Plant Selection, Organisation and Management

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Considerations before buying a plant or a piece of equipment

Type and size of job

Determine the type of equipment available and capable to do the job, and whether to buy or to lease

Reliability of equipment

Past experiences, reputations

Whether you are public or private company

Public: political pressures, non-tech factors
Private: more emphasis on technological considerations, credit facilities, competitive quotes.

Important to abide your organisation’s purchasing plant and equipment procedures

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Considerations before buying a plant or a piece of equipment

Versatility

Specialised or multi-purpose, track or rubber tyre

Life spans

After sales service, cost of carrying large stocks

Depreciation

Keep to limited brands or makes?

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Various Methods of Acquisition

1) Rent

2) Purchased for cash

3) Purchased on Hire Purchase terms

4) Leasing

Which is the best?

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Various Methods of Acquisition

Don’t buy when:

- No reasonable further work is forecasted
- Less than 50% Ultilisation Factor

Rent or purchase depends on:

- Periods of use
- Funds available
- Rate of interest
- HP financing terms
- Leasing attractive?

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Example on Hire Purchase

HP is generally pay some cash on delivery and remainder in monthly installments. Say a machine on HP is $15,000

Pay $ 5,000 cash upon delivery and the remaining $10,000 over 2 years at a simple interest rate I of 7.5%

Interest = $10,000 x 7.5% x 2 = $ 1,500

($10,000 + $1,500)/24 = $479.19 monthly

Payment Schedule		
1st month	$5,000 + $479.17	= $5,479.17
2nd month		= $479.17
:		:
24th month		= 479.17
	Total:	$16,500,00

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Example on Leasing

A contractor buys a plant for $15,000 on a leasing agreement. After 2 years, the contractor can buy the plant for a residual value of $6,750.

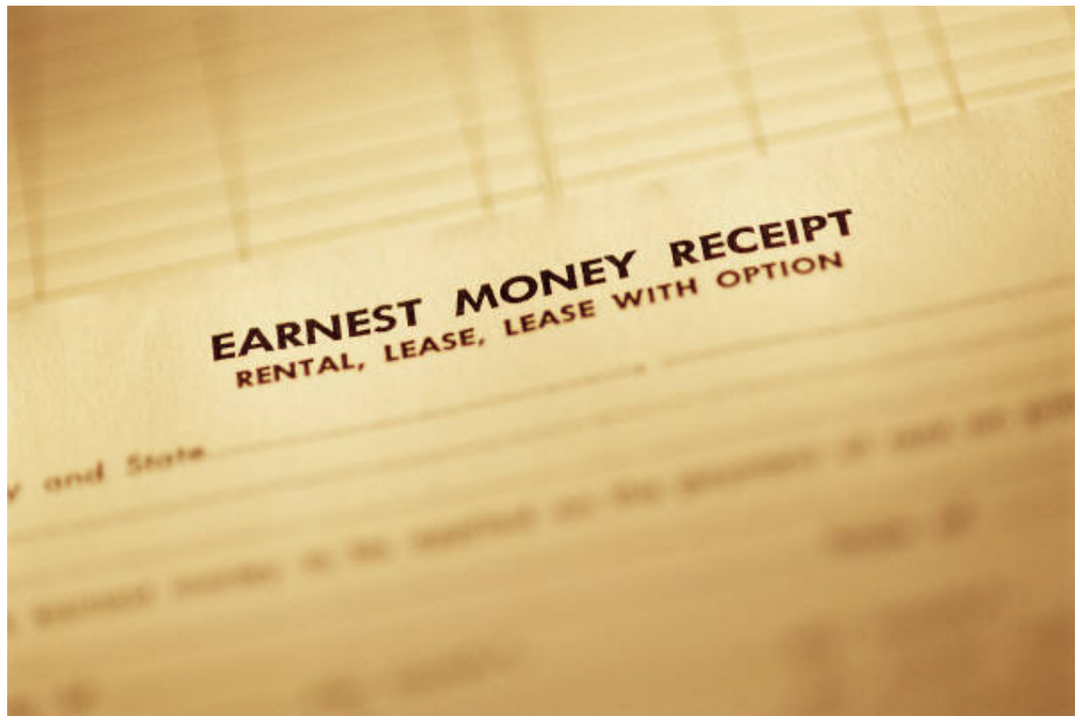
The finance company charges a simple interest of 7.5% p.a. on rental payment and 5.5% p.a. on the residual value.

Interest on rental = $8,250 x 7.5% x 2 = $1,237.50

Interest on residual value = $6,750 x 5.5% x 2 = $ 742.50

What's the Contractor's payment schedule?

$$\frac{8250 + 1237.50}{24} = \$395.31$$



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Example on Leasing (cont.)

Payment Schedule		
1st month		= $ 395.31
2nd month		= $ 395.31
:		:
23th month		= 395.31
24th month	($6,750 + $742.5 + $395.31)	= 7,887.81
	Total:	$16,980.00

Question?

If you are the finance company, would you want to set “residual value” as high or as low as possible? And why?

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Example on Leasing (cont.)

Example “A”

Residual value set as high

Say RV = $9,000 (60%)

Therefore Rental = $6,000 (40%)

Interest (7.5% flat) on rental = $6,000 x 7.5% x 2 = $900

Interest (5.5% flat) on RV = $9,000 x 5.5% x 2 = $990

Total = (6,000 + 900) + (9,000 + 990) = $16,890

Payment Schedule		
1st month		= $ 287.50
2nd month		$ 287.50
24th month	9000 + 990 + 287.50	= 10,277.50
	Total:	$16,890.00

Set RV low, get money first!

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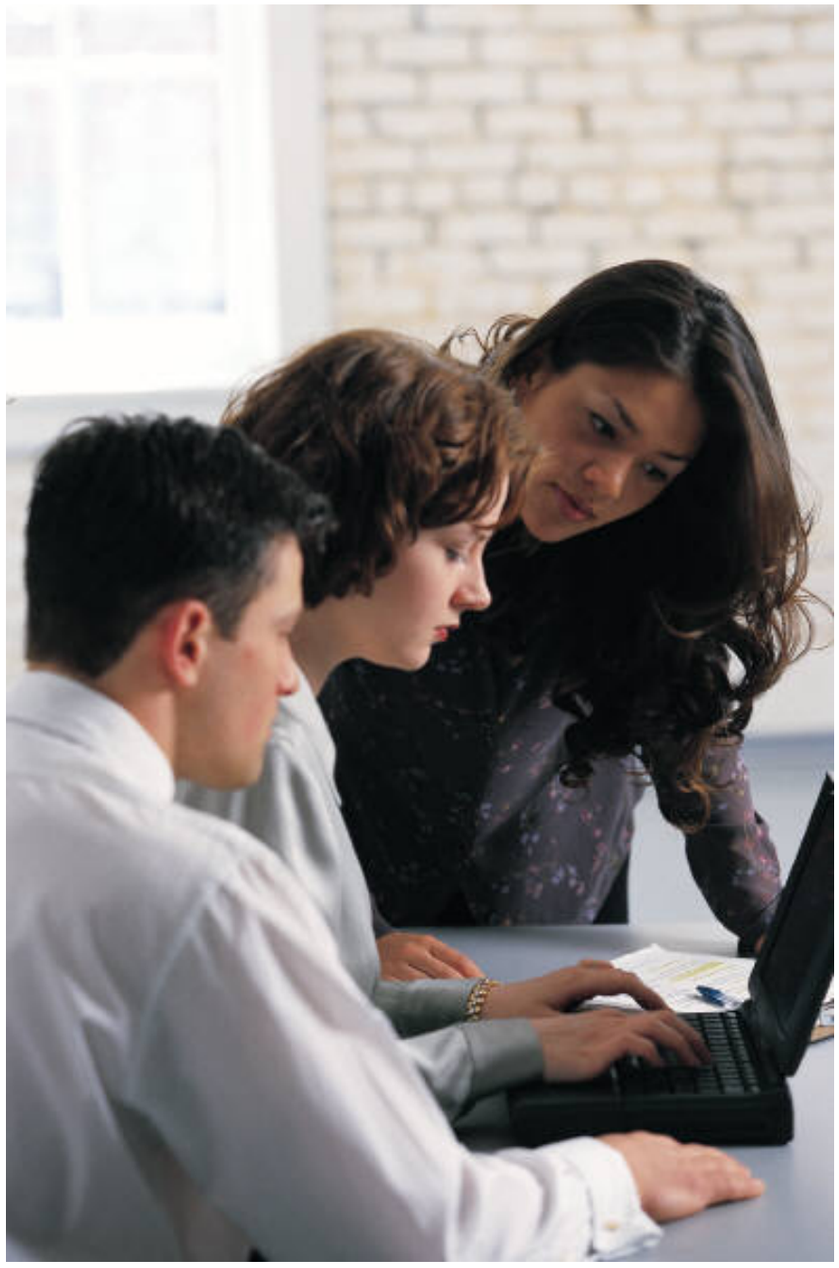
Operation and Maintenance

- Preventive maintenance
- Training and motivation of new and old personnel
- Importance of instruction manuals



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Understanding and calculation of:

a) Potential Operating Factor

b) Serviceability Factor

c) Utilisation Factor

Example:

40 hour week → 2000 hours/year. But only 1800 hours of work can be found. During the year, 300 hours are unserviceable hours (This 300 hours assumed to occur “within” the 1800 hours.)

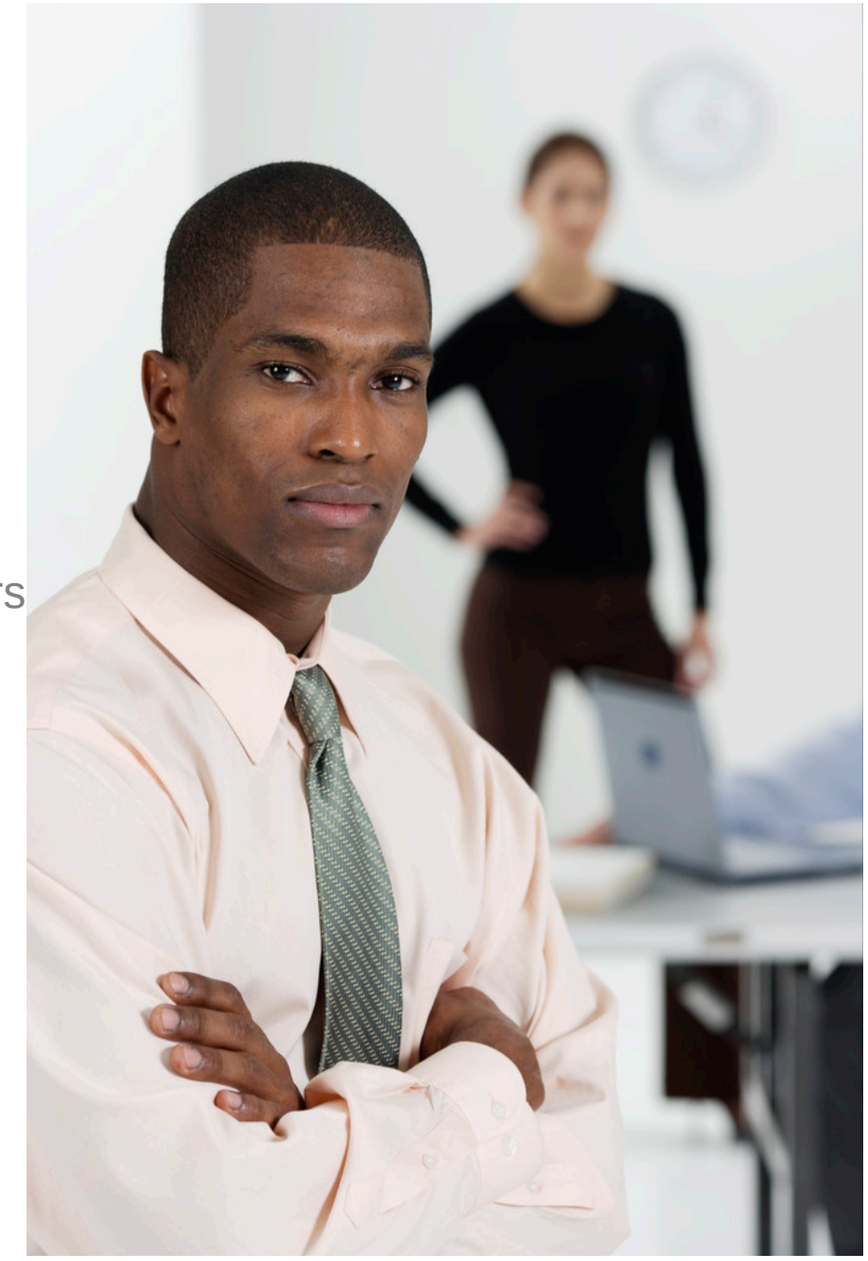
Potential Operating Factor = 1800/2000 = 90% #

Serviceability Factor = (1800 – 300) / 1800 = 83.3% #

Utilisation Factor = (1800-300) / 2000 = 75% #

(see Example on Plant Summary later)

Note:
S.F > 80 % → Considered Very Good
U.F < 50% → Don’t Own



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Plant Administration

- Central depot or local control? (or a mix?)
- Potential areas of conflict – different objectives of plant manager and site manager.

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Capital Recovery

This is the amount to be recovered each period from an investment in order that the invested capital and a specified rate of return can be recovered

The Capital Recovery formula is:

$$\left(\frac{A}{P}, i, n\right) = \frac{i(1+i)^n}{(1+i)^n - 1}$$

The Capitalized Cost is the Present sum which will finance the initial construction or manufacturing costs plus an annual cost at a fixed rate of interest in perpetuity

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Capital Recovery

Example:

If $5,000 is invested now, what is the amount that must be recovered each year for the next 5 Years to ensure a return of 10% on the original investment.

$A = P \times i(1+i)^n / (1+i)^n - 1$

$A = \$5{,}000 \times 0.1(1+0.1)^5 / (1+0.1)^5 - 1$

$= \$5{,}000 \times 0.1\ (1.61) / (1.61) - 1$

$= \$5{,}000 \times 0.161 / 0.61$

$= \$5{,}000 \times 0.264 = \$1{,}320$

Uniform series Capital Recovery factor

$$\left(\frac{A}{P}, i, n\right) = \frac{i(1+i)^n}{(1+i)^n - 1}$$

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Estimating – Unit Rates

Hired Plant

Determine the “all in” cost of hired plant as an hourly or weekly rate. The plant may be hired from an internal plant division or from a specialist plant company.

Basic cost is rate quoted PLUS the cost of operating sometimes not included in quotation.

CHECK if transport costs to and from the site are included. If not, this must be added to the basic cost.

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Estimating – Unit Rates

Operating costs include:

- Allowances for the operator
  Additional money may have to be provided for the salary of the operator.

- Fuel
  Calculated on an estimated number of litres per hour. Usually obtained from records and plant manuals.

- Oil and Grease
  Calculated as an allowance per hour of plant time or as a percentage of fuel costs.

- Other consumables
  Calculated as an allowance or percentage

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Estimating – Unit Rates

Bought Plant

If the plant is owned by the contractor, the rate must include OWNERSHIP and OPERATING costs.

Example on calculating the economic hire rate of a crane.

Capital Cost	$58,050
Resale value	$4,050
Anticipated life	10 years
Operating hours per year	2000 hrs
Insurance per year	$200
Licenses and tax per year	$150
Fuel @ 20L per hour	$1.20/L
Oil and grease	10% of fuel cost
Repairs and maintenance	15% of capital cost
Required rate of return on capital	15%
Overheads of business	Not Included

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Estimating – Unit Rates

FIRST calculate OWNERSHIP COST per annum

First calculate Present Value of $4,050 = $1,000 ($4,050 x 0.247)
(Use F = $4.050, i=15%, n = 10 years and get PVF = 0.247)

Determine Capital Recovery Factor
(Use P = $57,050 ($58,050 - $1,000), i = 15%, n = 10 years
and get CRF = 0.199) From formula or from Financial Tables

$$\left(\frac{P}{F}, i, n\right) = \frac{1}{(1+i)^n}$$

$$\left(\frac{A}{P}, i, n\right) = \frac{i(1+i)^n}{(1+i)^n - 1}$$

(57,050 x 0.199) =	$11,353
Licenses and Tax	$150
Insurance	$200
OWNERSHIP COST	$11,703

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Estimating – Unit Rates

THEN calculate OPERATING COST per annum

Consumables

Fuel at 20L /hr 20 x 1.20 x 2000hrs	$48,000
Oil @ 10% of fuel cost	$4,800
Repairs @ 15% of capital cost	$8,708
OPERATING COST	$61,508

TOTAL COST = OWNERSHIP + OPERATING COSTS = $73.21

HOURLY COST = $73,211 / 2000 = $36.61 per hour

This rate allows for sufficient income to replace the asset, covers operating costs and provides a return on initial investment.

It does not include operator's cost nor contribution to office overheads and profit of the business. Management will decide what to add on!

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Example of large volume excavation requiring cut and fill

Ascertain:

- Materials to be moved
- Volumes involved
- Transportation distances
- Mostly cut and fill or
- Mostly imported fill

Identify material categories:

- Excavation
  - Topsoil
  - Unsuitable material
  - Suitable material
  - Rock

- Fill
  - Suitable fill
  - Rock fill
  - Capping fill

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Example of large volume excavation requiring cut and fill

Excavation and transportation of topsoil

Total volume	= 26,180 m^3
Average lead distance	= 600m
Plant selected	= TS24 scraper with 20 km/hr speed loaded
	= 22.5 km/hr unloaded
	= Capacity 18 m^3

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Excavation and transportation of topsoil

Scraper capacity: 18 m^3

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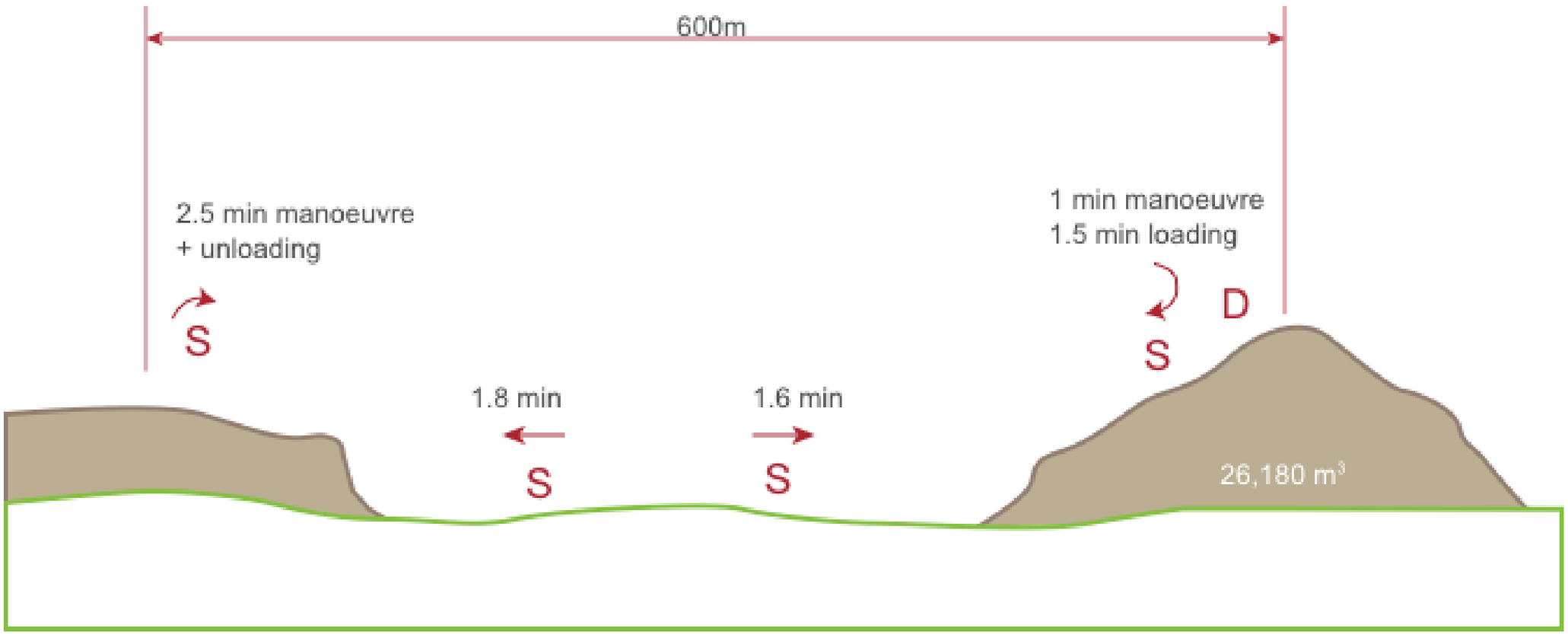
Example 3.1: Excavation and transportation of topsoil



S = Scraper

D = Bulldozer

Loaded speed = 20 km/hr
Unloaded speed = 22.5 km/hr
Capacity = 18 cubic metres

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Example of large volume excavation requiring cut and fill

a) Calculate cycle time:

Manoeuvre	= 1.00 min
Load	= 1.50 min
Haul (0.6 x 60/20)	= 1.80 min
Manoeuvre & unload	= 2.50 min
Return trip (0.6 x 60/22.5)	= 1.60 min
Total Cycle Time	= 8.40 min

Say 10 mins per round trip.

Bulking assumed to be allowed for by heaping of material.

Underloading prevented by push loading with a dozer.

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Example of large volume excavation requiring cut and fill

b) Calculate no. of scapers required to keep D8 bulldozer constantly working:

Cycle time / (manoeuvre + load time) =10/2.5 = 4 scapers

c) Calculate cost of plant:

TS24 scraper @ $62.91/hr x 4	$251.64/hr
D8 bulldozer @ 38.16/hr	$38.16/hr
TOTAL PLANT COST	$289.80/hr
Total plant cost for 50 hr week	$14,490.00

d) Calculate total volume hauled per week:

No. of scrapers x volume carried x trips/hr x hours worked

= 4 x 18 x 6 x 50 21,600 m^3

e) Calculate plant cost/m^3

14,490.00/21,600 $0.67/$m^3$

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Example of large volume excavation requiring cut and fill

f) Calculate labour cost/m^3

Ganger at $ 15.50/hr x 50	= $775.00
Dozer operator at $ 39.50/hr x 50	= $1,975.00
Scaper operator at $41.00/hr x 50	= $2,050.00
Labour cost = $ 4,800.00/21,600	= $0.22/$m^3$
TOTAL RATE = (0.67 + 0.22)	**= <u>$0.89/$m^3$</u>**