Engines

All Caterpillar engines are built to excel in even the most demanding jobs.

651E/657E Tractor

Four-stroke cycle, 12 cylinder 3412E turbocharged and aftercooled diesel engine.

Variable horsepower
Ratings at 1900 rpm*

Gross power	kW	hp
Gears 1-2	430	577
Gears 3-8	472	632
Net power		
Gears 1-2	410	550
Gears 3-8	451	605

The following ratings apply at 1900 rpm when tested under the specified standard conditions for the specified standard:

Net power	kW	hp	PS
Caterpillar	410	550	—
ISO 9249	410	550	—
EEC 80/1269	410	550	—
SAE J1349	406	544	—
DIN 70020	—	—	570

Dimensions		
Bore	137 mm	5.4 in
Stroke	152 mm	6.0 in
Displacement	27.0 liters	1649 cu in

657E (Scraper only)

Four-stroke cycle, 8 cylinder 3408E turbocharged and aftercooled diesel engine.

Variable horsepower
Ratings at 1900 rpm*

Gross power	kW	hp
Gears 1-2	312	418
Gears 3-8	341	457
Net power	kW	hp
Gears 1-2	299	400
Gears 3-8	328	440

The following ratings apply at 1900 rpm when tested under the specified standard conditions for the specified standard:

Net power	kW	hp	PS
Caterpillar	298	400	—
ISO 9249	298	400	—
EEC 80/1269	298	400	—
SAE J1349	295	396	—
DIN 70020	—	—	414

Dimensions		
Bore	137 mm	5.4 in
Stroke	152 mm	6.0 in
Displacement	18.0 liters	1099 cu in

*Power rating conditions

- based on standard air conditions of 25°C (77°F) and 99 kPa (29.32 in Hg) dry barometer
- used 35°, API gravity fuel having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 30°C (86°F) [ref. a fuel density of 838.9 g/L (7.001 lb/U.S. gal)]
- net power advertised is the power available at the flywheel when the engine is equipped with fan, air cleaner, muffler and alternator
- no derating required up to 1500 m (5000 ft) altitude

Features

- fuel system delivers fuel economy through Hydraulically actuated, Electronically controlled Unit Injectors (HEUI)
- electronic control provides precise speed governing, active and logged diagnostic codes, cold start-up mode, low oil pressure warning/derate and high temperature warning/derate
- integral inlet manifold porting with two intake and two exhaust valves per cylinder with valve rotators
- cam-ground and tapered aluminum-alloy pistons with three keystone-designed rings; cooled by oil spray
- steel-backed, copper-bonded, aluminum bearings, through-hardened crankshaft journals
- pressure lubricated with full-flow filtered and cooled oil
- dry-type air cleaner with primary and secondary elements
- 24-volt direct-electric starting system; tractor has 75 amp alternator with four 12-volt 100 amp-hour batteries, scraper has 35 amp alternator with four 12-volt 100 amp-hour batteries
- standard ether starting aid
- convenient sampling valve for obtaining oil sample for S•O•S analysis (for both tractor and scraper)

Transmission

Eight-speed automatic power shift.

651E, 657E Maximum travel speeds

		km/h	mph
Forward	1	5.1	3.2
	2	9.3	5.8
	3	11.2	7.0
	4	15.1	9.4
	5	20.4	12.7
	6	27.6	17.2
	7	37.0	23.0
	8	50.0	31.1
Reverse		9.1	5.7

Tractor and Scrapers (657E) Features

- single-lever shift control
- torque converter multiplies torque in first, second and reverse for higher rimpull and fast hydraulics when loading and dumping
- third through eighth gears are direct drive for maximum efficiency on haul roads
- all shifts up or down from second to gear selected are automatic
- push-button switch on the bowl control holds transmission in any gear
- microprocessor monitors output shaft speed and can override control to shift up or down one gear to ensure proper engine rpm
- Electronic Programmable Transmission Control System
- Intermittent Fault Detector, neutral coast inhibitor and top gear control
- Individual Clutch Modulation (ICM) for fast, smooth shifts and improved serviceability

Scraper Features (657E only)

- shifting is synchronized to tractor transmission by solid-state electronic switching

Steering

Full hydraulic power steering.

Ratings 651E

Width required for curb-to-curb 180° turn, right	13.64 m 44'8"
Width required for curb-to-curb 180° turn, left	14.53 m 47'8"
Steering angle	85° left 90° right
Hydraulic output at 2000 rpm and 6900 kPa (1000 psi)	579 liters/min 152.8 gpm
Ground-driven secondary steering (optional) system at 24 km/h (15 mph)	232 liters/min 61.2 gpm

Ratings 657E

Width required for curb-to-curb 180° turn, right	13.82 m 45'4"
Width required for curb-to-curb 180° turn, left	14.73 m 48'4"
Steering angle	85° left 90° right
Hydraulic output at 2000 rpm and 6900 kPa (1000 psi)	579 liters/min 152.8 gpm
Ground-driven secondary steering (optional) system at 24 km/h (15 mph)	232 liters/min 61.2 gpm

Features

- two double-acting hydraulic cylinders
- hydraulic follow-up system for automotive feel
- positive, modulated flow control for constant steering response
- optional supplemental steering system is ground-driven and provides hydraulic power for steering if needed
- optional supplemental steering system meets SAE J1511 (FEB94) requirements

Differential Control

Caterpillar differential lock.

Tractor Features

- helps prevent drive wheels from spinning in poor underfoot conditions
- allows normal differential action when not engaged

Scraper Features (657E only)

- automatic locking type

Final Drives

Planetary final drives and full-floating axles.

Features

- remove independently of wheel mounting for easy service
- double-row roller bearings are service-free
- protected with Duo-Cone Floating Ring Seals

Cushion Hitch and Gooseneck

Parallelogram-type linkage connects two-piece hitch.

Features

- vertically mounted hydraulic cylinder transfers road shocks to two nitrogen accumulators
- controlled oil flow dampens rebound oscillation
- leveling valve automatically centers piston in cylinder for all scraper loads
- cushion ride lock down control for positive cutting-edge down pressure when loading or spreading
- cushion hitch makes extensive use of steel castings, adding strength and eliminating many welded joints
- double-kingbolt design withstands high external forces, allows easy installation and removal
- box-section gooseneck reduces plate and weld stresses
- fabricated draft tube and cast center section
- wide-mounted bowl lift cylinders

Brakes

Meet the following standards: OSHA, MSHA, SAE J1473 OCT90, ISO 3450-1985 (E).

Service brake features

- air-applied and spring-released
- cam-operated expanding-shoe type

Parking brake features

- uses service brakes
- spring-applied and air-released
- manually applied with button on dash

Secondary brake features

- uses service brakes
- spring-applied and air-released
- can be manually applied with button on dash
- automatically applied if service air pressure drops to 276 kPa (40 psi)
- audible and visual action alert indicators inform operator when service air pressure drops to 414 kPa (60 psi)

Cab

Caterpillar cab and Rollover Protective Structure (ROPS) are standard in North America, Europe and Japan.

Features

- ROPS meets the following criteria:
  SAE J320a
  SAE J1040 APR88
  ISO 3471-1:1986, ISO 3471:1994
- also meets the following criteria for Falling Objects Protective Structure:
  SAE J231:JAN81
  ISO Level 2 3449:1992

Sound exposure

When properly installed and maintained, the cab offered by Caterpillar, when tested with doors and windows closed as per work cycle procedures specified in ANSI/SAE J1166 MAY90, results in an operator sound exposure Leq (equivalent sound pressure level) of 85 dB(A) for both the 651E and 657E.

This A-weighted sound exposure level can be used in conjunction with OSHA, MSHA and EEC Occupational Noise Exposure Criteria.

The exterior sound pressure level for the standard machine per the standard SAE J88 JUN 86, mid-gear-moving mode, is 86 dB(A) for the 651E and 85.5 dB(A) for the 657E.

Tires

For 651E and 657E.

Standard

- 40.5/75 R39** Radial Steel cord

Optional

- 37.5 R39** Radial Steel cord

Note:

In certain applications the scraper's productive capabilities might exceed the tires' metric tons-km/h (ton-mph) capabilities. Caterpillar recommends you consult a tire supplier to evaluate all conditions before selecting optional tires.

Controls

Three levers for actuation.

- bowl — raise, hold and lower
- ejector — dump, hold, return and detented return
- apron — raise, hold, lower, detented float
- auger activation switch

Weights

(approximate)

Model	651E		657E Standard		657E Push-Pull	
Shipping, with ROPS cab and 10% fuel						
Tractor	30 720 kg	67,726 lb	30 720 kg	67,726 lb	33 030 kg	72,819 lb
Scraper	29 480 kg	64,991 lb	36 880 kg	81,307 lb	38 350 kg	84,547 lb
Total	60 200 kg	132,717 lb	67 600 kg	149,032 lb	71 380 kg	157,366 lb
Operating, with ROPS cab, full fuel tanks and operator						
Empty, front axle	66%		60%		60%	
	40 126 kg	88,460 lb	41 447 kg	91,374 lb	43 714 kg	96,374 lb
Empty, rear axle	34%		40%		40%	
	21 000 kg	46,300 lb	27 631 kg	60,916 lb	29 143 kg	64,249 lb
Total	61 126 kg	134,760 lb	69 078 kg	152,290 lb	72 857 kg	160,623 lb
Loaded, based on a rated load of:	47 174 kg	104,000 lb	47 174 kg	104,000 lb	47 174 kg	104,000 lb
Front axle	53%		51%		51%	
	57 400 kg	126,543 lb	59 288 kg	130,708 lb	61 216 kg	134,958 lb
Rear axle	47%		49%		49%	
	50 900 kg	112,217 lb	56 963 kg	125,582 lb	58 815 kg	129,665 lb
Total	108 300 kg	238,760 lb	116 251 kg	256,290 lb	120 031 kg	264,623 lb

Hydraulics

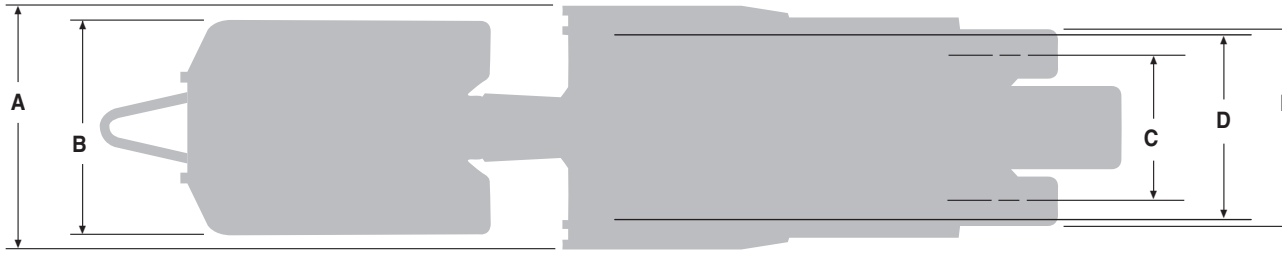
Open centered, full-flow filtered hydraulic circuits powered by vane-type pumps.

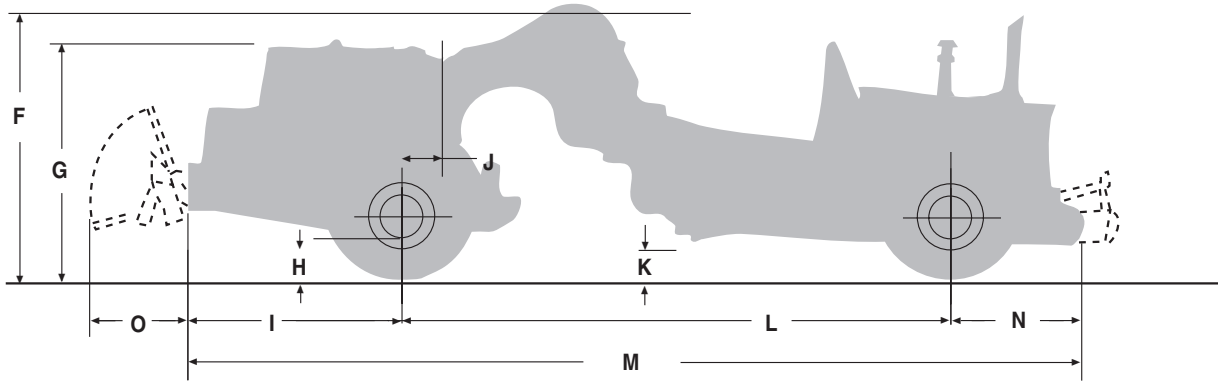
Model		651E		657E	
Double-acting bowl cylinders (2)					
Dimensions:	bore	235 mm	9.25"	235 mm	9.25"
	stroke	950 mm	37.4"	950 mm	37.4"
Double-acting apron cylinder (1)					
Dimensions:	bore	235 mm	9.25"	235 mm	9.25"
	stroke	760 mm	29.9"	760 mm	29.9"
Double-acting ejector cylinder: 2 for 657E/651E					
Dimensions:	bore	197 mm to 152 mm	7.75" 6.0"	*197 mm to 152 mm	7.75" 6.0"
	stroke	1946 mm	76.6"	1946 mm	76.6"
Output at 2000 rpm:					
Steering circuit		435 liter/min	115 gpm	435 liter/min	115 gpm
Scraper circuit		579 liter/min	153 gpm	579 liter/min	153 gpm
Cushion hitch circuit		36.3 liter/min	10 gpm	36.3 liter/min	10 gpm
Optional supplemental steering circuit		232 liter/min	61.2 gpm	232 liter/min	61.2 gpm
Relief valve settings for:					
Steering circuit		13 500 kPa	1960 psi	13 500 kPa	1960 psi
Implement circuit		13 790 kPa	2000 psi	13 790 kPa	2000 psi
Cushion hitch circuit		18 200 kPa	2640 psi	18 200 kPa	2640 psi

* 2 double acting, two stage cylinders

Dimensions

All dimensions are approximate.





Dimension/Model		651E		657E	
A	Overall machine width	4344 mm	14'3"	4344 mm	14'3"
B	Tractor width	3600 mm	11'10"	3600 mm	11'10"
C	Width to center of rear tires	2810 mm	9'3"	2810 mm	9'3"
D	Width to inside of bowl	3682 mm	12'1"	3682 mm	12'1"
E	Width to outside of bowl (Shipping width)	3914 mm	12'10"	3914 mm	12'10"
F	Overall shipping height	4710 mm	15'5"	4710 mm	15'5"
G	Height to top of exhaust stack	3935 mm	12'11"	3935 mm	12'11"
H	Ground Clearance (Tractor)	645 mm	2'1"	645 mm	2'1"
I	Length to front of machine from front axle	3770 mm	12'4"	3770 mm	12'4"
J	Axle to vertical hitch pin	608 mm	2'0"	608 mm	2'0"
K	Maximum scraper blade height	680 mm	2'3"	680 mm	2'3"
L	Wheelbase	9973 mm	32'9"	9973 mm	32'9"
M	Overall machine length	16 178 mm	53'1"	16 178 mm	53'1"
N	Length to rear of machine from rear axle	2435 mm	8'0"	2435 mm	8'0"
O	Maximum bail length for push-pull	—	—	1835 mm	6'1"

Scraper Bowl

High-carbon steel, box construction.

Model	651E/657E	
Maximum depth of cut	440 mm	17.3"
Width of cut, outside router bits	3846 mm	12'7"
Maximum rated load	47 174 kg	104,000 lb
Heaped, SAE rating	33.6 m^3	44 yd^3
Struck, SAE rating	24.5 m^3	32 yd^3
Maximum ground clearance (cutting edge)	580 mm	22.8"
Cutting edge dimensions		
Center section	35 x 482 x 1822 mm	1.38" x 19" x 71.75"
End section	35 x 406 x 908 mm	1.38" x 16" x 35.75"
Thickness of optional cutting edge	45 mm	1.8"
Maximum available hydraulic penetration force at cutting edge (empty)	542 kN	121,000 lb
Maximum depth of spread	508 mm	20"
Apron opening with bowl 150 mm (6 in) above ground level	2340 mm	92"
Apron closure force, cutting edge fully raised and apron opened 300 mm (12 in)	176 kN	39,200 lb

Service Refill Capacities

Model	651E/657E Tractor		651E Scraper		657E Scraper	
	L	Gallon	L	Gallon	L	Gallon
Fuel tank	—	—	954	252	1768	467
Crankcase	68	18	—	—	45	12
Transmission	136	36	—	—	121	32
Differential	136	35	—	—	168	44
Final drive, each side	23	6	—	—	30	8
Cooling system	144	37	—	—	110	29
Hydraulic system	303	79	—	—	—	—
Wheel coolant, each	130	34	130	34	130	34

Standard Equipment

Standard and optional equipment may vary. Consult your Caterpillar dealer for specifics.

Air horn
Air line dryer
Alternator (35 amp for scraper) (75 amp for tractor)
Back up alarm
Batteries, four, 12-volt, maintenance-free, on tractor and scraper
Bowl control valve, quick drop
Brake shields
Cab, ROPS, sound suppressed, with heater and air conditioner
Crankcase guard
Control lever, combination apron and bowl
Cushion hitch, electronically controlled
Dash lights
Differential lock
Downshift inhibitor
Electric starting (24-volt)
Dry-type air cleaner
Electric hour meter
Electronic Programmable Transmission Control II
EMS action alert system
Engine shut-off, ground level
Ether starting aid, automatic
Fast oil change system
Fuel system, fast fill
Flood light, cutting edge
Guard, scraper bowl overflow
Halogen lamps
Heater, engine coolant
Laminated Thermo-Shield
Muffler
Overspeed lamp
Parking brake
Radio compatible wires
Rear-mounted floodlight
Rearview mirrors
Retarder, hydraulic, tractor and scraper
Safety glass windshield
Seat belt
Secondary braking system
Servo-steering and hydraulic system
S•O•S oil sampling valves for engine, transmission and hydraulic systems
Starting receptacle
Stop/tail lights
Suction fan
Suspension seat
Throttle lock
Throttle, back-up
Tilt steering column
Tires, 40.5/75 R39**
Transmission, automatic, eight-speed
Transmission hold switch
Turn signals
Vandalism protection locks
Windshield wiper and washer, front and rear

Optional Equipment

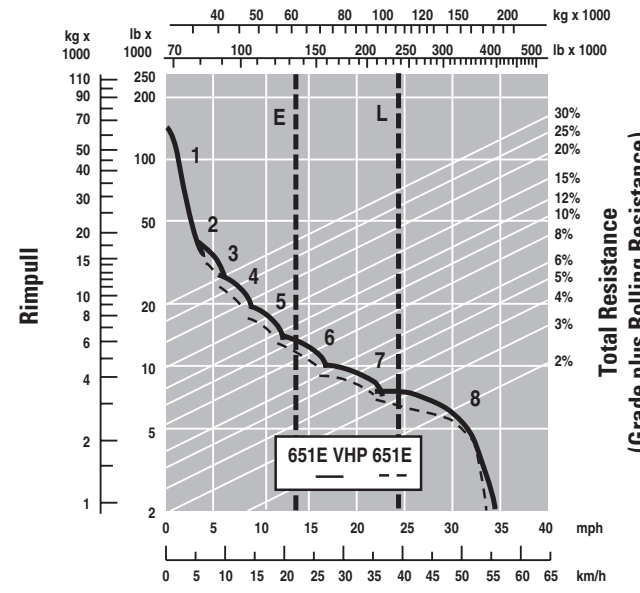
With approximate changes in operating weights.

Model	651E/657E	
Air conditioner removal	–162 kg	–358 lb
Supplemental steering	103 kg	226 lb
Tires, set of two, tractor or scraper		
37.5R39	–227 kg	–500 lb

Gradeability/Speed/Rimpull

To determine gradeability performance: Read from gross weight down to the percent of total resistance. Total resistance equals actual percent grade plus 1% for each 10 kg/metric ton (20 lb/ U.S. ton) of rolling resistance. From this weight-resistance point, read horizontally to the curve with the higest obtainable gear, then down to maximum speed. Usable rimpull will depend upon traction available and weight on drive wheels.

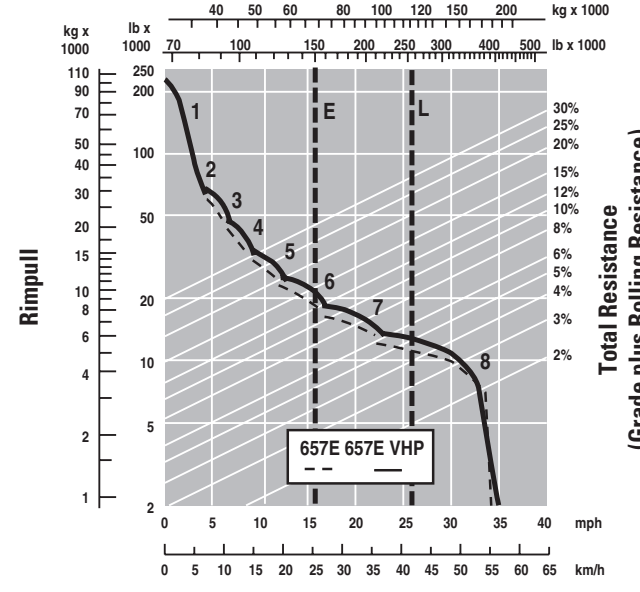
651E Gross Weight
37.5R39 Tires



1— 1st Gear Torque Converter Drive
2—2nd Gear Torque Converter Drive
3—3rd Gear Direct Drive
4—4th Gear Direct Drive
5—5th Gear Direct Drive
6—6th Gear Direct Drive
7—7th Gear Direct Drive
8—8th Gear Direct Drive

E—Empty 61 126 kg (134,760 lb)
L—Loaded 108 300 kg (238,760 lb)

657E Gross Weight
37.5R39 Tires



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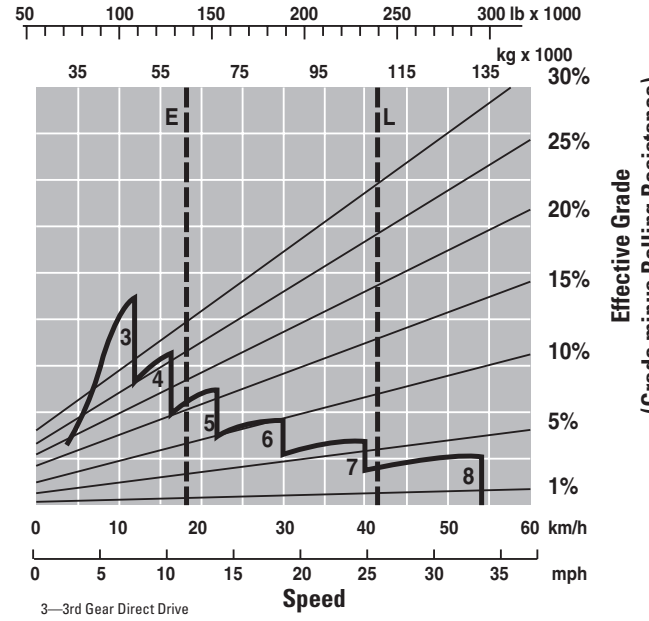
3—3rd Gear Direct Drive
4—4th Gear Direct Drive
5—5th Gear Direct Drive
6—6th Gear Direct Drive
7—7th Gear Direct Drive
8—8th Gear Direct Drive

E—Empty 69 078 kg (152,290 lb)
L—Loaded 116 251 kg (256,290 lb)

Retarding

To determine retarding performance: Read from gross weight down to the percent effective grade. (Effective grade equals actual percent grade minus 1% for each 10 kg/metric ton (20 lb/U.S. ton) of rolling resistance). From this weight-effective grade point, read horizontally to the curve with the highest obtainable speed range, then down to maximum descent speed the retarder can properly handle.

651E Retarding
Gross Weight
37.5R39 Tires



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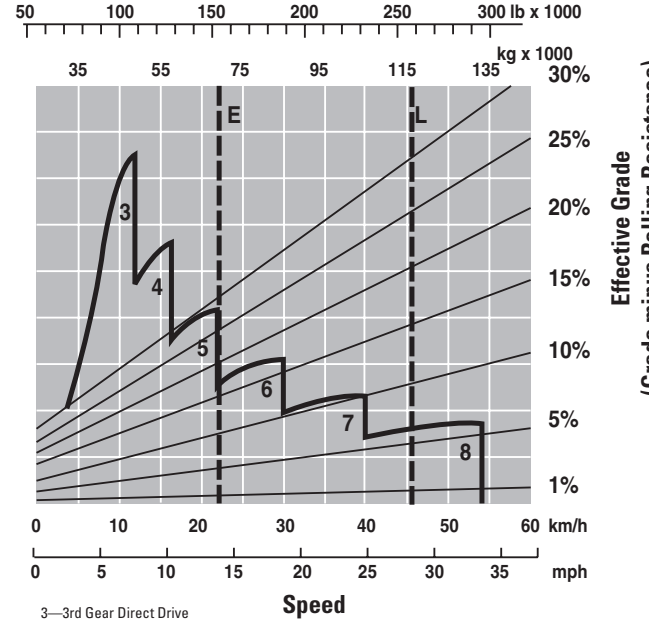
657E Retarding
Gross Weight
37.5R39 Tires



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