# Schedule Compression

The need to reduce the time allowed for a schedule, or a part of a schedule is routine, some of the times the need arises include:

- When the initial schedule is too long to meet contractual or other objectives;
- During a schedule density increase[1] (to bring the planned work back onto target);
- To recover time lost as a result of a delay or schedule slippage; or
- To meet a revised target date.

This White Paper will focus on the techniques and risks associated with schedule compression, for a discussion on the rights, obligations and costs of acceleration see: ***Assessing Delay and Disruption - Tribunals Beware***[2].

To reduce the duration of a sequence of activities it in necessary to either reorganise the work ***'What-If'***, overlap actives that would normally be schedule sequentially ***'Fast Track'*** or reduce the elapsed time taken to complete the work of an activity (or activities) ***'Crash'*** the work by working longer hours or deploying additional resources or both.

Whilst 'What-If', Crashing and Fast Tracking tend to be dealt with separately in most texts; my experience suggests you need to combine all three options to sort out a significant problem and achieve a realistic reduction in the overall time for the work.

## What-If

What-if scenarios change the model! The project team modify the schedule to understand the best option for undertaking the work, testing different sequences and different work or procurement options. Different options are developed and compared. Be honest about the situation with the project team (and where possible management and the client) and let them help you brainstorm some solutions.

The option offering best outcome should be selected. However, *'best'* is not defined simply in terms of the shortest duration; cost, risk exposure[3], quality and other factors also need to be carefully weighed. The final decision on the *'best'* option is an overall project management decision, not a scheduling decision.

## Fast Tracking

Whilst similar to 'What-if', the basic sequence of work remains the same in a fast tracking exercise. Fast tracking involves paralleling sections of the work (ie, overlapping activities) to finish the project in the shortest possible time. This can involve whole sections of the work such as starting development before design is complete or starting the finishing work before the roof is watertight. Or can be employed at the individual activity level by applying or adjusting leads and lags to overlap activities[4].

Care is required, it is easy to overlap work in a schedule, achieving the overlap in reality may not be as straightforward. Improper use of fast tracking, leads and lags, can distort the project schedule; they should

[1] For more on schedule density see WP1016: http://www.mosaicprojects.com.au/WhitePapers/WP1016_Schedule_Density.pdf

[2] Assessing Delay and Disruption - Tribunals Beware: http://www.mosaicprojects.com.au/Resources_Papers_035.html

[3] For more on risk assessment see WP1015: http://www.mosaicprojects.com.au/WhitePapers/WP1015_Risk_Assessment.pdf

[4] For more on Leads and Lags see: http://www.mosaicprojects.com.au/PDF/Links_Lags_Ladders.pdf

only be used where there is a real probability of the overlap producing the expected benefit. Some of the things to be considered before 'fast tracking' include:

- You can only overlap work that is done by different teams – overlapping you doing one job with you doing the next achieves nothing, there is only you working at 110% already and multi-tasking reduces efficiency.
- Preferably the teams are located in different work place as well – overlapping two teams of 10 people means there are now 20 people working concurrently.
- The increased complexity associated with progressively transferring work from one team to another (rather than at completion) – This needs very good management controls and inevitably increases the risk of something going wrong.
- In summary:
    - Fast tracking increases the number of people working on the project – this makes managing the work more difficult.
    - Fast tracking increases the complexity of design freezes, handovers and maintaining quality on the project – this makes managing the work more difficult.
    - It is very easy to draw overlapping lines on a Bar Chart – translating the accelerated work into real performance on the project makes managing the work more difficult.
    - If you are already having difficulty managing the project, making managing the project more difficult is a recipe for disaster…….

Fast tracking almost always results in increased risk and may result in rework that will counteract some of the initial gains and reduce the potential savings. However, the alternative of 'Crashing' the project is as equally prone to failure. Throwing more people at the work always costs money and frequently makes the situation worse.

## Crashing

Crashing is a resource based methodology; since its inception in the 1940s 'crashing' has involved throwing additional resources at a project to reduce the overall duration of the work. You either work the existing resources harder/longer or get more resources. This is a compound problem and needs careful analysis[5]:

- Excessive overtime = tired resources = lower productivity; but
- Brooke's Law has survived from 1975, *throwing more people at a bad project makes it worse*[6]; and
- If you accelerate one bit of the work by crashing, other bits/resource teams need to be capable of taking advantage of the acceleration (which may well translate to the need to accelerate non-critical areas to allow resources to be available when needed on the crashed work, therefore you need to consider the critical resource flows [not well dealt with in CPM] in conjunction with the inherent logic of the work).

Kelley and Walkers mission in the 1950s, that led to the development of CPM[7], was to identify a way of focusing the 'crashing' so that only activities that had an effect on the overall duration of the work were 'crashed' (it is obviously a waste of money shortening an activity that does not affect the overall completion). However, Kelley & Walker clearly understood the complex cost and time relationship involved in attempting to accelerate work by adding resources, the figure below is from their 1959 paper:

[5] Acumen Fuse now has the ability to test scenario based acceleration of selected activities based on any criteria in the schedule database (including the ability to re-assess risk). See: http://www.projectacumen.com/fuse/overview/

[6] See: ***The danger of effort driven durations*** in WP1052: http://www.mosaicprojects.com.au/WhitePapers/WP1052_Time_Estimating.pdf

[7] For more on the development of CPM see ***A Brief History of Scheduling***: http://www.mosaicprojects.com.au/Resources_Papers_042.html

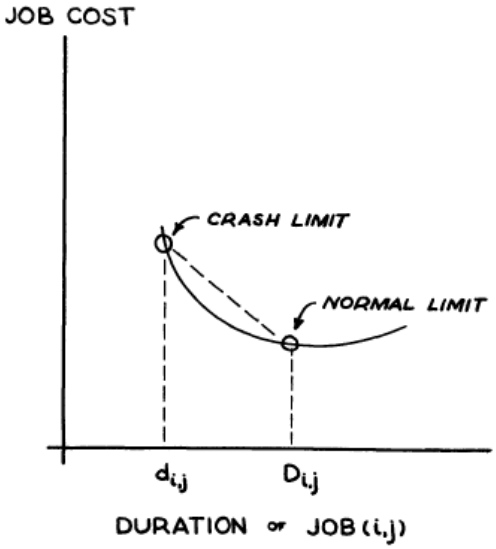


Fig. 2—Typical job cost curve.

The effort should be focused on work that is amenable to duration compression by adding resources, this increases the activity costs (once the optimum crew size is reached) but focused on the correct activities can pay dividends in time and overall project costs. However, as Brooke pointed out in his 1975 book, ***The Mythical Man Month***, some work will actually take longer if more people are involved! Balancing these conflicting effects is a sophisticated optimisation process[8].

In summary, crashing will almost always increase costs, may increase risk, but if used wisely it can buy a reduction in time that may offset the increased resource cost.

## Low productivity or low production?

It is important to understand the difference and the associated cause of any slippage or schedule overrun that may require 'crashing' or 'fast tracking' to accelerate:

- **Low productivity** is a function of the people (or equipment) – improved motivation, skills development, leadership and workplace organisation can lift productivity[9]. This is a management problem that needs fixing first. You need optimum productivity from the existing workforce before embarking on 'acceleration' options. Some areas to consider are effective work prioritisation (embedded in the schedule) and avoiding options such as multi-tasking which are known to reduce productivity. Get the team to help design the most efficient work processes, it lifts motivation and increases efficiency (this may also tie back to 'What-If' considerations discussed above).
- High productivity but **low production** levels means inadequate resources and there are only two options – allow more time for the work or get more resources if they can be accommodated efficiently.

Communicate the results to your team, your management and your client, if they now you are working close to 100% they may be willing to allow more time to complete the work rather than risk crashing or fast tracking.

[8] For more on resource optimisation see - ***Resource optimisation - a new paradigm for project scheduling***: http://www.mosaicprojects.com.au/Resources_Papers_152.html

[9] For more on leadership and motivation see:
- http://www.mosaicprojects.com.au/WhitePapers/WP1014_Leadership.pdf
- http://www.mosaicprojects.com.au/WhitePapers/WP1048_Motivation.pdf

## Risk considerations

Accelerating a project by reducing the duration of the critical path will inevitably reduce the amount of float remaining on the non-critical paths, and will increase the number of people working on the project; and will consequently increase the management challenges of dealing with the accelerated work. All three of these options increase the risk of not achieving the accelerated program:

- The reduction in float increases the likelihood of non-critical paths interfering with project completion, an effect similar to PERT Merge Bias[10].
- Increasing the number of people deployed increases the probability of team inefficiencies.
- Increasing the intensity of work increases the probability of management inefficiencies.

These factors need to be incorporated in the project risk register and appropriate mitigation action or contingencies created.

## Earned Value considerations[11]

Accelerating a project effectively should result in a significant improvement in the performance efficiency (SV and SPI) offset by a minimal (or no) change in the cost efficiency (CV and CPI).

The reason accelerating a project efficiently should result in minimal or no change in the cost efficiency (CV and CPI) is that whilst the cost expended per time unit (eg, day) will increase, so should the work accomplished in the time. For example, if by doubling the work force, the project produces twice as much 'value' the CV and CPI will remain steady. Usually the CV and CPI show a small negative movement due to the new resources being less efficient than the existing resources and/or more complex management issues making the workers less effective. If the CPI shows a negative change, the acceleration has not been efficient, but may still be necessary for other reasons; eg, a contract deadline.

However, there should be a significant improvement in the performance efficiency of the project (SV and SPI). By increasing the amount of work actually accomplished each day, there will be a positive shift in ratio between the amount of work originally planned to be accomplished and the amount of work actually in the time period, compared to the situation before the acceleration. If the SV an SPI do not show an improvement, the acceleration has failed.

For more on EV calculations see our White Paper:
http://www.mosaicprojects.com.au/WhitePapers/WP1081_Earned_Value.pdf

## Conclusion

Effective schedule reduction needs very proficient schedule management and intelligent decision making based on the best scenario generated by testing various options. It helps to look closely at the management and stakeholder issues that likely triggered the problem in the first place. The alternative is to simply throw money at the problem and hope (but 'hope is not a strategy').

Then beyond the analytical dimension, when compressing a schedule, there are always management issues focused around coordination, communication and motivating[12] the whole project team that have to be

[10] For more on ***PERT Merge Bias*** see: http://www.mosaicprojects.com.au/WhitePapers/WP1087_PERT.pdf

[11] For more on ***EVM*** see: http://www.mosaicprojects.com.au/WhitePapers/WP1081_Earned_Value.pdf

[12] For more on ***motivation*** see WP1048: http://www.mosaicprojects.com.au/WhitePapers/WP1048_Motivation.pdf

overcome. The challenges around setting targets to motivate performance -v- predicting likely completion dates are discussed in the paper ***Why Critical Path Scheduling (CPM) is Wildly Optimistic!*** *And why this is a good thing…..*[13]

Unfortunately, schedule compression is a fact of life in most projects; the challenge facing schedulers is to keep the 'compressed schedule' realistic and achievable. Schedules are useful when they are used to manage the project; as soon as the schedule loses credibility (ie, the team believe it is unrealistic) it becomes a compete waste of time and resources.

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For more information on scheduling and planning,
visit Mosaic's scheduling home page at:
http://www.mosaicprojects.com.au/Planning.html

[13] Download the paper from: http://www.mosaicprojects.com.au/Resources_Papers_117.html