OUTLINE

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• Cycle Time of Scraper
• Scraper Production
INTRODUCTION

- Excavating, loading, hauling, & dumping over medium distances.
- Can be used with pusher tractor for increased production.
- Some models have self loading capabilities
- Economical over a wide range of haul lengths
- Can self load and not dependent on other equipment
- Scraper are available with loose heaped capacities up to about 44 cy
TYPES OF SCRAPERS

• Push-Load
  - Single-powered axle
  - Tandem-powered axles

• Self Loading
  - Push-pull, tandem-power axles
  - Elevating
  - Auger
Types of Scrapers

- Push-Loaded: Single Powered Axle
Types of Scrapers

- Push-Pull: Tandem- Powered Axle
  Can work as a team or can operate individually with a pusher
Types of Scrapers

**Elevating** is loading and hauling scraper

- Used for utility work
- Very good in small quantity situation
- No pusher required
Types of Scrapers

**Auger Scraper**
- Can self-load in difficult condition (frozen material, lime-stone)
- More costly to own and operate than conventional single-or tandem machine
The capacity of scraper expressed in bank cubic yard

Test indicate that the swell factors should be increased by approximately 10% from material push-loaded into scraper

The volumetric load of a scraper may be specified as either the struck or heaped capacity of the bowl expressed in cubic yard

The struck capacity is the volume that a scraper capacity is the volume that a scraper would hold if the top of the material were struck off even at the of the bowl
VOLUME OF A SCRAPER (2)

- Example

If a push-loaded scraper haul a heaped load measuring 20.5 cy and the swell factor is 0.8.

The calculated bank measure volume will be

\[ 20.5 \text{ cy} \times (0.8 \times 1.1) = 18.04 \text{ bcy} \]
The cycle time for a scraper is the time to load, haul, dump, turn, return and turn back into position.

**Scraper Configuration**

- Job Condition, grades, rolling resistance and material type
- Average load time for push-loader scraper in common earth is 0.85 min

Both **haul** and **return** times depend on the distance traveled and the scraper speed.

**Dump** times vary with scraper size and project condition:
- Single engine 0.3 min – 0.44 min
- Tandem 0.26 – 0.28

The average **turn** time in the cut is 0.3 min and on the fill, the average is 0.21 min.
Scraper Production Chart
Example

1. If the scraper production cycle time of 5.52 min could be maintained for a period of 60 min, the unit would make

\[
\frac{60}{5.52} = 10.9 \text{ trips per hour}
\]

2. Efficiency Factor

Studies of scraper operation suggest that the average productive time is 69% of a perfect 60 min hour (excluding weather delay to the job)

The actual number of trips in the real world would be

\[
10.9 \times 0.69 = 7.5 \text{ trips per work hour}
\]
Example 2

**Problem**

Estimate the production of a single two-axle scraper

- Total Cycle Time = 7 min
- Max Heaped Volume = 31 LCY
- Max Payload = 75,000 lb
- Material: Sandy Clay, 3200 lb/BCY, 2650 lb/LCY,
- Operating Conditions = Average
Scraper Production Example

Loads per Cycle

• Heaped Cap. Wt. = 31.0 LCY x 2,650 lb/LCY
  = 82,150 lbs

• 82,150 lbs exceeds the 75,000 lbs Rated Max Payload of the Scraper.

• The maximum scraper volume is **limited by weight** to
  = 75,000 lbs (Rated Wt)/ 3,200 lb/BCY
  = 23.4 BCY/Load
**Scraper Production Example**

Number of Trip per 50 min hour 50/7 = 7.14 trips

Volume per scraper per 50 min hr 23.4 x 7.14 = 167 bcy/hr

Push time \( T_p = 1.4 \text{ Lt} + 0.25 \)

\[
1.4 (0.85) + 0.25 = 1.44 \text{ min}
\]

Number of scraper required \( T_{cycle/T_p} \)

\[
7/1.44 = 4.86 \text{ equal 5 scraper}
\]

Pusher contact per a 50 min hr \( 50/1.44 = 34.7 \text{ contact} \)

Production \( = (\text{efficiency/push time}) \times \text{volume per load} \)

\[
= 34.7 \times 23.4
\]

\[
= 811 \text{ bcy/hr or}
\]

\[
= 167 \times 4.86
\]

\[
= 811 \text{ bcy/hr}
\]
CONSTRUCTION EQUIPMENT AND METHODS