

Sheet 1(9)					BOMBARDIER	
Author J Parker Smith		Issue 1	Document number IS580001448A4	Save Date 01/09/08	File IS580001448A4 01.doc	

***BOMBARDIER* EBI** Track 200, 300 & 400 Track Circuits**

Operation with concrete slab track with steel reinforcing or iron lined tunnels

Author: J Parker Smith

Reviewed: Andrew Lovett

Approved: Mike Mackie

Date: 19/08/2008

Bombardier Transportation UK Ltd
Estover Close
Estover
Plymouth PL6 7PU
Tel : +44 1752 725000
Fax: +44 1752 725001

* *BOMBARDIER* and *EBI* Track are trademarks of Bombardier Inc. or its subsidiaries

This document and its contents are the property of Bombardier Inc. or its subsidiaries. This document contains confidential proprietary information. The reproduction, distribution, utilisation or the communication of this document or any part thereof, without express authorisation, is strictly prohibited. Offenders will be held liable for the payment of damages.

<i>Author</i> J Parker Smith	<i>Issue</i> 1	<i>Document number</i> IS580001448A4	<i>Save Date</i> 01/09/08	<i>File</i> IS580001448A4 01.doc
---------------------------------	-------------------	---	------------------------------	-------------------------------------

Table of Contents

1	Revision History	2
2	Terminology	2
3	Introduction	3
4	Determining risk and solutions	3
5	Summary	4
5.1	Indications of whether a problem may exist	4
5.2	Means of avoiding or reducing the effects of the problem	4
5.3	Other potential problems associated with reinforcing	5
6	Detailed description of the problem	6
7	Structures likely to cause the problem	8
8	References	9

1 Revision History

Issue		Date	Reason for Change	ECR No	Sig.
From	To				
-	1	19/08/08	First release	6..2417	

2 Terminology

ETU	End Termination Unit
LMU	Line Matching Unit
MMU	Metro Matching Unit
TCU	Track Coupling Unit
TU	Tuning Unit
Tx	Transmitter

Author J Parker Smith	Issue 1	Document number IS580001448A4	Save Date 01/09/08	File IS580001448A4 01.doc
--------------------------	------------	----------------------------------	-----------------------	------------------------------

3 Introduction

The purpose of this Information Sheet (IS) is to assist in determining whether the presence of metalwork such as steel reinforcing in concrete, or cast iron tunnel walls, is likely to influence the operation of *EBI* Track track circuits, and lead to downgraded performance. It gives examples of types of construction which are known to have, or would be envisaged to have, an effect on the tuned area sufficient to cause problems with *EBI* Track set-up and commissioning, and to advise on ways of avoiding these problems.

The result of this potential effect is to lower the series inductance of the rails due to a loading effect, and to increase the series loss due to eddy currents flowing in the coupled metalwork. Overall the rail's series impedance is lower and with a more resistive phase. This actually reduces track circuit signal attenuation in the main part of the track, but also has a detrimental affect on the tuned area.

Within the tuned area the lower inductance and higher loss mean that the launch voltage of a transmit end tuned area is lower than it should be, and that the receiver input current is lower for a given receive end rail current than it should be. The overall result is that the maximum track length that can be successfully set-up is significantly reduced. Another affect of the increased loss is to reduce the resonated impedance of the tuned areas, which can make it more difficult to shunt the track.

Practical testing of the influence of reinforcing of various geometries and distances from the rails would be a major undertaking. Accurate measurements would be required on either a large, and difficult to adjust, test arrangement, or on a wide variety of different infrastructures covering the range of construction designs likely to be encountered in future.

An accurate theoretical evaluation of the problem is also problematical, as it would require sophisticated (and expensive) simulation software. Therefore it is not easy to predict whether a particular construction would cause a major problem or not. This document summarises the knowledge on the subject built from site work to date, as well as from some simple and rather crude calculations, in an attempt to assist in avoiding the problem on future projects.

Any feedback from experience on new projects would be welcome, and will be used to improve the accuracy and usefulness of this IS. It should be made via the Engineering Manager, Manufacturing Engineering, Bombardier Ltd, Plymouth.

4 Determining risk and solutions

In order to evaluate the level of risk of there being a problem with a particular site, it will be necessary to have detailed construction drawings, or descriptions, showing the relative positions of the rails and track bed reinforcing system or tunnel walls. These details must be studied for evidence of any of the indicators listed in section 5.1, the result of which should give a good idea as to whether there may be a problem when the track circuits are installed and set-up attempted.

If there is a likelihood of a problem, then it may be possible to solve if the construction methods can be altered as per section 5.2. Other actions in section 5.2 may help to reduce the extent of the problem.

If there is any doubt, or it is suspected that there would be a problem, then this should be referred to the Engineering Manager, Manufacturing Engineering, Bombardier Ltd, Plymouth, so that an appropriate product expert can advise the project on the best way forward. This may involve conducting practical tests on site, depending on the state of the infrastructure.