

Technical Article-1

Study of Payload for Komatsu HD785-7 Dump Trucks at Khondbond Iron Mine

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Introduction:

Komatsu HD785-7 Dumper is a heavy-duty dump truck used in mining operations. It is powered by a Komatsu SAA12V140E-3 engine with a net horsepower of 879 HP. The dump truck has a payload capacity of 91 metric tons and a body capacity of 60 cubic meters (Heaped 2:1). It is known for its durability, reliability, and efficiency. Khondbond Iron Mines operates 10 dump trucks to mine



out the ROM and overburden material. One of the critical factors that determine the productivity of this dumper is its payload capacity. Payload capacity refers to the amount of material that the dumper can carry in a single trip. Therefore, improving the payload of this dumper will significantly enhance its performance and efficiency.

When fully loaded, the Komatsu HD785-7 dump truck has a load distribution of approximately 31.5% on the front axle and 68.5% on the rear axle. It is important to note that the load distribution may vary depending on the specific configuration of the dump truck and the type of payload being transported. Additionally, the load distribution may need to be adjusted based on the terrain and driving conditions to ensure optimal performance and safety.

Factors Affecting Payload:

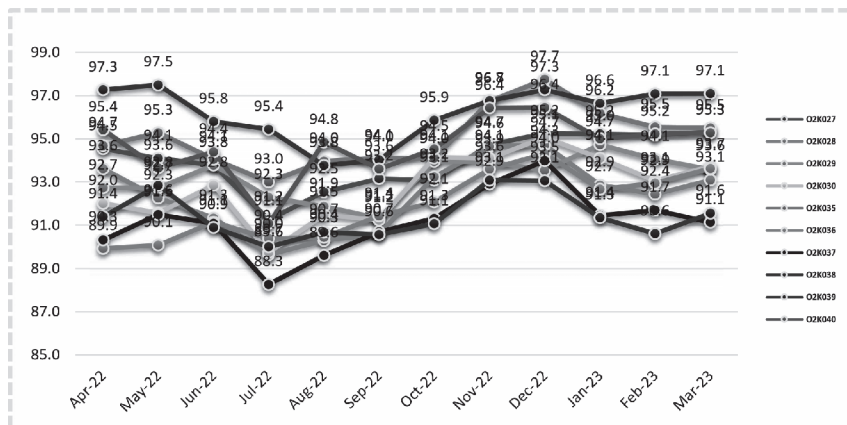
There are several factors that affect the payload capacity of a dump truck. These include the size and weight of the vehicle, the type of material being carried, the terrain, and the environmental conditions. In the case of Komatsu HD785-7 Dumper, the following factors affect its payload capacity:

1. **Weight of the vehicle:** The weight of the dumper itself reduces the amount of material that it can carry. Therefore, reducing the weight of the vehicle can increase its payload capacity. Empty vehicle weights around 72.30 tons and Gross weights was 163.3 tons with maximum load carrying capacity 91 tons.
2. **Engine Power:** The engine power of the dumper determines its ability to carry heavy loads. A higher engine power will enable the dumper to carry more material. Engine having Gross Horsepower of 895 kW.
3. **Suspension System:** The suspension system of the dumper affects its ability to carry heavy loads over rough terrain. A robust suspension system will enhance the dumper's payload capacity. Dumper is having Mac person type independent suspension at axle and hydropneumatics types of suspension system.
4. **Dump Body Capacity:** The size of the dump body determines the amount of material that the dumper can carry. Increasing the size of the dump body will increase the dumper's payload capacity.
5. **Blast Fragmentation:** Blast fragmentation refers to the size and distribution of the rock fragments produced during blasting. When the rock is fragmented into smaller pieces, it can increase the overall weight of the material being hauled, potentially reducing the payload capacity of the dumper.
6. **Face Dimension:** Face dimension is another important factor that can impact the payload capacity of dumpers. A larger face dimension typically means that more material needs to be hauled, which can reduce the overall payload capacity of the dumper.

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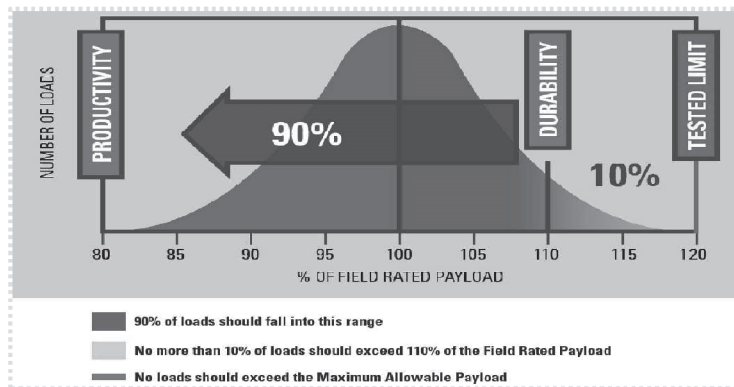
- Haul road: Haul Road condition refers to the surface condition of the road used for transporting materials. A poorly maintained or uneven road surface can increase the rolling resistance of the dumper, which can decrease its payload capacity.
- Road gradient: Road gradient is another factor that can impact the payload capacity of dumpers. A steep road gradient can increase the rolling resistance and reduce the speed at which the dumper can travel, thus reducing its payload capacity.
- RR: Rolling resistance is the force that opposes the motion of a rolling object, such as a dumper. Higher rolling resistance requires more energy to move the dumper, which can decrease its payload capacity.

Average Payload Trend of Komatsu HD785-7 Dump Trucks :



Komatsu HD 785-7 Loading Policy:

To balance the desire for maximum payload with the importance of optimizing machine and component life, Komatsu uses a 10/10/20 policy - recommending that no more than 10% of loads are over 110 % of target payload and never exceed 120%. The mean of the payloads should not exceed the target payload. To help you ensure you're meeting production goals while adhering to this policy, it's essential that you are accurately measuring payload.



Loading Efficiency:

For an operation to benchmark its operating practices, the following guidelines are suggested:

- Good: 80% of the loads within a $\pm 10\%$ range of the Field Rated Payload
- Excellent: 90% of the loads with a $\pm 10\%$ range of the Field Rated Payload

Placement of Payload:

Not only is component life impacted by the amount of payload, but it is also impacted by the placement of the payload. A decrease in component life will occur from improper load placement. Specifically, there are three types of improper load placement, load shifted towards the front, load

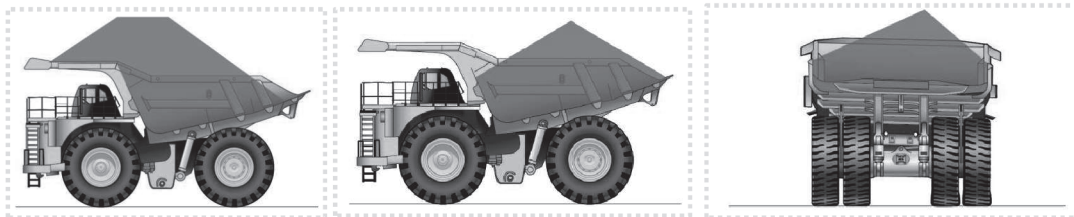
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shifted towards the rear, and load shifted towards the side. All three types of improper load placement negatively impact frame and body life.

If the load is shifted towards the front, the front brakes, bearings, front tires, steering, hydraulic hoist, body rest pads, and body canopy will be negatively impacted. Trucks with correct load placement and incorrect load placement with the load shifted towards the front.

If the load is shifted towards the rear, the final drive and rear tires will be negatively impacted. Furthermore, the payload will become unstable and dribble off the back of the body. Trucks with correct load placement and incorrect load placement with the load shifted towards the rear.

If the load is shifted towards the side, the final drive, bearings, hoist cylinders, and pivot bore areas will be negatively impacted. Trucks with correct load placement and incorrect load placement with the load shifted towards the side.



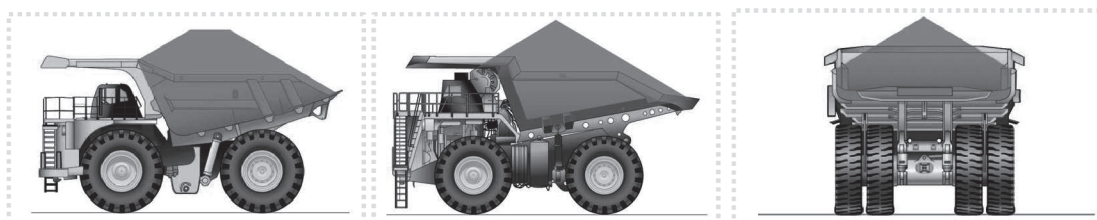
Dumpers Payload Monitoring:

Dumper payload monitoring is a critical aspect of mining operations, and there are several global practices for ensuring safe and efficient operations. Here are some of the most common practices:

1. **Load Monitoring Systems:** Load monitoring systems are widely used to measure the weight of the dumper payload accurately. These systems consist of load cells mounted on the dumper truck and provide real-time information to the operator about the weight of the payload. This helps the operator to avoid overloading, which can lead to accidents.
2. **Payload Management Systems:** Payload management systems are advanced systems that provide more than just weight measurements. They can measure and report payload volumes, densities, and other metrics that help operators optimize their loads and increase efficiency. These systems are especially useful in large mining operations where hundreds of dumpers are in operation.
3. **Automated Dumper Systems:** Automated dumper systems are becoming increasingly popular, as they offer several advantages over traditional manual systems. These systems use sensors, cameras, and other technologies to automate the loading and unloading process, reducing the risk of accidents, and increasing productivity.
4. **Training and Education:** Training and education are essential for maintaining safe and efficient dumper operations. Workers must receive adequate training on the operation of dumpers, load monitoring systems, and other equipment. They should also be trained in safety procedures and emergency response protocols.

These are just a few of the many global practices for dumper payload monitoring. Ultimately, the key to safe and efficient operations is a comprehensive approach that includes the use of advanced technology, rigorous training, and ongoing maintenance and inspection.

Desired Loading Practices: Few pictorial view of standard loading practices.



Improving Payload Capacity:

Based on the above factors, here are some recommendations to improve the payload capacity of the Komatsu HD785-7 Dumper:

1. Use Lightweight Materials: One way to reduce the weight of the dumper is to use lightweight materials such as aluminium or composite materials for the dump body and other parts of the vehicle.
2. Increase Engine Power: Upgrading the engine power of the dumper can significantly improve its payload capacity. A more powerful engine can carry heavier loads and traverse steeper inclines with ease.
3. Upgrade Suspension System: A robust suspension system can handle heavier loads over rough terrain. Installing high-performance shocks and springs will enhance the dumper's payload capacity.
4. Increase Dump Body Capacity: Increasing the size of the dump body will increase the amount of material that the dumper can carry. This can be achieved by extending the length or width of the dump body or by increasing its height. Austin trays having larger dimension in comparison to OEM's dump body.
5. Reduce Tire Pressure: Lowering the tire pressure can increase the surface area of the tire in contact with the ground. This will improve traction and enable the dumper to carry heavier loads.
6. Proper Loading: Operators should ensure that the dumper truck is properly loaded to prevent overloading, which can lead to loss of control and accidents. It's important to follow the manufacturer's guidelines on maximum load capacity and use weighing scales or load cells to accurately measure the weight of the payload.
7. Communication: Communication is key to ensuring safety during mine dumper payload operations. Operators should communicate effectively with other workers, including spotters and ground crew, to prevent accidents. They should also use hand signals or two-way radios to communicate with each other during loading and unloading operations.
8. Use technology: Advanced technology such as weigh-in-motion (WIM) systems or load cell systems can be used to help operators achieve the optimal payload. These systems can help operators identify the weight of the load and adjust the loading process accordingly.

Conclusion:

Improving the payload capacity of the Komatsu HD785-7 Dumper can significantly enhance its performance and productivity. The above recommendations can be implemented individually or in combination to achieve the desired results. By increasing the payload capacity, the dumper can transport more material in a single trip, reduce the number of trips required, and increase the overall efficiency of mining operations.
