (next due in 2010)	200	1825			
ARTC - Victoria					
North Melbourne to Sims St Jct	2.9	365			Yes
Sims St Jct to Tottenham Up track	2.7	365			Yes
Sims St Jct to Tottenham Down track	2.7	365			Yes
Tottenham to Jacana	19.8	365			Yes
Jacana to NSW border	288.3	365			Yes
Tottenham Jct to Newport	6.5	365			Yes
Newport to North Geelong	58.5	365			Yes
North Geelong to Maroona	173.5	365			Yes
Maroona to Ararat	21.4	365			Yes
Ararat to Pyrenees	4	365			Yes
Pyrenees to Serviceton	248.6	365			Yes
Total Length Mainline (approx)	828.9				

Broad Gauge Segments	Km From and To	Cycle Days	Jun	Jul	Aug
Victoria					
North Melbourne	1.6 - 2.3	365			Yes
Bunbury St Tunnel	4.2 - 6.8	365			Yes
Tottenham to Newport	17.1-10.7	365			Yes
North Geelong to Gheringhap	72.4 - 81.6	365			Yes
South Australia					
Gillman Jct to Port Adelaide	1.17 - 3.57	365		Yes	
Port Flat to Dry Creek	1.61 - 8.265	365		Yes	

5.3 Vehicle Movement Report example

ULTRASONIC RAIL TESTING						Run Number	Description
		Vehicle Movement Report					
Date		Client	ARTC	Report Author			
Report number		Division					
Operator		Track					
Hand sizing Op							
Ass. Op. / Driver							
R. R. Rep.							

Task	Start Time	End Time	Total time	Track	Direction	Start Km	End Km	Total Km	Comments	Base Code	Description	Run

OPERATOR COMMENTS						
Line - 1						
Line - 2						
Line - 3						
Line - 4						
Line - 5						
Sec.Run Completed						
Primary Run KM		**Missed KM**		**Shift Completion rate:**		

SUMMARY - TRACK NOT TESTED (missed)

Base Code	Description	Start Km	End Km	Total Km	Comments

SUMMARY - TOTALS

TASK	Total Time	Total Km		ITEM	DESCRIPTION	TOTAL TIME
(1) Testing				7	Total Hours Chargeable (items 2+3+4)	
(2) To / From				8	Total Service hours (items 1 & 7)	
(3) Run Light				9	Non Chargeable hours (item 6)	
(4) R.R. - Delays				10	Total hrs of Car operation (items 8 & 9)	
(5) Maintenance						Total Km
(6) Operator - Delay				11	Total Kms (1+2+3) (including extra)	

5.4 Vehicle Defect Report example

ULTRSONIC RAIL TESTING

	Test Vehicle Defect Report

Date		**Day Shift**	Client	**ARTC**	Report Author
Report number		**Version 1**	Division		
Operator			Track		
Hand sizing Op.					
Ass. Op. / Driver					
R.R.Rep.					

DEFECT information							WELD info.		RAIL info			COMMENTS	Base Code	Description
Number	Type	Track	Position	Size	mm	Location	Num.	Type	Weight	Rail	Geom			

Defective Rails	Rail Ident.	BB	BH	BR	CR	DW	DWFW	FW	HSH	HSW	HW	MJS	PR	SW	TD	NSD	TD/EBF	TDX	VSH	VSW	Totals not including NSD's	VSH/IB Total	NO ERRORS
	DN																						
	UP																						
	Totals																						

Total invalid entries (count of defects NOT EQUAL to Rail count)…..	

5.5 Rail Surface Condition Report example

ULTRASONIC RAIL TESTING

Rail Surface Condition Report

Date		Client	ARTC	Report Author	
Report number		Division			
Operator		Track			
Hand sizing Op					
Ass. Op. / Driver					
R. R. Rep.					

LOCATION				Track	RAIL			CONDITION	SLEEPER	GEOM.	GRIND Or INSPECT	Details of Probe Used'	Details of Probe Used'	Details of Probe Used'	Details of Probe Used'	Details of Probe Used'	Details of Probe Used'	COMMENTS
#	B Code	FROM	TO	UP/DN	UP/DN	Weight	Type		Type			Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		

Comments