Chapter # 4 Part #2

1) A hydraulic shovel will be used to excavate sandy clay and load it into 12 BCY dump trucks. The shovel's production at 100% efficiency is estimated to be 300 BCY/h, and job efficiency is 0.8. Truck travel time is estimated to be 8.0 min and truck fixed cycle time (excluding loading) is estimated to be 2.0 min. equipment costs for the shovel and trucks are \$40/h and \$20/h respectively.

a) How many trucks are theoretically required to obtain maximum production?

b) What is the expected production of the system in bank measure using this number of trucks?

c) What is the expected unit loading and hauling cost, \$/BCY?

Solution:

Truck cycle time = fixed cycle time + load time + travel time

Load time = $\frac{Trcu\,k\ capacity}{Loader\ \ production\ \ @\,100\%\,eff.}$ = $\frac{12\ BCY}{300\ BCY/hr}$ = 0.04 hour = 2.4 min

Truck cycle time = 2.0 + 2.4 + 8.0 = 12.4 min

a) Theoretical No. of trucks to produce max. production = $\frac{cycle\ \ time}{load\ \ time}$ = $\frac{12.4\ min}{2.4\ min\ /truck}$ = 5.17

➔ 6 trucks

b) Production of the system = 300 BCY/h × 0.8 = 240 BCY/h

c) Unit loading and hauling cost = $\frac{total\ \ cost\ /h}{production}$

Total cost = \$40/h + 6 × \$20/h = \$160/h

Unit loading and hauling cost = $\frac{\$160/h}{240\ BCY/h}$ = \$0.667/ BCY

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2) Using the data of the previous problem, calculate the expected production and unit cost of loading and hauling if the truck fleet consists of 5 trucks.

Solution:

% of resources left = $\frac{No\ of\ truck\ availabe}{Theoretical\ \ No\ of\ trucks} \times 100 = \frac{5\ trucks}{5.17\ trucks} \times 100 = 96.71\%$

➔ Production = 0.9671 × 240 BCY/h = 232.11 BCY/h

Unit loading and hauling cost = $\frac{total\ \ cost\ /h}{production}$

Total cost = \$40/h + 5 × \$20/h = \$140/h

Unit loading and hauling cost = $\frac{\$140/h}{232.11\ BCY/h}$ = \$0.603/ BCY

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3) The scraper whose performance curve is shown in figure 4 – 2 is operating at an altitude at which the derating factor is 10%. The scraper gross weight is 150000 lb and operating ip grade 3% over a haul road having a rolling resistance factor of 100 lb/ton. What is the maximum speed of the scraper?

Solution:

Effective grade = +3% + 100/20 = 8 %

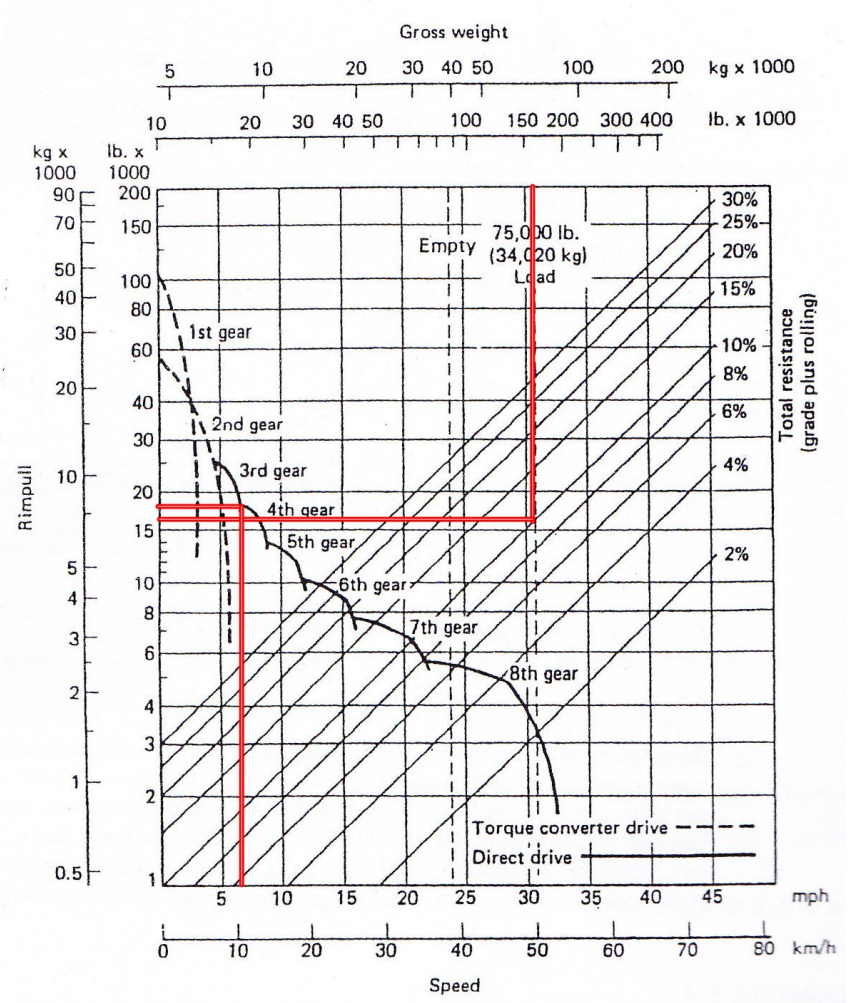

Figure 4–2 Wheel scraper performance curve. (Courtesy of Caterpillar Inc.)

Required pull = 17000 lb

Altitude adjustment = $\frac{required\ \ pull}{1-derating\ \ factor} = \frac{17000}{1-0.1}$ =18888.8889 lb

➔ Maximum speed ≈ 6.5 mph

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