AUSTRALIAN RAIL TRACK CORPORATION LTD

Engineering (Signalling) Note/Manual

Grade Crossing Predictor Design

ESN-06-01

Applicability

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

Introduction

ARTC is using the Safetran GCP4000 Grade Crossing Predictor to operate level crossing protection across its network. These detect the speed of approaching trains to give a constant warning time at the level crossing. Special requirements are needed for situations where the train may stop prior to the level crossing. This Technical Note provides guidelines for the design of the GCP configuration data and these situations. This model is preferred over the Safetran GCP3000 for all new ARTC installations.

Design Guideline

The design of the GCP4000 for a particular location is to be based on the following information in order of precedence:

- This Signal Engineering Note
- ARTC Type Approval Report and conditions 08-08-10-029 (ESA 01-0610-020) WRSA, GCP4000
- Safetran GCP 4000 Application Guidelines – document SIG-00-03-19
- Safetran GCP 4000 Reference Manual – document SIG-00-02-02

System Configuration Requirements

The following configuration items are to be set in the GCP data:

- Time is to be set as Eastern Standard Time or Central Standard Time as applicable. Daylight Saving Time is not to be used or configured.
- The 25 Character Site Name is to be in the format - "Town, Street name".
- The 6 figure crossing number is the same as applied for the level crossing monitor.
- The location is set in kilometres and metres as kkk.mmm
- The unit address is a unique ID allocated by ARTC Signals Standards. It includes the ARTC ID 047.

Site General Configuration Requirements

The system should normally be set with Enhanced Detection. This results in a 10 second allowance for the GCP to calculate a train. This is 5 seconds average for calculation of speed and 5 seconds average to allow calculation of changed track conditions. This time should be added to the required warning time for the level crossings equipment to determine the length of approach tracks based on the train speed at the location.

Motion Sense zone should be set in accordance with the conditions in the Safetran Application Guidelines. The value should normally be 25% of the approach distance. This may be varied between 20% and 30% depending upon the specific site conditions.

Issued by	**Date**
John Cowie, Manager Standards & Systems	29 January 2007

Positive Start zone should be set in accordance with the conditions in the Safetran Application Guidelines. The value should normally be 15% of the approach distance. This may be varied down to 10% depending upon the specific site conditions.

The approach requirements for all train paths to the level crossing shall be considered. Each approach path shall be recorded in the GCP Control Table. Station stop logic and trailing points logic may be required where special situations are encountered. The Safetran Application Guidelines shall be used to determine and implement this logic.

Multiple Track Requirements and Train Stopping Requirements

Pre-emption is used to provide holding for a second train in multiple track territory. This shall be configured in accordance with the Safetran GCP 4000 Application Guidelines.

There may be situations that require a train to stop within the approach to the level crossing. This may be a station platform, controlled signal or automatic signal or siding / points. The GCP shall be configured for these conditions using the general configuration details as above and special logic as required. Where a train stops within the detection zone, the train will be limited to increasing speed to 25 kph until it passes the level crossing. Generally in these situations the positive start zone is extended to include the station platform or 200 metres on the approach side of the signal to ensure that the required warning times are achieved. Additional logic may be required to ensure that the 15 seconds for boom gates to rise and fall is provided in cases of a second stopped train restarting within the detection zone.

Control Tables

All the requirements for the GCP are to be detailed in the Control Tables. Each level crossing shall have its own Control Table on a separate sheet or sheets. If multiple GCPs are required for the level crossing, then these shall be included on the same Control Table sheet. The Control Table shall detail all the parameters to be set in the GCP configuration. It shall have a separate section for each approach path and for common configuration data. The approach distances shall be defined in terms of distances, warning time and respective train speed. Special requirements for logic for the GCP shall be detailed in the Control Table.

Signalling Plan

The location of strike in points and all GCP equipment shall be detailed on the Signalling Plan. Strike in points and level crossing signs shall also be detailed on the Drivers Diagram.

Island Track Circuits

The island GCP track circuits are to be set to be longer than the longest wheelbase of rail vehicles. For ARTC this is nominated as island track circuits to be not less than 25 metres.

GCP Track Connections and Track Shunts

The track connections for the GCP shall be in accordance with the Safetran GCP 4000 Application Guidelines and Reference Manual. The appropriate hardwired shunt, wideband shunt or narrowband shunt shall be used to terminate the GCP. Bypass couplers shall be used on block joints when the GCP is overlaying conventional track circuits.

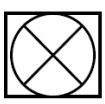
Level Crossing Signs

Trackside Level Crossing signs are required at the strike in point for the Predictor. The sign in NSW is detailed in ANGE 216 (see below RHS). The sign for Western Jurisdiction is defined in the ARTC amendment to the NCOP (see below LHS). The sign in Victoria is the same as for the NCOP amendment and is covered in the Victorian Book of Rules. The signs shall be placed at the location of the furthest Track Shunt.

33.2 LEVEL CROSSING PREDICTOR WARNING SIGN

The level crossing ahead is equipped with a predictor which calculates the speed of the approaching movement and governs the commencement of the level crossing warning device to give a constant ring time before the movement is at the level crossing.

Meaning - the Driver of a movement shall not increase the speed of the movement from the point of passing the sign until the lead unit of the movement has passed over the level crossing.



Rail traffic must not accelerate between the trackside sign advising approach to a Type F level crossing fitted with predictor circuitry and the level crossing.

FIGURE 4: Trackside sign before Type F level crossing with predictor circuitry

ARTC NETWORK RULES SEPT 2004 ISSUE 1 REV 1 UNCONTROLLED WHEN PRINTED PAGE 5 OF 8

Conditions of GCP4000 Equipment Approval

(from 08-08-10-029 [ESA 01-0610-020] WRSA, GCP4000)

i. All design for track circuit operation shall assume a minimum train shunt and ballast resistance in accordance with ARTC specification SPS 21 'Specification – Audio Frequency Jointless Track Circuits for Main Line Applications'.

ii. A special design analysis shall be undertaken and the results shall be submitted for Standards Section approval in each instance before GCP4000 track circuits are applied to dual gauge track (one track circuit equipment detecting trains on either gauge).

iii. Repeated use of any GCP4000 approach or IPI track circuit frequency on a single track for the control of separate crossings or transmitted from separate equipment assemblies shall require each usage to be separated by two insulated rail joints, without bypass coupler, in each rail or by a distance > 1.75km. The separation distance may be reduced to 350m if both track circuits using the same frequency are terminated by hardwire shunt.

iv. Separation > 3km and one insulated rail joint, without bypass coupler OR > 1km and two insulated rail joints, without bypass coupler, in each rail is required from a SAFETRAN PSO III track circuit installation using frequencies (f):- 2140, 2630, 3240 or 4000 Hz.

v. GCP4000 Grade Crossing Predictor track circuits may be used to overlay immune and non-immune DC feed track circuits, electronic coded track circuits and 50Hz AC feed track circuits (not including remote rectifier DC relay track circuits).

vi. GCP4000 Grade Crossing Predictor track circuits may be applied only to rails in which no electric traction current is conducted.

vii. For use in accordance with ARTC specification SDS 25 and standard typical circuits developed and/or approved specifically for GCP4000 equipment.

viii. Surge protection shall be provided in accordance with ARTC specification SCP 04 'Lightning and Surge Protection Requirements' for Electronic equipment subject to Category C exposure.

ix. Output relay for vital circuits shall be WRSA type QS2 housed in the GCP4000 equipment enclosure.

x. Vital track clear information for a signal interlocking shall be derived independently from GCP4000 equipment. Vital outputs from any part of the GCP 4000 equipment may only be used to directly control separate Level Crossing protection equipment (including adjacent GCP 4000 systems) and/or provide monitoring of the GCP4000 system.

xi. Design documentation shall record track related dimensions in both metric (meters) and imperial (feet) with imperial dimensions always shown in parenthesis following metric.

xii. Only components from the list 01-0610-020b may be utilised.

xiii. Operations, maintenance and Safeworking procedures, including amendments to routine maintenance and testing standards e.g. SMP 25, shall be published by ARTC before the equipment is commissioned.

xiv. A documented plan for preventing inadvertent updating of crossing characteristics i.e. site specific data; shall be in place before the commissioning of any GCP4000 sites. (e.g. password protection to be shown on design documentation)

xv. For new works only the latest approved version of module executive software, together with the associated maintenance & development system (DT) software, may be used.

xvi. All modules at a site (included in the same circuit book) shall use versions of executive software referenced on the same ARTC acceptance certificate.