Appendix: Monte Carlo Schedule Analysis

A large and complicated project such as the TTC-35 Corridor is, by its very nature, prone to variation in the planned versus actual schedule. That is, some project elements will be completed in less time than are forecast, (this is normally called a "benefit") while other portions of the project will be completed is more time than are forecast, (this is normally called "risk').

Generally, completing a task (within the context of the larger project) in less time than was scheduled will not adversely impact the overall project costs or time to completion. However, the opposite is true for task delays. Generally, completing a task (within the context of the larger project) in more time than was scheduled will adversely impact the overall project costs and time to completion. Thus, in schedule-risk analysis of the TTC-35 Corridor project evaluation and quantification of potential sources of task delays is important to overall project success. This is particularly important for those items that are "critical path" items. That is, those parts of the project that must be completed before the next step or stage can begin. For critical path items a single delay (outside of planned for parameters) can unacceptably lengthen the time to completion and escalate project costs to unacceptable levels. Thus, it is important to plan a reasonable amount of "delay" into the project schedule (and acceptable contingencies to correct the project schedule) to allow for inevitable project delays over the multi-year period of TTC-35 Corridor construction.

A common approach to this kind of analysis and planning is to use Monte Carlo simulation techniques. In a Monte Carlo simulation the potential sources and severity of potential project delays are identified and the probability that the sources of delay will occur, and where applicable - the ranges of severity of the sources of delay, are then estimated.

Each potential source of delay, (and if available, each counter-measure), are then linked to provide a "chain" of possible project delays. Finally, using random numbers, the probabilities of occurrence are perturbed through multiple (normally many thousands) of iterations until the probability of results "stabilizes" to a distribution that does not change if another iteration is performed.

If this analysis produces results that have a probability of occurrence that is outside the range of acceptability, (e.g., the project takes too long), then counter-measures can be added, (such as extra workers, 2nd shifts, faster delivery of materials, etc.) to better control the project completion timeline. This process is continued until the probability of results is within acceptable bounds and the simulation process can be finalized.

From time-to-time during the TTC-35 Corridor project, the remaining schedule will be re-simulated to correct and refine the schedule for the progress made to date and changes to information, (e.g., a particular supplier needs more lead time than another, a specific contractor is normally ahead of schedule, etc.) Thus, it is important to re-visit the schedule analyses on a frequent basis because at each simulation update, it may be discovered that some previously identified "problems" and "counter-measure" have different characteristics than previously anticipated. Also, it may be discovered that some corrective actions are better (or worse) than expected for different parts of the TTC-35 project.

In summary, use of Monte Carlo simulation analysis provides project managers with information necessary to avoid costly project delays and assure timely completion of the TTC-35 Corridor.