MINING INDUSTRY
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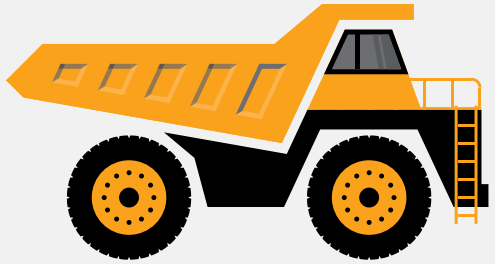
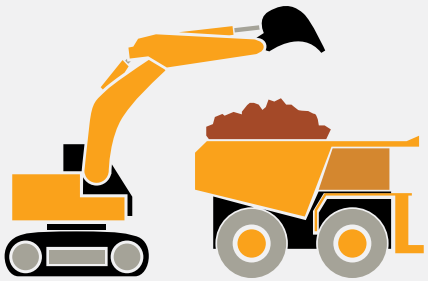


TRAFFIC MANAGEMENT

LEADING PRACTICE ADOPTION GUIDE

FOR OPEN CAST/PIT OPERATIONS IN SOUTH AFRICA



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MINERALS COUNCIL
SOUTH AFRICA

NEXT

PURPOSE OF THE GUIDE

The purpose of this guide is to provide adopter mines of the MOSH Open Cast/Pit **Traffic Management Leading Practice** with simple practical guidance to ensure acceptance and sustainability of the application of the practice.

The MOSH Adoption system has been developed to address the sustainability of technological initiatives in the mining industry. The system is **people oriented**, focussing extensively on behavioural aspects that are fundamental to the Adoption of a Leading Practice.

It is important for leaders and managers to understand **what MOSH** is and **what Adoption** is, in a manner that can be easily understood and communicated throughout their organisations.

It is also important for leaders and managers to be aware that all human behaviour can be explained. There are reasons why workers follow or disregard procedures or deactivate safety mechanisms. When this Adoption guide is diligently followed it will result in the **Traffic Management Leading Practice** being adopted by all affected parties as "the way" in which operations are done at all open pit and surface operations.

The Traffic Management Description that forms part of this Adopters guide describes the **Traffic Management Leading Practice** identified for industry-wide Adoption to improve safety performance of Open Cast/Pit operations.

This guide contains key lessons from mines that have previously adopted engineering related MOSH Leading Practices. The five principles of MOSH and the seven principles of Adoption are defined and provided in this guide.

The key differentiators of the MOSH Adoption system are **leadership behaviour and behavioural communication**. These elements are considered essential to ensure Adoption (making it one's own). The MOSH Adoption system is not a quick and easy way to implement systems or practices, it is a scientific behavioural based process that addresses a number of critical aspects required to ensure Adoption. Furthermore the overall process allows for the reduction of "challenges" for Adoption mines to the application of the process at a ***"first adopter"*** **mine**.

The activities defined and described in this guide are not considered a nice to have, it is what will provide the mine/company the best opportunity to adopt the Traffic Management Leading Practice in the shortest possible time and with the least effort.

The downside of implementing rather than adopting and operating outside of the MOSH initiative is:

- Potential unsustainability of the practice
- Lengthy implementation as a result of not being able to leverage the lessons from the first adopter and other Adoption mines
- Extended production impact due to the learning curve being longer than necessary as a result of ***"experimentation"***

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PART 1

- Strategic context
- MOSH principles
- Adoption principles
- Key lessons

STRATEGIC CONTEXT

At the 2014 Tripartite Occupational Health and Safety Summit, captains of industry committed to a Zero Harm vision for the South African mining industry.

This commitment has been supported by specific milestones, the most notable one being the elimination of fatalities by the end of 2020.

However, a **different thinking and commitment** from industry leaders is required. It is no longer acceptable to say *"This is not a risk at our mine since we have never had an incident"*. Where risks exist and controls are insufficient, accidents can still happen.

The thinking should be,

"Is there a risk? Let us put an effective control in place, manage it and ensure that accidents do not happen".

Open Cast/Pit operations in South Africa range from large international owned operations to small quarries. Consideration was given to small operations during the development of the Leading Practice by defining the practice first in principle and then in terms of specific standards.

It is highly recommended users of this guide should familiarise themselves with the:

5 principles of MOSH (see page 5)

7 principles of Adoption (see page 6)

THE 5 MOSH PRINCIPLES

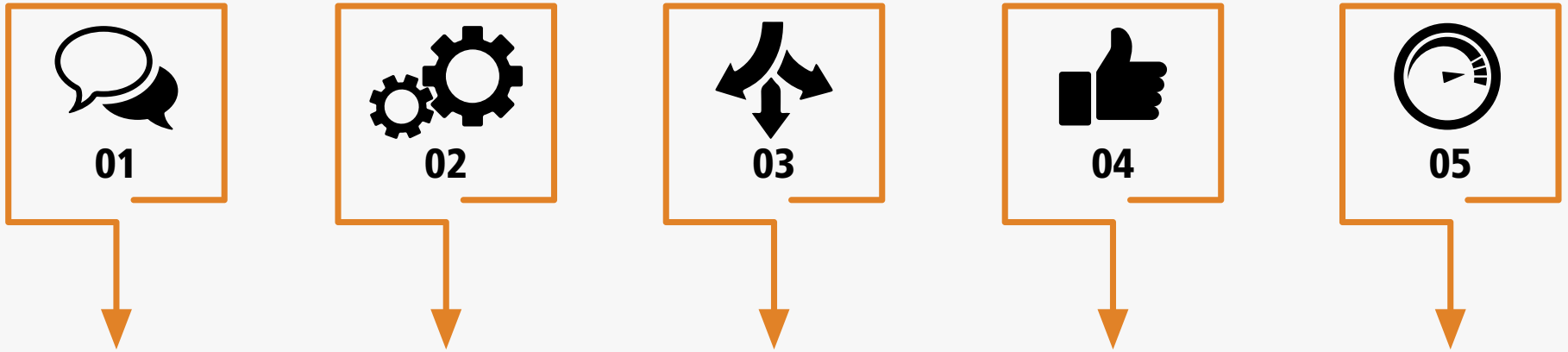
- Share for safety, sharing for people
- Learning from the best
- Maximum impact for minimum financial risk
- Adopt for less pain and more value
- Measure and compare results for sleeping well

THE 7 ADOPTION PRINCIPLES

- Know who can make it or break it
- Early engagement – find out who thinks what
- Communicate to connect, align and prepare the ground for change
- Leverage existing trust
- Train and test for competence
- Leaders are key for sustainability
- Measure benefit continuously

MOSH PRINCIPLES

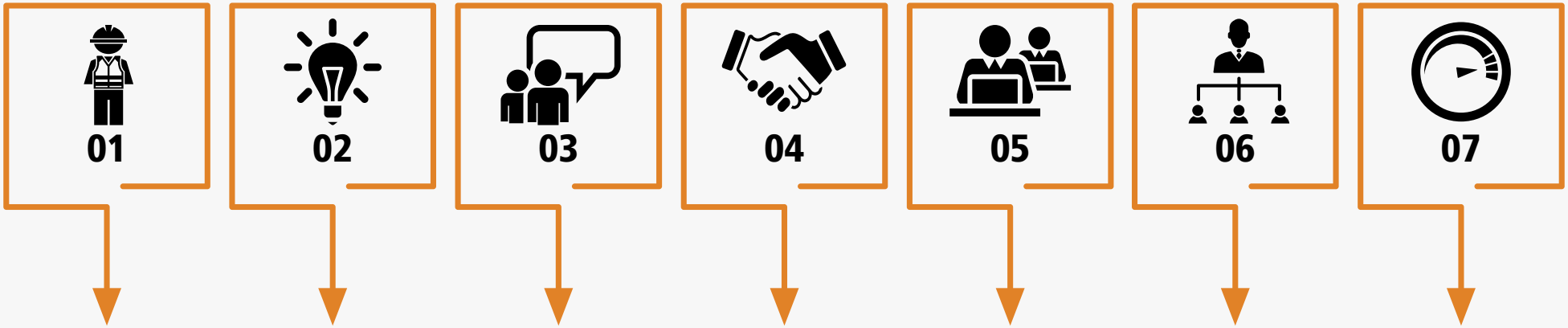
THE 5 MOSH PRINCIPLES



Sharing for safety	Learning from the best	Maximum impact for minimum risk	Adopt for less pain and more value	Measure and compare results continuously for sleeping well
Industry leaders committed to unreserved sharing of information of safety related practices. Over the last 5 years industry members benefited significantly from safety related investments made by some mines. Not only would it be too costly for every single mine to invest in a particular practice, it would take many years for the entire industry to get to a high level of take-on of the practice.	A MOSH Leading Practice is a practice that has a proven safety performance improvement record; it is the best available practice at any given time.	A MOSH Leading Practice is chosen for its potential to address the safety risk with the highest potential impact on industry wide safety performance, not necessarily the highest risks that a few mines experience. A MOSH Leading Practice is chosen after it is proven to have improved the safety performance of the source mine.	Adoption makes implementation easier and sustainability more probable.	Knowing the "before" performance and tracking the "after" performance gives confidence that the risk remains under control.

ADOPTION PRINCIPLES

THE 7 ADOPTION PRINCIPLES



01	02	03	04	05	06	07
Know who can make it or break it	**Engage upfront, find out who thinks what**	**Communicate to connect, to align, to prepare the ground for change**	**Leverage existing trust**	**Train and test for competence**	**Leaders are key for sustainability**	**Measure for benefit continuously**
Identifying the key stakeholders involved to successfully effect the change.	MOSH promotes the principle that the only way to know is to ask, to probe, to listen carefully and to act. To do it early, long before the actual technical aspects of the practice arrive at the mine.	The MOSH process propagates carefully crafted communication in different modes, in such a way that the recipient connects to the message and reorganises her/his mental model with regards to the impending change.	MOSH encourages mines to leverage existing trust relations and use that trust to ensure buy-in, sharing and alignment.	MOSH promotes the principle of training and testing for competence and not only for knowledge.	Leadership behaviour impacts significantly on Adoption. Leadership behaviour is key to sustainability.	Establish the measures that will be used to ensure effectiveness of the practice and make them a continuous process metric.

Key lessons

Key lessons from the previous Adoption projects have proved to be useful in providing some of the tasks in this Adoption guide. The aspects below are some of the key lessons that will assist adopter mines to adopt the **Traffic Management Leading Practice** efficiently and effectively:

ADOPTION VS. IMPLEMENTATION

One of the most significant lesson for Adoption mines is to come to grips with the philosophy of Adoption and its implication for the project and the mine in general. Mines that have had numerous interventions over a number of years, indicated that they struggled and/or are struggling with the "people side" (behaviourial issues). This is not surprising as it confirms the findings of an investigation regarding why technology implementation has largely been unsuccessful over the last twenty to thirty years in the mining industry.

The lesson is straight forward, **plan and execute for Adoption not implementation**. This document provides a practical guide to assist Adoption mines succeed. It is important to not only implement a practice but for the relevant workforce to adopt the practice as their own.

STAKEHOLDER BUY IN

The involvement of stakeholders, particularly labour unions from the onset of the project is a critical success factor. The use of union representatives as project members and interviewers/communicators where required is essential to ensure the efficiency and effectiveness of the project. Mines that do not have unions or mines that are very small, must have formal employee representatives as part of the team.

DEDICATED ADOPTION TEAM AND TEAM CONTINUITY

The success of the project is negatively affected by continuous change of project leaders, members and even mining and production managers. A dedicated team has to be assigned for the duration of the project or at least for complete roll-out of specific elements. A dedicated team does not imply a full-time team, however team members must be able to dedicate the required time to the project in order to achieve the project objectives.

MULTI-DISCIPLINARY ADOPTION TEAM

One of the challenges facing Adoption of the **Traffic Management Leading Practice** is that it requires interaction between different organisation functions and translates into a multi-disciplinary project team. Adopter mines/companies must make sure that all the roles as defined in this guide are allocated to a specific member of the Adoption Team.

EXECUTIVE TEAM INVOLVEMENT

It is important that the most senior manager at the mine acts as the project sponsor. The nature of and potential impact on production by the Adoption of the **Traffic Management Leading Practice** can lead to significant delays in the project. If the executive team that must provide strategic direction is not involved and progress is not on the executive team's agenda, it could cause unnecessary delays. It is important that the Mine Adoption Team gets active executive support for the duration of the Adoption project.

PART 2

DETAILED ADOPTION GUIDANCE

- Preparatory steps
- Change Management steps
- Execution steps

DETAILED ADOPTION GUIDANCE

At a MOSH T&M planning workshop held in October 2014, the need for effective Traffic Management for Open Cast/Pit mines was identified by industry representatives as a Leading Practice for achieving significant progress towards occupational safety and health.

THE MAIN CAUSES OF ACCIDENTS WERE IDENTIFIED AS

- Fatigue
- Visibility of pedestrians from HMEs
- Visibility of LDVs by HMEs
- Poor environmental conditions
- Production pressure
- Inadequate standards
- Not adhering to standard operating procedures
- Not having proper systems in place
- Ill-discipline

THE TRAFFIC MANAGEMENT LEADING PRACTICE ADDRESSES

- Injury to persons through collision of mobile equipment
- Injury to persons on foot (pedestrians) by mobile machines (working)
- Injury to persons entering hazardous areas
- Injury to persons entering restricted areas

Identifying the cause of accidents leads to practices that will effectively address the problems and lead to fewer accidents.

The Traffic Management Leading Practice consists of nineteen elements that were identified by the MOSH Open Cast/Pit industry team as essential for effective Traffic Management.

The Traffic Management Leading Practice consists of three main components:

- Technical description of the Traffic Management elements
- Behavioural communication plans and media
- Leadership behaviour plans and media

The MOSH Open Cast/Pit industry team visited several mines to determine the effectiveness in the application of specific sets of Traffic Management elements. It was on this basis, the professional knowledge and the collective experience of the team that the description of the **Traffic Management Leading Practice** was developed.

A first adopter mine will be selected for the first Adoption of **Traffic Management Leading Practice**. The lessons derived from the first adopter mine will be included in future revisions of this guide.

DETAILED ADOPTION GUIDANCE CONTINUED

The Adoption process comprises of a number of interrelated **steps** with various **activities** that need to be systematically and **fully** completed to have the best chance of Adoption.

NATURE OF ADOPTION

Adoption of a Leading Practice by all involved individuals is the result of a **structured change management** initiative. The MOSH Adoption process is a change management methodology that has been developed specifically for the South African mining industry. Change management is a key competence for the successful introduction of new ways of working but it is not yet widely acknowledged or accepted in the industry, which is the cause for minimal in-house capacity and competence. It is acknowledged that many open pit mines in South Africa are small quarries, sand and brick works and the like, where no formal change management capacity may exist. This Adoption guide has been enhanced to include tools that mines can use. The tools will be discussed in detail at the COPAs.

The Traffic Management Leading Practice comprises of a number of elements and based on the specific nature and design of operations, some of the elements will not be applicable. A matrix will be available to assist mines to document the applicable elements and priorities following the risk analysis.

The MOSH Traffic Management Leading Practice Adoption is a safety improvement initiative that mines need to manage as a formal project as per the mine's project management standards. Since the MOSH Adoption system is a people centric system this guide is structured into three stages. The first stage is all the preparatory steps; the second deals with change management steps and the third is all the execution steps. It is important for mines to note that the steps defined in this guide are the minimum steps required to ensure Adoption. Where mines have additional steps for the preparatory stages and particularly the execution stage those should be included into the mines Adoption Plan as developed in step 8.

STAGE 1: PREPARATION

STAGE 2: CHANGE MANAGEMENT

STAGE 3: EXECUTION

Preparatory stage

Change Leadership is a leadership competence needed to ensure that change is introduced smoothly.

Change leadership is a series of acts, decisions and conducts, it is not a position.

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1 DECIDE TO ADOPT

Adoption IS DECIDED BY **The mine/ general manager** WHO APPOINTS **The Project Leader** AND FORMALLY REGISTER WITH **The Minerals Council MOSH Learning Hub T&M team**

The decision to adopt the relevant elements of the Traffic Management Leading Practice must be formally made by the mine's executive and operations management team. The mine manager for small operations and general manager for bigger operations must be the sponsor for this Leading Practice.

Once the principle decision has been taken and the project leader has been appointed the decision has to be formally registered with the Minerals Council MOSH Learning Hub T&M team and then the rest of the activities can follow.

Registration can be done on the MOSH website under Transport and Machinery – Traffic Management Leading Practice.

http://www.mosh.co.za

2 APPOINT A PROJECT LEADER (ADOPTION TEAM MANAGER) (ATM)

The **mine/general manager** assigns a suitable person as the ATM to lead the project and champion the Adoption of the Traffic Management Leading Practice at the mine. The ATM must be from the line function that is legally responsible for the mining operation.

The fact that the Traffic Management Leading Practice has been developed by an engineering team does not automatically mean it is an *"engineering"* project. The change management work related to Adoption is a **line management** challenge and not a support function challenge. Systematic execution of the Adoption activities and successful Adoption of the **Traffic Management Leading Practice** should be a **key performance criteria** in the assigned person's performance contract with the mine.

The ideal Traffic Management ATM and champion should possess the following:

1.	**Credibility:** This is an essential requirement. He/she should be knowledgeable, enthusiastic and possess good leadership and communication skills.	✓
2.	**Involvement:** Having selected an individual with the right potential, it is essential that he/she has sufficient time available to adequately perform the functions of project management and championship. To do this, the person has to be actively involved in the details of the **Traffic Management Leading Practice** as well as the **people components**. The person should be knowledgeable about issues and problems and assist with finding tangible solutions.	✓
3.	**Leadership:** The person selected must provide leadership in overcoming challenges that arise. This will include the development of strategies and plans for the progressive Adoption of the **Traffic Management Leading Practice** across the mine.	✓
4.	**Change management:** The **ATM** must have good awareness and appreciation for the importance of change management theory.	✓
5.	**Communication:** Being an effective spokesperson is one of the key roles for the Traffic Management Leading Practice. The person must be a good communicator.	✓

3 JOIN THE COMMUNITY OF PRACTICE FOR ADOPTION (COPA)

The MOSH Adoption process is new to most mines. The Minerals Council MOSH Learning Hub Transport and Machinery Team will support mines for the duration of the Adoption journey through regular COPA meetings.

WHAT IS A COPA?

A COPA is a meeting of mine representatives that are in the process of adopting a Leading Practice. The Transport and Machinery ATMs will facilitate the COPAs and mines will be given further support with documents and tools.

The mine ATM should:

Contact a COPA coordinator to establish a working relationship

The mine ATM should contact the MOSH ATM to discuss the mine's COPA membership, and the nature and extent of support that might be sourced from the MOSH Adoption Team, the first adopter mine and COPA members.

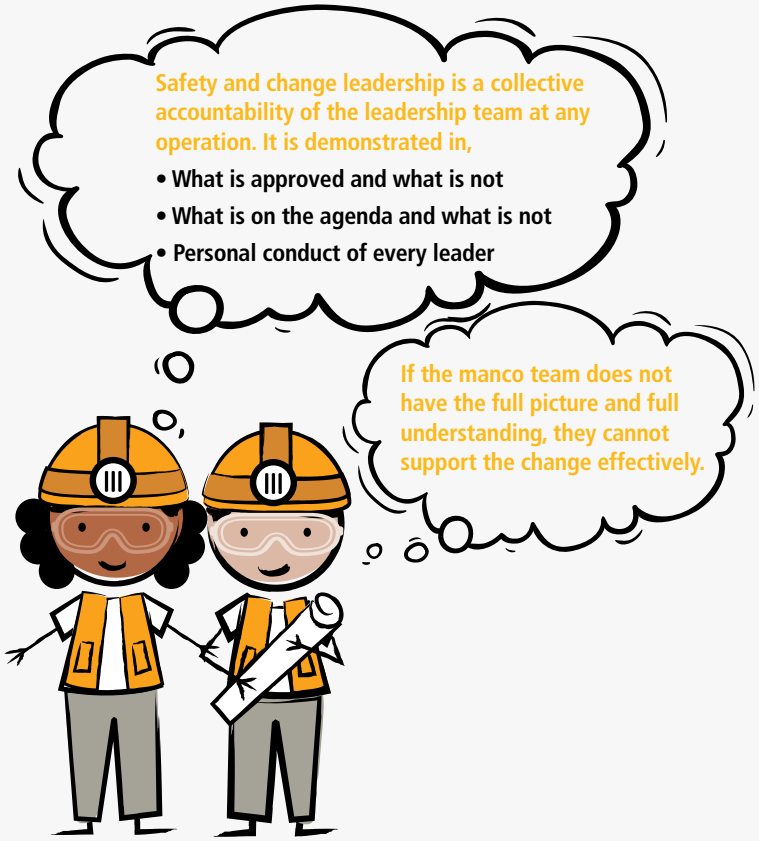
Attend COPAs

The relevant members of the mine Adoption Team must attend the COPAs. The ATM must attend every meeting. Members must be fully prepared to engage and ask questions.

First COPA focus

The first COPA in a specific region will be a full day session providing ATMs with a detailed overview of the MOSH Adoption process. Specific attention will be given to step 5, 6 and 7.

4 ORIENTATE MINE MANCO



Once a positive Adoption decision has been taken and registered with the MOSH Learning Hub, the mine's manco/exco needs to engage the MOSH Learning Hub T&M team to arrange for an orientation session of MOSH and the **Traffic Management Leading Practice**. Since there may be a number of smaller operations in one geographical location, it might be practical to do an orientation session for a number of mines at the same time on a regional / area basis.

Adoption decision

Register with the MOSH Leading Hub

Manco/exco engages the MOSH Learning Hub T&M team

Orientation session of MOSH and the **Traffic Management Leading Practice**

5 ENGAGE THE MINE SAFETY COMMITTEE

Key stakeholder buy-in and support is a make or break issue for Leading Practice Adoption. Share and listen. Listen and learn. Learn and act.

The ATM must engage the mine/regional union leadership by:

1.	Sharing the Adoption decision
2.	Listening to any concerns
3.	Formally introducing the MOSH Traffic Management Leading Practice to the mine's Safety Committee, Standardisation Committee and Standards Committee – if such is in place at the mine – with nominated union representative(s)

If the mine's union leaders are also members of the mine's safety committee, the union engagement can be combined with this activity.

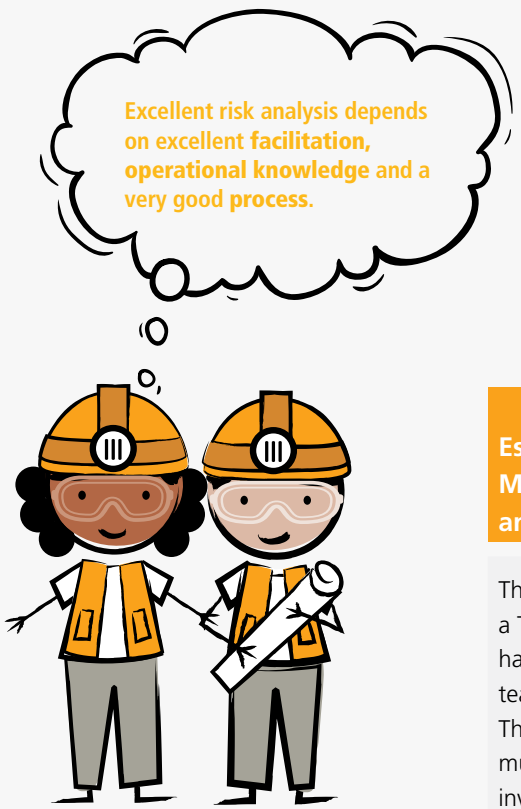
6 COMMUNICATE THE DECISION TO ADOPT

A briefing note must be issued by the mine/general manager to inform all employees of the decision to adopt the MOSH Traffic Management Leading Practice at the mine. This should be done after engaging the unions and with their support.

The note should communicate who the mine ATM is and that the Adoption process will involve engagement with various employees at all levels. It is recommended that general communication will consist of a number of posters at various places in the mine and on all notice boards. At the first COPA meeting this will be dealt with in detail and mines will be provided with examples that can be used.

7 CONDUCT A TRAFFIC MANAGEMENT RISK ANALYSIS

A key aspect of this Leading Practice is the Traffic Management risk analysis. The analysis is a **component of** mine's baseline risk assessment. Mines will be given extensive guidance on the risk analysis at the COPA and provided with a checklist that can be used to ensure availability of all the information needed to conduct the analysis.



Time dedicated to risk analysis will be well rewarded with good safety performance. Spend extra time on the risk analysis to prevent any incidents from occurring.

Only management should own risks. All risks must be assigned to a specific manager. Risk management must be a heavily weighted KPI.

Establish a Traffic Management risk analysis team	Mine risk analysis facilitator and reviewers training	Execute a Traffic Management risk analysis	Conduct an independent review of the risk analysis	Sign off Risk Analysis	Complete the Traffic Management element applicability matrix
The ATM will assemble a Traffic Management hazard and risk analysis team for the mine. The safety committee must be formally involved. Early provision must be made for contracting the independent reviewer of the risk analysis as per the guidance of the Leading Practice description.	The MOSH Learning Hub will schedule regular training sessions at different geographical locations for the mine risk analysis facilitators. Attendance of this training is an important part of the Adoption. If the mine makes use of an external consultant as a facilitator or independent reviewers they should also attend the training.	The mine's risk analysis team should follow the guidance according to Leading Practice description document and the MOSH training notes to conduct the risk analysis.	The Leading Practice requires a specific risk analysis process that includes an independent review of the Traffic Management risk analysis done by the mine.	Following an independent review of the risk analysis, the mine/general manager needs to sign off on the risk analysis report that will form the basis for deciding which elements of the Leading Practice need to be adopted.	Following the official sign off of the risk analysis the applicability matrix should be completed as the official record of the traffic management elements that will be adopted. The matrix will be explained and made available at the COPA meeting.

8 PREPARE A DRAFT PLAN FOR ADOPTION OF THE TRAFFIC MANAGEMENT ELEMENTS

The **Traffic Management Leading Practice** is a significant endeavour that will take many months, depending on the size of the operation and the number of elements to be adjusted or introduced.

It is critical that a documented project plan is developed based on this guide. The mine should also incorporate its own project management standards. Task duration and responsibilities should be allocated to allow project target dates to be met.

The **Traffic Management Leading Practice** Adoption has two focuses that must be logically integrated to succeed. The **Traffic Management Leading Practice** can be divided in elements that have:

- No impact on people
- Require intensive engagement with people and have a **behavioural focus** – beliefs, behaviour and communication

Dealing with behaviour takes time and reshaping/refocusing requires coaching and reinforcement. The two focuses must be addressed concurrently but with specific integration points identified. This needs to be included in the initial Adoption Plan. It is important that training, behavioural communication and leadership behaviour aspects be planned timeously. ATMs will be given further guidance and support at the first COPA that will be held in a specific region.

8 PREPARE A DRAFT PLAN FOR ADOPTION OF THE TRAFFIC MANAGEMENT ELEMENTS CONTINUED

When preparing a draft Adoption Plan

1 DECIDE THE STAGES OF ELEMENT INTRODUCTION

The key lessons recommend that the mine does not attempt to introduce all elements at once. A logical build-up of the elements based on the risks will provide a practical low risk for failure.

Negative production impact and project delays create negative perceptions of the changes to be introduced.

2 INCLUDE ALL THE PREPARATORY ACTIVITIES (STEP 1 TO 14) OF THIS GUIDE

The draft Adoption Plan must include all the preparatory steps.

3 INCLUDE ALL THE CHANGE MANAGEMENT ACTIVITIES (STEP 15 TO 19) OF THIS GUIDE

The draft Adoption Plan must include all the change management steps.

4 INCLUDE ALL EXECUTION ACTIVITIES (STEP 21 TO 26) OF THIS GUIDE

For every element that will be rolled out and adopted the mine's own process steps need to be followed together with step 21 to 26 in this guide.

9 ESTABLISH THE MINE ADOPTION TEAM

Assign a person to oversee behavioural and leadership plans (change management aspects) and communication at the mine

The mine/general manager must assign a behavioural plan overseer responsible for overseeing and/or executing the change management (behavioural aspects) of the project.

It is strongly advised that a competent person be assigned for the role and if no in-house capability or capacity exists an external service provider should be contracted to assist the mine.

All of the members in the Mine's Traffic Management Adoption Team must have sufficient time available to fulfill their roles and responsibilities. This should be appropriately reflected as a key performance area in their performance contracts with the mine.

Establish an Adoption Team at the mine

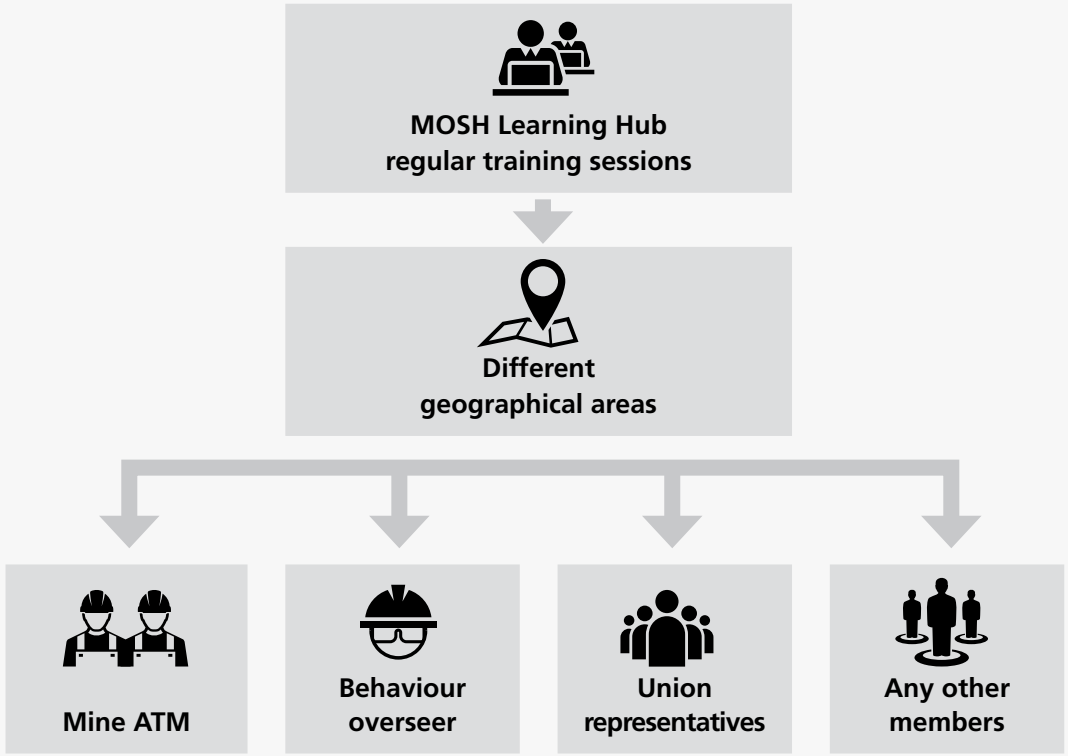
The Traffic Management Leading Practice requires multi-function involvement.

In addition to the *mine ATM* and the *behavioural plans overseer*, the mine's Traffic Management Adoption Team should include:

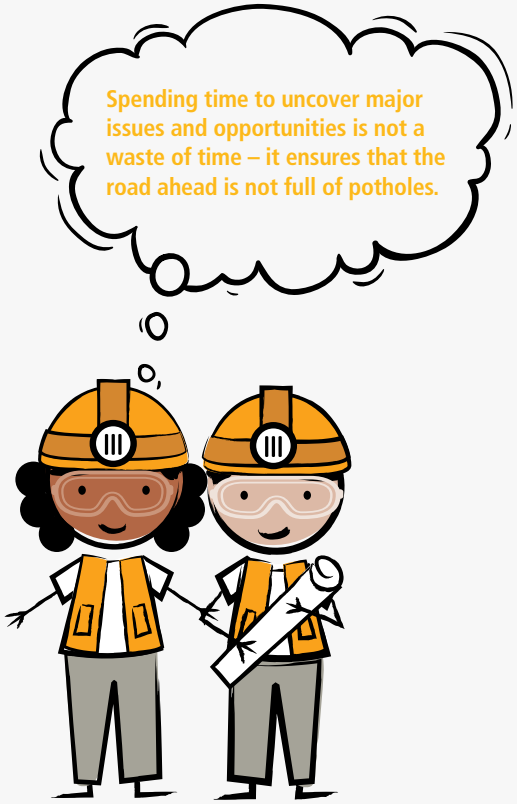
- A person(s) from the training department
- Operators, shift supervisors and bench foreman
- The line manager of the section in which the Traffic Management element(s) will be adopted
- Safety specialist/lead
- Technical/engineering lead
- Procurement/finance lead
- Maintenance and support lead
- Union leads (already decided) for all the unions that are officially recognised in the mine/company or employee representatives if no unions exist

10 TRAIN THE MINE ADOPTION TEAM

The MOSH Learning Hub will schedule regular training sessions at different geographical areas for the mine ATM, the behaviour overseer, union representatives and any other members that the mine wants to be trained with the principles of Adoption. Training will include a comprehensive session on this guide. Training arrangements will be arranged at the first COPA meeting.

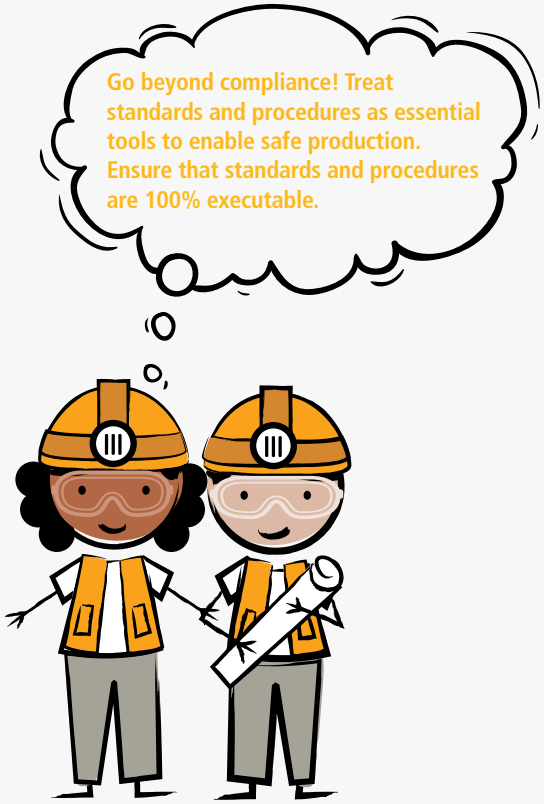


11 DEFINE MAKE OR BREAK ISSUES/ BARRIERS TO ADOPTION



Every mine/company has its own unique circumstances and challenges. It is important to identify a small number of specific issues that will be the focus during the project. These issues are the ones that the project team must identify as make or break issues/barriers to Adoption. Once identified the project team must establish a way to monitor these issues frequently to ensure that they get the correct attention within the organisation.

12 REVIEW, ALIGN AND UPDATE EXISTING MINE OPERATIONAL STANDARDS, COPs AND PROCEDURES



This activity must be done early on since it will identify tasks to be performed. It will also identify the adjustment and reviewing of existing Codes of Practice (COP), safe operating procedures, training materials and criteria that has to be included in the Adoption Plan.

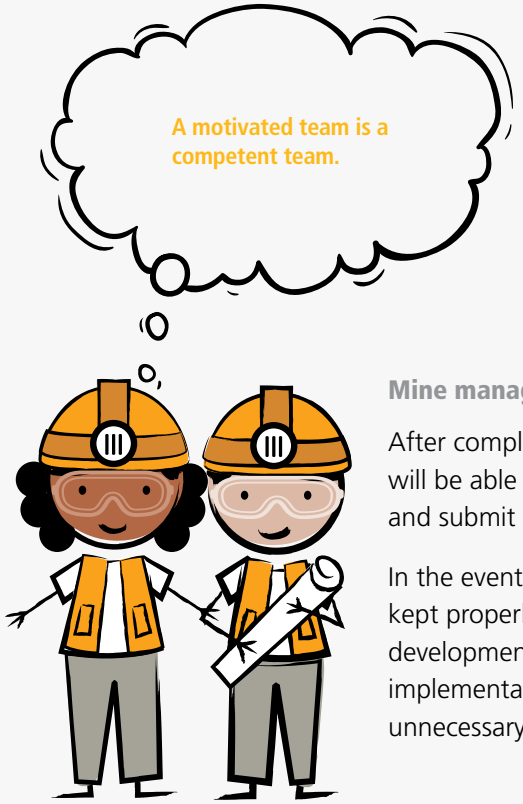
The practicality and acceptability of the operational details in implementing the **Traffic management Leading Practice** should be tested and confirmed with the operational managers at the mine.

The operational details of the **Traffic Management Leading Practice** must be reviewed in relation to mine standards to identify any potential conflicts or operational problems.

The activity will include identification and review of the relevant procedures and COPs that will be affected by the introduction of the **Traffic Management Leading Practice**. This will also require a dedicated effort between a number of functions in the mine/company. Most companies have corporate standards and procedures that are compulsory for the individual business units and mines.

The mine must not run the risk of getting a section 54 as a result of having implemented the Traffic Management Leading Practice. Standards and COPs have to be in line with the new operations.

13 FINALISE THE PLAN FOR ADOPTION OF THE TRAFFIC MANAGEMENT ELEMENTS



Mine manager Adoption Plan sign-off:

After completion of step 4 to 12, the ATM will be able to finalise the Adoption Plan and submit it for sign off.

In the event that management has been kept properly informed of progress and developments, a formal sign-off on the implementation plan may appear to be unnecessary at this stage.

14 IDENTIFY KEY MEASUREMENTS TO DETERMINE EFFECTIVENESS OF THE PRACTICE (MONITORING PROGRAMME)

KEY MEASUREMENTS MUST

1.	Quantitatively indicate performance	✓
2.	Identify the impact of the practice	✓
3.	Identify parameters and procedures	✓
4.	Identify responsibility for making the measurements	✓
5.	Be documented in a brief document with envisaged analysis	✓

The purpose of the Leading Practice is to eliminate and control hazards related to traffic management.

The establishment of the practice will require funding, time and other resources. Part of the MOSH Adoption system is to focus on the measurement of effectiveness of every element, especially leading indicators that will ensure that the controls are functional at all times.

After the decision to adopt, identification and planning of the monitoring process to record data to quantify the impact of the **Traffic Management Leading Practice** should start as soon as possible.

The key measurements (lagging and leading indicators) needed to quantitatively indicate the performance and impact of the practice must be identified by the mine Adoption Team well before commissioning of the practice begins.

The identified parameters, procedures and responsibility for making the measurements should be documented in a brief document. The document should also indicate the envisaged analysis and the responsibility for its execution. Mines will receive further guidance and tools at the COPA.

Change management stage

STEP 15 Identify stakeholders (interested and affected parties) **PAGE 27**

STEP 16 Leadership behaviour **PAGE 27**

STEP 17 Behaviour communication materials/ messages **PAGE 28**

STEP 18 Identify/develop or modify ideal behaviours per Leading Practice element **PAGE 29**

STEP 19 Plan and develop training materials **PAGE 29**

15 IDENTIFY STAKEHOLDERS (INTERESTED AND AFFECTED PARTIES)

The Adoption Team must identify all the interested and affected parties in every Traffic Management element.

Stakeholders include but are not limited to:

- MANCO/OPCO
- The Learning Hub
- All the Unions at the Mine
- Supervisors
- Operators
- Technicians
- Safety Officers

16 LEADERSHIP BEHAVIOUR

Engage the mine's supervisory team(s)

Structured conversations must be held with each supervisory level or individual separately to communicate the decision and solicit early input and feedback. The engagement will give the ATM an indication of the general level of support or resistance that can be expected from the specific stakeholder group.

Supervisors have a **key** role to play in ensuring smooth Adoption and they need to become the champions at operational level. Attention must be given to feedback from engagements with this group. The group must not only know about the **Traffic Management Leading Practice**, they must also know how it affects them, including the potential challenges and actions required under normal and abnormal operating conditions.

The COPA will provide specific guidance and draft presentations that the mines can use.

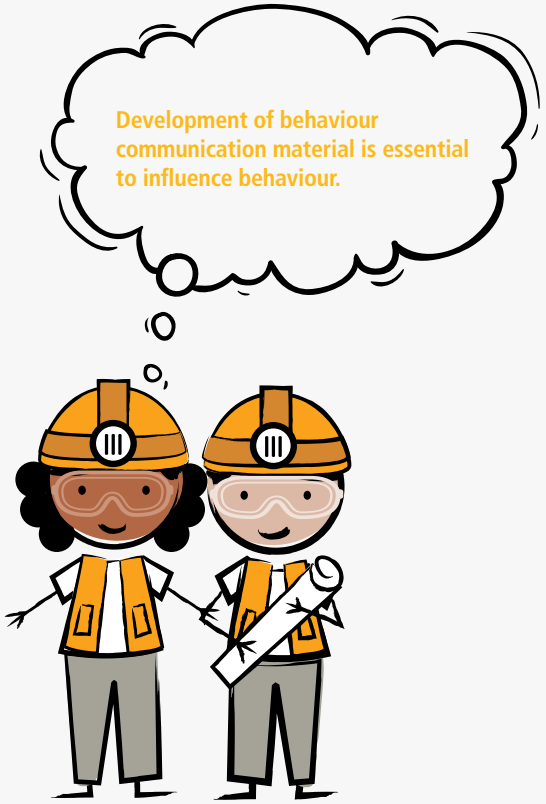
Modify/develop leadership materials/messages

There are two sets of leadership behaviour materials/communication that must be developed:

Behavioural communication must address any knowledge gaps, misperceptions and wrong beliefs that these groups may have. Mines should know that if they do not invest time and energy into this stakeholder group the probability of successful Adoption will be low.

Ideal leadership behaviour must be conducted and displayed by the supervisory groups in order to support and sustain the adopted elements of the Leading Practice. These include verbal and non-verbal leadership and communication.

17 BEHAVIOUR COMMUNICATION MATERIALS/MESSAGES



Communication is essential to ensure employees are fully informed about the risks and controls. It is important to decide what must be communicated and the best method of communication. As part of the preparation of this guide the industry team prepared behaviour communication messages and posters that mines can use as a starting point or use as is.

IT IS IMPORTANT TO,

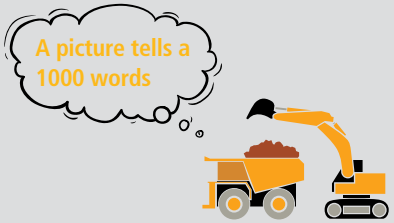
Have structured discussions/conversations with operators and technicians

The purpose of structured discussions with operators is to confirm their understanding of the risks and the practice. Structured discussions also assist to determine what operators believe is necessary to introduce to the practice and ensure that operators conform to the standards and procedures.

The discussions should be carried out one on one with the facilitator being a trusted person that has some training and experience in leading discussions. Trainers and full time safety representatives are good candidates as well as union representatives where mines have good labour relations.

The behavioural overseer is the key person in identifying facilitators, providing guidance and analysing the feedback to determine common messages, opportunities and challenges. The Leading Practice's many elements ensure that not all operators and/or technicians will have the same discussions. The topic of structured discussions will be extensively dealt with at the COPAs and mines will be supported by practical guides that can be used.

The use of visual communication has proved to be more effective than just verbal communication. There are a number of behavioural communication aspects that can be addressed by posters.



Create/modify risks posters

The risks should be explicitly communicated. From the risk analysis mines must create posters for all the Leading Practice elements that the mine will adopt. Posters should have graphics and be presented in different languages that will depict the mines employee diversity. The COPA will provide detail guidance and examples that mines can use.

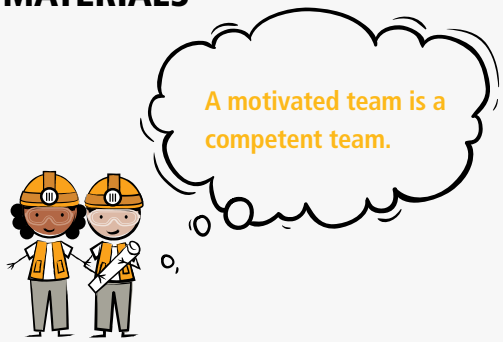
Create/modify Leading Practice posters

Posters should be developed from the Leading Practice description. The COPA will provide detail guidance and examples that mines can use.

18 IDENTIFY / DEVELOP OR MODIFY IDEAL BEHAVIOURS PER LEADING PRACTICE ELEMENT

It is important for Adoption, that all the different role players know what the ideal behaviour is for either facilitating Adoption (leadership behaviour) or executing the new controls (individual behaviour). The ideal behaviour must be incorporated into behaviour communication and training materials. To assist mines the MOSH industry team developed a foundation that mines can use to develop their own materials. These will be shared at the COPAs.

19 PLAN AND DEVELOP TRAINING MATERIALS



One of the 7 principles of Adoption is to train for competence and not for knowledge. The training that must be provided as part of the Traffic Management Leading Practice must be outcome based and specifically developed to achieve competence.

Plan training materials required

Existing training material will have to be updated and in many cases new training material will need to be developed. Many mining companies have training centres that co-ordinate training and the development of training material.

Prepare training documentation

The mine ATM, the training manager and the behavioural plans overseer should agree to the responsibilities and procedures for preparing the necessary training material and training lesson plans. The training manager and the behavioural plans overseer should oversee the process of developing the necessary training documents and for ensuring a quality outcome.

Prepare competence evaluation criteria

The mine must determine the outcome of key competencies and develop specific criteria and methods to determine if the outcomes have been reached by the trainees.

Execution stage

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STEP 21	Do leadership behaviour sessions	PAGE 31
STEP 22	Do behaviour communication	PAGE 31
STEP 23	Train the persons involved in adopting the practice	PAGE 31
STEP 24	Implement and maintain the monitoring programme	PAGE 32
STEP 25	Report on Adoption and performance achieved – to COPA	PAGE 32
STEP 26	Review and close out the Traffic Management Leading Practice project	PAGE 32

Execution of the applicable Leading Practice elements must follow the mine's standards and procedures for supply, contract and commissioning. With the execution of every one of the relevant elements, steps 20 to 24 must be done to ensure Adoption.

20 STEP

CONDUCT ISSUE BASED RISK ASSESSMENT OF ALL WORK TO BE DONE

The Adoption Team must do an issue based risk assessment for each one of the elements that the mine will adopt. This will ensure that all risks that may be introduced during the Adoption of a specific Traffic Management element are identified, controlled and managed.

21 STEP

DO LEADERSHIP BEHAVIOUR SESSIONS

Mines may consider to conduct leadership behaviour sessions with all the members of a specific management or supervisory level in one session. Sessions can be considered for,

- Team leaders
- Shift supervisors
- Production managers

22 STEP

DO BEHAVIOUR COMMUNICATION

Conduct structured conversations with individuals and/or groups as needed in the relevant element. Ensure that individuals have a clear and correct understanding of the risks associated with the element, how the specific element controls the risk and what is required to ensure that the control is always working.

23 STEP

TRAIN THE PERSONS INVOLVED IN ADOPTING THE PRACTICE

Initiate the training process according to the training programme that has been developed. The initial focus should be on those who require training to enable successful Adoption of the **Traffic Management Leading Practice**. Ensure that individuals are fully competent in the execution of the relevant element.

Analyse data to establish the performance and impact of the practice.

Execution of the applicable Leading Practice elements must follow the mine's standards and procedures for supply, contract and commissioning. With the execution of every one of the relevant elements, steps 20 to 24 must be done to ensure Adoption.

24
STEP

IMPLEMENT AND MAINTAIN THE MONITORING PROGRAMME

Once sufficient data has been collected, the mine ATM should arrange for the data to be analysed so that performance of the practice and the impact that it has had at the mine can be established.

25
STEP

REPORT ON ADOPTION AND PERFORMANCE ACHIEVED TO COPA

The mine ATM must ensure that key stakeholders are kept informed of progress.

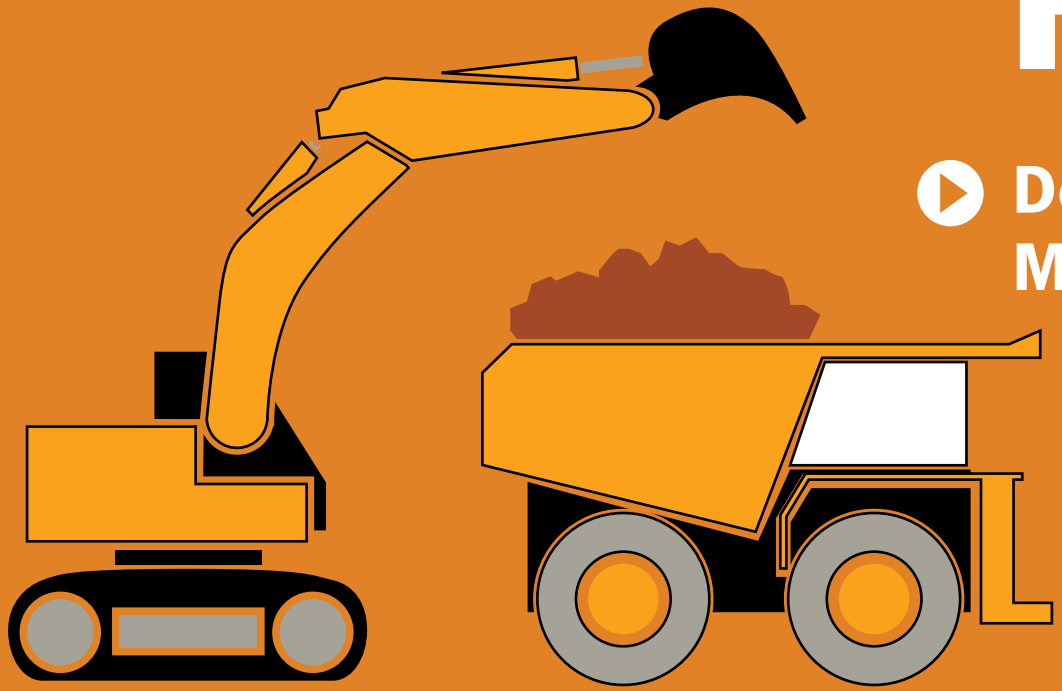
Brief progress updates should be prepared and issued regularly to the union leaders, mine management, and the MOSH ATM. Progress on the Adoption process should be reported to and discussed with the mine manager at least twice a month.

26
STEP

REVIEW AND CLOSE OUT THE TRAFFIC MANAGEMENT LEADING PRACTICE PROJECT

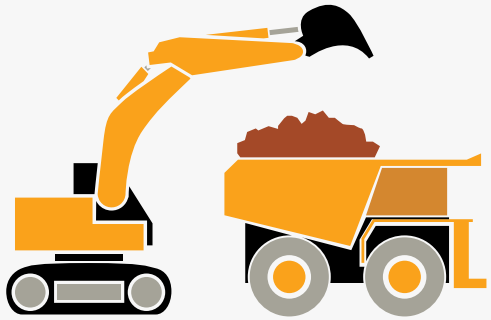
Once the mine has completed the Adoption of all the relevant elements of the Traffic Management Leading Practice and monitored performance, the mine must review and close the project officially.

Key lessons should be documented.



PART 3

Description of the Traffic Management Leading Practice



TRAFFIC MANAGEMENT

LEADING PRACTICE DESCRIPTION

FOR OPEN CAST/PIT OPERATIONS IN SOUTH AFRICA

Prepared by:
MOSH Open Cast/Pit Industry Team on Transport and Machinery
Facilitated by: MOSH T&M Adoption Team
Manager: Danie van der Merwe
Adoption Specialist: Kobus Blomerus

Industry Team Members

MINERALS COUNCIL
SOUTH AFRICA

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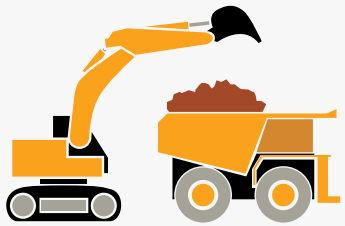

PART 3

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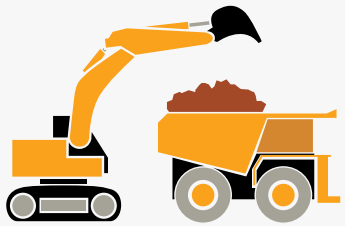
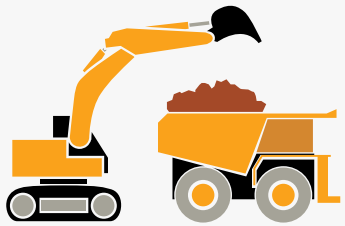


DEFINITIONS AND ACRONYMS

All words in the definition table are indicated by *Italics* in the document.

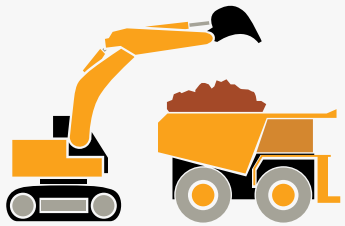
Access/secondary roads	Roads used for any other purpose than hauling.
Adoption	A process of introducing operational practices that include behavioral change and leadership behaviour aspects
Bench	A physical area used to facilitate controlled extraction of material (Google).
Braking system	A device or combination of devices capable of reducing the speed of a trackless mobile machine to a standstill.
Camber/cross fall	The convex or arched shape of a road surface.
CAS	Collision Avoidance System
Control	An object, human action or combination of the two introduced in operations in order to eliminate or mitigate occupational health and safety hazards.
COP	Latest revision of the Mandatory Guideline for a Code of Practice as described by section 9 of the MHSA.
Curves	Any significant change in the direction or elevation of a haul road, including horizontal and vertical curves
DMR	Department of Mineral Resources
Elevated roadways	Roadways of sufficient height above the adjacent terrain to create a hazard in the event that mobile equipment should run off the roadway.
EME	Earth Moving Equipment
Employee	A person who is employed or working at a mine.
Exclusion zone	No go area
FEL	Front-End Loader
Gradient	The amount of slope a haul road has from the horizontal along the length of the road. For the purposes of this document, standard gradient is expressed as a percentage. The grade (%) is determined by dividing the road's vertical rise by its horizontal run and multiplying this value by 100.
Green zone	Any low risk physical area that is not an orange or red area.
Hauling / haul roads	Primary route for movement of mined material from the point of extraction.
High risk	A risk with probability and /or consequence that is above the company criteria for risk classification.
HME	Heavy Mobile Equipment (including tracked vehicles) including EMEs.
HMV	Heavy Mobile Vehicles (tyred)
Immobilise	Isolated, locked out and inadvertent movement prevented by e.g. inserting stop blocks or lowering components to the ground.
Implementation	A process of introducing practices.
Induction	Any intervention / mechanism to communicate relevant rules of the mine and that have proof of doing.
Intersection	A place where two or more roads meet.
LDV	Light Delivery Vehicle
Leading Practice	The current best tried and tested way to do something.



DEFINITIONS AND ACRONYMS
CONTINUED

All words in the definition table are indicated by Italics in the document.

Medium risk	A risk with probability and /or consequence that is above the company criteria for risk classification.
MHSA	Mine Health and Safety Act (Act No. 29 of 1996)
MHSC	Mine Health and Safety Council
MOSH	Mining Industry Occupational Safety and Health
MOSH Leading Practice	A Leading Practice that comprises of three aspects: technical, leadership behavior and team member behavior and that conform to the criteria as set out in the MOSH Adoption system.
Open cast	A surface mining operation.
Open pit	A surface mining operation.
Orange zone	A physical risk area within the mine site area with medium risk, physically fenced off, clearly demarcated, with limited access points and physical control at each access point.
PDS	Proximity Detection System
Pedestrian	Any person on foot irrespective of any job category.
Quarry	A place, typically a large, deep pit, from which stone or other materials are or have been extracted.
Radius	The radius of a curve is to be calculated using the chord and the middle ordinate as illustrated.
Red zone	A physical, high (extreme/high) risk area within the mine site area that is physically fenced off, clearly demarcated, with limited access points and physical control at each access point.
Risk area	An area where there is a likelihood of uncontrolled interaction between vehicles or vehicles with individuals that may result in injury or harm to individuals or equipment.
Sponsor	The individual that is accountable for the success of the Adoption project.
Stock Pile	Any pile of material such as waste or minerals etc.
TMM	Trackless mobile machine: any self-propelled mobile machine that is used for the purpose of performing mining, transport or associated operations underground or on surface at a mine. The machine is defined by its movement on wheels, skids, tracks, mechanical shoes or any other device fitted to the machine, but excludes rail bound equipment, scraper winches, mono rail installations, static winches, draglines, winding machinery installations, track mounted conveyors and any equipment attached.
Traffic Management System	The collective mechanisms employed by the mine to ensure optimised and safe movement of vehicles and pedestrians.
Trailer	Any vehicle that is not self-propelled and needs to be towed by a trackless mobile machine by design.
Visitor	Any individual visiting the mine that is not a mine employee
Width	The running width of the road and excludes any additional space required for drainage ditches or berms, etc.



OBJECTIVE

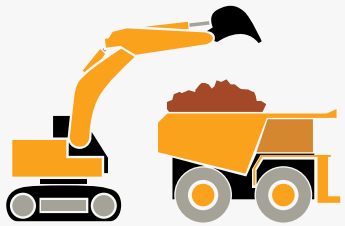
Traffic management, or the lack thereof, has been identified as one of several factors that if dealt with appropriately, could improve the safety performance of *Open Cast/Pit* operations significantly. Notwithstanding the prevailing requirements of all relevant legislation governing the operation and use of trackless mobile machines *(TMM)* at any mine, this document seeks to assist the mining industry to effect improvements to existing operations. In so doing, this will enhance the existing measures to prevent traffic related accidents.

APPLICABILITY

The *Leading Practice* was developed by industry members representing all *Open Cast/Pit* operation types in South Africa. Not all the elements of the *Leading Practice* may be applicable to all *Open Cast/Pit* operations across the diverse South African mining industry.

A START ON TRAFFIC MANAGEMENT

Open Cast/Pit operations in South Africa are very diverse in size and nature, ranging from father and son quarries and brick works to mega international operations, producing millions of tons of minerals per year. Fatigue and traffic management are the two main causes of fatalities and injuries.



Traditionally uncontrolled falls of ground (FoG) posed the most serious hazards in South African mines causing more fatalities and injuries than any other hazard in the industry at large. Advances in the prevention and mitigations of uncontrolled FoG over the last 10 to 20 years have resulted in transport and machinery becoming the largest contributor to fatalities and injuries in the industry specifically considering that FoG in *Open Cast/Pit* mining is rare and with lower consequences than transport and machinery.

UNDERSTANDING MINING OCCUPATIONAL HEALTH AND SAFETY (MOSH)

The mining industry's commitment to improving health and safety performance as agreed upon by the tripartite partners in 2003, lead to the Mining Occupational Health and Safety *(MOSH)* initiative to support the 2013 milestones. The *MOSH* Learning Hub was established from 2008 to 2012 to act as a facilitator of the initiative that coordinated industry members into specific focus areas: dust, noise, FoG and T&M. The higher risk operations were addressed first with a focus on underground coal and hard rock operations. In 2013 an industry team for *Open Cast/Pit* operations was assembled and started working in May of that year.

The initial focus of the team was to draw on the collective experience of the members all having a number of years of experience in *Open Cast/Pit* operations to establish what is called an **expert risk model** for transport and machinery operation. The model systematically identifies sources and causes of hazards. Following a fatality and injury analysis the team concluded in 2014 that, adressing **fatigue** and **Traffic Management** could improve safety performance of *Open Cast/Pit* operations significantly.

In 2014 industry members decided that **Traffic Management** would be addressed as a *MOSH Leading Practice*. The *MOSH* industry team formulated the content and elements that constitute the *MOSH* Traffic *Management Leading Practice*.

Acknowledging the diversity of operations the *Leading Practice* and its elements **is applicable only where the risk at the specific operation requires such controls**. If the law requires a mine to address a specific risk, this *Leading Practice* is the most appropriate way to deal with the risk.

This *Leading Practice* must be read in conjunction with the *TMM Regulations/TMM COP* guideline.

When a new site or mine is planned and designed the principles of this document must be considered and incorporated as part of the pre-planning and design.

Trackless Mobile Machinery and its operation is the most hazardous aspect for workers (pedestrians and operators), customers or contractors in Open Cast/Pit operations.

ACKNOWLEDGEMENTS

In the true spirit of "for industry by industry" this *Leading Practice* description was developed by the MOSH T&M Open Cast/Pit industry team. The Minerals Council that facilitated the development wishes to acknowledge the following industry members:

- **De Beers:** Mr. Gustaf van der Linde and Mr. Maarten Cuperis
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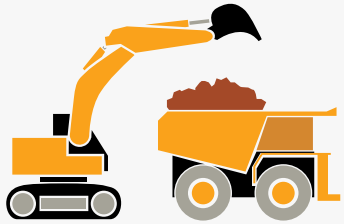
- **Petra Diamonds:** Mr. Ceaser Molobye
- **Glencore:** Mr. Dudley Lotter
- **SACEA:** Mr. Gerald Robinson
- **Rio Tinto, Richards Bay Minerals:** Mr. Anton Smal
- **Shanduka Coal:** Mr Anil Palad
- **Nkomati:** Mr. Juluis Hattingh and Mr. Koos Wilshnach
- **South 32:** Mr. Herman Heukelman

TRAFFIC MANAGEMENT SCOPE

Traffic Management Leading Practice consists of:

- The establishment of an effective *Traffic Management System*
- The maintenance and improvement of the *Traffic Management System*
- Assuring adherence to all controls used as part of the *Traffic Management System*
- Deals exclusively with the safe movement of people and vehicles

It is important to note that requirements and standards contained in this description are applicable in accordance with the mines risk analysis.



1 TRAFFIC FLOW AND RISK ANALYSIS

The *Leading Practice* for Traffic Management is based on a thorough Traffic Flow and risk analysis. The analysis will be based on the **current** operation and layout of the mine. The risk analysis does not need to consist of the entire mine **baseline risk assessment**, only the components related to **vehicle and pedestrian movement**. The risk analysis will identify all hazards related to vehicle and pedestrian movement for the specific mine.

The purpose of the risk analysis is to proactively identify all hazards and unwanted events related to vehicle and pedestrian movement that can cause people and operators harm. **The risk analysis aims to develop and manage controls that will prevent the unwanted events from happening**.

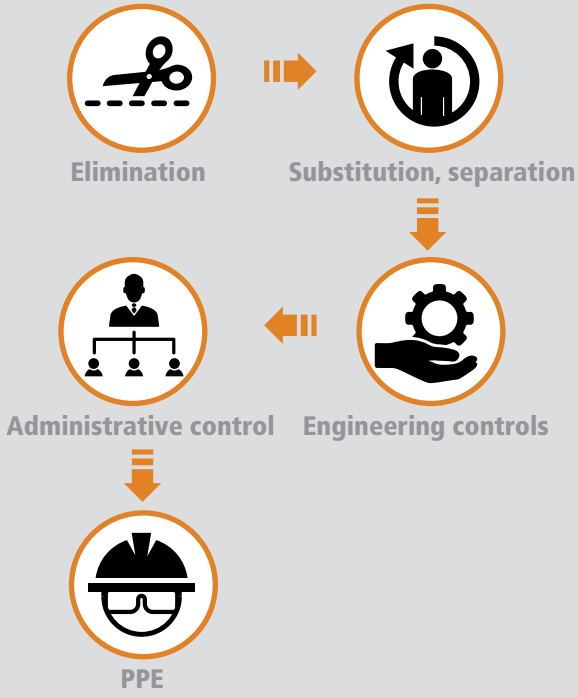
The mine's operational processes as **formally** defined for use as the basis in the mine's **baseline risk assessment** must be used for the identification of *pedestrian* and vehicle movements, related hazards as well as general movement of pedestrians and vehicles on the site.

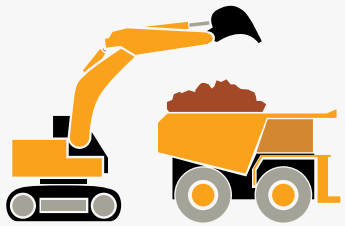
The mine must compile an information file (hardcopy and/or electronic) of all the data and information used and decisions made with regards to the traffic management risk analysis for purposes of traceability, record keeping and to be used for independent review.

The mine must follow the hierarchy of controls to mitigate identified risks. This will ensure that risks are eliminated in a practical manner.

The notion that a specific unwanted event has not happened for any number of years of operation is not a justification for ignoring a hazard or specific unwanted event.

The hierarchy of controls is listed below:





1 TRAFFIC FLOW AND RISK ANALYSIS
CONTINUED

1.1 DEFINITION OF CONTROLS

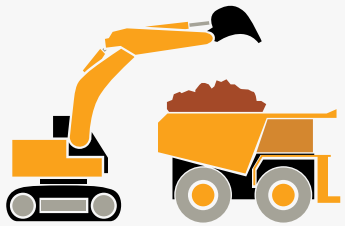
The MOSH Traffic Management Leading Practice risk analysis incorporates the ICMM definition of controls. The ICMM definitions are globally accepted as:

- A human act;
- An object (engineered) or
- A system (combination of an act and an object intended to prevent or mitigate an unwanted event.

The following are not considered controls:

- Codes of Practice
- Standards
- Training materials
- Training
- Policies
- Procedures

Refer to the ICMM good practice guideline on the MOSH website under T&M.



1.2 TRAFFIC FLOW ANALYSIS

The Leading Practice for the risk analysis includes the following elements:

1.2.1 The risk analysis must be based on the equipment described in the **official** equipment register and all requirements of the mandatory *COP* for the operation of *TMM*, in particular the selection of appropriate equipment for the operation (both mines own as well as sub-contractor equipment). Where current operations are performed with vehicles and equipment that are not conforming to the *COP,* the anomaly must be resolved before starting the risk analysis. (Updating COP)

1.2.2 A current (up to date) "as is" mining lease area **layout** with clearly identified access routes, pedestrian walk ways, parking areas and routes, delivery routes, collection points and routes, hauling routes as well as all other routes according to the specific operation must be used as the basis of the risk analysis.

1.2.3 Based on the hierarchy of controls the mine must eliminate as much as possible of the risk by **minimising**

- All vehicle movement, specifically that of LDVs
- The number of vehicles moving on the mine and/or
- The number of vehicles with permits that can enter different areas of the mine

Specific attention must be given by operations, such as many of the aggregate producers, where product are transported from the mine via national roads. These operations must make maximum use of stock piles that are situated to ensure **minimum on-mine vehicle movement** and maximum separation on access roads between the mine and the provincial/ municipal roads.

1.2.4 Special attention must be given to the general arrangements on aggregate and sand works or other mines where applicable to ensure:

- One directional traffic flow
- Minimum congestion
- Sufficient waiting areas to eliminate congestion
- Optimal one directional and sequential flow – entrance – load – weigh- unload if overfill – re weigh (if necessary) - exit
- No or limited pedestrians crossing any road where HMVs operate

1 TRAFFIC FLOW AND RISK ANALYSIS
CONTINUED

1.2 TRAFFIC FLOW ANALYSIS CONTINUED

1.2.5 Circular and optimal flow in mobile crushing areas if through fare is not possible.

1.2.6 The minimisation of pedestrian movement in general and the elimination of pedestrians having crossing roads to visit resting places (lunch, smoking, etc.) and restrooms.

1.2.7 Specific attention must be given to the location of parking places and movement of pedestrians to and from it.

1.2.8 The mine must determine where separation of vehicles can be achieved by:

- Separate LDV and HME roads
- Separation of LDV and HME movement on the same road by time zoning or traffic management rules e.g. stopping of HMEs if LDVs are on the road.
- Separation of HME roads to ensure one way vehicle movement.
- Separation of employee vehicles from mine vehicles including all staff parking areas.

1.2.9 Identify locations (physical places) of the different mining processes where movement of vehicles and pedestrians takes place on the mining lease area layout plan. It is important that the layout plan clearly indicates potential interaction points (places) between:

- Vehicles and other vehicles
- Vehicles and pedestrians
- Vehicles and objects and
- Vehicles and voids
- Pedestrians and voids

1.3 RISK ANALYSIS

1.3.1 Identify hazardous areas on **all** roads and routes on the site including but not limited to:

- Sharp bends and corners
- Intersections
- High walls
- Narrow roads
- Inclines and declines, etc.

1.3.2 Identify hazards and risks posed by vehicle and pedestrian movement related to all identified operational activities.

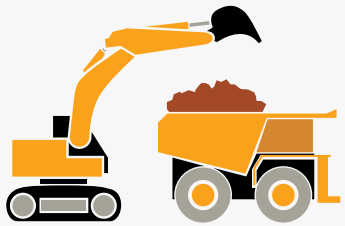
1.3.3 Identify and define all the Unwanted Events (UE) from each hazard.

1.3.4 Identify the hazard sources.

Hazard sources from equipment and equipment operators is not included in the scope of Traffic Management.

Hazards and hazard sources from the environment are included in the scope of Traffic Management. Amongst others the following to be considered:

- **Light or lack of**
- **Wind and dust**
- **Rain, flooding and fog**
- **Lightning**



1 TRAFFIC FLOW AND RISK ANALYSIS
CONTINUED

1.3 RISK ANALYSIS CONTINUED

1.3.5 Identify individuals that might be harmed by UEs such as:

- Operators
- Pedestrians
- Visitors
- Customers

1.3.6 Determine the worst-case consequence (pure risk) of each UE.

1.3.7 Determine the risk rating per risk, according to the mine's risk management procedure and risk matrix. The mine's risk management procedure should include:

- Elements of this *traffic flow and risk analysis* (section 1 of this document)
- Include a definition of significant risk
- The mine's tolerable risk standard

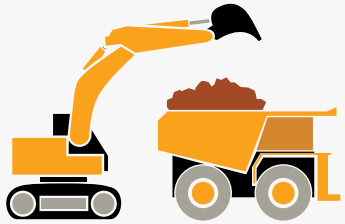
For the purpose of this *Leading Practice*, significant risk is defined as pure risks that can result in either a fatality or a serious injury.

1.3.8 Identify all potential controls per unwanted event to prevent and/or mitigate the risk and determine the effectiveness of each control

1.3.9 Document the analysis

1.3.10 An independent review of the risk analysis should be performed by reputable specialist(s).

Consideration should be given to the applicability and effectiveness of all the elements of this Leading Practice. The principles to reduce the probability and or consequence of a hazard in order to reduce the risk to below the tolerable risk factor of the mine.



2 MINE ACCESS AND MINE ACCESS ROUTE(S)

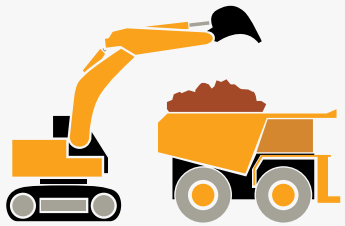
2.1 The mine should have a *Traffic Management System* to deal with the flow of traffic from any provincial road to the controlled mine access point. This includes:

- Signage
- Road markings
- Crossings
- Drop off points
- Visitor-parking areas, etc.

2.2 Site access (mine controlled access point) must ensure that sufficient safe waiting areas are provided for individuals that want to enter the mine. Employees should not have to wait on the side of public access roads to enter the mine.

2.3 The mine should place controls that ensure congestion is limited during high traffic volume periods. Such controls could include:

- Time zoning
- Separate parking/waiting areas etc.



3 MINE LAYOUT AND ROAD SYSTEMS (ROUTES)

The foundation of the mine's *Traffic Management System* is the site design and layout that includes road routing. There are many aspects that should be incorporated into a safe site layout, vehicle and *pedestrian* routing. Road systems and routing must be considered based on the following information:

- Road utilisation during normal operations
- Periods and durations of increased congestion – shift start and end, lunch and other breaks, last day of week/month
- Emergency evacuation routing
- Number of junctions and crossings during normal operations
- Number of junctions and crossing points
- Visibility at junctions and crossing points

The mines site layout will incorporate the following *Leading Practice* aspects:

3.1 ACCESS/SECONDARY ROADS

3.1.1 Roads will be routed to minimise:

- Vehicle and *pedestrian* proximity
- Vehicle congestion
- Dust exposure to operators and *pedestrians*

3.1.2 Road routing should be cognisant of:

- Overhead power lines
- Servitudes
- Dams
- Storage facilities
- Any other structures or voids

3 MINE ACCESS AND MINE ACCESS ROUTE(S) CONTINUED

3.1 ACCESS/SECONDARY ROADS CONTINUED

3.1.3 *Access/secondary* roads should have effective controls to prevent vehicles from leaving the road.

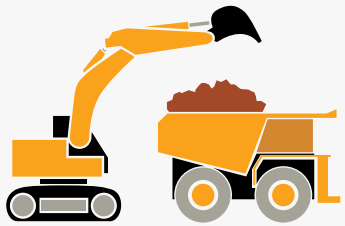
3.1.4 Roads should be routed to allow directed and controlled (no shortcuts) traffic flow.

3.1.5 *Pedestrians* should be separated from roads. Separation mechanisms such as dedicated walkways, marked crossings, handrails, time zones and/or movement rules should be utilised to achieve effective separation.

3.2 ZONING AND ZONE CONTROL

Zoning provides the mine with a practical control to ensure that only authorised vehicles and *pedestrians* **enter designated areas.**

3.2.1 Areas of the mine will be zoned according to the potential risks (including interactions) specific to the **area** in order to differentiate risk areas and controls.



3.2.2 The risk areas should be defined according to the three colored zones.

a. *Exclusion zones – No entrance for anybody*

b. *Red zoned* area will be controlled by:

- Physical access control to prevent unauthorised entrance
- Blasting (chapter 17 MHSA), explosives, fencing act

c. *Orange zoned* areas will be controlled by Physical access control to prevent unauthorised entrance

d. *Green zoned* areas will be controlled by the mine access control only

3.3 HAUL ROADS

3.3.1 *Haul roads* will be routed such that hauling equipment is separated from LDVs and *pedestrians*. Traffic flow should be directed and controlled with no shortcuts.

Separation can be achieved by:

- Separate roads
- Center berms
- Time zoning
- Rules for controlling movement

3.3.2 *Haul roads* should have effective controls to prevent vehicles from leaving the road uncontrolled. These controls include the installation of barriers or berms where risk requires such.

3.3.3 *Haul road* routes should provide for safe crossing under overhead power lines, bridges and other overhead structures or no crossing at all. Considerations should be given to all types of vehicles and equipment that will use the road.

3.3.4 *Haul roads* should be designed and traffic routed so that fully laden vehicles are prevented from crossing. If this is not possible, traffic from all directions should be stopped.

3.4 BENCHES

3.4.1 Where there is a road on a *bench* the practice for a *haul road* equally applies.

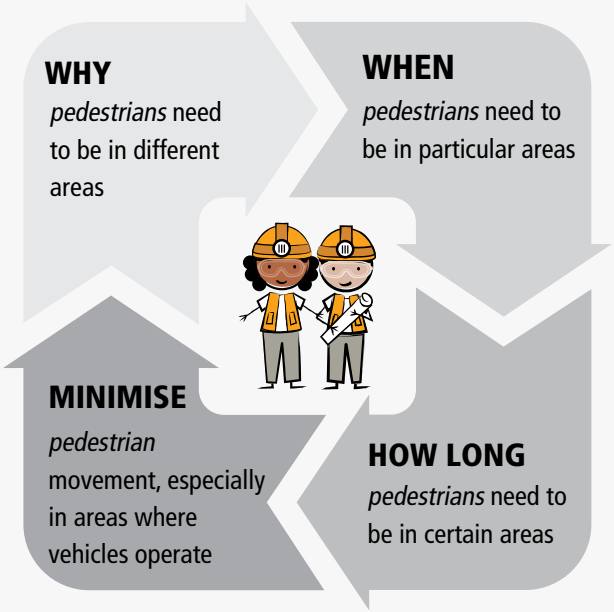
3.4.2 *Bench* edge protection should be provided if vehicles can access the edge.

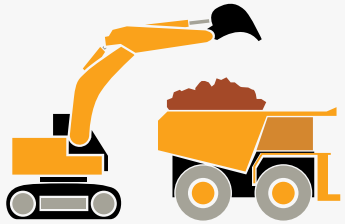
3.4.3 High wall stability should be confirmed and duly recorded before any traffic is allowed at beginning of every shift.

4 PEDESTRIAN MOVEMENT

Controlled *pedestrian* movement is as important as controlled vehicle movement.

4.1 The mine first has to carefully determine all *pedestrian* movement, keeping in mind the golden rule that *pedestrians* have a right of way.





4.2 *Pedestrian* access to the mine should be controlled to ensure that the mine's *Traffic Management System* functions as intended at all times.

4.3 All *pedestrians* allowed access to the mine must go through an induction that informs the *pedestrian* of all the applicable risks and rules.

- Proof and period of validity of the induction should be retained.
- *Pedestrian* routes should allow for the safest route between areas where *pedestrians* have to call, or work. If possible, these routes have to be separate from vehicle roads.
- Routes should be planned to minimise *pedestrian* exposure to vehicle movements through the installation of barriers, crossing points etc.
- *Pedestrians* should be protected from out of control vehicles, based on the size and frequency of vehicles operating/passing pedestrians.

4.4 *Pedestrian* routes or *zones* should be established and designated with suitable signs, barriers, road markings etc.

4.5 *Pedestrian* routes should be sufficiently barricaded to discourage *pedestrians* from moving outside the demarcated walk ways.

4.6 "No entry/*exclusion*" *zones* should be identified and clearly marked with signs, fencing, cones etc.

4.7 Uncontrolled *pedestrian* movement on *haul roads* should be completely eliminated. If elimination is not possible, *pedestrian* movement must only be allowed while hauling has been temporarily stopped. Time zoning should be applied where required.

4.8 No individual should enter operational areas as a *pedestrian* unless authorised to do so. *Pedestrians* should establish **positive** communication with the person in charge of the specific operational area that she/he wants to enter.

4.9 No *pedestrians* should be permitted to be within unsafe proximity of an operational loading shovel. A warning sign must be placed to demarcate any operational loading or dumping area.

5 CONTRACTOR OPERATIONS

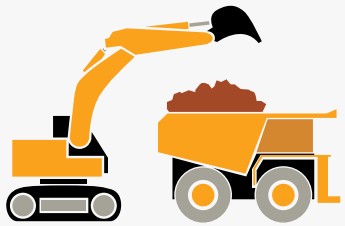
The mine needs to ensure that contractor(s) are in possession of this *Leading Practice* description and implement it.

Any contractors that perform any operational work for or on behalf of the mine will be subject to exactly the same *Leading Practice* elements that the mine follows.

6 CONTRACTOR HAULING VEHICLE MOVEMENT

Contractors that are hauling a product or product from the mine the site layout should consider the *Leading Practice* and the *Traffic Management System* should be designed accordingly. The following *Leading Practice* elements apply:

6.1 Contractors should collect product from a **controlled stock pile** or **loading point** (working area) only.



6.2 Stock pile area(s) should be **demarcated** with controlled movement of the area.

6.3 Contractor movement should be based on:

- Frequency of movement
- Time of the day
- Period of movement
- Maximum size of vehicle(s)

6.4 Contractor haulage vehicle operators should comply with any site specific **rules** applicable to **routes** and **areas** where they operate.

6.5 Contractor haulage vehicle operators should not be permitted to proceed into a working area until they have:

- Received appropriate **permission and instruction** relevant to any of the rule(s)
- Possession of a valid **permit** according to the mine's requirement(s)

6.6 The following specific **designated areas** should be provided:

- Parking
- Trimming off
- Sheeting
- Tailgate securing
- Vehicle inspection

6.7 When the hauling vehicle is in the loading area, positive communication between loading operators and hauling vehicle operators should be established at all times.

6.8 Contractor haulage vehicle operators should remain in the cab during loading operations and at all times in the loading area. In the event of an operator leaving the cab of the contractor haulage, the loading operator must stop operating until the hauling vehicle operator returns to the cab or moves to a safe place.

6.9 The mining lease area layout should indicate allocated area(s) where contractor haulage drivers are permitted to leave their vehicle.

6.10 Contractor hauling operators are required to ensure that all lights, directional indicators and reverse warning devices are working before entering the loading area. This can be done by doing a physical inspection at the access point or providing a duly completed hauling pre-use checklist for the day.

6.11 The mine must have an official procedure for contractor hauling vehicle breakdown on the mine site. The content of the procedure must be part of the mine's contractor induction and training programme.

6.12 In the event of a breakdown or an emergency involving a contractor haulage vehicle, the driver should remain in their vehicle unless it is not safe to do so and follow the local procedures for stranded vehicles. The use of mobile phones will be permitted in an emergency.

7 COLLECTION/DELIVERY VEHICLE MOVEMENT

7.1 All operators of collection and/or delivery vehicles should report to a designated control point to:

- Sign in
- Receive the necessary site rules
- Receive the appropriate site induction
- Receive delivery instructions and who to report to

7.2 The rules should include:

- Routes to be taken
- Parking arrangements
- *Pedestrian* control
- The need to observe signs and instructions regarding traffic control and segregation

7.3 Visiting operators must have clear instructions regarding their personal movements on site.

Special attention must be given to the risks posed by operators leaving or staying inside their vehicles.

7.4 Loading/off-loading areas with limited capacity, especially where pedestrians are present, should have **limited and controlled** vehicle access to ensure safe delivery or collection. Sufficient waiting area(s) should be provided for vehicles waiting to enter loading/off-loading areas.

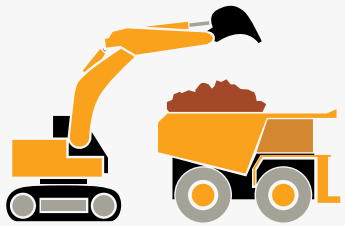
7.5 At the point of collection/delivery the receipt/dispatch of the goods must be controlled by a **designated person** who must also ensure that parking and loading/unloading rules are followed.

7.6 Site specific rules must be prepared and followed for the delivery/collection of:

- Gas
- Oil
- Explosives
- Any other hazardous materials

7.7 After loading or unloading, the vehicle must return to the designated control point to sign out.

7.8 Deliveries heading directly to the point of use should be escorted to the designated off loading or building area and a responsible mine employee must control the unloading.



8 TRAFFIC MANAGEMENT RULES

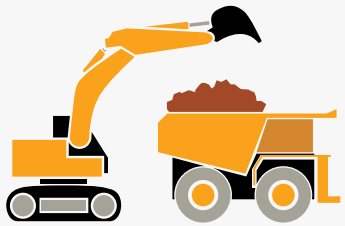
8.1 LOADING RULES

The mine must have a safe loading procedure that is based on the mines risk analysis which defines the rules and requirements for loading that address the aspects below.

8.1.1 During normal loading operations, the excavator/*FEL* operator must ensure that the truck is positioned so that the truck cab is never under or in reach of the excavator/*FEL* boom before she/he discharges the load from the bucket.

8.1.2 The excavator/*FEL* operator must give positive communication that the truck is in the correct position before loading.

8.1.3 When the load has been discharged and the excavator/*FEL* operator is satisfied that the truck is loaded according to the mine's specific loading rules, the **excavator/ *FEL* operator** needs to give positive communication to the truck driver to move off. The mine's loading procedure should also address the prevention of overloading and how to address overloading situations.



8.1.4 Where applicable, local authority requirements such as noise management should be addressed as part of the mine's risk analysis.

8.1.5 A waiting area should be made available when more than one dump truck is used in the operation. The waiting area will ensure that the maximum number of vehicles that can potentially approach the loading area can use the waiting area without the risk of interaction. The *Leading Practice* requires:

- A minimum of 3 vehicle lengths must be maintained when vehicles are parked behind each other
- A minimum of 2 vehicle widths must be maintained between vehicles when parked next to each other
- Vehicle interaction must be prevented and vehicles should be visible to operators at all times when staggered
- Interactions must be avoided in runback situations

8.1.6 If there is a need for any other vehicle to enter the loading area, the operator of the other vehicle must have positive communication with the excavator/FEL operator or appointed supervisor and obtain permission **before** entering the loading area.

8.1.7 If there is a need for any other vehicle to enter the loading area, all loading activities must be stopped with the excavator/FEL bucket in a safe position **before** the other vehicle enters the loading area.

8.2 DUMPING RULES

The mine must have a safe dumping procedure that is based on the mines risk analysis and defines the rules and requirements for dumping. The *Leading Practice* aspects below must also be addressed especially the risks associated with confined/congested dumping areas.

8.2.1 The procedure should include the list of the specific machines that the procedure addresses for the task.

8.2.2 Dumping areas must be demarcated and clearly marked as the appropriate *zone(s)*.

8.2.3 When more than one dump truck is used in the operation, a dumping vehicle waiting area must be established. The dumping vehicle waiting area will ensure that the maximum number of vehicles that can potentially approach the dumping area can wait in the waiting area without the risk of interaction.

8.2.4 Dumping should be done in an orderly fashion at all times that allows for attention to be given to all the vehicles in the dumping area.

8.2.5 While approaching the dumping/tipping area, the dump truck should be positioned such that it can safely reverse while taking into account other vehicles in the vicinity.

8.2.6 Dump trucks must have sufficient space to allow safe reversal into the tipping area and be maneuvered such that the dump truck can stop at right angles to the drop edge berm.

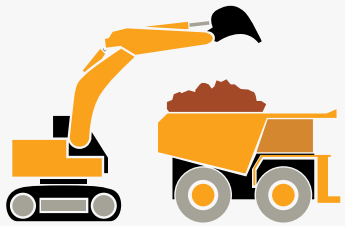
8 TRAFFIC MANAGEMENT RULES
CONTINUED

8.2 DUMPING RULES CONTINUED

8.2.7 Dump vehicle operators must make full use of all visibility aids including mirrors and other reversing aids throughout this operation. This allows the position of rear wheels to be monitored in relation to the tip edge berm.

8.2.8 Vehicles must not be reversed blindly in the tipping area. Operators must make full use of visibility aids including mirrors and should not reverse until they are certain that the path is clear and only if a stand-off or protection is in place and adjacent to any edge or hazard.

8.2.9 If there is a need for any other vehicle or *pedestrian* to enter the dumping area, the *pedestrian* or operator of the other vehicle must have **positive** communication with the operators of **all vehicles** in the dumping area and obtain permission from the dozer operator or appointed supervisor before entering the dumping area.



8.2.10 If a *pedestrian* or any other vehicle is entering or leaving the dumping area all vehicle movement in the dumping area must be stopped until the *pedestrian* and/or other vehicle has entered/left the area.

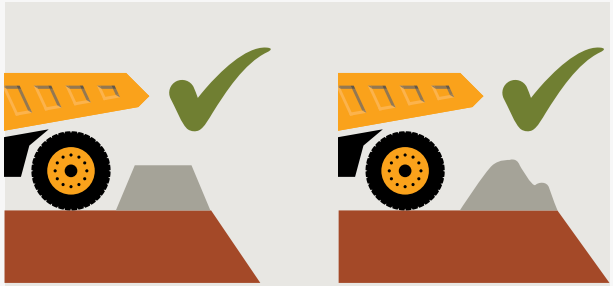
8.2.11 Suitable edge protection berms with a **minimum** height equal to the radius of the largest vehicle wheel, must be maintained at drop edges.

8.2.12 Berms at dumping areas should be designed and positioned to ensure stability and allow for the maximum rear axle weights and dynamic loading to prevent failure of the dump edge.

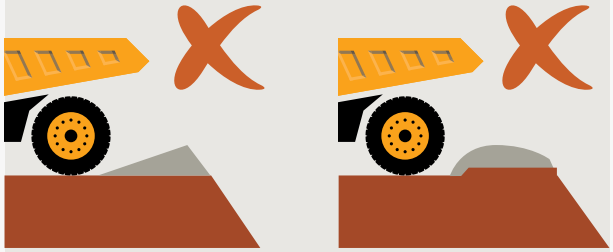
8.2.13 Loads must only be tipped when a suitable edge berm is in position. Berm inspection must be done before every shift and duly recorded. Berm inspection must include correct softness to prevent the vehicle from climbing over the berm.

8.2.14 No vehicles are permitted to climb up a tip edge berm. Tipping must be immediately stopped and berm hardness must be reported to the person in charge of the tipping area.

8.2.15 Tip edge berms must be maintained at all times to the designed profile (including profiles illustrated below) to prevent the truck from moving onto or over the berm.



SUITABLE EDGE PROTECTION BERM PROFILE



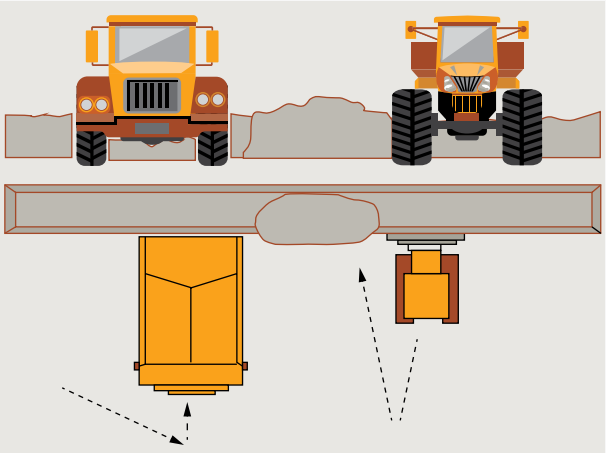
UNSUITABLE EDGE PROTECTION BERM PROFILE

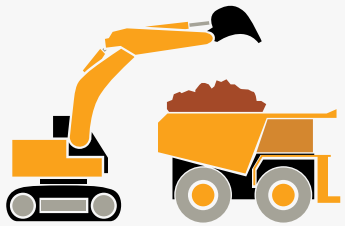
8 TRAFFIC MANAGEMENT RULES
CONTINUED

8.2 DUMPING RULES CONTINUED

8.2.16 When dumped material is dozed over the edge a sufficient berm as defined above should be maintained.

8.2.17 Dozers and dump trucks in the tipping area must remain in the view of the operator of a reversing truck or dozer at all times. Dozers and dump trucks must remain **at least one truck width apart** from each other while on tip edges. Dump truck operators should not drive into the reversing path of a dozer. (See below)





8.2.18 The dozer must work with at least the last tipped load distance between it and the dump truck to ensure a physical barrier is in place to maintain a safe distance (see above).

8.2.19 If the dozer operator is unable to form a suitable edge protection berm due to a breakdown or any unforeseen circumstances, the operator must stop all dumping activities in the specific dumping area immediately and inform the responsible person available.

8.3 STOCK PILES RULES

The mine must have a procedure for *stock piles* based on the mine's risk analysis that defines the rules and requirements and address the *Leading Practice* aspects below.

8.3.1 *Stock pile* areas must be demarcated and clearly marked as the appropriate zone.

8.3.2 No thoroughfare of any vehicle other than the truck that must be loaded and the *FEL* must be allowed in the stockpile area unless all activities at the *stock pile* are stopped and after positive communication between operators has been established.

8.3.3 The *FEL* operator must direct the truck to the best position she/he wants the truck to park for loading.

8.3.4 The *FEL* operator must give positive communication that the truck is in the correct position before loading.

8.3.5 On completion of the load and when the *FEL* operator is satisfied that the truck is loaded according to the mine's specific loading rules, the *FEL* operator must give positive communication to the truck driver to move off.

8.3.6 The mine's loading procedure must address the prevention of overloading/overfilling and address overloading/over filling conditions.

8.3.7 Local authority requirements such as noise and dust management must be addressed as part of the mine's risk analysis and procedures.

8.3.8 Where more than one truck is used, a *stock pile* waiting area must be established. The waiting area will ensure that the maximum number of trucks that can approach the *stock pile* can use the waiting area without the risk of interaction.

8.3.9 Uncontrolled *pedestrian* access to stockpile areas must be prevented. If a *pedestrian* or any other vehicle is entering the *stock pile* area all vehicle movement in the stockpile area must be stopped until the *pedestrian* and/or other vehicle has left the area.

8 TRAFFIC MANAGEMENT RULES
CONTINUED

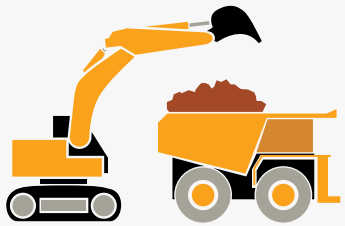
8.4 LOAD COVERAGE RULES

The mine must have a specific dedicated area away from the traffic flow where trucks can be parked and loads covered. The area must be sufficient in size to provide for the maximum number of trucks that will be covered at any given time. The layout must allow for one direction traffic flow and limit *pedestrian* and vehicle interaction.

8.5 ROAD RULES

The mine must have a procedure for road rules based on the mine's risk analysis that defines the rules, requirements and addresses the *Leading Practice* aspects below.

8.5.1 Drivers of all vehicles accessing and operating on the site must be authorised, licensed and have proof in their possession for the specific type of equipment that is mandated according to *COP* for operating *TMMs* as well as the *MHSA* regulations.



8.5.2 Operators of all equipment must perform the required inspections and/or tests according to the pre-use inspection requirements for the specific equipment at the mine.

8.5.3 All vehicles driven within the mine site must have headlights on at all times.

8.5.4 Operators must adhere to all speed limits of the site and reduce speed to the prevailing ground, weather and visibility conditions.

8.5.5 A safe following distance as determined by the risk analysis must be maintained between vehicles to allow:

- Timeous emergency action to be taken when required
- An increase in distance in adverse road or weather conditions

8.5.6 Light vehicles must not enter *zones* at heavy vehicle operational areas without permission from the responsible supervisors.

8.5.7 Vehicles must travel on the left side of the road.

8.5.8 Overtaking is not permitted unless a vehicle is stationary and positive communication has been established.

8.5.9 Vehicle operators must adhere to the traffic signs on roads at all times. No priority rules are allowed.

8.5.10 In the event of any activities on the road such as road maintenance, operators must adhere to the traffic control instructions given at the place of activity.

8.5.11 When an operator observes an unauthorised *pedestrian* on a *haul road*, the operator must notify the responsible person/security and take action to warn other road users.

8.5.12 The speed of vehicles must be determined by:

- Road design
- Road condition which varies according to the current road condition and is determined at the beginning and during shifts
- Vehicle manufacturer requirements
- Tyre manufacturer requirements
- Load, etc.

8.6 BENCH/DRILL BLOCK RULES

8.6.1 Benches and drill blocks must be appropriately barricaded and be *zoned* as *red zones.*

8 TRAFFIC MANAGEMENT RULES
CONTINUED

8.7 CRUSHING RULES

8.7.1 The mine must have a safe crushing procedure based on the mine's risk analysis that defines the rules and requirements for loading at the crushing site.

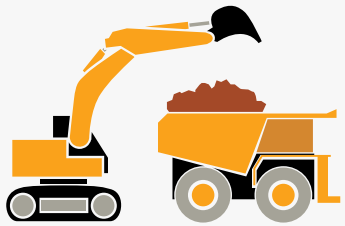
8.7.2 The crushing area must be *zoned* based according to risk. The crushing area cannot be a *green zone* it must be orange or red.

8.7.3 Transportation of a crusher to the site must be done under the supervision of a competent person.

8.7.4 A crusher must be positioned such that it does not impair the safety of individuals or other vehicles operating in the area.

8.7.5 Ensure that effective loading and tipping rules are enforced.

8.7.6 The mine must have a safe loading procedure based on the mine's risk analysis that defines the rules and requirements for loading in the crusher area.



8.7.7 Positive communication between crusher operator and the loading machine operator must be established.

8.7.8 The crusher operator must observe the *zone* rules.

8.8 BREAKDOWN AND RECOVERY RULES

The mine must have a procedure for breakdown, recovery based on the mine's risk assessments that defines the rules and requirements. The *Leading Practice* aspects below must be addressed.

8.8.1 The position of a stranded vehicle should be considered according to other traffic movements and site hazards including but not limited to:

- Slopes and gradients
- Blind corners
- Brows of hills
- High walls
- Tight areas
- Tipping operations
- Excavations and *haul roads*
- Stability
- *Bench* and drill block

8.8.2 Consideration to the immediate safety of the vehicle operator will be given before the recovery operation.

8.8.3 Risks to consider:

- Visibility of stationary vehicle(s)
- Operator becomes a *pedestrian* where operators are allowed to exit the vehicle
- Maintenance equipment results in further restrictions and congestions
- Towed and towing vehicles in close proximity
- Escort vehicles introduced to the area

8.9 SPECIAL VEHICLE MOVEMENT

Ad hock/special vehicle movement not addressed in normal operating procedures must be considered and governed by special instructions/procedures, that includes, lowbeds, cranes etc.

No positive communication = no operation.

9 ROAD DESIGN

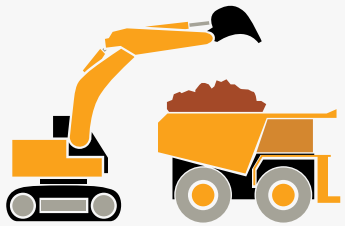
An accurate topographic map of all *haul roads* and ramps must be maintained and available on the mine.

The map must have the grades of all *haul roads* and ramps clearly indicated. Any changes in grade over a significant distance must be clearly marked on the map.

9.1 ROADWAY WIDTH

The required safe *width* of roadways depends on the size of the equipment in regular operation at the mine. The **minimum** standard for this *Leading Practice* is:

- Single direction:
  - 2x max operating width of the largest vehicle using the road provided that only right hand drive vehicles are used
  - 2.5x operating width of the largest vehicle using the road for centre drive vehicles
  - 3x operating width of the largest vehicle using the road for left hand drive vehicles
- Dual direction:
  - 2.5x max operating width of the largest vehicle using the road provided that only right hand drive vehicles are used
  - 3x operating width of the largest vehicle using the road for centre drive vehicles
  - 3.5x operating width of the largest vehicle using the road for left hand drive vehicles



9.2 SAFETY BERMS

9.2.1 Side berms

Side berms are constructed on the sides of the *haul road* where there is a risk of drop off or water accumulation to limit and/or mitigate the risk of equipment exiting the *haul road* at dangerous places. The function of berms is to absorb the momentum of the vehicle impacting the berm. Side berms must be constructed at dangerous places only. The minimum standard for this *Leading Practice* is:

9.2.1.1 The side berms must be:

- Constructed from suitable material such as loose overburden, top soil, aggregate etc.
- Shaped into a trapezoid shape with a flat top
- Maintained to ensure functionality at all times – free of vegetation, loose and soft

9.2.1.2 The required size of the safety berms is determined by the risk posed to the equipment and operator should it leave the roadway.

9.2.1.3 The berm height must be a minimum of 1m or at least 50% of the height of the tyre of the largest wheeled equipment in use.

9.2.1.4 The width of the berm is determined by the height and the angle repose of the material being used. The minimum top dimension must be 50% of the height.

9.2.2 Centre berms

The function of centre berms on *haul roads* is to eliminate or mitigate the risk of approaching vehicle interaction.

9.2.2.1 In general center berms cannot always prevent full speed collisions. Center berms:

- Constrict the roadway width
- Restrict drainage
- Make road maintenance difficult
- Might have unintended consequences
- Should only be used where risk requires it, such as intersections, bends etc.

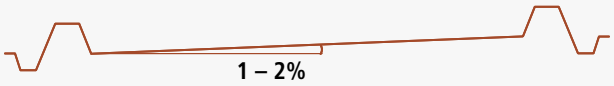
9 ROAD DESIGN CONTINUED

9.2.2.2 Where center berms are used, each side of the *haul road width* must meet the minimum criteria for a single directional *haul road* as defined in this *Leading Practice*.

9.3 CROSS FALL/CAMBER OF ROADS

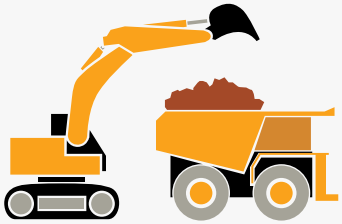
It is essential that road surfaces are cambered or cross fall to ensure water runoff depending on the drainage concept used. The requirements for the *Leading Practice* are:

9.3.1 Cross Fall



9.3.2 Camber

The cross fall or *camber* of the road should be between 1% and 2% minimum. Constant cross fall is preferable to a *camber* as it promotes even tyre wear and is easier to maintain.



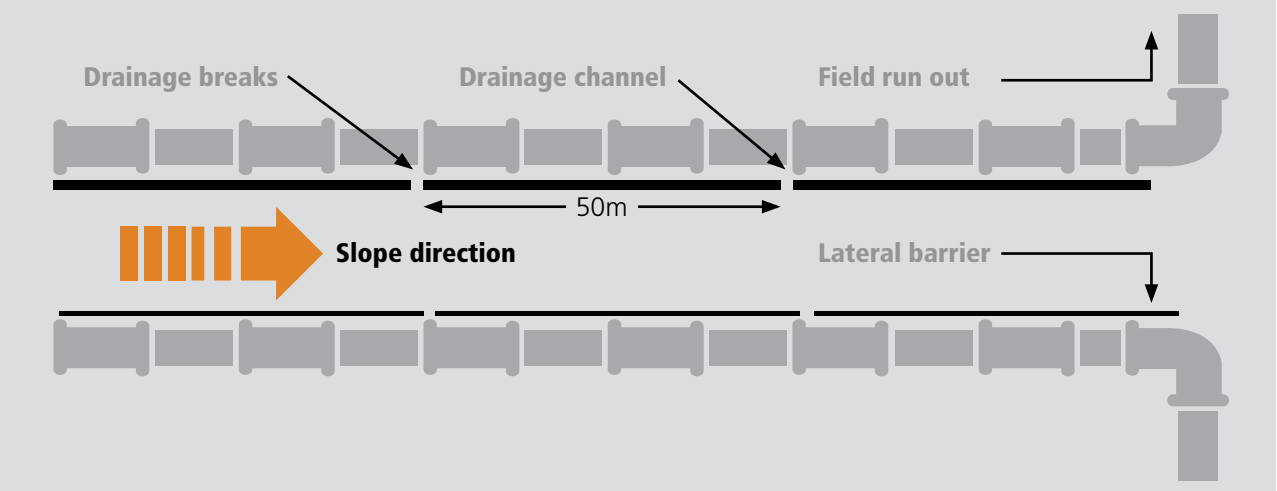
9.4 DRAINAGE

It is important that adequate drainage must be provided to remove water from the surface of the *haul road* and ensure that it does not permeate into the core of the road structure.

9.4.1 To ensure this, drainage holes must be made through side berms at a minimum of 50m as depicted in the sketch below.

9.4.2 A drainage trench must be constructed on the outside of the berm with sufficient slope to drain any water collected.

9.4.3 No standing water must be present in the drainage trench. Field run outs and collection points must be designed according to the topography. Water accumulation along the sides of roads must be avoided.



9 ROAD DESIGN CONTINUED

9.5 ACCESS RAMPS

9.5.1 Inclination

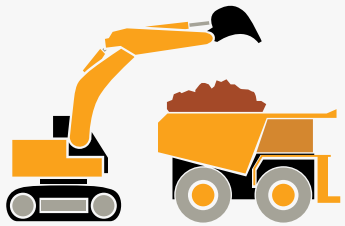
Ramps must be constructed with inclinations within the safe and productive operating parameters of the equipment in use at the mine.

9.5.1.1 The following ramp angles are the standards for the *Leading Practice*.

- Permanent production ramps (rigid frame trucks) 8% to 10%
- Production ramps (ADT's only) 8% to 12%
- Temporary access ramps (dozers, HDVs and LDVs only) up to 14%

9.5.1.2 Ramps should be built with a constant inclination as variation in grade detrimentally affects truck production.

9.5.1.3 Ramp construction materials must be the same as for *haul roads*.



9.5.2 Entry and exit transition

9.5.2.1 Entry to ramps (dip) from the horizontal must have a gradual transition to reduce dynamic loading. Similarly the exit from a ramp (crest) to horizontal must be gradual enough to ensure line of sight over the horizon.

9.5.2.2 The rate of transition over this distance must be constant.

9.5.2.3 The following transition distances are the standard for the *Leading Practice*.

	8% Grade	10% Grade
Dip transition	20m	30m
Crest transition	50m	70m

9.6 CURVES

9.6.1 The *radius* of *curves* must be as large as the topography and layout permits.

9.6.2 *Curves* on ramps for *strip mines* are not permitted.

9.6.3 Sharp horizontal *curves* at or near the crest of a ramp must be avoided.

9.6.4 Intersections near the crest of a vertical *curve* or a sharp horizontal *curve* must be avoided.

9.7 RADIUS

The following minimum horizontal *curve* radii is the standard for the *Leading Practice*.

Conditions	Speed	Min radius (m)
Restricted space	<15km/h	50
Loaded hauling – flat	15 – 30km/h	100
Unloaded return – flat	30 – 60km/h	200

Super Elevation

Super-elevation (banking) on *curves* is used to reduce tyre side loading and steering effort.

Super elevation standards for the *Leading Practice* are as follows:

9.7.1 Super-elevation angles above 10% should not be used.

9.7.2 The table below gives the super-elevation slopes (%) for use with specific speeds and curve radii.

9 ROAD DESIGN CONTINUED

The blocks marked in red are the combination of speed and radius not permitted.

Super Elevation (% slope)

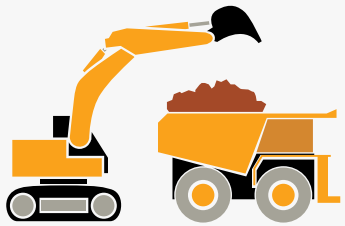
	Curve radius (m)			
Speed (km/h)	**50**	**100**	**150**	**200**
10	2.00	1.00	1.00	1.00
20	7.00	4.00	3.00	2.00
30		7.00	5.00	4.00
40			9.00	7.00
50				9.00
60				10.00

The transition from a straight road to a super-elevated *curve* should take place gradually and the maximum allowable rate of change is 0.2% per metre (flat to 10% super-elevation in 50m).

9.8 DEMARCATION

Road delineator's function is to:

- Assist operators to know where the side of the road is



- Judge following distance
- See the road at night or in poor visibility situations

9.8.1 Road delineators must be positioned on both sides of the road at intervals of 50m on straight roads and 25m apart around bends and crossings/ intersections starting at least 100m from such crossings/intersections.

9.8.2 The current best practice is to have delineators that are protruding so that the operator of the largest vehicle can easily observe the delineator.

- The delineators must be secured to allow it to remain in position despite extreme weather conditions.
- Delineators must have means to ensure visibility during day and night where appropriate, such as white coloured, reflective tape, solar powered led lights etc.
- Delineators must be made of material that is robust yet easy to be physically handled by construction and maintenance crews.

9.9 TRAFFIC SIGNS

The purpose of signage is to provide unambiguous information and/or instructions that are laid out for maximum visibility for all road users - large and small vehicles.

9.9.1 An updated mine traffic route map, showing the positions of all road signs must be kept on site.

9.9.2 All signs must be compliant with the national road traffic requirements and informed by road and vehicle design, road conditions as well as site specific visibility risks.

9.9.3 The following traffic signs must be used appropriately:

- Stop signs
- Keep left signs (i.e. at centre berms)
- Speed limits and speed hump signs
- Intersection warnings on main roads including chevron signs at T junctions
- Curve warnings
- Ramps
- *Pedestrian* crossings and *pedestrian* route signs
- Waiting areas for loading and dumping
- Overhead line crossing and other height restriction signs.
- Traffic direction signs (one way direction and no entry)
- Radio communication signs
- Procedural signs (brake test ramps etc.)
- Visibility limitation and instruction signs
- Signs communicating different zones (including mine area access) and requirements for entering/ access for both vehicles and people

9 ROAD DESIGN CONTINUED

9.10 INTERSECTIONS

9.10.1 Intersections must be designed and constructed to control traffic flow and minimise risk.

9.10.2 *Haul road* intersections must have center berms.

9.10.3 The height of centre berms must be decreased (tapered) to 1m at intersections to ensure visibility from light vehicles.

9.10.4 All intersections must be at right angles to facilitate visibility. Intersections utilising a yield or right of way must not be used.

9.10.5 T-junctions must be used for all intersections.

9.10.6 Multiple intersections must be spaced at least 100m apart.

9.10.7 A loaded truck must not be stopped on an incline or a decline unless with good reason.

9.10.8 No intersections or stops are allowed on an incline.

9.11 FALLING MATERIAL BARRIERS/ARRESTERS

9.11.1 When falling material risks are present and roads or *TMMs* are exposed to falling material, barriers must be constructed to retain falling material.

9.11.2 Construction and size of barriers must be of sufficient dimension and strength to stop falling material.

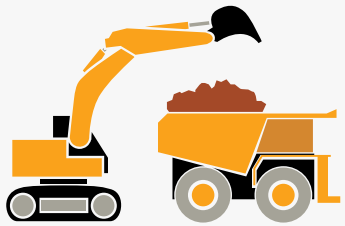
9.11.3 Barriers must be positioned far enough from the high wall to ensure retainment.

9.12 CIVIL CONSTRUCTION

Poor road condition increases the safety risk on roads significantly. Appropriate road construction is a key control to mitigate this risk. This is particularly important where weather has a negative impact on road conditions.

9.12.1 The cross sectional profile of each *haul road* should be designed to match the axle loading of the largest vehicle using the road as well as under road geo-technical conditions.

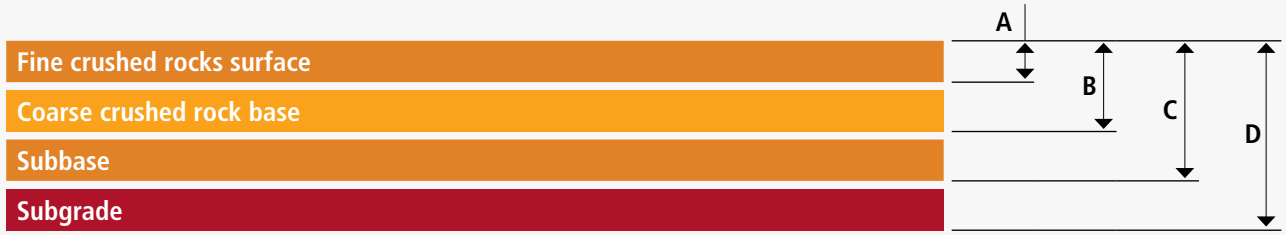
9.12.2 In general, roads must be constructed as depicted below on a relatively competent in situ subgrade.



9 ROAD DESIGN CONTINUED

9.12 CIVIL CONSTRUCTION CONTINUED

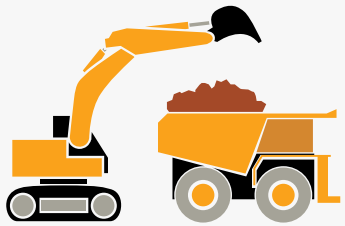
9.12.3 Where subgrades do not meet the competence requirements they must be excavated and backfilled. A guideline for layer sizes is shown below.



9.12.4 A guideline for layer thicknesses is given below for generic sizes of truck

Vehicles with max wheel loads smaller than 20 000kg: no specific requirements, mines must use the most suitable materials available.

Max wheel load (kg)		41,600	52,708	63,990
Fine crushed rock surface (CBR = 80) 25mm rock size	A	150mm	150mm	150mm
Coarse crushed rock base (CBR = 80) 100mm rock size	B	350mm	350mm	350mm
Clean sand sub base (CBR = 15)	C	850mm	900mm	1 000mm
Sandy clay sub grade (CBR = 5)	D	1 900mm	2 050mm	2 350mm



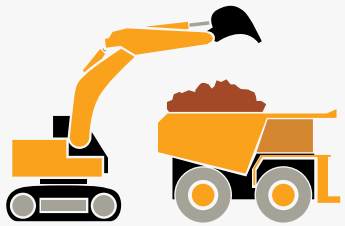
10 ROAD MAINTENANCE AND REPAIR

Poor road conditions significantly increase safety risks on roads. Road maintenance and repair is a key control to mitigate this risk. This is important where the weather may have had a negative impact on road conditions. Poor road conditions are also a major contributor to vehicle wear and tear.

10.1 Road conditions must be inspected and recorded at the beginning of a shift by the legally appointed (as per the *MHSA*) person for the safe declaration and safety of the area for the specific shift, provided that travelling routes and working areas remain the same for the duration of the shift.

10.2 Should travelling routes and working areas change during the shift, inspection and safe declaration must be repeated.

10.3 Road condition requirements must be pre-defined and available as part of the traffic management plan on the mine.



10.4 Road condition requirements must include:

- Dust generation prevention or reduction as required by *MHSA* and the Environmental Act
- Road surface stability such as slippery surface, sagging, etc.
- Maximum pothole sizes, subsidence, number of potholes in a defined area and maximum length of corrugation
- Water accumulation on the road
- Berms
- Delineators (presence and condition)
- Falling material barriers
- Ramps
- Inclines and declines
- Presence of debris and loose material
- Brake test ramps

11 GENERAL RULES FOR BREAKDOWN AND RECOVERY

Broken down vehicles and the recovery of vehicles, increases the safety risk on roads significantly.

11.1 The mine must prepare and maintain a breakdown and recovery procedure covering all mine vehicles based on the mine's risk assessment.

11.2 Breakdown must be reported according to the mine's breakdown procedure.

11.3 The individual in charge must communicate breakdowns to all other vehicles including all recovery and/or maintenance personnel in the applicable area by use of positive communication such as radio or better, etc. The communication must include action to be taken by all other vehicles in the area.

11.4 A risk assessment should be carried out and documented by the person that will be in charge of the recovery.

11.5 Based on the outcome of the risk assessment appropriate action must be taken, this includes:

- Demarcation
- Temporary suspension of operation in the affected area
- Diversion of traffic, etc.

11.6 All other vehicles in the area must be communicated to after the completion of t he recovery.

12 BRAKE TEST RAMPS AND TESTING POINTS

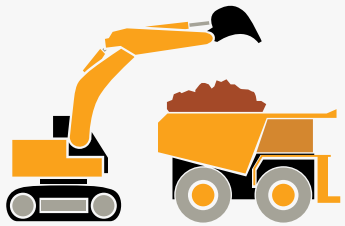
12.1 BRAKE TEST POINTS

Brake test ramps must be located at

- All entrances of the operational area(s) classified as orange or *red zones* **OR**
- The exits of vehicle parking areas **OR**
- En-route orange **OR**
- *Red zones* **OR**
- Whichever is the most practical - *EME, HME, LDV, HMV*

Test ramps must be located such that overruns do not pose any risk to the operator, other vehicles or *pedestrians*.

Brake testing is an important aspect to safety such that it is prescribed and covered by the *MHSA* and *TMM COP*.



12.2 BRAKE TEST RAMP DESIGN REQUIREMENTS

12.2.1 The brake-testing ramp must simulate the steepest angle of all ramps present at the mine.

12.2.2 The brake test ramp slope must be equal to the worst-case scenario ramp slope at the mine, plus additional gradient should provide a safety margin and simulate full load.

12.2.3 A one-size-fits all approach can be followed to establish one ramp that is tailored for a worst case scenario. Where practical, brake test ramps tailored for the different operational requirements can also be established.

12.2.4 Brake test ramps designed for specific sections/areas, must have clear demarcation/ indication to which sections/areas of the mine the ramp would be applicable.

12.2.5 During the brake testing all *TMM's* accessing the brake testing ramps must be subjected to:

- Brake testing upslope and down slope
- Brake testing procedure must be sign posted at the brake test ramp
- The brake test ramp facility shall be positioned off-line of any mainstream traffic flow

12.3 BRAKE HOLDING POWER TESTS TO BE PERFORMED

12.3.1 The static brake holding of every *TMM* must be tested every time an operator starts the *TMM* for the first time at the beginning of the shift or when an operator takes control of a *TMM* for the first time during the shift.

12.3.2 The dynamic brake holding power of all *TMMs* must be tested on a brake test ramp, at the start of every shift or for the first time an operator has taken control of such *TMM* or after any maintenance was done on the braking system of a *TMM*, to ensure the effectiveness of the brakes on the machine at all times.

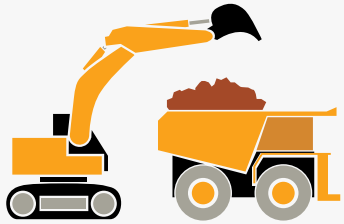
12.3.3 All braking systems on-board utilised by an operator that must control the speed and stop the *TMM* be subjected to testing including retardation systems where installed.

12 BRAKE TEST RAMPS AND TESTING POINTS CONTINUED

12.3.5

It is important to note that brake testing must be done for empty fully laden vehicles or with gradients that simulate such.

Fully laden vehicle brake tests will be conducted ascending or descending the ramp for the first time an operator has taken control of a vehicle. Payloads will not be altered in the time after the brake test has been performed and before entering the ramp.



12.4 BRAKE TESTING SAFETY REQUIREMENTS

People must be protected from injury in case of a run-away vehicle at the brake test ramps. Designs are selected based on energy to be dissipated, spatial constraints, and cost. The following designs must be considered:

- **Arrester bed:** a gravel-filled ramp adjacent to the ramp exit that uses rolling resistance to stop the vehicle. The required length of the bed depends on the mass and speed of the vehicle, the grade of the arrester bed, and the rolling resistance provided by the gravel.
- **Gravity escape ramp:** an upwardly-inclined path parallel to the test ramp exit. The length required is determined by the momentum gained by the vehicle under runaway conditions. Control can be difficult for the driver: problems include rollback after the vehicle stops for the first time (running backwards).
- **Sand pile escape ramp:** a short length of loosely piled sand. Problems include large deceleration; sand being affected by weather conditions (moisture and compaction); vehicles vaulting and/or overturning after contacting the sand pile.
- **Mechanical-arrestor escape ramp:** a proprietary system of stainless-steel nets transversely spanning a paved ramp parallel to the test ramp exit that engage and retard a runaway vehicle. Ramps of this type are typically shorter than gravity ramps and can have a downhill grade. Alternative to this, tyres and fencing could be used e.g. motorsport F1.
- **Alternatives:** such as a vehicle arresting barrier and safety berms being intersected at an angle.

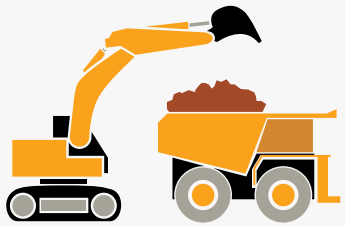
The brake testing by means of the brake testing ramp is mandatory in addition to the OEM's prescribed and suggested brake testing procedures. This prescribed test procedure standard must supersede any brake-holding test acceptable to OEM's and must not be accepted as a substitute or complementary brake test. An example of a typical brake test ramp design and calculation is shown in the Annexure (Element 19).

13 MINE SITE DESIGN/PRE PLANNING DESIGN

The mine must introduce a risk control to the mine that requires the mine to perform mine site design/ pre-planning as part of the establishment of the mine as well as when mine expansion/change is envisaged.

13.1 The plan must identify traffic routes, traffic flow, access points, parking areas and other traffic control areas. Particular attention should be paid to the following site areas:

- Weighbridge location
- Covers/tarpaulin and tipping areas
- Site offices and amenity areas
- Workshop layouts and designs
- Environmental control issues and requirements
- Operational designs for:
  - Haul roads
  - On-site parking areas
  - Stockpile/tips and excavations
  - Loading areas
  - Brake test ramp
  - Water management systems
  - Mineral *stock piling*,
  - Covers and tarpaulin areas, tip
  - In field servicing, re-fuelling and cleaning
  - Explosives magazines and roads and rapid loading area.
  - Public roads on mine property and footpaths



13.2 The plan must incorporate all the relevant principles and practices as defined in this document

13.3 The plan must be based on the risk analysis outcome according to this document.

13.4 The plan must be independently reviewed by a reputable specialist.

13.5 The plan must address at least the following aspects:

- Site access and controls
- Traffic routes, parking areas, delivery points
- Delivery/distribution point
- Processing areas

13.6 Particular consideration must also be given to traffic routes in working and operational areas that will change as site work progresses.

14 PARKING AREAS

14.1 PRIVATE AND OPERATIONAL LIGHT VEHICLE PARKING AREA(S)

When selecting operational and private light vehicle parking areas and designing car parks the following must be considered:

14.1.1 Sufficient parking spaces for *employees*, staff, site *visitors*, operational LDVs.

14.1.2 Special attention should be given to the *employee* parking system, if *employees* arrive and depart in large numbers at the same time.

14.1.3 One directional traffic flow.

14.1.4 Separation of operational and private vehicles.

14.1.5 Reverse parking for Operational Light Vehicles.

14.1.6 Parking bay sized to national Road Traffic Management Systems (RTMS) standards.

14.1.7 Fundamentally stable parking (rails, humps, level).

14.1.8 Traffic calming measures.

14.1.9 Demarcated *pedestrian* routes/walkways and crossings. Minimise *pedestrians* crossing vehicle traveling ways.

14.1.10 Drainage to prevent accumulation of water in roads and walk ways.

14.1.11 Sufficient natural and artificial lighting should be provided in areas where parking and travelling takes place in the dark.

14 PARKING AREAS CONTINUED

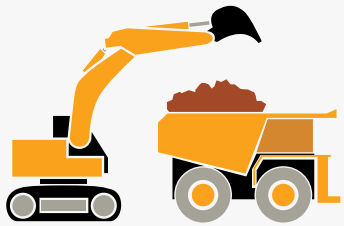
14.1.12 Special provision must be made for disabled persons.

14.1.13 Availability of parking space must be monitored and over flow parking requirements should be provisioned for.

14.1.14 Clear and unobstructed parking demarcation and traffic signs.

14.1.15 Parking and traffic signs must be included in the *induction* to site.

14.1.16 Light vehicle parking in close proximity of *HMVs* must be avoided.



14.2 IN-PIT PARKING (IN-QUARRY PARKING)

In pit parking provides,

- In-pit shift changeover
- In-field maintenance
- And/or inspections

14.2.1. Shift Changeover

If shift changeover cannot be done effectively outside the *pit/quarry*, the following aspects are the *Leading Practice*:

- Light vehicles must enter specific demarcated areas in the pit separate from operating production vehicles and make positive contact with all operating vehicles.
- All operations must stop before *pedestrians* leave vehicles and go to the dedicated demarcated areas.
- Light vehicles must leave before any operations resume.
- If a light vehicle has to enter the heavy vehicle operating area all operations must stop.

14.2.2 In-field maintenance and inspections

Refer to 18.2 within this document.

14.3 HARD PARKS/DEDICATED PARKING AREAS

A mine with a fleet of *TMMs* must have an established dedicated parking area to facilitate the safe and organised parking of *TMMs*. Hard parks can be in-pit or at workshop(s). When designing/selecting the area the following should be taken into consideration:

- Number of vehicles
- Size of vehicles
- Type of vehicles
- Turning radii of vehicles
- Type of activities to be performed
- Separation of vehicles – *LDV HMV* and *pedestrians*
- *Pedestrian* access
- Vehicle routing
- Environmental protection and management requirements
- Demarcation
- Illumination
- Drainage
- Dust
- Fire management
- Parking ditches
- Level to prevent runaways
- Protective berms

15 VISIBILITY AND AWARENESS

15.1 PEDESTRIANS

Pedestrians in orange and *red zoned* areas must wear high visibility (day and night) clothing.

15.2 OPERATIONAL LDVS

15.2.1 All operational LDVs must have:

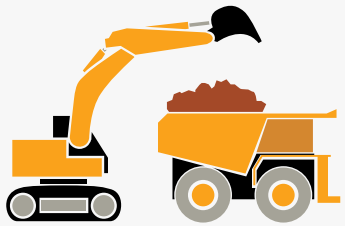
- Reflective strips on all sides according to the RTMS over and above manufacturer lights and reflectors
- Vehicle lights on at all times when operational
- Reverse warning devices
- Operational windscreen wipers

15.2.2 All operational LDVs that work during night or poor visibility must additionally have:

- Elevated rear lights
- Strobe lights

15.2.3 All operational LDVs that work in an operating area where *HMVs* operate must additionally have:

- Buggy whips



15.3 PUBLIC ROAD PERMITTED *HMVs*

15.3.1 All *HMVs* must have:

- Reflective strips on all sides over and above manufacturer lights and reflectors
- Moving off rules
- Reverse warning devises
- Operational windscreen wipers

15.3.2 All operational public road permitted *HMVs* that work during night or poor visibility must additionally have:

- Strobe lights

15.4 *HMVS*

15.4.1 All *HMVs* must have:

- Reflective strips on all sides over and above manufacturer lights and reflectors
- Strobe lights
- Moving off rules
- Reverse warning devises
- Operational windscreen wipers

15.5 WORK AREA ILLUMINATION

15.5.1 Illumination must be provided in darkness or in diminished lighting conditions.

15.5.2 Loading, dumping and critical *intersections* that have high traffic intensity and any other area where work is being carried out, must be adequately illuminated to ensure safety of the workers and the safe operation of equipment.

15.5.3 Where power supply cannot be provided in remote *high risk* areas, mobile lighting plants must be provided.

15.5.4 Lighting must be positioned to ensure that the vision of operators is not blinded.

15.6 DUST SUPPRESSION

15.6.1 Dust must be controlled on all *haul roads* to comply with requirements of the *MHSC*.

15.6.2 If dust impairs visibility to the extent that the operator cannot see clearly 50m ahead, the use of the *haul road* must be stopped. Delineators can be used as a measure.

15.6.3 On main *haul roads* a dust suppression agent (including water) must be applied.

15 VISIBILITY AND AWARENESS CONTINUED

15.7 WEATHER CONDITIONS

15.7.1 In adverse weather conditions, a measure must be in place to guide operators to determine when visibility has deteriorated to such an extent that operations must be stopped.

15.7.2 Signage (red dot at 50m) or road delineators can be used to indicate visibility.

15.8 STRUCTURES AND OBSTACLES

Where structures and obstacles can influence traffic, clear demarcation is required as well as effective barricading that is commensurate with the risk if a vehicle will interact with the structure.

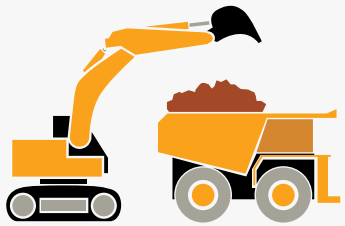
15.9 ADDITIONAL VISIBILITY AND AWARENESS AIDS

15.9.1 The visibility around the vehicle must allow the vehicle to be used in complete safety for the operator and any exposed persons. To maneuver safely the operator must see around the vehicle, whether it is large or small.

15.9.2 Should the risk assessment indicate that additional controls are required to improve visibility around vehicles the following should be considered:

- Additional mirrors such as convex mirrors
- Radar
- Cameras (for blind spots)
- Proximity Detection Systems (PDS)
- Collision Avoidance Systems (CAS)
- Motion Inhibitor Systems

15.9.3 There must be a wash bay provided the mine's HVMs and LDVs can be washed daily or as per the mine requirements. The wash bay should be designed to allow one directional flow with provisions the Operators to clean the windscreen, mirrors, lights and reflective strips. A wash bay attendant may be appointed to manage the area and control all vehicles moving in and out of the wash bays.



16 TRAFFIC MANAGEMENT AND SUPERVISION

The supervisor in charge of the operation of any mobile machines in a specific area must ensure:

16.1 Site traffic movement is organised and controlled to allow safe operations of vehicles. The risk of collision must be minimised if not entirely eliminated.

16.2 At the beginning of each shift the supervisor must inspect the area of operation, giving attention to :

- The complete route to be used during the shift
- Road surface conditions
- Signage and demarcation
- Loading and tipping area condition and illumination
- Visibility
- Safety controls such as edge protection
- Light vehicle parking areas
- *Zones*

16.3 The findings of the above inspection are communicated to the team and the area is declared safe after defects have been addressed.

16.4 The entry, parking and exit to areas operating heavy vehicles must be authorised and controlled, specifically for *pedestrians* and *LDVs*.

16.5 Continuous monitoring of operating conditions to ensure that vehicles can be operated safely (weather conditions or obstructions). Any change must be risk assessed and action taken to control the risk. Action must be communicated to the team.

16.6 Traffic rules are obeyed throughout the shift and the need for reversing is minimised.

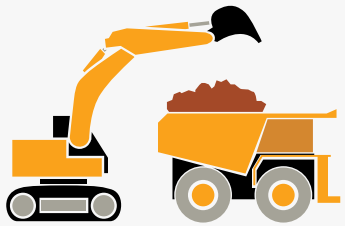
16.7 Gradients are inspected and monitored to ensure they are maintained within the set site limits.

16.8 The effective application of water, specifically during dry seasons and ensure effective dust suppression without causing slippery road conditions.

16.9 Take appropriate action to breaches of road rules.

16.10 Continuous positive communication is possible between operators of *HMVs, EME* and *HME* and himself/herself.

16.11 Positive communication between any individual entering the area of operation and himself/herself.



17 RE-FUELING AREAS

17.1 All re-fuelling areas must be zoned as a *red* or *orange zone* and treated accordingly.

17.2 The engine of any vehicle that is re-fueling must be switched off and the vehicle immobilised by the operator before anyone or the fuel bowser/ trailer approaches the vehicle to be re-fueled.

An *exclusion zone* must be observed by all individuals until lockout procedures have been completed. No individual may position themselves between the bowser/trailer and the vehicle to be re-fueled unless both are locked out.

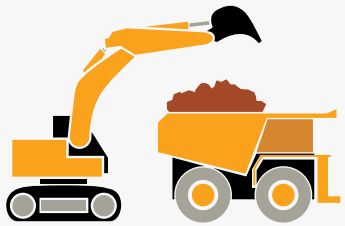
17.3 After completion of re-fueling activities the fuel bowser/trailer must leave the area before the vehicle being re-fueled is restarted.

17.4 All activities on the vehicle being re-fueled, must be completed and controlled before the vehicle can be restarted.

17.5 Fueling of loaded vehicles is strictly prohibited.

17.6 One way traffic flow into and out of the area must be in place at designated re-fueling bays.

17.7 Adequate illumination must be provided for the refueling area.



18 MAINTENANCE ACTIVITIES

18.1 WORKSHOP

18.1.1 The mine's *Traffic Management System* must include all maintenance activities including the workshop area(s) and the following should be included in the system/plan:

- Entrances and exits separating incoming and outgoing traffic from each other
- Designated parking/handover points
- One direction traffic flow only, unless practically impossible
- Drive through maintenance bays, to minimise reversing unless if practically impossible
- Clear road signs and demarcation
- Dedicated and demarcated *pedestrian* walkways (in and outside the workshop)
- Separation between *HMV* and *LDV* if possible

18.1.2 Clear rules for moving vehicles in and out of the workshop that will:

- Control interaction between vehicles and *pedestrians*. If total separation can not be achieved *pedestrians* must have a right of way.
- Control unauthorised vehicle movement in the workshop
- Prevent collisions between vehicles
- Prevent collisions between vehicles and equipment such as overhead cranes

18.1.3 All persons must at all times adhere to *zone* rules applicable to the area

18.2 IN-FIELD MAINTENANCE/REPAIR ACTIVITIES

18.2.1 Area must be adequately barricaded.

18.2.2 All persons must adhere to *zone* rules applicable to the area at all times.

18.2.3 The mining supervisor in charge of the area must be informed of the activities taking place.

18.2.4 The engine of any vehicle undergoing maintenace or repairs must be switched off. The vehicle must be *immobilised* by the operator before anyone or a maintenance vehicle approaches the vehicle undergoing maintenance or repairs.

18.2.5 The *LDVs* parked in close proximity of *HMVs* must be parked such that the *LDV* is visible from the operator cab of the *HMV*, i.e. parallel to the *HMV*.

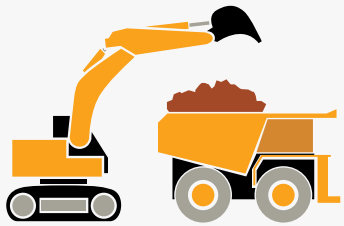
18.2.6 Should the vehicle breakdown be on a *haul road*, then it must be effectively communicated to other road users and the vehicle must be adequately barricaded/demarcated.

18.2.7 The operator must remain with the vehicle until the supervisor or assistance arrives.

19 ANNEXURE

19.1 Typical brake test ramp design layout

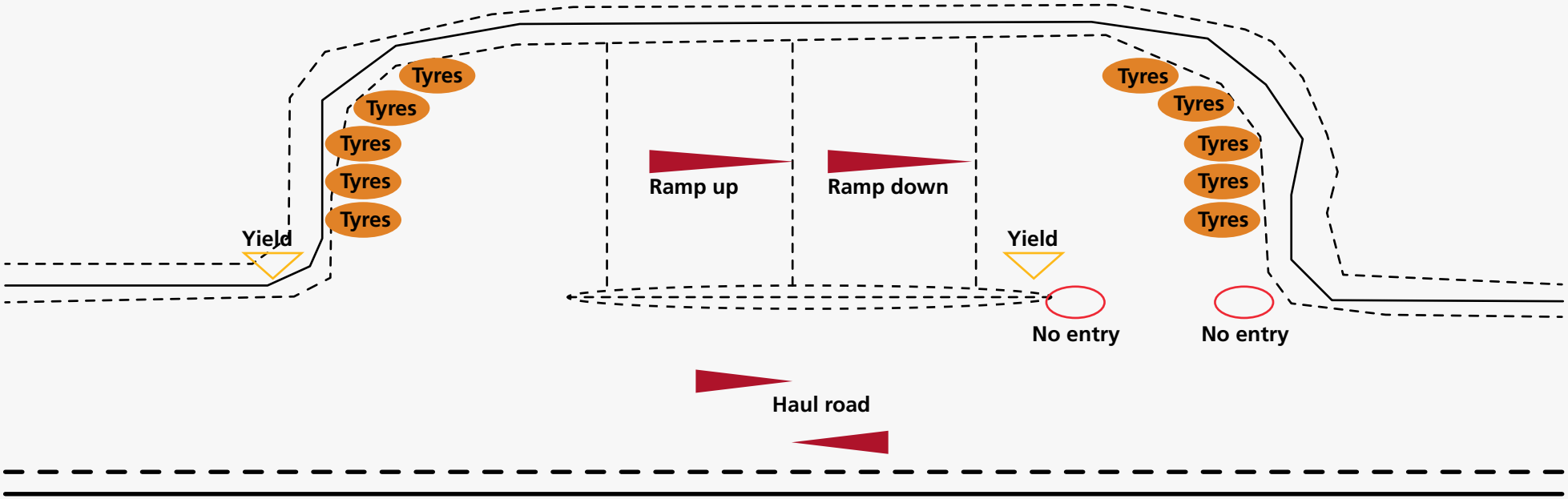
Brake test ramp profile

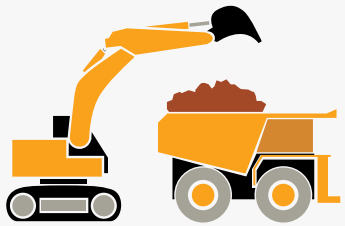


19 ANNEXURE CONTINUED

Brake test ramp layout

Note: Alternative to tyres are acceptable





19 ANNEXURE CONTINUED

Brake test ramp design

Braking force calculation		BRAKE TEST RAMP GRADE CALCULATION	
Force on front wheels = Pressure *Area	kN	3,413.0	Forces are more than gravity force therefore it will be able to hold the truck
Force on front wheels = Pressure *Area	kN	5,110.0	
Mpayload	kg	240,000.0	Average
Mtruck	kg	166,866.0	793D Gross mass operational from p34 793D mining truck document
Mtotal = Mtruck + payload	kg	406,866.0	793D Gross mass operational from p34 793D mining truck document
Grade	%	10.0	Maximum according to mine design and VM TMM COP p.60
Brake surface front (80817cm^2)		0817	
Brake surface front (134500cm^2)		13.45	
Operating pressure (415+/-35)			Assume minimum pressure to release will be what springs are applying
Force calculation (truck loaded)			
Θ = Tan (Grade/100)	Degrees	5.7	
Fgravity = Mtotal *G *Sin Θ	Θ	397,154.7	
Grade calculation (truck unloaded)			
Mtotal = Mtruck	kg	168,866.0	
Θ = arcSin(Fgravity/Mtotal*9.81)	Degrees	14.0	
Grade	Mg	**25.0**	Brake test ramp required for empty loaded truck to simulate full load truck brake holding force