CHAPTER

9

Construction Planning, Equipment, and Methods

Sixth Edition

FINISHING EQUIPMENT

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INTRODUCTION

Terms Used:

- ✓Finishing
- ✓Finish grading
- ✓Fine grading

INTRODUCTION

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

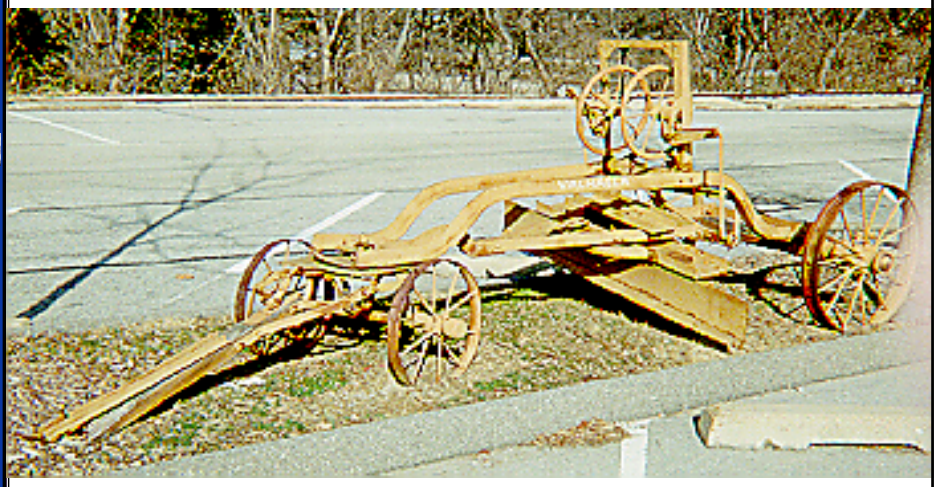
INTRODUCTION

- Finishing equipment include, but not limited to:
  - ✓Graders
  - ✓Gradalls
  - ✓trimmers

GRADERS

- **Graders are multipurpose machines used for:**
  - ✓Finishing
  - ✓Shaping bank
  - ✓Sloping
  - ✓ditching

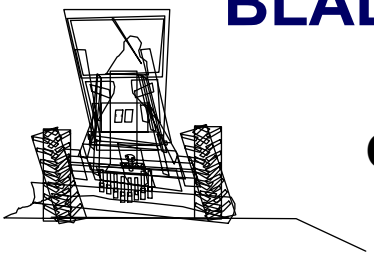
GRADERS



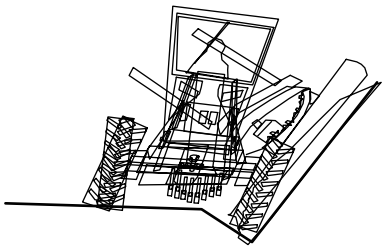
GRADERS

- A grader's primary purpose is ***cutting*** and ***moving*** material with the ***moldboard***.
- Graders can work on slopes as steep as 3:1.

BLADE POSITIONS

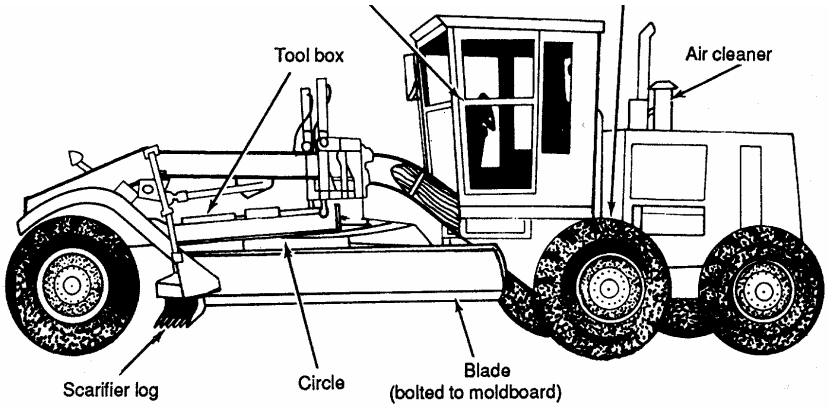


GENERAL GRADE



HIGH BANK CUT

GRADERS



MOLDBOARD

GRADERS

- **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.

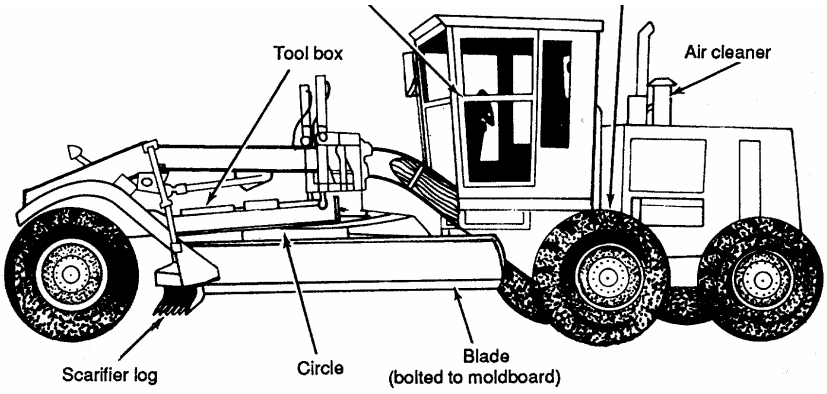
GRADERS

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

GRADERS

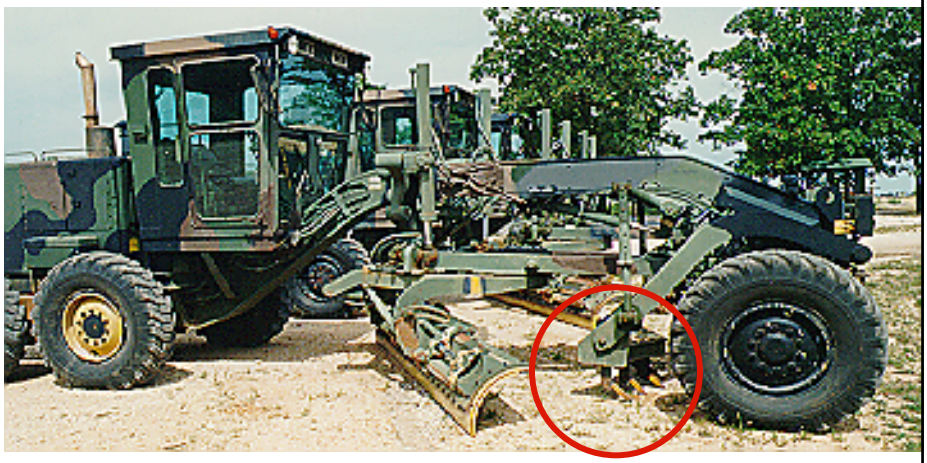
- **Important Components of Grader**
  - ✓The components of the grader that actually do the work of finishing are:
    - **Moldboard (Blade)**
    - **Scarifer**
  - ✓Graders may also be equipped with light rear-mounted **rippers**.

GRADERS



SCARIFIER

Front mounted scarifier.



RIPPERS

Rear mount ripper

LASER BLADE CONTROLS

GRADERS

- **Moldboard**
  - ✓The moldboard is commonly referred to as blade.
  - ✓It is the working member of the grader.
  - ✓A rotating circle carries the moldboard.

GRADERS

- ✓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.

GRADERS

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

GRADERS

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

GRADERS

Estimating Production

✓The following formula is used to estimate the total time

$$\text{Total Time} = \frac{P \times D}{S \times E} \qquad (1)$$

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

$$\frac{No.\ passes \times distance}{speed \times efficiency} = Time$$

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

STEP 1. NUMBER OF PASSES

Ditching	6 passes
Reshaping	9 passes
Final grading	4 passes

STEP 2. DISTANCE

Grading 4 miles

STEP 3. SPEED

CAT 120H

1st gear

2nd gear

3rd gear

27 ed Cat Handbook p. 3-10

STEP 3. SPEED

CAT 120H

1st gear 2.3 mph
2nd gear 3.1 mph
3rd 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

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

$$\frac{6 \times 4}{2.3 \times 0.83} \Rightarrow \frac{24}{1.91} = 12.6\ hr$$

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

$$\frac{9 \times 4}{3.1 \times 0.83} \Rightarrow \frac{36}{2.57} = 14.0\ hr$$

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

$$\frac{4 \times 4}{4.5 \times 0.83} \Rightarrow \frac{16}{3.74} = 4.3\ hr$$

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

FORMULA FOR DISTANCES IN FEET

$$\frac{No.\ passes \times distance}{88 \times speed \times efficiency} = Time$$

- 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.

GRADALLS

GRADALLS

- 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.

GRADALLS

- 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.

GRADALLS

- The three-part telescoping boom an be hydraulically extended or retracted to vary digging or shaping reach. It can exert breakout force both above and below ground level.

TRIMMERS

- 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.

TRIMMERS

TRIMMERS

- 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.

TRIMMERS

- 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.