THE EFFECT OF REINFORCEMENT PLATES FOR MINING TRUCK MAIN FRAME RAIL CRACKS

UNDERGRADUATE THESIS

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PLAGIARISM REPORT

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The Effect of Reinforcement Plates for Mining Truck Main Frame Rail Cracks

Indonesia is known for being the largest archipelagic country located in Southeast Asia and Oceania between the Indian and Pacific Oceans. Based on its geographic location and environment, Indonesia can be classified as a tropical country with plentiful natural resources. It is the world's largest exporter of thermal coal, refined tin, and (until the enforcement of the export ban in 2015) nickel ore. It is also a leading exporter of gold, bauxite, lead, zinc, and copper [1]. Through the occurrence of these natural resources, Indonesia's mining industry plays a significant part in the country's economy.

The current mining industry in Indonesia has been growing since the 1850's, starting to become more regulated and structured in the 1950s. Over the years, the industry's output has continuously grown, achieving the highest industrial growth of 7.78% Year over Year in the 3rd Quarter of 2021. At the same time, the productivity of the mining sector has grown rapidly, indicating that Indonesia can be one of the top countries to produce mining products for both raw materials and value-added goods [2]. However, the distribution of resources varies by region. While some regions are dominantly covered by mining reserves, others are not. The Grasberg mine in Papua has the world's third-largest copper reserves and the world's biggest gold reserves whilst East Kalimantan's GDP is mostly derived from direct exploitation of natural resources, such as coal [1].

With all these potential resources, with correct usage, many benefits can arise as Indonesia is still a developing country. When benefits flow to the community, the exploitation of natural resources provides a road out of poverty. As the revenues generated in the primary sector flow into the economy, increasing the fiscal take for the government. With the right policies, these revenues can help transform natural capital into physical, social, and human capital [1]. Despite this reality, there are still many challenges that act as a barrier in utilizing and marketing the available resources.

The mining industry, like any other industry, contains main sectors and several highly specialized niches within it. The mining industry accounts for prospecting, planning, and permitting the mine, extraction of raw minerals via surface mining and/or underground mining techniques, processing and mineral dressing, and the restoration or reclamation of the mine at the end of its economic life cycle [3]. The most distinctive duties are the extraction and processing of raw materials. These extractions are mostly done through,

·surface mining, also called open pit mining

·underground mining.

In the mining process, heavy equipment and machinery play an important part. Tasks anywhere from exploration, ground preparation, extraction and hauling are done by large machines and their operators. Blasthole drills are used to prepare the ground for explosives, dragline or hydraulic excavators and dozers are used to move overburden; loaders and haulers help transport ore and waste; and hoppers and trommels separate ore from waste. In recent times, partial and full autonomy has found its way into the mining industry from haulers and loaders to continuous miners [3].

The Mining Truck, often referred to as off-highway-truck (OHT) is a mobile piece of equipment used for material transportation. The truck is loaded by shovels, excavators, or wheel loaders. Procuring mining trucks requires large sums of capital to be invested by the owner. The trucks can run for up to 30 years through multiple rebuilds or lifecycles.

Due to the harsh operating conditions on mine sites, structures on heavy equipment can fatigue and fail over time. Risks include poor haul road conditions, problematic contamination control of compartments and lubricants, exposure to extreme weather, over-loading and operator-induced mechanical problems [3].

Besides wear and fatigue of certain components or parts such as tires, dump body, and canopy, another recurring problem is the damage to the main frame (also referred to as chassis) of mining trucks. The main frame is the base of the truck, like a chassis of a car. As stated by Richard Toner, president of Toner & Associates (Pentwater,

ABSTRACT

One of the most widely used haul trucks in Indonesia's mining industry is the 100 metric ton class mining truck. It is popular for its excellent lifecycle costing and well-known for its sturdy design, reliability, and compatibility with the country's operating environment. However, recent years have seen reports of issues with recurring main frame rail cracks that have the potential to affect the structural integrity, durability, and overall lifetime of the truck. For this comparative study, the aim is to understand and quantify the effectiveness and durability gains through adding internal stiffener plates into a truck's main frame. The study focuses on the background data provided by the mining industry to conduct statistical analysis, failure analysis, and simulations through finite element analysis (FEA). Through these testing methodologies the efficiency and performance of the reinforcement plates can be quantified, offering valuable insight into material properties and areas for future improvements.

***Keywords**: FEA Simulation, Plates, Mining Truck, Main Frame Rail Cracks.*

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NOMENCLATURE

Symbol	Description	Unit
σ	Tensile Strength	*MPa*
σ_y	Yield Strength	*MPa*
υ	Poisson's Ratio	
ρ	Density	Kg/m^3
E	Young's Modulus	*MPa*
F	Force	*N*
σ_{vm}	Von Mises Stress	N/m^2
σ_{all}	Allowable Stress	*MPa*
SF	Safety Factor	
S_{ut}	Ultimate Tensile Strength	*MPa*
S_e	Endurance Limit	*MPa*
S_l	Low Life Limit	*MPa*
σ_m	Mean Stress	*MPa*
σ_a	Alternating Stress	*MPa*
N	Component Life Cycles	