Off highway truck dump body maintenance strategy (Trends and Perspectives)

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Abstract
This paper aims to offer detailed insights into the planning, scheduling, and execution of preventive maintenance (PM) strategies that are crucial for sustaining the lifecycle of truck dump bodies, thereby fostering an effective maintenance framework. Observations indicate that crack formation and accelerated wear on mining haul trucks result from exposure to varying loads and loading cycles, which adversely affect metal structures and can lead to premature failure of the dump body. The dump-body mining haul truck, primarily utilized in transporting and unloading ore within mines and large civil earthworks, faces numerous challenges including material density, road conditions, distance, slopes, and curves. These factors not only impact the truck's dump body material but also contribute to the risk of sudden catastrophic failures, necessitating urgent maintenance interventions. The suspended dump body is typically connected to the main chassis frame via hydraulic tilt cylinders and rear pivot pins. Constructed from robust steel and hardox materials that resist punctures, abrasion, and tearing, this paper will delineate a periodic maintenance strategy essential for ensuring long-term efficiency and safe operation. Despite limited existing literature on dump truck body maintenance, this work seeks to provide valuable contributions for researchers and organizations aiming to enhance tray longevity.

Keywords- Maintenance, dump body, tray, field Insight, asset management, maintenance strategy, reliability, preventative maintenance, predictive maintenance, condition-based maintenance, Inspections, corrective maintenance.

Introduction

Dump bodies are high-wear components requiring regular inspections and management to maximize their potential. This paper emphasizes integrating periodic maintenance initiatives into a comprehensive dump tray maintenance plan aimed at enhancing longevity, reliability, safety while minimizing downtime and maximizing productivity. Some suspended dump trays can handle up to 240 metric tonnes per cycle. The challenging nature of aggressive materials loaded onto these trucks leads to continuous stress development on wear plates as well as fatigue around anchor pins [1]. Without adequate planned inspections or maintenance during ongoing operations, rock masses can negatively affect the metal structure of the dump body leading to varied degrees of wear and cracking [2]. This article proposes a systematic approach for early identification of potential failures along with timely maintenance interventions designed to extend the lifespan of dump trays.

Implementing a preventive maintenance program for truck dump bodies offers multiple benefits such as improved reliability, extended lifecycle, enhanced performance metrics, reduced downtime, and adherence to safety regulations. The discipline of maintenance management employs engineering principles for planning routine upkeep tasks related to mining equipment. This document will demonstrate that maintaining dump bodies should incorporate established standards while optimizing operational procedures to maintain maximum tray reliability and safety.

Furthermore, this paper discusses how software like Field-Insight can streamline scheduling processes by providing timely alerts, real-time data reporting capabilities, facilitating work order management while optimizing parts inventory alongside other systems involved in maintenance.

Additionally illustrated herein is a pitstop strategy designed for daily inspection of dump truck trays during operation to prevent unforeseen breakdowns while ensuring seamless functionality. Technologies employed for measuring thickness in dump bodies—such as ultrasonic methodologies—will also be explored for determining wear rates along with necessary adjustments for wear plates.

Truck dump body maintenance initiatives

Dump bodies on haul trucks face considerable wear due to heavy loads that increase strain on tray linings as well as hinge pin lubrication systems. Such loads may induce elastic stress within the body structure leading potentially towards crack formation.

1.Inspection maintenance strategy

The guidelines provided herein outline a practical checklist intended for monitoring the condition of dump trays through planned inspections focused on various aspects of their integrity. Each inspection must be documented both verbally and digitally using mobile devices capturing images alongside notes on observations or measurements —as exemplified by Table 1 below. Inadequate record-keeping exposes organizations not only to regulatory non-compliance but also elevates risks associated with audits or accident investigations. Checklists containing built-in documentation features serve as compliance proof required under FMCSA regulations alongside internal quality assurance protocols.

Table 1: Tray inspection sheet (Source: intranet)

Truck Number			
Date			
Inspector Name			
	Comments	**Good**	**Cracks/Bad**
Dump body (cracks, damage, wear) Location			
Hoist cylinders (pins, bushings) Play			
Tailgate and hinges (free play, wear, side play)			
Pivot points and pins (play , lubrication)			
Body-to-frame mounting (cracks, wear)			
Body liner (wear (mm))			
Paint work/ Discolouration			

The checklist should encompass visual assessments targeting leaks or damages alongside functional evaluations confirming operational efficacy while ensuring safety systems function properly. Basic servicing measures must also be included to mitigate contamination risks all documentation steps contributing towards compliance records generation are critical here too. Actual intervals between inspections should reflect usage intensity combined with environmental conditions rather than adhering strictly fixed schedules since cracks or corrosion may compromise safe load release conditions resulting in tip-over hazards if overlooked early enough through visual checks coupled with functional tests allowing prompt repairs before escalating issues arise endangering operators or surrounding personnel particularly under FMCSA regulations [3]. More thorough examinations frequently occur daily weekly monthly basis endorsed further by company policies enforcing annual reviews particularly crucial within high-utilization fleets operating under adverse conditions which may warrant increased frequency dictated instead through pragmatic risk assessments evaluating actual equipment performance instead arbitrary timelines set forth originally.

Dump body wear and thickness tests

Assessing wear levels along with thickness measurements remain vital practices aimed at ensuring optimal performance across your fleet's dumping operations where specific methods/tools used include:

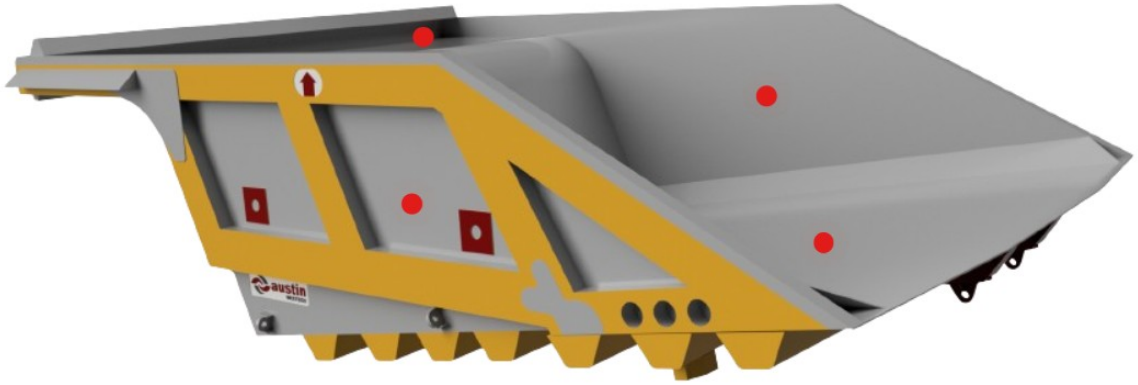


Diagram 1: Truck dump body (Source:[4])

Track Treads Management Software

Track Treads Tray Management Software is an advanced Digital solution designed to maximise the lifespan of your trays in both surface and underground mining operations. The system uses inspection data and predictive analytics to identify accelerated wear in components, and cracks so that proactive maintenance can be executed to avoid potential failures before they lead to costly downtime.
Bluetooth – Connects with ultra-sonic tool
Camera – attaches images to components
Limits – 0% and 100% dimensions for quick
Worn– Calculates automatically
Measurement image – quick reference for how to measure this component with the tool
Previous Inspection Reading– For comparisons

Ultrasonic thickness measurement

Ultrasonic thickness measurement (UTM) is a non-destructive technique that calculates material thickness (T = V x t/2) by measuring the time (t) an ultrasonic pulse takes to travel from a probe, through the material, and reflect off the back wall. This is a general procedure that describes the methods and principles for manual ultrasonic thickness measurements and corrosion monitoring of metallic materials. The examinations are to be carried out by direct contact, based on measurement of the time of flight of ultrasonic pulses. The procedure covers the measurement of materials and components in-service, during manufacture or under repair.

Flaw and crack detector test

Crack detection methodologies applied across various surfaces utilize three-stage non-destructive testing frameworks encompassing cleaner penetrant developer revealing surface anomalies present without compromising underlying metallic structures,
Components: The system includes a cleaner, a penetrant, and a developer.
Functionality: It shows up cracks as red lines and porous areas as red pinpoints on all types of metals.
Applications: It is used for inspection of tools, incoming materials, and welded areas to ensure they are free of defects and potential fatigue cracks
Advantages of Flaw and crack detector test

Non-destructive testing: It allows for the inspection of metal components without damaging them, preserving the integrity of the materials.
Visual detection: The system provides clear visual indicators of defects, making it easier to identify and address issues.
Versatility: Suitable for various metals and applications, including weld inspection, incoming materials inspection, and general engineering.
Cost-effective: It is a fast, economical, and reliable method of visual detection, reducing the need for costly repairs or replacements.

2 periodic maintenance strategy

Greasing the body lubrication points is recommended on a weekly basis. Start by greasing the rear hinge points, located on each side of the lower rear body. Then, raise the bed to provide easy access to tailgate hinge points and the high lift hinge point, if equipped. With the body raised and safety props in place, grease the lower hoist cylinder pivot point. Some hoist cylinders may be equipped with a grease fitting on the top pin. If so, this pin can be accessed through the hoist well cover inside of the bed. Regularly greasing these lubrication points prevents wear and tear on the equipment and keeps it operating smoothly. It is essential to keep the dumb body clean to prevent the buildup of corrosive materials that may be encountered in the field. Washing the body regularly will help prevent rust and other types of damage.

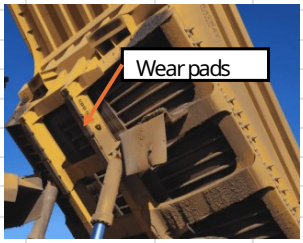
Truck Dump Body Maintenance Strategy

Preventative Maintenance | **Corrective Maintenance**

Predictive Maintenance	Planned Maintenance	Reactive Maintenance
Create work orders to execute	Execute and close work orders	Repair and close work orders
Daily tray pins lubrication	Daily pit tray inspection	Minor crack weldings
Tray bed cleanout(stuck debris)	Dove tail reinforcement	Dove tail damage repairs
Tray thickness wear measurement	Tray bushes play clearance	Accident damage repairs
Tray reinforcement	Tray hinge bearing change out	Wear plates replacement
Check tail gate operations	Hoist cylinder bearings change out	
Check tail gate latches	Inspect dump body for damage/cracks	
Verify cycle dump bed	Check dump body wear pads	
Test hoist under load-	Inspect dump body structural integrity	
for slowcycle or signs of sticking	Confirm bed liner is intact and not warped	
Verify payload weighing systems	Check for cracks or weld fatigue in trailer frame	
Monitor product improvement	Verify dump tray auto lube if installed	
Check for corrosion	Check for structural damage	

Figure 3: Truck body maintenance plan (Source: intranet)
The dump body is one of the most important components of a dump truck. However, due to the heavy-duty nature of its work, it is vital for maintenance to follow the planned routine mechanical activities listed in Figure 3 above. To minimize the need for extensive repairs, implementing a regular maintenance schedule is essential. Preventative maintenance helps identify potential issues before they become major problems and ensures that your dump truck operates efficiently.

	Truck dump body maintenance strategy	
	Raise body fully and secure with safety props	
24Hr PM	**Daily tray maintenance**	**Actions**
1xMechanic	Check for trapped material	Remove and clean load bin
1xWelder	Inspect for liner buckling	Advice proper loading procedure
	Check for accident damages	Report & raise work order
	Check for over loading signs	Report & clear roll over material
	Test hoist bearing excessive play	Record & report abnormal play
	Check for visible cracks	Record and report all cracks
	Check and test pins greasing	Manually grease all the pins
	Check body wear pads	secure loose bolts or replace
	Check dove tail wear plates	Report peeling plates
250Hr PM	**Weekly tray maintenance**	**Actions**
1xMechanic	Clean/wash the machine	Remove trapped material
Welder	Manually grease all grease points	Record actions carried out
Operator	Start and lift/drop tray	Record the play on bearings
	Check tray pin locks	Secure pin locks in position
	Check bin lining wear	Report and repair minor cracks
	Check for operational damages	Report damages
1000Hr PM	**Monthly tray maintenance**	**Actions**
1x wash bay	Wash down the dump body	spot cracks during cleaning
1x mechanic	Major bin cracks repair	Repair all visible cracks
1x welder	Use NDP to check liner thickness	Raise work order for shutdown
	Check tailgate hinges, pins, latches for wear	Repair immediately
	Inspect body to frame mounting points	secure loose bolts or replace
	Test body operation through complete cycle	Adjust and secure
	create back logs for major body repair work	Plan for shutdown repair
	protect all welding with paint work	Protect rust and oxidation
Shut Down PM	**Quartely tray maintenance**	**Actions**
1x wash bay	dump truck bed liner repair	attend to all tray repair work orders
1x mechanic	Repair all backlogs	close work orders when complete
2x welder	Reinforce bin/dove tail	Complete outstanding backlogs
1xAssistant	Inspect body to frame mounting points	Repair and replace
	paint all work for durabiliity	apply red oxide and paint



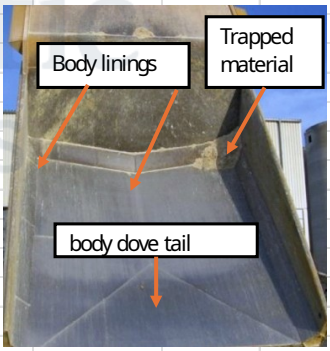


Figure 4: Planned Periodic maintenance strategy (Source: intranet)

Figure 4 above illustrates these step-by-step planned procedures for key maintenance tasks on your dump truck to ensure proper service and maximum component life. These maintenance intervention actions integrate most aspects of maintenance inspections planning, scheduling execution, and reporting, thereby enhancing coordination and streamlining component preservation processes [5].

Conclusion

The suspended dump body is not a mere component; it's a high-performance, engineered system that actively contributes to a more efficient, more reliable, and more profitable mine. Maintaining and repairing the dump body of your commercial dump truck is essential for ensuring its longevity, safety, and efficiency. By staying proactive with inspections, preventative maintenance, and choosing the right repair services, you can avoid costly breakdowns and keep your dump truck in top working condition. The trends highlighted in this literature review reflect the dynamic nature of the field and underscore the importance of adopting innovative approaches to maintenance. By addressing the challenges and embracing future directions, industries can enhance their maintenance practices, optimize asset performance, and achieve long-term operational success.

Refences

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