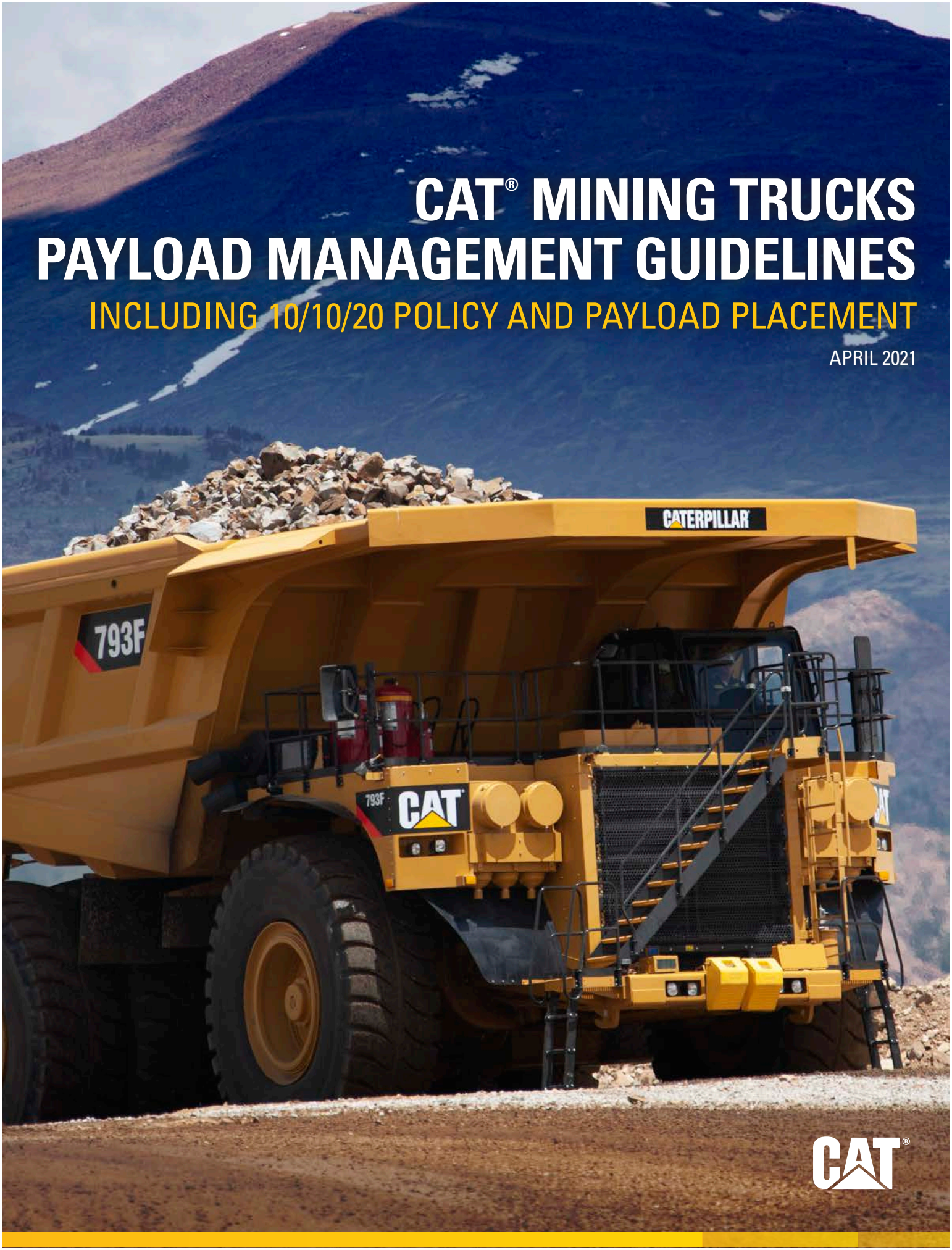
CAT® MINING TRUCKS PAYLOAD MANAGEMENT GUIDELINES

INCLUDING 10/10/20 POLICY AND PAYLOAD PLACEMENT

APRIL 2021



PART 1
» PAYLOAD

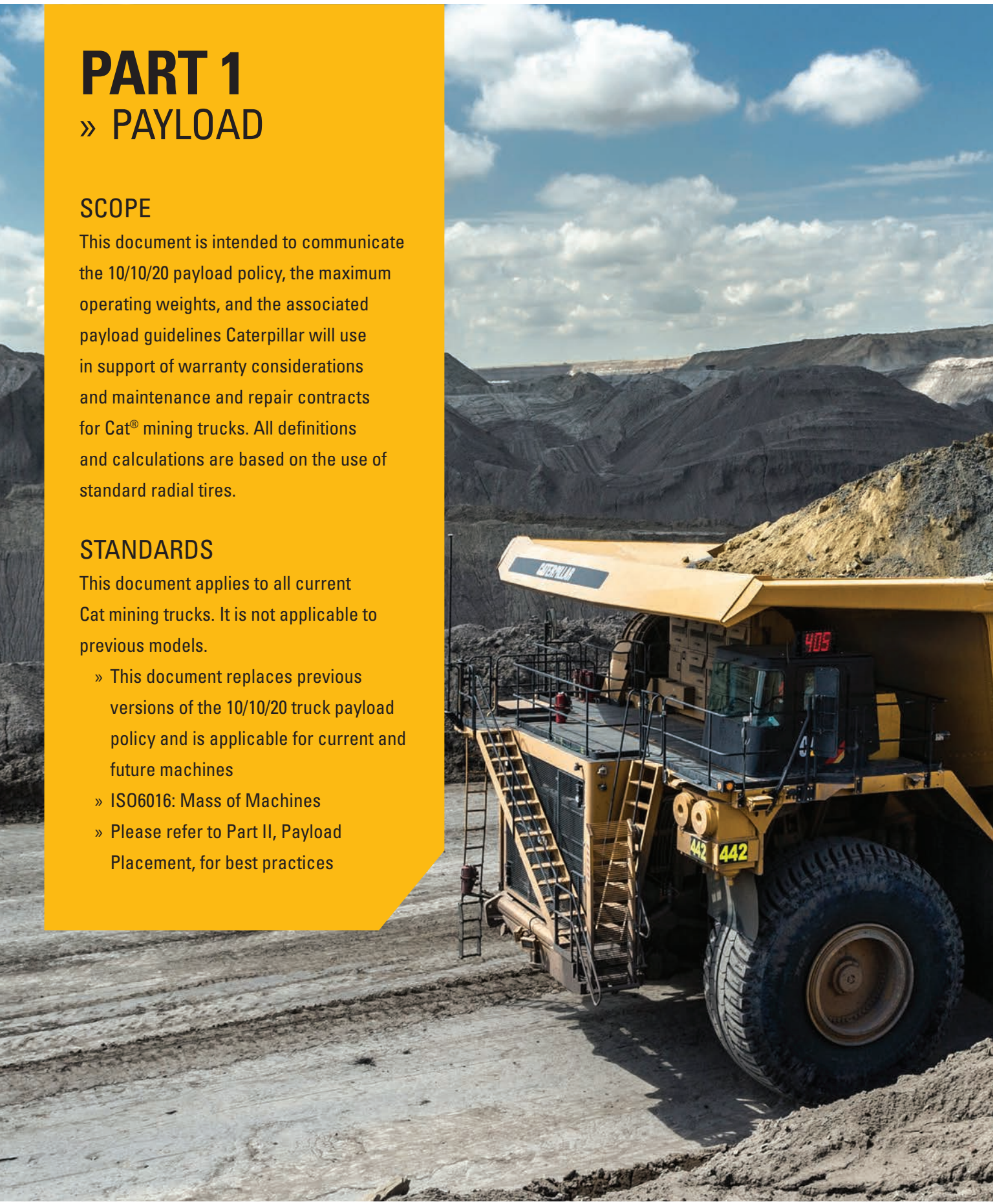
SCOPE

This document is intended to communicate the 10/10/20 payload policy, the maximum operating weights, and the associated payload guidelines Caterpillar will use in support of warranty considerations and maintenance and repair contracts for Cat® mining trucks. All definitions and calculations are based on the use of standard radial tires.

STANDARDS

This document applies to all current Cat mining trucks. It is not applicable to previous models.

- » This document replaces previous versions of the 10/10/20 truck payload policy and is applicable for current and future machines
- » ISO6016: Mass of Machines
- » Please refer to Part II, Payload Placement, for best practices



DEFINITIONS AND ABBREVIATIONS

There are two types of weights discussed in mining truck terminology: measured weights and specified weights.
Measured Weights are quantifiable; a person can take a truck in a given configuration, put it on a scale, and weigh it.
Specified Weights are limits or targets set through engineering calculation in order to ensure compliance with standard or particular performance criteria.

Caterpillar is adding the terms **Rated** and **Target** to better define the type of Payload and Gross Machine Weight being referenced.

Rated is the specification the truck was designed to.

Target is the value site targets. This may be more, less, or equal to the corresponding Rated value.

In addition, Caterpillar is defining if a Payload or Empty Machine Weight is a **Nominal** value based on specifications or an actual **Field** value. The purpose is to ensure that when discussing weights and payload, it's understood if they are generic defaults for a truck or an actual field weight.

Nominal is a good representation of a machine in standard configuration, this may not be applicable to all applications.

Field is an operating condition. This is a machine built up to meet the operational needs of the customer for a specific application (including liners and estimate of debris) or an actual scale weight from a mine.

MEASURED WEIGHTS

Base Machine Weight (BMW):	This is the basic chassis weight common to similar model trucks. This includes shipping fluids, but no attachments or options. This is called the "Common Arrangement Weight" in Configurators.
Operator Weight (OW):	Defined by ISO Standards as 75 kg (165 lb).
Attachments Weight (AW):	This is the selection of attachments, mandatory and optional, chosen for a particular truck configuration. Attachments include any purchased from Caterpillar or Customer/Dealer added. Rims, Tires and Fuel are considered mandatory attachments. Fuel is evaluated at 100%.
Chassis Weight (CW):	This weight includes Base Machine Weight plus Attachment Weight and Operator Weight. The weight excludes the truck Body Weight and Liner Weight.
Body Weight (BW):	The weight of the specified body, less Liner Weight.
Liner Weight (LW):	Liner weight specified for a specific body type. This can vary considerably depending on the application type, design of the body and customer needs (lighter weight versus more durability).

DEFINITIONS AND ABBREVIATIONS

MEASURED WEIGHTS

Nominal Empty Machine Weight (NEMW):	This is the standard configuration of a machine, consisting of standard/ mandatory attachments as well as a Body and Liner Package.
Field Empty Machine Weight (FEMW):	This is equal to NEMW plus Debris Weight, if any or any additional attachments that were not specified in the Attachments Weight. This is the weight of a truck specific to an application or is the weight of the machine in an operating condition.
Actual Payload (AP):	Weight of a particular payload under consideration.
Loaded Field Machine Weight (LFMW):	Simply a fully loaded truck, in an operating condition. Equal to the FEMW plus the Actual Payload.

SPECIFIED WEIGHTS

Maximum Gross Machine Weight (MGMW):	Value specified that allows 20% excess payload for most truck configurations. This weight includes a fully configured truck with full fluids, operator, payload and debris. An operating truck should never exceed the MGMW. This weight is certified to meet ISO & SAE steering and braking system standards.
Rated Gross Machine Weight (RGMW):	Optimum weight that in the opinion of Caterpillar, provides optimum Productivity and Cost Per Ton. RGMW is used for Performance Curves and Calculations.
Target Gross Machine Weight (TGMW):	Unless specified, this is the same as the Rated Gross Machine Weight. In the instance a site has a specific Payload Policy or Target Payload, the TGMW would reflect the updated figure provided by the manufacturer or FEMW plus Target Payload. This may be more or less than RGMW and should never exceed MGMW.

DEFINITIONS AND ABBREVIATIONS

CALCULATED WEIGHTS

Nominal Rated Payload (NRP):	A specified value that is representative of a typical TP. Nominal Rated Payload is used in general discussions to designate the truck size class. It does not account for Debris Weight and is equal to the Rated Gross Machine Weight minus the NEMW.
Field Rated Payload (FRP):	This value is calculated by taking the Rated Gross Machine Weight minus the FEMW. This is the optimum payload to get the most productivity while still adhering to the RGMW. This is the payload expected for a machine in a specific application.
Target Payload (TP):	As with TGMW, the Target Payload should equal the Field Rated Payload. In the event the customer is targeting a value other than Rated, that value is referenced as the Target Payload. The Target Payload should never cause the LFMW to exceed the MGMW.
Field Rated Payload Range (FRPR):	A calculated value that falls between 80% and 120% of the RP. This will maximize productivity while minimizing negative impact on component life. This number should not be below 80% and never exceed 120%.
Maximum Allowable Payload (MAP):	Typically equal to 120% of the FRP Calculation: (FRP x 1.2) = MAP This should never cause the LFMW to exceed the MGMW (Calculation: FEMW + MAP < MGMW). In the instance the 120% of the FRP causes the LFMW to exceed the MGMW, the MAP shall be equal to the MGMW minus the FEMW. (Calculation: MGMW – FEMW = MAP)
Debris Weight (DW):	DW is an application-specific value that accounts for normal mud and road material stuck to the truck. DW varies considerably depending on work conditions and can fluctuate between 2% to 8% of FEMW.

WEIGHT CALCULATION FLOW SHEETS

NOMINAL

NOMINAL RATED PAYLOAD CALCULATION

This is an approximate evaluation, consisting of the standard configuration of a truck. This is a good representation of the truck but may not be applicable to all applications.

Base Machine Weight (BMW)
Operator Weight (OW)
+ Attachment Weight (AW) (mandatory only)
Chassis Weight (CW)
Body Weight (BW) (default body)
+ Liner Weight (LW) (minimum required)
Nominal Empty Machine Weight (NEMW)

Rated Gross Machine Weight (RGMW)
– Nominal Empty Machine Weight (NEMW)
Nominal Rated Payload (NRP)

FIELD

FIELD RATED PAYLOAD CALCULATION

This is an exact evaluation, therefore it has applicable attachments, body, liner package and tires to meet the needs of the application. This may include consideration of debris.

Base Machine Weight (BMW)
Operator Weight (OW)
+ Attachment Weight (AW) (application specific)
Chassis Weight (CW) (application specific)
Body Weight (BW) (application specific)
+ Liner Weight (LW) (application specific)
Nominal Empty Machine Weight (NEMW)
+ Debris Weight (DW)
Field Empty Machine Weight (FEMW)

Rated Gross Machine Weight (RGMW)
– Field Empty Machine Weight (FEMW)
Field Rated Payload (FRP)

Maximum Allowable Payload Calculation:

Field Rated Payload (FRP)
x 120%
Maximum Allowable Payload (MAP)

Field Empty Machine Weight (FEMW)
+ Maximum Allowable Payload (MAP)
< Maximum Gross Machine Weight (MGMW)

TARGET PAYLOAD CALCULATION

This is an exact evaluation, therefore it has applicable attachments, body, liner package and tires to meet the needs of the application. This may include consideration of debris.

Base Machine Weight (BMW)
Operator Weight (OW)
+ Attachment Weight (AW) (application specific)
Chassis Weight (CW) (application specific)
Body Weight (BW) (application specific)
+ Liner Weight (LW) (application specific)
Nominal Empty Machine Weight (NEMW)
+ Debris Weight (DW)
Field Empty Machine Weight (FEMW)

Rated Gross Machine Weight (RGMW)
– Field Empty Machine Weight (FEMW)
Field Rated Payload (FRP)

Customer has Target Payload equal to FRP:

Field Rated Payload (FRP)
= Target Payload (TP)

Rated Gross Machine Weight (RGMW)
= Target Gross Machine Weight (TGMW)

Customer has Target Payload different than FRP:

Field Rated Payload (FRP)
≠ Target Payload (TP)

Field Empty Machine Weight (FEMW)
+ Target Payload (TP)
Target Gross Machine Weight (TGMW)
< Maximum Gross Machine Weight (MGMW)

PAYLOAD HAS A DIRECT EFFECT ON THREE AREAS:

» **Compliance to SAE and ISO brake and steering standards.**

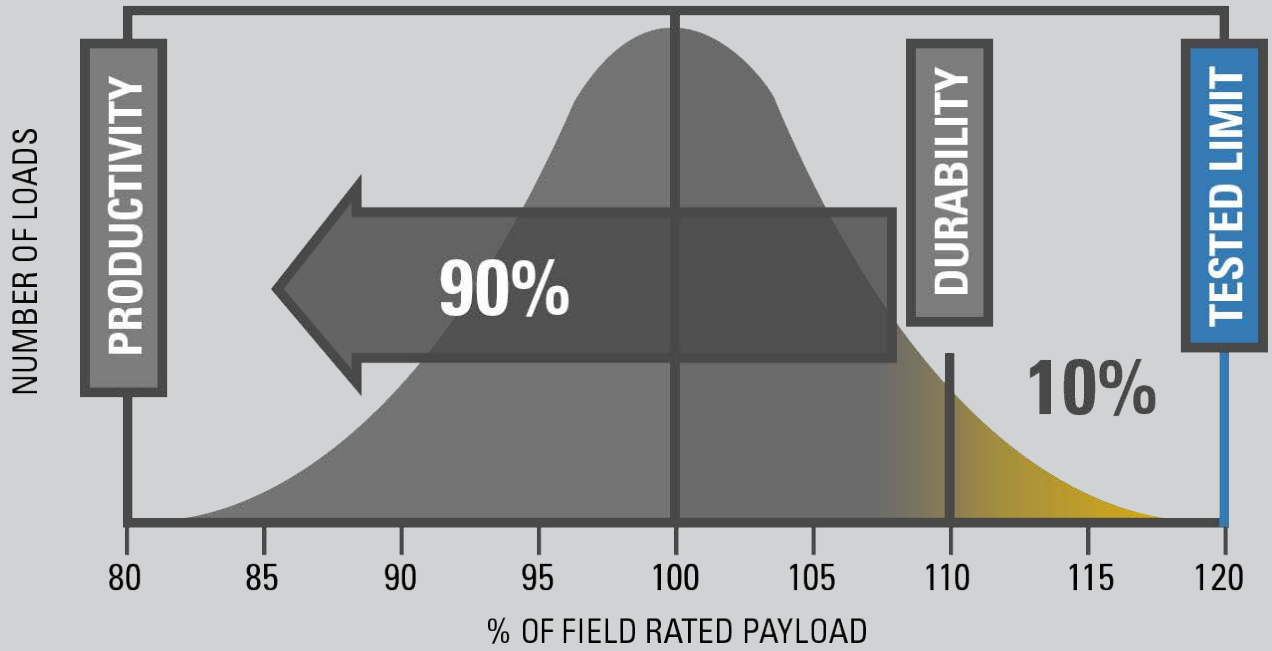
» **Component life is directly related to Loaded Field Machine Weight and Actual Payload.**

» **Support of warranty considerations / maintenance and repair contracts.**

STATEMENT OF POLICY 10 / 10 / 20

"No more than **10%** of payloads may exceed **110%** the Field Rated Payload; no single payload shall ever exceed the Maximum Allowable Payload, typically **120%** of Field Rated Payload. The mean of the payloads shall not exceed the Field Rated Payload."

— **The rated capacity of the tires should always be considered in any evaluation.**



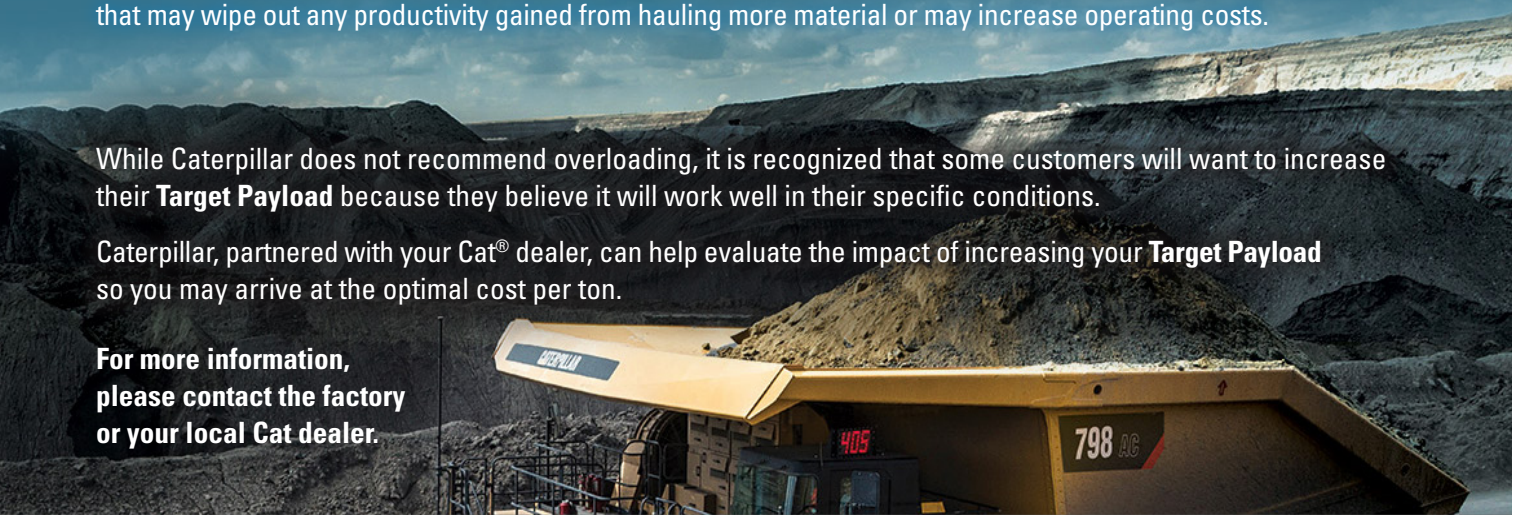
90% of loads should fall into this range

No more than 10% of loads should exceed 110% of the Field Rated Payload

No loads should exceed the Maximum Allowable Payload

SPECIAL CONSIDERATIONS

Trucks are designed around an optimal balance of factors to provide the lowest possible cost per ton. Payload is just one of these factors. Increasing payload can potentially upset that balance and have consequences that may wipe out any productivity gained from hauling more material or may increase operating costs.



While Caterpillar does not recommend overloading, it is recognized that some customers will want to increase their **Target Payload** because they believe it will work well in their specific conditions.

Caterpillar, partnered with your Cat® dealer, can help evaluate the impact of increasing your **Target Payload** so you may arrive at the optimal cost per ton.

For more information, please contact the factory or your local Cat dealer.

SUPPORTING INFORMATION

		Rated Gross Machine Weight (RGMW)		Maximum Gross Machine Weight (MGMW)	
MODEL	**SERIAL NUMBER PREFIX**	**lb.**	**kg**	**lb.**	**kg**
785D	MSY	550,000	249,476	617,120	279,921
785G*	RTL	550,000	249,476	629,999	285,763
785*	R2R (08A)	550,000	249,476	629,999	285,763
789D	SPD, SHH	715,000	324,319	797,600	361,785
789	TR2 (07A)	715,000	324,319	797,600	361,785
793D	FDB	846,000	383,739	951,200	431,457
793F*	D3T, RB4, SSP, RBT, SND, SXP	851,000	386,007	964,000	437,263
794 AC	MT5, HRT	1,150,000	521,631	1,278,000	579,691
796 AC	HRZ, HRY	1,270,000	576,062	1,419,777	644,000
797F	LAJ, LTZ	1,375,000	623,690	1,538,000	697,625
798 AC	ST3, ST7	1,375,000	623,690	1,543,236	700,000

*Note, different tire, rim and wheel station options may provide a different RGMW. The MGMW of the machine does not change.

PART 2
» PAYLOAD PLACEMENT

INTRODUCTION

Overloads will decrease component life, but payload placement can have significant impact as well. This addendum will discuss potential impact of the various types of payload misplacement and can be used to help reduce potential impact on component life and payload measurement.

The following three types of improper load placement occur:

- » Load shifted toward the front
- » Load shifted toward the rear
- » Load shifted toward the side

Each of the three will negatively impact component, tire, and body life.

FRONT-BIASED LOAD

A LOAD SHIFTED TOWARD THE FRONT WILL NEGATIVELY IMPACT:

the front brakes, front bearings, front tires, steering, suspension, hydraulic hoist, body rest pads, and body canopy.

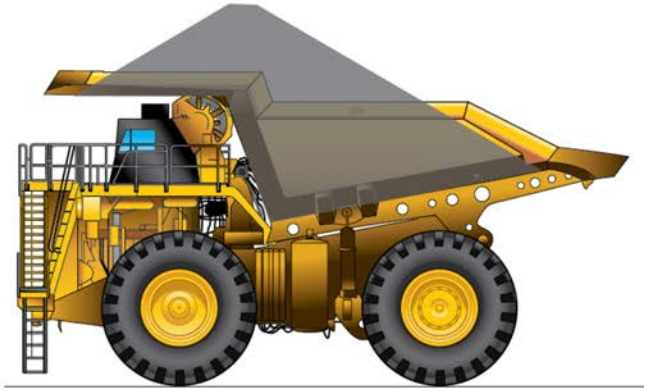
This illustration shows trucks with correct load placement and incorrect load placement with the load shifted toward the front on both High Productivity (HP) and High Efficiency (HE) bodies. Incorrect load placement will also decrease VIMS® payload accuracy.

CORRECT LOAD PLACEMENT

INCORRECT LOAD PLACEMENT

CORRECT LOAD PLACEMENT

INCORRECT LOAD PLACEMENT



REAR-BIASED LOAD

WHEN THE LOAD IS SHIFTED TOWARD THE REAR, THE FINAL DRIVE AND REAR TIRES WILL BE NEGATIVELY IMPACTED.

Furthermore, the payload will become unstable and slide off the back of the body. As with front-placed loads, this incorrect placement also decreases VIMS payload accuracy as discussed below.

This illustration shows trucks with correct load placement and incorrect load placement with the load shifted rearward on both HP and HE bodies.

CORRECT PAYLOAD PLACEMENT

INCORRECT PAYLOAD PLACEMENT

CORRECT PAYLOAD PLACEMENT

INCORRECT PAYLOAD PLACEMENT

PAYLOAD POSITION
AND VIMS® PAYLOAD ACCURACY

FOR PAYLOAD MONITORING ACCURACY, MAINTAINING THE CORRECT SPLIT BETWEEN THE FRONT AND REAR IS CRITICAL

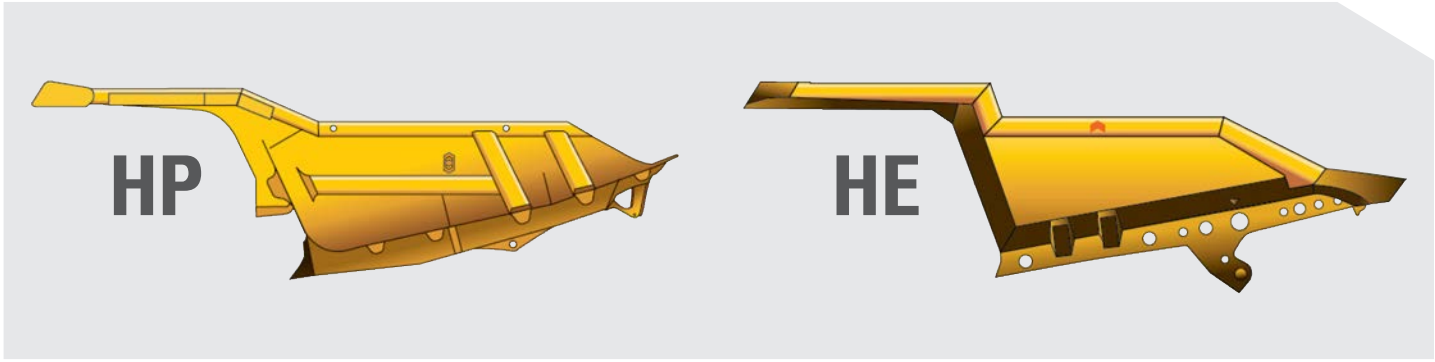
An ideal split for accurate payload reporting is 33% on the front axle and 67% on the rear.

» If the load is biased towards the front axle, VIMS payload will record "light."

» Alternatively, if the load is biased towards the rear axle, VIMS payload will record "heavy."

Consequently, the reduced visual length of the side can give a loader operator a false impression of where to place the load. When the loading tool operator centers the final two to three passes over the Target Arrow the load pile will end up in the proper position for a 1/3 : 2/3 axle split. There are a number of factors that can reduce VIMS payload accuracy such as loading on uneven ground, placing the load to one side, and improper strut maintenance, to name a few.

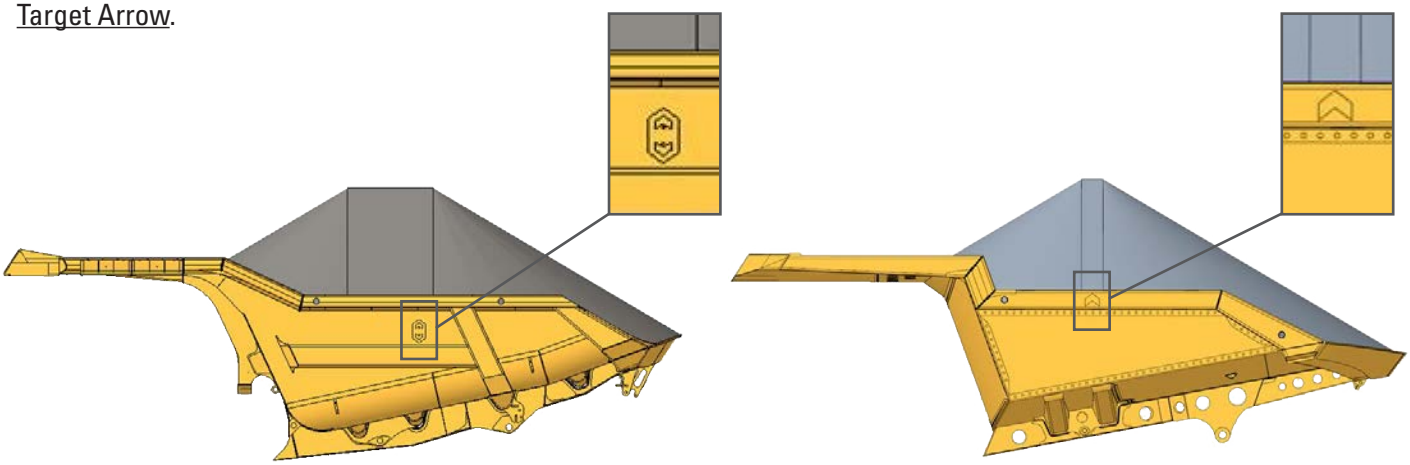
For more information, contact your local Cat dealer.



DISTRIBUTION

If the size of the loader requires five or more passes, distribute the first several passes forward and rearward of the loading arrow to achieve a good load distribution.

The distributed passes should be about equal in size and be placed approximately equal distance forward and behind the arrow. In any case the last pass or two, according to the total number of passes, should be centered over the Target Arrow.



SIDE PLACEMENT OF LOAD

IF THE LOAD IS SHIFTED TOWARDS EITHER SIDE

the final drive, bearings, tires, hoist cylinders, and pivot bore areas will be negatively impacted.

CORRECT LOAD PLACEMENT

INCORRECT LOAD PLACEMENT

LOADING EFFICIENCY

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

Good: 80% of the loads within a ±10% range of the Field Rated Payload

Excellent: 90% of the loads with a ±10% range of the Field Rated Payload

CAT® MINING TRUCKS
PAYLOAD MANAGEMENT GUIDELINES

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For more complete information on Cat products, dealer services and industry solutions, visit us at **www.cat.com**

Materials and specifications are subject to change without notice. Featured machines in photos may include additional equipment. See your Cat dealer for available options.