



UNIVERSITÀ  
DEGLI STUDI  
FIRENZE

Corso di Laurea in: **SCIENZE E TECNOLOGIE DEI  
SISTEMI FORESTALI**  
Curriculum: **PRODUZIONI LEGNOSE**

**Pianificazione ed  
organizzazione  
tecnologica**

***Stima dei costi strade forestali***



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**DAGRI**  
DIPARTIMENTO DI SCIENZE  
E TECNOLOGIE AGRARIE,  
ALIMENTARI, AMBIENTALI E FORESTALI

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## Importanza della stima dei costi

- Una stima accurate è molto importante nella progettazione di strade forestali poichè permette di:
  - Fare una analisi costi/benefice della strada proposta
  - Comprendere il costo e i fattori che incidono sui costi in relazione ai diversi aspetti progettuali
  - Determinare un prezzo dell'eventuale appalto che sia giusto e ragionevole





# Terminology: Fixed and Variable Costs

- Costs are divided into two types: variable costs, and fixed costs.
- Variable costs vary per unit of production. For example, they may be the cost per cubic meter of wood yarded, per cubic meter of soil excavated, etc.
- Fixed costs, on the other hand, are incurred only once and as additional units of production are produced, the unit costs fall. Examples of fixed costs would be equipment move-in costs and road access costs.
- Total cost = fixed cost + variable cost  $\times$  output       **$C = F + VN$**
- Unit cost = fixed cost/output + variable cost       **$UC = F/N + V$**





## Example of Breakeven Analysis

Evaluating whether to use a large dozer (D8) or a medium sized dozer (D6) for roadline earthworks.



VS.

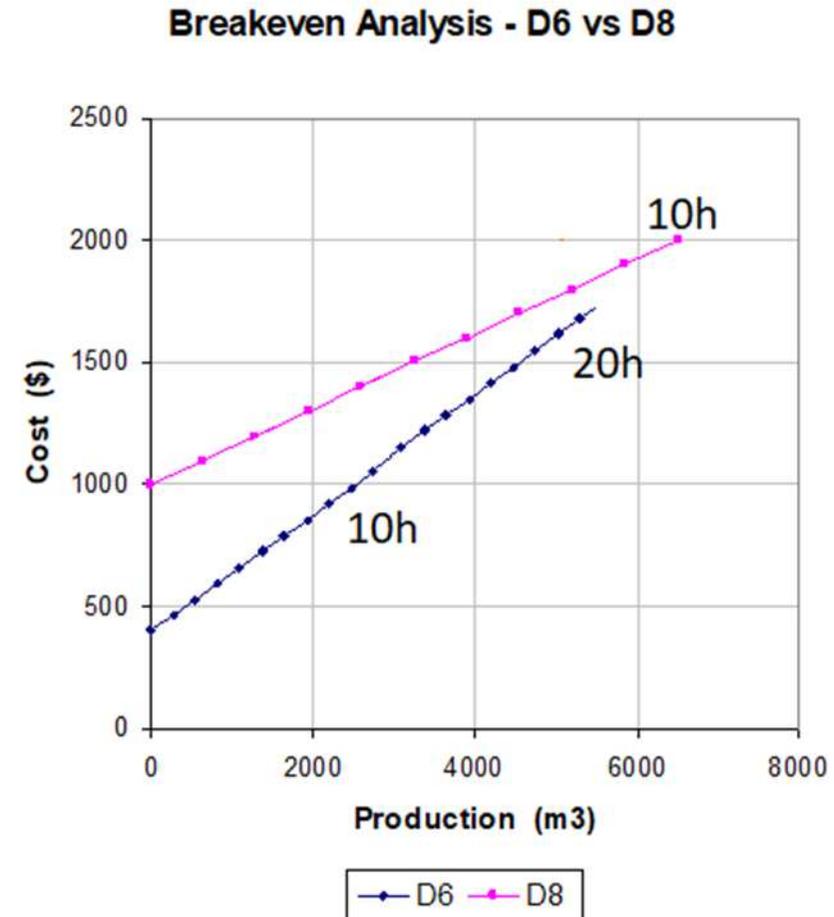


- What machine is cheaper to operate on a daily basis?
- What machine is cheaper to operate on a per tonne basis?



## BE Analysis – an example

- D6 Dozer
  - Fixed Cost \$400/day
  - Variable Cost \$65/hr
  - Production rate 275m<sup>3</sup>/hr
- D8 Excavator
  - Fixed Cost \$1000/day
  - Variable Cost \$100/hr
  - Production rate 650m<sup>3</sup>/hr





# Minimum Cost Analysis

- A different problem is the determination of the point of **minimum total cost**. Instead of balancing two methods with different fixed and variable costs, the aim is to **bring the sum of two costs to a minimum**.
- For example, minimum cost analysis could be used to determine the optimal **frequency of grading** the road surface. For example:
  1. Grading cost is \$700 per km.
  2. However, aggregate loss is a function of grading frequency:

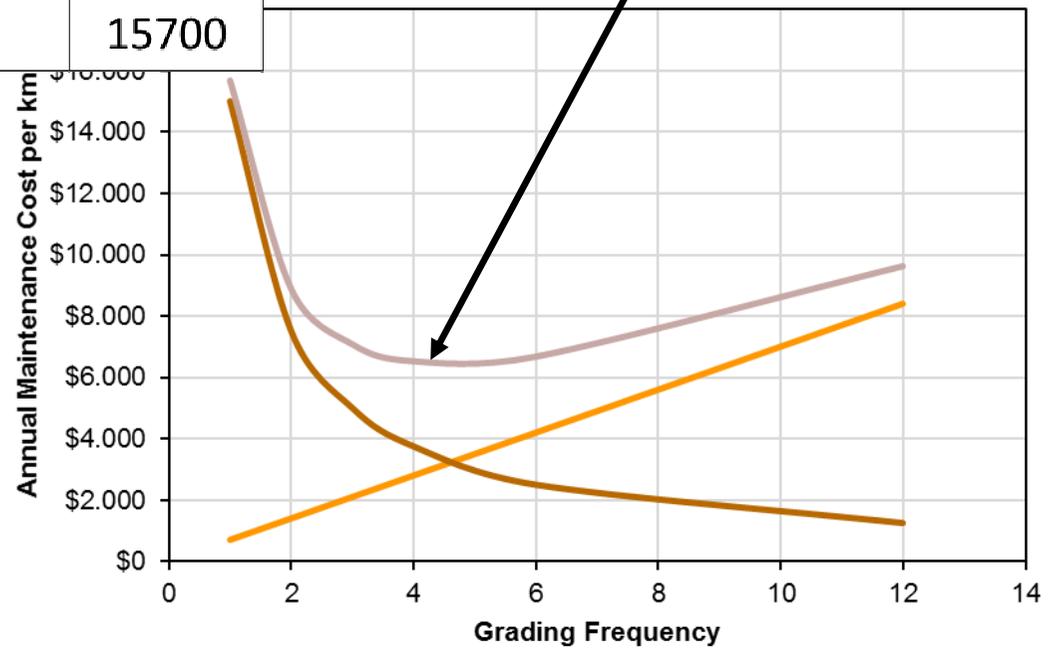
Aggregate replacement cost =  $(\$15,000/\text{Grading Freq})/\text{km}/\text{yr}$





Frequency of Grading per Year	Grading cost (\$/yr)	Aggregate Replacement Cost (\$/yr)	Total Cost (\$/yr)
12	8400	1250	9650
6	4200	2500	6700
4	2800	3750	6550
3	2100	5000	7100
2	1400	7500	8900
1	700	15000	15700

**Optimum**



— Grading Cost — Aggregate Replacement Cost — Total Maintenance Cost





## Types of Contract

- **Fixed Price** – where the price is agreed prior to commencement of work. Requires agreement on the scope and specification of work to be completed. Variations in required work generally results in price renegotiation.
- **Unit rate** – where the price is based on an agreed unit rate for work done (e.g.  $\$/m^3$ ). Requires agreement on a fair unit price and a mechanism to measure the units of work that have been completed.
- **Cost plus** – a contract where the costs of completing the work are summed and an agreed percentage is added to allow for the contractor's profits and overheads.

