# Chapter #4 Part #3

1 You are given the following data for a scraper job: a. Number of scrapers are seven single engines overhauling; b. tandem pusher will be used; c. the scraper will carry 28 BCY (full load); d. same route will be used for haul and return; e. chain loading method (pusher cycle time is 0.9 min); f. scraper fixed cycle time = 1.3 min; g. efficiency factor is 0.85 and job conditions are average. Sections of the haul route from the cut area to the fill area are as follows:

| Section | Distance (ft) | Grade (%) | Rolling resistance factor (lb/ton) | Eff. Grade | Max. speed | Average speed factor | Average speed | Travel time |
|---|---|---|---|---|---|---|---|---|
| 1 | 500 | − 3 | 100 | | | | | |
| 2 | 3000 | − 1 | 140 | | | | | |
| 3 | 1000 | +1 | 180 | | | | | |
| 4 | 700 | 0 | 200 | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |

What is the estimated fleet production in bank cubic yards per hour?

<u>Solution:</u>

Effective grades:

Section # 1, effective grade = − 3 + 100/20 = +2

Section # 2, effective grade = − 1 + 140/20 = +6

Section # 3, effective grade = + 1 + 180/20 = +10

Section # 4, effective grade = 0 + 200/20 = +10

Section # 5, effective grade = 0 + 200/20 = +10

Section # 6, effective grade = − 1 + 180/20 = +8

Section # 7, effective grade = +1 + 140/20 = +8

Section # 8, effective grade = +3 + 100/20 = +8

● Maximum speeds: from figure 4 – 2;

Section # 1, loaded: 31 mph

Section # 2, loaded: 14 mph

Section # 3, loaded: 8 mph

Section # 4, loaded: 8 mph

Section # 5, empty: 16 mph

Section # 6, empty: 21 mph

Section # 7, empty: 21 mph

Section # 8, empty: 21 mph

● Average speed factor: from table 4 – 3;

Section # 1, starting from zero: 0.65

Section # 2, decreasing max speed from previous section: 1.08

Section # 3, decreasing max speed from previous section: 1.19

Section # 4, coming to a stop: 0.70

Section # 5, starting from zero: 0.70

Section # 6, increasing max speed from previous section: 0.89

Section # 7, same max speed as previous section: 0.89

Section # 8, coming to a stop: 0.65

● Average speed, mph = maximum speed × average speed factor

● Travel time, min = (distance, ft/88) / average speed, mph

| Section | Distance (ft) | Grade (%) | Rolling resistance factor (lb/ton) | Eff. Grade (%) | Max. speed (mph) | Average speed factor | Average speed (mph) | Travel time (min) |
|---|---|---|---|---|---|---|---|---|
| 1 | 500 | − 3 | 100 | 2 | 31 | 0.65 | 21.15 | 0.269 |
| 2 | 3000 | − 1 | 140 | 6 | 14 | 1.08 | 15.12 | 2.255 |
| 3 | 1000 | +1 | 180 | 10 | 8 | 1.19 | 9.52 | 1.194 |
| 4 | 700 | 0 | 200 | 10 | 8 | 0.70 | 5.6 | 1.420 |
| 5 | 700 | 0 | 200 | 10 | 16 | 0.7 | 11.2 | 0.710 |
| 6 | 1000 | − 1 | 180 | 8 | 21 | 0.89 | 18.69 | 0.608 |
| 7 | 3000 | +1 | 140 | 8 | 21 | 0.89 | 18.69 | 1.824 |
| 8 | 500 | +3 | 100 | 8 | 21 | 0.65 | 18.69 | 0.304 |

Total travel time = 8.584 minutes

Fixed cycle time, table 4 – 7 but it is given 1.3 min

Total cycle time = 9.884 minutes

Production for one scraper = 28 BCY / 9.884 min × 0.85 = 2.833 BCY/min = 169.97 BCY/h

Production for seven scrapers = 169.97 × 7 = 1189.8 BCY/h

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