

A black and white photograph of a row of wind turbines in a field. The turbines are arranged in a line, receding into the distance. The sky is overcast and grey. The ground is dark and appears to be a field or tundra.

Software Options for Linear Project Planning

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Overview

Infrastructure projects such as rail, roads, pipeline, and power, bring unique challenges to the planning and execution phase when compared to facility or site-based planning. The most obvious difference with a linear project is that you don't control the right-of-way as you do in a facility project. ROW conditions, access (land ownership), environmental restrictions and the requirement to maintain traffic flow, create a challenge to any planner to adequately describe to project key stakeholders. Linear planning has been widely used for decades and is based on the Line of Balance (LOB) methodology developed by the US Navy in the 1950's. Time-Distance planning is also referred to as Time-Chainage plans, Time-Location diagrams and March Charts.

Linear planning takes into consideration all of these issues and can be described as a static picture using AutoCAD, Excel or some of the time-distance generating tools (such as LinearPlus TM). CPM (Critical Path Methodology) tools include Primavera, MS Project and PowerProject. These tools have been widely used by planners to create workable schedules for infrastructure projects but they are limited because they don't understand distance. Tools such as TILOS are being widely adapted for linear projects because of the ability to integrate engineering data, mass haul data, create Gantt charts and time-distance plans with a full CPM scheduling back end.

Key Advantages of Time-Distance Plans:

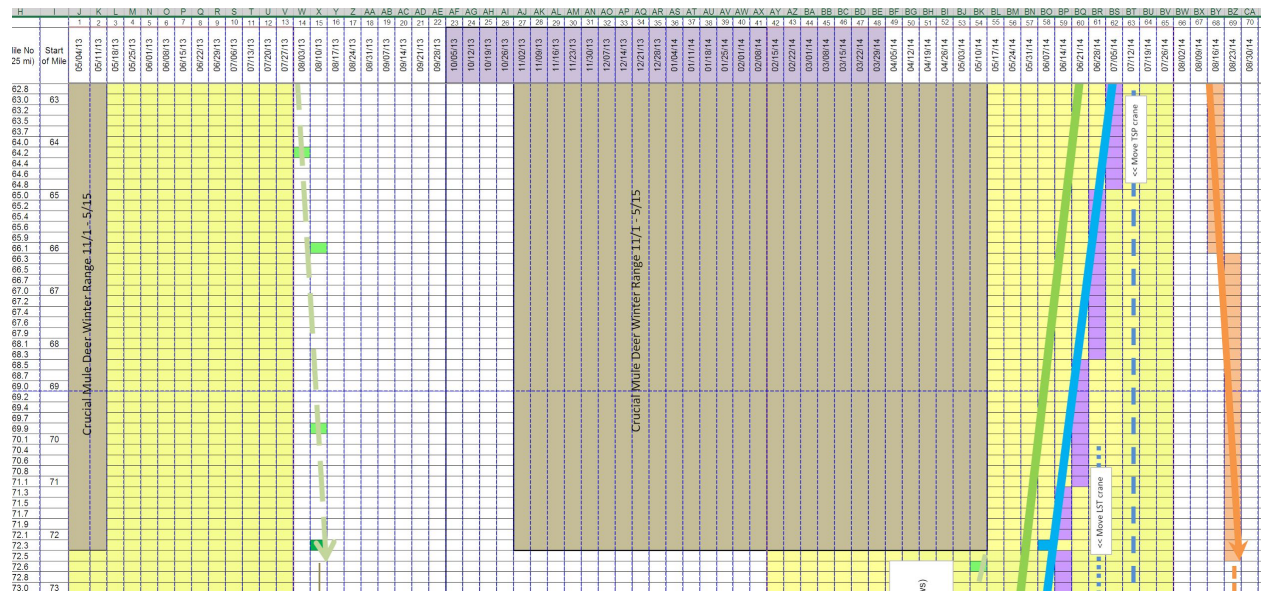
The advantages of seeing activities against both a time and distance axis are:

- You can determine **where** you will be at a specific date (to determine when hot bends are needed at a location, when are you crossing a road or do I need a second crew to reduce time in field).
- The sequencing of work, resources and the possible impact of environmental restrictions are all represented in the plan.
- You can see or calculate the rate of production – visually as a relative work rate compared to other tasks.
- You can identify conflicts where one activity will overlap another – these are referred to as clashes in time-distance planning.

This white paper will explore the different options available to planners with a description of the pros and cons of each option. The intent is that this will help make a well thought out, carefully considered, and strategic choice for planning your linear project.

Microsoft Excel™ / Other Spreadsheet Solutions

Spreadsheets are excellent tools that virtually everyone has installed on their workstations for data analysis. These cell based solutions can be used to present Gantt type schedules by colouring in a number of cells to represent the relative length of time an activity takes. It has also been used to create time-distance charts in the same manner. Stationary activities are represented by a series of coloured cells in a vertical column, while linear activities are represented by drawing lines for each activity.



Pros:

- No further investment in software required.
- Minimal skill required to create simple schedule representations.
- Ubiquitous – available to field personnel as well as planners.

Cons:

- Significant effort to create a detailed time-distance plan.
- Logic links and constraints cannot be incorporated due to lack of CPM engine.
- Float and critical path must be manually calculated.
- Requires substantial rework when the plan changes or to track progress during execution.
- Resource loading of activities and associated productivity rates is a cumbersome and manual exercise.
- Assessment of schedule adherence and variance is very challenging.
- Opportunities to accelerate schedule or mitigate schedule slippage requires extensive efforts.

AutoCad™ / CorelDraw™ and Other CAD Tools

These powerful drafting tools are universally used to create project drawings and alignment sheets for linear projects. Occasionally they are used to create time-distance plans. The use of CAD tools for time-distance planning is very similar to using Excel – a lot of effort required to create a plan and a lot of re-work when the plan changes.

Pros:

- Can create very detailed, scaled, static representations of a linear project.
- Already used to create alignment sheets by surveyors and project engineers negating additional software investment.

Cons:

- Very time consuming to create static time-distance plans.
- Not readily available to field personnel because of cost (hardware and software) and steep learning curve.
- Float and critical path must be manually calculated.
- Requires substantial rework when the plan changes or to track progress during execution.
- Resource loading of activities and associated productivity rates is a cumbersome and manual exercise.
- Assessment of schedule adherence and variance is very challenging.
- Opportunities to accelerate schedule or mitigate schedule slippage requires extensive efforts.

Primavera™/MS Project™ /AstaPowerProject™

These very widely used CPM tools have been used extensively for planning project worldwide.



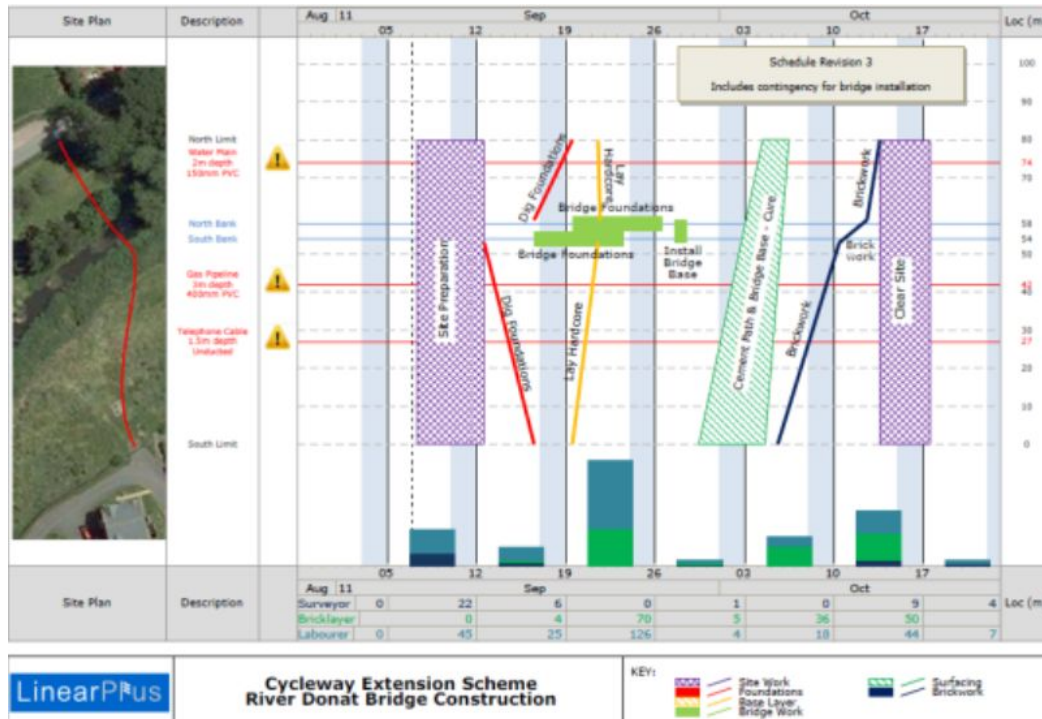
Pros:

- Widely available and used by planners worldwide
- Full CPM scheduling engine to create logic links, constraints (ALAP etc.)
- Multi-user enterprise solution
- Can easily group and sort by WBS or other codes

Cons:

- These systems do not understand distance therefore it is difficult to incorporate all constructability issues into the plan. This would include crossings by type, changing work rates/quantities over distance, environmental restriction
- Most key stakeholders do not understand complex Gantt charts
- Challenge to incorporate skips or move arounds into a Gantt chart CPM planning tool without increasing the total number of activities

Linear Plus generates a graphical representation of a project Gantt chart.



Pros:

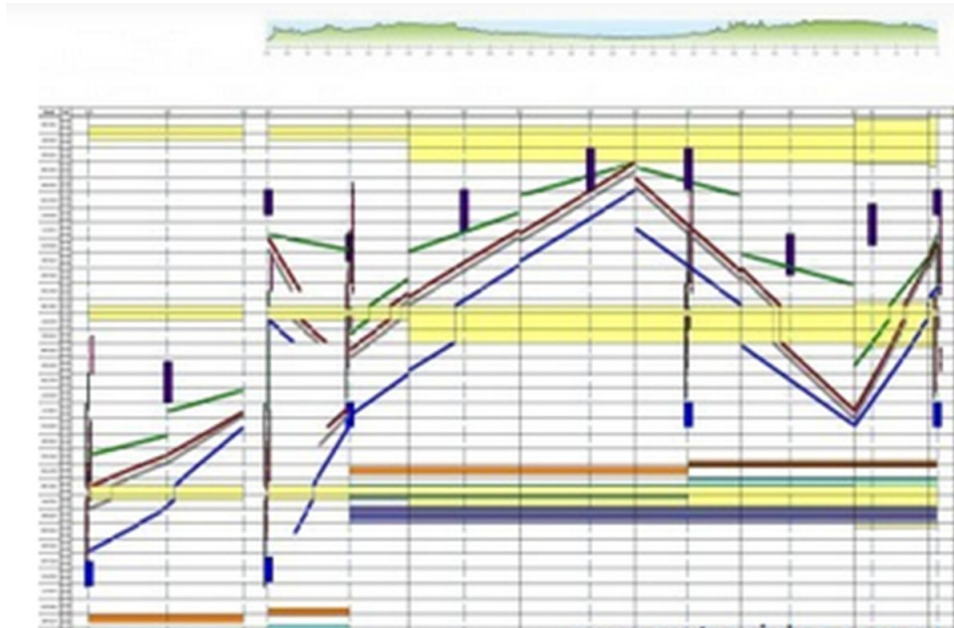
- Provides visual representation of project elements and scope.

Cons:

- Can't modify or add activities or logic. Have to go back to source document and re-import
- Creates a static 'picture' of the project
- Only used for a snapshot - not able to progress or control a project in the tool.

ChainLink™

ChainLink is an add-on utility to project management systems, such as Primavera, to produce graphical time-location charts.



Pros:

- Designed to work with existing project management software.
- Layouts are customizable.
- Diagrams, text boxes, and logos can be inserted into the plan.
- Data can be imported by using the built-in conversion utilities for interim files such as Microsoft Project Exchange (MPX), Primavera P6 (XER), Microsoft Excel (XLS) or Comma Separated Variable (CSV). Tasks can also be entered directly into the software.
- Cost effective software.

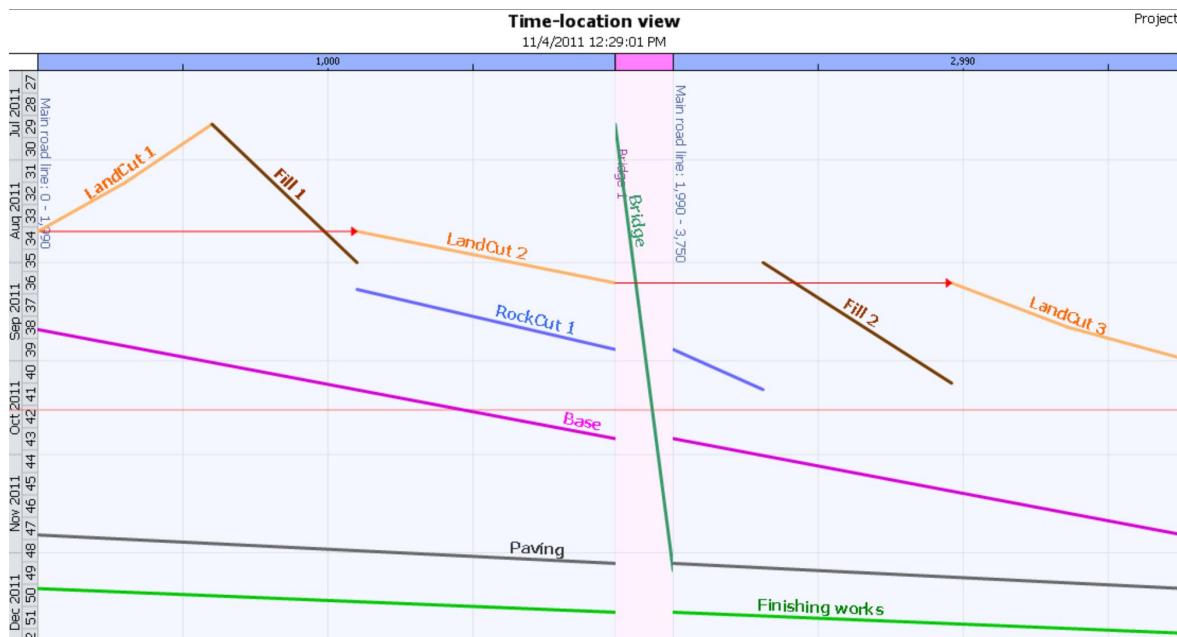
Cons:

- Restrictions on the numbers and types of charts on a layout.
- Not able to display or work with Gantt charts or distance based Gantt charts
- Baseline(s) not support or displayed
- Display of project constraints and restrictions such as environmental are not supported

DynaRoad (Topcon):

DynaRoad is an earthworks planning and scheduling tool that is integrated with TopCon for developing and optimizing mass haul plans and schedules for heavy civil road and rail projects. The graphic visualization, either as a Gantt chart or time-distance chart enables you to visualize the interaction of activities over a distance. DynaRoad consists of 3 integrated modules that can be used independently:

1. DynaRoad Plan - calculating mass balance and optimized haul distances, evaluating costs of different design and planning alternatives.
2. DynaRoad Schedule - creating an optimized and realistic construction schedule based on locations, quantities, resources and production rates.
3. DynaRoad Control - monitoring and controlling project execution.



Pros:

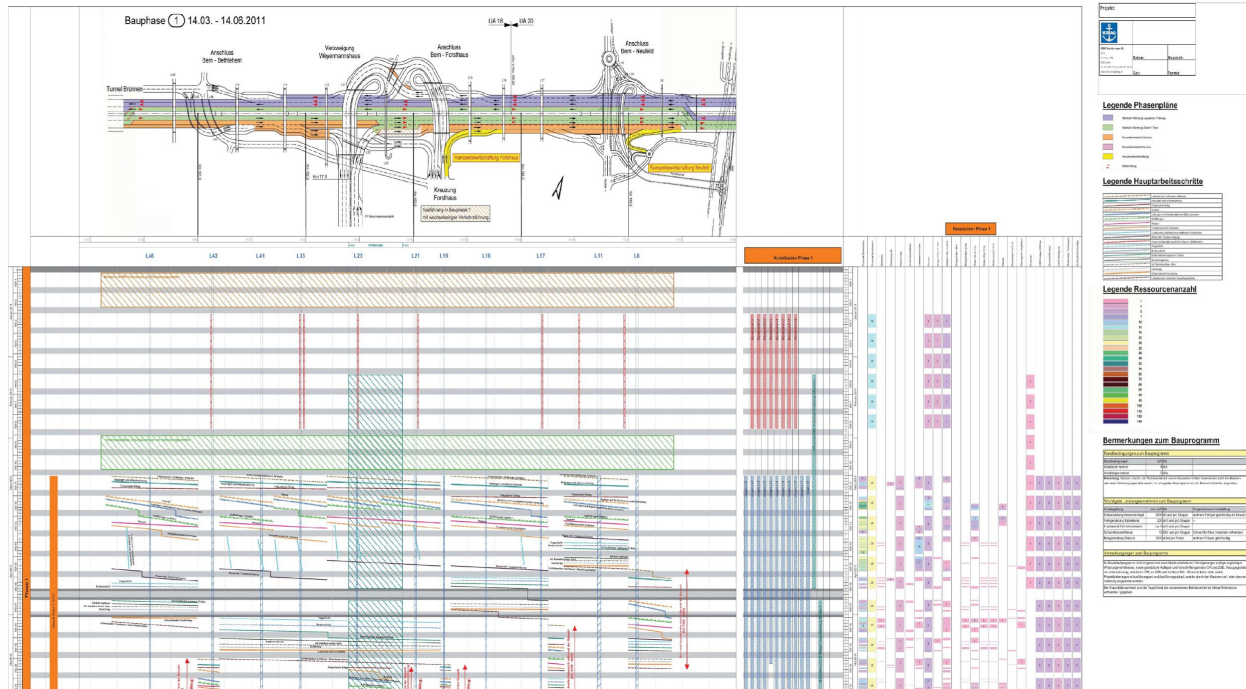
- Specifically designed for mass haul planning and scheduling for road projects
- Mass Haul optimization and planning with data imported from Excel
- Mass areas and haulages are displayed on the site map.
- Survey and machine data can be used for planning.
- Can schedules import from Primavera

Cons:

- Specifically designed for mass haul in roads and rail. Pipeline, transmission line and other project types not supported.
- Simplistic line representation of activities. Multiple shapes not available.
- Doesn't support multiple chart types/customization in one layout, including Gantt and time-distance.
- Doesn't export to Primavera to support contractual requirements

TILOS

TILOS (TIme LOcation System) is a desktop based scheduling software specialized for linear infrastructure construction projects such as roads, pipelines, tunnels, power distribution, and earthworks. It uses the time distance diagram to create and visualize the schedule embedded into the site layout of the project providing the technical background information of the production plan.



Pros:

- Multiple display formats in a single chart or individually: the Time-Distance chart, the Time-Gantt chart, the Distance-Gantt chart and the task list.
- Ability to display constraints and restrictions, such as environmental or regulatory constraints. Photos, symbols, and data can be inserted into the plan to show site conditions, progress, or highlight significant and relevant information.
- Has full Critical Path Methodology (CPM) functionality built into the software. It calculates the floats and critical path.
- Progress mapping provides the ability to connect and display the baseline versus actual progress on a GIS coordinate system, such as Google Earth or ESRI.
- Can import mass haul volumes and locations to generate mass balance and mass haul diagrams.
- Extensive resource management functionality, including resource-distance planning, GIS integration, resource based work rates, and multi-currency planning.
- Can be used as a standalone system or integrated with leading CPM tools such as MS Project™, Primavera™, and ASTA Powerproject™. For all other applications, if the data can be brought into Excel™, it can be imported into TILOS.

Cons:

- Does not have resource leveling functionality of other planning software programs.
- Is not available in an enterprise configuration

TILOS has been used in thousands of projects worldwide.

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TILOS is used by leading global construction companies, including:

