WHITE PAPER

York EMC Services

Taking the EMC Risk out of Rail Projects

Managing Compatibility, Assessing Risk & Improving Safety in the Rail Environment

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Why would a project need an EMC consultant?

EMC (Electromagnetic Compatibility) is an important part of any Rail Project, be it recommissioning or refurbishing Rolling Stock, Track and infrastructure renewals, electrification and stabling projects, or adding additional electronic items to existing systems.

EMC management, from a risk based viewpoint, is something that needs to be carried through all of the stages of a project; ideally from conception to completion. EMC is a specialist subject that not everyone is comfortable with – but this is not so when an EMC Consultant is used.

Eurofins York (formerly York EMC Services) gets involved in the EMC of many rail projects from major electrification through to technical documentation for apparatus and research into new and emerging technologies for use in the rail environment, with a particularly high aptitude in EMC Management and Risk Assessment. For fixed installations the EMC Directive requires that there is a Responsible Person for EMC. The Directive states that the Responsible Person does not have to be an EMC expert but has to have access to EMC expertise, which is where Eurofins York comes in.

Managing the EMC of a Project

The electromagnetic (EM) environment within the railway is very complex, and is quite different from other EM environments that are encountered for example in the Built Environment or the Energy sectors. The main concern for EMC Consultants is the EMC Risk Assessment. There are often a multitude of EMC documents that are required by rail projects, and the driver behind all of them is the concept of closing hazards.

The EMC activities of a project hang on the EMC Strategy and the Risk Assessment. The Strategy outlines the way EMC will be dealt with throughout the life of the project, and may be updated as the project progresses. EMC Control Plans or Management Plans often stem from this document. Other documents such as Design Reviews, Compliance Matrices and Procurement Specifications plus activities such as Site Surveys or additional lab-based testing (depending on the size of the project) are generally decided by the Risk Assessment.

The Role of the EMC Risk Assessment

The Risk Assessment takes place in an early stage of the project with one of the outputs being a Hazard Log and Risk Register. A Risk Register produced by Eurofins York will suggest mitigation actions to close out all of the hazards identified, or

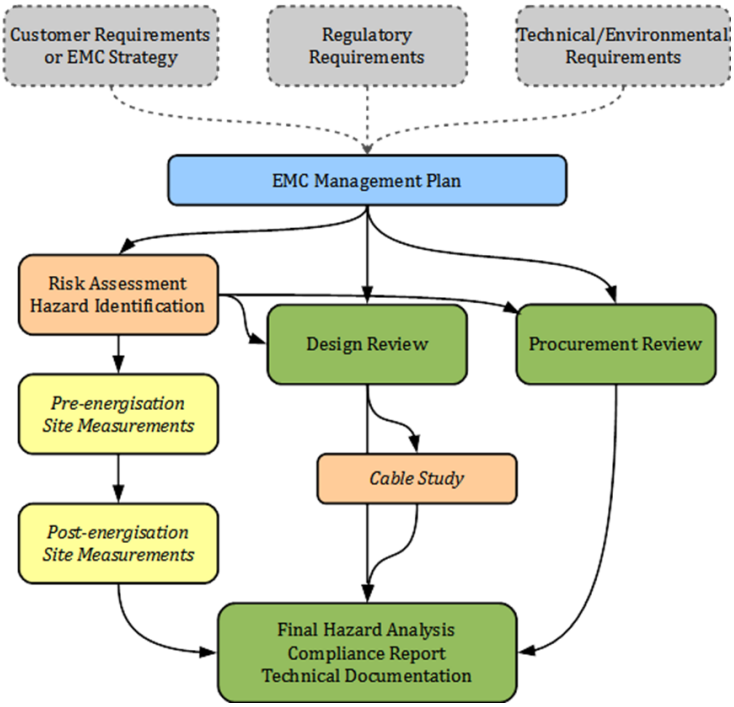

Figure 1: EMC Management Process for a Fixed Installation

at least reduce to ALARP (as low as reasonably practicable).

The difficulty with this is keeping the EMC process

up to date throughout the life of the project as contractors and subcontractors change at the different stages. Ideally the Risk Register is up and running before designs are finalised; then subsequent activities reduce the hazards identified in the Risk Register to ALARP at the end of the project.

During this process, hazards can be identified which require further action. An example would be if a sufficient degree of parallelism or lack of separation is identified between traction current carrying cabling and signalling cabling. In this situation the concern is with both touch potential and the continued operation of apparatus on either end of the victim cabling.

Induction from traction current and other HV feeder systems can be modelled, and, if an issue is identified, it can then be designed out of most railway installations. This is often an important step in reducing the hazards in the Risk Register, and is of obvious benefit to carry out at a design stage before cabling is installed.

Safety Implications – EMC

In addition to safety implications for rail operatives (for example, induction causing excessive voltages on cables that are not expected to be electrified), induction into lineside structures accessible to the public such as fences can also be a necessary subject of study. One interesting point of example is that armoured fibre optic cable is still able to have current induced onto the armouring if installed incorrectly. When carrying out risk assessments, the EMC Consultant groups the hazards into categories; one of these is safety, which is then sub divided into operative and public aspects. Hazards like failure of Depot Protection Systems, signalling systems (including GSM-R), and failure of level crossing systems are examples of hazards in the safety category. There may also be a requirement or a request by the client for EMF (Electromagnetic Field) measurements and/or assessment for the effects of non-ionising radiation on Rail staff, mainly those who have reason to work in substations or other parts of the traction generating sector. Again, these hazards are captured in the Risk Register and appropriate mitigations suggested, which in the substation case, is often an EMF site survey to establish levels.

Figure 2: Measuring high frequency emission at a new build depot (pre-energisation survey)

In terms of compatibility of the railway with itself, it is of course of vital importance that the signalling systems are not interfered with by both external effects or by the railway itself. In order to ensure that this is unlikely, the Risk Assessment will highlight any situation that may result in a malfunction of equipment or apparatus. This will then be closed out by subsequent activities, for example Procurement Reviews or Compliance Matrices, or by Signalling Compatibility Studies or testing if required.

The Role of On-site EMC Measurements

On-site testing is important from the point of view of closing risks. On-site testing is only recommended when a risk will be appreciably reduced using the results or if it felt that it will be beneficial to the project. There may be a requirement for electromagnetic emissions to be measured both prior to works being started and upon completion of works to check the ambient EM Environment.

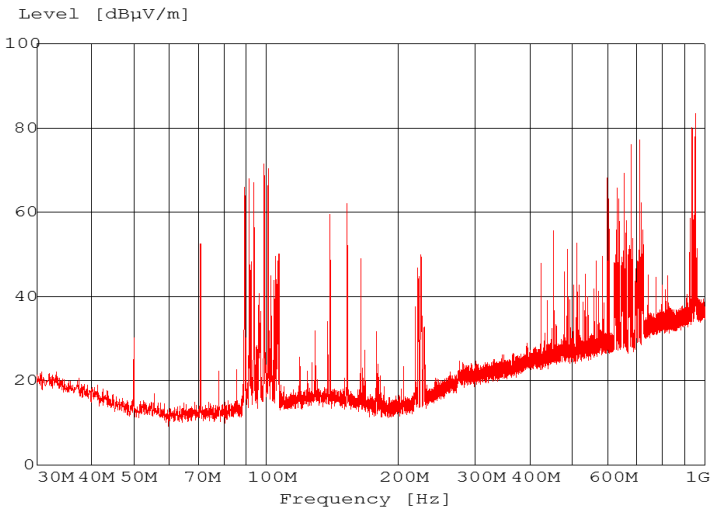

Figure 3: Example of a scan of an Ambient EM Environment (UK) from 30 MHz to 1 GHz

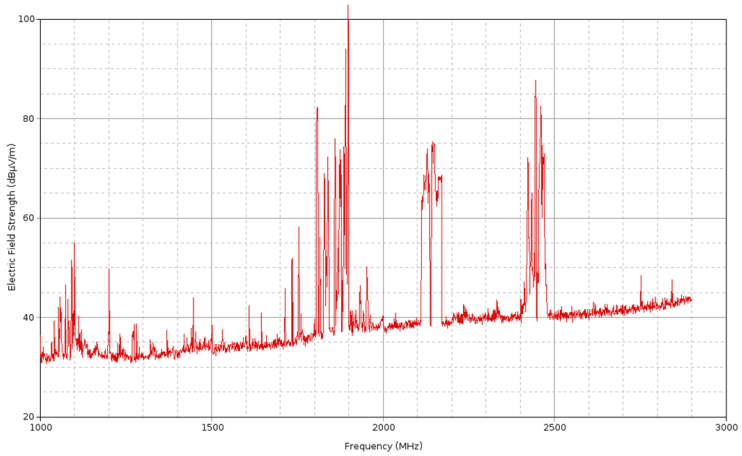

Figure 4: Example of a scan of an Ambient EM Environment (UK) from 1 GHz to 3 GHz

Examples of reasons for performing measurements prior to any works include:

- Benchmarking the existing emissions so that a comparison may be made with the new installation(s)
- Identifying any particular EM threats at the location for inclusion in the hazard analysis and the design review
- Gathering evidence in the case that future claims are made by neighbours or users regarding interference to radio communications services or other equipment.

It may therefore be recommended that pre-construction (or pre-energisation) site surveys are carried out at a number of locations around the project.

Finalising the project and meeting the requirements of the EMC Directive

A Final Hazard Analysis is normally carried out to provide an end-of-project Risk Register in which all hazards will have either been closed or set to ALARP.

Throughout this EMC process it is not unusual for contractors to change or for EMC to be side-lined. York EMC Services has a proven track record in helping contractors with EMC issues that have been left to a stage where they are now high on the project agenda. To that end York EMC Services has developed a set of documents in addition to what is often asked for in order to help contractors in this position, and have had a high degree of success when implementing them.

The EMC documentation presented by the Responsible Person at the end of a large infrastructure or other fixed installation project will demonstrate, through reference to the EMC activities, that the essential requirements of the EMC Directive, along with additional requirements that might stem from Network Rail, London underground, Crossrail or any other organisation, have been met.

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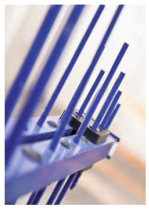

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