Guideline for the Compilation of a Mandatory Code of Practice for Underground Railbound Transport Equipment

Mine Health and Safety Inspectorate
for Development and Prosperity
GUIDELINE FOR THE COMPILATION OF A MANDATORY CODE OF PRACTICE
FOR
UNDERGROUND RAILBOUND TRANSPORT EQUIPMENT

Chief Inspector of Mines

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1 FOREWORD

1.1 The Commission of Inquiry into Safety and Health in the Mining Industry chaired by the Honourable Mr Justice R N Leon identified haulage and transport accidents as the second largest category of accidents in mines.

In an initiative to address this problem, a tripartite task group was established under the auspices of the MRAC to revise the existing DME guideline for underground railbound transport, and the existing Minerals Act regulations, Chapter 18, dealing with railbound transport and in force in terms of Schedule 4 of the MHSA.

1.2 According to the SAMRASS, railbound transport contributed approximately (10%) of all reportable accidents during the period 1 January 1988 to 31 December 2001. Of the 11 226 railbound reportable accidents, 567 persons lost their lives and this can be broken down into the following categories:

- Locomotive drawn vehicle 55,0%
- Hand tramming 20,0%
- Locomotive 19,0%
- Rerailing 3,0%
- Coupling/Uncoupling 3,0%

1.3 This document was compiled, bearing the significant risks associated with underground railbound transport equipment in mind. This can be tested, as found in paragraph 8 of this guideline.

2 LEGAL STATUS OF THE GUIDELINE AND COPs

2.1 In accordance with section 9(2) of the MHSA an employer must prepare and implement a COP on any matter affecting the health and safety of employees and other persons who may be directly affected by activities at the mines if the Chief Inspector of Mines requires it. These COPs must comply with any relevant guideline issued by the Chief Inspector of Mines (section 9(3)).

2.2 Failure by the employer to prepare or implement a COP in compliance with this guideline is a breach of the MHSA. Any contravention of, or failure to comply with, a COP is not in itself a breach of the MHSA, except a contravention or failure by an employer that also constitutes a failure to implement the COP. Since the DME does not approve COPs, its focus is not to enforce them either. The focus of the DME is to ensure that employers provide healthy and safe working environments at mines, i.e. focussing on system failures and compliance with the MHSA, rather than enforcing compliance with the COP.

2.3 The fact that a contravention of, or failure to comply with, a COP is not a breach of the MHSA does not mean that such breaches will have no legal implications. As far as the employer is concerned, there are numerous specific and general obligations
on the employer in the MHSA, aimed at ensuring the health and safety of all employees and all persons who are not employees but who may be directly affected by the activities at the mine. Where any failure to comply with a COP also constitutes a breach of any of the employer’s obligations under the MHSA, the employer could be liable to an administrative fine for such breach. An inspector could also issue various instructions to the employer and employees in terms of section 54 to protect the health or safety of persons at the mine. Failure by an employer to comply with such an instruction could render the employer liable to an administrative fine.

2.4 As far as employees are concerned, section 22 places a number of obligations on employees, including that they must take reasonable care to protect their own health and safety and the health and safety of other persons who may be affected by their conduct. Where a failure by an employee to comply with a COP would also constitute a breach of the employee’s duties in terms of section 22 (or a breach of section 84, 86(1) or 88), the employee could be criminally charged for such breach. As is the case with employers, the inspectorate could issue instructions to employees in terms of section 54 and failure to comply with such an instruction constitutes a criminal offence.

2.5 Employers should deal with breaches by employees of the COP in terms of the mine’s standard instructions and the employer’s disciplinary procedures. This is not the responsibility of the State.

3 THE OBJECTIVE OF THIS GUIDELINE

3.1 The objective of this guideline is to enable the employer of every mine to compile a COP for minimum standards, which, if properly implemented and complied with, would improve the health and safety of persons using or affected by railbound transport and equipment.

4 DEFINITIONS

In this guideline for a COP or any amendment thereof, unless the context otherwise indicates:-

1 ‘abnormal load’ means a load not regularly transported on standard rolling stock due to its excessive mass or physical dimensions, or both;

2 ‘arresting device’ means a device or combination of devices, excluding the brakes, holding a train or part of a train stationary;

3 ‘battery tender (battery car)’ means the rolling stock carrying the motive energy (batteries) for a locomotive;
‘bogie’ means a specifically designed material car that is normally used for the slinging and transporting of long and cumbersome material and that can independently articulate on its own set of wheels;

‘braking system’ means a device or combination of devices capable of reducing the speed of a locomotive or train to a standstill including emergency brake, park brake and service brake;

5.1 ‘emergency brake’ means an easily accessible device, which when applied, will bring the locomotive or train to a standstill under all operating conditions;

5.2 ‘park brake’ means the brake capable of holding a fully loaded, parked train stationary, at the maximum operating gradient and loading, without the support of any other braking system;

5.3 ‘service brake’ means the primary operating brake.

‘buffer’ means a device permanently attached to a locomotive or rolling stock, which enables coupling with other locomotives or rolling stock;

‘COP’ means Code of Practice;

‘coupler’ means a device or set of devices specifically designed to couple two buffers;

‘deceleration rate’ means the rate of decrease of speed of motion of a locomotive or train;

‘dedicated haulage’ means a rail haulage way, designated specifically for the transportation of persons, material or minerals, as directed by the employer;

‘dedicated loading platform’ means a loading platform, specifically designed for the safe loading or offloading of persons or material.

‘DME’ means the Department of Minerals and Energy;

‘dynamic type test’ means the test conducted on a train to determine the deceleration rate and braking efficiency;

‘energy absorption device’ means a device or combination of devices capable of dissipating the maximum kinetic energy of a moving train without premature failure or causing harm to any persons on the train;

‘gradient’ means the ratio of the difference in elevation between two given points and the horizontal distance between them;

‘hand tramming’ means the movement of rolling stock on rails, manually by a person or persons;
17 ‘locomotive’ means a self-propelled railbound machine which requires either a driver for manual operation or an operator for automatic operation;

18 ‘MHSA’ means the Mine Health and Safety Act;

19 ‘MRAC’ means the Mining Regulation Advisory Committee;

20 ‘overspeed device’ means a device fixed to the locomotive, which will automatically prevent the locomotive from exceeding a predetermined speed or warn the driver when a predetermined speed is exceeded;

21 ‘ramp’ means an inclined railway, terminating in a horizontally elevated platform;

22 ‘RBE’ means railbound equipment;

23 ‘rolling stock’ means any railbound equipment that is not self-propelled;

24 ‘safe stopping distance’ means the distance within which the locomotive or train and its maximum attached load can safely stop without danger to persons;

25 ‘SAMRASS’ means the South African Mines Reportable Accident Statistical System;

26 ‘SIMRAC’ means the Safety in Mines Research Advisory Committee;

27 ‘speed indicator’ means a device fixed to the locomotive to indicate the speed of the locomotive;

28 ‘static test’ means the test carried out to determine the compliance of the brake holding power of a locomotive braking system measured against the design specification or an appropriate safety standard;

29 ‘train’ means one or more locomotives and rolling stock, all coupled;

30 ‘turnouts and crossings’ mean the mechanisms which enable traffic to switch from one track to another;

31 ‘unbraked mass’ means the total mass of rolling stock and its load, of which no wheel or wheels are fitted with brakes and which forms part of a train;

32 ‘visibility’ means the human ability to distinguish colour, size, movement and distance in the field of vision;

33 ‘wheel profile’ means the angle of the wheel in contact with the rail.
5 SCOPE

5.1 This guideline covers the health and safety risks associated with:

5.1.1 design and specification of RBE;
5.1.2 design and specification of the operating environment of RBE;
5.1.3 operational requirements of RBE;
5.1.4 maintenance of RBE;
5.1.5 personnel operating RBE.

5.2 This guideline excludes the following installations:

5.2.1 endless rope haulage installations;
5.2.2 monorails;
5.2.3 chairlifts;
5.2.4 overhead cranes and crawls;
5.2.5 railbound equipment used in shafts, winzes and raises;
5.2.6 lifting machines;
5.2.7 stackers and reclaimers.

6 MEMBERSHIP OF THE RAILBOUND TASK GROUP PREPARING THE GUIDELINE

This document was prepared by the MRAC Railbound Task Group.

The members who assisted in the compilation of this guideline were:

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PART B: AUTHOR’S GUIDE

1. The COP must, where possible, follow the sequence laid out in Part C “Format and Content of the COP”. The pages as well as the chapters and sections must be numbered to facilitate cross-reference. Wording must be unambiguous and concise.

2. It should be indicated in the COP and on each annex to the COP whether -

(a) the annex forms part of the COP and must be complied with or incorporated in the COP or whether aspects thereof must be complied with or incorporated in the COP; or

(b) the annex is merely attached as information for consideration in the preparation of the COP (i.e. compliance is discretionary).

3. When annexes are used the numbering should be preceded by the letter allocated to that particular annex and the numbering should start at one (1) again. (e.g. 1, 2, 3, .... A1, A2, A3, ....).

4. Whenever possible illustrations, tables, graphs and the like, should be used to avoid long descriptions and/or explanations.

5. When reference has been made in the text to publications or reports, references to these sources must be included in the text as footnotes or sidenotes as well as in a separate bibliography.

6. Relevant SIMRAC projects should also be considered when assessing risks. A list of relevant projects is included as ANNEX 2 (which is attached for information purposes).
PART C: FORMAT AND CONTENT OF THE CODE OF PRACTICE

1 TITLE PAGE

The title page must include the following:

1.1 name of mine;
1.2 the heading: “Mandatory Code of Practice for the operation of underground railbound transport equipment”;
1.3 a statement to the effect that the COP was drawn up in accordance with guideline 16/3/2/2-A3 issued by the Chief Inspector of Mines;
1.4 the mine reference number for the COP;
1.5 the effective date; and
1.6 revision dates.

2 TABLE OF CONTENTS

The COP must have a comprehensive table of contents.

3 STATUS OF MANDATORY CODE OF PRACTICE

Under this heading the COP must contain statements to the effect that:

3.1 the mandatory COP was drawn up in accordance with Guideline 16/3/2/2-A3 issued by the Chief Inspector of Mines;
3.2 this is a mandatory COP, in terms of sections 9(2) and (3) of the MHSA;
3.3 the COP may be used in an accident investigation/inquiry to ascertain compliance and also to establish whether the code is effective and fit for purpose;
3.4 the COP supersedes all previous relevant COP; and
3.5 all managerial instructions or recommended procedures (voluntary COPs) and standards on the relevant topics must comply with the COP and must be reviewed to assure compliance.

4 MEMBERS OF THE DRAFTING COMMITTEE

4.1 In terms of section 9(4) of the MHSA the employer must consult with the health and safety committee on the preparation, implementation or revision of any COP.
4.2 It is recommended that the employer should, after consultation with the employees in terms of the MHSA, appoint a committee responsible for the drafting of the COP.
4.3 The members of the drafting committee assisting the employer in drafting the COP should be listed giving their full names, designations, professional qualifications, affiliations and experience. This committee should include competent persons sufficient in number to effectively address the drafting of the COP.

5 GENERAL INFORMATION

The general information relating to the mine must be stated in this paragraph. The following minimum information must be provided:

5.1 a brief description of the mine and its location;
5.2 the commodities produced;
5.3 the mining methods/mineral excavation processes;
5.4 a description of the railbound transport systems used at the mine listing the types of railbound equipment and indicating the machine population; and
5.5 other relevant COPs.

6 TERMS AND DEFINITIONS

Any word, phrase or term of which the meaning is not absolutely clear or which will have a specific meaning assigned to it in the COP, must be clearly defined. Existing and/or known definitions should be used as far as possible. The drafting Committee should avoid jargon and abbreviations that are not in common use or that have not been defined. The section on definitions should also include acronyms and the technical terms used.

7 RISK MANAGEMENT

7.1 Section 11 of the MHSA requires the employer to identify hazards, assess the health and safety risks to which employees may be exposed while they are at work and record the significant hazards identified and risk assessed. The COP must address how the significant risks identified in the risk assessment process must be dealt with, having regard to the requirement of section 11(2) and (3) that, as far as reasonably practicable, attempts should first be made to eliminate the risk, thereafter to control the risk at source, thereafter to minimize the risk and thereafter, insofar as the risk remains, to provide personal protective equipment and to institute a programme to monitor the risk.

7.2 To assist the employer with the risk assessment, all possible relevant information such as accident statistics, ergonomic studies, research reports, manufacturers’ specifications, approvals, design criteria, performance figures for all relevant underground railbound transport systems and equipment must be obtained and considered.
7.3 In addition to the periodic review required by section 11(4) of the MHSA, the COP should be reviewed and updated after every serious incident relating to the topic covered in the COP, or if significant changes are introduced to procedures, mining and ventilation layouts, mining methods, plant or equipment and material.

8. ASPECTS TO BE ADDRESSED IN THE MANDATORY CODE OF PRACTICE

The COP must set out how the significant risks identified in the risk assessment process referred to in paragraph 7 above will be addressed. The COP must cover at least all the aspects set out hereafter unless there is no significant risk associated with that aspect at the mine.

Notwithstanding the obligation on the employer in terms of section 11 of the MHSA to perform a risk assessment the following risks have been identified and are included in this guideline, in addition to other risks which may be identified in the risk assessment process by employer.

8.1 DESIGN AND SPECIFICATION: RAILBOUND EQUIPMENT (RBE)

8.1.1 LOCOMOTIVE

In order to prevent the RBE from running out of control, derailing, colliding with persons or other RBE, the COP must address the following:

8.1.1.1 the type of prime mover must be listed, including battery operated, diesel operated, electrical trolley line, or hydrostatic;

8.1.1.2 the design of locomotive controllers must comply with SABS 1809: “Failsafe Underground Mine Locomotive Control Systems” and with the normative referenced standard therein SABS IEC 60529 ‘Degrees of protection provided by enclosures (IP Code), but need not comply with any normative references listed in SABS IEC 60529.

8.1.1.3 the basic design and performance of an effective braking system, which must at least ensure that;

(i) the train is held stationary at the maximum operating gradient and loading, without the support of any other braking system;
(ii) the average deceleration rate as determined through a dynamic type test of a fully loaded train must not be less than 0,18 metres per second squared, under normal operating conditions ;and
(iii) the maximum ratio of the unbraked mass to the locomotive mass must not exceed 7 to 1 for a maximum gradient of 1 in 200. (Refer to Annex 1, which must be complied with);
81.1.4 design calculations in respect of power, speed, brakes, deceleration, skidding, surface friction and gradient, including:

a) safety requirements, including devices and measures to prevent overspeeding;
b) possible speed indication and speed limits for ensuring travelling at safe speeds;
c) audible warning devices;
d) locomotive lights;
e) driver-to-guard communication systems;
f) remote controlled locomotives; and
g) driver protection and guarding;

8.1.1.5 displaying in a conspicuous position on the locomotive the following:

a) manufacturer’s name;
b) mass of locomotive;
c) maximum design speed; and
d) maximum permissible hauled load (mass). (Refer to Annex 1, which is to be complied with);

8.1.1.6 displaying the combined mass of the battery set in a conspicuous place; and

8.1.1.7 the remote operation of the braking system for remote controlled locomotives.

8.1.2 ERGONOMICS

In order to allow driver comfortability, the safeguarding of the driver and ensure safe operation of the RBE, the ergonomic design of any locomotive should provide for the following factors, in addition to other factors identified by the employer that may influence the safe operation of the locomotive:

a) safe positioning of, and seating for, the locomotive driver(s);
b) cab lighting;
c) driver and guard protection;
d) illumination;
e) driver and guard vision;
f) ease of operation;
g) accessibility/ingress/egress; and
h) minimising vibration.

8.1.3 ROLLING STOCK

In order to prevent the risk of injury to persons during coupling operations, derailments of rolling stock and during re-railing, the COP must address the following:

8.1.3.1 (a) the safeguarding of personnel performing coupling/uncoupling and re-railing operations;
(b) compatibility of coupling systems;
(c) coupling heights;
(d) **buffer** length and width;
(e) coupling pin design for easy use and safe operation;
(f) safety chains design and connections;
(g) draw bar connection to **buffer**;
(h) axle spacing for load bearing capability and sharp rail radii; and
(i) safe clearance between hoppers;

8.1.3.2 the examination at regular intervals by a competent person of all **buffer** connections integral or attached to the chassis, whether welded, huck bolted or bolted, to prevent inadvertent disconnection of **rolling stock**;

8.1.3.3 the maintenance of **rolling stock** to ensure it is in compliance with the manufacturer’s standards and design.

8.2 DESIGN AND SPECIFICATION: THE OPERATING ENVIRONMENT

In order to minimise the risk of derailments, collisions, unsafe operation, fires and runaways of **RBE**, the **COP** must address the following:

8.2.1 Track and rails

the design and construction of the rail system, including overhead trolley lines, which must comply at least with the following requirements:

a) SABS 0339:2000 - the South African Bureau of Standards Code of Practice for the Design, Construction and safe Use of Permanent Underground Track-work in Mines; including the following two normative references listed therein:
   • SABS 916 – 1973 – Fishbolts and Nuts for Light Rails; and
   • SABS 914 – 1974 – Fishplates for Light Rails together with Amendment 1 dated 23 August 1978
     Amendment 2 dated 2 November 1983
     Amendment 3 dated 19 July 1993
     Amendment 4 dated 4 May 2000

b) determining a safe operating speed for all tracks, as speed is a function of track condition. Existing tracks must be classified as proposed in the SABS 0339:2000 in accordance with Annex A, Classification criteria, Table A.1, which Annex must be complied with.

8.2.2 Ramps

the design and use of any **ramp** provided for **RBE** maintenance, such **ramp** must incorporate at least the following aspects:

a) failsafe **arresting devices** to prevent inadvertent runaway of **RBE**; and
b) a suitable device must be provided for the raising or lowering of **RBE**;
8.2.3 Traversers

the design for traversers, where used, to permit only one RBE at a time to pass.

8.2.4 Haulages

the design of U/G haulages where RBE is used, including the following aspects:

a) safeguarding of persons against accidental contact with RBE;
b) the number of trains in use, as well as station lay-out, dimensions, obstructions or restrictions;
c) dedicated haulages for preventing persons travelling while RBE are operated;
d) safe loading platforms;
e) illumination;
f) number of tramming cycles;
g) traffic control measures; and
h) one and bi-directional tramming;

8.2.5 Tipping arrangements

the design of tipping arrangements, including the following:

a) illumination;
b) safeguarding of persons from falling into orepasses or being struck by falling rock by provision of safety devices such as safety belts, lockout facilities, closing or opening of ore passes when tipping is not in progress;
c) dust control; and
d) facilities for the re-railment of RBE;

8.2.6 Battery charging station/bay

8.2.6.1 a procedure for preventing persons from changing or charging any traction battery of a locomotive at a mine other than at a battery charging station approved by the employer. This requirement does not apply in the case of on-board battery charging of batteries during tramming operations;

8.2.6.2 the design and layout of a battery charging station, including the following aspects:

a) effective measures of extinguishing fires;
b) measures to prevent or minimise the spillage of electrolyte;
c) emergency water supply for extinguishing fire;
d) measures to prevent persons from smoking or using naked lights;
e) means to prevent the accumulation of flammable and other gases generated by battery charging;
f) explosion protected lights for illumination; and
g) interlocking of battery bay ventilation fans during power failure;
8.2.7 Push versus pull

the requirements for a locomotive when pushing its attached load, including the following:

8.2.7.1 the reduction of the operating speed of the train to a safe limit;

8.2.7.2 an effective two-way means of communication between the driver and the guard, taking into account noise, visibility, and the environment, except where the locomotive driver is operating a locomotive or train remotely from the leading end of the train; and

8.2.7.3 measures to prevent uncoupled rolling stock from being pushed by a locomotive or train;

8.2.8 Services

the design, layout and locality of the workshop, repair bay and refuelling facilities, taking cognisance of the operating environment/conditions;

8.2.9 Illumination of the RBE Environment

the provision of illumination for the general area where transport of persons, material, attached load, mineral or explosives takes place by means of RBE, including the following:

8.2.9.1 positioning and spacing of lights for the driver to identify unsafe conditions;

8.2.9.2 intensity and dispersion of light;

8.2.9.3 reflectivity of the surrounding area; and

8.2.9.4 a procedure to follow in case of illumination failure;

8.2.10 Visibility of RBE and persons

the use of road signs and warning devices, having regard to at least the following aspects:

8.2.10.1 the placing of signs to warn persons against the presence of parked, stationary and broken down RBE;

8.2.10.2 measures to ensure the visibility and safety of pedestrians, cyclists or other persons in the proximity of RBE;

8.2.10.3 timeous warning systems, where persons are required to work in haulages where RBE are operated/driven, for either the driver/operator or such persons; and
8.2.10.4 dust control so as not to impair **visibility**;

8.2.11 **Safety devices**

8.2.11.1 the specification and description of signalling/warning devices, including the following:

a) flashing lights for acknowledgement of remote control *locomotives*;
b) warning lights when entering danger areas;
c) tail lights for acknowledging the direction of travel of *RBE*;
d) clearance markings and restrictions in confined space where persons travel;
e) loudness of bells or sirens for acknowledgement by persons whilst travelling where *RBE* operate;
f) overhead electric line warnings;
g) dead mans device to protect the driver/operator of *RBE*;
h) signals systems to clearly distinguish instructions;
i) speed governers as a means of regulating speed;
j) **speed indicators** for operators of *RBE* equipment to know actual speed;
k) speed restrictions to safeguard other people against *RBE* equipment operating in the area of travel;
l) warning devices, including traffic lights, to control traffic;
m) overspeed alarms to warn operators if speed is exceeded;
n) communication systems for effective control and instruction; and
o) the selection band of radio frequencies for communication systems or remote control devices must be taken into consideration to prevent interference or unsafe condition that can endanger the life of people;

8.2.11.2 the description and specification of safety devices, including at least the following:

a) **arresting devices**;
b) farm gates;
c) “huizens” devices;
d) “vulu-vala” devices;
e) **energy absorption devices**;
f) sledge devices;
g) pits for derailing equipment;
h) traversers; and
i) “T” and skid sprags;

8.2.11.3 the inspection and testing of devices described/used at regular intervals, where applicable;

8.2.11.4 a procedure that ensures that the use, supply and awareness of PPE is in accordance with section 6 of the *MHSA*;

8.2.11.5 effective means of extinguishing fires on **trains** must be described and specified;
8.2.11.6 the use of warning devices and signals which may form part of safety devices, including at least the following:

   a) the types of warning devices or signals, such as pre-start or tramming devices, which may be required after an assessment of the noise, visibility or other significant risks; and
   b) visual or audible signals, including the codes for the signals to be used for communication;

8.2.12 Diesel-Powered RBE

measures for the control of diesel fuel storage, including the following:

8.2.12.1 spillage prevention during refuelling;
8.2.12.2 minimise leakage from diesel tanks; and
8.2.12.3 effective means of extinguishing fires.

8.3 OPERATIONAL REQUIREMENTS

To minimise the risk of tramming accidents, loss of life, unsafe operation of RBE, the failure and lack of use of safety devices, the COP must address:

8.3.1 Railbound Cycles

transportation of persons by means of railbound cycles, including the following:

   a) measures to limit the operating speeds to safe speeds;
   b) effective braking requirements;
   c) proper seating arrangements to prevent standing of persons during transport;
   d) the number of persons allowed to travel on the cycle;
   e) audible warning device to warn other RBE users in the vicinity;
   f) illumination; and
   g) visibility of the cycle under ambient conditions;

8.3.2 Selection of RBE

the selection of RBE, making provision for safe clearances and restrictions;

8.3.3 Use of RBE in the vicinity of shafts

the use of the RBE within shaft boundaries, having regard to the regulations dealing with the design of shaft station layouts and safety stopping devices;
8.3.4 General operational requirements

general operation requirements for RBE, including the following:

a) emergency procedures;
b) overhead trolley line systems;
c) safe start-up, operation, parking, shut-down procedures, loading, securing and prevention of unauthorised access to RBE and rolling stock;
d) lockout systems (mechanical, electrical, hydraulic, pneumatic, radio frequency);
e) areas where people are travelling, including traffic control, speed and clearance restrictions, rerailing of rolling stock and spillage control;
f) transport of persons, materials, minerals, explosives, hazardous chemical substances, abnormal loads, long material, special purpose cars, loaders, etc;
g) towing of RBE;
h) hand tramming of RBE;
i) safe tramming of RBE through obstructions such as ventilation doors and other restricted areas such as regulators, fire doors, bull noses, water doors, battery bays, workshops, fuelling stations, as well as blind curves, etc;
j) demarcation of restricted areas where clearances are not met;
k) the protection of driver, guard and other persons during transport activities;
l) recording and reporting of any failures or incidents involving RBE affecting health and safety;
m) transport of tools and equipment permitted in the locomotive cab;
n) the safe remote operation of a locomotive or train that is remotely operated;
o) the safe operation of any manually operated switch on any track from a safe position clear of the track by means of a suitable tool or device;
p) measures to prevent inadvertent run-away of a locomotive or train; and
q) remote or manual operating methods of ventilation doors;
r) fouling marks to indicate switches, etc.

8.4 MAINTENANCE

To minimise the risk of accidents due to poor maintenance, inadequate working facilities and procedures, the COP must address the following:

8.4.1 Maintenance measures of RBE

a) the measures to ensure the maintenance of the RBE is in accordance with the manufacturer’s specification or the amended employer specifications;
8.4.2 Track maintenance

measures to ensure that tracks are maintained in accordance with clause 8 of the requirements specified in SABS 0339:2000 – the South African Bureau of Standards Code of Practice for the Design, Construction and Safe Use of Permanent Underground Trackwork in Mines;

8.4.3 Maintenance practice

a) the maintenance frequencies;
b) measures to ensure competent persons conduct maintenance and over-inspections; and
c) the establishment and maintenance of safe working procedures, including lockout procedures;

8.4.4 Maintenance of ramps, Traverses and loading/tipping arrangements

measures to ensure that traversers and loading and tipping arrangements are properly maintained;

8.4.5 Modification to RBE

a procedure for any modifications to RBE, requiring a risk assessment, proper record keeping of design and specification changes and updating of engineering drawings;

8.4.6 Procedure for the testing of braking systems

a procedure for the testing of braking systems, including the following:

8.4.6.1 the static testing of braking systems;

8.4.6.2 the dynamic type testing of braking systems; and

8.4.6.3 the recording of the results of static and dynamic type tests.

8.5 PERSONNEL

To minimise the risk of incompetent persons operating and maintaining the RBE, the COP must address the following:

8.5.1 Selection criteria

The selection criteria for drivers and guards should cover the following:
a) co-ordination;
b) ability;
c) reaction time;
d) attention span;
e) eyesight;
f) angle of vision;
g) night or colour blindness;
h) hearing depth perception;
i) aggressiveness;
j) anthropometrics (size, height, mass, etc);

8.5.2 Training and record keeping

a) a procedure for the maintenance of records in respect of training, testing and re-training of all locomotive drivers, guards and maintenance personnel;

b) procedures to manage emergencies involving RBE, which must form part of the training;

8.5.3 Authorisation to operate and maintain

procedures to ensure that only authorised persons operate, test and maintain RBE.
PART D: IMPLEMENTATION

1 IMPLEMENTATION PLAN

1.1 The employer must prepare an implementation plan for its COP that makes provision for issues such as organisational structures, responsibilities of functionaries and programmes and schedules for this COP that will enable proper implementation of the COP. (A summary of/and a reference to, a comprehensive implementation plan may be included). The implementation plan must make provision for all SABS Standards for RBE referenced in paragraph 8 of this guideline to be complied with by December 2005.

1.2 Information may be graphically represented to facilitate easy interpretation of the data and to highlight trends for the purpose of risk assessment.

2 COMPLIANCE WITH THE COP

The employer must institute measures for monitoring and ensuring compliance with the COP.

3 ACCESS TO THE COP AND RELATED DOCUMENTS

3.1 The employer must ensure that a complete COP and related documents are kept readily available at the mine for examination by any affected person.

3.2 A registered trade union with members at the mine, or where there is no such union, a health and safety representative on the mine, or if there is no health and safety representative, an employee representing the employees on the mine, must be provided with a copy of the written request to the manager. A register must be kept of such persons or institutions with copies to facilitate updating of such copies.

3.3 The employer must ensure that all employees are fully conversant with those sections of the COP relevant to their respective areas of responsibility.
ANNEX 1 (This annex must be complied with)

GRADIENT vs HAULED MASS / LOCO MASS at $f = 0.18 \text{m/s}^2$

UNITED KINGDOM LOAD RULE CALCULATION:

$$L = W(K_l-K_r)/(0.108f-K_r+G)-W$$

Where:
- $L$ = max trailing load (tonne)
- $W$ = loco mass (tonne)
- $K_l$ = loco brake ratio (typically 0.16)
- $K_r$ = trailing load rolling resistance (0.003 for roller bearings)
- $f$ = train deceleration (min 0.18m/s²)
- $G$ = gradient (+0.005 for 1:200 downhill)

**UPHILL**

**DOWNHILL**

**GRADIENT X 100**

**HAULED MASS / LOCO MASS RATIO**
REFERENCES

The following documents were consulted in drafting the guideline:

(1) **RECOMMENDED PRACTICE FOR SAFE OPERATION OF LATERAL UNDERGROUND TRANSPORT** – PUBLISHED BY THE CHAMBER OF MINES;
(2) **GUIDELINES FOR THE DESIGN, INSTALLATION & MAINTENANCE OF UNDERGROUND TRACK WORKS** – CHAMBER OF MINES PUBLICATION OF 1987;
(3) **TRUCKING AND TRAMMING RISK ASSESSMENT** – ISSUED BY IRCA;
(4) **FEDERAL MINE SAFETY & HEALTH ACT OF 1977**;
(5) **DEPARTMENT OF MINERALS & ENERGY GUIDELINE AND MINIMUM STANDARDS FOR THE PREPARATION OF A CODE OF PRACTICE FOR UNDERGROUND RAIL TRANSPORT**;
(6) **SIMRAC final PROJECT REPORT "INVESTIGATION OF THE CAUSES OF TRANSPORT AND TRAMMING ACCIDENTS OTHER THAN COAL, GOLD AND PLATINUM (1966)"**;
(7) **INCREASING THE EFFICIENCY, ECONOMY AND SAFETY OF TRACKED TRANSPORT** – PUBLISHED BY THE UNDERGROUND RAILWAYS ASSOC;
(8) **REPORT OF THE COMMISSION OF INQUIRY INTO THE VAAL REEFS MINING ACCIDENT**
(9) **TRUCKING & TRAMMING – A RISK ASSESSMENT APPROACH TO ACCIDENT REDUCTION** – PUBLISHED BY GRANT PURDY & FRANK PASCOE
(10) **REPORT BY THE MINING REGULATIONS ADVISORY COMMITTEE TASK GROUP ON HAULAGE AND TRANSPORT ACCIDENTS** – NOVEMBER 1996;
(11) **LOCO INSPECTION SERVICES CC – CHECKLIST**;
(12) **STATISTICAL SUMMARY OF ACCIDENTS REPORTED TO THE CHIEF INSPECTOR OF MINES : 1/1/84 – 31/12/97**;
(13) **HEALTH & SAFETY EXECUTIVE – UNDERGROUND LOCOMOTIVE HAULAGE**;
(14) **TRACKLAYING FOR UNDERGROUND HAULAGE** - PUBLISHED BY THE NATIONAL COAL BOARD (REVISED 1973);
(15) **MACHINES FOR UNDERGROUND MINES – EUROPEAN STANDARD – PUBLISHED BY CEN**;
(16) **INDUSTRIAL BUFFERS – PUBLISHED BY OLEO**;
(17) **PROCESS & GUIDING PRINCIPLES FOR THE FORMULATION OF REGULATING MECHANISMS UNDER THE MINE HEALTH & SAFETY ACT** – PUBLISHED BY MRAC 29/5/98 : CIRC.42REV1/98
(18) **AIDE MEMOIRE – PUBLISHED BY MRAC**
(19) **SIMRAC DRAFT – REPORT ON INVESTIGATION OF SAFETY OF RAIL VEHICLES AND SYSTEMS OPERATING IN SOUTH AFRICAN MINES** – GAP 520 – PUBLISHED BY TURGIS TECHNOLOGY (RESEARCH AGENCY)
(20) **SOUTH AFRICAN BUREAU OF STANDARDS CODE OF PRACTICE FOR THE DESIGN, CONSTRUCTION, MAINTENANCE AND SAFE USE OF PERMANENT UNDERGROUND TRACKWORK IN MINES – SABS 0339:2000**;
(21) **GUIDELINE FOR A CODE OF PRACTICE FOR TRACKLESS MOBILE MACHINERY**
(22) **FAILSAFE UNDERGROUND MINE LOCOMOTIVE CONTROL SYSTEMS** – SABS 1809 OF 1999
(23) **PERFORMANCE REQUIREMENTS FOR LOCOMOTIVE BRAKING SYSTEMS** – SIMRAC GAP 635 REPORT.