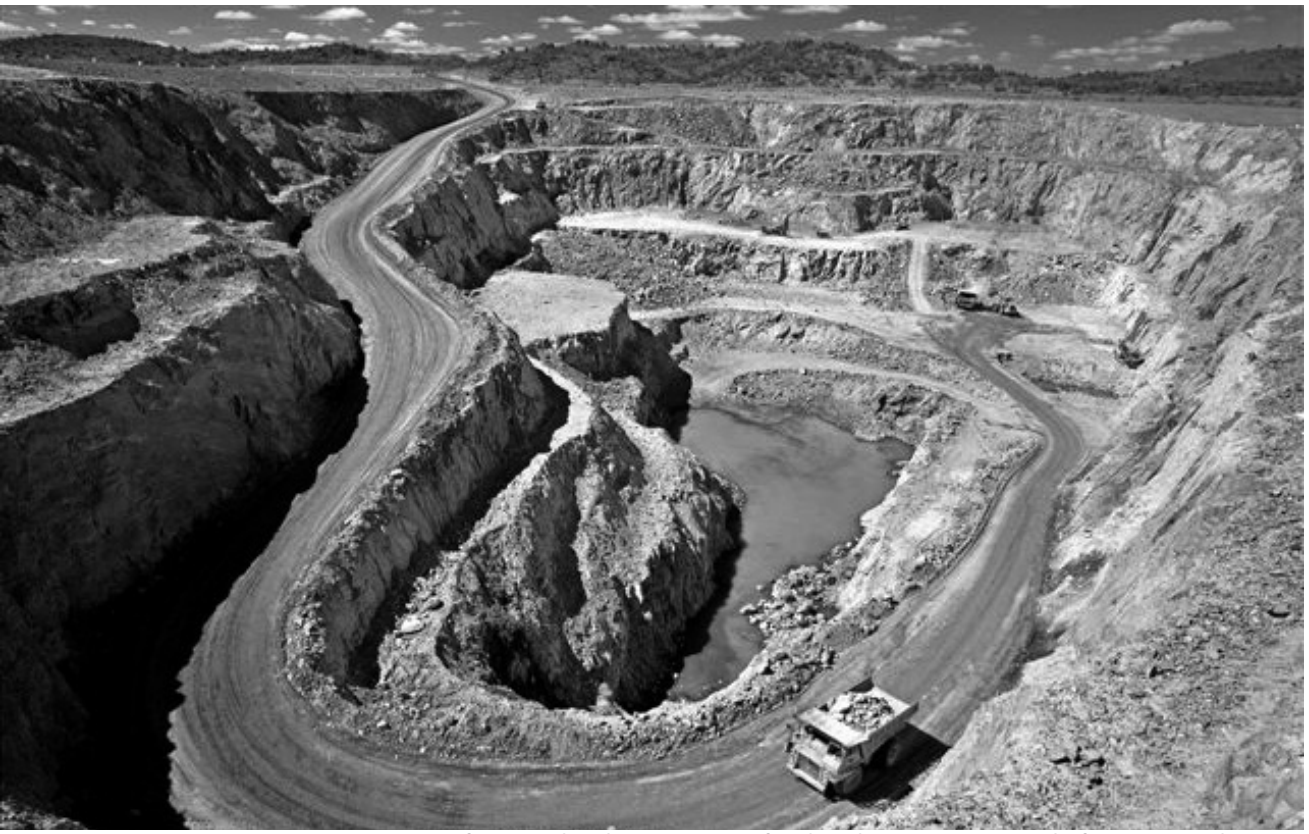
DRAFT

Code of Practice

ROADS AND OTHER VEHICLE OPERATING AREAS



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ROADS & OTHER VEHICLE OPERATING AREAS
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FOREWORD

This Code of Practice on roads and other vehicle operating areas at a mine is an approved code of practice under section 274 of the *Work Health and Safety Act* (the WHS Act).

An approved code of practice is a practical guide to achieving the standards of health, safety and welfare required under the WHS Act and the Work Health and Safety Regulations (the WHS Regulations).

A code of practice applies to anyone who has a duty of care in the circumstances described in the code. In most cases, following an approved code of practice would achieve compliance with the health and safety duties in the WHS Act, in relation to the subject matter of the code. Like regulations, codes of practice deal with particular issues and do not cover all hazards or risks which may arise. The health and safety duties require duty holders to consider all risks associated with work, not only those for which regulations and codes of practice exist.

Codes of practice are admissible in court proceedings under the WHS Act and Regulations. Courts may regard a code of practice as evidence of what is known about a hazard, risk or control and may rely on the code in determining what is reasonably practicable in the circumstances to which the code relates.

Compliance with the WHS Act and Regulations may be achieved by following another method, such as a technical or an industry standard, if it provides an equivalent or higher standard of work health and safety than the code.

An inspector may refer to an approved code of practice when issuing an improvement or prohibition notice.

This Code has been developed by Safe Work Australia in conjunction with the National Mine Safety Framework Steering Group as a model code of practice under the Council of Australian Governments' *Inter-Governmental Agreement for Regulatory and Operational Reform in Occupational Health and Safety* for adoption by the Commonwealth, state and territory governments.

A draft of this Code of Practice was released for public consultation on [*to be completed*] and was endorsed by the Select Council for Workplace Relations on [*to be completed*].

SCOPE & APPLICATION

This Code provides practical guidance on how to manage roads and other vehicle operating areas to reduce the risk of the hazards associated with vehicle and pedestrian movement and interaction around mines. It also provides information on preparing a principal mining hazard management plan that identifies the hazards, assesses the risks and outlines risk control measures associated with roads and other vehicle operating areas in operating metalliferous and coal mines, quarries and exploration sites. It includes both underground and surface operations.

Who should use this code?

You should use this Code if you are a person conducting a business or undertaking and have management or control of roads and other vehicle operating areas at a mine.

This Code can be used by workers and health and safety representatives who need to understand the hazards and risks associated with the use of vehicles on roads and in other operating areas.

How to use this code of practice

This Code includes references to both mandatory and non-mandatory actions. The references to legal requirements contained in the WHS Act and Regulations (highlighted in text boxes in this Code) are not exhaustive and are included for context only.

The words ‘must’, ‘requires’ or ‘mandatory’ indicate that legal requirements exist, which must be complied with.

The word ‘should’ indicates a recommended course of action, while ‘may’ indicates an optional course of action.

1. INTRODUCTION

1.1. What is a road and other vehicle operating area?

A road is a constructed travel way between designated locations on a mine designed to accommodate the vehicles that operate at that mine. Other vehicle operating areas are all areas on or in a mine where mining operations involve the use of vehicles take place, for example, ROM pads and stockpiles.

Roads and other vehicle operating areas include all traffic thoroughfares used by mine heavy or light vehicles.

A vehicle is self propelled equipment or plant used for the carriage of goods, material or people for mining operational requirements.

It is necessary to pay attention to roads and other vehicle operating areas because of the potential risk of the following:

- single and multiple fatalities occurring on roads or other operating areas
- vehicle to vehicle or vehicle to person contact, and
- roads conditions to be affected by adverse environmental conditions.

Roads and other operating areas are considered to be a principal mining hazard

1.2. Who has duties in relation to roads and other vehicle operating areas?

Under the WHS Act, all persons who conduct a business or undertaking have a duty of care to ensure, so far as is reasonably practicable, that workers and other persons are not put at risk from work carried out as part of the business or undertaking.

The WHS Regulations identifies roads and other vehicle operating areas as a principal mining hazard. To effectively control the risks, the mine operator must follow a *risk management process* and prepare and implement a hazard management plan which is included in the work health and safety management system (WHSMS). This Code provides guidance to help the mine operator meet this duty.

General guidance on the risk management process is available in the *Code of Practice: How to Manage Work Health and Safety Risks.* Further guidance to develop a WHSMS is available in the *Code of Practice: Work Health and Safety Management System*.

Consultation

When managing risks, the mine operator must consult with workers and other persons at the mine including other persons conducting a business or undertaking. Further guidance on consultation, cooperation and coordination can be found in the *Code of Practice: Work Health and Safety Consultation, Co-operation and Co-ordination.*

2. IDENTIFYING THE HAZARDS

There are a number of ways to identify hazards at the mine. Some of these include:

- consulting with workers at the mine as they can provide valuable information about potential hazards.
- conducting a visual inspection of the mine focussing on the roads and other vehicle operating areas, and
- reviewing available information, including incident records and accident reports.

Trends or common problems can be identified from the information collected and may show locations or areas that are more hazardous. It could indicate a problem with the design and layout of that work area or the way work is a carried out there. These trends may help in deciding which areas to address as a priority.

The types of vehicle activities conducted on the road or operating area will indicate the sorts of hazards that may be present. The unwanted events associated with roads and other vehicle operating areas are as follows:

- vehicles rolling over
- vehicles going over edges
- ground failure onto or below vehicles
- collisions between vehicles
- uncontrolled movement of vehicles
- pedestrian interaction with vehicles
- vehicles contacting overhead power lines and structures
- contact with environmental hazards
- dust inhalation
- whole body vibration, and
- slips trips and falls while getting onto or off vehicles.

3. ASSESSING THE RISKS

Regulation 9.2.11 of the WHS Regulations requires that when conducting a risk assessment, the mine operator must use investigation and analysis methods that are appropriate to the principal hazard being considered. The mine operator must also consider the principal mining hazard individually as well as cumulatively with other hazards at the mine.

The risk assessment must:

- state the likelihood of the principal mining hazard causing or contributing to any harm to the health and safety of any person, and the severity of the harm
- describe the investigation and analysis methods used in the assessment
- describe all control measures considered to control risks associated with the principal mining hazard, and
- state reasons for deciding which risk control measure to implement.

Assessing the risks will help the mine operator take the correct action to eliminate the risk or where this is not reasonably practicable, minimise the risks from roads and other operating vehicle areas. When undertaking a risk assessment to determine control measures, the following factors as outlined in Schedule 9.2 of the WHS Regulations that contribute to the unwanted event occurring must be considered:

- mobile plant characteristics, including stopping distances, manoeuvrability, operating speeds, driver position, driver line of sight, remote control mobile plant
- the effects of expected environmental conditions during operating periods including the time of day, visibility, temperature and the effects of weather on road conditions
- the impact of road design and characteristics including grade, camber, surface, radius of curves and intersections
- the impact of mine design including banks and steep drops adjacent to plant operating areas
- the potential for interactions between mobile plant with different operating characteristics including heavy and light vehicles, volume of traffic and speed of traffic
- the potential for interactions between mobile plant and pedestrians including consideration of park up areas and driver access
- the potential for interaction between mining mobile plant and public traffic, and
- the potential for interaction between mobile plant and fixed structures including overhead and underground power lines, tunnel walls and roofs.

A risk assessment must be undertaken in consultation with a cross section of workers who will be using the road or vehicle operating area. It is often more effective to involve a team of people in the risk assessment process to draw on a range of knowledge and experience.

4. CONTROLLING THE RISKS

Regulation 9.2.3 of the WHS Regulations requires the mine operator to eliminate the risks associated with the principal mining hazard. If eliminating the risks is not reasonably practicable, the mine operator must minimise risks associated with mining operations so far as is reasonably practicable by implementing any or a combination of the following control measures:

- substitution
- isolation, or
- engineering controls.

If the above measures do not minimise the risk, administrative controls must be used. If this does not minimise the risks, personal protective equipment (PPE) must then be used.

The risks associated with vehicles and pedestrians travelling on roads and in other operating areas should take into consideration the following factors when establishing, managing and conducting activities on mine roads and other operating areas.

4.1. Design

Terrain and geotechnical considerations

When designing and establishing mine roads, the terrain and geotechnical issues must be taken into account as they will impact on the type of operation that will be carried out, the mobile equipment to be used and where infrastructure can be located.

Existing operations will have to determine how best to manage the design and the establishment of the mine roads to accommodate prevailing terrain and geotechnical conditions.

Prevailing weather and environmental conditions

Prior to constructing and establishing roads, it is necessary to consider the weather and environmental conditions and how they will impact on materials used to construct the road and maintenance requirements. Consideration should be given to:

- the nature and type and load of vehicles to use the road
- the expected volume of traffic
- weather conditions, for example, dry versus wet conditions
- vehicle operating speeds
- gradients, and
- the materials available for road construction and maintenance.

Primary Roads design, construction and maintenance

Primary roads should be designed and constructed to carry the designed wheel loadings without undue deformations and subsidence.

Sub-base and Pavement

The following should be considered in the design of the road sub-base and pavement:

- available materials
- shear forces of wheel loads
- braking and acceleration forces
- effects of water ingress and drainage requirements
- selected design speed
- ride characteristics of haul vehicles, and
- potential for road material to be projected by vehicular traffic.

The outputs of the sub-base and pavement design should be:

- construction and compaction specifications for the sub base and pavement
- drainage plans-drains and road crown and road cross fall specifications, and
- maintenance specifications for remediation and restoration of the road shape, surface condition and drainage.

Secondary roads design, construction and maintenance

- Secondary roads will generally be constructed with in-situ material, or with waste overburden. The use of these materials may lead an increased risk of road surface degradation, unacceptable surface roughness and reduced steerage and traction. Spillage may also lead to surface degradation and a loss of traction.
- Condition monitoring processes should be applied, with vehicle speeds, road maintenance and watering plans adjusted accordingly.

Road widths

The widths of a road should be based on the size of the largest vehicle in use, for example, the larger the vehicle the more clearance is required.

For surface operations, each lane of travel should be at least 1.5 times the width of a vehicle. For a two lane road, the width should be at least 3.0 times the width of the largest vehicle. Extra room will need to be provided for drains, windrows, bunds or centre berms.

For underground operations, the width of any road should be at least 1.5 times the width of the largest vehicle with provision at appropriate locations for passing and two-way traffic.

Road gradients

The gradients of roads must be within the operating parameters or specifications of the equipment operating on those roads. Materials used to construct the road on steep gradients must provide adequate friction to be able to maintain control of the vehicle. Speeds and loads of equipment operating on steep gradients must be managed to ensure control of equipment is maintained.

Road curvature – Vertical and Horizontal

Vertical and horizontal alignment (curvature) should take into account the following characteristics of the equipment using the road:

- design speed
- stopping and braking capabilities (stopping distance)
- vision from the equipment (sight distance), and
- interference lighting from adjacent facilities.

Sight distance

Sight distance is the distance a driver can see ahead of their vehicle. Roads should be designed so a driver has sufficient sight distance to see a hazard, react to it and bring their vehicle to stop.

Different sized vehicles have differing sight distances, for instance, a driver can see further down a road from the cabin of a truck than from a ute.

Sight distance can be reduced by environment factors including dust, rain and night time operations. The sight distance at night is what the operator can see in the beam of their headlights.

To manage sight distance, the mine operator must consider:

- removing obstacles that are limiting sight, for example, vegetation or piles of materials
- making curves more gradual
- cutting down crests
- ensuring vehicles are well lit and have suitable headlights
- the speed of vehicles (where sight distance is an issue reduce the speed of the vehicle to ensure the stopping distance of the vehicles is within the available sight distance), and
- the use of convex mirrors on intersections where appropriate.

Stopping distance

Stopping distance is the distance it takes to bring a vehicle to a stop. It is made up of three components:

- the distance the vehicle travels between the operator recognising a need to stop and the operator applying the brakes (operator response)
- the distance the vehicle travels during the time it takes for the brakes to apply after the operator has pressed the brake pedal (vehicles brake system response), and
- the distance the vehicle travels while coming to a stop under braking effort.

There are a number of factors which impact on the stopping distance including:

- the speed of the vehicle (the higher the speed the greater the distance travelled over time)
- the response time of the operator (factors such as sight distance and fatigue can increase the response time of the operator)
- the condition of the vehicles braking components and tyres (worn or poorly maintained components take longer to apply and develop less friction)
- the condition and nature of the road (poorly maintained and wet roads reduce the friction that can be achieved between the tyre and the road), and
- rolling resistance (the physical resistance to free rolling of the vehicle including deformation of the road surface, flexing of the tyres and irregularities in the road surface).

Drainage

Poorly maintained or inadequate drainage results in mud, ponding and potholes. Water running across haul roads can cause erosion and not only presents a hazard to mobile equipment but can cause structural damage to the road if the water penetrates into the various layers of the road. Bunding or windrows on the side of the road needs to have sufficient gaps to enable water to run off the road. Roads should also be constructed so direct water can run off the road as quickly as possible and limit or prevent ponding or erosion.

Road surface

The road running surface should be sheeted with competent material to provide adequate traction when wet, to maintain a suitable coefficient of friction. This should enable the surface condition to be restored through normal road maintenance.

When suitable sheeting material is not available, the maintenance plan and watering plan should be adjusted to provide the required ride and traction characteristics.

Depending on the nature of the material used to construct the road it may also be necessary to change speed and load limits depending on the weather or road conditions.

Edge protection
Safety berms or windrows must be placed on haul roads where there is the potential for a piece of mobile equipment to drive off an edge. The height of a safety berm or windrow should be at least half the diameter of the tyre of the largest vehicle to use that road and should be constructed so that it is as vertical as possible.

Intersections
Intersections should be located and constructed so operators have sufficient sight and stopping distances. This can be achieved by:

- keeping the intersection away from areas of vertical or horizontal alignment changes
- avoiding 4 way intersections that encourage traffic to drive straight through. Use 3 way “T” intersections where possible
- keeping the intersection as close to 90 degrees as possible
- using traffic islands to split and clearly delineate traffic
- keeping the area around the intersection clear of vegetation that may restrict vision
- construct windrows or berms at the intersection lower than normal to increase sight distance
- ensuring that intersections are constructed to accommodate the largest vehicle using the intersection
- ensuring that signage is clearly visible to all equipment using the intersection, and
- establishing clear right of way rules that apply consistently to all traffic.

Parking areas
When establishing parking areas for mobile equipment consideration should be given to:

- locating on as flat level ground as possible
- being consistent in design and layout
- where possible, have one way movement (limit need for reversing)
- have drains or humps to prevent unintended movement of vehicles
- separate light and heavy vehicles
- manage/limit pedestrian vehicle interaction with mobile equipment, and
- have clear signage.

Overhead powerlines and structures
Overhead powerlines and other structures including pipe bridges and conveyors can present a hazard to operating equipment. Consideration should be given when locating these structures or constructing roads to ensure the risk of mobile equipment contacting overhead power lines and structures is controlled.

Considerations for managing this hazard include:

- positioning roads, stockpiles and dumps clear of overhead structures
- where possible, routing powerlines under roads rather than over
- maintaining vertical and horizontal clearance distances between mobile equipment and overhead powerlines. Ensure that there is sufficient barricading or bunding to prevent vehicular access to restricted areas, and
- using height restriction barriers.

Dumps and pads

When establishing dumps and pads thought should be given to the vehicle activities that will occur in these areas and controls established to manage the risk. When establishing controls to manage this risk consider:

- ensuring there is sufficient room for vehicles to operate
- where possible, have traffic flow in one direction
- managing stockpiles so that they do not encroach on vehicle operating areas
- managing stockpile size so that it does not restrict vision of operators
- restricting vehicular and pedestrian access, and
- providing additional lighting if operating at night.

Workshops and fixed plant areas

The risk of a vehicle collision with a pedestrian or plant is greatly increased in workshop and plant areas. To reduce the risk of this occurring consideration should be given to:

- providing specific parking areas
- restricting vehicular access
- establishing clearly identified pedestrian crossings and walkways
- providing bollards or barricading to protect equipment close to roads, and
- establishing appropriate speed limits.

Runaway vehicle provisions

Where there is the possibility for vehicles to run away, for example on steep grades where vehicles are operating close to their design limits, or experience shows there is a problem keeping vehicles under control then provision for runaway control should be made. Two types of runaway provision commonly used are escape ramps and centre berms.

Considerations for escape ramps include:

- the size and expected speed of a runaway vehicle that might be required to enter the ramp
- alignment of the ramp and the haul road. An operator of a runaway vehicle should be able to steer the runaway vehicle into the ramp
- size and length of the ramp. The ramp needs to be wide enough and of sufficient length to allow vehicle access and time for it to slow and stop, and
- construction material for the ramp should offer a high rolling resistance and not tend to compact.

Considerations for centre berms include:

- the nature and size of the equipment that might need to drive onto or straddle the centre berm
- material of construction, so that it provides sufficient drag on the vehicle but does no or limited damage to the underside of the vehicle, and
- positioning of centre berms so that vehicles have had limited time to pick up momentum.

4.2. Construction and Maintenance

A stable road base is one of the most important factors in road design and construction. Where the road base cannot support the weight of the traffic on it, this will allow for rutting, sinking and deterioration of the roadway. It then becomes difficult to steer and control equipment on the road. The road will also require constant maintenance.

When constructing a road consider:

- the strength of the in situ material - the softer it is the thicker the base layer must be, and

- the wearing course or sheeting - choose a material that will provide adequate wear and friction in the environment it is exposed to.

Once constructed the road should be subject to regular inspection maintenance of its surface and drainage.

4.3. Separation and Segregation of Vehicles and Pedestrians

One of the highest risks associated with mobile equipment is the consequence of a collision between mobile equipment and mobile equipment or mobile equipment and pedestrians. This risk can be reduced by considering the following control measures:

- separating mobile equipment and pedestrians by clearly establishing restricted areas, pedestrian crossing or zones and designated parking areas
- separating light and heavy mobile equipment by separating roads, restricting access areas, implement minimum stand-off distances between light and heavy mobile equipment and right of way rules
- restricting the access to operational areas including loading areas, dumps & stockpiles, workshops and plant areas and designated parking areas within these zones
- clear communication rules between mobile equipment/mobile equipment and mobile equipment/pedestrians, and
- use of collision avoidance technology.

4.4. Restricted Access Exclusion Zones

Restricted access areas and exclusion zones are those areas where there is a need to restrict or limit access of mobile equipment to be able to manage the risk effectively. Each site must assess the areas or locations it has or consider restricted access areas and exclusion zones including:

- ROM
- stockpiles, dumps
- drill pads
- blast pads
- haul roads
- workshops and plant areas, and
- stopes or unventilated areas.

Once identified, systems and procedures to manage these areas should be established and include:

- clear delineation and signage
- barriers where necessary
- access points and procedures, and
- escorting requirements.

Consideration should also be given to procedures and systems for establishing and clearing temporary restricted access areas for example, when undertaking maintenance on haul roads, weather events or during emergencies.

Highwall drop zones

Haul roads are often located alongside high walls, these present a hazard of a rock fall or collapse. Highwalls can become less stable over time due to factors such as weathering and effects of water. Highwalls should be subject to regular inspection for evidence of rock falls, open joints, water damage, or overhangs. Unstable material should be removed if possible or where this is not possible then access to the area restricted.

When establishing the barricading for the restricted area consideration should be given to from how high and how far out the rocks may fall and bounce from the base of the wall and the use of earth bunds.

Remotely operated mobile equipment locations

Remotely controlled equipment presents specific hazards and risks that must be managed. To achieve this, the following should be considered:

- selection and maintenance of the remotely controlled equipment
- training and assessment of the operators
- establishment of procedures and standard work instructions
- restricted access to equipment operating areas with physical barriers
- clear communication requirements, and
- separation of operators and remote control equipment whilst it is operating in remote:
    - physical barriers
    - electronic barriers, and
    - minimum separation distances.

4.5. Vehicle Selection

When selecting vehicles, consideration should be given to the existing or planned road layout and conditions on site to ensure that the selected vehicles can operate within their design specifications and capabilities.

4.6. Communications

Communication systems should be in place to ensure that workers and other persons operating on roads clearly understand the rules, can communicate with each other and report hazards or other issues when they arise. This can be achieved through:

- induction and refresher training
- clear radio communications policies and rules for example, call points, emergencies, and call up and confirmation procedures
- consistent signage, and
- managing changed conditions.

4.7. Lighting

When operating in low light conditions or at night the sight distance of the operator is significantly reduced. Provision of appropriate lighting may improve the operator's sight distance. When assessing lighting requirements consideration should be given to:

- nature and type of activities being undertaken
- the types of vehicles involved
- the speed the vehicles will be travelling, and
- if pedestrians will be encountered.

General control measures include:

- suitable lighting on vehicles, for example, driving, operating, clearance and tail lights
- use of lighting towers in operating areas, and
- provision of lighting in areas where pedestrians are present, for example in workshops and plant areas, parking bays and pedestrian crossings.

4.8. Traffic rules

To ensure the effective management of risks associated with traffic and roads, each operation should have clear and consistent traffic rules. Once established these should be communicated to and be clearly understood by all personnel on site. The traffic management rules should include as a minimum:

- site road layout and traffic flows
- operating speeds
- right of way
- signage
- vehicle operating requirements
- overtaking, parking and breakdown procedures
- radio communications
- restricted area requirements, for example, dumps, stockpiles, park bays, overhead powerlines and obstructions
- equipment separation distances, and
- pedestrians

4.9. Signage

Traffic signs are important to ensure that there is orderly and predictable movement of traffic. To be effective signs should be clearly visible, easy to understand, positioned so that people have sufficient time to identify, read and react to the sign and consistent.

For ease of recognition and purpose traffic signs on mine sites should be consistent with those used on public roads for example, stop, give way, speed limits.

Once erected traffic signs need to be maintained to ensure that they remain visible and are still relevant.

4.10. Training

To manage the risk associated with mobile equipment and traffic, workers and other persons should be adequately trained. This can be achieved through:

- induction training which includes traffic and road rules
- specific equipment operator training, and
- training in road construction and maintenance.

4.11. Inspections and monitoring

Once the controls for roads and other vehicle operating areas are established then it is important to ensure that these continue to function and are maintained. To achieve this it is important to establish systems of regular inspection and monitoring. The inspection and monitoring systems should include:

- review of effectiveness of training provided
- pre start inspections of equipment by operators (Note: avoid generic pre-start checks where possible as they may not be suitable for all the vehicles at the mine)
- regular routine equipment maintenance
- workplace inspections and monitoring of compliance by supervisors, and
- regular inspection and maintenance of roads, signage and traffic controls.

5. REVIEW OF CONTROL MEASURES

It is important to monitor risks and check the control measures to ensure they remain effective. Regulation 9.2.4 of the WHS Regulations requires a review of the control measures to be undertaken whenever there are any changes associated with the road or other vehicle operating areas.

In undertaking the review, workers using the road or vehicle operating area and their health and safety representatives must be consulted and the following questions be considered:

- Are the control measures working effectively in both their design and operation?
- How effective is the risk assessment process? Are all hazards being identified?
- Are workers actively involved in the risk management process? Are they openly raising health and safety concerns and reporting problems promptly?
- Have new work methods or new equipment made the job safer?
- Are safety procedures being followed?
- Has instruction and training provided to workers been successful?
- If new legislation or new information becomes available, does it indicate current controls may no longer be the most effective?

If problems are found, go back to any point in the risk management process, review the information and make further decisions about risk control.

APPENDIX A: OTHER RELEVANT INFORMATION

Codes of Practice

- *Code of Practice: Traffic Management for non-construction sites, Safe Work Australia*
- *Code of Practice: Traffic Management for construction sites, Safe Work Australia*
- *Code of Practice: Work Health and Safety Management System, Safe Work Australia*
- *Code of Practice: How to Manage Work Health and Safety Risks, Safe Work Australia*
- *Code of Practice: Work Health and Safety Consultation, Co-operation and Co-ordination, Safe Work Australia*

Other publications

- Guidelines for Mine Haul Road Design, Dwayne D. Tannant & Bruce Regensburg (2001)
- Haul Road Inspection Handbook, MSHA Handbook Series – PH99-I-4 (1999)
- Mining Roads – Safety and Design Workshop Handbook, ARRB Group and Curtin University