Differentiating between activities and work = **Resource Optimization**

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Outline

- The status of scheduling
- The cause of 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 ineffective
    - Unskilled schedulers? Bad process?
    - Poor information?
    - No real schedule?
  - There is a strong correlation between effective scheduling and project delivery
    - Does Better Scheduling Drive Execution Success? Dr Dan Patterson, 2011
    - Managing the Risk of Delayed Completion in the 21st Century. CIOB, 2008

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The status of scheduling

- Far too many projects overrun time
  - **Option 2** – Management did not believe the schedule as developed
    - Based on prior experience
    - Lack of respect for process or people
    - Ignorance or short term 'politics'
  - Unrealistic expectations are unlikely to be fulfilled! - Proactive response EIU/Oracle 2011

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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 cause of the problem

- Lack of skills, knowledge & qualifications
  - Planners & Schedulers see SUN25 – *Should Schedulers be Certified?*
  - Senior management??? We have a problem!
- Legal / contractual paradigms
  - We have a bigger problem!!
- Sub-optimal tools and models?
  - The focus of this presentation

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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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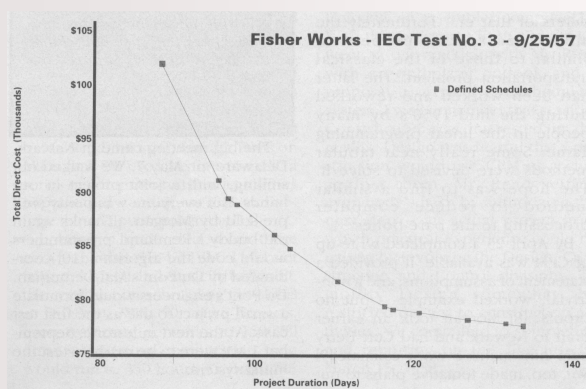https://mosaicprojects.com.au/PMKI-SCH-010.php#Process5

4

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

- 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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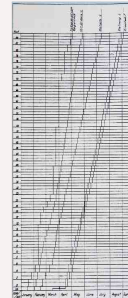
Existing & historical options

- Line of Balance was used in the 1930s

Empire State Bldg.
completed in 1931

"We always thought of it as a parade in which each marcher kept pace and the parade marched out of the top of the building, still in perfect step."

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
  - Focuses on workers handing off work to the next person as soon as possible
  - Each job is completed 100% as quickly as possible
  - No multi-tasking, No task splitting
- Henry Gantt (1919) introduced a similar approach to workers and workflow
  - The real purpose of 'Gantt Charts'

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Existing & historical options

- 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
  - But CPM was 'dumbed down' to work on the computers of the 1950s

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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
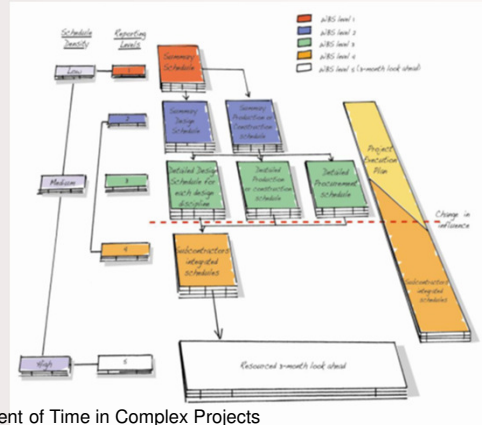 &
  Schedule Density

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)
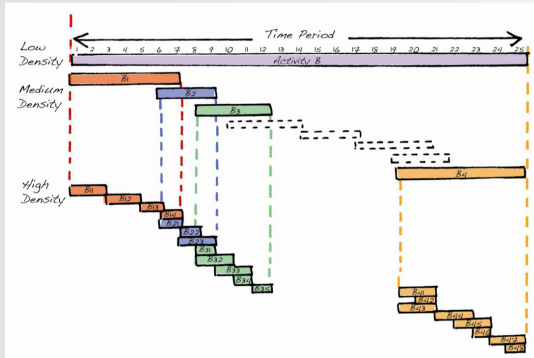 – Therefore, add detail when appropriate

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Schedule Density

Figures © Guide to Good Practice in the Management of Time in Complex Projects
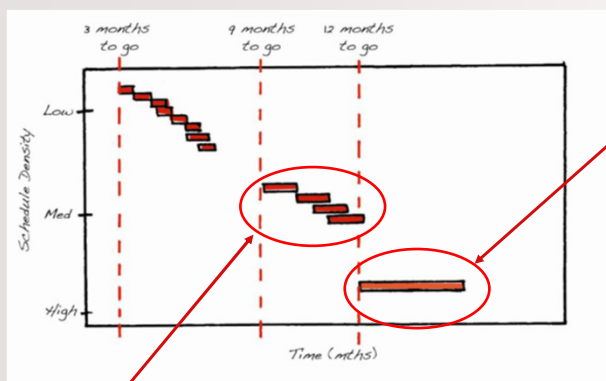
Activities are progressively expanded to greater levels of 'density' as more information becomes available

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.

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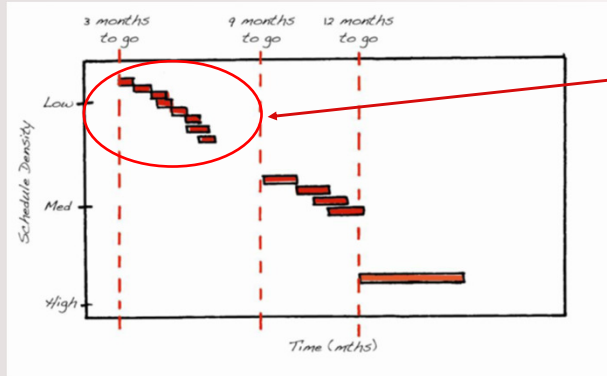
Schedule Density

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.

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Schedule Density

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

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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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https://mosaicprojects.com.au/PMKI-SCH-010.php#Process5

13

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

- **A few questions based on modern computing power**
- The focus of the questions is allowing the planner to set the parameters and then using the scheduling tool to suggest optimum solutions
- The planner retains ultimate control
- The tool helps the planner develop the optimum solution

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A long term solution

- **Q1:** Why can't durations be parametized based on the work content and resource availability
  - Min time, max resources
  - Optimum time, preferred resources
  - Max time, min resources
  - Set based on work/resource type (with override options)
  - Weighted towards the optimum

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A long term solution

- **Q2:** Why can't links be parametized based on their purpose
  - Mandatory links that must be honoured
  - Work-flow links that are preferred
  - Alternative work-flow links to facilitate resource optimisation
  - Include max and min options on lags
  - Allow the tool to optimise the schedule within the rules

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A long term solution

- **Q3:** Why can't the optimisation process be interactive
  - Computer assisted optimisation to integrate:
    - The planners 'common sense'
    - Rules built into the model
    - Computer power to run true optimisation
  - Allow review and override options to create a preferred model

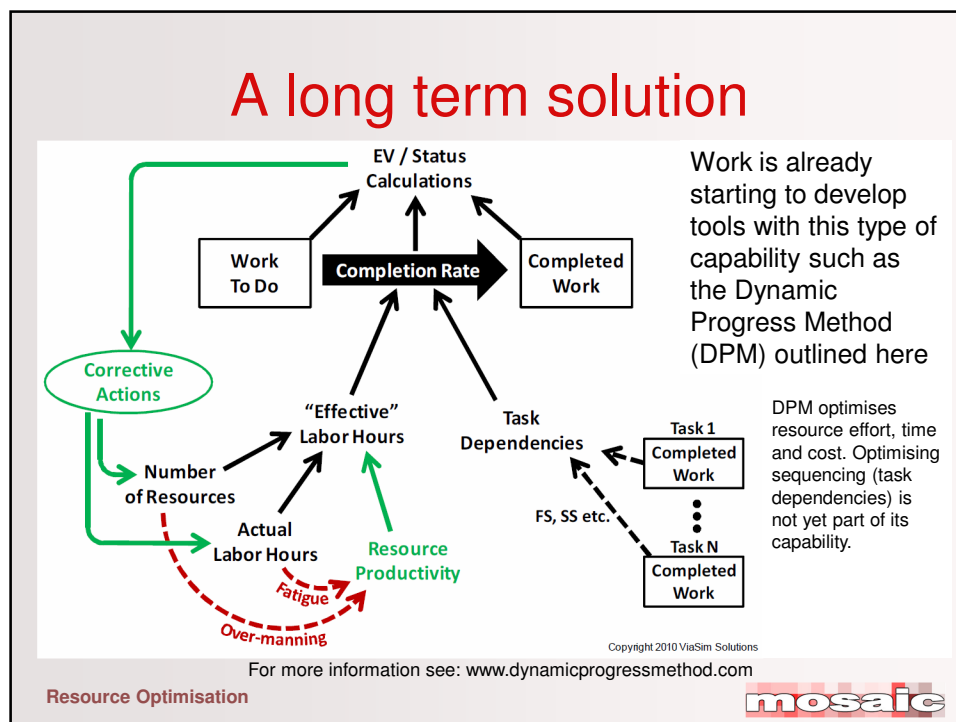Resource Optimisation

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A long term solution

- The solutions exist:
  - We already have the computing power
  - We already have the basic optimisation algorithms
  - Tools are starting to be developed
  - Why can't these be applied routinely to planning and scheduling?

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A long term solution

EV / Status Calculations

Work To Do — **Completion Rate** — Completed Work

Corrective Actions

"Effective" Labor Hours

Task Dependencies

Number of Resources

Actual Labor Hours

Resource Productivity

Fatigue

Over-manning

FS, SS etc.

Task 1 Completed Work

Task N Completed Work

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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A long term solution

- Linking to Schedule Density makes sense
  - Low Density schedules are time based objectives, this is the 'contract program'
  - Medium Density schedules are time based with resource requirements aggregated/ smoothed – the strategic intent / requirements
  - High Density schedules are resource optimised within the currently available resource availabilities

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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)
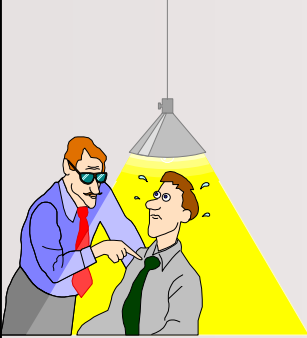
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Conclusions

- 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

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Discussion

Useful schedule are useful because they are used!

- Questions please
- Contact details:
  - Free planning and scheduling resources:
    https://mosaicprojects.com.au/PMKI-SCH.php
  - Email: patw@mosaicprojects.com.au

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