



مجموعة جامعة
الجميع الذكية
للتعليم القابضة

MIDOCEAN
UNIVERSITY

Project Time Management

Lecture 10

PMG 212

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Resource Loading

- Resource Loading
- What is Resource Loading in Projects
- Why use Resource Loading?
- Resource Loading Benefits
- Resource Loading Process
- Baseline, Current, and Forecast Schedule Discipline
- Schedule Analysis
- Resource Leveling versus Resource smoothing
- Estimate Cost Techniques

Resource Loading

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Resource Loading

- What is resource scheduling?
- Why do we use it?
- How does it work?

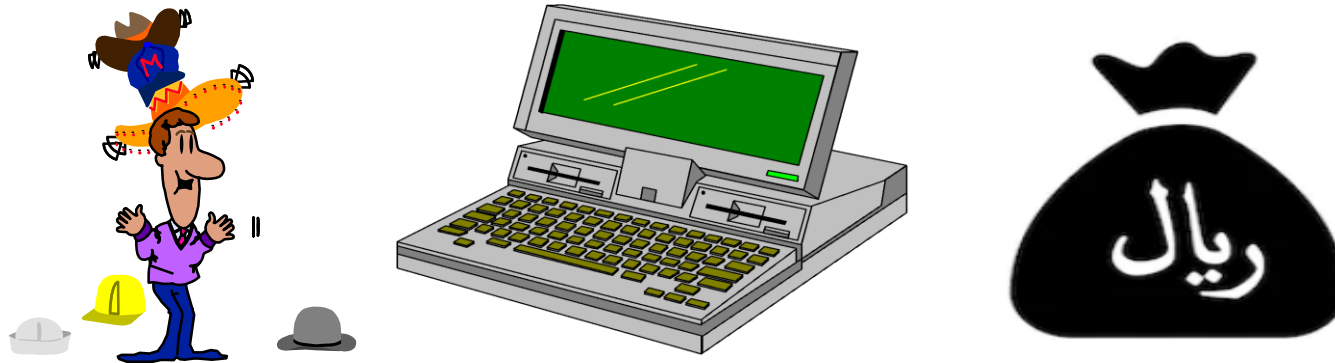


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What is Resource Loading in Projects

- People, equipment, money, space, bulks...



- It defines which resources should be utilized on specific tasks - between which dates.

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Why use Resource Loading?

- Analytically **manage** and use schedule **float**
 - Analyze **staffing requirements**
 - Evaluate **effects of limited staffing**
 - **Avoid wide fluctuations** in daily need for various resources (leveling)
- Produce more realistic schedules
 - Produce progress & resource curves
 - Comply with client requirements

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Resource Loading Benefits

- Helps maximize utilization of resources
- Produces realistic start/finish dates
- Avoids peaks and valleys in staff
- Helps in scheduling constrained resources

Good resource scheduling is the basis for maximizing the productivity of people and equipment while minimizing their cost.

Resource Loading

ACTIVITY
A

TF = 0

ACTIVITY
B

TF = 45

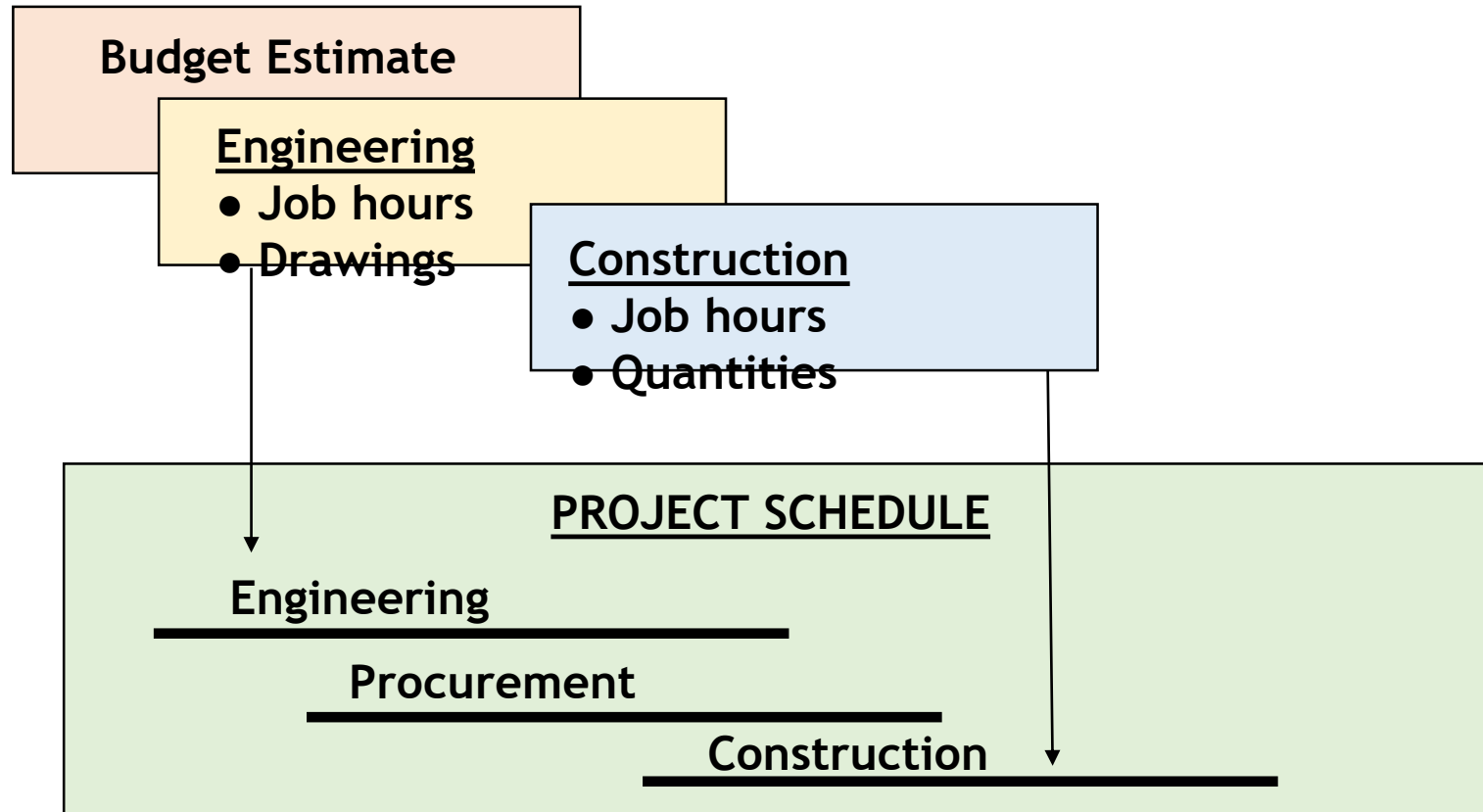


- **Competing** for the **same resource** at the same time.
- Activity with the **least TF** is scheduled **first**

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Resource Loading Process



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Baseline, Current, and Forecast Schedule Discipline

- **Baseline Schedule**
 - Represents the approved project plan
 - Contains project execution activities, logic, and budget resources
 - Provides the means for measuring actual project progress against the plan
- **Revised Baseline Schedule**
 - The Baseline Schedule with updates for Schedule Change Notices (approved scope changes and Project Manager approved changes in the execution plan)

Baseline, Current, and Forecast Schedule Discipline

- **Current/Forecast Schedule**
 - Presents the actual progress of the project
 - Includes projections

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Schedule Analysis

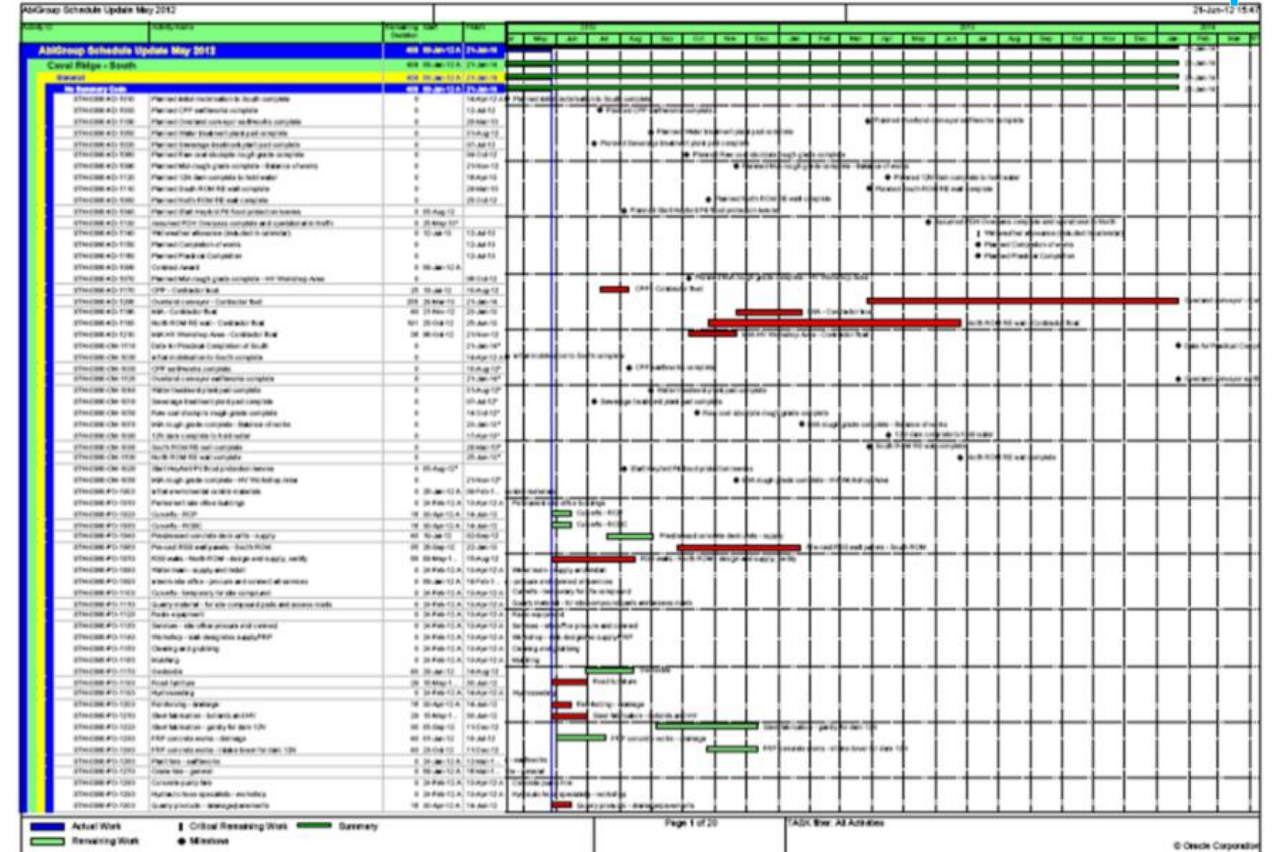
- Is the **project on schedule**?
 - What activities are ahead or behind schedule?
 - What impact will to-date poor or good productivity have on the to-go portion of schedule?
 - Has the execution plan or work process changed?

Schedule Analysis

- What is the **critical path**?
 - Has it changed from the baseline?
- What are the means to **recover the schedule**?
 - What are the resource requirements?
 - What will it cost?

Schedule Analysis Methods and Tools

- **Critical path analysis**
 - Changes to the primary critical path and key milestones
 - Impact on near critical path
- **Float analysis**
 - Impact on overall schedule (total and free float)



Resource Loading

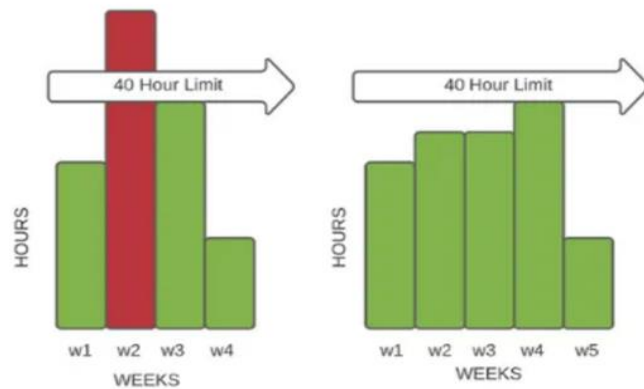
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Resource Leveling versus Resource smoothing

- Resource leveling – This is used when scheduling the production of available resources is limited and needs to be used optimally.
- Resource smoothing – This is used when time constraints are the biggest factor blocking production.

Resource Loading

Resource Leveling



Resource leveling can be used when shared or critically required resources are available only at certain times or in limited quantities, or are over-allocated, or there is a need to keep resource usage at a constant level.

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Estimate Cost Techniques

- **Three-Point Estimates**

- Triangular Distribution.

$$\checkmark \text{ cE} = (\text{cO} + \text{cM} + \text{cP}) / 3$$

- Beta Distribution (from a traditional PERT analysis).

$$\checkmark \text{ cE} = (\text{cO} + 4\text{cM} + \text{cP}) / 6$$

- Standard Deviation = **(Pessimistic-optimistic) / 6**

Estimate Cost Techniques

- **Earned Value Management (EVM)** is a methodology that combines scope, schedule, and resource measurements to assess project performance and progress.
- EVM can be used for analysis of cost and schedule baselines
- Earned Value Management is carried out using the three main inputs:
 - Planned Value (**PV**)
 - Earned Value (**EV**)
 - Actual Cost (**AC**)

Earned Value Analysis

- The earned value (EV), is a measure widely used in construction,
- Earned Value Management (EVM) is a technique for calculating the 'percent complete' of a control account.

"Earned Value Analysis" is an industry standard way to:

- measure a project's progress,
- forecast its completion date and final cost,
- provide schedule and budget variances.

EVM Three Main Measurements

By integrating three measurements, it provides consistent, numerical indicators with which you can evaluate and compare projects.

- **Planned Value (PV)** = Hourly Rate × Total Hours Planned
- **Actual Cost (AC)** = Paid Hourly Rate x Actual Hours
- **Earned Value (EV)** = Total value of work done = (Project value) x (% Completed)

EVM can measure **VARIANCE** and **PERFORMANCE INDEX**

Basic EVM Formulas

EVM is based on monitoring three aspects along the project in order to reveal the health of the project with the following indices:

(example of building 10 houses each has a value of US\$10,000 expected to be completed in 10 Months in proportion):

- **Planned Value (PV)** — The **budgeted value** of the work completed so far at a specific date
example: at end of Month 4, altogether 4 houses should be completed, the PV is US\$40,000

- **Earned Value (EV)** — The **achieved value** of the work completed so far at a specific date
example: by end of Month 4, only 3 houses are completed, the EV is US\$30,000

- **Actual Cost (AC)** — The total expenditure for the work so far at a specific date
example: by end of Month 4, \$35,000 was spent, the AC is \$35,000

Schedule and Cost Variance

- **Schedule Variance (SV)** — difference between PV and EV, to tell whether the project work is ahead of / on / behind **schedule**
- **SV = EV – PV**
 - If the project is behind schedule the SV will be negative (i.e. achieved less than what planned)
 - If the project is on schedule the SV = 0
 - If the project is ahead of schedule the SV will be positive (i.e. achieved more than what planned)
- **example:** by end of Month 4, the $SV = EV - PV = \text{US\$}30,000 - \text{US\$}40,000 = -\text{US\$}10,000$ (behind schedule)

Schedule and Cost Variance

- **Cost Variance (CV)** — difference between PV and AC, to tell whether the project work is
 - under / on / over **budget**
 -
- **CV = EV – AC**
 - If the project is over budget the CV will be negative (i.e. achieved less than spent)
 - If the project is on budget the CV = 0
 - If the project is under budget the CV will be positive (i.e. achieved more than spent)
- **example:** by end of Month 4, the CV = EV – AC = \$30,000 – \$35,000 = - \$5000 (over budget)

Schedule and Cost Performance Index

- **Schedule Performance Index (SPI)** — ratio between EV and PV, to reflect whether the project work is ahead of / on / behind **schedule in relative terms**

SPI = EV/PV

If the project is behind schedule the SPI < 1 (i.e. achieved less than what planned)

If the project is on schedule the SPI = 1

If the project is ahead of schedule the SPI > 1 (i.e. achieved more than what planned)

example: by end of week 4, the SPI = EV/PV = US\$30,000/US\$40,000 = 0.75 (behind schedule)

Schedule and Cost Performance Index

- **Cost Performance Index (CPI)** — ratio between EV and AC, to reflect whether the project work is under / on / over **budget in relative terms**

CPI = EV/AC

If the project is over budget the $CPI < 1$ (i.e. achieved less than spent)

If the project is on budget the $CPI = 1$

If the project is under budget the $CPI > 1$ (i.e. achieved more than spent)

example: by end of week 4, the $CPI = EV/AC = \$30,000 / \$35,000 = 0.86$ (over budget)

- **Note both SV and SPI / CV and CPI give similar information on schedule / budget but the indices will give more insights into the actual performance with a meaning comparison.**

Thank You