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Why do Many 'EPC Projects' Face Schedule Overrun?

O. Arivazhagan
CEO, International Institute of Project Management

It is not an exception to hear that many EPC (Engineering, Procurement, Construction) Projects in India often face schedule overruns. Almost all Projects, be it Government or Private, face some kind of schedule slippages due to various reasons that are attributable to various stakeholders. There are several causes for schedule slippages of EPC projects, that are "Controllable" by some of the key stakeholders which, when controlled may reduce or mitigate the schedule overruns.

One of the major reasons, according to the author is the scheduling method used by the EPC Contractor or the Consultant to arrive at the project completion time. There are several scheduling methods like, CPM, PERT, GERT, Monte Carlo Simulation, etc. Of these methods the one that is more widely used by many EPC Contractors / Owners / Consultants is the Critical Path Method (CPM). Although CPM has been in use for several decades, to find out the Critical Path within the Project Network & the total project duration based on the Critical Path, it is surprising to note that not many planners, schedulers & Project Managers are aware of the fact that CPM is not a good / efficient scheduling method.

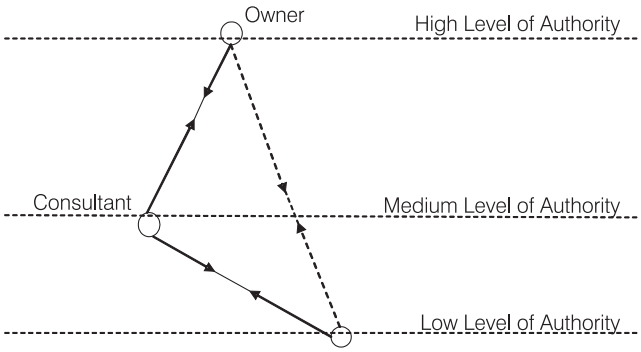
CPM gives a project completion time that has only 50% probability of success. In other words, an EPC project that is managed by monitoring and controlling a Critical path found by CPM has 50% chances of facing schedule overruns. This is one of the main reasons why many EPC projects are being reported as schedule overruns. The truth is that many PMs, Contractors, Schedulers, Sponsors, Clients are not aware of this fact and get into litigation or LD claims, when in fact it should not be the case if the project completion time is rightly scheduled.

Still many planners, schedulers, PMs, consultants use this CPM method without tweaking the estimated project completion duration found by it and eventually end up in a false schedule overrun.

Key Project Stakeholders

The key stakeholders that are directly or indirectly responsible for the schedule overruns are the Owners, the Contractors, the Consultants. Unfortunately the Schedulers & Project Managers are using mainly CPM to find out the minimum total project duration needed to complete a project.

The Owner – Consultant – Contractor Interactions



In general, all the three key stakeholders are responsible for the schedule overruns of Projects. However, in many cases, the contractor is made the party that is mainly responsible for any schedule overruns. It is because of the communication / interaction equations amongst these three & differing levels of authority in approving or rejecting Baseline information with respect to initial schedule & project completion time for the project. As shown in the above sketch, the contractor is at the receiving end of communications related to project information and approval for majority of the EPC contracts. The project completion time is normally stated in the bidding documents. This project completion time is generally arrived by the consultant in coordination with the owner & using mostly CPM technique during pre-bid stage.

The consultant scheduler uses a scheduling tool such as MS Project / Primavera, which in turn uses CPM as a technique to find out the minimum time required to complete the project (Total estimated project duration) which is what stated in the bidding documents as the contractual completion time. The main point that is missed by the owners & consultants at this

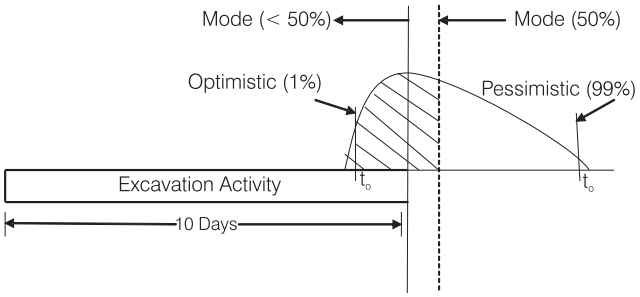
early stage i.e., pre-bid stage is that the project completion time arrived during bidding stage & that is stated in the bidding documents as the contractual completion time, has only 50% chances of being successful i.e., the project, if awarded to any contractor, has only 50% probability of being executed by the time found by the CPM technique.

Why CPM technique is inefficient?

As the name indicates, CPM technique relies on the total duration of activities that lie on the critical path within the project network to estimate the minimum time required to complete the project. However, this total project duration estimate found by CPM technique is based on 2 major assumptions by the estimators or schedulers & unfortunately both of the assumptions are not valid for majority of the project situations.

Assumption 1 – Resources available are unlimited for the EPC project.

Assumption 2 – Estimated activity durations are single point, deterministic durations which are mostly the modal estimates. The modal estimate is the one that is most frequently occurring estimate when the activity is done by the same team several times under given site conditions.



Activity Duration with Right Skewed Distribution

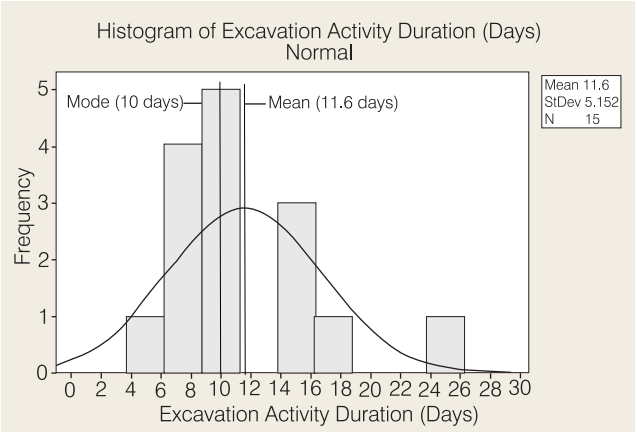
However, this modal estimate is mostly found to be skewed to the right, thereby implying a probability of less than the mean duration which will have 50% probability. If a scheduler adds all the activity durations of a critical path using the above modal estimate, the total project duration is likely to have less than 50% probability of being successful. For eg., if the total duration of an EPC project is calculated using CPM technique as 16 months, there is a 50% chance that the project will not be completed within 16 months and the project completion time is likely to go beyond 16 months even if all the activities of the critical path are completed on time.

We tend to estimate durations that are closer to optimistic than pessimistic. This is why the modal estimates in a right skewed distribution gets less than 50% probability.

If you take an estimated duration from 15 persons for an activity in an EPC project say excavation, the following could be the duration estimates in days.

5, 7, 8, 10, 10, 18, 15, 25, 10, 15, 15, 10, 8, 8, 10

If you construct a histogram of estimated duration required to complete the the activity (Excavation) using the above data, it would look like the following.



One can notice that the modal estimate of 10 days is the one normally taken as the single point deterministic estimates by the PMs / Schedulers to determine the Critical Path, you may notice also that the modal estimate has less than 50% chance of being achieved if all the Critical Path activity durations are added (which are nothing but model estimates) then the resulting total Project duration will also have 50% probability only.

The Uncertainty in Project Schedule

It may be observed from the above points that the total project duration, arrived by the Owner / Consultants using CPM & that is stated in the bidding documents as contractual completion time, has only at the best 50% probability of being achieved.

Knowingly or unknowingly EPC contractors do not object / challenge this estimated completion time during bidding stage & silently agree to complete the project within this duration by signing the contract. It clearly indicates that it is detrimental / suicidal for the contractors to sign such contracts without validating the practicability of such completion time stated in the contracts. Hence, all projects that were scheduled using CPM technique are bound to exceed the contractual completion time if enough contingency amount is not added to the total project duration at the outset itself. It may also be stated that the schedule slippages of several projects could be false overruns, as the contractual completion time stated has only 50% probability.

Possible Solution

To overcome this situation and to possibly avoid or minimize the Liquidated Damages (LD) due to schedule slippages, the author suggests to the contractors to go in for simple probabilistic methods of duration estimates like PERT (3-point estimates) and / or advanced Simulation techniques like Monte Carlo to arrive at a total project duration that has at least 98% probability of success (3 sigma), assuming other constraints are managed well. □