WHITE PAPER

York EMC Services

EMC in Urban Rail Transport

How to avoid interference and compatibility problems with new or upgraded Light Rail or Metro systems

By Dr Rob Armstrong
Consultancy & Training Manager
Consultancy & Research Department
Eurofins York Ltd
www.yorkemc.com

eurofins

Urban Rail Transport – Electromagnetic Compatibility (EMC) is Important

Eurofins York (formerly York EMC Services) on how to avoid interference and compatibility problems with new or upgraded Light Rail or Metro systems

Eurofins York has been working in the rail sector for over 20 years; managing, assisting and supporting suppliers, operators, manufactures and installers. One of the main activities we undertake is EMC Management to ensure that projects meets with the legal requirements of the EMC Directive.

Light Rail and Metro Systems are being looked at more closely in recent years, as commuters and out of town residents seek easy access to city centres. Many of the older Light Rail and Metro systems are looking to upgrade to increase reliability, passenger numbers and service levels.

EMC

EMC is the art of ensuring that products, apparatus and fixed installations all function together satisfactorily. Anything that contains electronics is capable of electromagnetic **emissions**; in general, the larger the currents or voltages involved ,the larger the emissions. This makes the railway electromagnetic environment very harsh. The other side of EMC is **immunity**; the capacity of a piece of electronic equipment to withstand the emissions from another piece of equipment and still function satisfactorily.

If EMC emissions and immunity are not appropriately managed and controlled there is a risk of electromagnetic **interference** affecting functionality, performance and ultimately safety. In the rail environment unwanted interference therefore has a knock-on effect on RAMS considerations (reliability, availability, maintainability and safety).

Here at Eurofins York we are able to advise on and measure the existing EMC environment, any changes to the environment and take a risk based approach to ensure that EMC hazards are appropriately managed and mitigated.

EMC Legal Obligations

EMC in itself is governed by a European-wide Directive 2014/30/EU; the text within this directive covers what is known as the “essential requirements”.

The essential requirements of the EMC Directive are as follows:

1) Equipment shall be so designed and manufactured, having regard to the state of the art, as to ensure that:

> (a) The electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended;
>
> (b) It has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use.

2) Specific requirements for fixed installations, installation and intended use of components:

> A fixed installation shall be installed applying good engineering practices and respecting the information on the intended use of its components, with a view to meeting the essential requirements set out in point 1.

When we look at a Light Rail or Metro system we see a combination of equipment and fixed installations.

Fixed installations include things like substations, depots and electrification systems. Rolling stock counts as a piece of equipment under this definition.

So we can see that to comply with the EMC Directive there needs to be some consideration to the EMC of all equipment used as part of the project, be it on-board a piece of rolling stock, part of a substation build, or a lineside installation.

Urban Rail EMC Environment

The urban rail EMC environment is particularly harsh in terms of emissions from rolling stock and infrastructure for reasons which include:

- High currents, and in some cases voltages.
- Large and electromagnetically noisy mobile apparatus (rolling stock).
- The ongoing issue of space.

One of the best solutions to reduce EMC interference problems is the physical separation of

source and victim; where the "source" is the generating the EMC emissions and the "victim" is adversely affected by the emissions. This is a particular struggle for urban rail environments where there may be very limited space available to increase the actual distance between potential sources and victims. By understanding the electromagnetics involved, Eurofins York can help when designing systems to ensure that traction power signalling, control and low power cabling can be sited as close as possible to each other without causing interference problems. In an urban environment where space is at a premium this is therefore often the optimum or only way to proceed in order to reduce interference risks.

In general, EMC emissions (and immunity requirements) are segmented into three different environments:

1. RCLI (Residential Commercial and Light Industrial).
2. Industrial environment.
3. Railway environment.

In order of emissions requirements, the RCLI environment has the most stringent and the Rail the least stringent, with the Industrial lying between the two. In terms of immunity, the Rail environment has the highest requirements, the RCLI the lowest and the Industrial again between the two. This range of environments can cause problems when installing a harsh rail environment (with the least stringent emissions requirements) in a residential, commercial or light industrial environment (with the lowest immunity requirements).

Urban EMC Management and Control

The interface between rail and urban electromagnetic environments therefore needs to be carefully managed, normally using an EMC Strategy, an EMC Management Plan or an EMC Control Plan. The exact purpose of these documents varies in the details but the overall effect is the same; that an EMC Management plan or Strategy ensures that the risk of incompatibility with neighbours is correctly dealt with. This risk management becomes particularly important when

changing the electromagnetic environment, including:

- New installations e.g. tram lines in cities.
- Upgrading existing infrastructure e.g. electrification.

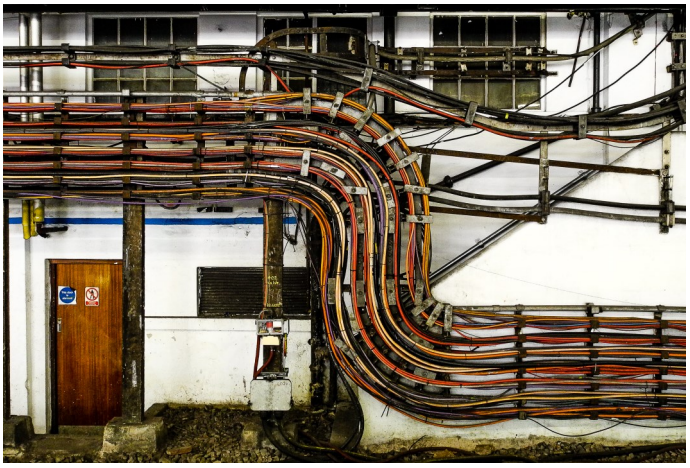
Eurofins York have worked on many such major London Underground projects along-side urban and extra-urban Network Rail, Thameslink and Crossrail projects. During these projects we have carried out a range of management, reviews and testing activities.

Induced Voltage

Of particular relevance to light rail and metro systems are induced voltage studies that cover not only rail systems but also lineside equipment. Induced voltages occur from lineside cabling such as signalling and communications cables having a

voltage induced on them from power cables; normally either HV or traction power. There are three aspects to these induced voltages:

- Inducing a voltage capable of giving someone an electric shock.
- Inducing a voltage capable of affecting equipment.
- Inducing a voltage in-between cores within a cable that affects the signal or data in that cable.



The first two also apply to armoured fibre-optic cables. Eurofins York has extensive experience of modelling such scenarios which are often essential in an electrified railway project or environment. We have also been involved in electromagnetic modelling for tram systems and bespoke DC stay current measurements for power systems.

Overview

The Urban Rail EMC environment is both complex and harsh. EMC mis-management or omission can have major consequences, adding to project costs and timescales and can adversely affect brand reputation. In the worst case scenario poor EMC management can compromise customer and public safety. Eurofins York is experienced in all aspects of urban rail EMC support and solutions. Help can be supplied in the form of just a few hours on the phone or assisting at project meetings, right through to full EMC management and control.

Rob Armstrong, Training & Consultancy Manager at Eurofins York.

For more information please contact us:
E-mail: enquiry@yorkemc.com
Tel: +44 (0) 330 430 3456
www.yorkemc.com

Y2480FLY2