MINING INDUSTRY
OCCUPATIONAL
SAFETY & HEALTH

MINERALS COUNCIL
SOUTH AFRICA

MOSH UNDERGROUND TRAFFIC MANAGEMENT TECHNICAL GUIDE CASE STUDY

"The BRMO approach towards the safe movement of persons and vehicles was to take a human-centered approach focusing on three pillars: people, collision avoidance technology, and process integration."

FULL DESCRIPTION OF THE RISK ADDRESSED

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 underground trackless operations significantly. Notwithstanding the prevailing requirements of all relevant legislation governing the operation and use of trackless mobile machinery (TMM) at any mine, the MOSH underground traffic management technical guide seeks to assist the mining industry to identify potential improvements to existing controls and operating procedures.

This case study documents the application of the MOSH principles at Assmang's Black Rock Mining Operations (BRMO) towards the application of traffic management principles in an underground environment. This process has enhanced existing measures aimed at preventing traffic-related accidents.

FINDINGS AND LESSONS LEARNED FROM THE ADOPTION OF THE PRACTICE OR IMPLEMENTATION OF THE COMPANY BEST PRACTICE

The approach of BRMO towards the safe movement of persons and vehicles was to take a human-centered approach focusing on three pillars, namely: people, collision avoidance technology,and process integration. This approach evolved into three focus areas which are safe people, safe vehicles, and safe roads.

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OVERVIEW

Mining company

Assmang Manganese

Commodity

Manganese

Operation/Mine

Black Rock Mining Operations (BRMO)

Health and safety case study

Application of the MOSH underground traffic management technical guide

Number of employees affected by the health and safety case study

1500

Stakeholders consulted

Full-time health and safety structures

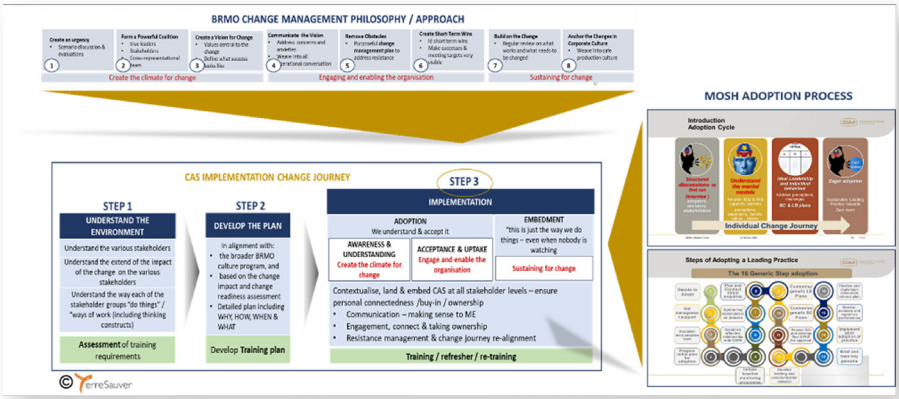
Occupations affected/benefited

Mine manager, production and engineering personnel, and technical service personnel

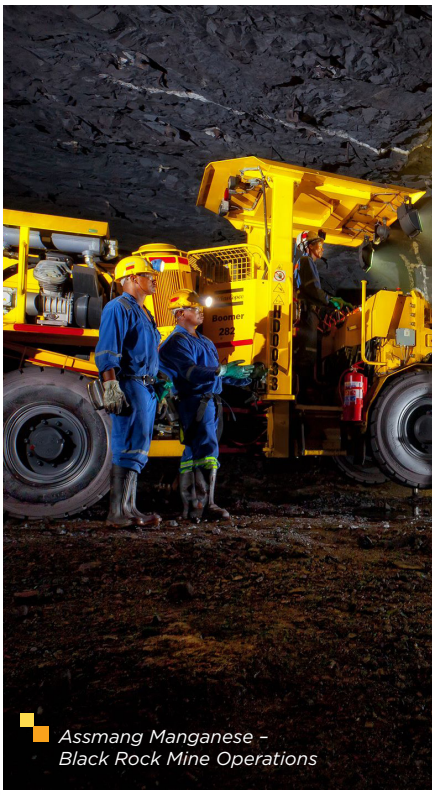
Above change management model made real:

1. Safe people

This recognized that human-centered change management is critical in the establishment of the foundation of traffic management, collision avoidance technology introduction and operational discipline to support the required changes. The process was designed through the merger of the MOSH adoption principles and Kotter's 8-step change management model applied on the mine. The outcome resulted in an integrated change management model as seen in the diagram below.



To orientate and gather buy-in from employees, several sessions were organized and led by the immediate manager down to each team supervisor. The mine's leadership team formed a critical component of the messaging and value add of the traffic management initiative. This approach was considered as a "Leader Led" approach. The process included facilitated focus group sessions with management by an external party focusing on key decisions and stage gates related to traffic management, safety messaging and leadership commitment. These sessions were then replicated by the management team to their immediate subordinates who also replicated the process with their teams. Some of the organizational people centered discussions included risk perception, control effectiveness, risk awareness and capacitating of change leaders.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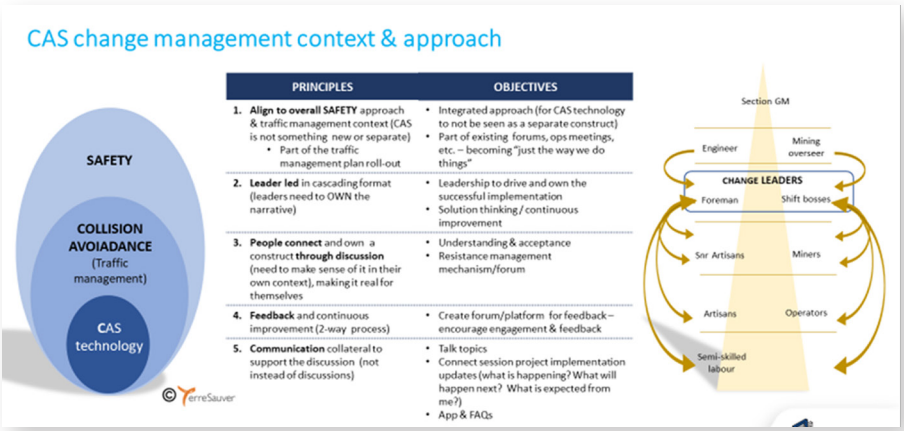
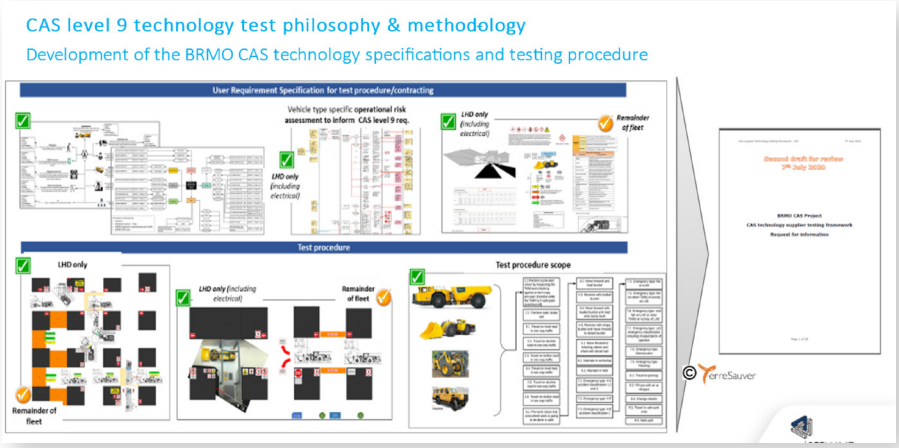


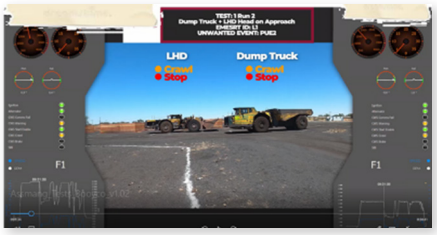
2. Safe vehicles

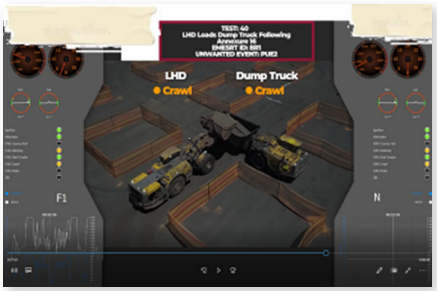
The effectiveness of collision avoidance systems (CAS) technology is a key enabler of the TMM safety drive within BRMO. Two main elements of this pillar included clear User Requirement Specification (URS) for CAS level 9 and a rigorous testing procedure to determine an appropriate technology supplier. The URS was developed based on 6 criteria namely, compliance, safety, accuracy, reliability, user friendliness and ease of maintenance. The input to the URS was drawn from extensive consultation with the following stakeholders:

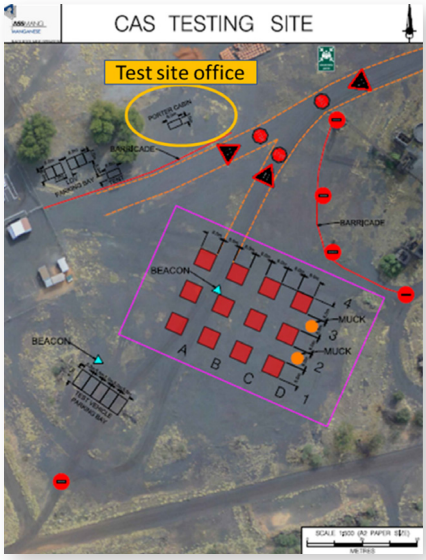
- Operators/ drivers
- Pedestrians
- Mining Production crews
- Training
- IT
- Management
- Maintenance resources
- OEMs
- Engineering resources
- Shareholders
- SHERQ resources

The responses from the above stakeholders to the URS were consolidated and incorporated into a technology supplier selection process document. This was issued on a tender to interested technology suppliers. The outcomes of the process resulted in the development of an onsite test facility with a clear CAS technology supplier testing framework. The test facility as seen in the diagram below was a replica of the most prominent underground conditions.



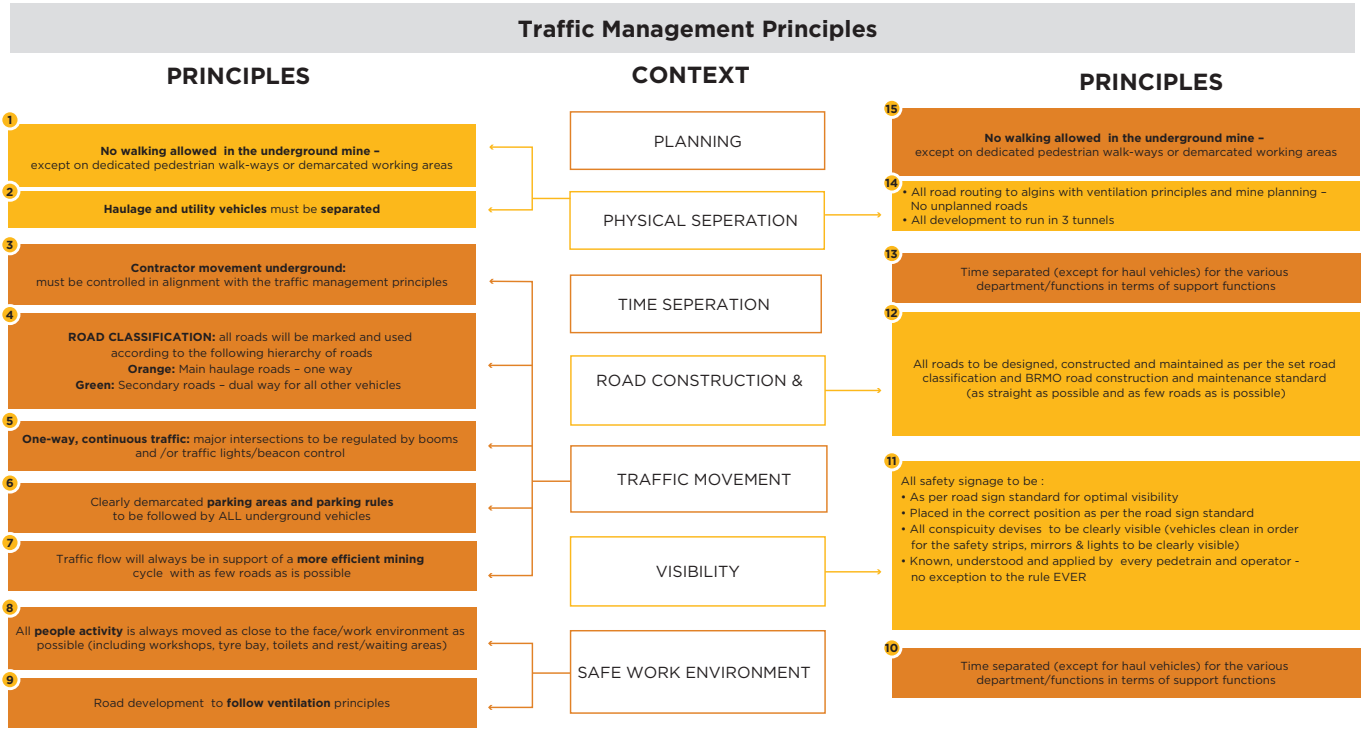




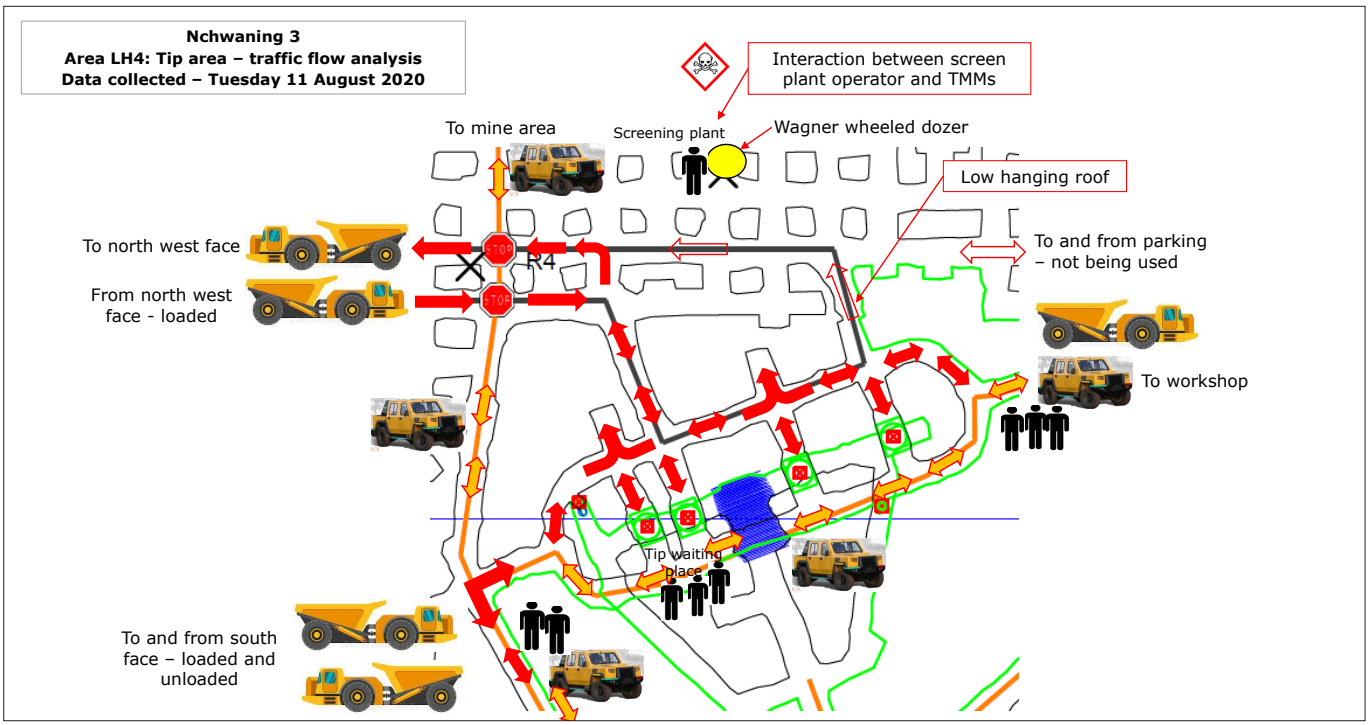


"The effectiveness of CAS technology is a key enabler of the TMM safety drive within BRMO. "

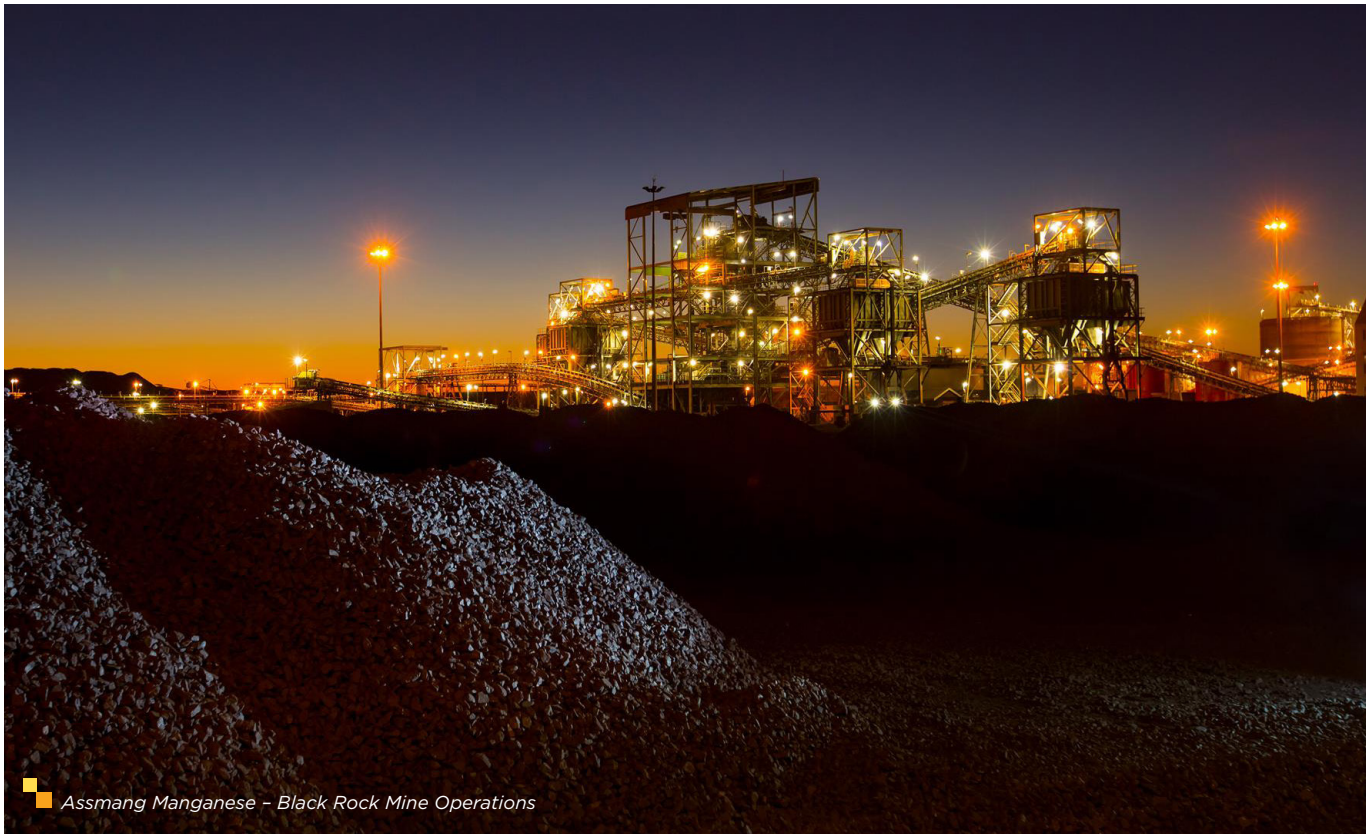
Further tests were conducted underground to corroborate surface outcomes. These tests provided insights on the impact of rock properties and elevation on the technology response and effectiveness. The outcomes of the surface and underground test results were incorporated into an overall CAS performance report.



Some of the findings from the discussions and physical verifications were presented as shown in the diagram below. This included the specific geolocation, direction flow, equipment type, pedestrian movement, and potential interaction points.



The analysis led to improved illumination at intersections and main haul road through the installation LED lights across the entire mine. The separation of the mine into various geolocations resulted in dedicated signages at various points which allowed for better directed traffic movement. Roadway maintenance has also become a priority during operational planning sessions.



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BENEFITS AND IMPROVEMENTS REPORTED BY AFFECTED STAKEHOLDERS

The operation managed to successfully identify all potential priority unwanted events (PUE) related to the movement of persons and TMM per geolocation by undertaking the traffic flow and risk analysis process. This led to the incorporation of traffic management principles into the short and long-term mine design, planning, and development. Separation now forms part of the critical thinking around the mining of BRMO orebody.

Dedicated travel routes for haul trucks resulted in the mine reducing the overall cycle times from loading to tipping areas while eliminating the risk of haul trucks colliding with other small vehicles. Operators have found this to be a key motivator as production targets are now efficiently achieved.

The people-centric change management approach enabled the mine to embed ownership of the traffic management principles across all levels of the organization including the technology-related controls. This is a good precursor for the introduction of CAS level 9 technology in underground operations.

MINE MOSH ADOPTION TEAM

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