Traffic management in mines and quarries

MinEx

Health and Safety in NZ extractives

Contents

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1 Introduction

Vehicle related incidents represent 30% of all incidents with the potential to harm in New Zealand mines and quarries. Collisions is one of the four fatal hazards that result in 80% of fatalities in the extractives sector, both in New Zealand and internationally.

This booklet has been developed to assist mines and quarries in developing and implementing effective traffic management strategies, to control the hazards associated with the use of mobile equipment on site and to prevent injury to persons.

Whilst each mine and quarry are different with respect to size and nature, a number of common controls have been identified by industry as effective. The controls contained in this booklet should be considered as part of the risk management process when developing a site's traffic management strategies.

It is important to ensure that a traffic management risk assessment is completed before you develop your site traffic management strategies.

2 Site design and layout

Effective traffic management begins with a well-designed and documented mine/quarry plan that considers site layout, geological and geotechnical characteristics, nature and type of equipment that will be used during operations, and traffic management strategies.

To ensure effective traffic management, the following needs to be considered during the mine/quarry planning stage:

- Site geology, property boundaries, access
- Production rates/constraints, staging of development
- Size and type of mobile equipment (haul road gradient/width)
- Location of plant, infrastructure, stockpiles
- Weather
- Final design and end use
- When to review the plan (operational, equipment, production, periodic)
- Resource consent conditions

When considering the above, reference should be made to industry codes of practice, standards, guidelines and other relevant information.

3 Equipment

Selection

All mobile equipment selected to operate on site, including contractors' equipment, hired equipment, and existing site equipment must be checked to ensure that it is fit for purpose. This means that the site must know the Original Equipment Manufacturer (OEM) limits and specifications and ensure that the equipment always operates within them. In addition, the site should establish the minimum requirements for mobile equipment on site.

Your sites' minimum requirements may include, but not be limited to:

- Load limit (clearly identified GVM, GCM, Tare)
- Isolation points
- Emergency stops
- Park brake alarm
- Reversing beepers/alarms
- Flashing lights/flags etc. to make vehicles visible
- Effective/operational communications (2-ways)
- Seatbelts
- Seat (ergonomic)
- Safe access/egress (designated walkways and handrails)
- Access to OEM Manuals
- Body-up alarms on trucks

Operation

Inspection and testing of equipment should be carried out by a competent person when it arrives on site to ensure that it is fit for its intended purpose, complies with OEM specifications, and meets minimum site requirements.

Safe operation of mobile equipment is critical to ensuring that traffic management strategies are achieved. Whilst OEM operational manuals do provide information on safe operation of equipment, further controls should be considered to ensure equipment is operated safely, and human error minimised.

Operators must be trained and assessed as competent to operate equipment to the conditions on site. The training should include the requirements of the task, OEM requirements and any additional site controls, as identified in the site's traffic management plan.

Your sites' additional controls may include, but not be limited to:

- Process for assessing that workers are fit for work
  - Worker Health Control Plan
  - Regular health surveillance
  - Observation and supervision
- Induction training and refreshers
- Site specific operating procedures
- Process for managing visitors to site
- Cash sale customers
- Short-term contractors
- Suppliers
- Escorted visitors
- Proximity detection/collision avoidance

Maintenance

To ensure mobile equipment continues to be fit for purpose, the site must implement a maintenance programme that considers the OEM requirements. These requirements should be a minimum. Site conditions and equipment usage should be considered in determining the frequency of maintenance. For example: on-highway, truck's drum brakes are subject to increased wear due to abrasive muddy conditions when used in quarries as bin trucks.

All maintenance checklists must be specific to each piece of equipment and include safety critical requirements identified in OEM Manuals.

Persons carrying out maintenance work must be competent, and have access to the OEM Manuals, to ensure correct inspection, servicing, repairs and adjustments are carried out.

Your sites' maintenance programme should include, but not be limited to:

- All required OEM Manuals
- Assessment of plant on arrival at site
- Record of all mobile equipment on site
- Routine maintenance schedule (e.g. 250 hour service)
- Documented records of all maintenance and repairs
- Prestart checks
- Process to control, manage, and certify modifications
- Breakdown and recovery procedures
  - Procedures and resources to secure and make safe areas where breakdowns or accidents have occurred
  - Use suitably qualified personnel for the recovery/maintenance
  - Suitable towing/recovery equipment
  - Identify weights, towing and lifting points on mobile equipment

4 Road construction and maintenance

Well designed, constructed and maintained roads will enable mobile equipment to operate safely on site. This will not only mean a reduction in accidents and incidents, but will also lead to a reduction in maintenance and operating costs.

When designing and constructing roads, consideration must be given to the nature, type and size of equipment that will be using the roads. This is to ensure that the equipment remains within OEM operating specifications and limits, and can operate safely on site.

When designing and constructing roads you should consider:

1. Weather and environmental conditions

- Rainfall
- Dust control
- Geology and terrain (undermining faults, loose rocks, vegetation)
- Crests all at suitable angles and scaled so that rocks don't end up on the roads

2. Road life and usage

- Expected load
- Size and capacity of equipment
- Duration of road use

3. Quarry plan parameters

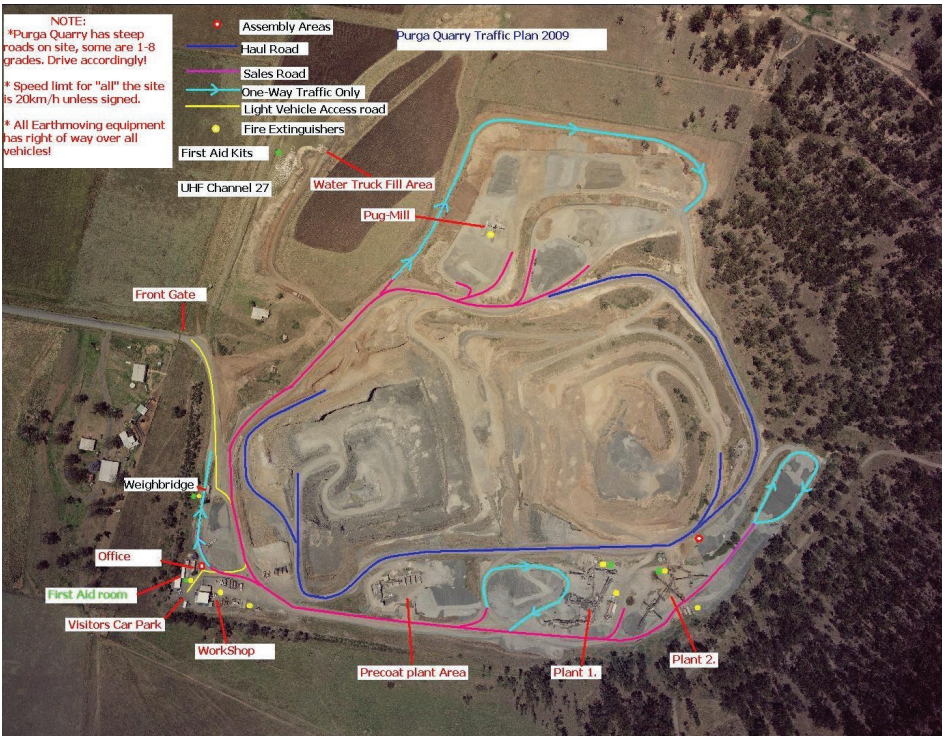
- Staging of quarry development
- Physical site restrictions (creeks, boundaries)
- Bench design

4. Single or two lane

- If vehicles are required to pass each other on the same road, the width of the road at the point of passing should be 3 times the width of the largest vehicle on site. This does not include provision of bunds
- Single lane roads should be 1 ½ times the width of the largest vehicle on site This does not include provision of bunds
- Segregate traffic on dual carriage ways (centre bunds, lane separation)

5. Material used for construction

- Road foundation and stability
- Compaction and binding
- Sealing of high use haul roads



6. Drainage

- Flow diverters
- Under road drainage
- Cambers divert water to drains

7. Cambers

- Adequate for water drainage
- Slope to inside of turns (no reverse cambers)

8. Intersections

- “T” intersections (avoid “Y” intersections)
- Use Waka Kotahi (NZTA) guidelines as a reference for intersection design
- Use of convex mirrors
- Clear of vegetation
- Blind spots
- Stopping distance under load
- Visibility of signage

9. Gradient and length of haul

- Gradient recommended 10% (1:10)
- Additional controls required when above 14% (1:7)
  - Limit speed
  - Restricted access to fit for purpose vehicles
  - Use low gear
  - Limit load size
  - Increased maintenance
  - Number, size, type of construction material, and maintenance of bunds
  - Emergency run-offs
  - Continuous vertical grade to avoid changes in grade

10. Edge protection/bunding

- At least half height of largest vehicle’s wheel diameter
- As vertical as possible
- Suitability of construction material
- Maintenance
- Provision of drainage
- Continuous (restrict gaps in bunds)

11. Clear identification of roadways and edge protection

- Guideposts
- Clear and concise signposting

12. Segregation of light and heavy vehicles

5 Vehicle interaction

To effectively manage the risks associated with mobile equipment, interaction between vehicles must be eliminated where possible, or controlled. For example: separating light and heavy vehicles and restricting access of vehicles into operational areas.

The site needs to consider the following controls:

1. Clear procedures for overtaking and right-of-way

- Positive communication prior to overtaking
- Designated passing bays
- Separation distance from any vehicle (30-50 metres)
- Always give way to heavy vehicles
- Separation of light and heavy vehicles (designated haul roads)
- Restrict light vehicles accessing haul roads and operating areas

2. Traffic flow

- One-way where possible
- Limit crossovers
  - Example: vehicles crossing the path of oncoming traffic
- Control of vehicles at site entrance

3. Proximity detection/collision avoidance

- GPS object detection
- Detection zones (radar, sonar, infrared)
- Cameras
- Identify no-go areas around operating equipment
  - Example: don't park in the swing radius of an excavator, or blind spot of a truck

6 Exclusions and separation

Parking

Any person on site must be clearly identified and controls in place to ensure that they are not injured due to movement of a vehicle on site.

The site must identify exclusion zones and separation distances that will ensure persons on site are not exposed to harm from mobile equipment.

The site should consider the following clearly identified and dedicated parking areas:

1. Visitors and/or Employee parking area

- Directions from site entry (signage)
- Separate from operating areas
- Close as possible to office, to limit unescorted access to site

2. Designated tarping and tip-off areas

- Working at height issues addressed
- Away from haul roads and major thoroughfares

3. Heavy vehicle parking area that includes:

- Restricted to heavy vehicles
- Runaway prevention (spoon drain or hump)
- Open flat area free of obstructions and other congestion
- One-way entrance/exit
- Limited pedestrian access
- Adequate lighting

4. General parking on site

- Light vehicle reverse park
- Turn wheels to prevent runaway on gradients
- Horn signals – for example:
  - Start (one beep)
  - Forward (two beeps)
  - Reverse (three beeps)

5. Parking in production areas

- Assigned parking areas
- Positive communication before exiting from vehicles

Pedestrians

Pedestrian interaction with mobile equipment should be kept to a minimum and pedestrians should be managed so that they do not enter operational areas. The site should consider:

- Designated pedestrian walkways
- Clearly marked pedestrian crossings on roadways
- Hi-visibility clothing and PPE
- Pedestrian no go areas
- Carry and use handheld 2-way radios in operational areas
- Escorting visitors
- Visitor/employee/contractor induction
- Positive communication between pedestrians and mobile equipment
- Pedestrians should never approach operating equipment

Public access

Access to site by members of the public should be controlled and restricted to non-operational areas. The site should consider:

- Fencing and site security
- Signage restricting access and directing visitors
- Segregate operational areas from public areas
- Only allow vehicles/personnel on site who are authorised/approved
- Inductions
- Limit control access points
- Restrict small cash/ex-bin sales to the public
- Product sampling away from operational areas

In the event of an accident or incident requiring emergency services, the site should have procedures to enable emergency service vehicles to access the scene. Consider the establishment of a helicopter landing area in case of an emergency.

7 Loading areas, tipping areas and stockpiles

Due to the high volume of; traffic, restricted space, limited visibility, risk of mobile plant rollover and interaction with non-site personnel and equipment – the risk of accidents and incidents are high around loading areas, tipping areas and stockpiles.

In such areas, the site needs to consider the following controls:

1. General

- Restricted access for light vehicles and pedestrians
- The site is clearly signposted
- Flags and flashing lights on vehicles
- Positive communication between truck and loader
- One-way traffic flow
- Regular inspection of loading, stockpile, and tipping areas
- Tarps removed before entering tipping/ stockpile areas
- All tarping and removal of tarps should be done from the ground or designated working platform
- Stop loading/tipping if pedestrians or maintenance personnel are working in loading/tipping areas

2. Loading areas

- Maintain visual contact with truck driver (when loading trucks)
- Truck drivers should always remain in cab of truck
- Bucket down if loader operator loses site of truck driver
- No loading over the cabin of trucks
- No overloading
- Loader must have bucket lowered when tramming/travelling
- Loader should travel in a forward direction while tramming

3. Tipping areas

- Only tip on level ground
- Maintain bunding, install stop logs
- No tipping over benches (dump short and push or side cast over benches)
- Body down before moving off
- Tip control devices/indicators at boot/feed bin
- Physical barriers to restrict tipping/access to boot during maintenance

4. Stockpile management

- Site stockpiles with clearance for loading
- Designated tarping/tip off areas
- Stockpile heights should not exceed the reach of the loader (manage engulfment hazards)
- No stockpiling under overhead powerlines
- Management of stockpile floor quarry RLs

8 Power lines

Incidents involving mobile equipment contacting overhead powerlines are common within the mining and quarrying sector. These incidents are extremely hazardous and need to be prevented.

Sites need to consider the following controls:

- Do not place infrastructure, stockpiles or tipping areas under overhead powerlines
- Measure and signpost clearance distances and exclusion zones and ensure they are within acceptable limits
- Physical barriers to manage clearance distances and exclusion zones (e.g. bunds)
- Site plan must clearly identify overhead powerlines and buried services
- Visual indicators on overhead powerlines (e.g. tell tales)
- Identify clearance heights of vehicles entering site (e.g. cranes, drill rigs)
- Install vehicle height restrictors
- Procedure for dealing with mobile equipment contacting overhead powerlines

9 Communication

Clear and concise communication between personnel on site, and clear signage controlling traffic movement, will ensure that accidents and incidents involving mobile equipment are minimised.

Sites need to consider the following controls:

- Where possible sites should consider dedicated radio frequencies
- Communication should be positive between operators of mobile equipment (a verbal acknowledgement rather than a button click)
- Restrict volume of unnecessary chatter on 2-way radios
- Banning mobile phone usage or having dedicated usage areas within operational zones
- Do not use handheld 2-way radios or mobile phones whilst operating mobile equipment (including light vehicles)
- Site radio channel and contact details must be signposted at entry to the site
- Ensure all personnel on site are aware of site rules/procedures
- Ongoing and regular consultation with workers
- Behaviour observations (ensure procedures are being followed)
- Mud map/plan displayed
- Ensure contractors/suppliers are aware of expectations
- Clear and concise signage
- Communicating effectively with persons for whom English is a second language

10 Changing operating conditions

Over time changes will occur in the ongoing mine/quarry development, extraction processes, layout of plant and equipment on site. Traffic management strategies need to be reviewed to ensure that the risks to personnel from mobile equipment interaction are kept at an acceptable level.

The site needs to consider the following when operating conditions change:

- Identify the triggers that will indicate a change has occurred and action is required (e.g. weather, new machinery, change in extraction process, increased production)
- When changes occur, conduct a risk assessment to ensure that hazards are identified and controlled
- Review equipment to ensure it is fit for purpose
- Ensure new roads, ramps, stockpile areas etc. meet requirements of site traffic management strategies
- Update signage, site plans and maps
- Update induction training and conduct refresher training for workers

11 Monitoring effectiveness and inspections

The implementation of traffic management strategies must be regularly monitored to ensure their ongoing effectiveness.

The site needs to consider:

- Regular workplace inspections preferably conducted by someone tasked with the responsibility for implementing actions
- Behaviour monitoring
- Vehicle inspections
- Regular updating of the mine/quarry plan
- Refresher training
- Robust accident/incident investigation process, ensuring implantation of effective controls
- Regular consultation with workers on site

12 Traffic management checklist

The following Traffic Management Checklist will assist in identifying and managing traffic hazards:

People	Comments/Observations
Are all operators trained and assessed as competent to operate mobile equipment	
Has refresher training been conducted annually or when changes occur (e.g. changed traffic management, new plant)	
Is signage on site suitable to ensure workers follow the Traffic Management Plan	
Equipment	**Comments/Observations**
Is maintenance of mobile equipment conducted in accordance with Original Equipment Manufacturer (OEM) requirements	
Is all mobile plant fitted with the correct operating and safety features (e.g. wipers, seatbelts, horns)	
Are daily prestart checks completed on all mobile equipment used, and are these documented and reviewed	
Is installed proximity detection/collision avoidance equipment working as intended	

Task	Comments/Observations
Is a traffic management plan in place and is it regularly reviewed	
Are traffic management rules being followed by all workers	
Have sensible speed limits been established and are they being adhered to	
Do all drivers check their loads before leaving site	
The environment	**Comments/Observations**
Is there adequate separation of light and heavy vehicles, and pedestrians	
Have suitable parking areas been established for light and heavy vehicles	
Is there adequate control of visitors and people entering the site	
Are haul roads of sufficient width and adequately maintained	

Useful resources

Health and safety at opencast mines, alluvial mines and quarries – WorkSafe New Zealand

https://www.worksafe.govt.nz/topic-and-industry/extractives/guidance-position-statements/health-and-safety-at-opencast-mines-alluvial-mines-and-quarries/

Surface mining traffic management – CoalPro

https://www.safequarry.com/pdf/CoalProHealthandSafetysub-committeeTrafficManagementDocument.pdf

Guidance about traffic management – Department of Energy, Mines, Industry Regulation and Safety

https://www.dmp.wa.gov.au/Safety/Guidance-about-traffic-6268.aspx

Traffic calming and mining safety – Mining Safety

https://www.miningsafety.co.za/dynamiccontent/121/Traffic-Calming-and-Mining-Safety

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