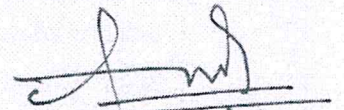


From Pre-page

The study report as above in respect of PLMS (Pay load monitoring system) fitted in the 60 Te dumpers carried out at Gondegaon OCM (Komatsu make dumpers), Inder-Kamptee OCM (BEML make dumpers) and Niljai OCM (Caterpillar make dumpers) be perused.

The salient observations and recommendations are as below.

1. The dumper factor at three places for Coal reporting was found 24 Te, whereas the dumpers in the said study with PLMS and also weighment of coal of some of the dumpers at weighbridges, explicitly indicate that coal carried out by these dumpers particularly in Caterpillar and Komatsu make dumpers are more than 30 Te (30 Te to 32 Te) in each case.
2. Therefore, the Dumper Factor need to be re-examined immediately and should be in sync with PLMS data.
3. The BEML make dumpers showed some arbitrary results and therefore BEML authorities be informed for immediate corrective action.
4. It has been emphasized earlier also that weighment of all type of coal transportation including face to stock must be ensured, to avoid any approximation in coal reporting system. However, till this is achieved, it may be ensured that dumpers with PLMS feature may only be deployed for coal transportation to stock and same is reconciled on regular/monthly basis. This PLMS data be preserved and analysed at HQ also.
5. A meeting was conducted with these vendors for authenticity of PLMS data. Caterpillar and Komatsu have explicitly reiterated about authenticity of their data subject to following of SOP in dumper operation. The SOP/points to be taken care of for effective working of PLMS as provided by Caterpillar and Komatsu is enclosed herewith for further examination and wide circulation to field units to be followed. HQ team may also check while their filed visits.
6. As the number of trips measured by these dumpers (Caterpillar and Komatsu) are found correct in study, the manual trip count for reporting may also be reconciled with PLMS generated trip data on regular basis to avoid any over reporting as observed in one of the study, the report of which will be shared separately.
7. Field units may be encouraged to use the PLMS feature to its full potential.
8. Some of the dumpers found having VHMS (Vehicle Health Monitoring System) as well, which should also be examined and utilised effectively.


CVO WCL 20/3/22

CMD WCL



वेस्टर्न कोलफील्ड्स लिमिटेड

Western Coalfields Limited
(A Subsidiary of Coal India Ltd)

Regd. Office : Coal Estate, Civil Lines, Nagpur – 440 001 (MS)

Office of the Chief Vigilance Officer

REPORT ON PLMS OF 60 Te DUMP TRUCKS IN WCL

REF: WCL/NGP/VIG/BS/2022/

Dt : 09.03.2022

1.0 Scope of report:

- a. Introduction to monitoring system of payload installed in 60 Te dumpers (dump trucks) in WCL and models of dumpers in use.
- b. Results of checks carried out to verify the data generated by PLMS by making physical measurements with regards to number of trips, weight carried and diesel consumption.

2.0 Make/ Model of dump trucks checked and mines where the check was carried out:

The following three Make of dumpers were checked:

- a. Komatsu Make 60 te Dumpers (At Gondegaon OCM of Nagpur Area).
- b. BEML Make 60 te Dumpers (At Inder-Kamptee Amalgamated OCM of Nagpur Area).
- c. Caterpillar Make 60 te Dumpers (At Niljai OCM of Wani Area)

3.0 Introduction to monitoring system:

The following requirement has been specified by the company during procurement of the 60 Ton dump trucks.

Pay Load Monitoring & Management System: Suitable diagnostic information storage for all system events, Pay-load Monitoring system (Load Cell), abnormal machine condition/ or incorrect machine operation and prognostic information for better maintenance support shall be provided. The Pay load Monitoring with Engine, Transmission & Braking System monitoring System shall have diagnostic capability to store and retrieve sufficient data, on board as-well-as off board such as active, intermittent and calculated data etc. of at least one month in its memory before it is downloaded with electronic device (laptop) for analysis. The Diagnostic Tools with all accessories such as Laptop loaded with required software – 1 no Laptop computer shall be provided to each project as per allocation with one additional quantity. This Laptop shall be loaded with suitable compatible software for monitoring & storing the data & parameters of Engine etc.

The system is generally identified by the following acronyms:

PLMS: Payload monitoring/ Measurement/ Management system

VHMS: Vehicle health monitoring system

TPMS: Truck payload measurement system

The payload weight is latched through pressure sensors located in the suspension of the trucks, clinometer, body float detection, neutral detection and travel speed detection.

4.0 Dumper Factor in use: (COAL)

All the three mines where the study was carried out have adopted a Dumper Factor of 24 Tonnes (Metric) for coal determined as per provisions of Yellow Book 2020.

5.0 Measurement units:

The measurement units for payload measurement are as follows:

US ton : 907.185 Kgs

Metric Tonnes : 1000 Kgs.

The payload is measured in Metric tonnes and the dumper is rated in US tons (60 Tons).

6.0 Data from the study: (All measurement figures mentioned in Metric Tonnes)

The following is the results of the data from the study:

Date	18 th December 2021	
	KOMATSU	CATERPILLAR
Number of dumpers taken for study	6	5
Total trips recorded in PLMS -Day	253	212
Total trips recorded Physical -Day	252	213
Total Tonnage recorded in PLMS - Day	7865.400 Te.	6856.600 Te.
Average Tonnage per trip - PLMS	31.089 Te.	32.342 Te.
Diesel Consumption Per Hour - PLMS	40.7 Ltrs	39.434 Ltrs.
Diesel Consumption Per Hour - Physical	38.539 Ltrs	43.318 Ltrs.

Date	18 th January 2022		
	KOMATSU	CATERPILLAR	BEML
Number of dumpers taken for study	5	5	5
Total trips recorded in PLMS -Day	257	256	175
Total trips recorded Physical -Day	257	256	175
Total Tonnage recorded in PLMS - Day	8830.800 Te.	8122.4 00Te.	7077.000 Te.
Average Tonnage per trip - PLMS	34.360 Te.	31.730 Te.	40.440 Te.

	KOMATSU	CATERPILLAR	BEML
Number of dumpers taken for study	6	5	2
Total trips recorded in PLMS	6	5	2
Total Tonnage recorded in PLMS	188.900 Te.	168.700 Te.	83.500 Te.
Average Tonnage per trip - PLMS	31.483 Te.	33.740 Te.	41.750 Te.
Physical Measurement - Actual in weigh bridge	184.970 Te	158.750 Te	64.970 Te
Average Tonnage per trip - Actual in weigh bridge	30.828 Te.	31.750 Te.	32.485 Te.

7.0 Conclusion

	BEML	KOMATSU	CATERPILLAR
TRIP COUNTS	NO VARIANCE	NO VARIANCE	NO VARIANCE
PAYLOAD/ WEIGHT	28.52 %	2.12 %	6.27 %
DIESEL CONSUMPTION	Not Provisioned	5.61 %	-8.97 %

	BEML	KOMATSU	CATERPILLAR
DUMPER FACTOR	24 Tonnes	24 Tonnes	24 Tonnes
PAYLOAD/ WEIGHT - Average	32.485 Tonnes	30.828 Tonnes	31.750 Tonnes

8.0 Recommendations/ Suggestions

- 8.1 The trip counts have been established as being reliable in the PLMS data and the role of trip-man may be rendered obsolete as a result of the same.
- 8.2 Physical measurement have established that the actual load that is being carried is higher than the dumper factor determined by the units (where study was carried out). Management may take steps to apply suitable corrective measures for the same.
- 8.3 At present the PLMS data has to be downloaded to a PC/ Laptop by physically connecting the PC through a cable to the data unit of the dumper. Steps can be explored to transmit the data wirelessly to the server/ ERP system/ PC/ Laptop/ Mobile.

9.0 Deficiency observed at Inder-Kamptee OCM

During the study it was observed that on 28th January 2022, the mine management had reported 222 trips in coal, though the PLMS and physical counting had recorded only 175 trips in coal. It was also observed that the dumpers run in coal were not mapped in the production reporting system. The same was investigated and a separate report in this regard has been submitted.

10/3/2022

B.Sivakumar
Chief Manager (Mining)

10/3/2022

Avirash Kumar
Chief Manager (MM)

10.03.2022

N.S.Rao
Chief Manager (Mining)

General Manager (Vigilance)

A copy of SOP for proper functioning of PLMS is also attached (CAT & Komatsu)

30/3/22

CVO, WCL

on next page



Western Coalfields Limited

Area/Dept./Colliery

NOTING SHEET
: Gondagaon Sub Area

o/c ①

व. कोयला क्षेत्रों में नए/संशोधित/पुनर्विद्युत / 117

SHEET No/

Date: 10/08/2021

Name of Officer : COMMITTEE REPORT

Sub. - Report of the Committee constituted for determination of dumper factor of OB and Coal at Gondagaon Open Cast Mine, Nagpur Area.

A Committee Constituted as per guidelines of New Yellow Book "Revision 2020" for determination of Dumper Factor for OB & Coal of Gondagaon OCM of Nagpur Area. The above Committee consisting following Executives visited Gondagaon OCM as on 10/08/2021

1. General Manager (Operation) : Chairman
2. Area Finance Manager or Representative : Member
3. Area Survey Officer : Member
4. Project Officer/Agent of Concerned Mine : Member
5. Colliery Surveyor/Survey Officer : Member

A Committee assembled at Gondagaon OCM and exercised the procedure for determination of Dumper Factor for OB & Coal as per guidelines given in the sub clause "methodology for Dumper Factor of Over Burden (OB) and Coal" of clause 10 in the :New Approved Yellow Book (Revision 2020)"

For determination of Dumper Factor of Departmental Coal 05 no of dumpers BH-60 Tc selected for loading of coal from face. The entire coal of 05 numbers of dumper unloaded at level ground, after removal of extraneous material by manually. The entire coal loaded in the low capacity tippers for weighment, because the arrangement of high capacity weighbridge for weighment of 60 Tc dumpers not available in the Mine.

The detail of the exercise executed is given in Annexure "A" (copy enclosed ANNEX A)

DUMPER FACTOR FOR DEPARTMENTAL COAL

Sl No	Inv No	DUMPER NO	TARE WEIGHT (KG)	GROSS WEIGHT (KG)	NET WEIGHT OF COAL
1	X	MH40BG8277	13480.000	36350.000	22870.000
2	X	MH40AK7439	12790.000	44100.000	31310.000
3	X	MH40Y3747	11690.000	37060.000	25370.000
4	X	MH22AA3414	14500.000	42990.000	28490.000
5	X	MH34M6278	9550.000	21540.000	11990.000
				TOTAL	120030.000

Total weight of 5 trips 120030 Kg = 120.030 Tes @5 trips = 24.006 Tes/Dumper. Say 24 Tes/Dumper

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①

Determination of Dumper factor of OB :

The mine has provided swell factor of OB (copy enclosed). Thereafter 06 no. trips of OB loaded in departmental Dumper BH 60 Te capacity has been dumped over a levelled surface to measure the volume of total OB .Dumped OB Stacked in geometrical shape and measurement of stack recorded in M.B .

The details of the exercise executed is given in Annexure "B" (copy enclosed ANN X B)
DUMPER FACTOR FOR DEPARTMENTAL OB (FD)

SI No	Dumpers	Volume (V = Avg.L X W X H)	Swell Factor (Provide by Mine Management)	(V1) = V X Swell Factor	N (Number of trips)	Dumper Factor = V1/n	Remarks
1	BH-60 M (Cap 60 Te)	143.637 M3	0.835	119.937	6	19.990 Cum/Trip Say 20.00 Cum/trip	DEPT

Similarly the determination of dumper factor of HOE patch 06 no strips of OB loaded in Volvo & Scania Tippers of contractor has been dumped over a levelled surface to measure the volume of OB separately, the quantity stacked in geometrical shape and measurement of stack has been recorded in M. B .

The details of the exercise executed are given in Annexure "C" (copy enclosed ANN X C)

DUMPER FACTOR FOR HOE OB (FD)

SI No	Dumpers	Volume (V = Avg.L X W X H)	Swell Factor (Provide by Mine Management)	(V1) = V X Swell Factor	N (Number of trips)	Dumper Factor = V1/n	Remarks
1	VOLVO	107.696	0.835	89.926	6	14.988 Cum/Trip Say 15.00 Cum/trip	HOE
	SCANIA	107.779	0.835	89.995	6	14.999 Cum/Trip Say 15.00 Cum/trip	HOE

Submitted to Area General Manager, Nagpur Area for approval please.

[Signature]
 Colliery Surveyor
 Gondgaon OCM

[Signature]
 Project Officer /Agent
 Gondgaon Sub Area

[Signature]
 10/08/2021
 Area Survey Officer
 Nagpur Area

[Signature]
 10/8/21
 Area Finance Manager or Representative
 Nagpur Area

[Signature]
 10/8/21
 General Manager (Operation)
 Nagpur Area

Above report submitted for approval of AGM, Nagpur Area.

[Signature]
 Approved

[Signature]
 10/8/21
 Area General Manager
 Nagpur Area

(2)

ANNEXURE - A

WESTERN COALFIELDS LIMITED
NAGPUR AREA
GONDEGAON SUB AREA
GONDEGAON OPEN CAST MINE

Determination of Dumper Factor of Departmental Coal at Gondegaon OC Mine of Nagpur Area

Date: 10/08/2021

BH-60 Te Dumper (Departmental)

Sr. No.	INV No	DUMPER NO	Tare Weight (KG)	Gross Weight (KG)	Net Weight (KG)(N)
1	X	MH40BG8277 -	13480.000 ✓	36350.000 ✓	22870.000 ✓
2	X	MH40AK7439 -	12790.000 ✓	44100.000 ✓	31310.000 ✓
3	X	MH40Y3747 ✓	11690.000 ✓	37060.000 ✓	25370.000 ✓
4	X	MH22AA3414 ✓	14500.000 ✓	42990.000 ✓	28490.000 ✓
5	X	MH34M6278 ✓	9550.000 ✓	21540.000 ✓	11990.000 ✓
Total Weight :-					120030.000

Number of dumpers (n) :- 5

Average dumper (in te per dumper) = N/n

120030/5

24006 kg/dumper

24.006 Tes/Dumper


Say 24.00 tes/dumper

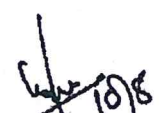
Note :- 1000 kg = 1 tes


Colliery Surveyor
Gondegaon OCM


Project Officer / Agent
Gondegaon Sub Area


Area Survey Officer
Nagpur Area


Area Finance Manager or Representative
Nagpur Area


General Manager (Operation)
Nagpur Area

3

WESTERN COALFIELDS LIMITED
NAGPUR AREA
GONDEGAON SUB AREA
GONDEGAON OPEN CAST MINE

Determination of Dumper Factor of Departmental OB (FD) at Gondegaon OC Mine of Nagpur Area

Date: 10/08/2021

BH-60 Te Dumper (Departmental)

Heap No.01 (Dimension of Heap)

Sr. No.	Length (Mt.)	Width (Mt.)	Height (Mt.)
1	10.30	6.10	2.60
2	10.10	5.80	2.40
3	9.90	5.40	2.20
4	10.40	6.20	2.30
5	10.10	5.90	2.50
6	9.80	5.50	2.40
7	10.40	6.10	2.70
8	10.10	5.80	2.50
9	9.70	5.50	--
Total	90.80	52.30	19.60
Average	10.089	5.811	2.450

VOLUME = Avg (L x W x H) = (10.089 X 5.811 X 2.450) M³
 VOLUME = 143.637 M³ (V)

LOOSE OB CONVERTED TO IN-SITU VOLUME (V1) = V X SWELL FACTOR

143.637 X 0.835 = 119.937 CUM

= (V1/n) (n= number of dumpers selected)

119.937 / 6 = 19.990 cum/Dumper

SAY 20.00 CUM/DUMPER

DUMPER FACTOR

[Signature]
 Colliery Surveyor
 Gondegaon OCM

[Signature]
 Project Officer / Agent
 Gondegaon Sub Area

[Signature]
 10/08/2021
 Area Survey Officer
 Nagpur Area

[Signature]
 Area Finance Manager or Representative
 Nagpur Area

[Signature]
 General Manager (Operation)
 Nagpur Area

(4)

WESTERN COALFIELDS LIMITED
NAGPUR AREA
GONDEGAON SUB AREA
GONDEGAON OPEN CAST MINE

Determination of Dumper Factor of HOE OB (FD) at Gondegaon OC Mine of Nagpur Area

Date: 10/08/2021

VOLVO DUMPER

Heap No.01 (Dimension of Heap)

Sr. No.	Length (Mt)	Width (Mt.)	Height (Mt.)
1	15.80	6.10	1.40
2	15.60	5.65	1.16
3	15.20	5.25	1.30
4	16.00	6.25	1.30
5	15.80	5.55	1.15
6	15.30	5.10	1.25
7	15.55	6.10	1.20
8	15.40	5.55	1.10
9	15.30	5.00	-
Total	139.95	50.55	9.86
Average	15.550	5.617	1.233

$$\text{VOLUME} = \text{Avg} (L \times W \times H) = (15.550 \times 5.617 \times 1.233) \text{ M3}$$

$$\text{VOLUME} = 107.696 \text{ M3 (V)}$$

LOOSE OB CONVERTED TO IN-SITU VOLUME (V1) = V X SWELL FACTOR

$$107.696 \times 0.835 = 89.926 \text{ CUM}$$

DUMPER FACTOR

$$= (V1/n) \quad (n = \text{number of dumpers selected})$$

$$89.926/6 = 14.988 \text{ Cum/Dumper}$$

SAY 15.00 CUM/DUMPER

Determination of Dumper Factor of HOE OB (FD) at Gondegaon OC Mine of Nagpur Area

Date: 31/07/2021

SCANIA DUMPER

Heap No.02 (Dimension of Heap)

Sr. No.	Length (Mt)	Width (Mt.)	Height (Mt.)
1	16.10	6.00	1.46
2	15.80	5.60	1.15
3	15.30	5.30	1.00
4	16.00	5.90	1.40
5	15.60	5.50	1.20
6	15.10	5.20	1.46
7	16.10	6.10	1.12
8	15.50	5.70	1.05
9	14.90	5.25	-
Total	140.40	50.55	9.84
Average	15.600	5.617	1.230

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 (S) [Signature] [Signature]

VOLUME = Avg (L x W x H) = (15.600 X 5.617 X 1.230) M3

VOLUME = 107.779 M3 (V)


LOOSE OB CONVERTED TO IN-SITU VOLUME (V1) = V X SWELL FACTOR

107.779 X 0.835 = 89.995 CUM


DUMPER FACTOR

= (V1/n) (n= number of dumpers selected)
89.995/6 = 14.999 Cum/Dumper

SAY 15.00 CUM/DUMPER


Colliery Surveyor
Gondegaon OCM


Project Officer /Agent
Gondegaon Sub Area


Area Survey Officer
Nagpur Area


Area Finance Manager or Representative
Nagpur Area


General Manager (Operation)
Nagpur Area

CAT 773E Dumpers

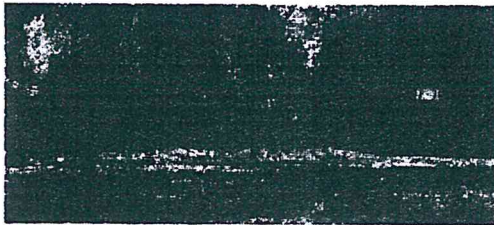
Do's & Don't's for Achieving the Payload Accuracy

There are some conditions that could affect the accuracy of the Truck Payload Measurement System (TPMS) weighing process when the truck is under the loader.

Some of these conditions are listed here with Do's & Don't's:

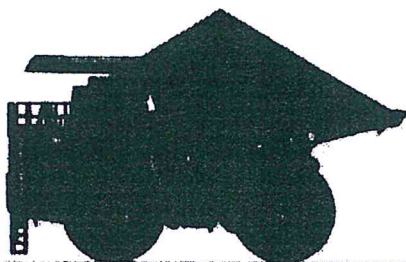
Do's

1. Do verify the Suspensions charged as per Specification & recommended procedure.
2. Do the Payload Calibration whenever suspensions were serviced?
3. Keep the Loading area in level and free from boulders using wheel dozer.

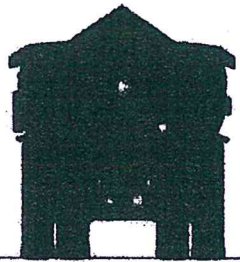


4. Ensure Truck Positioned on the level ground.
5. Do Keep the transmission in neutral, and the parking brake is applied while loading.
6. The minimum payload weight on the truck must be met (Minimum Weight detectable by Truck Payload System is 7.5 Ton)
7. Signal should be given by Dumper operator to Shovel Operator using Horn for starting the loading after positioning the truck on level surface.
8. Shovel Operator should load the truck on the centre of the Dump body (Indicator Provided on Dump Body) without touching the bucket on the dump body'.

CORRECT LOAD PLACEMENT



CORRECT LOAD PLACEMENT

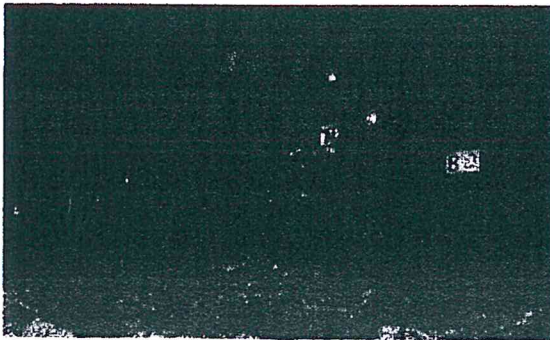


CAT

9. Shovel Operator should load the truck based on the Payload Indicator Lamps (RED & GREEN) and Last Pass indicator provided on the Dumper LH & RH Side of the Dumper.
10. Once fully loaded, Shovel operator should signal the Dumper operator using horn.
11. Once the Truck moved and the payload reweighed in 2nd Gear and final payload will be recorded.

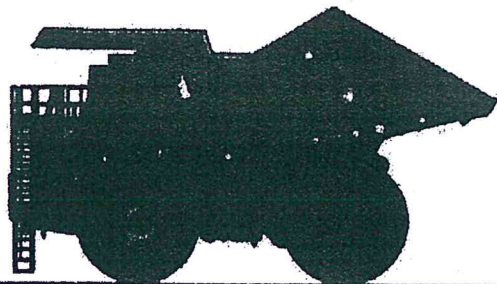
Dont's

1. Do Not position the Dumper on Uneven Surface or on Berms.

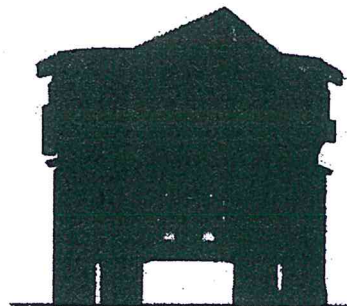


2. Do Not Use Retarder/Service Brake during Loading & Dumping.
3. Do Not Move the Dumper while the shovel is loading.
4. Do Not Actuate the "body raise lever" during loading
5. Do Not Load the Truck Unevenly.

INCORRECT PAYLOAD PLACEMENT



INCORRECT LOAD PLACEMENT





6. Do Not Push down on the load with the loading tool during the loading process
(packing the load)
7. Do Not Touch the Shovel Bucket on the Dump body while loading.
8. Do Not Use conveyor or a continuous feed system for loading
9. Do Not load the Dumper on a sloped surface that is greater than 5%.

For Accuracy in Payload monitoring system Following Points needs to be Taken care –

1. **WORKING CONDITION** :- Needs to be followed for accuracy and proper function of Payload monitoring system
 - a. Proper leveled ground required at loading and unloading point
 - b.
 - c.
 - d.
2. **OPERATIONAL DO'S & DON'TS** :- Should be followed by operator during operation
 - a. Machine / Engine Should be on during loading
 - b. Gear shift leaver should be in neutral during loading / unloading .
 - c. Parking break should be on during loading / unloading
 - d. Retarder break should be off during loading / unloading
 - e. Dump body should be in float position.
 - f. While dumping the load, if the machine shakes and the payload display fluctuates, wait for the payload display to stabilize before dumping the load.
3. **PERFORMING CALIBRATION** :- Carry out Calibration at the following occasions
 - a. At the time of commissioning of the Machine / Pay load system.
 - b. When the suspension cylinder gas pressure and oil amount have been adjusted (Suspension has been adjusted) ..
 - c. When the suspension pressure sensor , controller has been replaced.
 - d. After replacement of Tyres
 - e. When the machine has been modified and the weight of the machine when empty has changed more than 100 Kg.(21lb).
 - f. Once in a month or after 500 working Hrs.

Important Note :-

1. At the dumping point , record the payload when the dump leaver is moved from FLOAT to any position other than FLOAT .
2. The payload meter is set to judge that the loading is completed when the machine has travelled 160 m (524 ft11 in) continuously from the loading point. If the dumping point is within 160 m (524 ft 11 in) from the loading point, the system will not judge that dumping has taken place, so the cycle data at that point will be incomplete.
3. The payload display at the loading point (immediately after the loading) may be slightly less (1 to 5 tons) than the value displayed at the dumping point. This is caused by the differences in the friction force of the suspension, and it is impossible to remove this.
4. Incorrect operational practices by dump truck operators (sudden acceleration and deceleration creates impact on suspension cylinders which effect the logic sequence of payload calculation and unnecessary usages of hoist levers while traveling. Material of different densities handled by the dump truck .