Choosing the linear method

Lorne Duncan, Petroglyph Project Analytics, Canada, explores linear planning methodology and presents a tool that has great value in the planning and execution of pipeline projects.

Planning a pipeline project is never an easy process. Right of way (ROW) selection, land acquisition, environmental constraints, crossings, access to the ROW and seasonal considerations all come into play when trying to optimise the construction execution plan and strategy. The traditional approach has been to incorporate all this into a critical path methodology (CPM) planning tool, such as Primavera™ or MS Project™, in order to develop a Gantt chart representation of the execution sequence of the project and then progress against this plan. Unfortunately, these typical planning tools do not give a project team any indication of where or what the major challenges are and when the work was completed in a specific area. Often, it is left to the Construction Manager to keep track of completed sections by marking alignment sheets.

Traditional Gantt based tools cannot describe issues that can occur and potentially lead to claims. The majority of stakeholders have very little comprehension of the nuances of a lengthy and expansive Gantt chart representation. As a result, TILOS can be used as an effective, collaborative planning tool to visually represent all the ROW and stakeholder concerns that are typical of a pipeline project.

Linear planning made easy

The inherent advantage enabled by linear planning is the ability to incorporate as much or as little detail as required. TILOS is a layer based system that allows a user to finely control what is shown by only displaying specific layers, certain activities (such as welding) via the building of a filter, or by changing the time and distance dimensions to show multiple years, a single spread or all the spreads of a pipeline project.

Figure 1 is a simple representation of a pipeline project that shows some of the fundamental features available to the user. All stakeholders, regardless of planning experience, can visually see how key construction challenges impact the construction execution plan.

First of all, a major river crossing/horizontal directional drill (HDD) is located about the middle of the view (1). Access to the ROW, combined with the major crossing, has resulted in the work starting at either end of the spread and working towards the river, as indicated by the arrows. The two environmental restrictions are indicated by the orange rectangular shapes (2) and it is evident that none of the planned work encroaches on these restricted areas. All mainline crews are represented by a series of lines (3) on either side of the river crossing. The planning methodology lends itself to a leaner schedule because, while each crew can be represented by several segments (due to skips, reverse lays, ROW access), this is considered to be a single activity. A CPM approach would see each segment as a different activity, which inflates the number of activities in the plan.

Other features of the execution plan that are displayed in the view include the hydro test plan, represented by a series of blue rectangles (4), and the ROW elevation that was imported from LIDAR data (Excel file) provided by the survey company (5). Foreign crossings, road bores, and other crossings (typically those that do not involve an HDD) are usually added to the distance scale (6) as a point of reference; but not included directly in the time distance chart.

If the activities are resource and cost loaded, then it is very easy to develop a spend profile (7), a manpower curve (to calculate camp requirements) or other time related curves and histograms.

In parallel to the creation of the time distance view, the software is also creating a Gantt chart representation of the execution plan (Figure 2). Stakeholders can easily switch between any number of views, depending on their requirements.
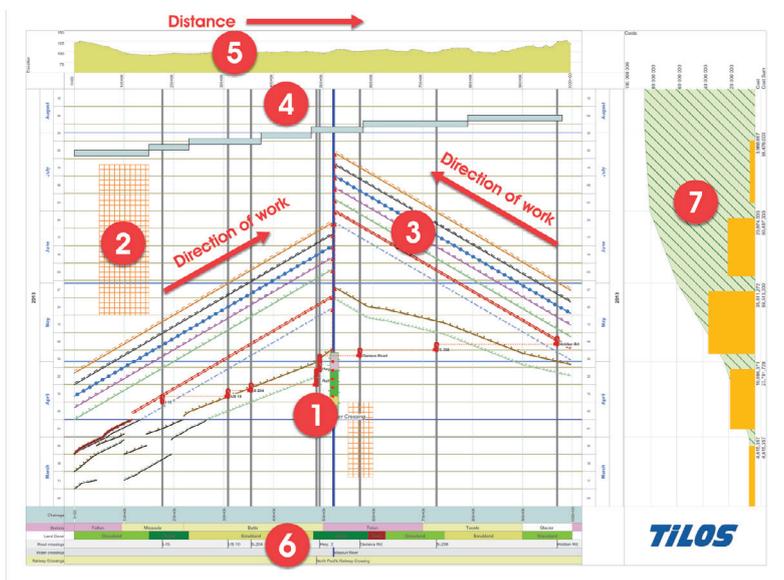
Figure 1. Sample pipeline plan.

Figure 2. TILOS Gantt chart representation of sample pipeline project.
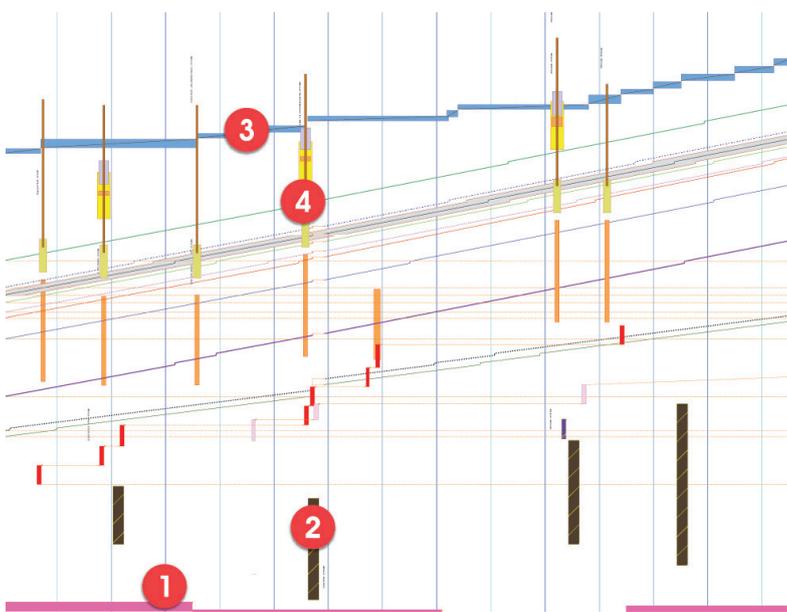
Figure 3. Example TILOS pipeline project showing key elements.

The following example represents one spread of a multi-spread project. As with the previous example, the planner has added the stockpile supply zone (1), the stockpile site (2), the hydro test segments (3) and a number of mainline block valves (4) in addition to all of the mainline activities.

Essentially, you can add as much or little detail as required for your purpose.

Interfacing with other CPM planning tools

Being able to exchange activity data and progress information with traditional CPM tools, such as Primavera or MS Project, is an important consideration when creating time distance plans. Often there are contractual requirements that require any external schedules to be imported into the corporate planning system, or the organisation uses some CPM system as their Enterprise solution. TILOS can easily exchange data with any of the leading CPM planning tools.

Many contractors now prefer to do their planning and progressing in TILOS and then send this information back to Primavera (for example). Similarly, many owners create TILOS project files and then import the contractor's plan into the system in order that 'what-if' scenarios can be analysed in order to make sure the project scope and construction issues are fully understood.

The best approach is to create a baseline plan in TILOS (either from scratch, or by importing from another system), apply any reported progress in TILOS and then export the progress, if necessary, to the CPM product of choice such as Primavera or MS Project. The advantage of this approach is that TILOS tracks where and when a specific crew worked on the ROW. This is an important consideration in the event of a claim as TILOS retains a definitive record of the execution of the job.

After updating the progress of all mainline crews in TILOS and exporting the progress to Primavera, both systems are reporting that Clear & Grub is 43.75% complete (Figure 4 and Figure 5). It is important to keep in mind that TILOS keeps track of the progress for each reporting period (typically daily) and calculates the work rate for that period. This information is then used to forecast the end date of the project, based on the average daily performance.

In the time distance chart it is evident that the early clear and grub activities (3 – checked boxes indicated completed segments) were not contiguous, perhaps due to ROW conditions,
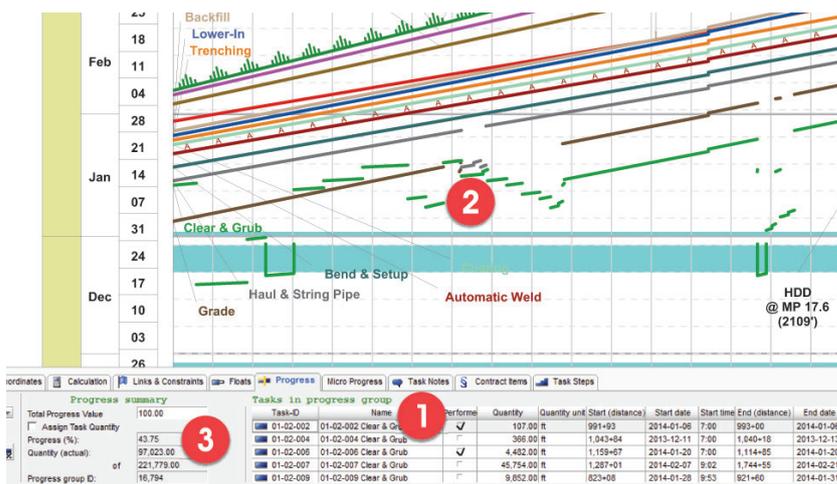
Figure 4. TILOS pipeline project showing clear and grub progress.

Figure 5. Export of TILOS progress to Primavera.
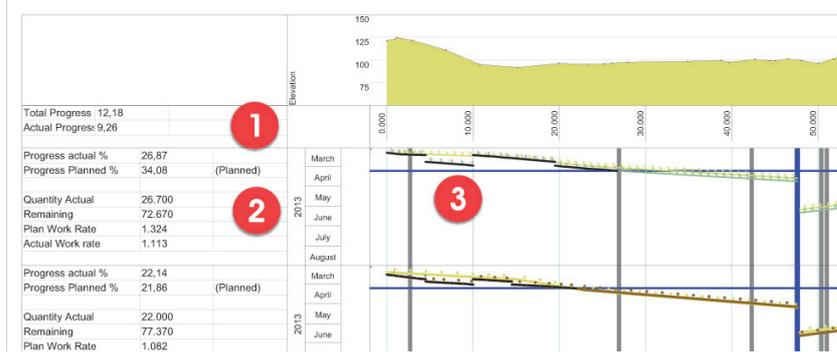
Figure 6. Progress view in TILOS showing overall and crew based progress.
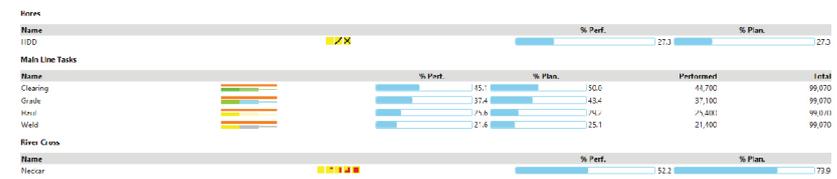
Figure 7. TILOS Progress Map showing progress in time lapse.

Figure 8. Overlay of TILOS plan and progress in GIS system.

environmental restrictions or other execution priorities. Traditional CPM planning tools are not designed to understand distance therefore all we know from Primavera is that clear and grub is 43.75% complete, with no indication of where that progress occurred or how many crews were involved!

The TILOS Progress Map feature allows the user to connect a TILOS plan to a GIS system using the standard KMZ format. Progress reporting can be done in either TILOS or TILOS Progress Map. To report progress in TILOS, the user simply creates a view with appropriate layers and filters applied to create output as below (Figure 6). Based on the weighting of each crew, the total planned progress for all crews is 11.34% while the actual progress is 8.26% (1). In this view, we can also see the statistics for each crew on the left hand column (2) and a visual representation of where work has been completed in the right hand time-distance view (3). Progress can be represented in a tabular, Gantt chart or time distance view (Figure 6).

TILOS Progress Map enables a user to combine the ROW alignment (in GIS co-ordinates) with the TILOS plan. It also has a strong reporting feature that enables a user to step through the progress of the project in pre-defined time slices. We can see from Figure 7 that the HDD is on track (1), the mainline crews are somewhat behind the planned progress (2), and the HDD at the Missouri River is substantially behind the planned progress (3).

Once the ROW GIS co-ordinates have been linked to the plan, TILOS Progress Map can be used to export a standard KMZ file that can be imported into any GIS system. In Figure 8, the thick blue line (1) represents the alignment, the thin lines adjacent to the ROW alignment represent the mainline crews that have been selected for display and the thick lines (3) show the baseline progress (grey line) versus the actual (coloured thick line). Location and progress of each HDD is represented by the yellow squares (X = 100% complete). We can see that this representation matches our sample TILOS pipeline plan (Figure 1) in that we have work proceeding from either end of the spread towards the major river crossing.

Conclusion

TILOS is a visual and collaborative tool that has great value in planning and execution of pipeline projects, and any projects that are planned linearly. This is evidenced by the fact that owners, EPC and contractors are choosing to use this approach to effectively incorporate all the construction challenges into a planning tool. For those organisations using Primavera or MS Project, it is an easy process to exchange activity data and progress between the systems. Optimally, it is better to plan and track progress in TILOS and push the results to one of the other tools if necessary. 🄬