

MINI PROJECT

**HAUL ROADS
MAINTENANCE
IN SURFACE
MINE**



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CONTENT

- 01** **Introduction**
- 02** **Haul road design**
- 03** **Routine maintenance activities**
- 04** **Structural maintenance**
- 05** **Safety considerations**
- 06** **Equipment and tools for maintenance**
- 07** **Environmental considerations**
- 08** **Cost-effective maintenance strategies**
- 09** **Conclusion**



INTRODUCTION

Haulroad maintenance plays a significant role in surface mining operations, ensuring safety, efficiency, and cost-effectiveness of material transport.

It is a critical component of a mine's overall transport operation, minimizing hazards and costs. Poorly designed or neglected roads can lead to increased rolling resistance, reduced speed, and higher operational expenses. A well-maintained haulroad leads to safer, efficient operations, but the process must be carefully managed to balance cost savings with safety and performance. Haulroad maintenance includes routine inspections and major repairs, preserving the road's structural integrity and functionality, managing wear and tear, optimizing road conditions, and ensuring the road network supports the mine's production requirements.

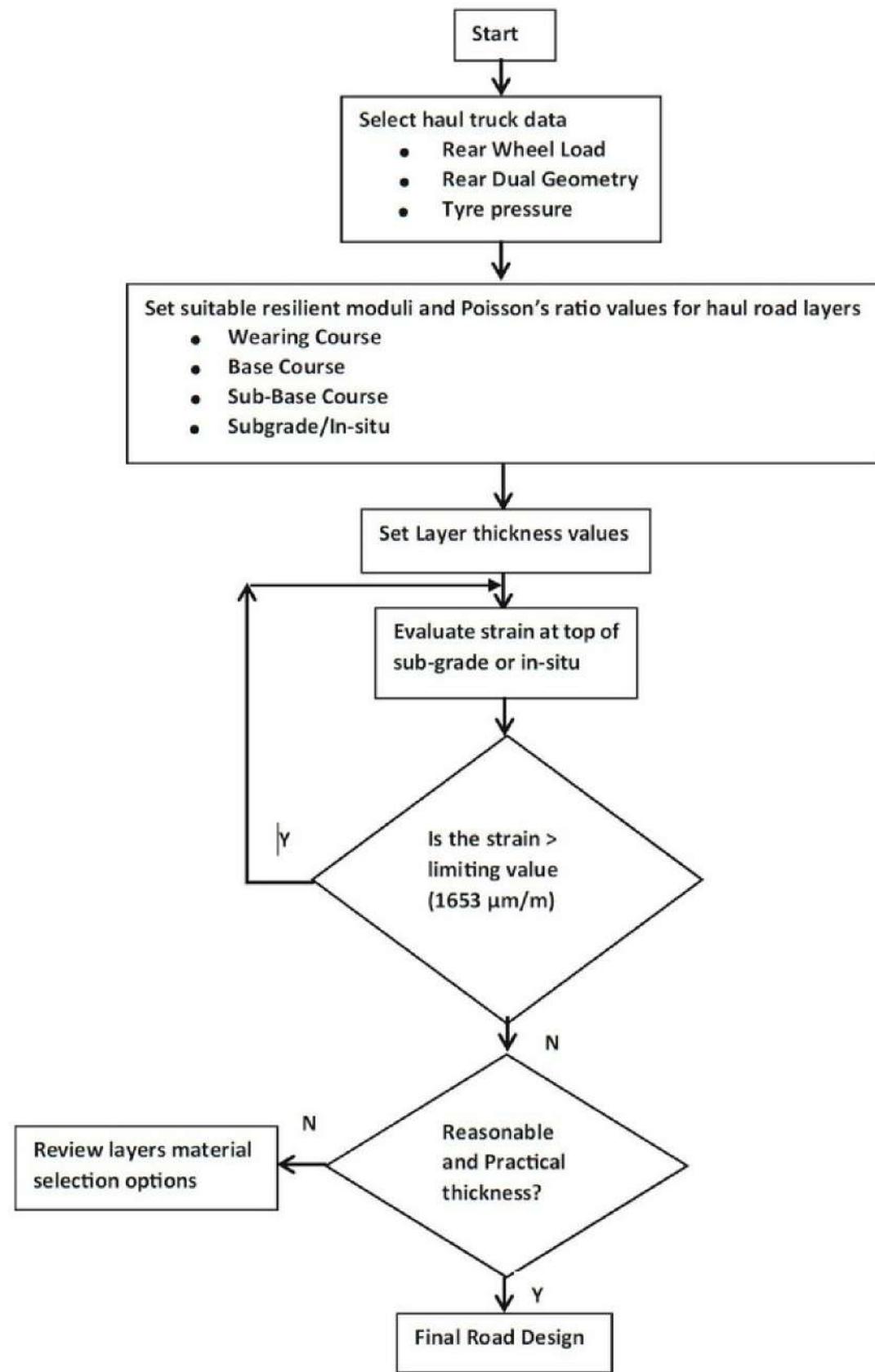
Haul Road Design

Haul road construction and maintenance procedures followed by various mines are based on past experience and trial and error methods..

Here there are some design parameters for mine haul road design as follows :

- Haul Trucks and Construction/Maintenance Equipment
- Haul Road Length
- Haul Road Geometry
- Haul Road Construction Materials
- Symptoms and Causes of Haul Road Deterioration
- Haul Road Maintenance
- Evolution of Haul Road Design at Syncrude
- Layer Thickness
- Construction Techniques

Haul Road Design



Routine Maintenance Activities

Routine maintenance activities in surface mines are essential to ensure the safety and efficiency of mining operations.

- **Regular Inspections:** Conducting daily inspections of haulroads to identify any irregularities or damage that may require attention.
- **Road Grading:** Regularly grading the haulroads to maintain a smooth and even surface, which is crucial for the safe operation of heavy vehicles.
- **Dust Suppression:** Implementing dust control measures, such as water spraying or the use of chemical suppressants, to improve air quality and visibility.
- **Pothole Repairs:** Promptly repairing potholes and other surface damages to prevent them from becoming larger issues.

Routine Maintenance Activities

- **Drainage Maintenance:** Ensuring that drainage systems are functioning properly to prevent water accumulation and erosion.
- **Vegetation Control:** Managing vegetation along the haulroads to maintain clear visibility and prevent root systems from damaging the road structure.
- **Surface Compaction:** Compacting the road surface to increase its density and load-bearing capacity, which helps to extend the road's lifespan.
- **Equipment Servicing:** Regular maintenance of the equipment used for haulroad maintenance, such as graders, rollers, and water trucks, to keep them in good working condition.
- **Safety Audits:** Conducting safety audits to identify potential hazards and implementing corrective actions to mitigate risks.

Structural Maintenance

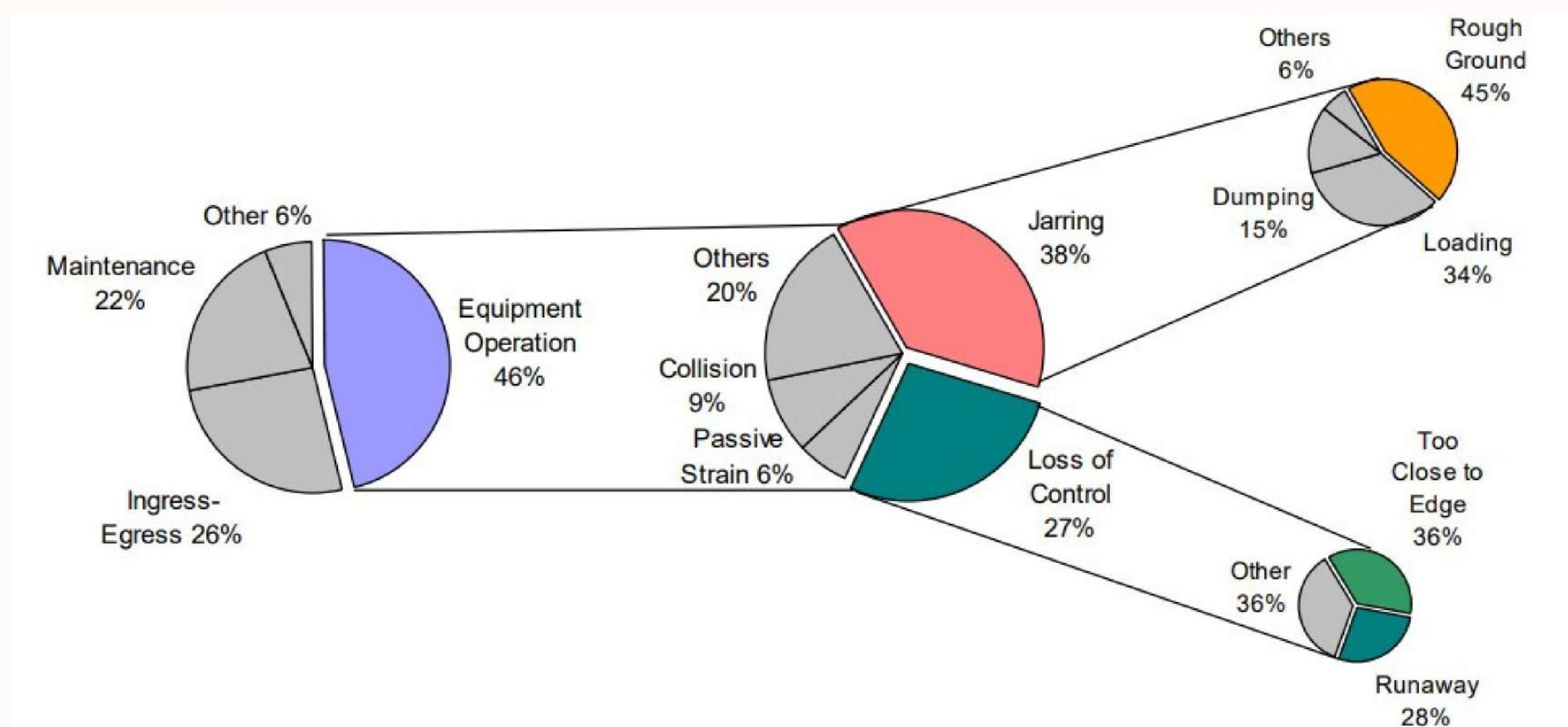
The maintenance system not only comprises the on-going application of product, but also the following proprietary processes as and when required:

- Sweeping (using specially designed mine haul road sweepers) to control dust, contamination and loose material on the surface established and treated with DASProduct.
- Skimming of the wearing course surface with a grader or similar means to remove heavy contamination and loose material
- Re-scarifying of the riding surface to maintain the integrity of the seal layer and retain adequate surface texture properties
- Pothole repair
- Repair of failed sections of the haul road
- Repair of damaged sections of the haul road

Safety Considerations

Safety Critical Defects In Mine Road Design

In their study of surface coal mining, equipment operation was the most common category of accident for haulage trucks (46% or 1251 accidents). Within the equipment operation sub-set, jarring (38%) and loss of control (27%) accidents predominate.



Safety Considerations

- **Geometric Design**
 - Junction layout
 - Safety berms
 - Road shoulders
 - Run-aways- brakes
- **Structural Design**
 - Jarring
 - Directional stability
- **Functional Design**
 - Dustiness
 - Poor visibility
 - Skid resistance
 - Large stones
- Well designed and maintained haul roads are the key to minimizing truck haulage on-road hazards and costs, as well as increasing productivity.
- Augmented design and management guidelines have been developed over the past decade, both in response to the requirements of mine operators for more safe and efficient haulage systems, and the truck manufacturers' requirements for a more predictable and controlled operating environment.

Environmental considerations

Environmental considerations for haul road construction and maintenance are crucial for reducing dust generation, minimizing soil erosion, enhancing water management, and promoting sustainable practices.:

- **Dust Control:** Dust generated from haul roads can have detrimental effects on air quality, vegetation, and nearby ecosystems. Well-designed haul roads incorporate dust control measures such as surface stabilization, watering, or the application of dust suppressants.
- **Soil Erosion:** Erosion caused by water runoff can lead to soil degradation, sedimentation in water bodies, and loss of fertile topsoil. Well-designed haul roads incorporate proper drainage systems and erosion control measures, such as erosion control blankets, sediment control basins, or retaining walls.
- **Water Management:** Improperly designed or poorly maintained haul roads can contribute to water runoff issues, leading to localized flooding, soil erosion, and sediment transport into water bodies. Well-designed haul roads prioritize proper water management by incorporating culverts, drainage channels, or retention ponds.

Environmental considerations

- **Environmental Impact:** Haul road construction and maintenance should consider the broader environmental impacts, including water consumption, diesel usage, operational costs, carbon emissions, and road maintenance.
- **Non-Corrosive Alternatives:** Magnesium Chloride and Calcium Chloride are popular for dust control but possess highly detrimental corrosive properties, making their widespread use a danger to local water bodies and nearby roadside vegetation. Non-corrosive alternatives, such as DUST/BLOKR®, are more attractive due to their environmental benefits and safety implications.
- **Organic Solutions:** Hydrocarbon-based dust suppressants have negative environmental impacts, such as harmful hydrocarbon contaminated run-off when it rains and potential slippery conditions in wet weather. Organic solutions, like DUST/BLOKR®, offer a completely organic solution with no risk to the environment or human/animal health risks.
- **Sustainable Approach:** Traditional dust control methods relying on frequent watering or hydrocarbon-based products are outdated. Adopting an intelligent and sustainable approach, such as using non-corrosive and organic dust suppressants, is crucial for preserving mine haul roads and minimizing environmental impact.

Equipment and tools for maintenance

- 1. Water Blasters:** Used for high-pressure cleaning, water blasters like the Autocar ACX or ACMD are recommended for projects requiring intense cleaning.
- 2. Water Tankers:** Essential for transporting materials like hot asphalt, the Autocar DC-64D is suitable for construction and road maintenance tasks.
- 3. Paint Stripers:** For painting lines on roads, the Autocar ACMD is a reliable truck that can carry ample paint and create clear lines on pavements.
- 4. Street Sweepers:** These trucks are used for cleaning streets and are vital for maintaining road cleanliness and safety.



Cost-effective maintenance strategies

Cost-effective maintenance strategies for haul road maintenance include:

- **Routine grading, compaction, and application of dust suppressants or surface treatments:** Regular surface maintenance helps maintain a smooth, stable, and dust-free road surface, enhancing vehicle traction and reducing wear and tear.
- **Drainage management:** Clearing debris, sediment, and vegetation from drainage channels, culverts, and ditches prevents waterlogging and erosion, preserving road stability and preventing surface degradation.
- **Pothole repair:** Prompt filling and patching of potholes and surface defects prevent further deterioration and ensure safe driving conditions.
- **Geotechnical stabilisation:** Monitoring and addressing geotechnical issues such as slope instability, erosion, and subsidence through techniques like slope reinforcement, embankment repairs, and water management measures.
- **Remote monitoring and predictive analytics:** Integrating remote monitoring technology and predictive analytics enables the early detection of maintenance issues. Real-time data collection and analysis allow mining companies to anticipate road deterioration and implement proactive maintenance, reducing downtime and operational disruptions.

Cost-effective maintenance strategies

Cost-effective maintenance strategies for haul road maintenance include:

- **Design considerations:** Proper design of haul roads, including traffic volume and composition, geotechnical conditions, water management, and traffic management, can significantly reduce the need for routine maintenance.
- **Innovative approaches:** Adopting sustainable materials, such as recycled aggregates from reclaimed asphalt pavement (RAP) or recycled concrete, can offer durability and cost-effectiveness while reducing the environmental impact of mining.
- **Preventive maintenance:** Implementing preventive maintenance strategies, such as regular inspections and timely repairs, can help extend the life of haul roads and reduce the need for costly corrective maintenance.
- **Training and education:** Providing training and education to equipment operators and maintenance personnel on best practices for haul road maintenance can help reduce wear and tear and prolong the life of the road.
- **Optimising maintenance schedules:** Regularly reviewing and optimising maintenance schedules based on factors such as traffic volume, road condition, and weather patterns can help ensure that maintenance activities are carried out at the most cost-effective times.

CONCLUSION

Haul road maintenance emphasizes the importance of proactive and data-driven strategies to optimize road conditions, enhance production efficiency, reduce maintenance costs, and improve operator safety and morale. By leveraging real-time strut pressure data, payload readings, and GPS coordinates, mining operations can identify and prioritize sections of haul roads that require maintenance, leading to quantifiable improvements in production, maintenance costs, and operator well-being.

The significance of adopting advanced monitoring technologies, prioritizing road maintenance based on data-driven insights, and continuously improving maintenance practices to achieve optimal haul road conditions, operational efficiency, and overall cost-effectiveness in mining operations

CONCLUSION



Predictive Maintenance:

True predictive maintenance, focusing on road conditions influenced by truck speed, payload, and other factors, can prevent failures and enhance production efficiency



Data-Driven Approach.

Utilizing real-time data on road conditions, such as strut pressure and payload readings, allows for intelligent road maintenance prioritization and dispatching of road crews to high-impact areas



Benefits

Improvements in production efficiency, reduced maintenance costs, and enhanced operator health and safety are the direct outcomes of effective haul road maintenance strategies

THANK YOU