RSC-G-016 Guidelines for the Safety Assessment of New Light Rail Rolling Stock

1. Introduction

The ***Railway Safety Act 2005*** obliges railway undertakings to submit a 'Safety assessment of new works' or a 'Safety assessment of new rolling stock' to the Railway Safety Commission (RSC) before the bringing into use of same (sections 42 and 43). The RSC ***Guidelines for the Safety Assessment of New Infrastructure Works & New Rolling Stock*** (RSC-G-009) and ***Guidelines for the Safety Assessment of New Light Rail Rolling Stock for PPP Schemes*** (RSC-G-018) provide general guidance on this (including, for instance, the 5-staged approach to rolling stock acceptance, and a broad and general outline of the contents of a New Rolling Stock Assessment (NRSA)) and should be referenced where appropriate for the project being undertaken. Note also that general guidance on safety related design principles in relation to light rail rolling stock is given in the following sections of the RSC ***Draft Guidelines For The Design Of Railway Infrastructure And Rolling Stock (GDRIRS):***

- ***Section 0 Introduction and the Top-Level Principles*** (RSC-G-001),
- ***Section 6 Trains*** (RSC-G-007), and
- ***Section 7 Tramways*** (RSC-G-008).

These ***Guidelines for the Safety Assessment of New Light Rail Rolling Stock*** (RSC-G-016) contain further and more detailed information in relation to the safety assessment of new light rail rolling stock, within the context of the Railway Safety Act 2005. These Guidelines consist of this document and its appendices:

- Appendix 1 - guidance on a structured approach for a light rail NRSA, presented in a matrix format, and
- Appendix 2 - guidance on the allocation of the content of the above-referenced sections 0, 6 and 7 of GDRIRS (RSC-G-001, RSC-G-007 and RSC-G-008 respectively) to the individual subsections of the Light Rail NRSA matrix presented in Appendix 1.

For clarification, within the context of the Railway Safety Act 2005, the definition of 'New' Rolling Stock includes new builds and existing rolling stock undergoing significant modification. Where modifications are proposed, RSC should be informed of the scope of such modifications for advice on whether they are deemed sufficiently significant as to require NRSA submissions.

For the purposes of these Guidelines, 'light rail' includes tram and metro systems operating on underground or overground lines, and which may include sections of on-street running in conjunction with road traffic.

2. Process of New Rolling Stock Acceptance

The general process of submission and review of the NRSA shall follow the approach outlined in the RSC ***Guidelines on Safety Assessment of New Infrastructure Works & New Rolling Stock***, RSC-G-009, or ***Guidelines for the Safety Assessment of New Rolling Stock for PPP Schemes,*** RSC-G-018, as appropriate. A sufficient timeframe must be allocated within project programmes to allow for the submission and review cycle at each of the defined stages. Each cycle should include sufficient time for the development of robust submissions, for review by the RSC, and for any subsequent iterations of the submission through revisions and re-reviews prior to acceptance.

The new rolling stock acceptance process typically contains 5 stages. In specific projects, the RSC may agree to waive or combine individual stages where the railway undertaking is able to demonstrate that this approach would not be detrimental to overall project safety.

For each stage of the approval process, an interim submission of the NRSA and, if appropriate, an Independent Assessor's report, must be prepared and submitted to the RSC.

At each stage of the approval process, and in order for the RSC to develop its judgement on the safety and fitness for purpose of the new rolling stock, the RSC reserves the right to review any or all of the supporting safety evidence and to participate in relevant verification and validation processes of aspects related to the NRSA process.

The RSC's normal intention, however, is to undertake a number of spot checks in order to gain sufficient confidence in the ability of the railway undertaking's safety management processes to assure the safety and fitness for purpose of new rolling stock.

Range and depth of these spot checks will generally depend on:

- engineering judgement,
- safety criticality of the individual aspects,
- availability of an Independent Assessor report, and
- findings of the initial spot checks.

3. Fundamental Risk Acceptance Concept

The RSC expects all stakeholders to apply a three tiered risk acceptance concept.

Stage 1: Risk mitigation by compliance with current Irish and European laws and regulations

As Stage 1 safety related requirements are of mandatory nature, any non-compliance is not acceptable. It is however understood that not all risks in relation to a rolling stock project can be addressed by this means. Any remaining risk shall be addressed as detailed in the Stages below.

Stage 2: Risk mitigation by compliance with current best industry practice (described, for instance by current industry standards)

While employing this approach, care shall be taken to ensure that

- a suitable and integrated set of standards is employed on the project,
- the equipment or process is being used as intended by the standards employed,
- the standards cover the project specific situation and integrate with the Irish railway environment (some standardised requirements might need justified adaptation in order to comply with this aspect),
- all project related risks are covered in their entirety by the chosen suite of standards,
- there are no obvious and reasonably practicable ways of reducing risk further.

It should be noted that the above suite of suitable standards should include a standardised safety management concept (for instance EN50126 and the full suite of related CENELEC standards, the UK 'Yellow Book').

Stage 3: Risk assessment to demonstrate GAMAB or ALARP nature of the residual risk

It might be the case that due to a specific or novel nature of the risk, no industry standard is available to address the risk, or it is not reasonably practicable to employ a standard within the merit detailed in Stage 2 above. Only in these specific cases it shall be permissible to employ a project specific risk mitigation concept in connection with a risk assessment to demonstrate the GAMAB or ALARP nature of the residual risk. Where the ALARP concept is used, the related risk acceptance criteria shall be proposed by the railway undertaking for acceptance by the RSC within the staged acceptance process.

4. Structured Approach on Content of New Rolling Stock Assessment

The preparation of a pre-defined project life cycle as well as a planned concept on the scope of project related safety management activities are typical core requirements of safety management concepts.

For the benefit of clarity and completeness, the expected typical content of a NRSA, as well as the expected timeline for submittal within the project life cycle, is provided in a matrix format in the appendix to these Guidelines. This matrix has been divided into Part 1, Management of Acceptance Process, and Part 2, Design Features. Should there be any aspect of a specific project which is not integrated into the items listed in the matrix, it is expected that the matrix will be amended accordingly by the author of the NRSA. If an alternative structure to the NRSA is proposed by the railway undertaking, this should be proposed to the RSC at the earliest opportunity, together with demonstration that the proposed structure fulfils the same requirements as set out in the appendix.

5. Employment of GDRIRS

The guidance contained in the applicable sections of the RSC's GDRIRS shall be applied as a principle to each light rail rolling stock project. The applicable sections of GDRIRS are sections 0 (top-level principles), 6 (rolling stock) and 7 (tramways). In order to facilitate a system engineering approach, Appendix 2 contains the content of GDRIRS which has been matched against the aspects of the NRSA matrix from Appendix 1.

6. Testing

It is a fundamental safety management principle that, in order to validate any safety related design calculations, simulations and assumptions, type testing should be performed. Any deviation from this principle shall be justified.

Routine testing must cover a suitable subset of the type testing scope in order to demonstrate that a series production item complies with the core parameters of the design.

The tests shall be of repeatable nature and be covered by retrievable test reports. A test report shall include (but is not limited to):

- identification of the tested item and description of its parameters,
- the method of testing,
- description of environmental parameters,
- all results of testing,
- any deviations from the test method,
- the determination of conformity made from these results,
- all information needed to understand and interpret the report.

All information shall be reported correctly, accurately, and clearly.

Type and routine testing should follow legislative requirements as well as current best industry practice where appropriate (refer to section 3).

7. Safety Evidence

All stakeholders responsible for preparing a NRSA shall ensure that full and auditable records are maintained in order to provide evidence that the planned safety management activities have been carried out.

The records shall be valid, complete, unambiguous, consistent, auditable and comprehensive.

These records may include (but are not limited to):

- the results of design activity,
- safety analyses,

- test procedures and test reports,
- review records,
- records of near misses, incidents and accidents in relation to the specific project,
- maintenance and renewal records,
- records of decisions that affect safety.

It is recommended that the project related safety evidence is structured in a format which mirrors the items and numbering scheme of the NRSA matrix attached to these Guidelines as Appendix 1.

8. Independent Professional Review

All safety management approaches contain the fundamental requirement that safety management activities must be reviewed by independent professionals who are not involved in the activities concerned.

These reviews may be structured as a series of safety audits and safety assessments. Audits provide evidence that the planned safety management approach have been followed and are effective. Assessments provide evidence that safety requirements are met.

Frequency, depth and level of independence of each type of review shall depend on the extent of the risk as well as novelty and complexity of the design.

As a general principle it is expected that the following design features (refer also to Part 2 of the attached matrix in Appendix 1) require independent professional review by a qualified professional, who is a member of an organisation independent from those organisations involved in the design decisions:

- running dynamics,
- structure,
- braking system,
- overall fire performance and concept of evacuation,
- train control,
- access and egress system.

This principle is driven by the magnitude of potential consequences of the related risks and any exemptions to this principle require justification.

The work carried out by the independent professional shall be covered by a retrievable report. The report shall include all the results of examinations and the determination of conformity made from these results as well as all information needed to understand and interpret them. All this information shall be reported correctly, accurately, and clearly.

It should be noted that further independent professional reviews of specific scope or nature are mandated through legislation (e.g. Notified Body reviews with respect to EC directives, project-level Independent Assessment under the Railway Safety Act 2005 where directed by the RSC and as detailed further in section 9 below) or may be voluntarily applied on a project in accordance with good industry practice.

The full range of independent professional reviews may be carried out by a single organisation, or each individual review can be carried out by a different organisation. In each case, the requirement for independence of the reviewing organisation must be respected at all times.

9. Independent Assessor

In complex projects, the RSC may direct the railway undertaking to employ a competent Independent Assessor (IA). The role of the IA shall be to undertake a review of all safety-related aspects of the project to a level that is consistent with the RSC's own review processes, thereby supplementing and supporting the role of the RSC in assessment of NRSA submissions.

The evidence of system performance provided by the IA review shall enable the RSC's own scope and depth of review to be reduced, normally to spot checks. The selected IA should be advised to the RSC at an early point in the project for agreement that the individual's competence is appropriate for scope of the project.

Where employed, the IA shall issue reports at each staged NRSA submission. The reports shall include all the results of assessments performed and conclusions reached, as well as all information needed to understand and interpret these results and conclusions. All this information shall be reported correctly, accurately, and clearly. The report shall also contain a clear statement of the IA's level of support for the NRSA submission.

The RSC's decision on the acceptability of the safety and fitness for purpose of the new rolling stock, and thereby the decision on acceptance of each NRSA submission, shall be based on the findings within the IA report and the RSC's own conclusions from its review of the NRSA and spot checks undertaken.

10. Further Clarification

Further clarification on these Guidelines can be sought from the RSC.