RESPONSE 99

FIRE PROTECTION EQUIPMENT CAPACITY

Made By: AGM/HPR
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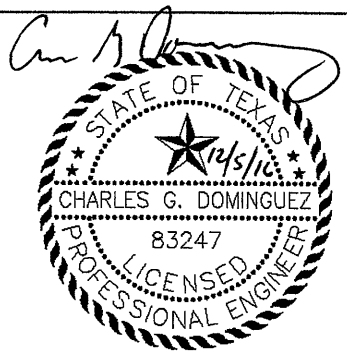

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Professional Engineering Firm
Registration Number F-2578

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1.0 OBJECTIVE

Evaluate the adequacy of the on-site equipment to place a 6-inch layer of earthen material within 1 hour of detecting a fire on the working face area that is not already covered. Evaluate the capacity of the equipment to haul soil from a borrow area 1,000 feet away and for a bulldozer to spread the soil over the open area. The equipment to be evaluated includes excavators, each with a 4-cubic yard (cy) bucket, dump trucks, each with a 20-cy capacity, and CAT D8 bulldozers. The equipment being evaluated is typical and may be replaced with equivalent equipment of a different brand or size.

2.0 ASSUMPTIONS

I) A working face size for a typical operation is 10,000 ft^2 (100 feet by 100 feet), but at maximum may be as much as 80,000 ft^2 (400 feet by 200 feet).

II) Volume of working face with 6-inch layer, including an additional 20%, ranges from approximately 222 cy for a 10,000 ft^2 working face to 1,778 cy for an 80,000 ft^2 working face. This material is stockpiled adjacent to the working face and used for daily cover.

III) Distance to earthen material borrow area is 1,000-feet.

IV) Time to cover working face is 1 hour (60 minutes).

V) Bulldozer will be used at the working face for spreading.

VI) The site currently has one (1) excavator, two (2) dump trucks, and two (2) bulldozers. The capacity of these pieces of equipment will be first evaluated for adequacy. Additional operating requirements, if needed are provided.

2.1 Equipment Specs

2.1.1 Excavator

Estimated per Reference 1, using the CAT 345D L-VG excavator specifications (p. 4-19) and time cycle charts (p. 4-189).

Bucket Volume (heaped)	4 cy
Load Bucket	0.13 min
Swing Loaded	0.07 min
Dump Bucket	0.02 min
Swing Empty	0.06 min
Cycle Time per Load	0.28 min

2.1.2 Dump Truck

Estimated per Reference 1, using the CAT 770 truck specifications (p. 9-3) and travel time charts (p. 9-18).

Dump Capacity	20 cy	
Loading Time = (Dump Truck Capacity / Excavator Bucket Volume) * Excavator Cycle Time		
Loading Time	1.4 min	
Hauling Time (10%grade)	1.2 min	
Dumping Time	0.5 min	(Assumed)
Return Time (10% grade)	0.6 min	

3.0 CALCULATIONS

3.1 Excavators and Dump Trucks

Excavator

Cycle Time = 0.28 minutes
Bucket Volume = 4 cy
Total Volume in 60 minutes = 856 cy

Dump Truck

Cycle Time = Load + Haul + Dump + Return
Cycle Time (per truck) = 3.7 min

In 60 minutes:
Number of Loads (per truck) 16
Volume of Material (per truck) 320 cy

One (1) Excavator and Two (2) Dump Trucks
Total Volume in 60 minutes = 640 cy

The exisiting site equipment can haul up to 640 cy. In order to haul 1778 cy, the capacity required for an 80,000 ft^2 working face, additional equipment will be required. Alternatively, material can be stockpiled near the working face in order to provide adequate volume. Table 1 shows the stockpile volumes necessary to supplement the hauling capacity of the existing site equipment.

Table 1: Working Face Stockpiling Requirements

Working Face Area (ft^2)	Required Cover Material Volume (cy)	Hauling Capacity[1] (cy)	Working Face Stockpile Requirement (cy)
10,000	222	640	0
20,000	444	640	0
30,000	667	640	27
40,000	889	640	249
50,000	1111	640	471
60,000	1333	640	693
70,000	1556	640	916
80,000	1778	640	1138

[1] Hauling capacity of existing equipment (one excavator and two haul trucks)

3.2 CAT D8 Bulldozers

In an emergency fire situation, the bulldozers will push nearby soil already hauled and dumped next to the working face, plus they will push storm water run-on/run-off control berms to create a fire break and then to cover exposed waste.

Average dozing distance assumed as 100 feet.
Dozer production = maximum production * correction factors:

Max production per D8 Dozer =	900	cy/hr	Ref. 1 (p. 1-47)
Loose stockpile, correction factor =	1.15		
Excellent Operator, correction factor =	1.00		
Production =	1035	cy/hr	

Total Soil handled by each bulldozer = 1035 cy/hr
Total Soil handled by two (2) bulldozers = 2070 cy/hr

The existing bulldozers have adequate capacity to spread 1778 cy, the volume corresponding to the maximum working face area of 80,000 ft^2.

4.0 CONCLUSION

On-site bulldozers will be available to place a 6-inch layer of earthen material on the working face waste area within one hour of detecting a fire. Stockpiles near the working face should be maintained to supplement the hauling capacity of existing equipment when large working faces are being operated. The existing onsite excavator and haul trucks can haul 640 cy of soil to the working face within one hour. If additional soil volume is required, adequate soil needs to be stockpiled near the working face per Table 1. Alternatively, the site may add additional equipment.

5.0 REFERENCES

1) Caterpillar Performance Handbook, Edition 40, January 2010.



MODEL	345D L – FIX		345D L – VG		345D L – VG	
Sourcing	Japan, U.S.		U.S.		Belgium	
Flywheel Power	283 kW	380 hp	283 kW	380 hp	283 kW	380 hp
Operating Weight*	45 375 kg	100,040 lb	46 970 kg	108,610 lb	52 230 kg	115,167 lb
Bucket Capacity Range (heaped)	1.0-3.1 m³	1.3-4.03 yd³	1.0-3.1 m³	1.32-4.03 yd³	2.0-3.6 m³	3.0-5.0 yd³
Engine Model	C13 ACERT		C13 ACERT		C13 ACERT	
Rated Engine RPM	1800		1800		1800	
No. of Cylinders	6		6		6	
Bore	130 mm	5.1"	130 mm	5.1"	130 mm	5.1"
Stroke	157 mm	6.2"	157 mm	6.2"	157 mm	6.2"
Displacement	12.5 L	736 in³	12.5 L	736 in³	12.5 L	736 in³
Max. Implement Hydraulic Pump Output at Rated RPM	2 × 360 L/min	2 × 95 gpm	2 × 360 L/min	2 × 95 gpm	2 × 367 L/min	2 × 97 gpm
Relief Valve Settings:						
Implement Circuits	35 000 kPa	5080 psi	35 000 kPa	5080 psi	35 000 kPa	5080 psi
Travel Circuits	35 000 kPa	5080 psi	35 000 kPa	5080 psi	35 000 kPa	5080 psi
Swing Circuits	31 400 kPa	4550 psi	31 400 kPa	4550 psi	31 400 kPa	4550 psi
Pilot Circuits	4110 kPa	596 psi	4110 kPa	596 psi	4100 kPa	596 psi
Maximum Drawbar Pull	331 kN	74,380 lb	331 kN	74,380 lb	338 kN	76,050 lb
	Two Speed Travel		Two Speed Travel			
Maximum Travel Speed at Rated RPM	Lo: 3.5 km/h Hi: 4.7 km/h	2.2 mph 2.9 mph	Lo: 3.5 km/h Hi: 4.7 km/h	2.2 mph 2.9 mph	4.7 km/h	3.0 mph
Track Shoe Width	750 mm	2'6"	750 mm	2'6"	600 mm	2'0"
Overall Track Length	5.36 m	17'7"	5.34 m	17'6"	5330 mm	17'6"
Ground Contact Area with Std. Shoe	7.07 m²	10,960 in²	5.63 m²	8730 in²	5.21 m²	8045 in²
Track Gauge	2.74 m	9'0"	2.4 m	7'10"	2390 mm	7'10"
Extended	—		2.89 m	9'6"	2890 mm	9'6"
Fuel Tank Refill Capacity	705 L	186 U.S. gal	705 L	186 U.S. gal	710 L	188 U.S. gal
Hydraulic System (includes tank)	570 L	150 U.S. gal	570 L	150 U.S. gal	570 L	151 U.S. gal
Hydraulic Tank	—		—		262 L	69 U.S. gal

*Operating weight for 345D L – FIX and 345D L – VG (U.S. Sourced) includes coolant, lubricants, full fuel tank, standard shoes, bucket and operator 75 kg (165 lb). Operating weight for 345D L – VG (Belgium Sourced) includes coolant, lubricants, full fuel tank, one-piece boom, long stick, small profile bucket, operator 75 kg (165 lb) and wide shoes (standard shoes on 345D L – VG).

NOTE: Certain models may not be available in all Sales areas.
Specifications may also vary by Sales area.
Contact your Cat dealer for details.

Cycle Time Estimating Chart

Model		307C	308D CR	308D CR SB	311D LRR	312D, 312D L	315D L	319D L, 319D LN	M312, M313C, M315C, M313D, M315D	M315, M316C, M316D	M318C, M318D	M322C, M322D
Bucket Size	L yd³	280 0.37	220 0.30	220 0.30	450 0.59	520 0.68	520 0.68	800 1.05	610 0.80	750 0.98	900 1.18	1050 1.37
Soil Type		← Packed Earth →							← Sand/Gravel →			
Digging Depth	m ft	1.5 5'0"	1.8 6'0"	1.8 6'0"	1.5 5'0"	1.8 6'0"	3.0 10'0"	3.0 10'0"	3.0 10'0"	3.0 10'0"	3.0 10'0"	3.0 10'0"
Load Bucket	min	0.08	0.09	0.08	0.07	0.07	0.07	0.09	0.05	0.06	0.06	0.08
Swing Loaded	min	0.05	0.03	0.03	0.06	0.06	0.06	0.09	0.05	0.05	0.06	0.06
Dump Bucket	min	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04
Swing Empty	min	0.06	0.06	0.08	0.05	0.05	0.06	0.07	0.04	0.04	0.05	0.05
Total Cycle Time	min	0.22	0.21	0.22	0.21	0.21	0.24	0.28	0.17	0.18	0.20	0.23

Cycle Time Estimating Chart

Model		320D	320D RR, 321D CR, 323D	324D	328D LCR	329D	336D	345D	365C L	385C
Bucket Size	L yd³	800 1.05	800 1.05	1000 1.31	N/A	1100 1.44	1400 1.83	2400 3.0	1900 2.5	3760 5.0
Soil Type		← Hard Clay →								
Digging Depth	m ft	2.3 8	2.3 8	3.2 10	N/A	3.2 10	3.4 11	4.0 13	4.2 14	5.6 18
Load Bucket	min	0.09	0.09	0.09	N/A	0.09	0.09	0.13	0.10	0.19
Swing Loaded	min	0.06	0.06	0.06	N/A	0.06	0.07	0.07	0.09	0.06
Dump Bucket	min	0.03	0.03	0.04	N/A	0.04	0.04	0.02	0.04	0.03
Swing Empty	min	0.05	0.05	0.06	N/A	0.06	0.07	0.06	0.07	0.07
Total Cycle Time	min	0.23	0.23	0.25	N/A	0.25	0.27	0.28	0.30	0.35

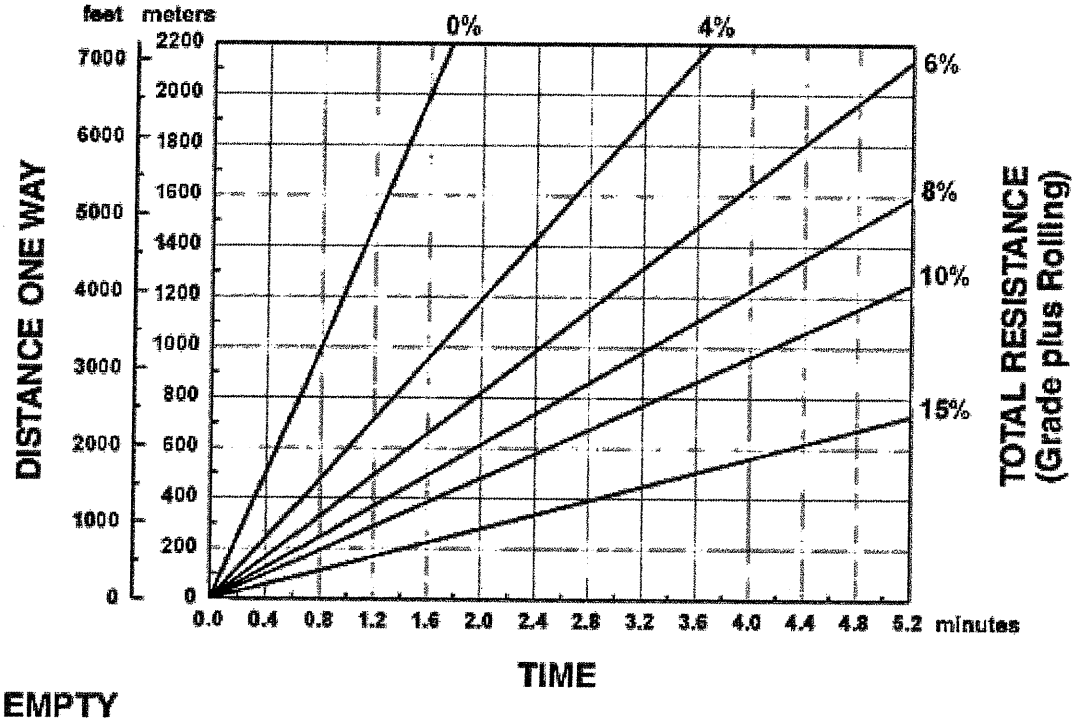
N/A = Not Applicable



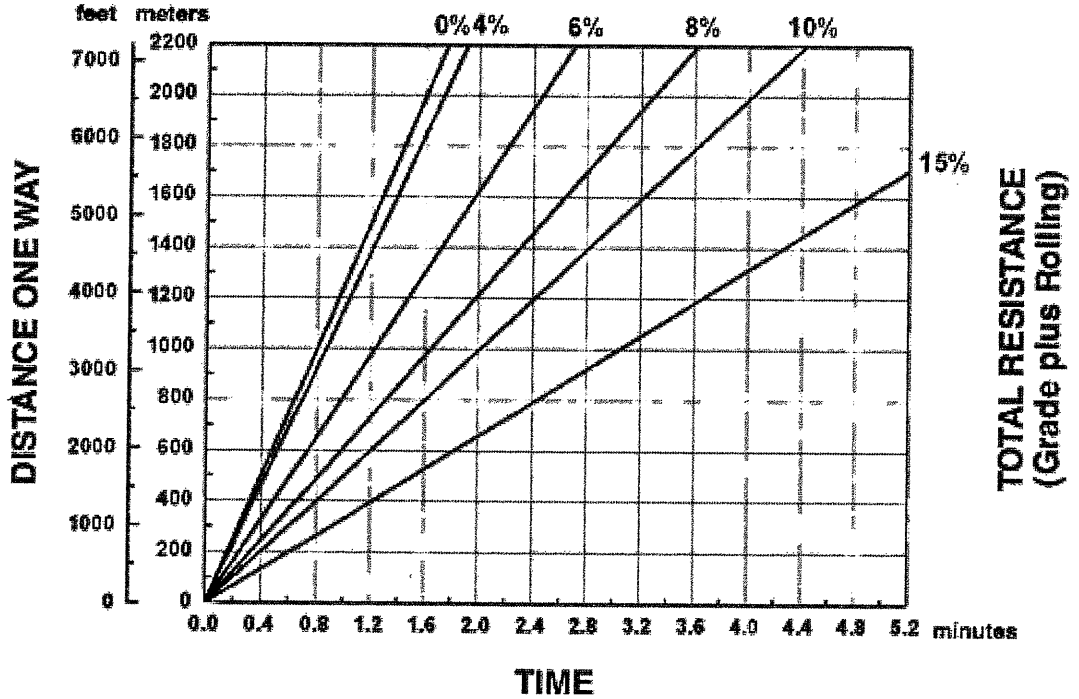
MODEL	770		770		772	
Body Type	Medium Impact Steel Flat Floor		Medium Impact Steel Dual Slope		Medium Impact Steel Flat Floor	
Gross Machine Weight	71 214 kg	157,000 lb	71 214 kg	157,000 lb	82 100 kg	181,000 lb
Chassis Weight*	24 613 kg	54,262 lb	24 613 kg	54,262 lb	25 425 kg	56,053 lb
Body System Weight	10 029 kg	22,110 lb	10 019 kg	22,088 lb	10 439 kg	23,013 lb
Target Payload**	36 572 kg	80,626 lb	36 582 kg	80,650 lb	46 236 kg	101,934 lb
Capacity:						
Struck (SAE)	16.4 m^3	21.5 yd^3	16.4 m^3	21.5 yd^3	23.3 m^3	30.5 yd^3
Heaped (2:1) (SAE)	25.1 m^3	32.8 yd^3	25.1 m^3	32.8 yd^3	31.3 m^3	41.0 yd^3
Distribution Empty:						
Front	48%		48%		48%	
Rear	52%		52%		52%	
Distribution Loaded:						
Front	33%		33%		33%	
Rear	67%		67%		67%	
Engine Model	C15 ACERT		C15 ACERT		C18 ACERT	
Number of Cylinders	6		6		6	
Bore	137 mm	5.4"	137 mm	5.4"	145 mm	5.7"
Stroke	171 mm	6.7"	171 mm	6.7"	183 mm	7.2"
Displacement	15 L	928 in^3	15 L	928 in^3	18 L	1105 in^3
Net Power	355 kW	476 hp	355 kW	476 hp	399 kW	535 hp
Gross Power	381 kW	511 hp	381 kW	511 hp	446 kW	598 hp
Standard Tires	18.00R33 (E4)		18.00R33 (E4)		21.00R33 (E4)	
Machine Clearance Turning Circle	20.2 m	66'3"	20.2 m	66'3"	21.5 m	70'10"
Fuel Tank Refill Capacity	529 L	140 U.S. gal	529 L	140 U.S. gal	529 L	140 U.S. gal
Top Speed (Loaded)	74.8 km/h	46.5 mph	74.8 km/h	46.5 mph	79.7 km/h	49.5 mph
GENERAL DIMENSIONS (Empty):						
Height to Canopy Rock Guard Rail	4.14 m	13'7"	4.14 m	13'7"	4.22 m	13'10"
Wheelbase	3.96 m	13'0"	3.96 m	13'0"	3.96 m	13'0"
Overall Length (Operating)	8.74 m	28'9"	8.74 m	28'9"	8.74 m	28'9"
Overall Length (Shipping)	8.74 m	28'9"	8.74 m	28'9"	8.74 m	28'9"
Loading Height (Empty)	3.12 m	10'3"	3.12 m	10'3"	3.50 m	11'6"
Height at Full Dump	8.26 m	27'2"	8.26 m	27'2"	8.36 m	27'5"
Body Length (Target Length)	5.55 m	18'3"	5.55 m	18'3"	5.55 m	18'3"
Width (Operating)	4.75 m	15'8"	4.75 m	15'8"	4.75 m	15'8"
Width (Shipping)***	3.96 m	13'0"	3.96 m	13'0"	3.95 m	13'0"
Front Tire Tread	3.11 m	10'3"	3.11 m	10'3"	3.17 m	10'5"

*Weights include lubricants, coolants and 100% fuel.
**Refer to Caterpillar's 10/10/20 Payload Policy for Quarry & Construction Trucks.
***Disassembled.

LOADED



EMPTY



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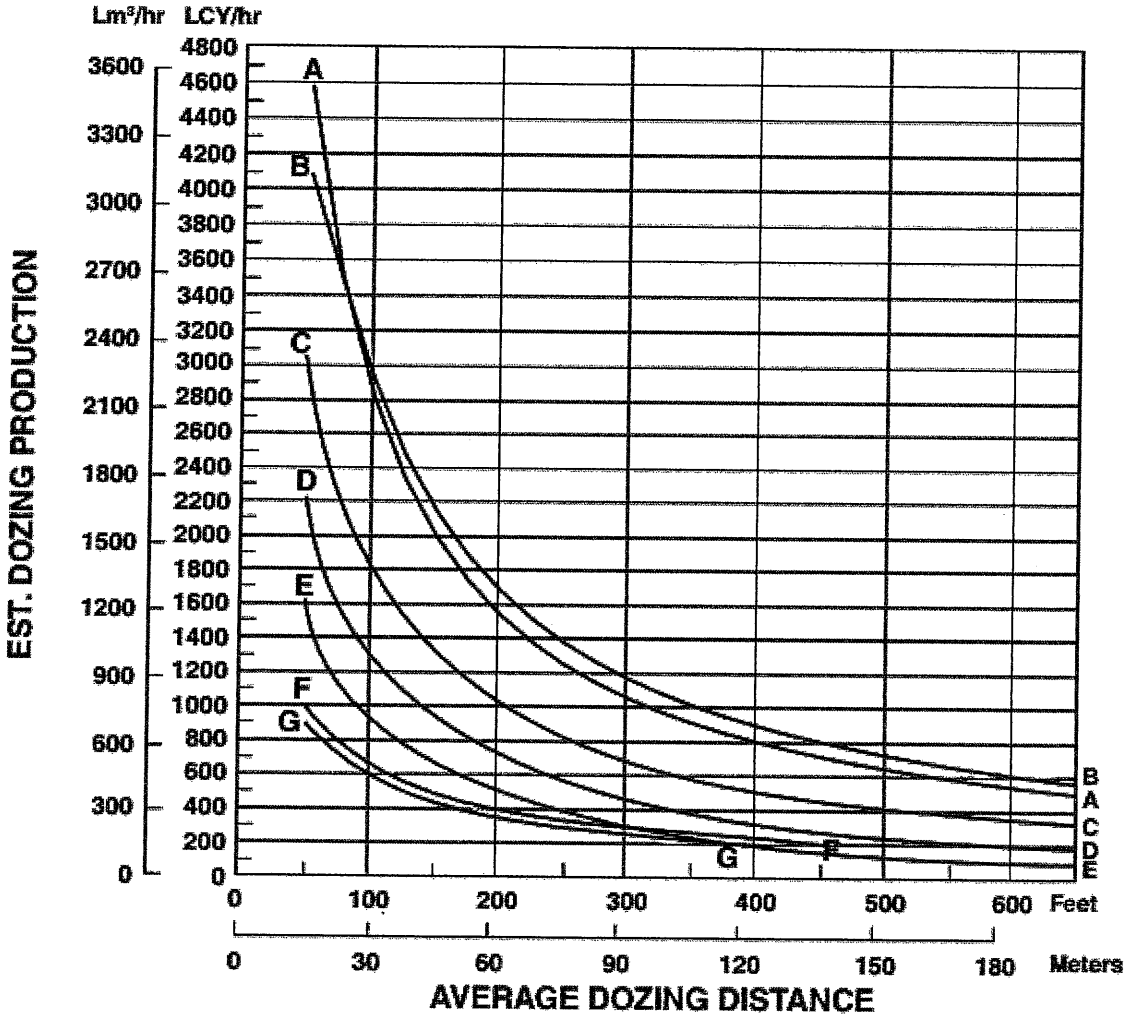

KEY

A — D11T-11U
B — D11T CD
C — D10T-10U
D — D9R/D9T-9U
E — D8R/D8T-8U
F — D7R Series 2-7U
G — D7G-7U

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

8/8