0 INTRODUCTION AND THE TOP-LEVEL PRINCIPLES

0.1. FOREWORD

0.1.1.1. Soon after the British Railway Inspectorate was formed in 1840, they issued the first written advice on the standards of construction which was considered to be important for the safety of the railway. The advice was aimed at those who were building new railways. It outlined good practice and helped to produce consistency between different places and different railways.

0.1.1.2. Over the years this advice on good practice was extended to cover most aspects of railway construction and although it did not have statutory status became commonly referred to as 'The Requirements'. When existing British railway law was adopted by the State of Ireland in 1921, those standards were, and until now have continued to be, referred to so far as they are applicable to the Irish railway systems. The last full review and updating was published in 1996 by the UK Health & Safety Executive in a novel format and re-titled 'Railway Safety Principles and Guidance'.

0.1.1.3. Since 1998 the Department of Public Enterprise (the Department) has been reviewing railway safety in Republic of Ireland and the systems for regulating it. A major outcome of this work is a complete modernisation of the regulatory system as represented by the Railway Safety Act 2002. It became clear that supporting guidance would be valuable to help railway undertakings meet their duties under that Act. In addition standards emanating from the EU, initially towards compatibility of high-speed train systems but moving towards compatibility of other train systems, show a need to review, revise and reissue in a fully Irish-orientated format that guidance and those standards which hitherto have been 'borrowed' from other administrations. The documents that follow are the outcome of that work.

0.1.1.4. The Department is grateful to the Health and Safety Executive in the UK, for its permission to draw upon the content of its own guidance where it is appropriate in the Irish context.

0.1.1.5. During the development of the new format and preparation of the principles and guidance, the Department has consulted extensively with the railway industry and other organisations who could usefully contribute to the work. Much assistance and many constructive comments have been received and the Department is most grateful for the time and help it has been given.

0.1.1.6. The guidelines attempt to identify all the issues to be addressed to secure safety in design of infrastructure works and rolling stock for use on Irish railways. The guidelines often give examples of how adequate safety may be achieved, and only when considered necessary do they give prescriptive detail. It is always open to railway undertakings to come forward with alternative ways of achieving the objectives identified.

0.1.1.7. The publication of this guidance does not mean that any situation in the Republic of Ireland which falls short of its recommendations must immediately be modified to comply.

0.1.1.8. Although the core document has been developed by the Department, the custodian of the guidance in The Republic of Ireland is the Railway Safety Commission (RSC). The Commission will be pleased to receive any comment on the documents that will help to ensure that any revisions of it enhance its value in promoting appropriate standards of railway safety.

0.2. INTRODUCTION

0.2.1. Objective

0.2.1.1. This suite of documents, the *'Guidelines for the Design of Railway Infrastructure and Rolling Stock'* (the guidelines) is intended to help railway undertakings to ensure that any new works or rolling stock introduced into use meet appropriate safety standards. Evidence of compliance with this guidance will be persuasive in demonstrating compliance with duties contained in the Railway Safety Act 2002 (the 2002 Act), in particular sections [43 and 44]. Following the guidelines is likely to lead to a proposal that the RSC can accept., but the status and structure of the guidelines in many cases enable alternative solutions to be offered which also meet the over-arching Principles which form the structure of these guidelines.

0.2.2. Intended readership

0.2.2.1. The contents of the guidelines should be studied by anyone who is concerned with the design and putting into service of new railway works or rolling stock. Those responsible for alterations to existing works should also be aware of the guidelines and strive to incorporate the guidance into any alterations or modifications which they are promoting. Those responsible for the safety of existing public level crossings will need to take the guidance into account in association with the contents of the relevant Regulation Order which may itself need revision if improvements are justified.

0.2.2.2. Others who operate railway systems not covered by the 2002 Act (such as industrial railways) may also find the guidance helpful towards their planning and management of safety.

0.2.3. Relationship to requirements mandated from Europe

0.2.3.1. Implementation of EU Directives relating to the interoperability of railways will mandate certain high-level principles called Essential Requirements (ERs) and a number of quite prescriptive Technical Specifications for Interoperability (TSIs), developed by multi-national committees of experts at European level. TSIs for certain defined trans-European high speed routes will be complete early in 2002, and these will be followed in due course by TSIs for conventional railways, for which a Directive and ERs already exist.

0.2.3.2. The scope covered by the ERs and TSIs does not exactly match the intended scope of this guidance document, nor are they drafted solely to harmonise safety standards, they do address some issues of compatibility outside of safety alone. For example ERs and TSIs deal with maintenance and operational management issues, neither of which fall within the scope of these guidelines. Conversely neither the ERs nor TSIs say anything about level crossing safety, which is covered in some detail in this document.

0.2.3.3. In summary the guidance in this document aims to be consistent with the ERs and TSIs, but not to duplicate nor to conflict in any way with them. Rather it is to supplement or complement them, often by providing advice at a level mid-way between the high-level ERs and the very prescriptive TSIs, and to provide advice on those areas which are considered important to railway safety in The Republic of Ireland but which are not addressed at all, or adequately in the Irish context, by the mandates from Europe. This guidance will also be relevant to any lines which fall outside those specified as requiring interoperability on which, in consequence, the ERs and TSIs will not be mandatory.

0.2.4. Relationship to other standards

0.2.4.1. Nowhere does this guidance intend to be at variance with established Irish or international standards with respect to the safety standards of any works, plant or equipment, including rolling stock. Such standards may be cited by promoters of works as evidence of the adequacy of their proposals. There is more about the application of other standards in Section 0.6.

0.3. SCOPE

0.3.1. General

0.3.1.1. The document covers the design of all the types of works, plant and equipment that may be found on all types of railway including main-line (heavy) railways, mass transit, light rail, tramway and heritage systems. For convenience, works, plant and equipment are grouped into categories such as permanent way, stations, trains etc., whilst because of their particularly different characteristics tramways have a section dedicated to their special features.

0.3.1.2. These Guidelines do not provide advice on occupational safety and health issues, except so far as these are protected by the safety of railway operations. General issues of safety from work activities are covered separately by legislation under the Safety, Health and Welfare at Work Act 1989 and guidance issued from time to time by the National Authority for Occupational Safety and Health.

0.3.2. Operational safety

0.3.2.1. The guidance focuses on 'hardware' or design standards for the physical features of railway equipment and does not provide any guidance on operational safety. But any design must also take account of how the works, plant or equipment are to be used and maintained, with particular reference to 'human factors' and designing-out opportunities for human error which may lead to danger.

0.3.3. The construction and other processes

0.3.3.1. The principles apply to the finished works, plant or equipment but not to the actual processes of designing or building. In this regard designers and builders need to be aware of the responsibilities imposed upon them by the Safety, Health and Welfare at Work Act 1989 and any relevant subordinate legislation (regulations) made under it. But the specification of any proposed design should take account of whole-life safety issues including the construction processes, proposed methods of use and of maintenance, and ultimate disposability with safety and without harm to health or the environment. Both normal operation and potential failure modes should be considered for each phase of life of the equipment.

0.3.4. Application

0.3.4.1. Clearly not every safety principle applies to all aspects of all railways, and none of the guidance in these documents is statutorily mandated. Railway undertakings proposing new works will need to demonstrate to the RSC that they have considered the range of hazards which will be presented by the proposal, have identified the safety principles which might mitigate those hazards, and have then applied this guidance, or equivalent safety measures, in the design of their proposals. In some cases adoption of the advice in these guidelines might be disproportionate to the risk (ie not 'reasonably practicable') when the railway may make a case for alternative action from that recommended. In other cases specific prescriptive standards may emerge (such as TSIs) which the railway must adopt if relevant to their project.

0.3.5. Effects on existing works

0.3.5.1. *The Guidelines* in principle may be applied to all railways, old and new, but their publication does not imply that any existing condition, which does not comply, must immediately be improved. The improvement of safety in a large and complex system such as a railway will normally be a gradual process making use of progressive opportunities to effect change. But where existing works are being considered for replacement or up-grading then the guidelines should be taken into account in the design of the resultant new works, even if the project is nominally a 'like-for-like' replacement. Particular examples of where the guidelines may have application to existing works are;-

a) Where the existing conditions are not as safe as is reasonably practicable;

b) Where renewals for other than safety reasons allow safety to be improved at reasonable cost;

c) Where there are safety-related interfaces between proposed new works and the existing railway.

0.3.5.2. Small incremental improvements to existing works should not be postponed solely because simultaneous improvement to the whole associated infrastructure or rolling stock equipment cannot be justified, or because exact technical compliance with the guidelines cannot be achieved at reasonable cost. Progressive small increments in safety are preferable to an 'all-or-nothing' approach.

0.3.6. Application to tramways

0.3.6.1. While most of the Guidelines are worded for traditional 'heavy' railways, the principles supporting them are also applicable to tramways, so that in general where the term ‘railway’ is used in the text, it is intended to include ‘tramway’ and similarly ‘train’ to include ‘tramcar’. A separate section deals with the particular features and variations from the railway norms, which are appropriate for tramways.

0.3.7. Application to heritage systems

0.3.7.1. In principle the top-level principles in these Guidelines also apply to heritage railways and heritage tramways. But where there is deliberate policy and intention to keep in use historic equipment, such usage may be at variance with the more detailed guidance in the separate sections. Historic equipment is likely to be less inherently safe than its modern equivalents but the consequent higher risks may be offset by operational limitations, such as a low permissible speed of trains. If heritage railways find the guidance incompatible with their objectives then they will need to demonstrate to the RSC that the equipment and methods of operation they propose will not increase risks above historic levels and, so far as is reasonably practicable, will reduce their risks to the equivalent that modern equipment can provide.

0.3.8. Treatment of existing but obsolete technology

0.3.8.1. In some cases design guidelines are described for equipment currently in use which is generally regarded as obsolete. An obvious example is semaphore signalling. It is not intended or expected that the use of such technology will be expanded, but the inclusion in the guidelines is to ensure any material alterations to existing installations are properly designed.

0.3.9. Application to temporary works

0.3.9.1. The guidelines should also be taken into account, and applied if it is reasonably practicable, whenever it is necessary to introduce temporary works into use on the railway. In principle the use of temporary works should not lead to an increase of risk, and it may be justifiable or necessary to apply the standards of this guidance to a temporary situation. It is not appropriate to apply some arbitrary duration to determine compliance or non-compliance, although the duration of a temporary situation is one factor in the likelihood of a hazard being realised and hence in the assessment of reasonable practicability. If there is doubt about the appropriate level of compliance the RSC should be consulted at an early stage.

0.3.10. Other guided transport systems

The Guidelines apply to railways as defined in the 2002 Act, or as extended in particular cases by the RSC under [section 5] of that Act. At present the RSC does not have jurisdiction over or enforcement powers with regard to any other kind of guided transport system.

0.4. STRUCTURE OF THE GUIDELINES

0.4.1. Technology groups

0.4.1.1. This section 0 of the whole document includes a top-level and all-embracing Safety Mission (section 0.11) but also provides background and outlines the structure for the more detailed contents of the principles and guidance that follow in other documents. Firstly the necessary parts of a railway are divided up into areas, each of which will be the subject of a separate section.

0.4.1.2. The Groups into which the guidance is divided are as follows:

Section 1 - Permanent Way, Earthworks and Structures.

Includes track, embankments, cuttings, bridges, tunnels, clearances, and sidings design.

Section 2 - Stations

Includes safe spaces for people, platforms, fire precautions, and station control.

Section 3 - Electric Traction Systems

Electrical safety from the railway supply point to power collection by trains, but not on-train equipment

Section 4 - Signalling and Telecommunications

The full scope of signalling technology for the safe control of trains, plus all aspects of safety-related telecommunications for both normal and degraded/emergency use.

Section 5 - Level Crossings

Details of the full range of pedestrian and vehicular unprotected and protected level crossings and their presentation to the public.

Section 6 - Trains

Includes running gear, structural integrity, speed control, fire safety, interior design, and communications.

Section 7 – Tramways

Includes special features needed for operations not segregated from other vehicles or pedestrians.

0.4.2. Safety Principles

0.4.2.1. Each of the areas listed above has several high level principles assigned to it, which need to be addressed in order to demonstrate safety of the equipment. The principles are listed later in this document.

0.4.2.2. The principles describe the performance required of an item of works, plant or equipment in relationship with people or other items of work, plant or equipment. The principles are either:

a) directly concerned with the safety of people; or

b) concerned with the safety of the environment, in so far as it may have a subsequent effect on the safety of people; or

c) concerned with the safety of the works, plant or equipment, in so far as they may have a

subsequent effect on the safety of people.

0.4.2.3. Each principle is then further developed in more detailed guidance following this introductory part. The guidance is intended to advise and it is foreseeable that alternative, perhaps better, options may arise which may also meet the underpinning duties to provide adequate safety. The RSC will be prepared to consider such proposals if justified by appropriate risk assessments.

0.4.3. Relationships between the principles

0.4.3.1. Many of the safety principles are related. Where a principle is concerned with an item of work, plant or equipment then there is likely to be a related principle. The relationship between them is usually evident either in the wording of the principles or in the factors for consideration.

0.4.4. Applicability of principles

0.4.4.1. Even if not explicitly stated, where it is relevant and appropriate the principles should be taken as being applicable throughout the operational life and disposal of any particular asset. The top-level Mission Statement, introduced below, is supported by a number of 'Factors for Consideration' which reflect this holistic approach which should be regarded as underpinning all the principles.

0.4.4.2. Not all principles apply to all railways. For example some of the principles do not apply to the on-street running sections of a tramway where the tramway is not segregated from people and road traffic.

0.4.4.3. A ‘Note’ is provided where there is a need to note exceptions and interpretations.

0.4.4.4. In the document, some words or expressions are used in a particular way which may mean something different to what they mean in every day usage, or they have a meaning that is different to that accepted by different parts of the Railway Industry. Section 0.8 gives an explanation of the words and expressions used.

0.5. SYSTEM PERFORMANCE VARIATIONS

0.5.1. Operating conditions

0.5.1.1. In assessing the suitability of any proposed safety measures or arrangements, it is important to take into account:

a) 'Normal conditions' which means the conditions which a part of the railway is designed to accommodate. This would include the peaks, e.g. rush hours, and troughs in demand experienced during the day.

b) 'Degraded conditions' which means the state when the railway system continues to operate in a restricted manner due to the failure of one or more components.

c) 'Abnormal conditions' meaning extreme loading on a part of the railway system. For example, this may be the result of extended delays on one part of the service impinging on another.

d) 'Emergency situation' which means a current unforeseen or unplanned event which has life threatening or extreme loss implications where the immediately available resources are inadequate to secure or maintain safety. e.g. any fire.

0.5.2. Environmental conditions

0.5.2.1. Each assessment should consider the effects of the full range of foreseeable environmental conditions to which the works, plant and equipment may be subjected. This includes severe weather conditions such as extremes of wind, rain and other precipitation, and both high and low temperatures, etc.

0.5.3. Fire

0.5.3.1. Each assessment should also consider the causes and consequences of a fire and the measures that may be necessary to minimise risk to persons in case of fire.

0.5.4. Inspection and Maintenance

0.5.4.1. The safe inspection and maintenance of any works, plant and equipment should be allowed for throughout their lifetime, as well as their decommissioning and disposals. The RSC, in considering acceptance of new works safety assessments, will not require to see details of these continuing activities but will scrutinise their existence and their effectiveness as part of their continuing monitoring of railway safety. General duties under [section 38] of the 2002 Act, [section 6] of the SH&W at Work Act 1989, and other occupational or environmental safety regulations may also be relevant to these activities.

0.6. OTHER SAFETY STANDARDS

0.6.1. National regulations, specifications and standards

0.6.1.1. Works, plant or equipment may be subject to other specific regulations, for example, any made under the SH&W at Work Act 1989, product safety legislation founded in EU directives, and others. Where obvious and appropriate, cross-reference to these is made in the text of the guidance, but such references should not be taken as complete and authoritative. In some cases there will be a need to liaise with other regulatory bodies to achieve an appropriate safety standard and to apply their specifications e.g. for traffic signs and signals at level crossings. The assessment of safety, required by the 2002 Act, should include references to all the relevant standards to which the proposals will be constructed, whether they be internal, national or international.

0.6.2. International specifications and standards

0.6.2.1. The TSIs will represent the most railway-specific technical standards and must be adopted where they are relevant. Irish railways may be granted derogation from some details of TSIs, owing to its island status and Irish track gauge. Where they apply, compliance with TSIs will be confirmed by Notified Bodies appointed for the purpose by national governments, and confirmation of those compliances will form part of the evidence of safety which the RSC will wish to review.

0.6.2.2. Other standards related to product safety in a wider context, often developed in the EU, will also be relevant to some railway works and should be adopted and referred to in any safety assessment. Examples include standards for lifts, escalators, general electrical appliances and others.

0.7. RSC ACCEPTANCE OF PROPOSALS

0.7.1. Fixed Works

0.7.1.1. In order to comply with the requirements of [section 41] of the 2002 Act, which deals with new or material changes to railway infrastructure , the information required by the RSC in a new works assessment is likely to include, but may not be limited to, the following components:

a) the nature and purpose of the new works;

b) the design specifications;

c) the standards covering such works;

d) details of the safety management systems governing the operation of such works;

e) the compatibility of the new works with the existing railway infrastructure and railway operations;

f) compliance with any relevant principles and guidelines adopted by the Authority;

g) a certificate of safety validation by a competent third party, where required by order of the Authority;

h) any other matters which the railway undertaking deems appropriate to comply with its general duty under [section 38], or such other matters as may be requested by the Authority in particular instances or set down in regulations made by the Authority from time to time;

i) a statement from the railway undertaking that on the basis of paragraphs (a) to (h) the bringing into operation of the new works complies with its general duty under [section 38].

0.7.2. Rolling Stock

0.7.2.1. In conformity with [section 44] of the 2002 Act, that is before bringing into use new rolling stock or material alterations to existing rolling stock , the information required by the RSC in a rolling stock assessment is likely to include, but may not be limited to, the following components:

a) the nature and purpose of the new rolling stock;

b) the design specifications;

c) the standards covering such rolling stock;

d) details of the safety management systems governing the operation of the rolling stock;

e) compatibility of the new rolling stock with the existing rolling stock and railway infrastructure;

f) where appropriate in the opinion of the Authority, a certificate of safety validation by competent third parties of the new rolling stock;

g) any other matters that the Authority or the railway undertaking may deem appropriate;

h) a statement from the railway undertaking that on the basis of paragraphs (a) to (g) the bringing into operation of the rolling stock complies with its general duty under [section 38].

0.8. COMMON TERMS

0.8.1.1. Where possible the document has been written in plain English and the use of technical expressions or jargon have been avoided. However, to keep the document reasonably concise and to avoid the repetition of phrases which only serve to provide an extended definition, some words or expressions are used in a way which has slightly different from their common meaning, or that is different from that accepted by disparate parts of the Railway Industry.

0.8.1.2. The following are terms used within the document:

0.8.2. General Railway Terms

0.8.2.1. **'Railway'** has the meaning defined in the 2002 Act, namely:-

(i) a railway which has a gauge of not less than 350mm and which is used for the carrying of fare paying passengers, or for fee paying members, or the conveyance of merchandise for monetary gain;
(ii) any part of such other railway that has a physical interface with a railway under paragraph (i), or a physical interface with a public roadway;
(iii) any other railway which may be specified by the Authority in accordance with [section 5].

0.8.2.2. It therefore includes, where they fit the definition above, mainline (heavy) railways, mass transit, light rail, tramway, and heritage systems.

0.8.2.3. **'Light Railway'** typically involves the use of lighter rolling stock running at lower maximum speeds than traditional or 'heavy' railways, which in turn may allow a lighter construction of track and supporting structures and a simplified signalling system. A light railway will normally operate on track not shared by heavy rail trains, and may run on streets when it gains the special status of a tramway. Except when it is a tramway, and needs the features described in Section 7, a light railway should still incorporate the Principles in Sections 1-6 and the Guidance thereunder, so far as it is reasonably practicable to do so,

0.8.2.4. **'Tramway'** means a railway as defined above but which specifically has been designed to have a significant element that operates on line-of-sight on a road.

Note: In the context of tramways, 'roadway' is used to mean any, or a combination, of the following: carriageway, cycle track, footway, land of the verge of a carriageway or between two carriageways and any other place to which the public has access (including access only on making a payment).

0.8.2.5. **'Heritage Railway'** means a railway undertaking which operates train services or railway infrastructure of historical interest and wishes to maintain that historic status.

0.8.2.6. It may therefore utilise the technology or operating practices of a railway branch line of former times, or may reflect no particular era but demonstrates a wide variety of motive power and rolling stock at work, irrespective of the company (or country) of origin.

0.8.3. People Terms

0.8.3.1. The term 'people' is used extensively in the Guidelines and, depending on the safety hazard being addressed by any particular section, may include any or all of the following: Workers on the railway, passengers, people on business, level crossing users, emergency services personnel, trespassers and neighbours. These terms are amplified further below:

0.8.3.2. **'Workers'** means staff and contractors directly employed on the railway (including the train crew, station staff, signalling staff etc) and contractors employed in the supply industries, maintenance facilities and disposal organisations. The workers may be employed at a fixed location or move about the railway.

0.8.3.3. **'Passenger'** means any person who is on railway property and is travelling, or intends to travel,

or has recently finished travelling on the railway. Consideration should be given to a wide range of passenger characteristics and classification, for example:

a) Passengers who are disabled (physical, sensory or mental impairment);

b) Children and unusually short and tall adults;

c) Passengers with heavy luggage, pushchairs, young children, etc. (mobility impaired)

0.8.3.4. Passengers may be on the station premises (waiting to purchase a ticket, waiting on the platform, etc) or on a train.

0.8.3.5. **'People on business'** mean people who:

a) Visit railway premises as non-travelling 'passengers' (people meeting or seeing off passengers, train spotters, customers or suppliers of station retail units, etc);

b) Official visitors to the railway.

0.8.3.6. **'Level crossing users'** means people crossing the railway on or at a level crossing. This includes pedestrians, cyclists, horse-riders and occupants of road and agricultural vehicles.

0.8.3.7. **'Emergency services personnel'** people who, whilst acting in their capacity as members of the emergency and rescue services, may legitimately be on the railway in places and at times when, for their personal safety, they would not normally be allowed.

0.8.3.8. **'Trespasser'** means a person who is on any part of the railway undertaking's land or premises where he has no right or authority to be.

0.8.3.9. **'Other member of the public' or 'neighbour'** means any person who is none of those listed above but whose safety or welfare could be affected by railway operations. (e.g. users of bridges, occupants of lineside properties)

0.8.4. Infrastructure terms

0.8.4.1. **'Railway infrastructure',** as defined in the 2002 Act, means the fixed assets used for the operation of a railway, including stations, permanent way and plant used for signalling or exclusively for supplying electricity for operational purposes to the railway;

0.8.4.2. It is convenient to the structure of this guidance to separate these various elements, so in this guidance the basic line of route features will be called 'Permanent Way, Earthworks and Structures' which *includes* earthworks, bridges, tunnels etc but *excludes* signalling, electrification works, and stations.

0.8.4.3. **'Sidings & Depots'** means places with railway tracks which do not form part of the lines of route of trains in transit, but where freight may be loaded or unloaded, or trains stabled, cleaned, serviced or maintained.

0.8.4.4. **'Station'** in this guidance means a railway passenger station or terminal, but does not include any permanent way or works, signalling or electric traction supply systems at the same location, on which guidance appears in other appropriate sections. For tramways, 'station' includes a tram-stop or platform. A station includes a halt, terminal station and a station complex with or without retail units but does not include associated public places outside the premises, such approach roads and car parks.

0.8.4.5. **'Sub-surface station'** means a station of which more than half of any one platform is within a tunnel or under a building.

0.8.4.6. **'Tunnel'** - A tunnel means a structure that encloses the railway from both sides as well as above and below it, which is built to support the ground, buildings or water enclosing the railway. There is no specific defining length of the structure to designate a tunnel. If there is doubt as to whether a structure is to be regarded as a tunnel, the principles and guidance for

tunnels should be reviewed to determine if the risks associated with the structure are of a magnitude that requires those principles and guidance to be applied.

0.8.5. Train and traction terms

0.8.5.1. **'Train',** as defined in the 2002 Act, means a vehicle with flanged wheels designed to operate on guiding rails for whatever purpose, and "carriages" and rolling stock" shall be construed accordingly.

0.8.5.2. These Guidelines have a slightly narrower focus than implied by this wide definition. The Guidelines are intended to apply primarily to design features of rolling stock, including rail-borne plant, which may run on the railway in normal operations. It does not refer to specialised flange-wheeled vehicles (sometimes with retractable road/rail wheels) which are only put on the track when the railway is closed to normal traffic.

0.8.5.3. Clearly within the definition, a train may consist of a single vehicle or a number of vehicles coupled together including any locomotives or power units. For tramways, 'train' means a tramcar, or two or more tramcars coupled together, and also includes non-passenger vehicles.

0.8.5.4. Occupational safety and health issues relating to rail-borne plant are not covered by this guidance

0.8.5.5. **'Electric traction system'** means the electrical equipment and conductors necessary to power trains on the railway from the point at which the power is generated by the railway or taken from a public electricity supply company as the case may be. It includes the switchgear and transformers which control the electric current at line voltage, the distribution network and the overhead line equipment. It does not include the collection equipment of the train or other on-board equipment.

0.9. HAZARDS, RISKS AND SAFETY DEFINITIONS

0.9.1. Hazards

0.9.1.1. 'Hazard' - A situation that could occur during the lifetime of a product, system or plant that has the potential for human injury, damage to property, damage to the environment, or economic loss.

0.9.1.2. In considering how to apply the Guidelines, care should be taken to:

a) identify the complete range of foreseeable hazards;

b) assess each hazard and establish its associated risk;

c) provide a means of preventing or controlling the hazard, if possible or;

d) provide a means of mitigating the effects of the hazard in appropriate ways; and

e) provide a means of recovery from the hazard, if appropriate.

Note that it is important to consider causal factors that arise from outside the railway system and may lead to hazards at the boundary as well as from within the railway system.

0.9.2. Risk

0.9.2.1. 'Risk' – A combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

0.9.3. Safe/Safety

0.9.3.1. 'Safety' means the freedom from unacceptable risks of personal harm, ie the avoidance of accidents and incidents.

0.9.3.2. The RSC, in judging whether any works, plant or equipment provides a sufficient level of safety, will wish to be satisfied that due consideration has been given to implementing the safety principles in this document in a way that ensures that all intolerable risks have been eliminated and that all remaining risks have been reduced to be as low as reasonably practicable (known as ALARP).

0.9.3.3. 'Accident' - An unplanned or unexpected event which may result in loss, injury or damage.

0.9.3.4. 'ALARP' – As Low As Reasonably Practicable. See 'in so far as is reasonably practicable'.

0.9.3.5. 'Emergency' - means an unforeseen or unplanned event which has life threatening or extreme loss implications where the immediately available resources are inadequate to secure or maintain safety, e.g. an uncontrolled fire.

0.9.3.6. 'Human Factors' – human psychological, social, physical and biological characteristics contributing to the design, operation or use of products or systems.

0.9.3.7. 'Incident' - An unplanned unexpected event that has the potential but does not necessarily result in damage, loss or injury.

0.9.3.8. 'In so far as is reasonably practicable' - A computation made in which the quantum of risk is placed on one scale, and the disadvantages involved in the measure necessary for averting the risk is placed upon the other and where it can be shown that there is a gross disproportion between them - the risk being insignificant in relation to the disadvantages.

0.9.3.9. 'Operation' - in relation to a railway undertaking includes the operation of railway services or the operation of railway infrastructure, or both the operation of railway services and railway infrastructure, and any other ancillary activities.

0.9.3.10. ‘Safety Management System’ – a formal framework for integrating safety into day-to-day railway operations and includes safety goals and performance targets, risk assessments, responsibilities and authorities, rules and procedures, and monitoring and evaluation processes.

0.9.3.11. ‘Safety targets’ - quantitative or qualitative safety levels to be achieved.

0.10. TERMINOLOGY - THE USE OF PARTICULAR ADVISORY OR MANDATORY WORDS IN THE GUIDANCE

0.10.1.1. Throughout the document, verbs with specific meanings are used as follows:

a) should - the primary verb for statements of guidance;

b) may - where the guidance suggests options;

c) must - only used where there is a legal/statutory requirement for the measures described to be employed. Reference to the relevant Act or Regulations will be provided;

d) is (are) required - having decided upon a particular option or arrangements, some consequential choices stem from that first decision. This expression is used to indicate those consequential choices and where firmer guidance is considered appropriate.

0.11. SAFETY MISSION

0.11.1.1. The design of new and altered railway works and rolling stock should, so far as is reasonably practicable, not impair the safety or health of any people who may be affected.

Note: This is an overriding principle that applies to all fixed works, plant and equipment, and to mobile plant and equipment, including trains, tramcars and any other rolling stock. Achievement of an adequate standard to meet this goal should ensure compliance with both railway-specific and occupational safety and health legislation.

0.11.2. Factors for consideration in support of the Safety Mission

0.11.2.1. The following are factors which need to be considered in the achievement of the goal represented by the Safety Mission. These factors are of general application across all the technology groups and their safety principles, so far as they are relevant in each particular case. They represent a guide to all the 'what if' questions which need to be addressed in determining the safety of railway equipment in all foreseeable conditions.

a) the interactions between the particular works, plant and equipment and other new, altered or existing works, plant or equipment on the railway;

b) the interactions between the particular works, plant and equipment and those of other railways and other guided transport systems;

c) the intended use and the method of operation of the works, plant and equipment, and the safety management system employed;

d) human factors, including both intended and unintended interactions between people and plant and equipment in normal and foreseeable abnormal conditions;

e) trespass, vandalism and wilful acts;

f) the interactions between the railway and its adjacent environment including physical interfaces, noise, vibration and electrical and magnetic interference;

g) the reliability and durability of the works, plant and equipment, and the level of maintenance required;

h) the arrangements for safe inspection and maintenance throughout the life of the works, plant and equipment, and their decommissioning and disposal;

i) the implications in respect of the risk posed when degradation occurs;

j) the integrity of safety critical works, plant and equipment;

k) the foreseeable climatic conditions;

l) the limitation of fire load, ignition sources, fire spread and the prevention of hazardous emissions from fire;

m) the arrangements for the disabled .

0.12. THE PRINCIPLES

Section 1 - Permanent Way, Earthworks and Structures.

Principle 1.1 The track

The track should provide for the safe guidance and support for the trains allowed to run on it.

Principle 1.2 Earthworks, embankments and cuttings.

Earthworks should be stable under all foreseeable loads imposed on them to prevent risk from collapse of the works.

Principle 1.3 Bridges

Bridges should be capable of carrying all foreseeable loads on them and minimise risks from intrusion onto the railway from above or the fall of trains from the railway.

Principle 1.4 Tunnels

Enclosed spaces such as tunnels should provide a safe environment for people and safe means of evacuation in emergency.

Principle 1.5 Clearances

There should be safe passing clearances between trains and to adjacent structures and, where such access is permitted, safe clearances for people while trains are running.

Principle 1.6 Control of Access

Provisions are needed to prevent unauthorised intrusion of people, animals, plant or vehicles but allow legitimate access to the railway in safety

Principle 1.7 Location identification

Adequate means to identify any particular structure or location on the railway should be provided.

Principle 1.8 Sidings and Depots

Sidings and depots should be installed and equipped to minimise risk to persons having work to do in or around the trains.

Section 2 - Stations

Principle 2.1 Spatial design

Stations should provide for the free and safe movement of all the people who may occupy them.

Principle 2.2 Platforms

Platforms should be designed for safety of access and safe waiting, boarding and alighting conditions for all passengers, including those of impaired mobility.

Principle 2.3 Terminus features

Station arrangements should prevent danger to people from a train over-running any dead-end track.

Principle 2.4 Evacuation

Station design should allow safe evacuation of its foreseeable occupants in an emergency.

Principle 2.5 Fire precautions

Stations should have fire prevention, detection and control measures that are appropriate to the risk.

Principle 2.6 Control

Appropriate facilities should be provided to manage safety at any station in normal and emergency situations.

Principle 2.7 Sub-surface stations.

Sub-surface (including underground) railway stations should be designed and have facilities to address the particular dangers that they present to people.

Group 3 - Electric Traction Systems

Principle 3.1 Safe for people

Electric traction systems should minimise safety hazards to people.

Principle 3.2 Compatibility

Electric traction systems should not generate or be at risk from dangerous interactions with any other systems.

Principle 3.3 Control

Appropriate facilities should be provided to safely manage and control electric traction systems in normal and all foreseeable degraded and emergency conditions.

Section 4 - Signalling and Telecommunications

Principle 4.1 Safeguarding of train movements

Systems are required to ensure that trains are authorised to proceed only when and to the extent it is safe for them to do so, to minimise risk of collision and, so far as the system can reasonably control it, also to minimise the risk of derailment.

Principle 4.2 Detection of trains

Appropriate means should be provided to detect and record the location of trains on the system.

Principle 4.3 Separation of trains

The signalling system should have sufficient logic (interlocking) to provide for the safe routing, spacing and control of trains and it should behave in a safe manner in the event of malfunction.

Principle 4.4 Information to drivers

The outputs of the control system should be presented to train drivers in a clear and safe manner.

Principle 4.5 Degraded conditions

The signalling system should facilitate continued operation in safety in specified degraded conditions.

Principle 4.6 Control

Appropriate management and communications facilities should be provided to maintain safety in normal, abnormal, degraded and emergency situations.

Principle 4.7 Telecommunications

Appropriate and reliable systems of communication both for railway operations and emergency services should be provided.

Principle 4.8 Compatibility

Neither the signalling nor the telecommunications equipment should generate nor be at risk from dangerous interactions with other systems.

Principle 4.9 Staff protection

The signalling system may be used to protect workers on the line from being struck by a train.

Section 5 - Level Crossings

Principle 5.1 Safe for users and trains

Where a right of way crosses the railway at track level, safety arrangements commensurate with the level of risk at that place should be determined and provided.

Principle 5.2 Information to users

Sufficient and appropriate information to enable crossing in safety should be presented to users.

Principle 5.3 Safe crossing place

The actual crossing place should be of adequate width, surface quality and profile for all reasonably foreseeable users to cross in safety.

Section 6 - Trains

Principle 6.1 Running gear

The running gear should guide the train safely along the track within the operational parameters specified.

Principle 6.2 Structural integrity

The structural integrity of trains should be maintained in normal operation and provide protection to all occupants in an accident or emergency.

Principle 6.3 Speed regulation

The speed regulation system should meet normal operational safety requirements, be compatible with the design of the infrastructure elements and behave in a safe manner in specified abnormal conditions and not endanger people or goods carried.

Principle 6.4 Powered systems

Electrical and other on-board powered systems should not endanger people or other systems.

Principle 6.5 Access and Egress

Trains should have a safe means of access and egress which is not available whilst in motion.

Principle 6.6 Interiors

Interiors of trains should provide a safe environment for people sitting, standing or moving inside, and should minimise harm in an accident or emergency.

Principle 6.7 Communications

There should be effective means of communicating safety messages to, from and within a train.

Principle 6.8 Fire safety

Trains should be designed for minimum risk of fire, but with adequate emergency egress in case of fire for all foreseeable occupants, including the mobility impaired.

Principle 6.9 Compatibility

Trains should be compatible with the infrastructure they will operate on, especially regarding clearances, signalling systems and electric traction systems.

Principle 6.10 Driver Interface

The driver's cab and environment should be sufficient to allow the safe operation of the train over its intended routes and type of service.

Principle 6.11 On-track machines

On-track machines which may run on the operational railway should be compatible with the standards of other rolling stock and the infrastructure.

Section 7 – Tramways

Principle 7.1 Integrating the tramway

Tramways should be integrated into the roads environment so as to minimise any risks to other people as well as to users of the tramway.

Principle 7.2 Clearances

The operating environment of trams among other traffic and pedestrians requires clearance rules that are particular to this mode of operation.

Principle 7.3 Civil engineering works (track, bridges and structures, access control)

Embedded on-street track should minimise risks to other road users. Structures may need special measures to prevent any new risks from tram operations. Careful design should facilitate authorised access to trams and across the tracks, whilst deterring risk-taking.

Principle 7.4 Tramstops

Tramstops should be designed for safety of access and safe waiting, boarding and alighting conditions for all passengers, including those of impaired mobility.

Principle 7.5 Electric traction system

Any overhead traction current system should be installed and managed to minimise the risks it presents to people in the public environment, and environmental risks from stray currents. A central control facility should monitor the electric traction system and safely manage any variations from normal operation.

Principle 7.6 Signalling

Any off-street running may be signalled as a normal railway, but on-street tram signals should be provided only to allow safe movement in relation to other road users. The system should be supported by a central control and a radio communications network.

Principle 7.7 Trams

Trams should be designed to be safe for the conveyance of passengers and staff and to minimise the risks they may present to other road users, both vehicles and pedestrians.

Principle 7.8 Tramway signs to tram drivers

Signs imparting information to tram drivers only should minimise the risk of confusion with other road signs.