# Differentiating between activities and work = Resource Optimization



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# Outline

- The status of scheduling
- The problem
- The challenge
- Some existing & historical options
- A short term solution
- Suggestions for a long term solution

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## The status of scheduling

- Far too many projects overrun time
  - Option 1 – The schedule was wrong
    - Unskilled schedulers?
    - Bad process?
    - Poor information?
  - Option 2 – Management did not believe the schedule as developed
    - Based on prior experience
    - Lack of respect for process or people

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## The status of scheduling

**Insanity: doing the same thing over and over again and expecting different results**
Albert Einstein

- Most project's ignore the contract schedule (Glenwright)

- Terms of contract and penalty clauses don't work (CIOB Report)

- Construction project's have shown no improvement in productivity for 40 years (BSI Report)

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## The problem

- Our tools are based on very simplistic models
  - The focus is task, duration and sequence
  - The basic structure has not changed for 55 years
  - CPM was a gross simplification of the original ADM models
  - PDM was designed as a simplification of CPM **FOR MANUAL ANALYSIS**

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## The problem

- Computers have improved 10,000 percent in the last 50 years
- Scheduling uses exactly the same simplistic models that were 'dumbed down' to work on computers in the early 1960s
- **Its time for a change!**
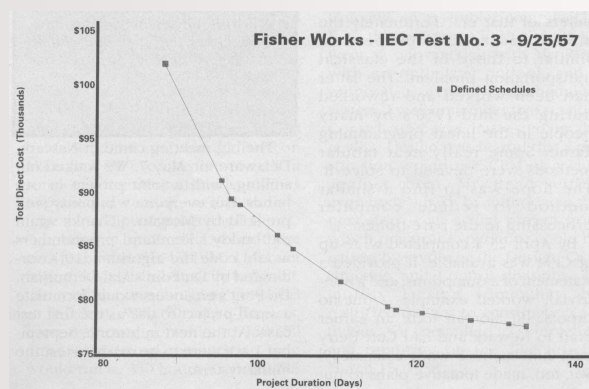
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## The challenge

- Kelley & Walker set out to solve the 'time / cost conundrum'
- Where to best use scarce/expensive additional resources to shorten project durations
- Their focus was resource optimisation

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## The challenge



Fisher Works - IEC Test No. 3 - 9/25/57

- Their 1957 model plotted time against the cost of the additional resources used

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## The challenge

- K&W mapped the cost and benefit of paying for 'crashed activity durations' against the overall time for the project
- But the analysis required many hours of computer time
- The estimate to run all Du Pont projects using the model was over 490 hours per month – **so the model was simplified!**

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## Existing & historical options

- Effective resource management was used to build the pyramids
    - Work to cut granite beams was started 10 years before they were needed on the Great Pyramid at Giza.
- Barcharts have existed since at least the 18th century (Priestly 1765)
    - They are still the most popular way of planning the use of time in projects. Why?
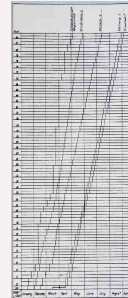
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## Existing & historical options

- Line of Balance was used in the 1930s



**Empire State Bldg.**
completed in 1931

**102 Floors
built in
410 days**

The steel frame rose at the rate of four and a half floors per week

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## Existing & historical options

- Critical Chain arrived in the 1990s
- Historically:
  - Effective time and sequence management has been used for 1000s of years
  - Resource coordination and workflow balancing are core to LoB and Critical Chain
  - CPM originally made durations a function of resource effort

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## The current challenge

- Scheduling is supposed to focus on making the most efficient use of scarce resources to achieve the optimum project duration balancing time against the cost of the resources
  - Durations are a factor of the resources applied to the work and their efficiency
  - Only some sequences are mandatory, most should be based on resource efficiency

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## The current challenge

- Our scheduling tools:
  - Assume durations are a fact (unchangeable)
  - Assume all logic is a fact (unchangeable)
  - Focus on tasks, durations & float calculations
  - Delay activities if resources are not available
  - OR make incredibly simplistic assumptions about durations and effort (Brookes 1975)
  - Resource levelling is a one-pass deterministic calculation (based on rules)

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## The current challenge

- The focus is on the work (activities)
- But we want to make efficient use of the workers (resources)
- There are some partial solutions
  - Focus on work flow
    - Location based scheduling (derived from LoB)
    - Critical Chain
  - Resource optimisation based on activities
    - SPIDER (Russia)

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## A short term solution

**Only plan in detail what you know in detail**

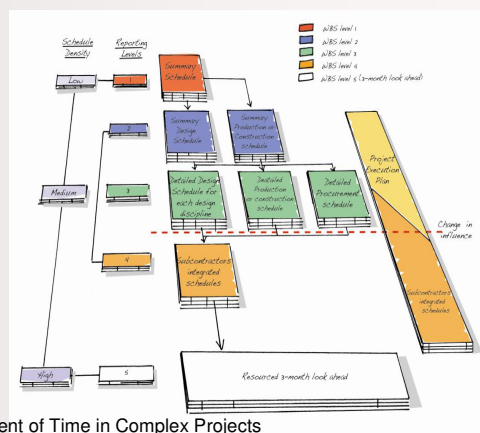- Schedule Levels
  &
  Schedule Density



Figure © Guide to Good Practice in the Management of Time in Complex Projects
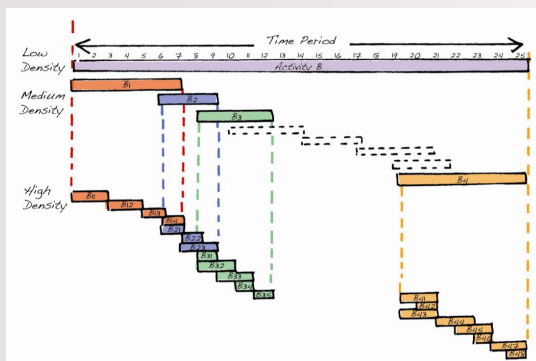
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# A short term solution

- Schedule Density
  - Overall framework is essential for Time Management….. But
  - Detail planning requires the people doing the work to be involved (eg, Last Planner)
  - Therefore, add detail when appropriate

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# Schedule Density

Figures © Guide to Good Practice in the Management of Time in Complex Projects



Activities are progressively expanded to greater levels of 'density' as more information becomes available

Unless the work is designed in its entirety and all subcontractors and specialists appointed before any work commences, it is impossible to plan the work in its entirety, in detail at the beginning of a project.

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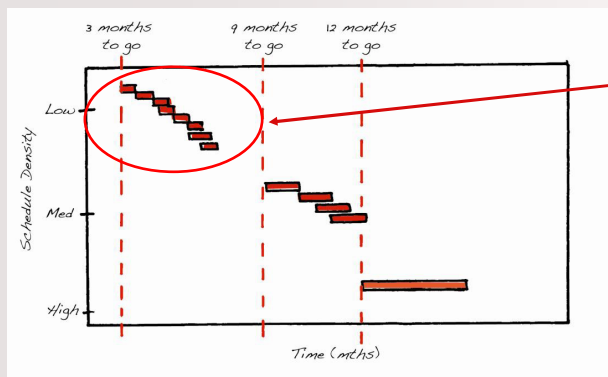
## Schedule Density
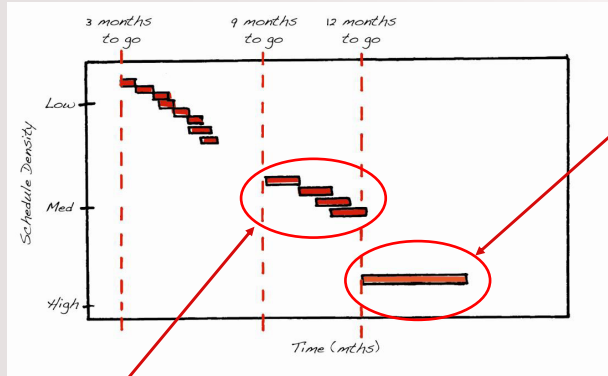


Low-density is appropriate for work, which is intended to take place 12 months, or more in the future.

Tasks may be several months in duration

Medium density is appropriate for work, which is intended to take place between 3 and 9 months after the schedule date. At this stage the work should be designed in sufficient detail to be allocated to contractors, or subcontractors. Task durations should not exceed 2 months.

## Schedule Density



High-density scheduling is an essential prerequisite for undertaking work. The schedule is prepared with the people doing the work.

Task durations should be no more than the update cycle

As the density is increased, adjustments to the plan take into account actual performance to date, resources, work content, and other factors necessary to achieve the overall schedule objectives.

## Schedule Density

| Location | Zone | Area | Section | Item | Description | Activity ID |
|---|---|---|---|---|---|---|
| **Low Density** | | | | | | |
| A | B | A | | | Substructures | ABAZZ00010 |
| **Medium Density** | | | | | | |
| A | B | A | A | | Excavations | ABAAZ00010 |
| A | B | A | B | | Piling | ABABZ00010 |
| A | B | A | C | | Ground beams | ABACZ00010 |
| A | B | A | D | | Floor slabs | ABADZ00010 |
| **High Density** | | | | | | |
| A | B | A | C | | Ground beams | ABACZ00010 |
| A | B | A | C | A | Formwork | ABACA00010 |
| A | B | A | C | B | Reinforcement | ABACB00010 |
| A | B | A | C | C | Placing concrete | ABACC00010 |
| A | B | A | C | D | Curing | ABACD00010 |
| A | B | A | C | E | Strike formwork | ABACE00010 |
| A | B | A | C | F | Backfill | ABACF00010 |

The activity coding structure (ID) maps high to medium to low density

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## A short term solution

- Schedule Density & Levels
    - Use Schedule Levels to keep individual files small and manageable
    - Low density schedule sets the overall 'time budget' objectives for the project (contract)
    - Medium density sets the strategy to deliver the objectives
        - Working with contractors and suppliers
    - Low density defines the short-term tactics to achieve the strategy

## A short term solution

- As density increases, re-plan based on what you **know now** to:
  – Obtain future resources (medium density)
  – Make 100% effective use of the available resources (low density)
  – Achieve the overall 'time budget' objectives
- New forms of contract are being developed to achieve this solution
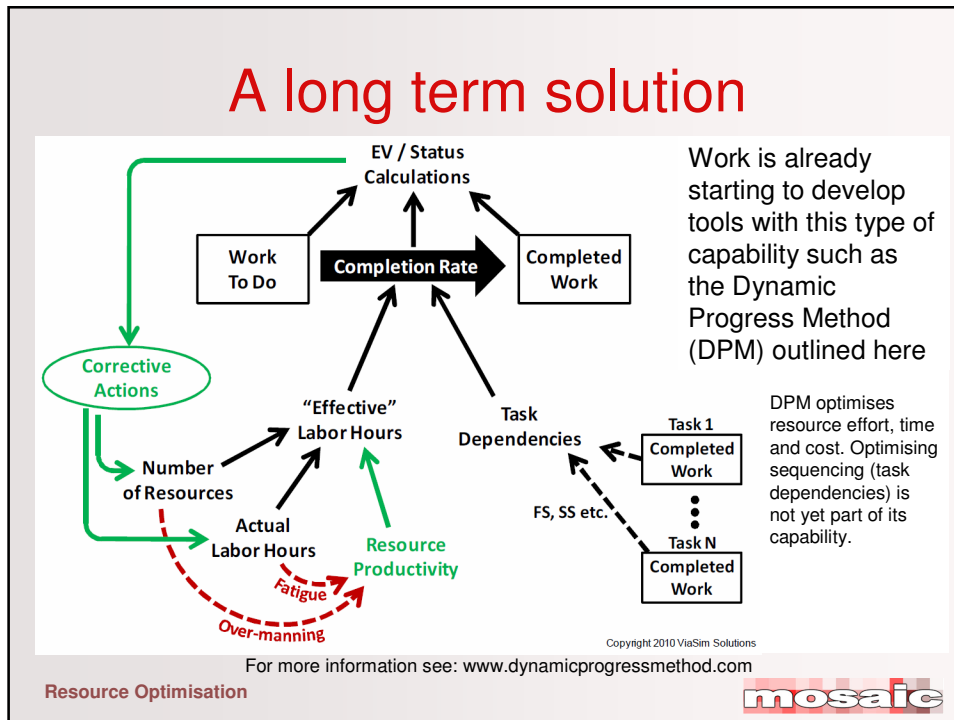
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## A long term solution

- Develop new software that:
  – Focuses on work flow and resources
    - The idea is not new!
  – Has constrained flexibility for durations based on resource allocations (not 'straight line')
  – Optimises resource allocation, usage and overall time (back to Kelly and Walker)
  – Actually helps planners manage time effectively (applies rules based 'intelligence')

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## A long term solution

Work is already starting to develop tools with this type of capability such as the Dynamic Progress Method (DPM) outlined here

DPM optimises resource effort, time and cost. Optimising sequencing (task dependencies) is not yet part of its capability.

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For more information see: www.dynamicprogressmethod.com

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## Conclusions

### If you always do what you've always done, you will always get what you've always got!

- As a profession, we need to do better!

- Schedules need to provide a process to make the optimum use of the project's workers (delay and disruption should be the same thing)
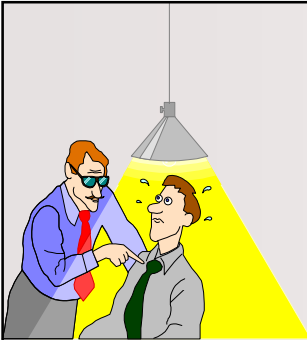
## Conclusions

- We need tools that use 21st century capabilities
- We need trained and capable schedulers
- We need to ditch the critical path and focus on the critical work done by the critical workers

## Discussion

**Useful schedule are useful because they are used!**

- Questions please
- Contact details:
  - Free planning and scheduling resources:
    http://www.mosaicprojects.com.au/Planning.html
  - Email: patw@mosaicprojects.com.au