

## Schedule Density

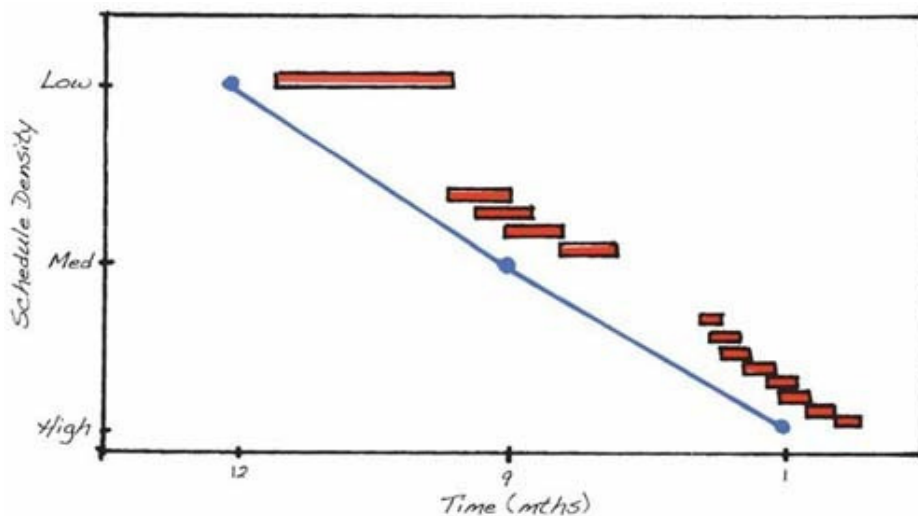
Developing an effective schedule for a complex project is an art. The schedule has to be an effective communication medium at many different levels:

- Communicating strategy and the overall concepts of the project to senior management (ideally on one page)
- Providing direction to managers within the project on what's required of their section (eg, design or procurement)
- Coordinating issues between sections
- Providing details of the work to be done this week by maybe 2000+ people.

The *Guide to Good Practice in the Effective Management of Time in Complex Construction Projects*<sup>1</sup> (**The Guide**) invokes two concepts to achieve this task. The use of Schedule Levels and the use of Schedule Density (Schedule Levels are discussed in our Scheduling White Paper<sup>2</sup> of the same name).

### Schedule Density

The concept of *schedule density* contained in **The Guide** is not dissimilar to *rolling wave* planning<sup>3</sup> but has far more practical advice. The concept is based on the idea that it is practically impossible to fully detail a schedule for a complex project at 'day 1' – too many factors are unknown or still to be developed. **The Guide's** advice is to plan the overall project at *Low Density*, expand the work for the next year to *Medium Density* and then expand the next 3 months at *High Density*.



### Schedule Density Over Time

The concept of *schedule density* includes:

- Initially the overall project is planned at *Low Density*; this schedule defines the long-term strategic commitments of the project. *Low Density* activities may be several months in duration. Work more than 12 months in the future is retained at *Low Density*. The contract baseline is created at this level of detail.

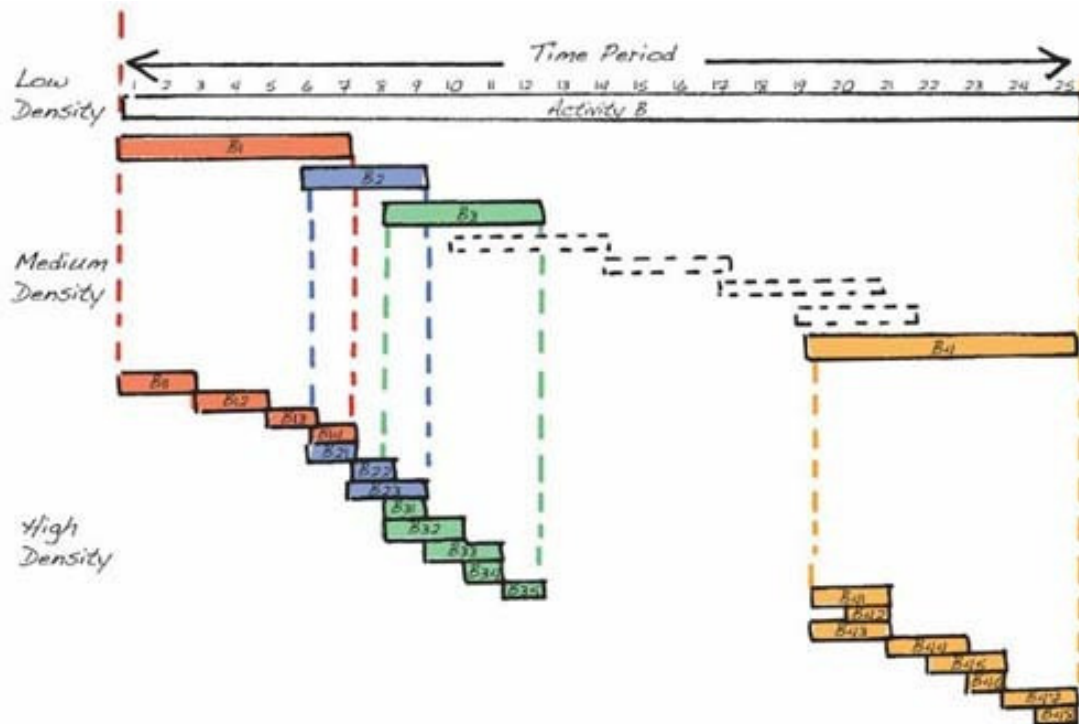
<sup>1</sup> See: [http://www.mosaicprojects.com.au/Books.html#CIOB\\_Guide](http://www.mosaicprojects.com.au/Books.html#CIOB_Guide)

<sup>2</sup> For more on Schedule Levels see: [http://www.mosaicprojects.com.au/PDF/Schedule\\_Levels.pdf](http://www.mosaicprojects.com.au/PDF/Schedule_Levels.pdf)

<sup>3</sup> For more on rolling wave see: [http://www.mosaicprojects.com.au/WhitePapers/WP1060\\_Rolling\\_Wave.pdf](http://www.mosaicprojects.com.au/WhitePapers/WP1060_Rolling_Wave.pdf)

- Work planned to occur within the next year or so is scheduled at *Medium Density*. This level of expansion defines the tactical approach to achieving the overall strategy set out in the *Low Density* schedule. *Medium Density* activities are no longer than 2 months and focused on one type of work in one specific location.
- Work planned to occur in the next 3 months is scheduled at *High Density* and defines in detail who will be doing what, where and when. *High Density* activities are fully resourced, with a planned duration<sup>4</sup> no longer than the schedule update period and with specific workers (resources) allocated and the activity durations and sequences based on actual quantities, team sizes, production levels and agreed workflows.

As the *density* of the schedule is increased, at each stage, the plan takes into account the current status of the work, current production rates and what is required to achieve the overall objective of the project defined by the *Low Density* schedule. This approach has a range of advantages over more traditional ways of scheduling not the least of which is engaging the people who will be responsible for doing the work in the next 2 to 3 months in the detailed planning of ‘their work’ and allowing a practical consideration of schedule compression options<sup>5</sup> as work proceeds.



Activities are expanded to increase density

The schedule levels defined in *The Guide* are generally aligned with long established practices pioneered by Bechtel, Fluor and other major contractors. However, *The Guide* expands the concept of schedule levels to potentially aligned to a WBS<sup>6</sup>

<sup>4</sup> For more on estimating durations see: [http://www.mosaicprojects.com.au/WhitePapers/WP1052\\_Time\\_Estimating.pdf](http://www.mosaicprojects.com.au/WhitePapers/WP1052_Time_Estimating.pdf)

<sup>5</sup> For more on Schedule Compression see: [http://www.mosaicprojects.com.au/WhitePapers/WP1059\\_Schedule\\_Compression.pdf](http://www.mosaicprojects.com.au/WhitePapers/WP1059_Schedule_Compression.pdf)

<sup>6</sup> For more on WBS see: [http://www.mosaicprojects.com.au/WhitePapers/WP1011\\_WBS.pdf](http://www.mosaicprojects.com.au/WhitePapers/WP1011_WBS.pdf)

## The Practical Application of Schedule Density

Schedule density can be used in most scheduling tools, including Microsoft Project.

The starting point is to develop the contract baseline schedule as a Low density schedule – this starts from day 1 and goes through to the end of the project. The original or latest approved version of this is stored as the ‘contract baseline’.

Activities in the ‘current’ low density schedule are changed to summary tasks when they are about 1 year into the future (initially for the full first year). The underlying detail that is added to the schedule are the Medium density activities – this level of the schedule is adjusted as needed to fix major issues and automatically rolls up into the summary / low density schedule and shows if work is planned to achieve, or is planned to get back onto the baseline. Adding to the Medium Density schedule should be done in a major planning session every two or three months to ensure there is always around 12 months worth of medium density schedule projecting into the future and that by the end of the 12 months ‘look ahead’ the project is back onto the agreed baseline. Remember summary activities do not have a set duration (this is rolled up from the detail level) and should not be logically linked – the logic is transferred into the Medium density layer (except at the very end where it transitions back into the Low density layer).

Activities in the medium density schedule are in turn converted into summary activities at around 3 months into the future and the next layer of detail added is the High density activities. As previously discussed, logic is removed from the summary portion of the Medium density schedule and transitioned to the High density level. High density activities should accurately represent the work that is actually capable of being achieved by the project team as it currently exists. If the project team can only achieve 50% of the required work in a week, only the 50% that can be achieved is scheduled so that the current work-plan for the existing project workforce is accurate and usable (the schedule problems this inevitably creates are fixed by editing the Medium density schedule). Whatever is actually planned in the High density level rolls up into the Medium density summary and then up into the Low density summary so all three schedules are automatically aligned. More Medium density activities are converted to summary activities with underlying High density activities every 2 to 4 weeks to keep this part of the schedule accurate for the next 2 to 3 months.

As all of the actual work is occurring in the part of the schedule expanded to High density, the regular project status / updates are always done at the High density level and the consequences are rolled up into the Medium and Low density schedules. The comparison with the baseline still only occurs at the Low density level because this is where the baseline is stored.

This process allows the High and Medium density levels of the schedule to be adapted and optimized as needed to achieve the best possible time management outcomes and is supported by the CIOB CPC2013 contract<sup>7</sup>.

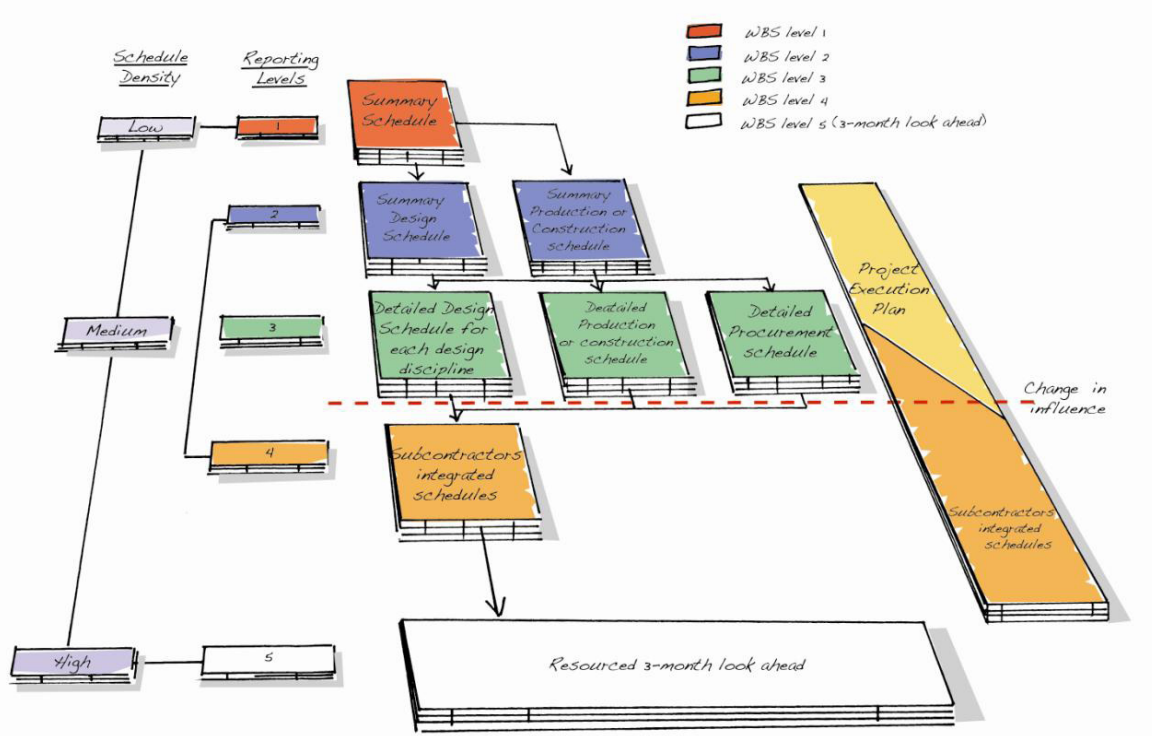
## Designing a Schedule Structure

Melding schedule levels and schedule density into a plan for the management of schedules on a major project is not so straightforward, particularly once the role of individual contractors is taken into account. The diagram below, Figure 11 in *The Guide*, shows one possible solution. Using dynamic linking between the different schedules in the coloured boxes allows the intent of both levels and density to be accommodated.

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<sup>7</sup> For more on the CPC 2013 form of contract see:  
<http://mosaicprojects.wordpress.com/2013/07/05/the-new-the-complex-projects-contract/>





CIOB Schedule Levels / WBS

**Schedule Density Summary**

The core philosophy contained in *The Guide* is to change the project schedule from a static tool used as evidence in disputes after the event to a proactive management tool focused on achieving the best possible time for completion of the project. Which was after all, the reason CIOB started on this task and why many volunteers from around the world have been happy to contribute time and resources.

Even if you are not in the construction industry, *The Guide* will be a valuable resource for anyone involved in scheduling major projects.

This White Paper is part of Mosaic's **Project Knowledge Index** to view and download a wide range of published papers and articles see: [http://www.mosaicprojects.com.au/PM-Knowledge\\_Index.html](http://www.mosaicprojects.com.au/PM-Knowledge_Index.html)



For more on *The Guide*, see: [http://www.mosaicprojects.com.au/Book\\_Sales.html#CIOB](http://www.mosaicprojects.com.au/Book_Sales.html#CIOB)



## Mosaic's Scheduling Core Papers

#1	A Guide to Scheduling Good Practice	<a href="http://www.mosaicprojects.com.au/PDF/Good_Scheduling_Practice.pdf">http://www.mosaicprojects.com.au/PDF/Good_Scheduling_Practice.pdf</a>
#2	Attributes of a Scheduler	<a href="http://www.mosaicprojects.com.au/PDF/Attributes_of_a_Scheduler.pdf">http://www.mosaicprojects.com.au/PDF/Attributes_of_a_Scheduler.pdf</a>
#3	Dynamic Scheduling	<a href="http://www.mosaicprojects.com.au/PDF/dynamic_scheduling.pdf">http://www.mosaicprojects.com.au/PDF/dynamic_scheduling.pdf</a>
#4	Links, Lags & Ladders	<a href="http://www.mosaicprojects.com.au/PDF/Links_Lags_Ladders.pdf">http://www.mosaicprojects.com.au/PDF/Links_Lags_Ladders.pdf</a>
#5	Schedule Float	<a href="http://www.mosaicprojects.com.au/PDF/Schedule_Float.pdf">http://www.mosaicprojects.com.au/PDF/Schedule_Float.pdf</a>
#6	Schedule Levels	<a href="http://www.mosaicprojects.com.au/PDF/Schedule_Levels.pdf">http://www.mosaicprojects.com.au/PDF/Schedule_Levels.pdf</a>

Mosaic's Scheduling Home Page is at : <http://www.mosaicprojects.com.au/Planning.html>

