VULCAN MINE

Mine Operating Procedure
Design and Construction of Mine Roads

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1. PURPOSE

This procedure provides specifications for the design and construction of mine haul roads. The procedure has been developed in compliance with section 128 of the Queensland Coal Mining Safety and Health Regulation (2017) and Recognised Standard 19 Design and construction of mine roads.

2. SCOPE

This procedure is applicable to all persons at the Vulcan Mine including employees, contractors, service providers and visitors.

The controls within this procedure are mandatory.

3. DEFINITIONS

Authorised Person	A person who has the required competencies and who has been appointed by the Site Senior Executive to carry out a designated scope of duties.
CMSHA	Queensland Coal Mining Safety and Health Act (1999).
CMSHR	Queensland Coal Mining Safety and Health Regulation (2017).
CMW	Coal Mine Worker.
Competent Person	Competence for a task at a coal mine is the demonstrated skill and knowledge required to carry out the task to a standard necessary for the safety and health of persons.
HME	Heavy Mobile Equipment.
HST	Health, Safety and Training.
JHA	Job Hazard Analysis.
LV	Light Vehicle.
MP	Mobile Plant.
MV	Medium Vehicle.
SHMS	Safety and Health Management System.
SISD	Safe Intersection Sight Distance.
MOP	Mine Operating Procedure.
SSE	Site Senior Executive
WRAC	Workplace Risk Assessment & Control.
Take 5	Personal Risk Assessment.
Operating Width	Width of the outer extremities of the vehicle.

4. PROCEDURE

4.1. General

Constructing mine roads to a design guideline may provide a range of benefits such as:

- improve road operational safety & reduce potential hazards;
- increased tyre and rim life;
- reduce traffic & equipment interactions;
- less structural and mechanical damage to the truck;
- improved haulage cycle time; and
- reduce operator fatigue.

The criteria for the design of roads includes:

- the expected life span of the road;
- equipment used: haulage trucks or light vehicles only;
- frequency of road use & traffic congestion;
- road grades and intersections;
- construction material available;
- weather conditions, including drainage design on & off-road;
- comply with the manoeuvrability of the vehicle used;
- can segregation be engineered to reduce heavy vehicle / light vehicle interaction.

4.2. Road Design Criteria

Primary haul road:

- A main haulage road constructed for use over an extended period for mobile plants to move overburden, coal and waste material.
- May include permanent sections of coal haulage ramps.
- An extended period of time is the life of a particular pit or mining area.

Secondary haul road:

- May include some sections of ramp haul roads, in-pit haul roads, and bench and dump roads which are generally made redundant with the advance of the pit or mining area.

Primary access road:

- These are roads generally used over an extended period of time by light and medium vehicles.
- An extended period of time is the life of a particular pit or mining area.

Secondary access road:

- These are roads used by light and medium vehicles over a short period of time and are normally made redundant with the advance of the pit or mining.
- Typically, these are access roads into drills, blasting areas, pumps, pipelines, highwall crests, exploration, the mine boundary, etc.

4.2.1. Primary Haul Roads

Primary haul roads regularly used for two-way traffic shall be designed and maintained to be a minimum of 3.5 times the width of the largest vehicle (HME) regularly using the road. The width is considered the road's useable running pavement clear of guideposts, grader rills and safety berms.

The criteria for the design of primary haul roads include:

- a long-term major haul road, with a life expectancy greater than 12 months;
- used by haul trucks and light vehicles;
- high frequency constant traffic use;
- formed construction;
- delineated; and
- consideration of segregation to reduce heavy vehicle/light vehicle interaction and exposure.

4.2.2. Secondary Haul Road

The criteria for the design of secondary roads include:

- short term major haul road, with a life expectancy less than 12 months;
- used by haul trucks and light vehicles;
- high frequency traffic use;
- non-formed construction; and
- delineated or bollard if less than 48hrs.

Dump and stockpile roads are temporary haul roads located on the dump or stockpiles. They run from the haul road to the dump face. The criteria for the design of dump and stockpile roads include:

- short term major haul road, with a life expectancy less than 12 months;
- used by haul trucks and light vehicles;
- high frequency traffic;
- non-formed construction; and
- delineation where reflective surfaces are non-existent (e.g. large open areas of top dump).

Temporary haul roads regularly used for two-way traffic such as bench and dump roads shall be designed and maintained to be a minimum of 3.5 times the width of the largest vehicle (HME) regularly using the road.

Road widths should not be excessive to reduce the amount of road maintenance and dust suppression required.

The following haul road traffic surface widths are to be applied to straight sections of all permanent and temporary haul roads.

Table 1 : Haul Road traffic surface widths for straight sections of all permanent and temporary haul roads.

Road Type	Definition
Straight Single Lane Roads	**1.5** times the operating width of the largest vehicle using the road (plus berms) ***note - A CAT 793 Haul Truck has an overall width of 8.56 metres which equates to a minimum single lane road width of 12.84 metres.***
Straight Double Lane Roads	**3.5** times the width of the largest vehicle using the road (plus berms) ***note - A CAT 793 Haul Truck has an overall width of 8.56 metres which equates to a minimum single lane road width of 12.84 metres.***
Curved Roadway width	A multiplication factor of 1.25 to be applied to allow for turning Radii of haul trucks.

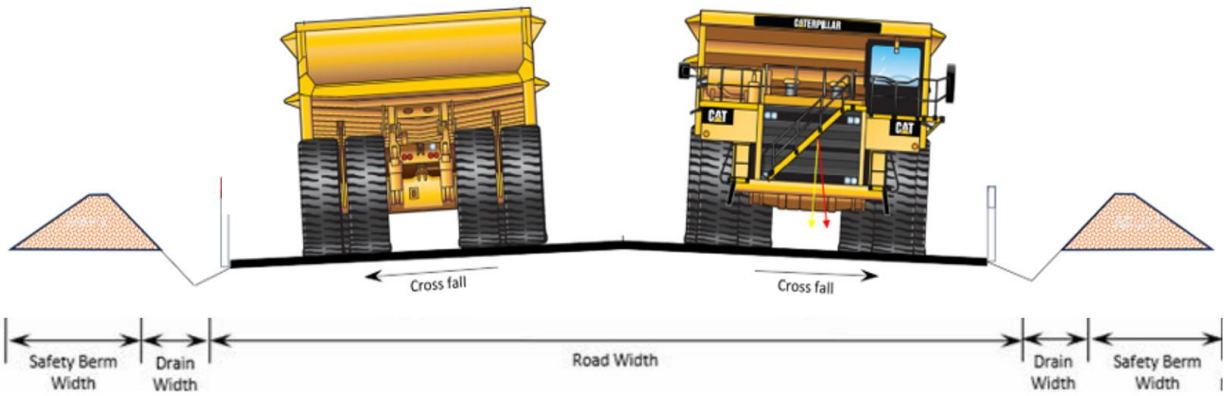


Figure 1 : Minimum requirement for a double lane haul road

4.2.3. Primary Access Roads

Primary Access roads may be permanent or temporary. They are access roads around the perimeter of the pit, between Primary Haul roads and Secondary Haul roads and on the surface. The criteria for the design of Primary Access roads include:

- a long-term road, with a life expectancy greater than 12 months;
- used by light & medium vehicles and service vehicles only;
- low and high frequency traffic use;
- formed construction, if permanent in nature; and
- adequate delineation.

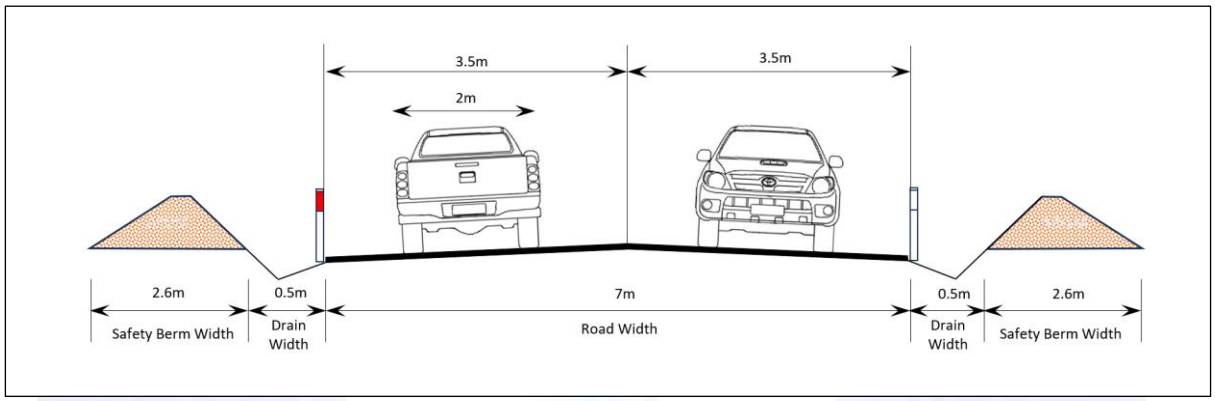


Figure 2 : Minimum requirement for double lane roadway for access roads

4.2.4. Secondary Access Road

Secondary access roads are short-term access roads only utilised by light, medium vehicles, and service vehicles. These are temporary and removed as the pit progresses. Typically, these are access roads into drills, blasting areas, pumps, pipelines, highwall crests, exploration, mine boundary etc.

4.2.5. Sight Distance

The provision of adequate sight distance at an intersection on both the horizontal and vertical planes is fundamental to safe road and intersection design. Sight distance is the extent of peripheral area visible to the vehicle operator, and is influenced by:

- the designed speed of the road;
- condition of the road surface;
- smallest vehicle height using the road (LV); and
- the stopping distance of the largest vehicle using the haul road in the worst-case driving conditions.

On hill crests, the sight distance may be restricted by the vertical curve or crest of the hill, in this instance the crest may need to be flattened, thus increasing the sight distance and lengthening the operator reaction time.

At bends or intersections of the road, the sight distance may be restricted by batters, signs or other obstructions. Where possible, bends and intersections should have all sight restrictions removed or minimised. The batters may be laid back to increase the sight distance. Refer to Table 2 or intersection examples for sight distances based on road speed

Table 2 : SISD requirement for various speed

Speed (km/hr)	Safe intersection sight distance (SISD)*
10	10m
20	30m
30	50m
40	70m
50	90m
60	110m
70	145m

Longest stopping distance (e.g. Dump Truck)

SISD requirements are calculated based on stopping distance calculation shown below with the addition of SSD to SSID conversion factor.

$$Stopping\ distance = {}^{1}/_{2}\ gt^2\ sin\theta + 0.28\ v_0 t + \left(\frac{(gt\ sin\theta + 0.28\ v_0)^2}{2g\ (U_{min} - \sin\theta}\right)$$

where:

g	=	acceleration due to gravity (m/s^2)
t	=	driver reaction AND brake activation time (s)
Θ	=	grade of road (degree) {+ down & - up}
U_{min}	=	coefficient of friction between tyre & road (0.4 dry road & 0.2 wet road)
V_0	=	vehicle speed (km/hr)

To maximise the SISD at intersections throughout the mine the following considerations shall be made:

- Sight distance shall be measured for the driver eye height of the lowest vehicle using the road (e.g. utilise 1.5m for a light vehicle) to largest vehicle with the longest stopping distance (e.g. Dump Truck)
- Consideration shall be given to sight distance in both the horizontal and vertical planes and if required controls e.g. speed restriction shall be adopted to achieve safe intersection sight distance (SISD) requirements

4.2.6. Cross-fall

Cross fall is the falling slope from the centre-line to the shoulders. It maybe also referred as crown or camber. Cross-fall assists in diverting water away from the haul road surface, i.e. reducing water pooling, mud and potholing. If water is allowed to accumulate on the running surface, deterioration of drainage on the sub-base due to water saturation may occur. If the sub-base becomes exposed, tyre damage may occur.

Ramps should be constructed as much as practicable with one continuous cross-fall and not crowned. This is particularly important if the hauls expose tyres to overheating.

Ideally the rate of cross-fall on roads should allow for rapid water movement without adversely affecting steering control of equipment.

The degree of cross-fall is dependent and directly related to:

- road gradient;
- expected rainfall (during normal weather conditions); and
- construction materials used on the traffic surface and the expected deterioration of the surface.

For the Vulcan Mine, the following cross-fall percentages are recommended:

Cross fall on mine roads should vary between 1% and 4% depending on the above criteria. In applications where tyre wear may be an issue (e.g. long hauls), cross fall on loaded lanes should be kept to a minimum.

4.2.7. Gradient

The gradient on a ramp is the grade line profile along the road centre line, in the vertical plane. It should allow for smooth transitions between straight sections of road. The grade should be kept as constant as possible to reduce the tendency of trucks to change through gears on the upgrade hauls. This affects:

- haulage cycle times;
- fuel consumption;
- stress on the mechanical components of the vehicle, e.g. transmissions and torque converters; and
- excessive chassis flexing due to uneven surfaces (racking).

In general, the gradient of permanent and temporary haul roads at the Vulcan Mine should not exceed 10% or and the lowest gradient practical (0% target) on bends or switchbacks.

4.2.8. Superelevation

Superelevation is the cross-fall applied to switchbacks, corners and curves on the road. It allows the vehicle taking the corner to counteract the centrifugal forces by directing the vehicle weight towards the centre of radius of the curve. The amount of superelevation on the corner is directly related to the radius of the corner and the desired vehicle speed through the corner.

Typically, superelevation rates of 2% - 6% suit most mine road applications. Rates above 6% shall not be used. The application of negative superelevation (adverse cross fall) should be avoided.

Tech Services Dept shall consider superelevation when designing mine haul roads.

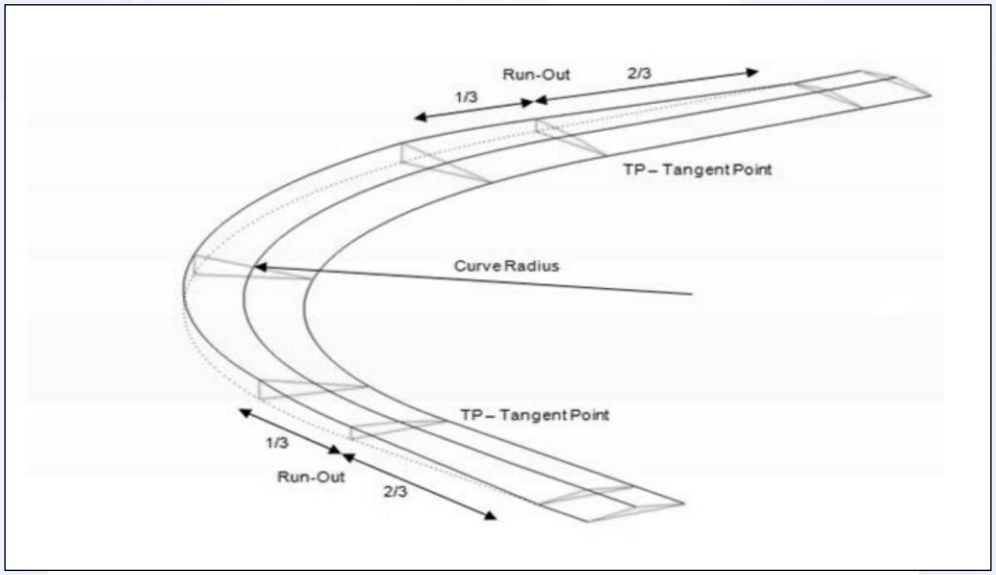


Figure 3 : Superelevation and run-out schematic

4.2.9. Safety Berms

A Safety berm which may also be referred to as berm, safety bundwall, bundwall, or bund, is a triangular or trapezoidal shaped mound of earthen material used to redirect wandering vehicle and/or to absorb the impact energy if a vehicle hits them. Any road where the vertical drop-off exceeds 0.5 metres shall have protective berms that are sufficient to stop any vehicle travelling that road from going over the drop-off. Side slopes of grades of steeper than 1:4 is considered drop-offs.

Safety berms shall be sufficient to stop any vehicle travelling that road and from breaching the berm.

It is important to consider the material type being used when constructing a safety berm in that the material should be competent enough to stop a vehicle. Less competent material may require berms to be wider.

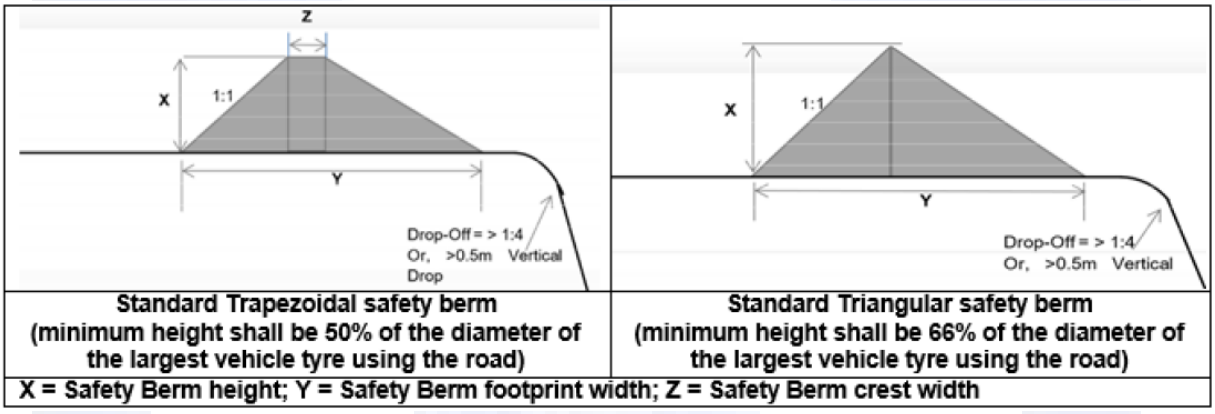
Design of safety berms should include provision for the drainage of water and drains are to be no greater than one metre wide and angled away from the direction of travel.

Safety berm dimensions shall be increased to a height of greater than or equal to 3m, with a minimum footprint width of 7m in areas that represent a higher level of risk such as:

- where drop- off heights are greater than five metres directly along the road edge;
- where travel or approach speeds are high;
- where only poorer quality material is available to construct the safety berm; or
- the safety berm control changes from a deflection mechanism to more of an impact absorption mechanism, for example when approach angles are more obtuse.

Safety berms should also be used as road dividers where extra traffic control is required or a particular hazard exists, such as ramp crests and toes, tight radius turns, sweeping left downhill bends at the toes of ramps and switchbacks. Any safety berms used for this purpose should be constructed using crushed material to avoid tyre damage. This type of berm is not required to be as substantial as an edge protection berm but still just be a minimum of half the tyre height of the largest vehicle.

Design requirements for safety berms are presented in Figure 4 below.



Standard Trapezoidal safety berm (minimum height shall be 50% of the diameter of the largest vehicle tyre using the road)	Standard Triangular safety berm (minimum height shall be 66% of the diameter of the largest vehicle tyre using the road)
X = Safety Berm height; Y = Safety Berm footprint width; Z = Safety Berm crest width	

The following table details typical safety berm dimensions for vehicles:

Vehicle	Standard tyre size	Inflated tyre diameter	Standard trapezoidal safety berm			Standard triangular safety berm	
			X	Y	Z	X	Y
MV / LV	Various	1.4m	0.7m	2.6m	1m	1m	2.3m
Cat 777	27.00R49	2.7m	1.4m	4.1m	1m	1.8m	4.2m
Cat 785	33.00R51	3.2m	1.6m	5.1m	1.4m	2.2m	5.1m
Cat 789	37.00R57	3.5m	1.8m	5.5m	1.4m	2.4m	5.6m
Cat 793	46.90R57	3.6m	1.8m	5.6m	1.4m	2.4m	5.6m
Kom 930E	53.80R63	3.8m	1.9m	6.0m	1.6m	2.6m	6.0m
Cat 797	59/80R63	4.0m	2.0m	6.3m	1.6m	2.7m	6.3m
<Insert/delete truck types as required>							
Note: Safety berm footprint width is based on a roadside facing batter angle of 45° and an outer side batter angle of 37°. Some dimensions have been adjusted for standardization.							

Figure 4 : Design requirements for standard Trapezoidal and Triangular safety berms.

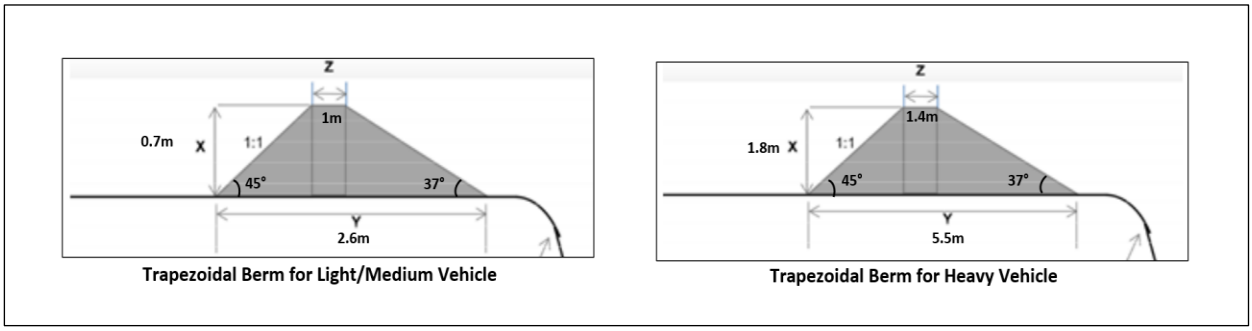


Figure 5 : Minimum requirement for Trapezoidal berm dimension for Vulcan mine

4.2.10. Road Drainage

Drains need to be allowed for water to rapidly drain from the road surface with the aim to reduce unsafe driving conditions and degradation of the road surface or the edge of elevated roads due to water saturation.

V-drains are recommended due to ease of construction, maintenance, and design. The following design parameters are recommended where possible in areas other than ramps:

- the drain should be located in undisturbed material rather than fill;
- the side slopes shall be 4:1 or flatter, and should not exceed 2:1;
- drains should be regraded when the depth has been reduced by 50%; and
- drains shall comply with the surface water management plan.

Where culverts are required under roads, they will be built to suit individual design requirement specifications. In most instances it may be more effective to make breaks in the safety berms and allow water to drain into non-active mining areas. Where designated floodway cross roadways (as either low level crossings or culvert crossings) the road base (and outlet locations in the event of a culvert crossing) should be constructed with suitable material to withstand significant erosion in the event of water flowing over the roadway.

Provision of drainage breakthroughs may be made where required. They should be no greater than 1m wide and angled away from the direction of travel

4.2.11. Intersections

Appropriate traffic control shall be provided at intersections to enable the safe and efficient movement of vehicles through an intersection.

Traffic volume, loaded haulage routes and mine traffic rules should be considered when determining traffic flow priority through an intersection.

Median or centre safety berms should be used to provide traffic separation within an intersection and be positioned and sized (max. 1.2 metres high) so that they do not restrict sight distance on approach and throughout an intersection. Median or centre safety berms should be positioned to "channel" vehicles into the required orientation (square, 90°) during the approach to an intersection.

Adequate signage should be installed to provide warning on approach to an intersection and to provide clear direction within the intersection.

The following should be utilised to control traffic at intersections:

- stop signs should be utilised to control right of way obligations at intersections.

- for primary roadways, bi-directional hazard marker signs placed where roads terminate.
- keep left signs placed on median or centre safety berms.
- stop sign ahead signs placed on the road approach where sight vision on approach to the stop sign is less than SISD requirements.
- Intersection or junction warning signs utilised to provide warning to road users of intersecting roads.

Intersection design and layout standards are presented in Figure 6 to Figure 8

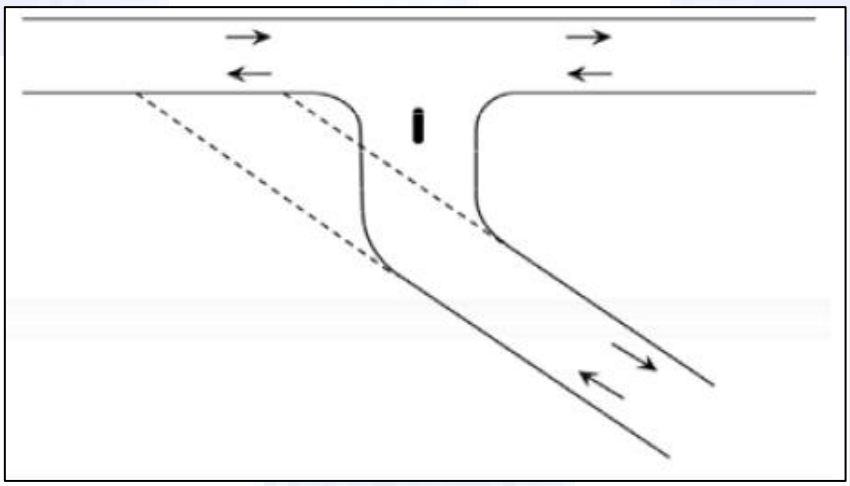


Figure 6 : 'Y' intersection treatment example.

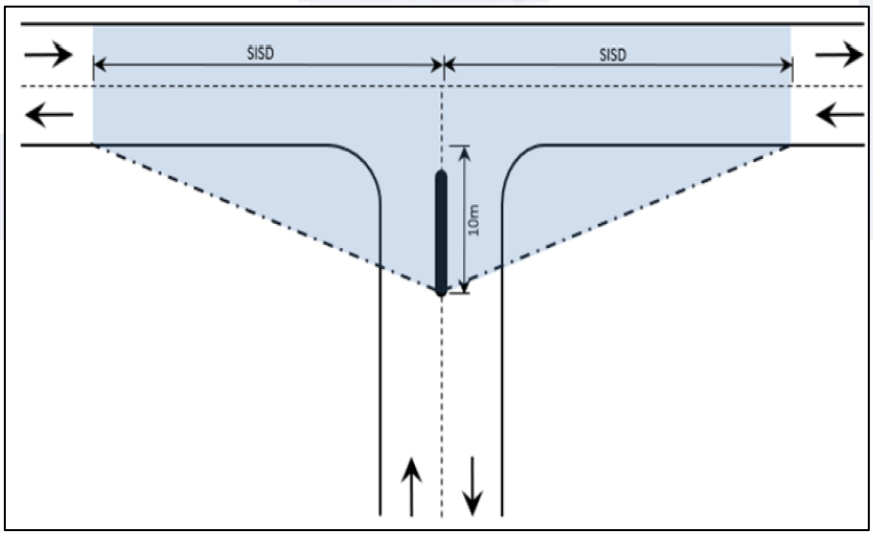


Figure 7 : Intersection sight distance envelope requirements for a sign controlled 'T' intersection.

In general, intersections should be designed and constructed in accordance with the following criteria:

- Intersecting roads shall be at 90° (+/- 5°) to each other. 'Y' intersections shall not be used and treatments shall be applied to ensure roads intersect at 90° (+/- 5°).
- 'T' intersections should be utilised where possible.
- '+' intersection shall only be used, when necessary, with a risk assessment approved by the SSE.
- Complex intersections (intersection of more than 2 roads) shall not be used.
- Intersections within close proximity to each other shall be separated by a 70m centre-line to centreline offset.
- Where roads intersect at the base of ramps a flat spot of at least 25m should be provided as a level braking zone. Similarly, where roads intersect at the top of ramps priority should be given to vehicles coming up the ramp or a flat spot of at least 25m provided, particularly if there is a requirement for vehicles to stop at the top of the ramp.
- Centre bunding throughout intersections must not exceed 1.2m.
- When establishing a new intersection on site, A Vulcan Mine Intersection Checklist must be completed. The completed form is to be scanned and emailed to Technical Services Department for verification against the mine plan and addition to the Vulcan Mine Intersection Register as soon as practicable once the intersection is in place.

Turning radii within the intersection shall ensure that vehicles regularly using the road do not encroach into opposing lanes whilst traversing the intersection.

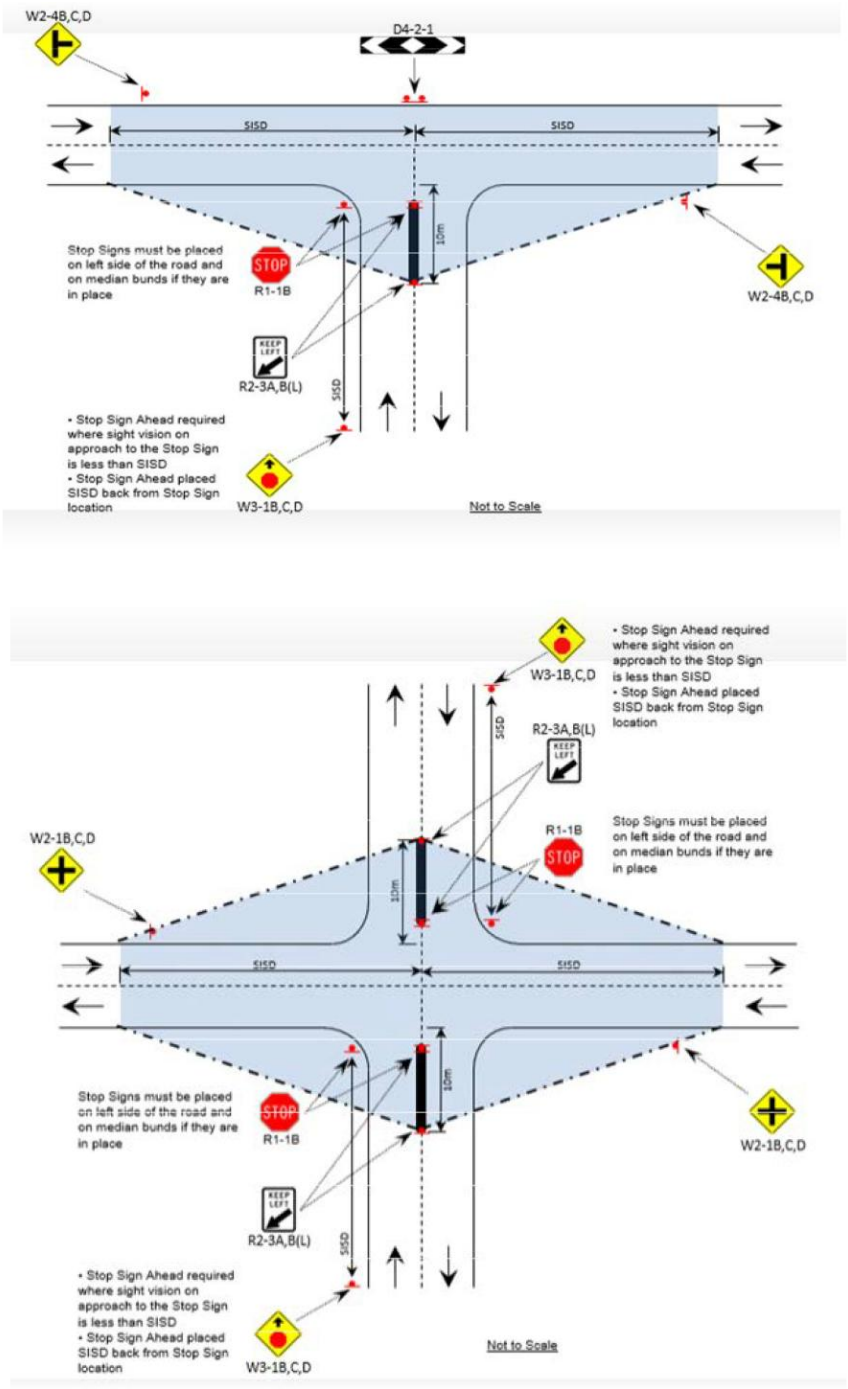


Figure 8 : Intersection traffic control requirements for 'T' and '+' intersections (Australian signs displayed).

- Note - '+' intersection shall only be used, when necessary, with a risk assessment approved by the SSE.

4.2.12. Road Construction Materials

Good construction practices will result in haul roads requiring less maintenance and therefore:

- provide safer driving conditions;
- reduced ancillary plant costs;
- improve production cycle times;
- reduce mechanical down time; and
- provide more durable surfaces in adverse weather conditions.

Set out below are the main requirements of constructing permanent haul roads. Many of the requirements are applicable to temporary and light vehicle roads.

4.2.13. Survey Requirements

All roads shall be constructed on alignments which maximise the haul road life in conjunction with the long-term Mine plan.

Survey control is required for the correct construction of the roads. Regular survey inspections will be conducted to ensure continual compliance. Designs may be uploaded in the machine guidance systems.

4.2.14. Construction

Prior to the building of surface roads, the following steps should be followed:

- the area is to be cleared and stripped of topsoil and stockpiled for environmental rehabilitation;
- roll the surface with a haul truck to highlight any soft spots; and
- remove any soft spots and backfill with consolidated material.

4.2.15. Base Material Requirements

The base course is the platform for the wearing or running surface. It is a supplementary layer usually composed of better quality and high bearing capacity material to increase the thickness of the pavement when sub-grades are weaker. For primary haul roads the following elements should be utilised as a general guideline for base course construction:

- base course thickness selection is dependent on the strength of available material. the material should typically be composed of the best rocky material with a lump size <250mm.
- base course material should be free of plastic material such as clays and carbonaceous materials.
- base course material should be placed in adequately compacted layers no thicker than 300mm.
- the base course should be shaped to suit the design road geometry profile of the final running surface.
- roadside drainage works should be established during this construction stage.

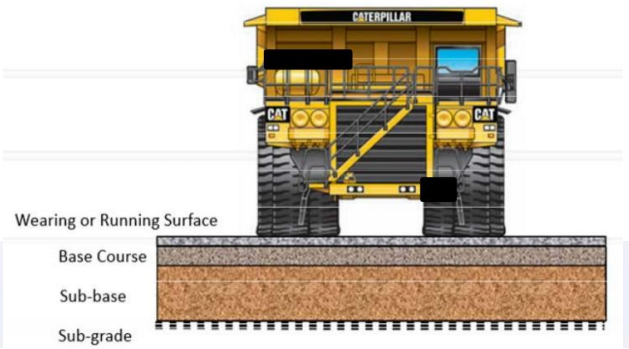


Figure 9 : Base material structure for mine haul road

4.2.16. Running Surface Material

The wearing or running surface provides the layer upon which mobile plant will operate. The wearing or running surface material selection and construction process should provide a hard and smooth surface with an appropriate friction co-efficient value whilst minimising dust generation. Expected road watering practices and the requirements of VUL-SOP-129-Maintain and Water Haul Roads shall be considered when

determining the material and construction process. The following elements should be utilised as a general guideline for wearing or running surface construction:

- the wearing or running surface may be designed to provide for periodic replacement over time;
- the wearing or running surface thickness should generally be 200mm dependent on the strength of material available;
- the particle size (or grading), moisture content, and drainage of the wearing or running surface are key elements in maintaining the surface in good condition;
- avoiding wearing or running surface failures (e.g. surface corrugations, pot holing, excessive dust generation and loose or slippery materials) requires both strong particles (to limit crushing under the tyre loading) and a strong surface, in which individual particles cannot be easily pulled out of the surface matrix. This is generally achieved by using a "well graded" material with a small quantity of cohesive fines and moisture, to assist in binding the surface together;
- in dry climates a comparatively fine surfacing material with not less than 5% fines is desirable to effectively retain moisture, and lead to better binding characteristics;
- in a wet climate a wider grading range, tighter fines limits of not more than 10% and harder material is required to provide wearing course strength and to resist softening;
- high levels of compaction should be used to firmly lock particles together;
- the final design road geometry profile shall be achieved at the completion of this construction stage; and
- design of the road wearing or running surface shall take into consideration vehicle tyre specifications (rubber composition, tread pattern, TKPH, tyre dispensations, etc.). Further guidance can be found in Recognised Standard 13 Tyre, wheel and rim management.

4.3. Road Signs and Delineators

Road signs should not be ambiguous and should serve as warnings or provide instructional information. For further information refer to Recognised Standard 19 Design and construction of mine roads

4.3.1. Signs and Placement

Signs shall be placed so that road users have time to interpret and react to their message. Signs should be washed after periods of rain to ensure they remain clear and free of mud. Consider the following when placing signs:

- signs shall be located and placed at a height that is within the driver's line of sight. Regulatory signs (e.g. stop signs) shall be placed such that the base of the sign is a minimum of 1.5 metres above the road surface.
- signs shall be placed on the left-hand side of the roadway, and when in place, on median or centre safety berms at intersections.
- warning signs should be placed 1.5 times the local speed limit prior to an oncoming hazard (e.g. 50km/hr speed limit – sign placed 75 metres before hazard).
- regulatory signs (e.g. stop signs) shall be placed at the point at which a specific regulation commences.
- signs should stand out and be placed so that the background does not make them unnoticeable.
- signs should be appropriately placed so they do not create 'sign pollution' (i.e. too many, or inappropriately positioned signs so that drivers are confused or miss the required information).

'Light Vehicle Access Only' signs are to be used on roads designed for light vehicles only. Examples of light vehicles covered by this plan are:

- authorised four-wheel drives; and
- authorised buses.

The following list details minimum specific sign use and placement requirements:

- signs for controlling traffic at intersections shall comply with the requirements detailed in section 4.2.11 Intersections;
- chevron alignment marker signs should be utilised to augment the delineation of tight radius curves on primary roads. Where used, a minimum of three markers shall be used at any one curve,

with a minimum of two markers shall be visible on approach to the curve, and they shall be aligned for the direction of approaching traffic;
- Pedestrian Crossing signs shall be utilised at designated pedestrian road crossing locations.
- where median or centre safety berms are utilised on roadways, Keep Left signs shall be utilised on each end of the safety berm;
- signs indicating the Maximum Permissible Vehicle Height and where applicable, Powerline Crossing Number shall be utilised where roadways pass under overhead power lines or structures;
- Floodway Crossing signs and Water Depth Indicators shall be utilised where designated floodways cross roadways; and speed signs.

4.3.2. T-Junction and Cross Road Intersection Signs

T-Junction and Cross Road intersection signs are to be used in conjunction with other intersection signage to warn road users or an upcoming intersection.

4.3.3. Delineators

Delineators should be provided to adequately define the edge of the running surface of a road.

Consider the following when selecting and placing delineators:

- delineator height should be adequate to match the equipment used on the roadway.
- the spacing of delineators on straight sections of road should be a maximum of 100 metres apart with the posts in pairs, one each side of the road.
- around tight curves and over crests the spacing of delineators should be reduced to a maximum of 50 metres or closer such that the reflectors from at least three delineators on the same side of the road can be seen at any one time whilst traversing the curve or crest:
    - for primary and secondary haul roads guideposts shall be between 1.5 and 2.4 metres high.
    - for primary and secondary access roads guideposts shall be a minimum of 900 millimetres high.
- delineator spacing should be reduced in areas subject to frequent visibility restrictions such as fog.
- delineator density should be increased to identify such things as culverts, median/centre safety berms, traffic islands, road intersections etc.
- the red reflector shall be placed on the left-hand side of the road and the white reflector on the right-hand side of the road.

4.4. Overhead Powerlines and Structures

In operational areas where overhead powerlines and structures are present, all HME shall:

- be measured to determine the equipment height (under normal travelling conditions; for haul trucks including the typical load height); and
- have equipment height stickers displaying that height affixed inside the cabin.

Any locations where overhead power lines or structures cross mine and access roads shall:

- be passively measured by survey (for power lines preferably at a time of lowest catenary);
- for overhead structures, have the maximum permissible vehicle height determined by applying a one metre minimum clearance distance;
- for power lines, have the maximum permissible vehicle height determined by the EEM using the minimum clearance requirements in Table 3;
- for power lines be recorded in a site register, indicating:
    - crossing location coordinates;
    - power line crossing number;
    - survey height, date and time;
    - power line voltage; and
    - maximum permissible vehicle height.
- have signs installed to indicate the maximum permissible vehicle height and where applicable, power crossing number; and
- install pre-warning clearance indicators at power line crossing locations where the height of any vehicle capable of operating on that road exceeds the maximum permissible vehicle height of the crossing.

Table 3 : Power lines minimum clearance requirements

Power Line Nominal Voltage (phase to phase) (KvA)	Minimum Clearance
≤ 1.1	1.0 m
> 1.1 ≤ 33	2.3 m
> 33 ≤ 66	2.5 m
> 66 ≤ 110	3.0 m
> 110 ≤ 220	4.0 m

4.5. Roads and Structures

Roads travelling under structures:

- with a clearance distance of more than 4.6 metres must have signage installed to alert drivers to minimise the risk of inadvertent contact; and
- where the clearance distance is less than any vehicle designated to operate on the road must have a physical barrier warning device.

4.6. Design, Construction and Certification Process

All haul roads will be designed in accordance with Recognised Standard 19 and this procedure and be issued by the Technical Services Department as part of the mine planning process.

Where physical constraints exist to prevent the construction of a road or intersection to the standards mentioned in this procedure, a Risk Assessment shall be undertaken to ascertain additional controls necessary to ensure risk is managed appropriately.

Once the intersection or road has been constructed, the mining supervisor and OCE shall inspect and complete the intersection checklist: VUL-FRM-20-02- Mine Intersection Inspection.

Any defects shall be communicated and actioned. Following the completion of the remedial actions, the completed inspection checklist shall be handed to the Tech Services Department for a survey compliance check and recording into the Intersection register.

4.7. Lighting pollution

Along roads and at intersections consideration shall be given to the following:

- the location and impact of background lighting and its potential to disorientate or confuse operators and/or members of the public whilst driving on haul roads, public roads and at intersections.
- the adequacy of lighting to ensure safe operations.
- additional lighting in areas where interaction with pedestrians occurs.
- the visibility of heavy vehicles and in particular, haul trucks during night operations.
- light absorption - any dark coloured material will absorb light and reduce visibility, e.g. high fines content of rejects leads to dusty matte surface rather than shinier flat surfaced fresh gravels.
- All lighting plants throughout the open cut excavation must have impact protection bunding established around them prior to operations commencing.

5. ROLES AND RESPONSIBILITIES

SSE	• Shall review and approve this procedure.
HST Superintendent	• Shall ensure that all provisions of this procedure are implemented, and that compliance is achieved.
Managers/Superintendents	• Shall be responsible for their area of operations and the implementation and application of this procedure; • Provide adequate training, information, structure and supervision to ensure that this procedure is implemented; • Carry-out a periodic review of activities to ensure the appropriate application and understanding of this procedure; and • Ensure immediate and appropriate steps are taken to investigate and rectify any risks to health and safety arising from these activities.
Supervisors	• Ensure all CMWs are familiar with, have access to and comply with the requirements set out in this procedure.
All CMWs (including visitors and contactor)	• Shall comply with the requirements of this procedure.

6. REFERENCES

- AS 1743 Road signs – Specifications
- Coal Mining Safety and Health Act 1999 (Qld)
- Coal Mining Safety and Health Regulation 2017 (Qld)
- Significant Incident 17 Dump truck with unbalanced load becomes unstable
- Safety Bulletin 34 Light vehicle incidents
- Significant Incident 38 Dozer runs over light vehicle
- Significant Incident 46 Haul truck reverses over quarry bench
- Safety Bulletin 99 Uncontrolled movement on mine roads, including skidding, sliding and light or heavy vehicle roll-over
- Safety Bulletin 135 Pedestrian and light vehicle interaction with loaders at surface mines
- Recognised Standard 19 Design and construction of mine roads
- VUL-SOP-129-Maintain and Water Haul Roads
- VUL-FRM-20-02- Mine Intersection Inspection

7. REVIEW

This document shall be reviewed at a minimum every two years, or as follows:

- when there is a change of method and/or technology and/or legal or other requirement that may affect the accuracy of this document;
- when operational changes occur that effect the currency of the document;
- when there has been a significant event to which this document was relevant; and
- as a result of relevant audit findings.

8. DOCUMENT CONTROL

Version	Date	Description	Document Controller
01	21/05/2020	Initial draft for review	Rachael Dacker
02	07/07/2020	Risk Workshop	Shane Johnson
03	29/04/2021	Review and Formatting	Nicole Davey
04	24/09/2021	Review and Formatting	Rachael Dacker
05	02/08/2023	Review and Update	Allira Spencer
06	22/05/2025	Review and Update	Kelly Jensen
07	20/11/2025	Review and Formatting	Kelly Jensen