CHAPTER 9. FINISHING EQUIPMENT

INTRODUCTION

Terms Used:

- Finishing
- Finish grading
- Fine grading
These terms are used in reference to the process of shaping materials to the required line and grade.

Finishing equipment include, but not limited to:
- Graders
- Gradalls
- trimmers
Graders are multipurpose machines used for:

- Finishing
- Shaping bank
- Sloping
- ditching
A grader’s primary purpose is cutting and moving material with the moldboard.

Graders can work on slopes as steep as 3:1.
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BLADE POSITIONS

GENERAL GRADE

HIGH BANK CUT

GRADERS

Tool box
Air cleaner

Scarrifier log
Circle
Blade (bolted to moldboard)
MOLDBOARD

Comparison with Dozers

- A grader is restricted to making shallow cuts in medium-hard materials.
- They should not be used for heavy excavations.
GRADERS

**Comparison with Dozers**

- A grader can move small amounts of material but cannot perform dozer-type work because of the structural strength and location of its moldboard.

GRADERS

- Grader are capable of progressively cutting ditches to a depth of 3 ft.
- It is more economical to use other types of equipment to cut ditches deeper than 3 ft.
Important Components of Grader

- The components of the grader that actually do the work of finishing are:
  - Moldboard (Blade)
  - Scarifier

- Graders may also be equipped with light rear-mounted rippers.
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SCARIFIER
Front mounted scarifier.

RIPPERS
Rear mount ripper
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LASER BLADE CONTROLS

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GRADERS

Moldboard

- The moldboard is commonly referred to as blade.
- It is the working member of the grader.
- A rotating circle carries the moldboard.
The moldboard is used to side cast the material it encounters.

The ends of the moldboard can be raised or lowered together or independently of one another.

By convention, the toe of the moldboard is the foremost end of the moldboard in the direction of travel and the heel is the discharged end.

Moldboard Angle

- The moldboard can be positioned (angled) at almost any angle
  - To the line of travel
  - Parallel to the direction of travel
  - Shifted to either side, or
  - Raised into vertical position.
MOLDBOARD ANGLE

MOLDBOARD ANGLE
Estimating Production

Estimate grading 4 miles of dirt road using a CAT 120H.

- Ditching: 6 passes, 1st gear
- Reshaping: 9 passes, 2nd gear
- Final grading: 4 passes, 3rd gear
Estimating Production

The following formula is used to estimate the total time

\[
\text{Total Time} = \frac{P \times D}{S \times E} \quad (1)
\]

- **P** = number of passes required
- **D** = distance traveled in each pass, in miles or feet
- **S** = speed of grader (mph or fps)
- **E** = grader efficiency factor
FORMULA FOR DISTANCES IN MILES

\[
\frac{\text{No. passes} \times \text{distance}}{\text{speed} \times \text{efficiency}} = \text{Time}
\]

- Distance in miles
- Speed in miles per hour
- Time will be in hours

STEP 1. NUMBER OF PASSES

<table>
<thead>
<tr>
<th>Task</th>
<th>Passes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ditching</td>
<td>6</td>
</tr>
<tr>
<td>Reshaping</td>
<td>9</td>
</tr>
<tr>
<td>Final grading</td>
<td>4</td>
</tr>
</tbody>
</table>
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ENCE 420 ©Assakkaf

STEP 2. DISTANCE

Grading 4 miles

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ENCE 420 ©Assakkaf

STEP 3. SPEED

CAT 120H

1st gear

2nd gear

3rd gear

27 ed Cat Handbook p. 3-10
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STEP 3. SPEED

CAT 120H

1\textsuperscript{st} gear 2.3 mph
2\textsuperscript{nd} gear 3.1 mph
3\textsuperscript{rd} gear 4.5 mph

27 ed Cat Handbook p. 3-10

STEP 4. EFFICIENCY FACTOR

For an average operator during daylight hours would expect a 50 min-hour efficiency or an 0.83 efficiency factor
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STEP 5. TIME TO DITCH

STEP 1: Number of passes = 6
STEP 2: Distance = 4 miles
STEP 3: Speed = 2.3 mph
STEP 4: Efficiency factor = 0.83

\[
\frac{6 \times 4}{2.3 \times 0.83} \Rightarrow \frac{24}{1.91} = 12.6 \text{ hr}
\]

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STEP 5. TIME TO RESHAPE

STEP 1: Number of passes = 9
STEP 2: Distance = 4 miles
STEP 3: Speed = 3.1 mph
STEP 4: Efficiency factor = 0.83

\[
\frac{9 \times 4}{3.1 \times 0.83} \Rightarrow \frac{36}{2.57} = 14.0 \text{ hr}
\]
**CHAPTER 9. FINISHING EQUIPMENT**

**STEP 5. FINAL GRADING**

STEP 1: Number of passes = 4
STEP 2: Distance = 4 miles
STEP 3: Speed = 4.5 mph
STEP 4: Efficiency factor = 0.83

\[
\frac{4 \times 4}{4.5 \times 0.83} \Rightarrow \frac{16}{3.74} = 4.3 \text{ hr}
\]

**STEP 5. TOTAL TIME**

- Time to ditch: 12.6 hr
- Time to reshape: 14.0 hr
- Final grading: 4.3 hr
- Total time: 30.9 hr
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FORMULA FOR DISTANCES IN FEET

\[
\text{No. passes} \times \frac{\text{distance}}{88 \times \text{speed} \times \text{efficiency}} = \text{Time}
\]

- Distance in feet
- Speed in miles per hour
- Time will be in minutes

GRADALLS

- The gradall is a utility machine which combines the operating features of the hoe, dragline, and motor grader.
- The full revolving superstructure of the unit can be mounted on either crawler tracks or wheels.
The unit is designed as a versatile machine for both excavation and finishing work.

Being designed as a multi-use machine affects production efficiency in respect to individual applications, when compared to unit designed specifically for a particular application.
The gradall will have lower production capability than those single purpose units.

The bucket of a gradall can be rotated (that is, the gradall’s arm can rotate) 90º or more, allowing it to be effective in reaching restricted working areas and where special shaping of slopes is required.

The three-part telescoping boom can be hydraulically extended or retracted to vary digging or shaping reach. It can exert breakout force both above and below ground level.
Trimmers are specialty machines to fine finishing for special jobs.
The result is better accuracy and greater production compared to the fine-grading with a grader.
It has been shown that the production from one dual-lane trimmer is equal to that achievable with four to six graders. The automatic trimmers also enable grade control to closer tolerances.

Production of a Trimmer

- A large full-width trimmer can have speeds of about 30 fpm.
- A small, single-lane trimmer, can be rated at 128 fpm.
- As operating speed is increased, there is usually a decrease in quality.