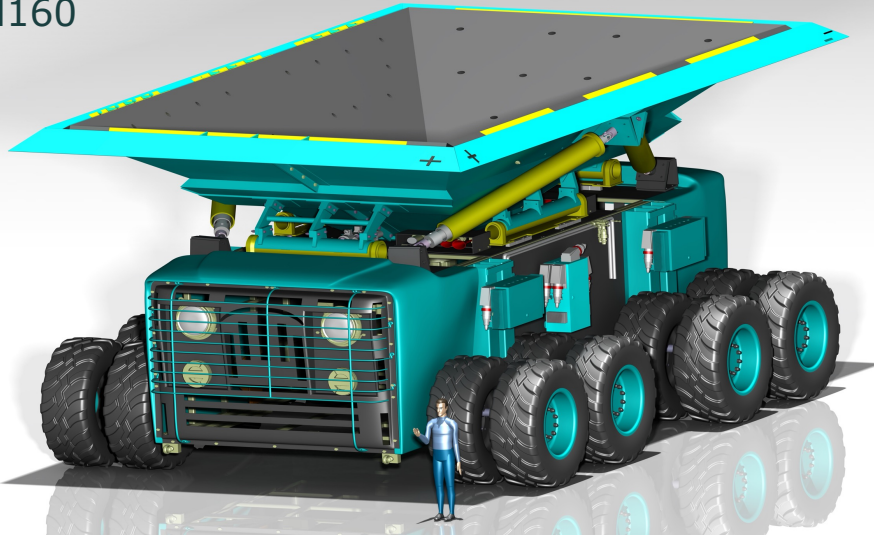




AutoDrive Mining Truck

M160

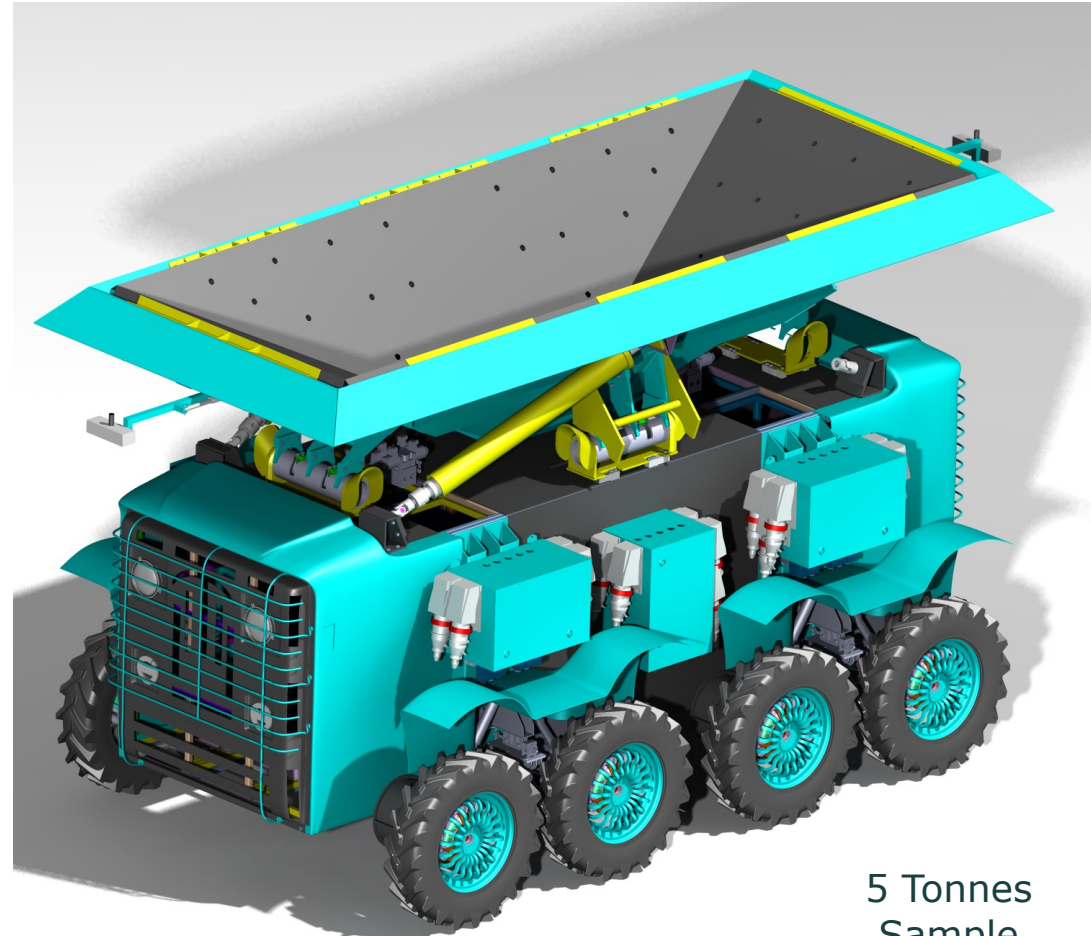


Product Catalog
50-320 Tonnes

Contents



- Specifications	P03
- Features	P06
- Operation	P08
- eAxle	P14
- Chassis	P18
- Maintenance	P21
- Option	P24

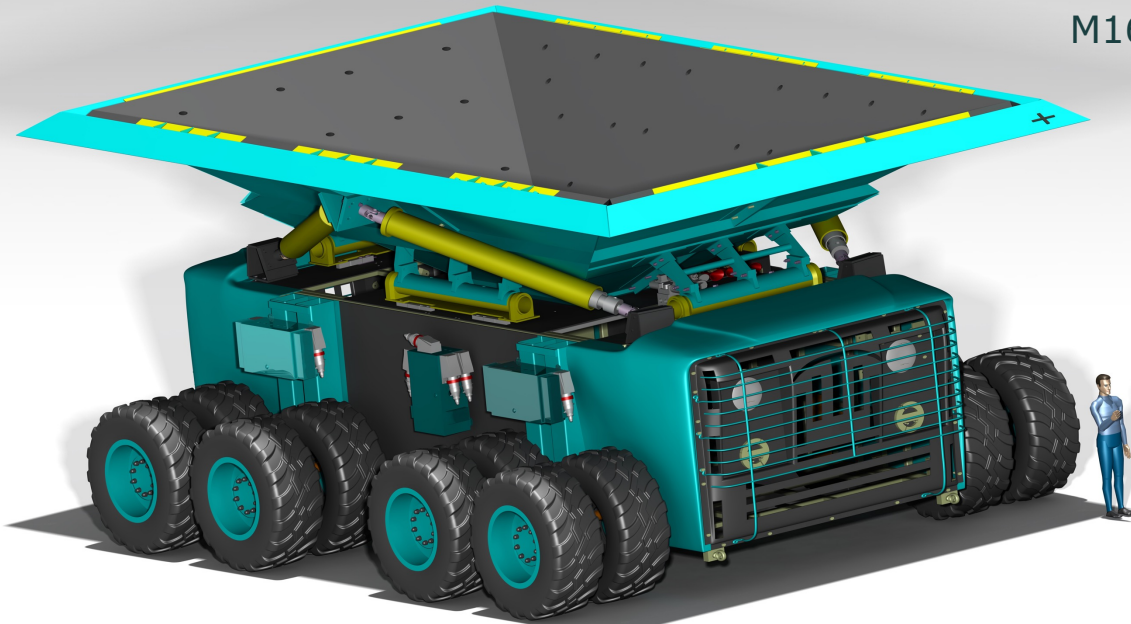


Specifications, General



Mining Trucks Spec.

Code	Max. Payload Tonne	Max. Weight Tonne	Max. Speed km/h	Max. Power # kW	Max. Grade %
M050	50	70	46	8x165	15%
M080	80	110	49	8x250	14%
M100	100	140	46	16x165	15%
M160	160	220	49	16x250	14%
M200	200	280	46	32x165	15%
M320	320	440	49	32x250	14%



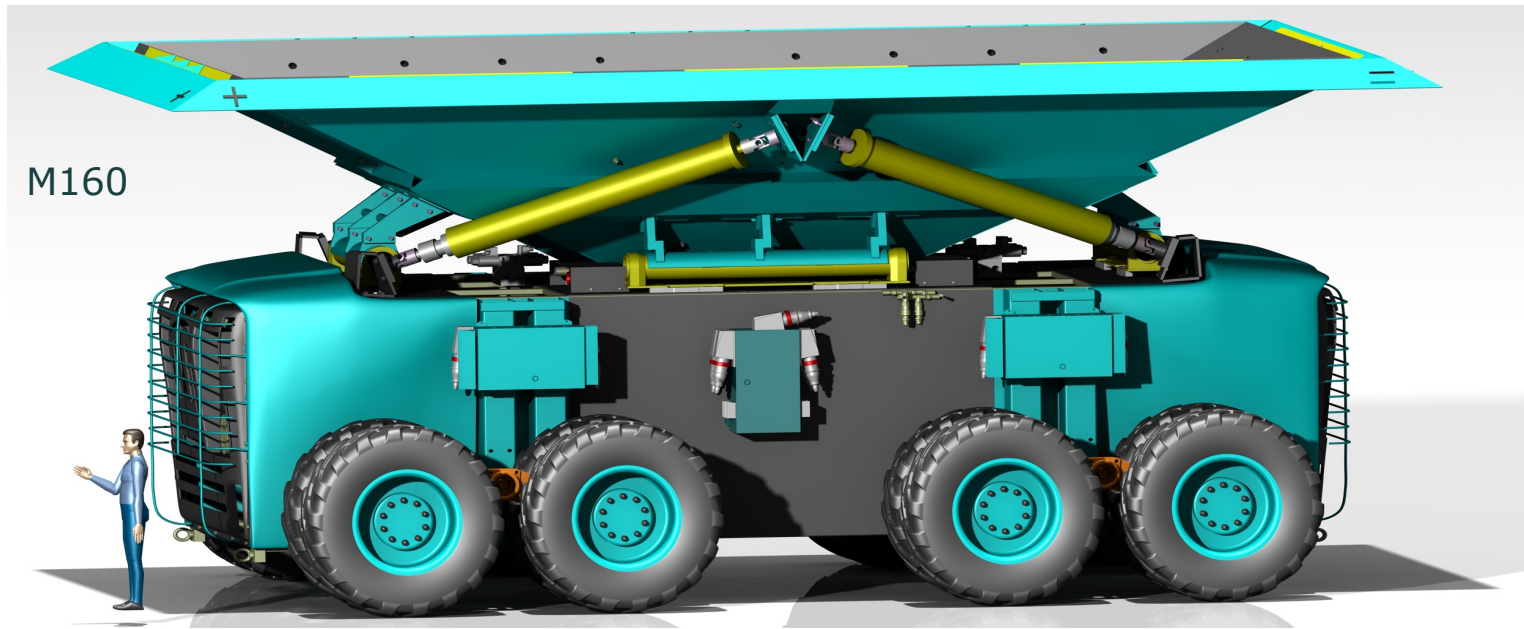
M160

More speed available with lower ratio gearboxes, which results less gradeability and vice versa.

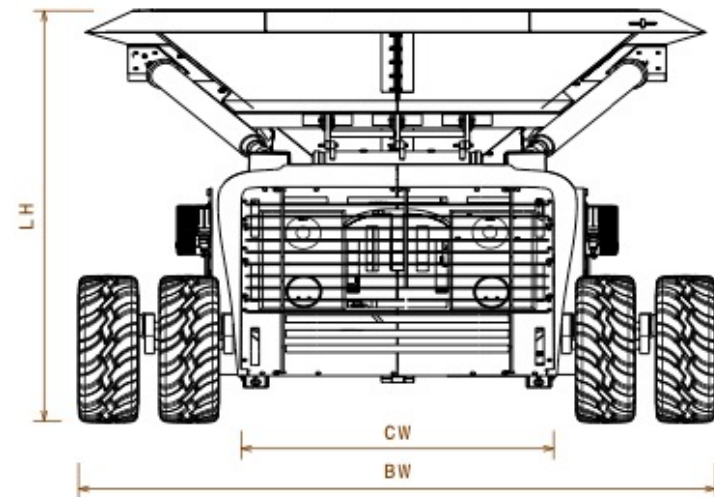
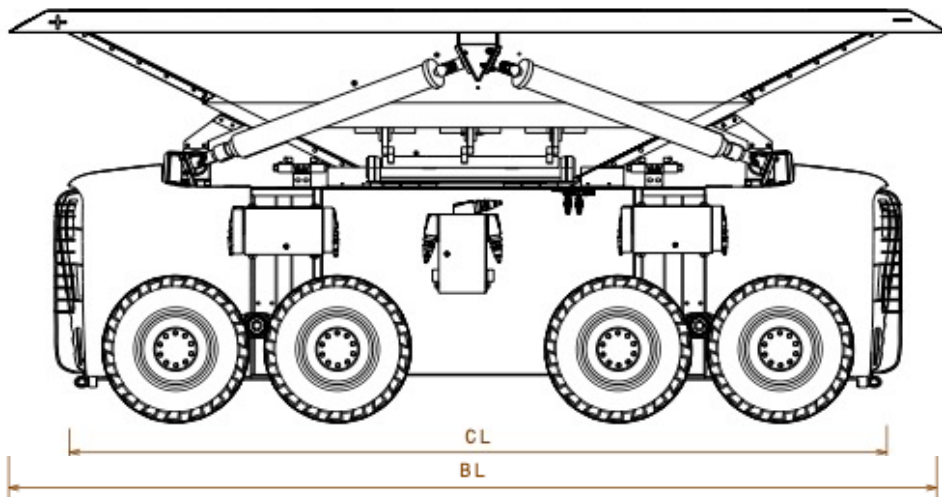
Specifications, Dynamics



Mining Trucks Dynamics								Zero Grade		Max. Grade			
Code	Max. Weight Tonne	Motor Code #	Motor Number #	Continu. Power kW	Continu. Torque Nm	Gearbox Ratio #	Continu. Traction kN	Max. Revolution RPM	Max. Speed km/h	Normal Revolution RPM	Max. Speed km/h	Continu. Grade %	30s Grade %
M050	70	M5	4x2	165	330	27.00	103	4 800	46	1 600	15	15%	30%
M080	110	M6	4x2	250	500	31.20	148	4 800	49	1 600	16	14%	28%
M100	140	M5	4x4	165	330	27.00	206	4 800	46	1 600	15	15%	30%
M160	220	M6	4x4	250	500	31.20	295	4 800	49	1 600	16	14%	28%
M200	280	M5	8x4	165	330	27.00	413	4 800	46	1 600	15	15%	30%
M320	440	M6	8x4	250	500	31.20	590	4 800	49	1 600	16	14%	28%



Specifications, Dimensions



Mining Trucks Dimensions

Code	Max. Payload Tonne	Chassis Length mm	Chassis Width mm	Chassis Height mm	Bucket Length mm	Bucket Width mm	Bucket Height mm	Loading Height mm	Ground Clearance mm
M050	50	8 000	4 000	2 400	8 000	5 705	1 522	4 722	400
M080	80	10 000	4 000	2 400	10 000	6 094	1 823	5 223	500
M100	100	12 000	4 000	2 400	12 000	7 410	1 562	5 162	600
M160	160	14 000	4 000	2 400	14 000	8 189	1 938	5 738	700
M200	200	16 000	4 000	2 400	16 000	7 410	2 343	6 343	800
M320	320	18 000	4 000	2 400	18 000	8 189	3 015	7 215	900

Features, Advantages



	Technology	Performance	Maintenance
1	Only One Central Software	No Driver Cabin	Quick Connection Ele. & Hyd.
2	LIDAR Obstacles Detection	4 Way Dumping	40ft Container Shippment
3	New Tech Planetary Drive	Low Loading Height	Modular Electronic Boards
4	Axial Flux PMSM eMotor	Battery/Diesel Capable	Remote Software Update
5	GPS based Autotrack	Hydraulic Heavy Brakes	Small Low Cost Tires
6	FOC Motor Controller	Swapable Battery/Diesel	General Spare Parts
7	Similar zone ECUs	All Data in Control Room	Fast Replace Boxes
8	X by wire	Routes Autotrack Ability	Low Oveall Cost
9	Linux OS	Pantograph Charging Capable	Low Sleep Time

Features, Special

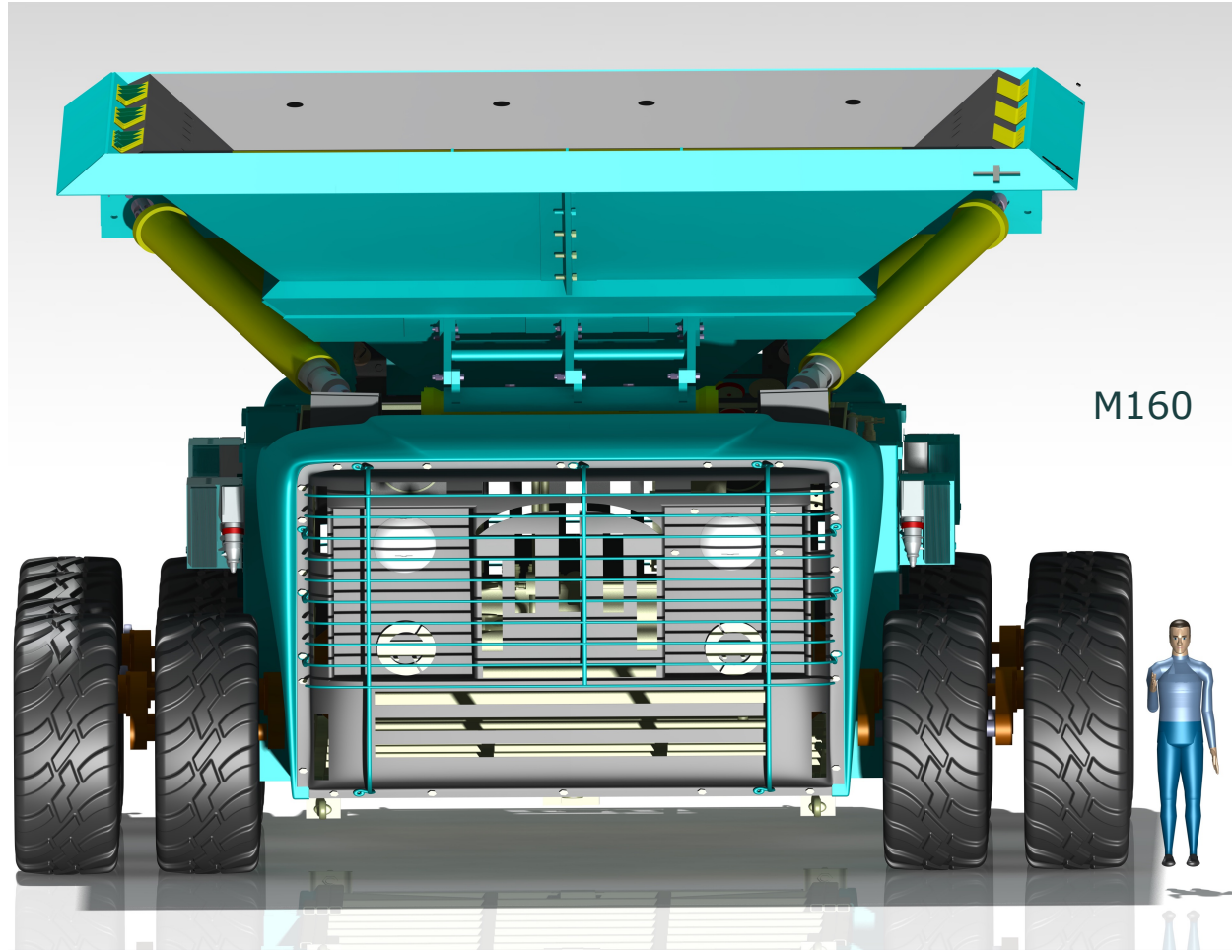


Battery Tiro vs Other Diesels:

- 80% Less Accidents for Driver
- 50% Less Vibration vs Diesels
- 80% Less Maintenance Offtime
- 20% Less Maintenance Costs
- 80% Less Noise vs Diesels
- No Fuel Supply problems

Diesel Tiro vs Other Diesels:

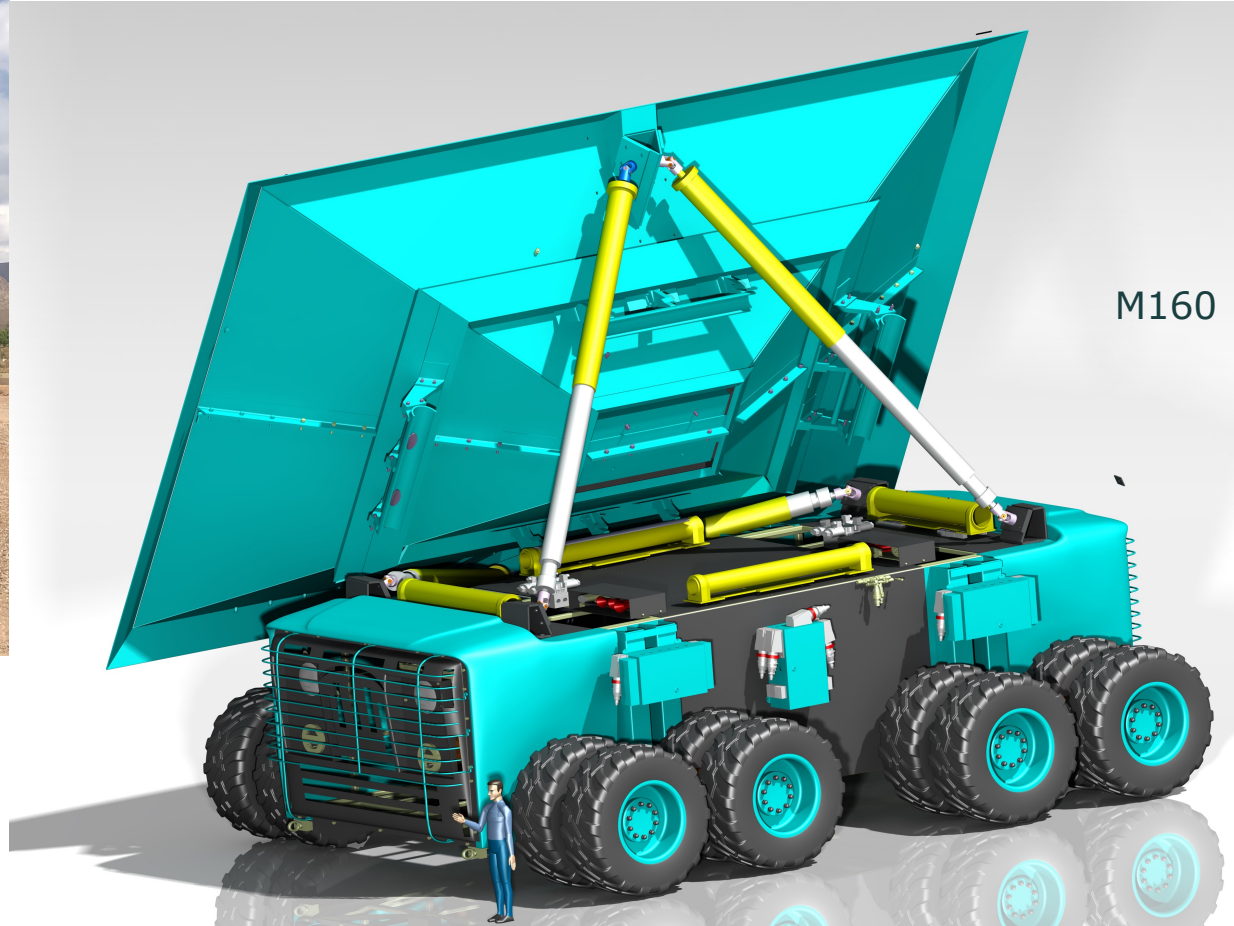
- 80% Less Accidents for Driver
- 80% Less Maintenance Offtime
- 20% Less Maintenance Costs



Operation, Side Unloading



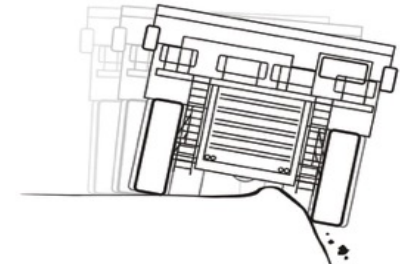
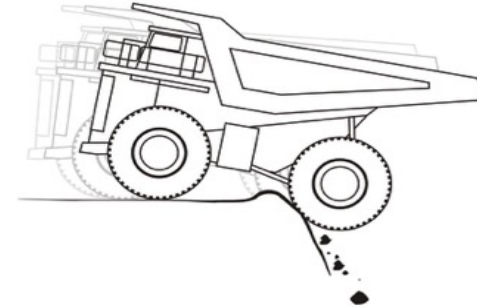
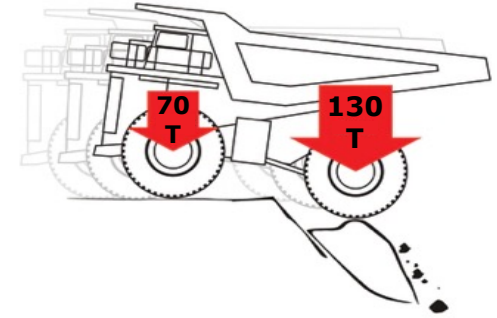
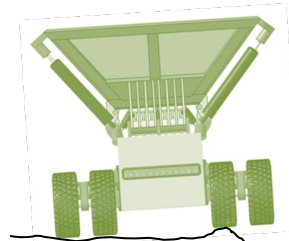
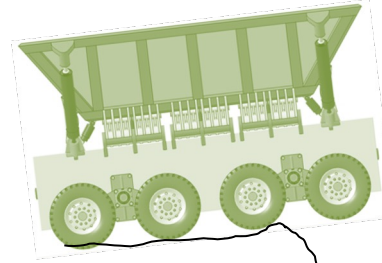
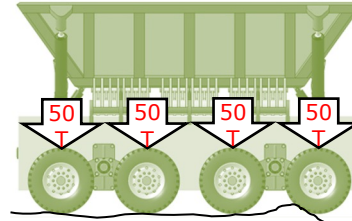
5 Tonnes
Sample



Operation, Challenges



M160



RouteDrive:

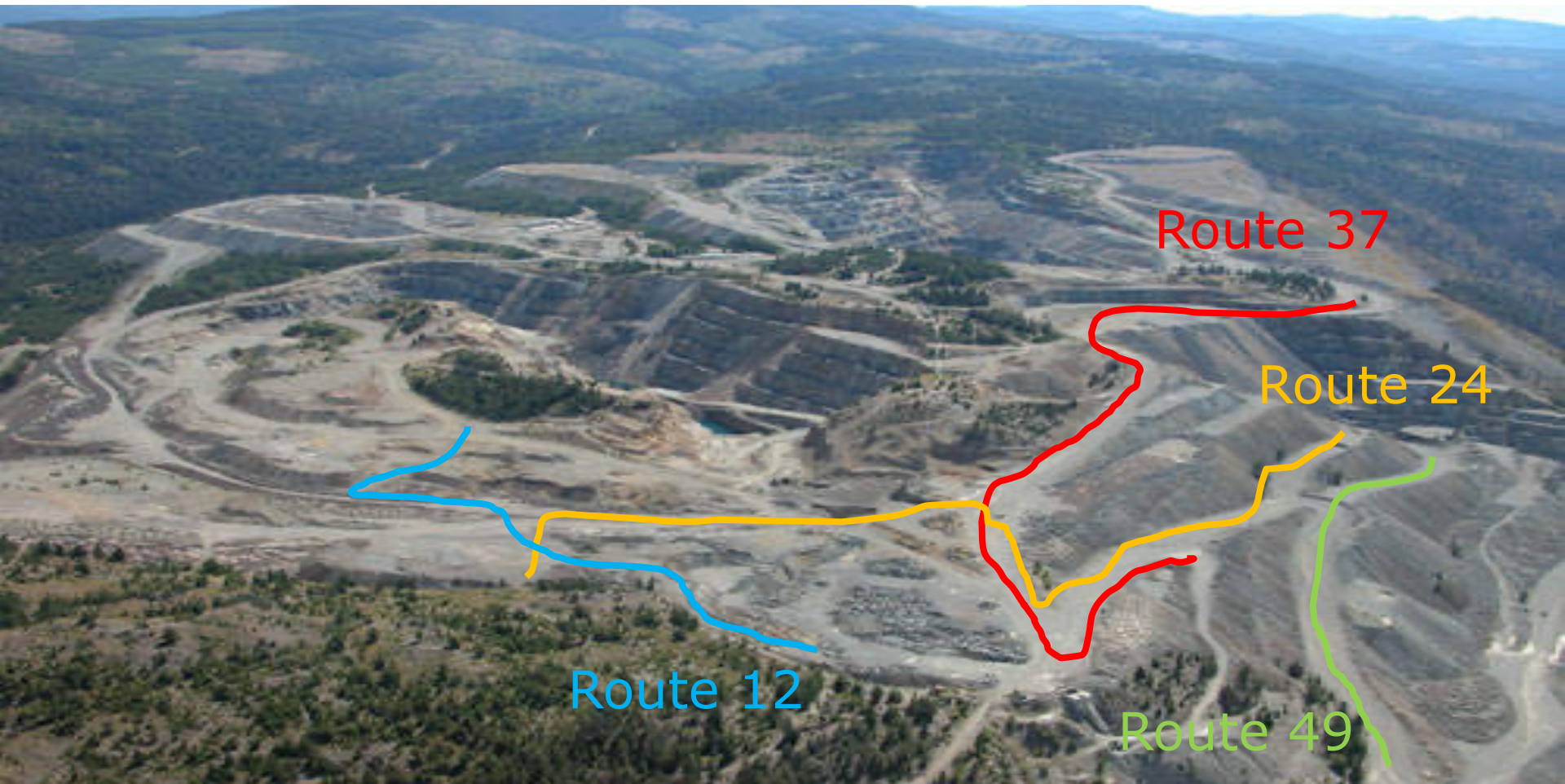
- Base on GPS
- Learn a route by driver
- Loading & unloading by driver
- Copy the route each time
- Stop on obstacle

TeleDrive:

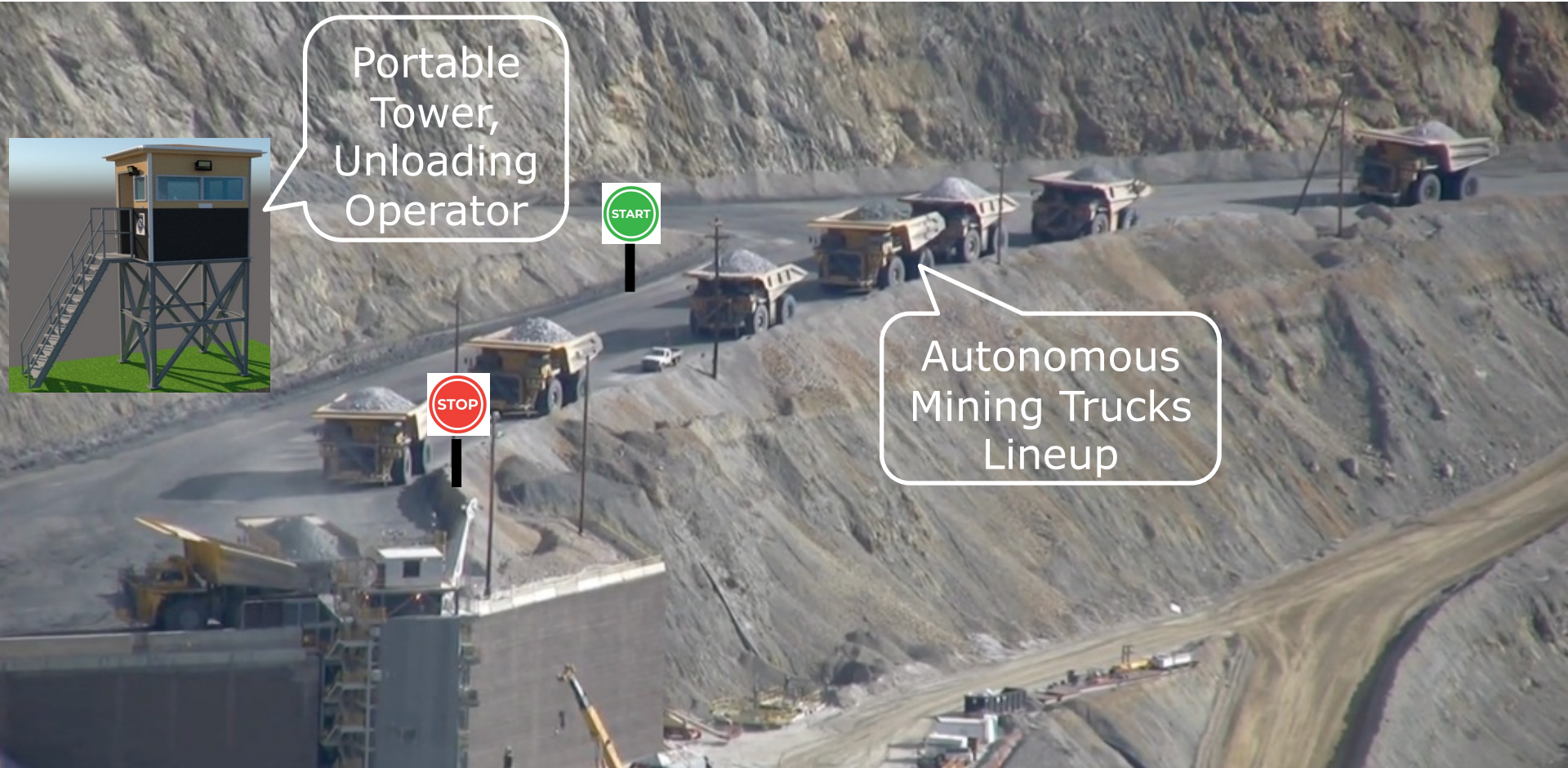
- Base on tele driver
- Driver seat in a building
- 8 cameras
- Sound transfer
- Stop on obstacle



Operation, Mine Routes



Operation, Unloading Zone



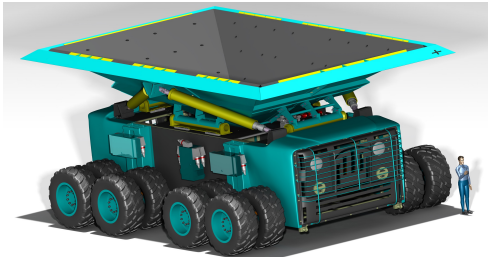
Operation, Loading Zone

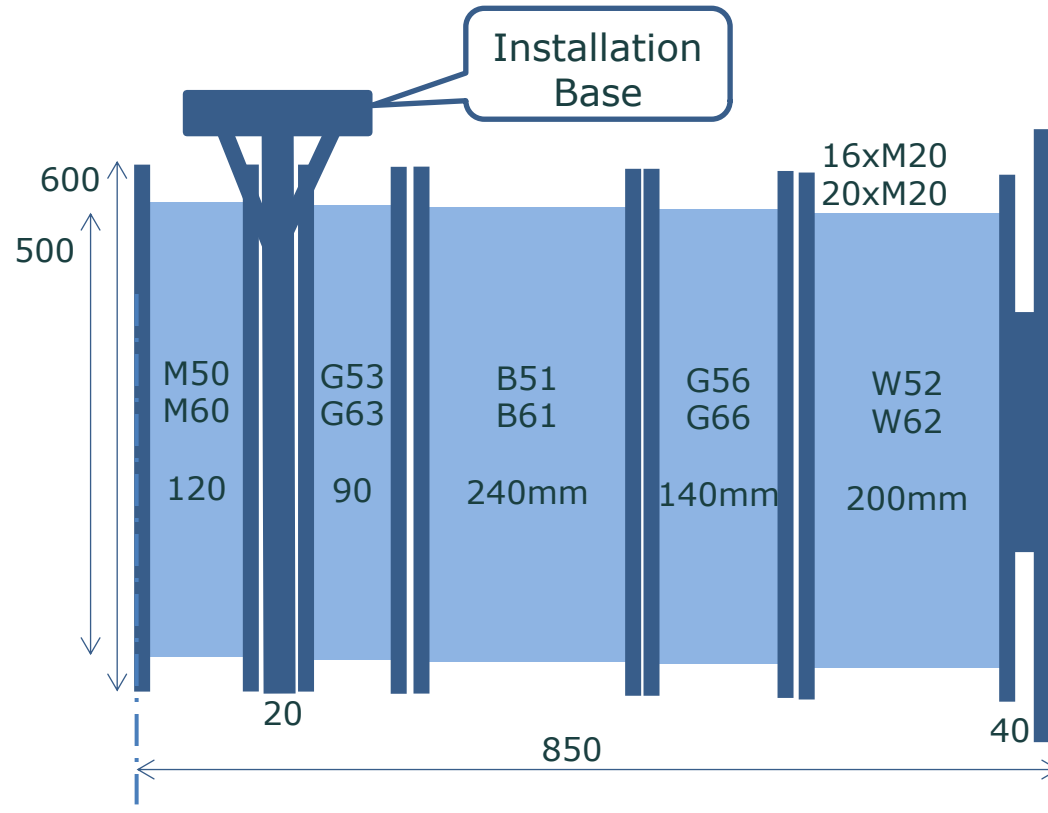


Operator:

1. Truck Getting
2. Truck Loading
3. Truck Delivering

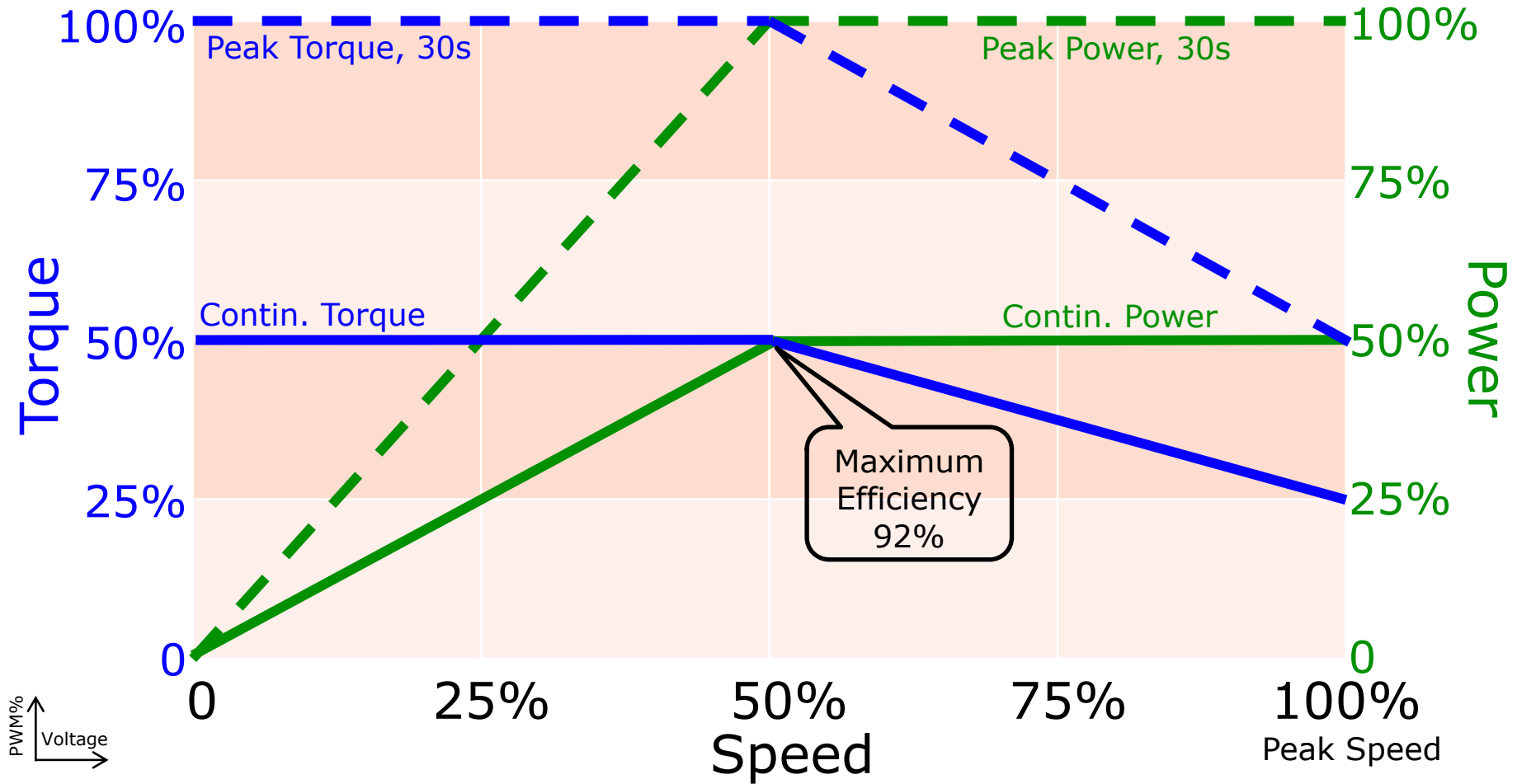
Two Way
Mining Truck





4 Sets: Motor, Gearbox, Brake, Gearbox, WHub

eAxle, Motor Performance



eAxle, Motor & Gearbox



Motor. Axial Flux PMSM. Liquid Cooling. 0-500 Volts. 1 Stator & 2 Rotors

M #	Peak Power kW	Peak Torque Nm	Peak Speed RPM	Nominal Dia. Inches	External Width mm	Stator Cols #	Rotor Magnets #	Input Cable mm2	O Shaft Ref. Dia. DIN 5480	O Hub Ext. Dia. mm	O Hub Bearing ####	Total Weight kg
1	60	90	6000	ø06" ST	100	12	10	3x10	30	40	6206	10
2	100	160		ø08" ST				3x25				18
3	160	260		ø10" ST				3x50				28
4	180	370		ø12" XS				3x120				48
5	330	660	4800	ø16" XS	120	18	16	3x185	40	60	6208	85
6	500	1000		ø20" XS				3x300				133
7	520	1400	3600	ø24" 30	140	24	22	3x400	60	100	6212	223
8	750	2000		ø28" 30				3x500				304
9	980	2600		ø32" 30				3x625				397

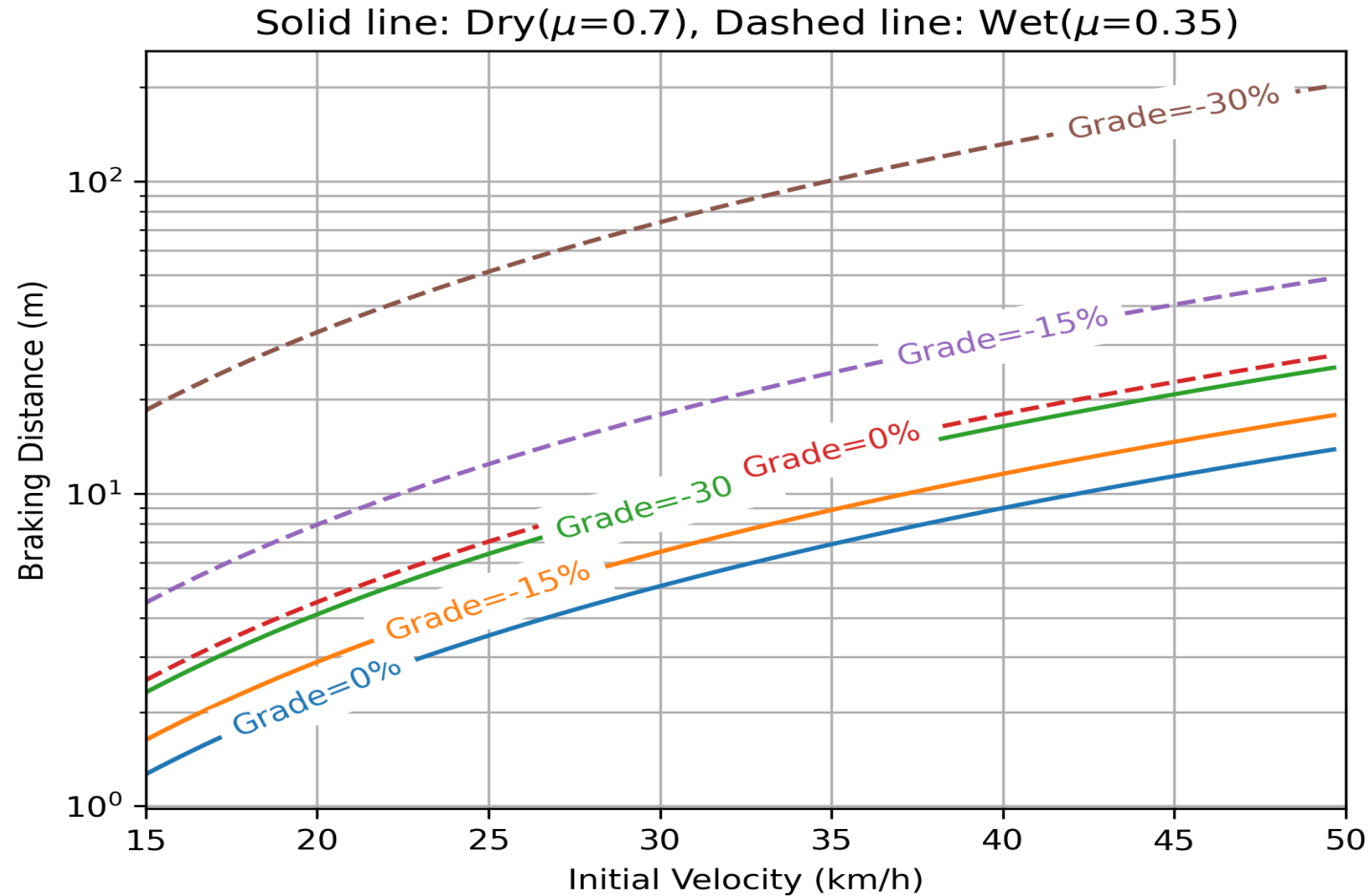
Hub min hadness is 60RC.

14 €/kW = Price

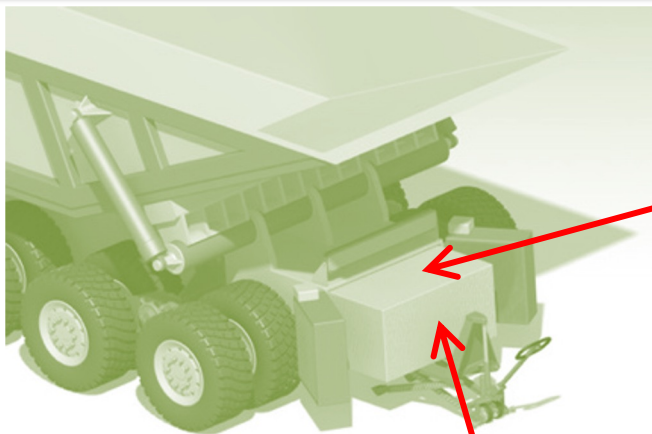
Peak torque & power only for 30s, Contin. torque & power are 50% of peaks.

The best efficiency is 92% at 50% of max continuous speed with resolver sensor.

Gearbox Combl Ratios, G1-3							Gearbox Combl Ratios, G4-7							Gearbox Combl Ratios, G8-9						
Stage 1	Stage 2		Stage 3				Stage 1	Stage 2		Stage 3			Stage 1	Stage 2		Stage 3				
			-	Ratio7	Ratio8	Ratio9				-	Ratio7	Ratio8	Ratio9				-	Ratio7	Ratio8	Ratio9
			-	2.75	3.00	3.33				-	3.13	3.43	3.83				-	3.50	3.86	4.33
-	-	-	1.00	2.75	3.00	3.33	-	-	-	1.00	3.13	3.43	3.83	-	-	-	1.00	3.50	3.86	4.33
	Ratio4	3.43	3.43	9.43	10.29	11.43		Ratio4	4.00	4.00	12.50	13.71	15.33		Ratio4	4.57	4.57	16.00	17.63	19.81
	Ratio5	3.83	3.83	10.54	11.50	12.78		Ratio5	4.50	4.50	14.06	15.43	17.25		Ratio5	5.17	5.17	18.08	19.93	22.39
	Ratio6	4.40	4.40	12.10	13.20	14.67		Ratio6	5.20	5.20	16.25	17.83	19.93		Ratio6	6.00	6.00	21.00	23.14	26.00
Ratio1 4.43	-	-	4.43	12.18	13.29	14.76	Ratio1 5.29	-	-	5.29	16.52	18.12	20.26	Ratio1 6.14	-	-	6.14	21.50	23.69	26.62
	Ratio4	3.43	15.18	41.76	45.55	50.61		Ratio4	4.00	21.14	66.07	72.49	81.05		Ratio4	4.57	28.08	98.29	108.31	121.69
	Ratio5	3.83	16.98	46.68	50.93	56.59		Ratio5	4.50	23.79	74.33	81.55	91.18		Ratio5	5.17	31.74	111.08	122.42	137.53
	Ratio6	4.40	19.49	53.59	58.46	64.95		Ratio6	5.20	27.49	85.89	94.24	105.36		Ratio6	6.00	36.86	129.00	142.16	159.71
Ratio2 5.00	-	-	5.00	13.75	15.00	16.67	Ratio2 6.00	-	-	6.00	18.75	20.57	23.00	Ratio2 7.00	-	-	7.00	24.50	27.00	30.33
	Ratio4	3.43	17.14	47.14	51.43	57.14		Ratio4	4.00	24.00	75.00	82.29	92.00		Ratio4	4.57	32.00	112.00	123.43	138.67
	Ratio5	3.83	19.17	52.71	57.50	63.89		Ratio5	4.50	27.00	84.38	92.57	103.50		Ratio5	5.17	36.17	126.58	139.50	156.72
	Ratio6	4.40	22.00	60.50	66.00	73.33		Ratio6	5.20	31.20	97.50	106.97	119.60		Ratio6	6.00	42.00	147.00	162.00	182.00
Ratio3 5.80	-	-	5.80	15.95	17.40	19.33	Ratio3 7.00	-	-	7.00	21.88	24.00	26.83	Ratio3 8.20	-	-	8.20	28.70	31.63	35.53
	Ratio4	3.43	19.89	54.69	59.66	66.29		Ratio4	4.00	28.00	87.50	96.00	107.33		Ratio4	4.57	37.49	131.20	144.59	162.44
	Ratio5	3.83	22.23	61.14	66.70	74.11		Ratio5	4.50	31.50	98.44	108.00	120.75		Ratio5	5.17	42.37	148.28	163.41	183.59
	Ratio6	4.40	25.52	70.18	76.56	85.07		Ratio6	5.20	36.40	113.75	124.80	139.53		Ratio6	6.00	49.20	172.20	189.77	213.20



Chassis, Packs



Frame
Channel
H2400
W2000



Lithium Pack 116kWh

Pack Energy	116 kWh
Pack Voltage	500V DC
Pack Length	800 mm
Pack Weight	750 kg
Pack #	45
Nor. Charge	5 Hours
Fast Charge	2 Hours

Lead Pack 90kWh

Pack Energy	90 kWh
Pack Voltage	500V DC
Pack Length	800 mm
Pack Weight	2500 kg
Pack #	40
Nor. Charge	5 Hours
Fast Charge	2 Hours

Diesel Pack 200kW

Pack Power	200 kW
Pack Voltage	400V 3Ph
Pack Length	2800 mm
Pack Weight	1800 kg
Diesel Type	OM 457
Consu. 50%	25 lit/h
Consu. 100%	45 lit/h

Diesel Pack 320kW

Pack Power	320 kW
Pack Voltage	400V 3Ph
Pack Length	3600 mm
Pack Weight	3700 kg
Diesel Type	CAT C13
Consu. 50%	60 lit/h
Consu. 100%	94 lit/h

Diesel Pack 800kW

Pack Power	800 kW
Pack Voltage	400V 3Ph
Pack Length	4400 mm
Pack Weight	6300 kg
Diesel Type	CAT C27
Consu. 50%	117 lit/h
Consu. 100%	213 lit/h

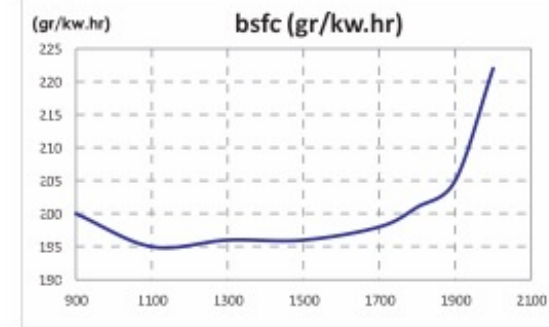
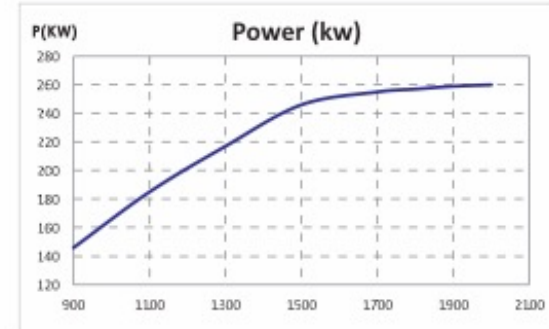
Hydraulic Pack 50kW

Pack Power	50 kW
Pack Voltage	400V 3Ph
Pack Length	800 mm
Pack Weight	620 kg
Oil Delivery	200 L/min
Oil Capacity	200 lit
Oil Pressure	200 Bar

Chassis, Diesel Generator



OM 457.945

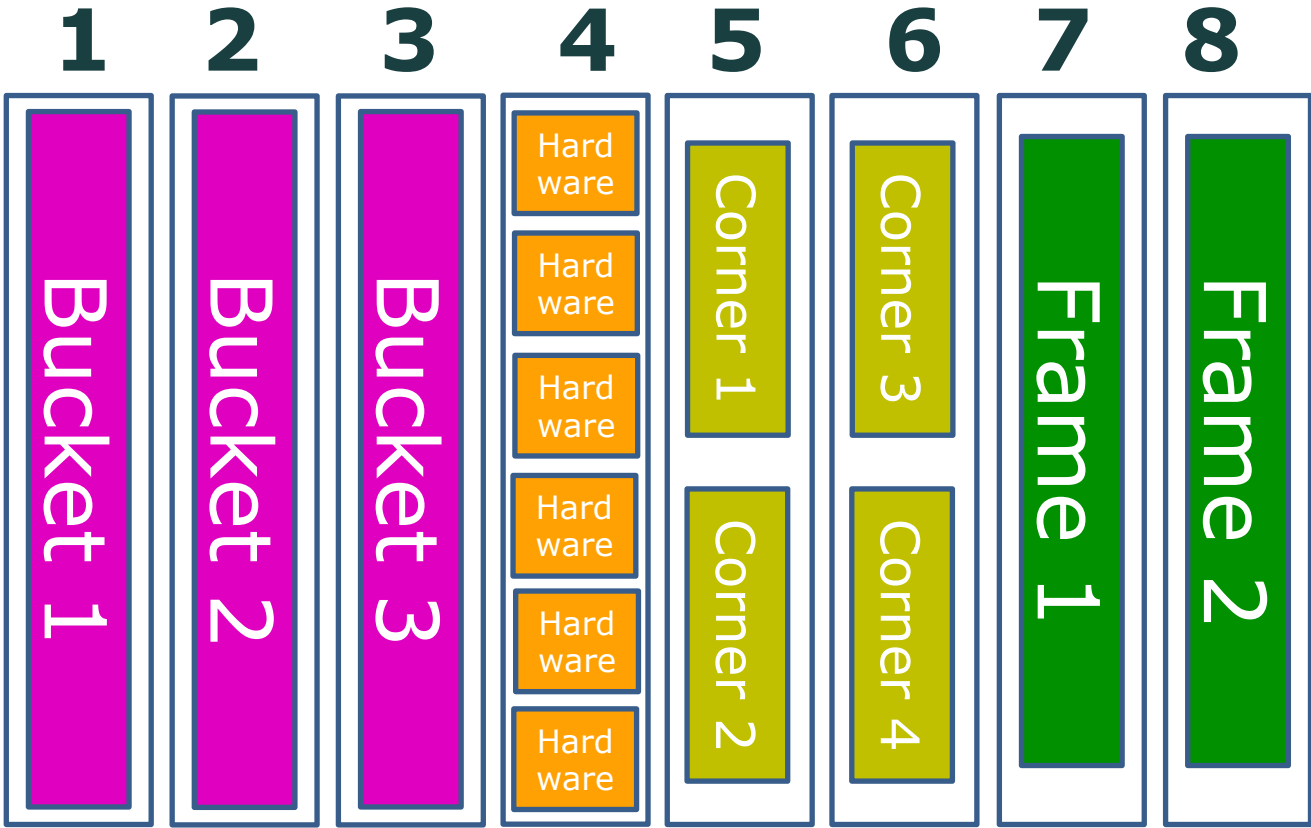




M080 Transport

All Tiro Mining
Trucks transport in
40ft High shipping
containers

Title	Containers Combination	Total
M050	3+1+2+2	8
M080	3+1+2+2	8
M100	8+1+2+4	15
M160	8+1+2+4	15
M200	8+2+4+4	18
M320	8+2+4+4	18



Warranty:

2 years or 10,000 Hours

Whichever ends first

Parts Supply: 10 Years

Maintenance

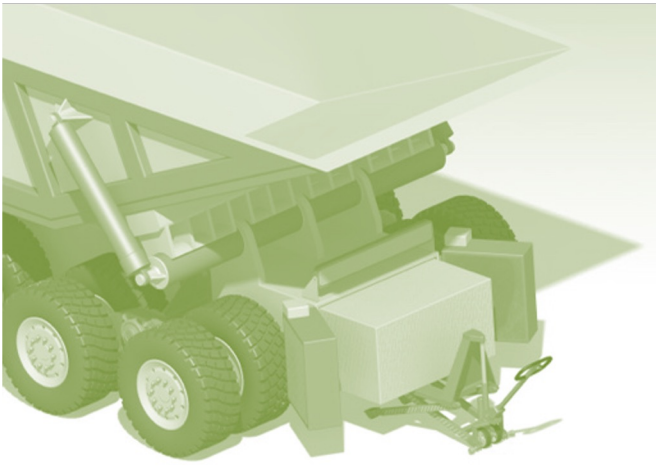


Mining Trucks Tires								
Code	Tire Number #	Tire Size -	Load Index -	Max. Load Tonnes	Overall Diameter mm	Rolling Diameter mm	Section Width mm	Tire Weight kg
M050	4x2	23.5R25	185B	9.2	1 625	1 381	609	336
M080	4x2	29.5R25	200B	14.0	1 990	1 692	748	597
M100	4x4	23.5R25	185B	9.2	1 625	1 381	609	336
M160	4x4	29.5R25	200B	14.0	1 990	1 692	748	597
M200	8x4	23.5R25	185B	9.2	1 625	1 381	609	336
M320	8x4	29.5R25	200B	14.0	1 990	1 692	748	597

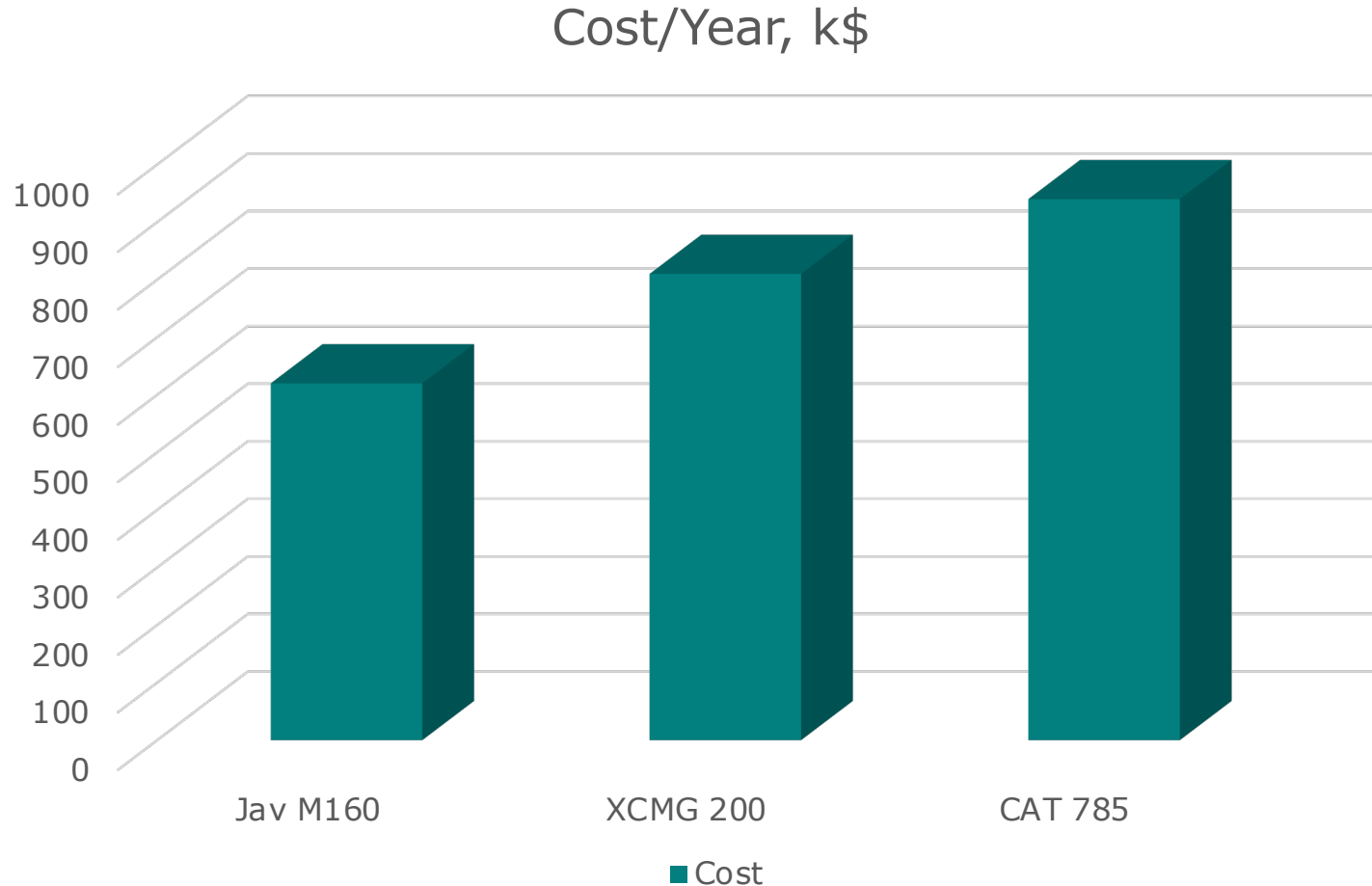
Pack Change: 10 min./Pack

Tire Change: 15 min.

Corner Change: 30 min.



Maintenance, Comparison



Option, Control Center



Options, Power



#	Options	Cap. Unit	Price €	Max. #	Description
1	Diesel Generator Pack	200 kW	€38k	2	Each pack add 5% continuous gradeability
2	LeadAcid Battery Pack	90 kWh	€8k	2	Each pack add 5% gradeability for 20 minutes
3	TeleDrive Network	1 each	€48k	1	for max. 20 trucks in 7 km
4	TeleDrive Pack	1 each	€32k	1	1 driver in close room
5	Hydraulic Pack	20 kW	€12k	3	to reduce unloading time