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1 **Introduction**

TILOS is a general linear scheduling software tool for planning and controlling of linear projects such as road, highway, railway, light rail, metro, tunnel pipeline and other linear projects. It is used for new construction, but also for reconstruction and maintenance work.

TILOS can be used as a fully featured, integrated, stand-alone planning system but it can also be used in combination with any other planning system, such as MS Project, Primavera or ASTA Powerproject.

The purpose of this document is to describe, in detail, how TILOS can be used on short time track renewal projects. The goal is to plan and execute small and medium size projects in a minimum of time to reduce planning costs and deliver an optimal developed production plan for execution and logistic issues.

Based on the fact, that all projects are executed with the same well developed techniques and resources but on different sites, also the planning of these high repetitive works can be optimized. The logistic is a key issue having mostly limited access to the construction site for the very big machines and trains.

TILOS has a library of comprehensive templates and standard processes that can deliver a work program within minutes to show the feasibility of performing the project within the planned time frame. TILOS makes use either of standard planning processes stored inside TILOS and is able to calculate the effect of the track description (complexities) to this standard processes. The result is a detailed execution plan containing the task, the resource load, the costs and also the train movements required for logistical support.

The work is done in the following steps:

1. Create a new project and define the base data (execution date and time as well as distance start and end coordinates).
2. Enter the complexities in TILOS or import from an Excel table
3. Plan and schedule the construction activities
4. Plan the of labor and equipment requirements
5. Plan the train logistic



2 *Preparing the project*

Each project is based on a TILOS template. The project template has a set of data especially designed for planning construction work in the railway industry. This data includes:

- 1 A library of resources needed to perform the work
- 2 Pre-calculated activities with work rates and pre-assigned resources
- 3 Complexity types (crossings, bridges) and their effect to the production
- 4 Display symbols to draw a site map with all complexities
- 5 Predefined layouts for railway planning

2.1 *Create a new project*

Using the **File - New** function a new project is created based on the template “Trak maintenance work”, which can be downloaded along with this document from the TILOS.org homepage.

The screenshot shows a dialog box titled "New Sub-Project Settings". The "Project name" field contains "Trak maintenance work". Below this is a section titled "Set distance and time properties for sub-projects and views". The "Default distance unit" is set to "m". The "Start (distance)" is "0" and the "End (distance)" is "3.000". The "Start date" is "06.12.2010" at "0:00", and the "End date" is "09.12.2010" at "0:00". The "Default time unit (working)" is set to "h". There is a "Calendar for view" dropdown menu. At the bottom, there are "Apply" and "Skip" buttons.

The project details, such as the start and end coordinates, in distance and time, are defined for the new project. All predefined views in the project are adjusted to the values set in the project new dialog.



2.2 The complexities

Complexities are elements that need special handling during the construction process. These are changes in the standard profile along the track such as bridges, crossings etc.

This data are usually provided as an Excel table. In TILOS we use the sector profile and the sector types to describe construction complexities.

	A	B	C	D
1	Name	Type	Start	End
2				
3	CR2001	Crossing	461	470
4	Radius 495	Curve	470	870
5	Renewal area	Construction zone (2B)	470	1.800,00
6	Strome	Bridge	1.100,00	1.190,00
7	CR2001a	Crossing	1.495,00	1.505,00
8	Crosstunnel	Tunnel	1.605,00	1.705,00

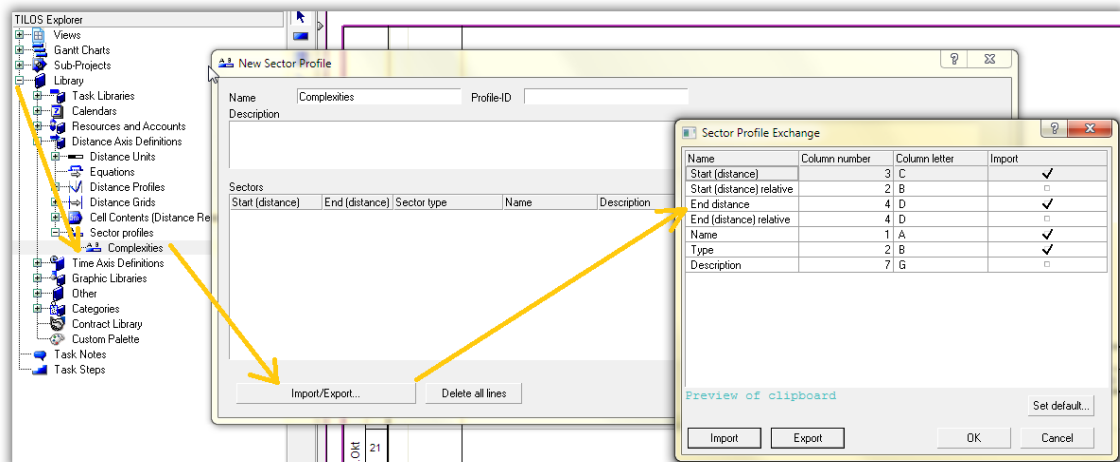
Name This is the name of the complexity (e.g. Oak bridge)

Type This describes the type of sector, if it is a bridge, a crossing or whatever.

Start & End These 2 fields contain the distance coordinates.

This data can be directly imported into TILOS using the clipboard import function. In Excel, select all the data rows (excluding the header) and copy that to the clipboard.

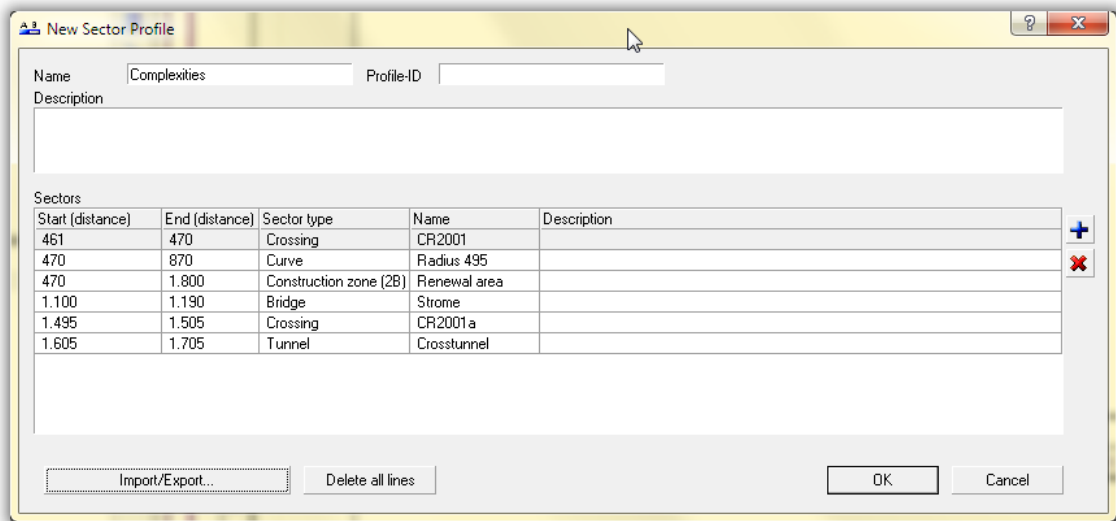
Switch back to TILOS and open the folder Libraries / Distance axis definition / Sector profile. Double click on the entry **Complexities**. This is a predefined profile that is already connected with the task templates and other items of TILOS.



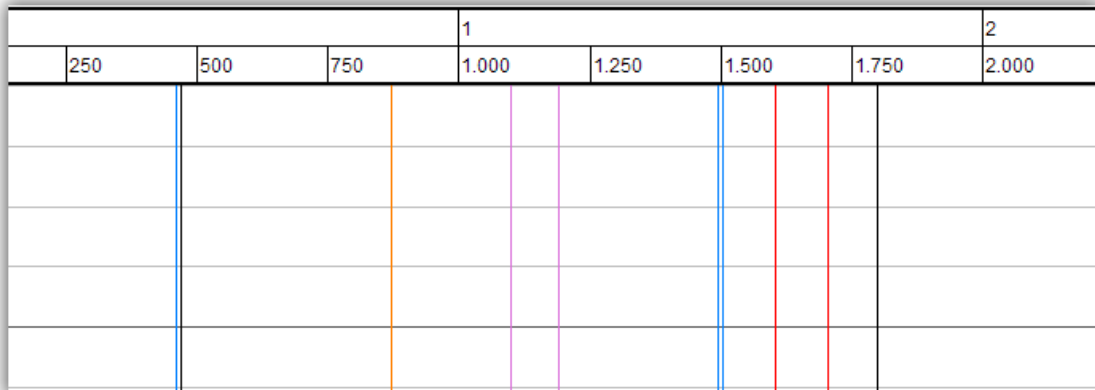
Click on the button: **Import / Export** and map the available data fields of the profile to your Excel table (e.g. Start Distance = Column D).



The data is imported from the clipboard and is displayed in the dialog for the sector profiles.



Select OK and TILOS will evaluate the imported complexities and update all views and data connected with the sector profile.



TILOS builds the grid lines in different colors related to the sector type that is assigned. The grid lines will also work for snapping the tasks and for positioning of the tasks.



2.3 The rail plan

As an example, to illustrate what can be done with profiles, we just will import the rail distribution plan that describes the length of the rails used along the track. This is used for graphical display and as a plan to lay the rails as well as for calculating the welding work later.

Again in an Excel table you can specify the type of rails and their length. This will be imported to a TILOS distance profile. They can be used to generate scales and graphs but will also be used in task calculations.

Each line represents one rail. The start point is taken from the line above. E.g. rail in line 3 of the following table starts at 470 and ends at 590 and is 590 m long. For each rail 2 welds have to be done. For the last one 4 have to be done to connect with existing track.

	A	B	C
1	Distance	Name	Welds
2	470		
3	590	l = 120	2
4	710	l = 120	2
5	830	l = 120	2
6	950	l = 120	2
7	1070	l = 120	2
8	1190	l = 120	2
9	1310	l = 120	2
10	1430	l = 120	2
11	1550	l = 120	2

Distance Enter the distance coordinate where the rail ends. The entry in the line above is the start of the this rail

Name Enter any name or like above calculate the length of the rail using an Excel formula.

Welds Enter the number of welds that have to be performed. This is 2, one at each end.

Select the table without the header and copy the data into the clipboard. We will now use another function of TILOS, the distance profile to calculate distance based quantities.

Switch to TILOS and open the folder Libraries / Distance axis definition / Distance profiles. Double click on the entry Rails. This is a predefined profile and the correct import setup is already done.

In the print view ("HO: Printing View" in the TILOS Explorer), there is a scale produced with one compartment for each rail based on the rail distance profile.

Rail length		l = 120	l = 120	l = 120	l = 120	l = 120	l = 120	l = 120	l = 120	l = 120	l = 120	l = 120	
KP		470	590	710	830	950	1.070	1.190	1.310	1.430	1.550	1.670	1.800



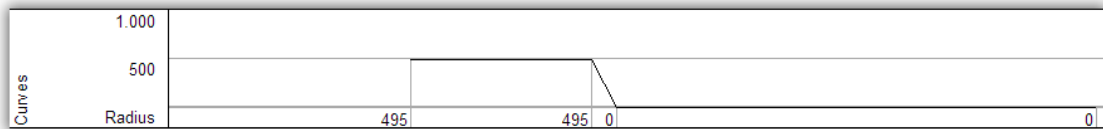
This profile will be used later to calculate the duration for the welding task.

2.4 The curves

In a similar way a diagram showing the curves, with their radius, can be generated.

	A	B
1	Distance	Radius
2	470	495
3	820	495
4	870	0
5	1.800,00	0

A pre-defined distance profile called "Curves" has been prepared in the TILOS template. Import the values from the Excel table into this profile using the clipboard and the following graph in print view is generated.





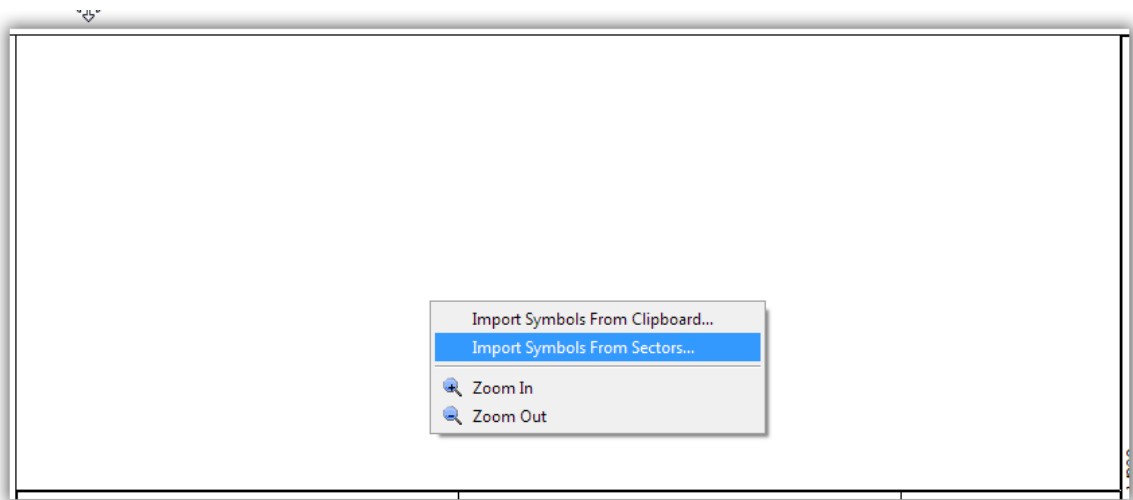
3 *Preparing a graph for the track*

Creating a graph with complexities

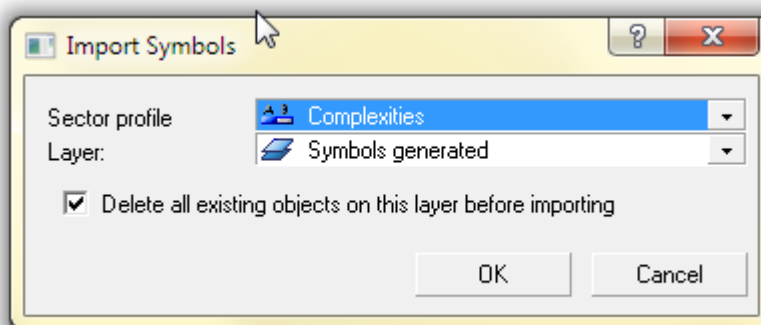
The upper cell is designed to represent the track graph and is defined as a distance cell. Symbols or pictures can be entered at exact distance coordinates.

TILOS can generate also symbols based on the list of the complexities.

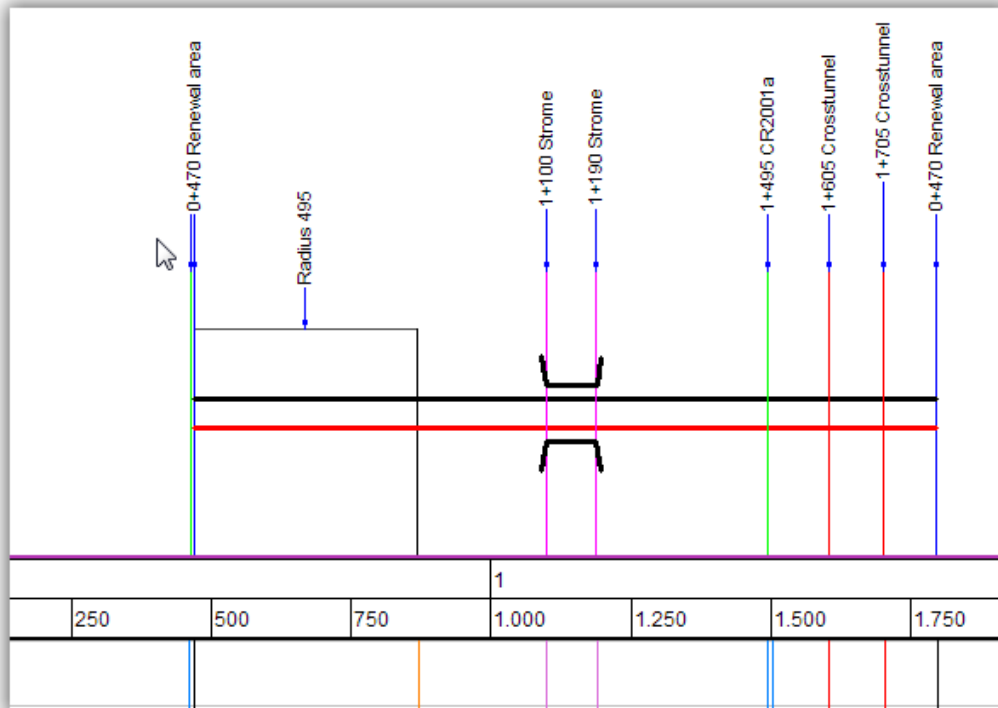
Click the right mouse button and use the option: **Import Symbols From Sectors**



The dialog Import Symbols appears.



Select the profile Complexities and also the prepared layer for symbols and press OK.

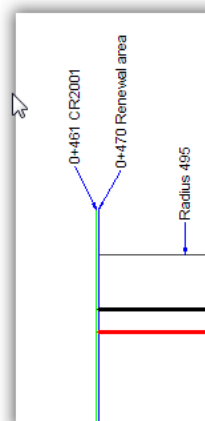
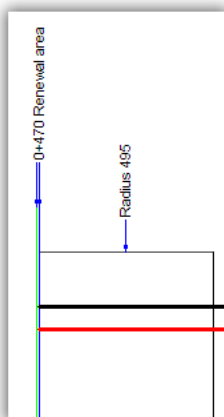


For each complexity a symbol is created based on the sector type if there is matching symbol in the TILOS symbol library. The distance values are taken from the sector values, the width values are taken from the relative height coordinates in the sector type value.

The scaling is set to both axes, meaning distance coordinates and percentage height. This means that the symbols will stretch in both axes when changing either scale, height or the view.

Changing generated symbols

Each symbol can be changed in position by clicking on it and moving it around. The text fields attached to the symbols can be moved independently.

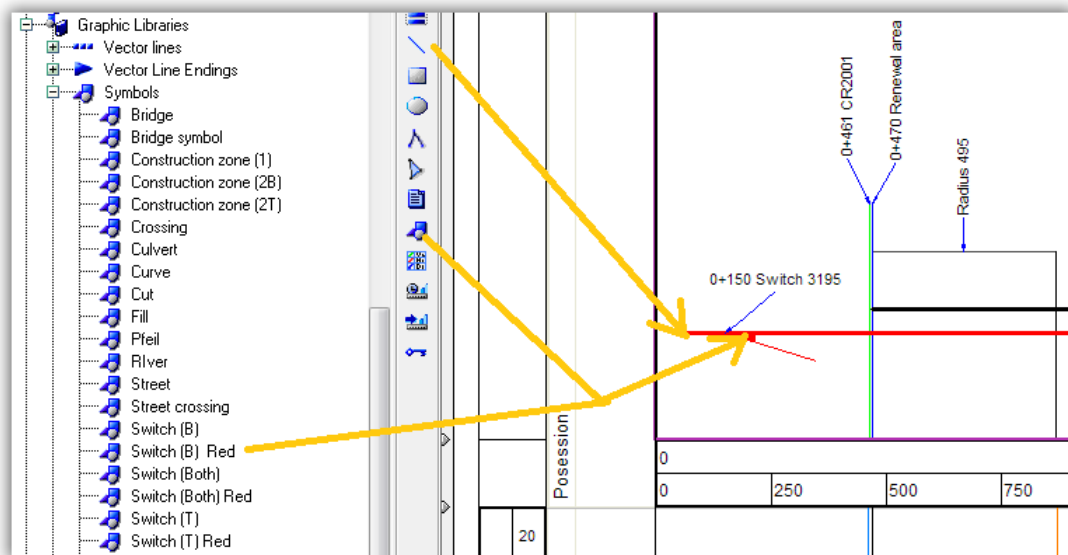




Inserting new symbols

Extra symbols can be added graphically into the same cell by inserting:

- additional symbols
- graphical objects
- text objects



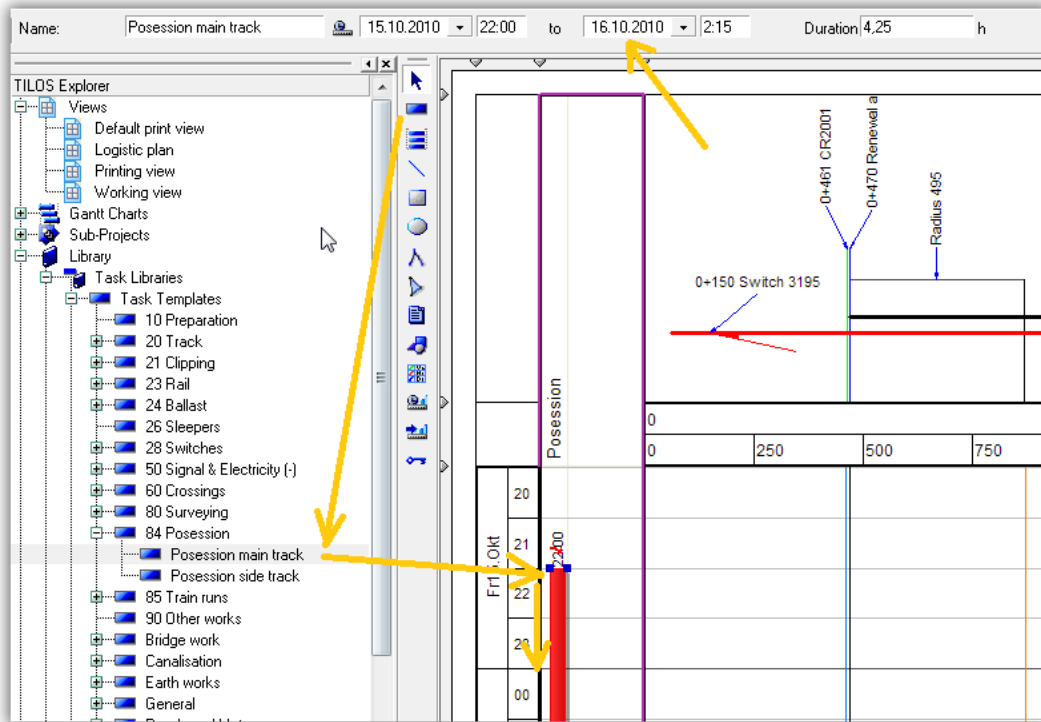
It is recommended to add the extra symbols on a different layer. In the event you need to regenerate the symbols, these additional symbols will not be deleted

4 Working time and calendar creation

Generally calendars are created using the TILOS calendar function. However, it is also possible to define the working time based on the possession time of a track which can be different for each track.

Defining the possession

Insert a Gantt chart cell to the right of the time scale and insert a possession main track activity. This can be simply drawn into the Gantt chart and you can create a set of tasks on the same bar line. Each bar in that Gantt chart represents the working time on the site. You may also change the start and end directly on the toolbar. These tasks can also be created by using the function: Create repetitive tasks.

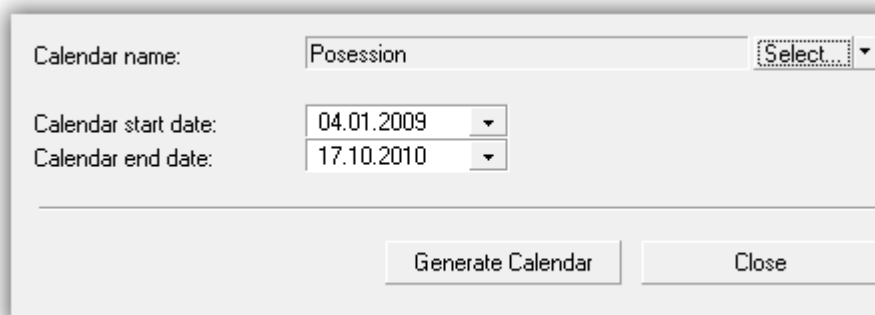


Repeating tasks, e.g. shut down every night can be entered as a repetitive tasks.

Possession calendar

Based on the tasks on a bar line, a calendar can be generated showing working time wherever a bar is shown on that line. To create a calendar based on an existing activity:

Right click in the text panel area of that barline and select the right mouse function: **Create Calendar from Barline**.



The name of the calendar is taken from the bar line's name. However, any other calendar can be selected, but it will be overwritten with the new data.

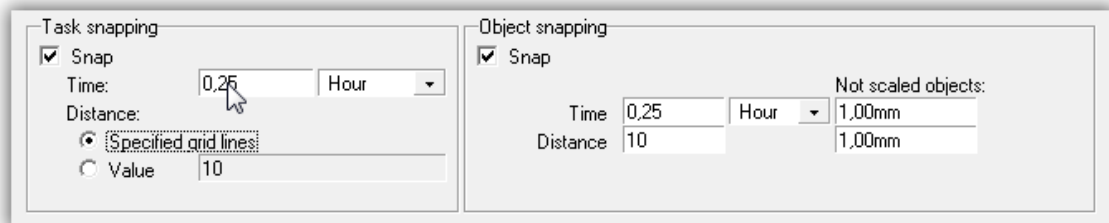


5 Track renewal train (High output)

In this section the exchange of tracks is shown for a high output system using track renewal trains. The construction program is planned directly in a graphical way using the time distance diagram.

Tasks are always created based on a templates. The templates are pre-defined tasks that are inserted into a project plan by drawing directly on the time-distance cell or by importing the task data.

The snapping function makes is very easy to position the tasks on the time-distance cell. Snapping can be done based on a constant value, or using grid lines.



New task are created in the following way:

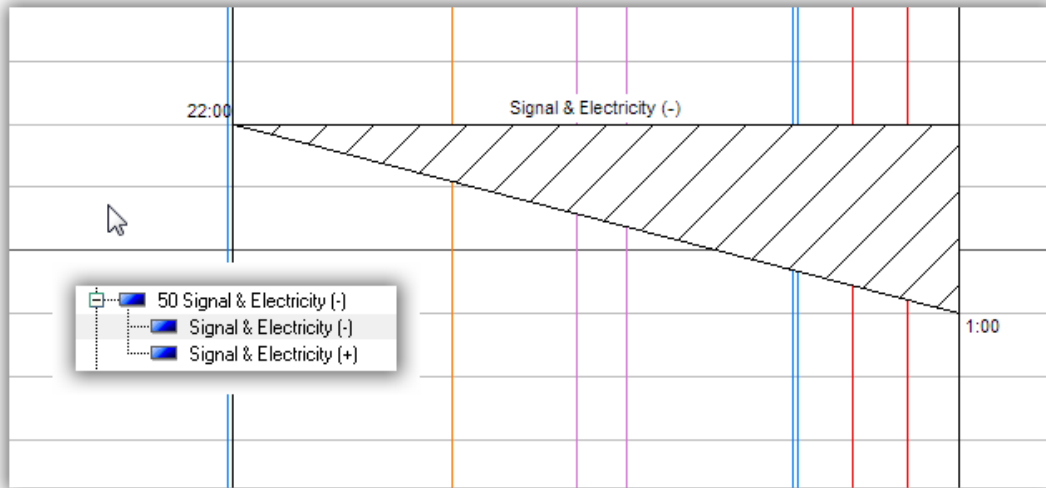
1. Select the Insert task button
2. Select the template in the explorer or in the toolbar.
3. Position the cursor and draw the task.

Most tasks in the railway library calculate the duration based on the distance of the task. Thus, just changing the distance coordinate changes will also change the duration.



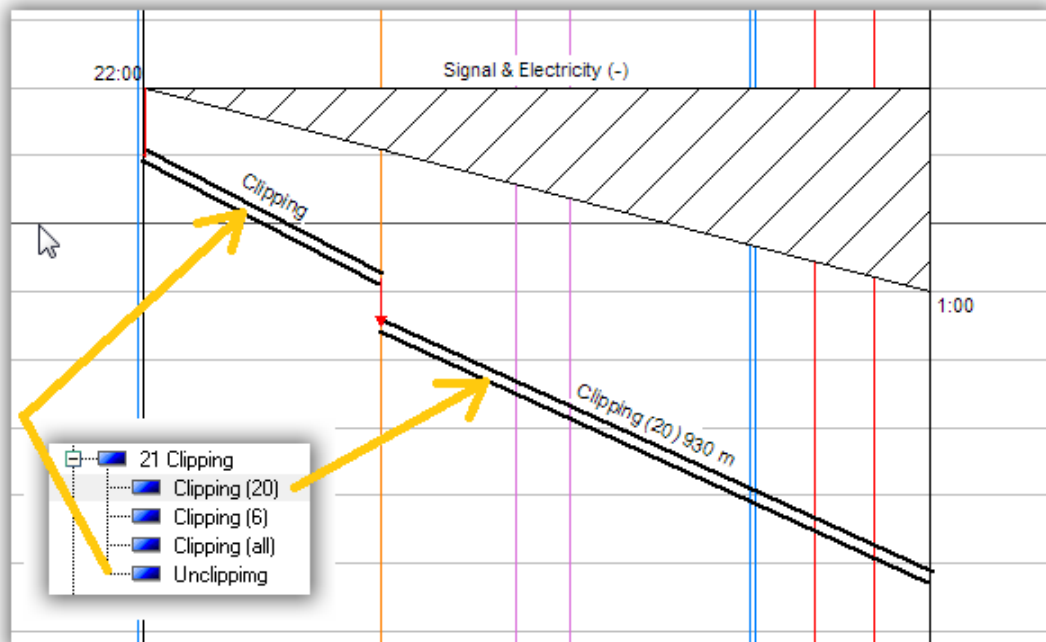
5.1 Signal and Electricity

This is normally the first task in any rail project and is normally shown as a triangle.



5.2 Clipping work

Clipping is done in two steps: For the first 400 m all clips are removed, further along, every 20th stays and is removed shortly ahead of the train. In our example, two tasks were inserted with different templates.





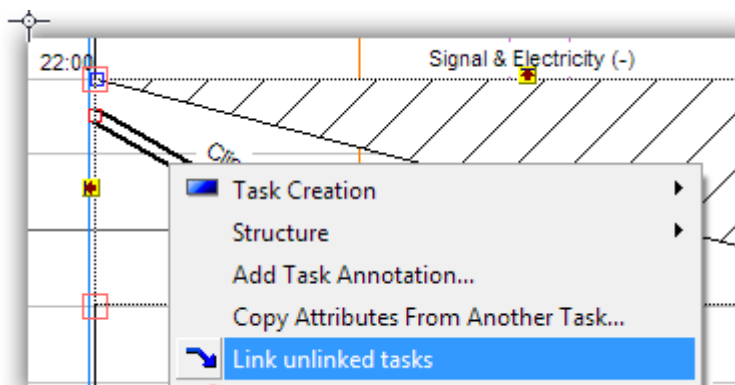
This tasks have a special calculation method to calculate duration based on the length of the task.

The field Quantity is calculated based on the length of the task and the work rate is set by the user.

Linking tasks

The easiest way of linking tasks is to select at least 2 or more tasks while holding down the CNTRL key, right clicking and select: Link unlinked tasks. TILOS tries to set the correct link based on the position of the 2 tasks.

Select the Signal and electricity task and the Clipping task. Using the right mouse function: Link unlinked tasks. A start to start link is created.



If you want to keep the distance in time like it was when the link is created, then press the button: **Copy lag from chart position**. This sets the lag to the difference in start time of the 2 tasks.



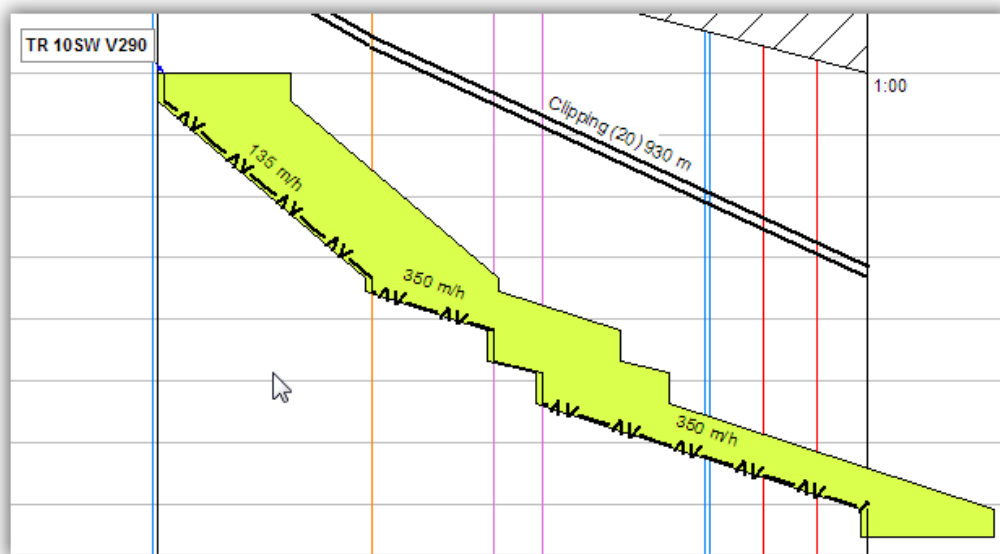
Select the two clipping tasks, right click and select the function: Link unlinked tasks. The 2 clipping tasks are linked with a finish to start link.

Press F9 to recalculate the schedule.

5.3 Track renewal

This is the main track building task and has special consideration.

The task is based on the template **Track exchange incl. Ballast cleaning** in the folder "20 Track".




This task inherits the following calculations from the template:

Calculate	Duration (Speed from Sector types)	Set quantity by	Task length	UM 10Dgrw V290
Sector	Complexities	Quantity factor	1,0000 m/ m	
Seasonal		Base speed:	350 m/h	<input checked="" type="checkbox"/> Apply to task shape
Quantity	1,230,000 Unit: m	Setup time:	Start: 0,45 End: 0,45	<input type="checkbox"/> Train setup
Work rate	162,914 m/ h			<input type="checkbox"/> Track renewal train
Duration	7,55 h			Direction: <input type="text" value="Pulled"/>

- 1 The base speed of the train is 350 m / h. In certain areas the speed is slower, in other areas no work is performed. Although the task length is 1320 m, only 1230 m of track are replaced. This is because of the bridge where the tracks are not replaced by machine. An average work rate of 162 m / h is achieved.
- 2 At the beginning and end of the task the setup time is automatically entered.
- 3 In the curve, a speed of only 135 m/h is assumed. This is controlled by the sectors defined along the track.



Sector type	Speed[m/h]	Non-Working	Setup time	Setup time	Description
Bridge	500	<input checked="" type="checkbox"/>	0,50	0,50	
Curve	135	<input type="checkbox"/>	0,00	0,20	

Click on the button  in the tab calculation right of the base speed field the task sector table will be opened. For each sector type, a different speed can be entered as well as setup time before and after the sector.

Based on this entries, the different slope and speed of the task is calculated.

- 4 Between 1+100 and 1+190, the bridge forces a stop and move over without performing any work. This is why the task line is printed with a different line style.
- 5 At the end of the task a setup time is also added.
- 6 Resources are also added to the task automatically based on the template:

Name	Cost centre	Model	Role	Input value	Effort	Unit	Allocation
AZ-Lok V290	Equipment	Allocation	Locomotive	1,0000	7,5500	h	1,00
Sleeper wagon	Equipment	Cargo	Wagon (to calculate)	125,9748	75,5000	h	10,00
Track renewal machine	Equipment	Allocation	Track renewal machine	1,0000	7,5500	h	1,00
Sleepers	Material	Quantity / Unit		1,6670	2.050,4100	Stck	

The locomotive and the track renewal machine are added with model **Allocation** in a simple way. The total effort is calculated.

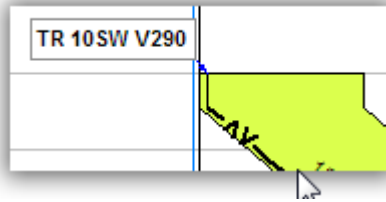
The quantity of sleepers calculated, based on length, is 2050 (1.667 per m of the track).

The number of wagons need to transport the sleepers are calculated based on the cargo capacity that 1 wagon can take and the number of sleepers needed for one m of track. Using this information TILOS calculates what length one wagon can service and then calculates the total number of wagons needed. The system can store different workloads depending on the type of sleepers.

Description Default Work Rates		
Rate	Calculator	Description
125,975	210 Concrete sleepers per wagon / 1,667 per m	Concrete sleepers
165,567	276 Steel sleepers per wagon / 1,667 per m	Steel sleepers
197,960	330 Wood sleepers per wagon / 1,667 per m	Wood sleepers

In total 10 wagons are needed.

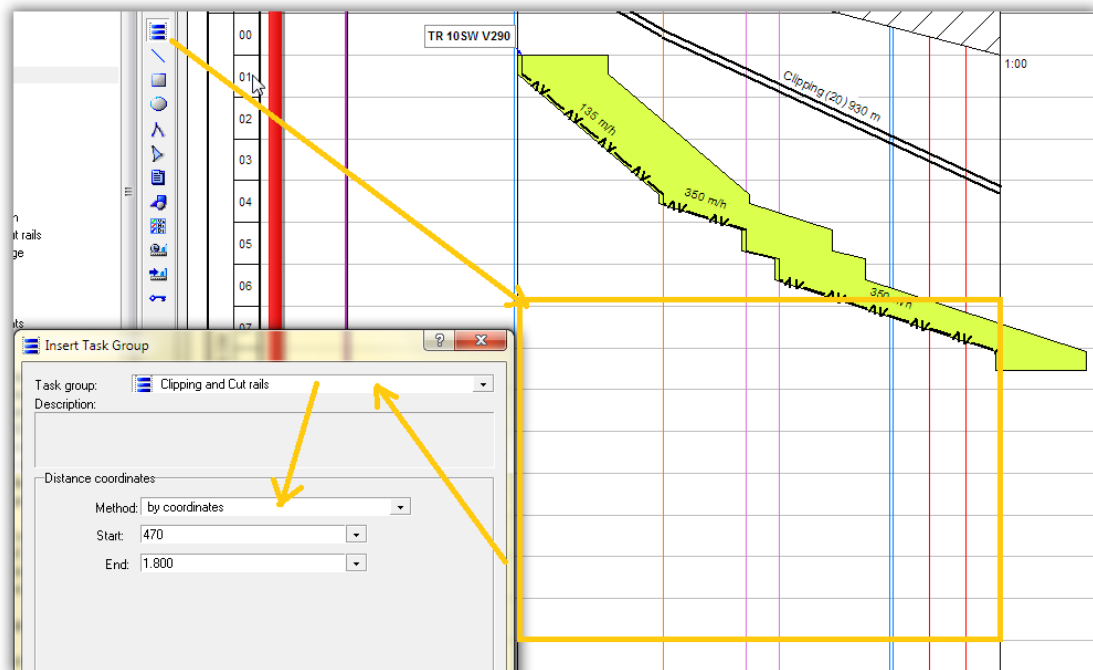
- 7 The shape is drawn as parallelogram based on the calculated length of train, taking the allocation and the length of each resource into account.
- 8 The tasks can be automatically annotated. The configuration of the train is shown in the direction of movement. .



- TILOS can also calculate speed needed to finish the job within a certain time. Enter an new end date & time and TILOS calculates the needed speed.

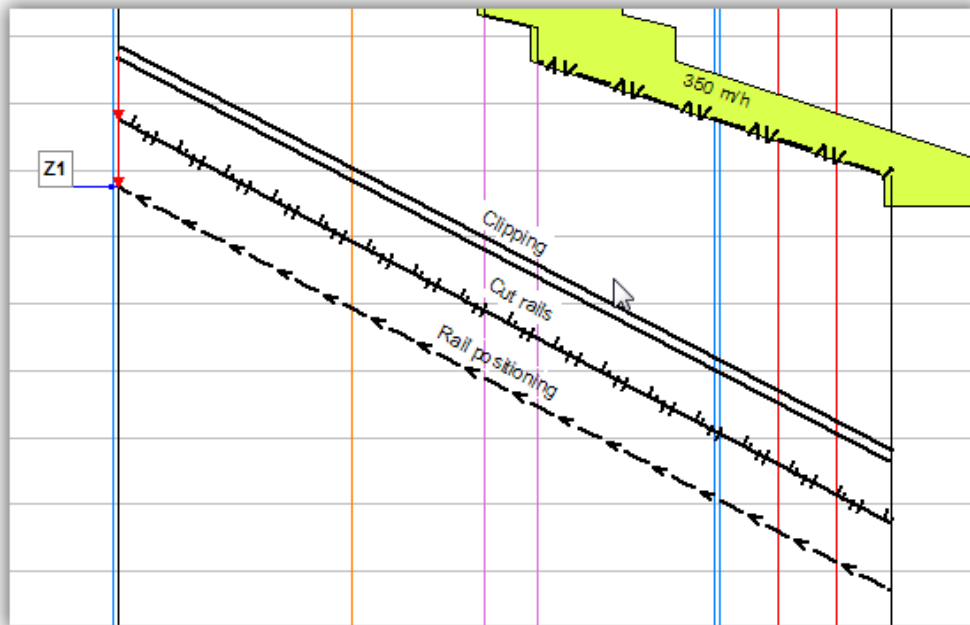
5.4 *Cut and remove old rails*

Existing rails are cut and stapled for transportation. This is done based on a set of four parallel activities that are already modeled in TILOS as a task group and can be inserted in one go.



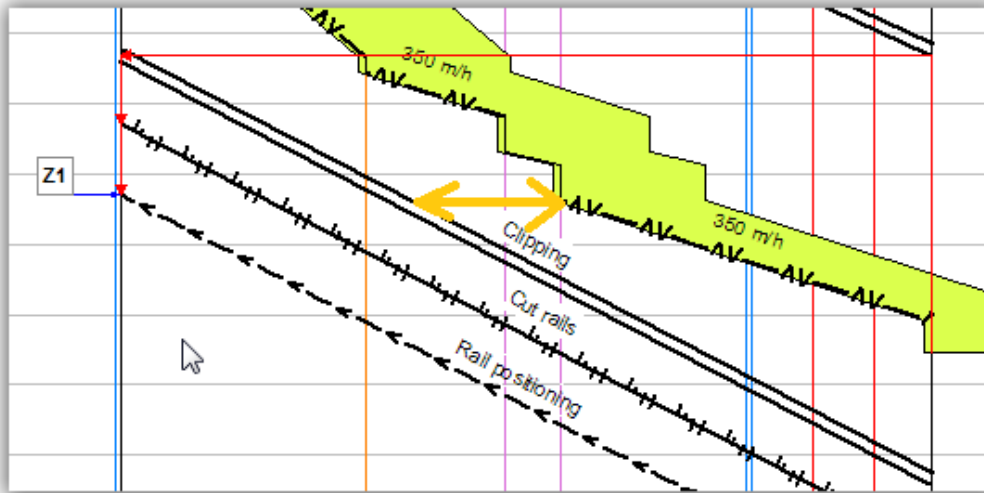
To enter a task group, click on the button  and drag a rectangle in the position where the task group should be inserted.

Select the group that should be inserted and the method: By coordinates. This generates the tasks and calculates its length automatically.

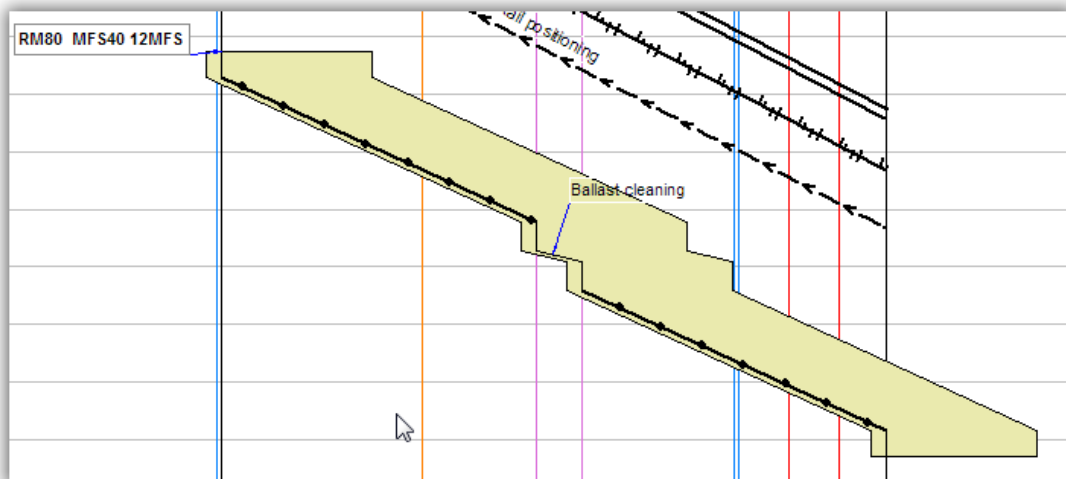


The first task is linked with a finish to start link. There should always be a distance lag of 250 m to the successor task

This can be achieved by entering the mode Calculate lag by: Distance to successor and a distance lag value of 250 . This minimum distance is kept over the whole length of the task.



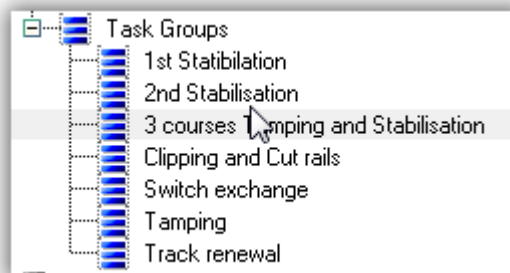
5.5 Ballast cleaning



This task also reflects that over the bridge no work is assigned. For this task, the different working speed in the curve section does not apply.

5.6 Tamping and Stabilization

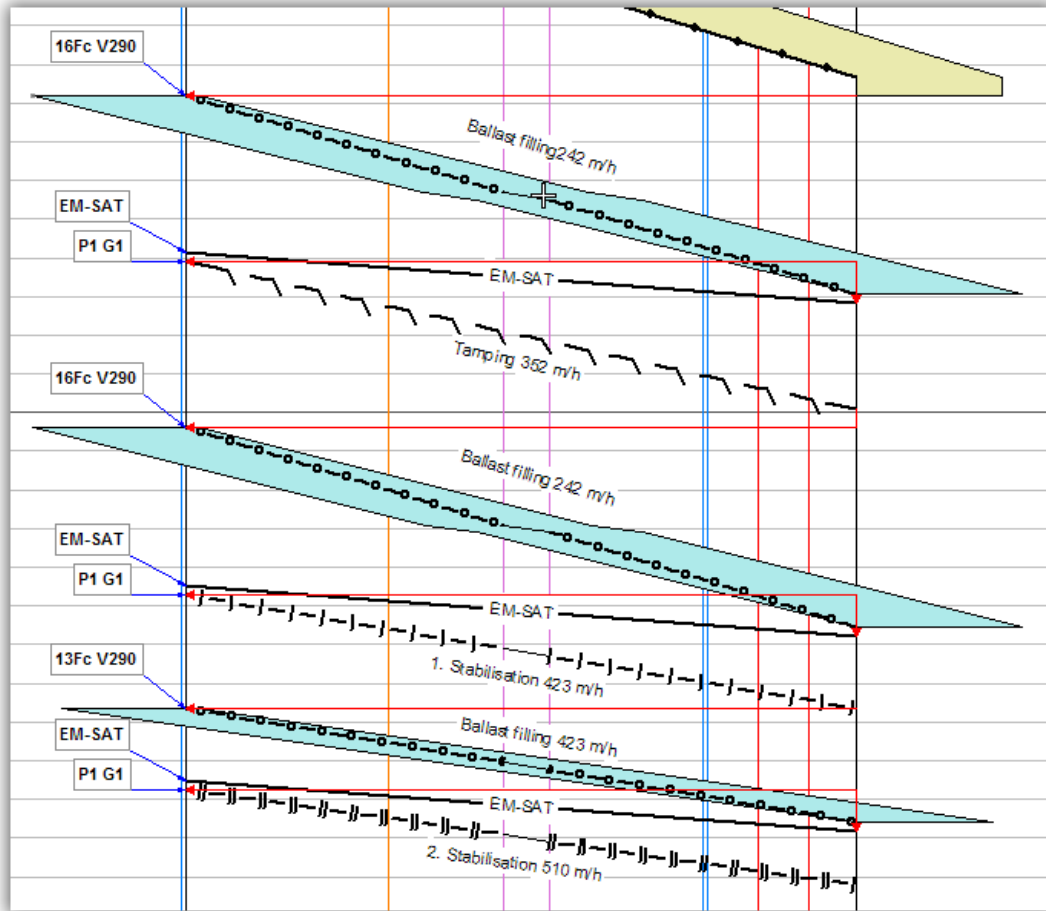
For the tamping and stabilization, 3 runs are required. The library contains a predesigned process for each run, but also a combined one containing all 3 repetitions.



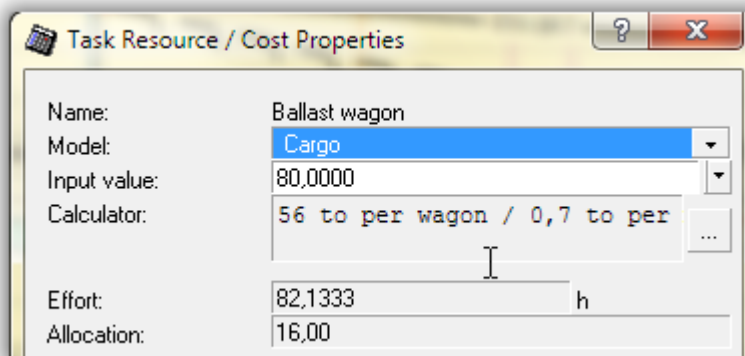


Each run contains 3 tasks: Ballast filling – Position checking with EM-SAT – Tamping / Stabilization.

Inserted the task group for the whole length of the project the durations are calculated.



Ballast filling is shown as a blue task. Per m of the track 0,70 tons of ballast should be unloaded. Each wagon has a 56 ton capacity so it can service 80 m of track.. This project requires 16 ballast wagons to complete the work. The calculator will determine the number of wagon required based on a formula that you can enter.

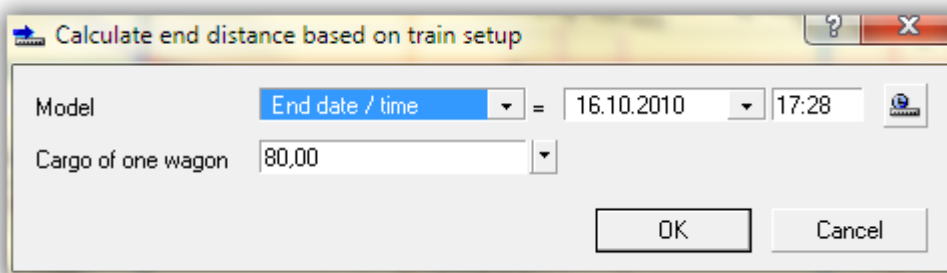




Further Calculation Options for Ballast Filling:

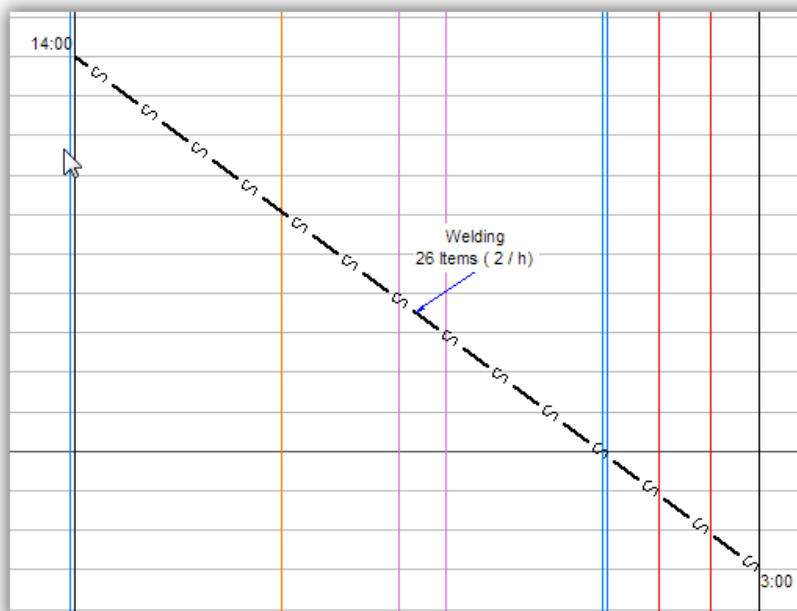
Assuming, that there is a specific end date (end of working shift) TILOS calculates the length can be completed until the end of the shift and calculates the required ballast and the number of wagons.

The other way round, giving number of wagons, TILOS can calculate the length of the task, that can be serviced.



5.7 Welding

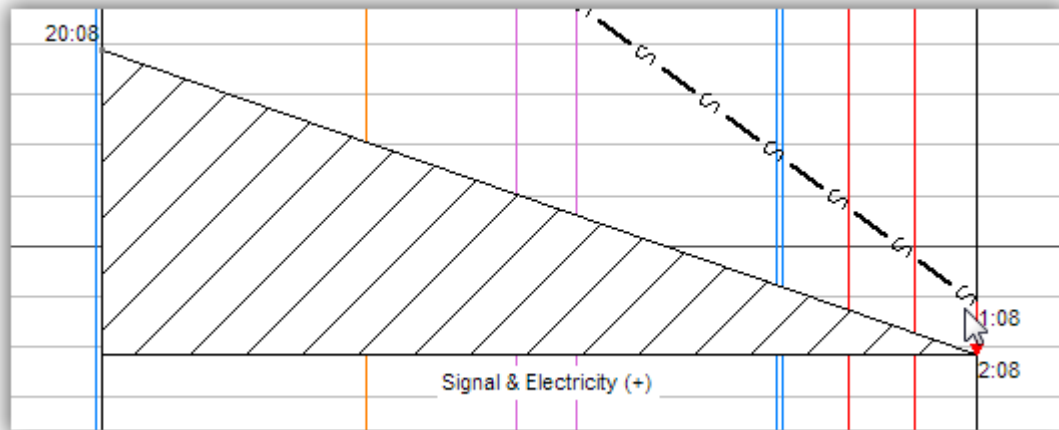
Welding is inserted as a single task based on the template Welding in the task folder 23 Rail.



The template Welding is connected with the profile Rails. From this the exact number of welds required is calculated between the start and the end of the task.



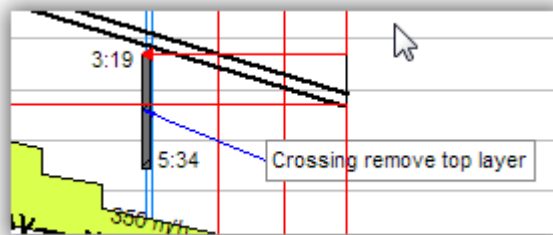
5.8 *Install signal & electricity*



This task describes the reinstallation of the signals. It shows up as a triangle, as behind installation, no further work on the track can be done.

5.9 *Further work*

All inserted tasks are executed over the whole distance of the maintenance project. Any further work can be easily added in the same way and linked with the other tasks.



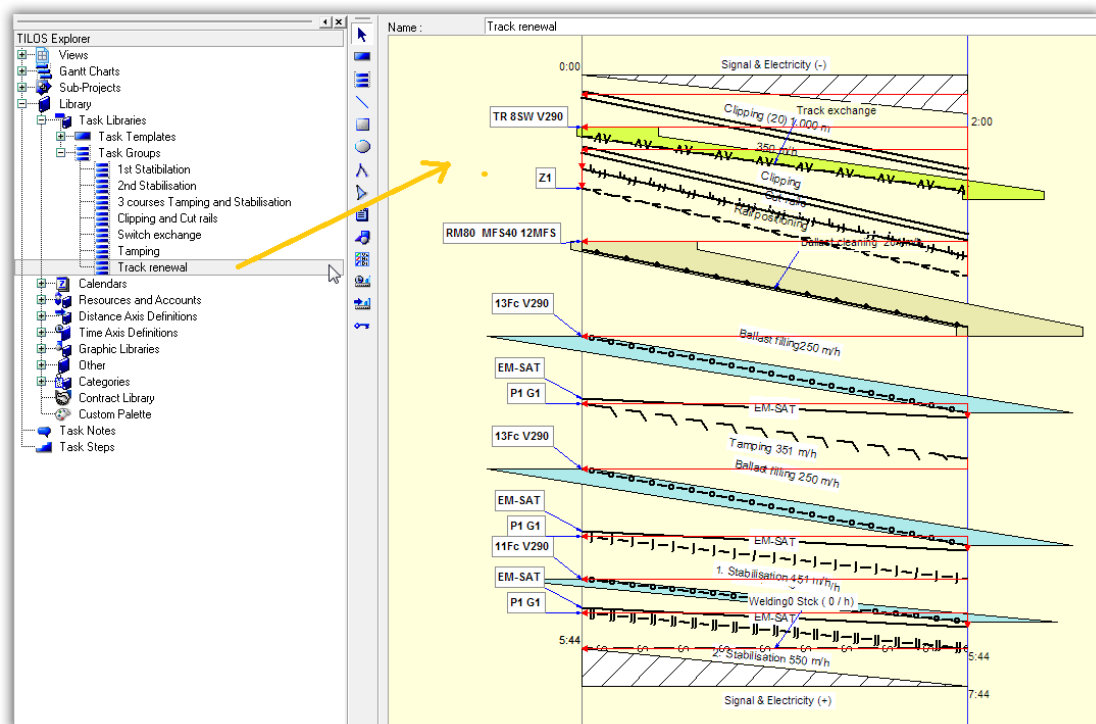


5.10 Insert Whole Program as Task Group

All of the different tasks have been added using special templates or task groups from the Task Library in TILOS. All of the calculations (duration, speed, etc) of these inserted tasks based on pre-assigned modeling. The site specific data (complexities) added at the beginning of the process controls if work has to be performed in one of the sectors (i.e., bridge) or if there is a different working speed (i.e, curve).

These pre-defined tasks and task groups reduces the amount of editing work for each project and therefore reduces the planning time.

However in the project template, there is a task group called 'Track renewal' defined. This allows the insertion of all the required tasks using one single task group.



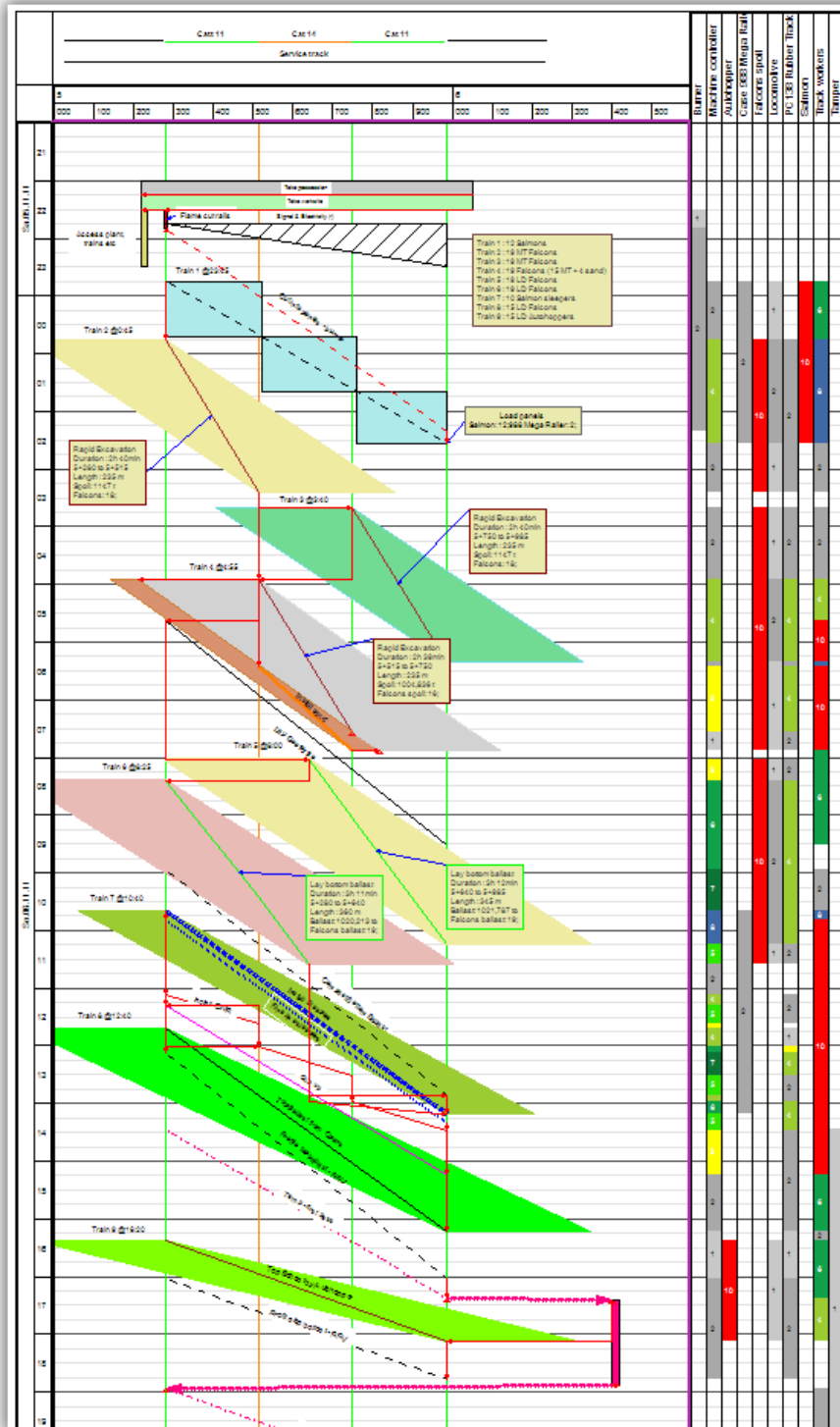
Adding this task group into a project TILOS::

- 1 Calculates the exact quantities based on the length of the task or based on profiles
- 2 Alters work rates along the tracks based on defined complexities such bridges and calculates setup time for the heavy equipment.
3. Calculates the resource utilization
- 5 Avoids overlapping tasks based on the distance links.



6 The Traditional Technique

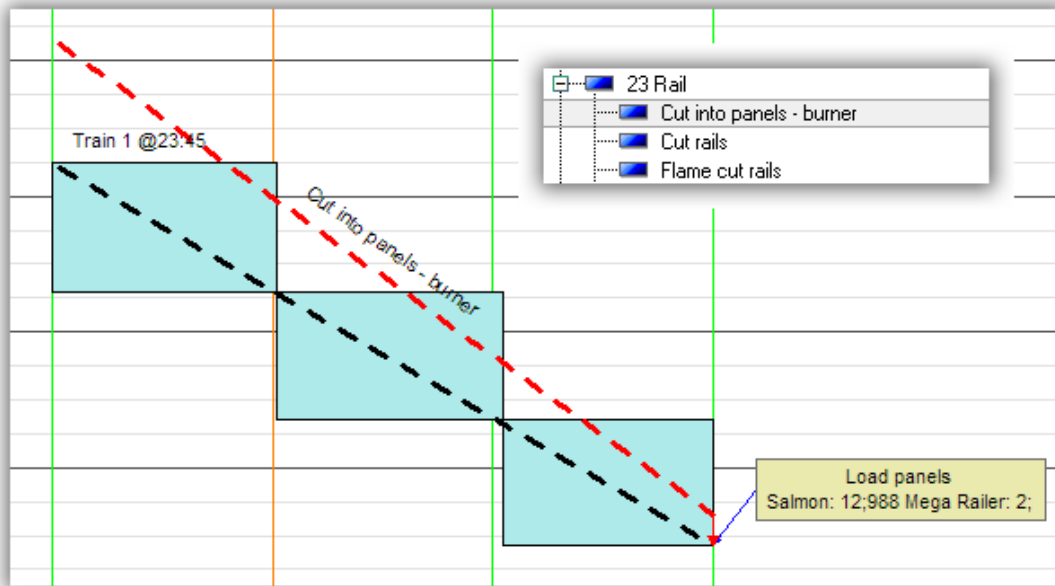
In the following section, a track repair project based on the traditional technology will be developed. Traditional, in this sense, means not using fully automated track renewal machines.



www.linearproject.com



6.1 Remove old tracks



The first task describes the cutting of the rails into panels with the resource Burner. The slope of the task is determined by the work rate of the crew and mainly the burner.

The 2nd task represents loading the panels on to a train standing on an adjacent track.

Name	Model	Role	Input value
Locomotive	Allocation	Locomotive	1,0000
Track workers	Allocation		6,0000
Salmon	Cargo	Wagon (to calculate)	60,0000
Case 988 Mega Railer	Allocation		2,0000
Machine controller	Allocation		2,0000

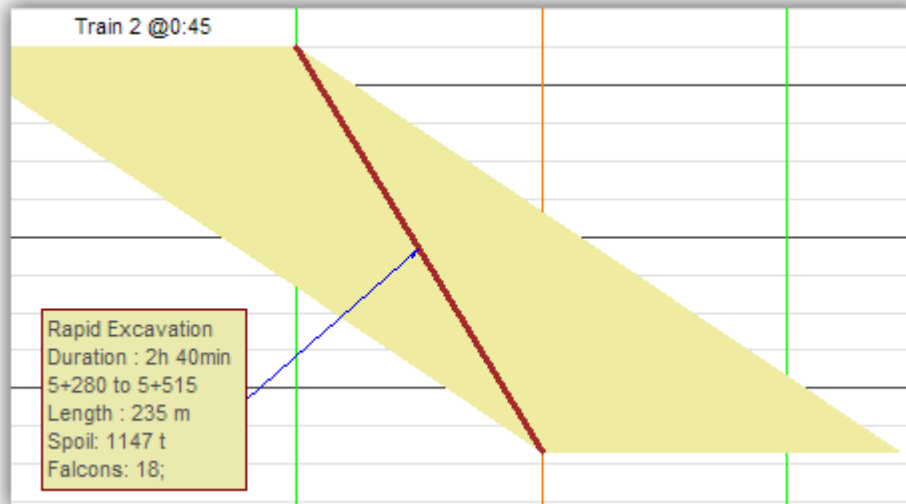
The excavator loads the panels on to the Salmons (wagons). TILOS automatically calculates the number of Salmons required. The longer the task, the more wagons are needed. Each wagon has a capacity for 60 m of track. After the first 240 m are done, the train moves forward to the next section, which is shown by the rectangle (each 240 m long). If these sections are not constant, a profile can be used to calculate the length of each rectangle showing the train stops.

As the train stands on the adjacent track, there is no problem with the overlap in shape.



6.2 Rapid Excavation

Train 2 is the spoil train entering at 0:45 into the construction site.

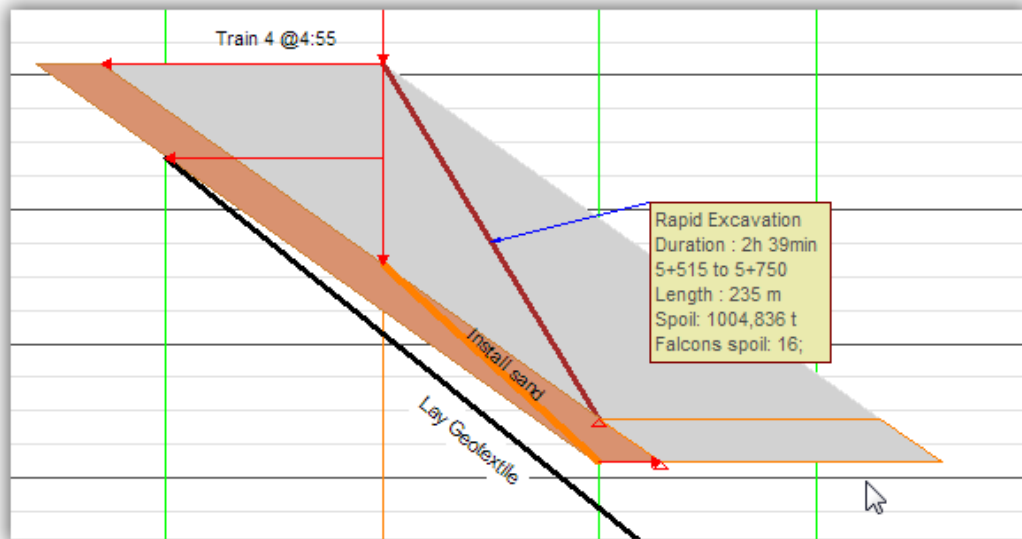


The capacity of each Falcon is 64 tons therefore the 1147 tons of spoil requires 18 Falcons based on load capacity.. After each change of the task, the resource setup is updated. There are further options to calculate the task:

- 1 Enter the length of the task in m and TILOS will calculate which how long it will take and how many wagons are needed.
- 2 Enter the train parameters (e.g. 18 Falcons and TILOS will calculate what length of the track can be serviced.
- 3 Enter the shift length (time) and TILOS will calculate what length can be done in that time and how many wagons are required to add to the train.

The quantity for the task is taken from a profile containing the spoil quantity to excavate.

In the Cat 14 section an additional sand layer has to be excavated and later replaced. The sand is carried by 4 extra wagons at the end of Train 4.



Parallel to excavating, the sand is unloaded when the last 4 wagons arrive at beginning of the section Cat 14. This is shown by the task "install sand".

To show the exact train shape, a group of 4 tasks are used.

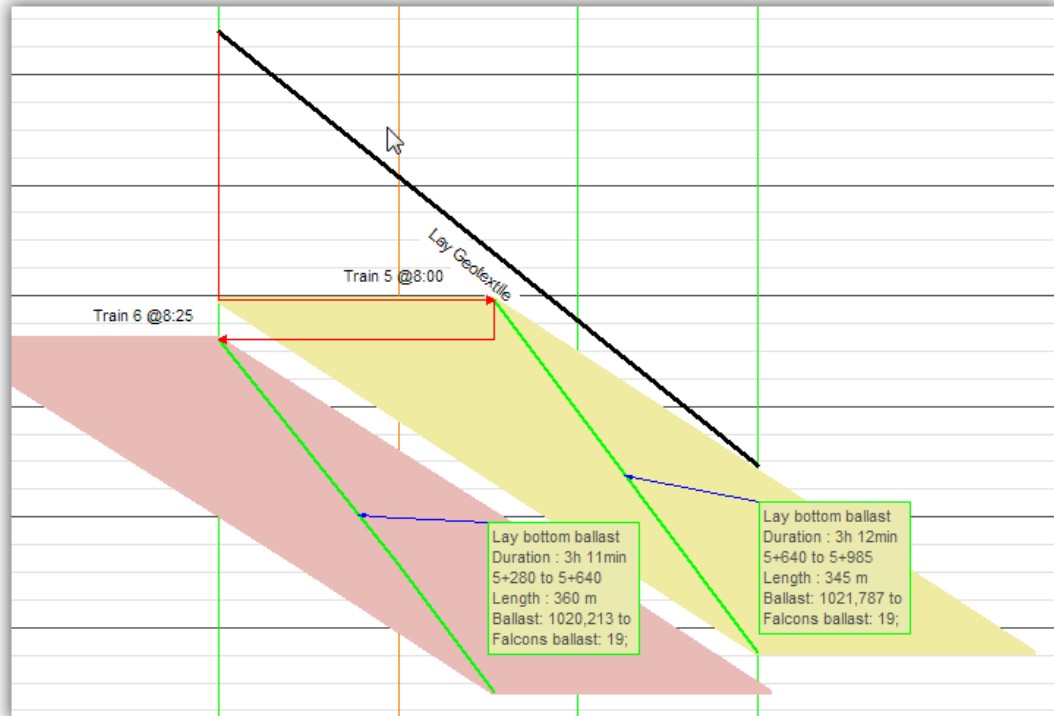
- 1 The **Excavation** is shown (see above) in grey and represented as a parallelogram.
- 2 The **Install sand** task has a **Start - start** link from excavation with the option keep distance (reflect shape). So it starts when the first sand wagons reaches section Cat 14.
- 3 Once the excavation is finished, the train still moves forward, but it is controlled now by the speed of unloading the sand. A special filler task has been added as intermediate task. Both the duration, and also distance coordinates are calculated based on the links from the "Install sand" task.
- 4 The sand wagons are added as parallelogram at the end of the train. This is also an intermediate task getting its duration from the 2 controlling tasks.

After the excavation, the geotextile is installed.

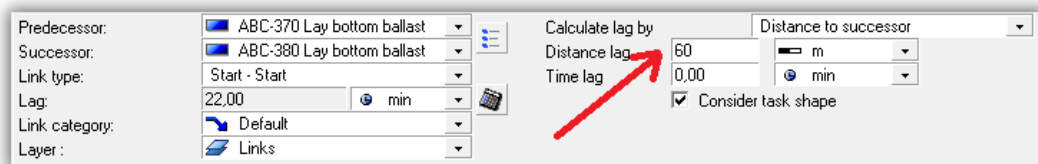


6.3 Ballast filling

Train 5 and Train 6 are distributing the bottom ballast for the sleepers.



The TILOS distance based link avoids any clash based on overlapping shapes representing the train inside the construction field.

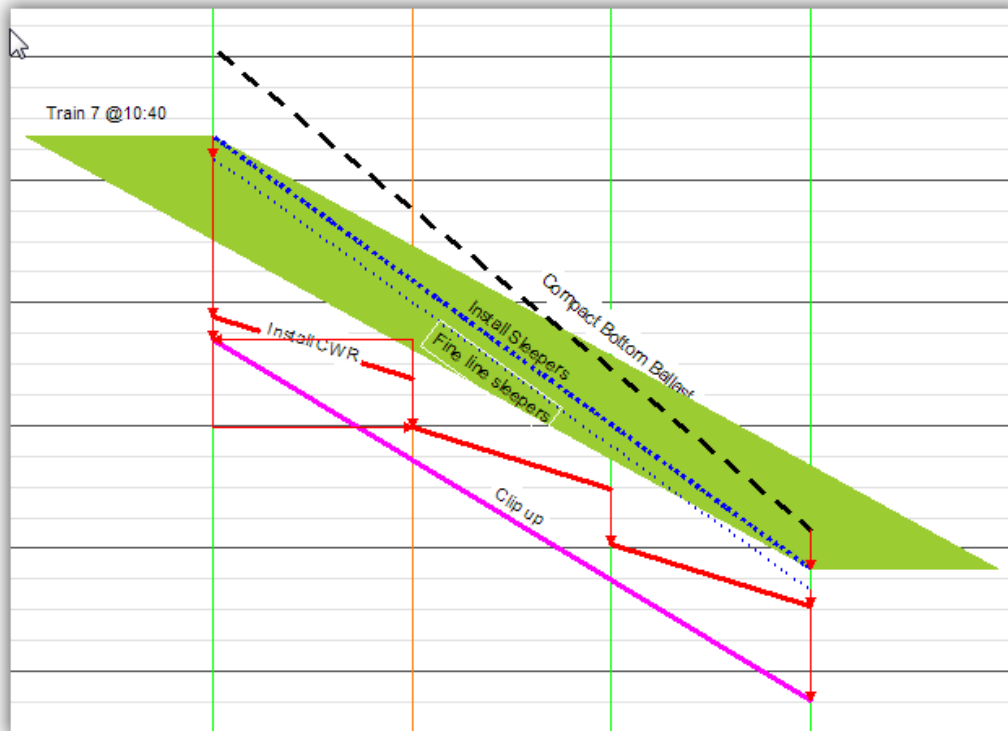


Based on the speed of each train and its position, a time gap for the cpm link is calculated to have a 22 minute delay in the start of Trains 6 so they do not overlap as they are both operating on the same track.



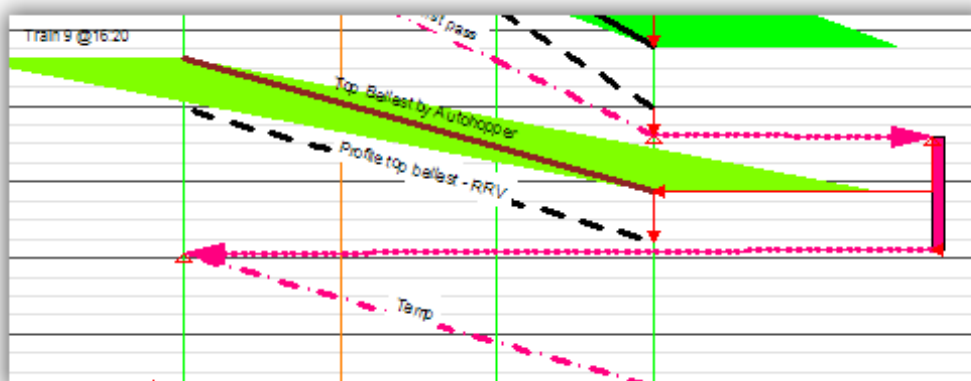
6.4 Track laying

Train 7 delivers the sleepers which are unloaded by excavators, installed and fine lined. The installation of the rails is completed in 3 parts with a waiting time in between. That is calculated based on the distance parameters to stay behind the sleeper crew.



6.5 Tamping

Tamping is planned for the high output. A special task showing the waiting sector of the tamper is added.

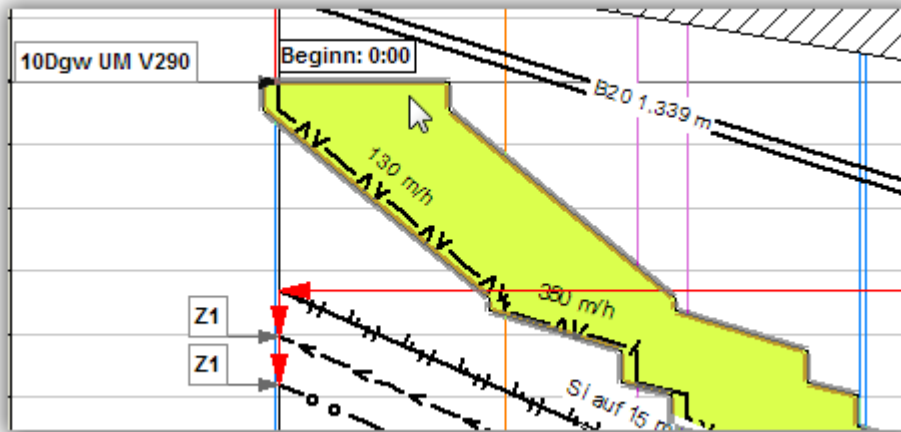




7 Resource Usage Plan

All resources needed to execute the tasks are already assigned to the templates and the consumption is calculated based on the conditions inside the project.

For each task, the resources are listed inside a text box that is attached to the tasks as required. Whenever resources change, the text is updated.

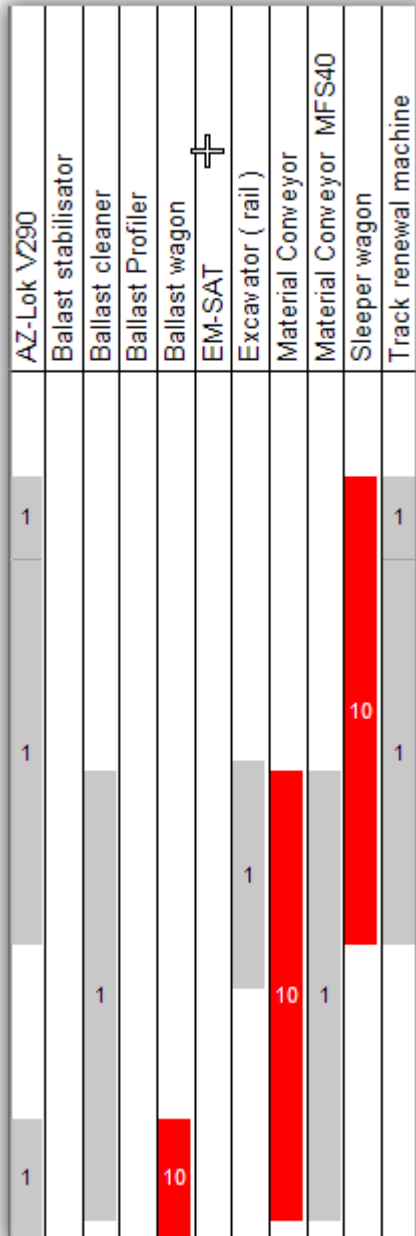


Various reports are available:



Resource usage bar chart:

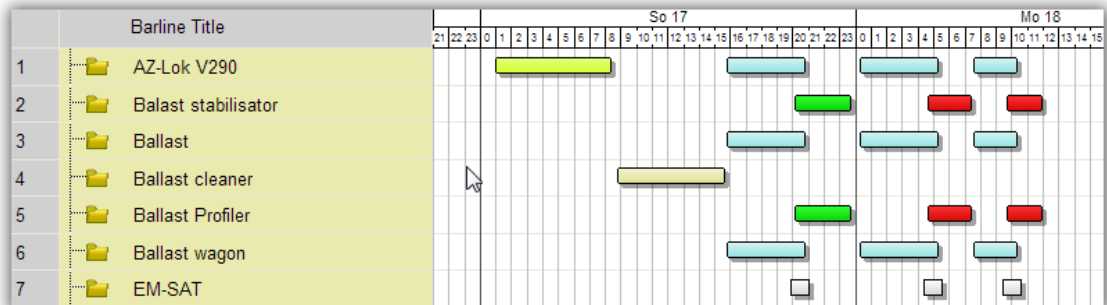
This diagram shows the usage of each resource as bar using different colors to show how many units are used at a time. This diagram is preconfigured parallel to the time axis in each view.



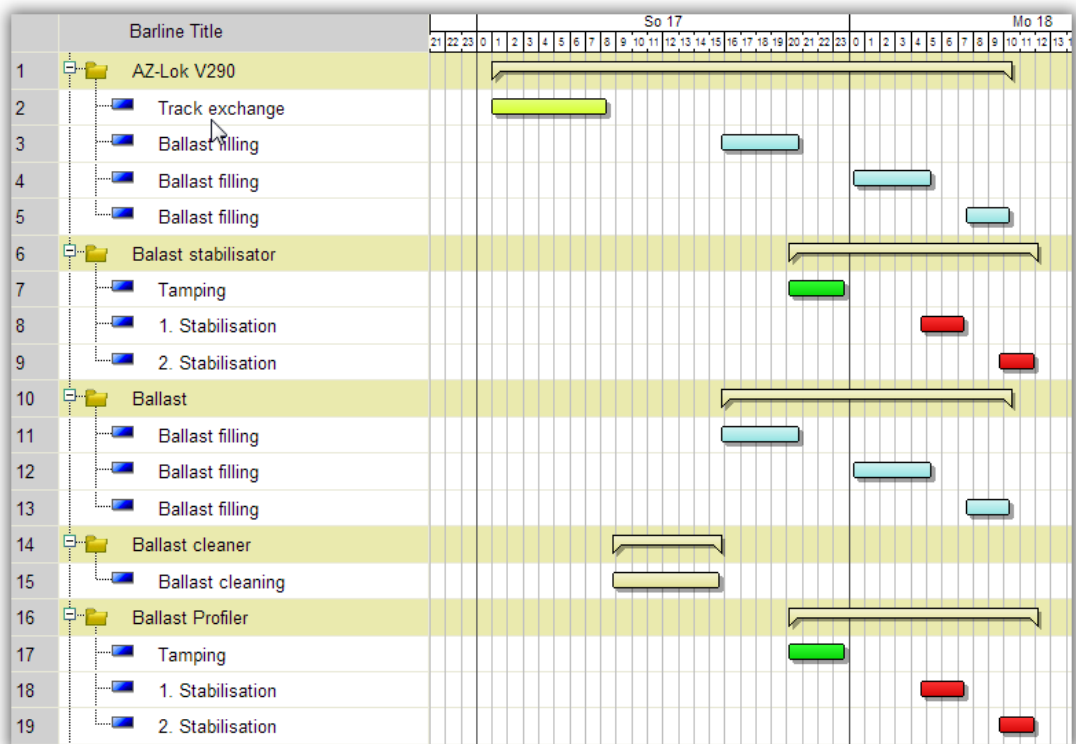


Grouped Gantt Chart (based on resource usage)

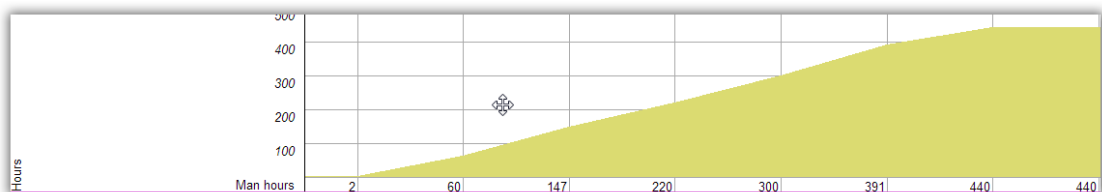
This Gantt chart shows each allocation of a resource as a separate bar inside a bar chart and is not simply summing the consumption like above.



In the single task per line mode, a summary is created for each resource and under this the allocation to specific tasks is shown.



In addition, standard S curves and other data can be shown.



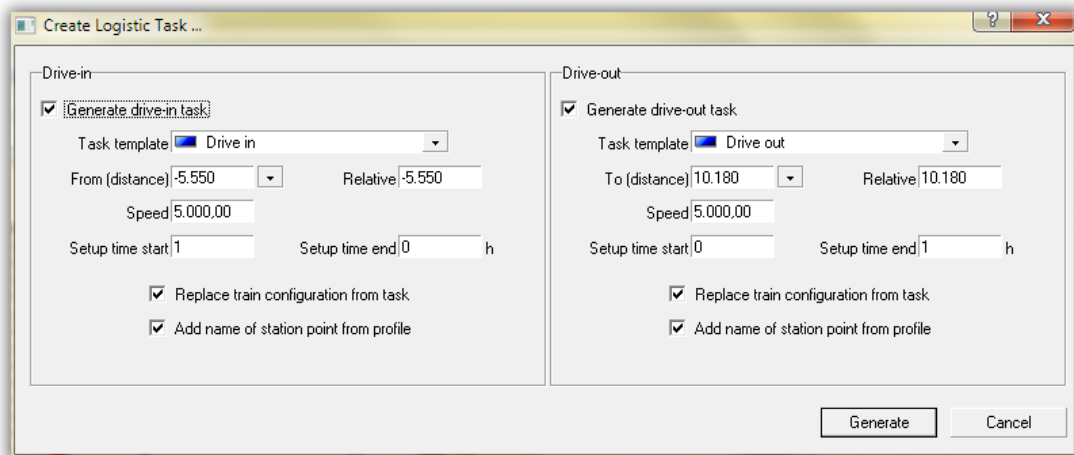


8 Train Logistic

During the construction period, trains are moved to the site and also have to move out to holding sites. As one train can't overtake the other, this needs special care. TILOS will calculate when a train needs to start from the holdings site where it is parked to be in time on site. The train travel times to and from holding areas are shown as tasks inside the time chainage diagram.

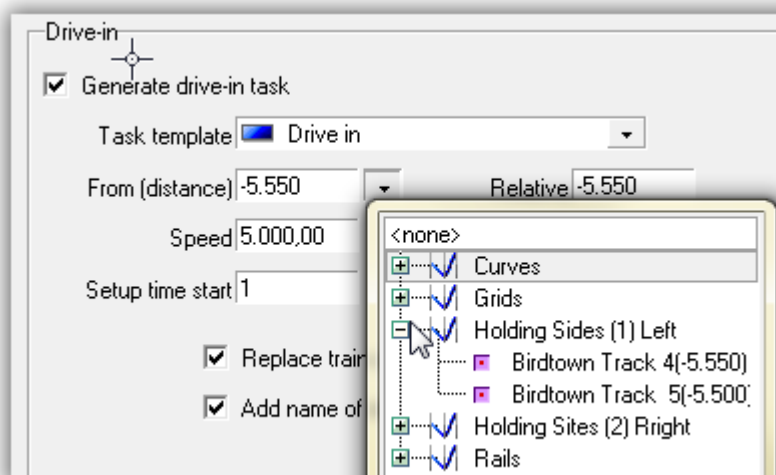
The following describes how to create these logistic tasks.

Select a task inside the TILOS plan and press the right mouse button: **Task Creation / Create Logistic Task.**



The drive in tasks will be calculated in a way so that the end of this task aligns with the start of the selected task. To calculate the start point, the following information is needed:

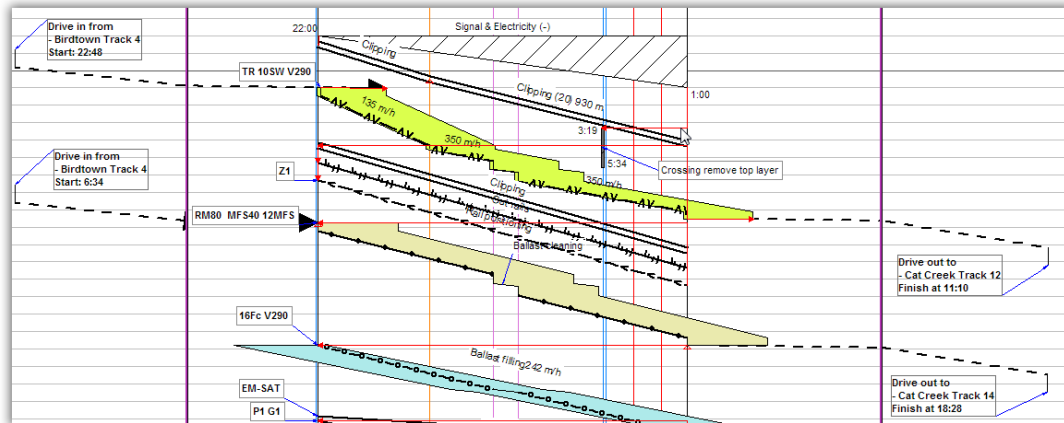
- Distance point or holding site where the train starts from.
- Driving speed, which can also be given as a profile (if it changes along the track).
- Setup time needed at the start or end of the drive in.





TILOS now generates the driving tasks and displays it in the time distance diagram. A special logistic view has been prepared, at the left and right side of the time distance diagram, shows the extra space for the train rides, This view shows the same sub project in 3 time-distance cells, but the outer cells a have different scale.

The links are modeled in a way, that if main task is changed, the driving tasks update themselves automatically, including start and end date as well as the resource configuration..



All train rides can also be shown in a sparate Gantt Chart..

Barline Title	Template name	Configuration	Start	Time	Fr 1S	Sa 16
1 - Birdtown Track 4	Drive in	TR 10SW V290	15.10	22.48	2122230	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0 1 2 3
2 - Cat Creek Track 12	Drive out	TR 10SW V290	16.10	8.33		
3 - Birdtown Track 4	Drive in	RM80 MFS40 12MFS	16.10	6.34		
4 - Cat Creek Track 14	Drive out	RM80 MFS40 12MFS	16.10	15.48		



9 Summary

TILOS is ideal instrument to plan and execute railway works for small and medium size projects. Typically, the work has to be done in short possession periods over night or over a weekend. In each shift the same kind of work is performed.

Being designed for planning repetitive work in linear projects, the work can be planned with a minimum effort on behalf of site data compiled into TILOS. This generates a layout plan but also directly affects the schedule setup times, reduced speed or move over (where no work is performed). It also leverages the quality of the planning as real quantities and site constraints are turned into a realistic plan.

After a short planning session, the feasibility of the project (if it can be done within the suggested possession) is clear.

The result is not just a drawing which you get using Excel or any other CAD drawing system, but it is a real project plan with material consumption and resource (labor and machine) utilization.

TILOS is also superior if you use standard project management software for this case and then export the data to generate TILOS time distance chart. In TILOS you have industry specific support functions designed for railways work planning and also special linking methods that are designed to avoid collisions of crews if parallel work is designed along a track (distance keeping). Clashes can be identified easy and interactively solved.

Finally TILOS has been proven in industry, based on its use in many rail construction projects, as the product of choice. We developed TILOS over the past decade and have consequently improved it based on working closely with our clients.

James Lyon from HDR Inc. in USA:

Before we started using TILOS, we were exclusively using Primavera P5 for scheduling. Getting information and updates for the P5 schedule were difficult and the engineers took little interest in helping us keep the schedule current as design unfolded. In other words, getting updates was like pulling teeth.

"TILOS transformed our engineers' attitude toward project scheduling from something extra they never had time for to a tool they "owned" and wouldn't go to a meeting without."

Geert Bijmolt from NACAP in Netherlands:

"I appreciate that the TILOS team continuously improves this application and also listens to the client for improvement, so please continue on this level."