

ORACLE PRIMAVERA P6 RESOURCE LEVELING FUNCTIONS

1 Introduction

Many contractors like to resource level a project schedule for a number of reasons but mainly to reduce resource demand to the available resources or due to limitations of a site such as accommodation limitations.

P6 has some Resource Leveling functions and this paper is an extract from my P6 book that explains how the P6 leveling functions operate.

2 Aim

The aim of this paper is to explain how to level a P6 schedule and focusing on the P6 Leveling Function.

3 Methods of Resource Leveling

After resource overloads or inefficiencies have been identified with Resource and Tables, the schedule may now have to be leveled to reduce peaks in resource demands. Leveling is defined as delaying activities until resources become available.

There are several methods of delaying activities to level a schedule:

- **Turning off Automatic Calculation and Dragging Activities.** This option does not maintain a critical path and reverts to the original schedule when recalculated. This option should not be used when a contract requires a critical path schedule to be maintained, as the schedule will no longer calculate correctly.
- **Constraining Activities.** A constraint may be applied to delay an activity until the date that the resource becomes available from a higher priority activity. This is not a recommended method because the delay of the higher priority activity may unlevel the schedule.
- **Sequencing Logic.** Relationships may be applied to activities sharing the same resource(s) in the order of their priority. In this process, a resource-driven critical path is generated. If the first activity in a chain is delayed, then the chain of activities will be delayed. But the schedule will not become unlevelled and the critical path will be maintained. In this situation, a successor activity may be able to take place earlier and the logic will have to be manually edited.
- **Leveling Function.** The software Resource Leveling function levels resources by delaying activities without the need for Constraints or Logic and finds the optimum order for the activities based on user defined parameters. Again, as this option does not maintain a critical path developed by durations and relationships, it should not be used when a contract requires a critical path schedule developed in this way. The Leveling function may be used to establish an optimum scheduling sequence and then Sequencing Logic applied to hold the leveled dates and to create a critical path.

The Resource Leveling function enables the optimization of resource use by delaying activities until resources become available, thus reducing the peaks in resource requirements. This feature may extend the length of a project.



The leveling function should be used by novices with extreme caution.

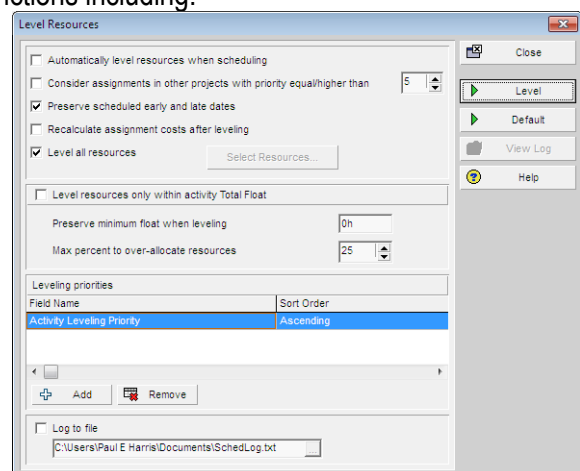
- It requires the scheduler to have a solid understanding of how the software resourcing functions calculate.
- Leveling increases the complexity of a schedule and requires a different approach to building a schedule. In principle, the sequencing logic is replaced by Priorities but a Closed Network should still be maintained.

Your ability to understand how the software operates is important for you to be able to utilize the leveling function with confidence on larger schedules. It is recommended that you practice with small simple schedules to gain experience in leveling and develop an understanding of the leveling issues before attempting a complex schedule.

4 Resource Leveling Function

This section outlines the software Resource Leveling functions including:

- **Level Resources** form,
- Leveling Examples, including Resource Shifts,
- Guidelines on Leveling, and
- What to look for if resources are not leveling.



5 Level Resources Form

The **Level Resources** form enables you to assign most of the Leveling prerequisites. Select **Tools, Level Resources...** to open the **Level Resources** form:

- **Automatically level resources when scheduling** – levels the schedule each time the schedule is recalculated and is not recommended.
- **Consider assignments in other projects with priority equal/higher than.** – levels resources and at the same time considers the demands of other projects. The leveling priority is set in the **Projects Window, General** tab.
- **Preserve scheduled early and late dates** – in simple terms, when unchecked enables the option of **Late Leveling**. This is explained in more detail in the following paragraphs as the computations are a little more complicated. **Late Leveling** pushes forward in time activities from their late dates to meet the resource availability and provides the latest dates the activities may be started and finished without delaying the finish date of the project.
- **Recalculate assignment costs after leveling** – is used with the resource **Effective date** and **Price/Unit**. These facilities allow a change in the cost of a resource over time. The Resource Costs are recalculated based on the resource **Price/Unit** if an activity is moved into a different price bracket when this check box is marked.
- **Level all resources** – if checked, the schedule levels all the resources; if unchecked, enables the **Select Resources** form to be opened and one or more resources selected for leveling.
- **Level resources only within activity Total Float**
 - When checked, the leveling process will not generate negative float but may not completely level a schedule. Thus, the activities will only be delayed until all float is consumed and leveling will not extend the finish date of the project. This option will also check the **Preserve scheduled early and late dates** option.



- When unchecked, leveling will allow activities to extend beyond a **Project Must Finish By date**, when assigned in the **Projects Window Dates** tab, or beyond the latest date calculated by the schedule and may create **Negative Float**.
- **Preserve minimum float when leveling** – works with **Level resources only within Total Float** and will not level activities if their float will drop below the assigned value.
- **Max percent to over-allocate resources** – works with **Level resources only within activity Total Float** and enables the doubling of the resource availability, although this new limit is not displayed in the histogram limits.
- **Leveling priorities** – sets leveling the priorities, and activities are assigned resources according to the Data item chosen in the first line. If two activities have the same value in the first line then the priority in the second line is used. The Activity ID is the final value used to assign resources. There are many options for leveling priority and the following are some to consider:
 - **Activity Leveling Priority** is a field that may be set from 1 Top to 5 Lowest; the default is 3 Normal. Those with a priority 1 Top are assigned resources first.
 - **Activity Codes** or **User Defined Fields** and many other data fields such as **Remaining Duration**, **Early Start**, **Total Float**, and **Late Start** may be used to set the priority for leveling.

6 Leveling Examples

Two simple examples can assist you in understanding how the software works:

- The first will allow the schedule to level with positive float, and
- The second will NOT allow the schedule to level with positive float and may generate negative float.



It is recommended that you set up a small schedule and try the various options until you understand what the software is doing and how it operates before trying your hand with a large schedule.

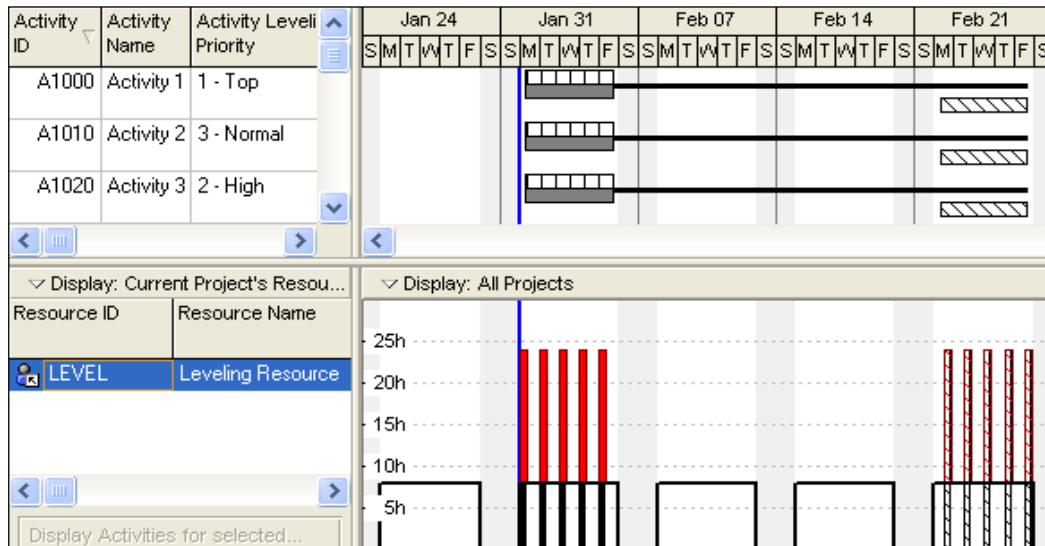
You should then look at leveling more complex schedules only after you have mastered leveling a small schedule like the examples in this paper.

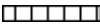




7 Leveling with Positive Float

The following picture displays the schedule unlevelled:

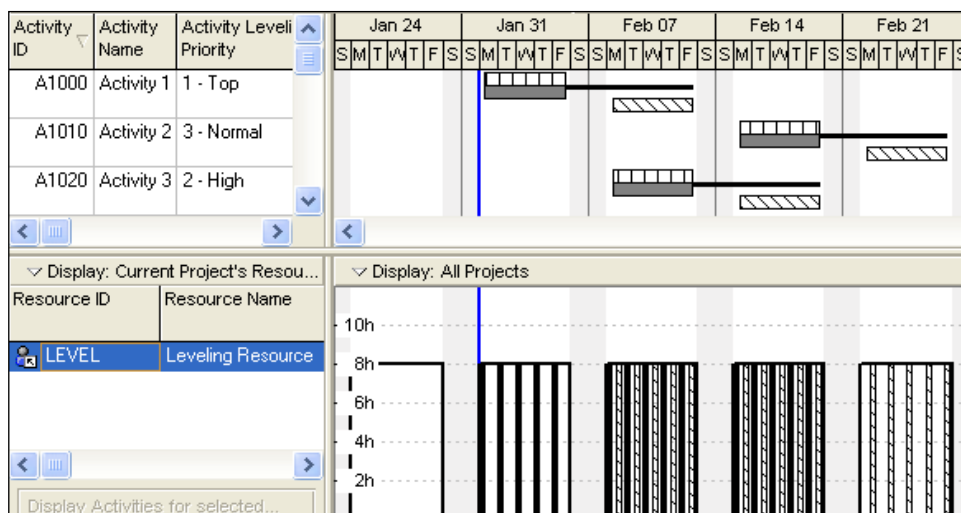
- A project **Must Finish By Date** of 27 Feb has been set.
- The histogram shows both the Early and Late resource histogram is overloaded.
- The bars displayed are the **Early**, **Remaining**, the **Late** and **Total Float**:



Early Bar – 
 Remaining Bar – 
 Late Bar – 

After Leveling with all the Leveling options off except the **Select Resource...** option:

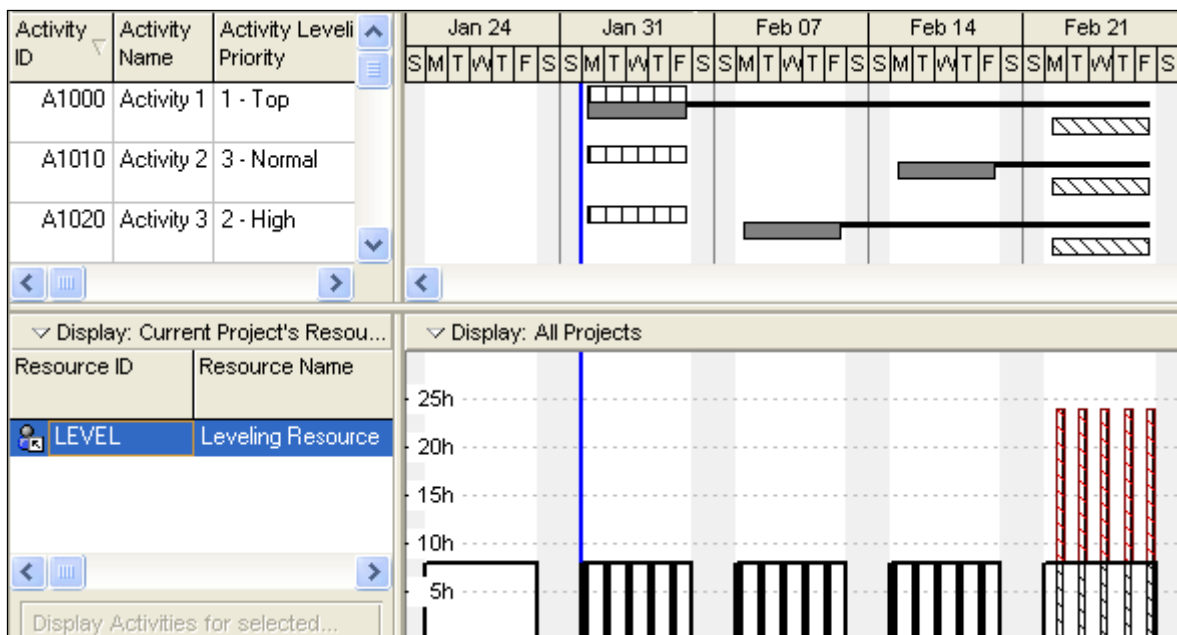
- Early and Late leveling has taken place and the Early and Late histogram are leveled.
- The Early and Remaining Bars have the same dates and are leveled.
- The Total Float is the difference between the Late and Early Finish and provides a similar result if there is a relationship between the activities.





With **Preserve scheduled early and late dates** option checked:

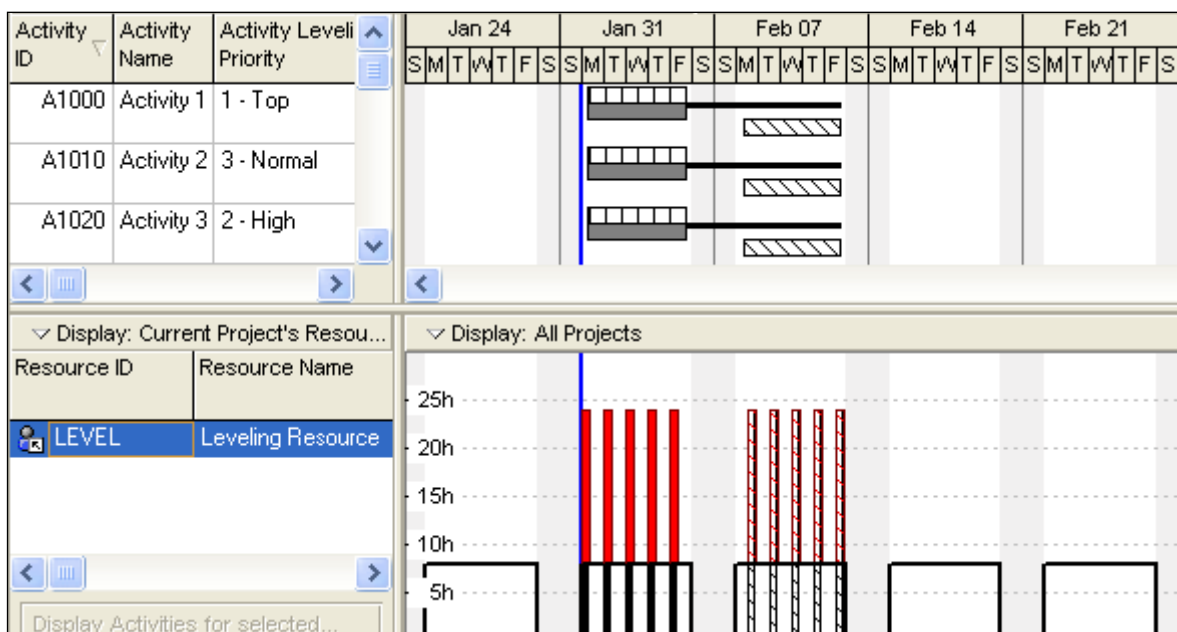
- Early leveling of the Remaining dates has taken place and the Early histogram is leveled.
- Late leveling has NOT taken place and the Late histogram is NOT leveled.
- The Early and Late Bar have NOT been leveled.
- The Total Float is the difference between the Late and Remaining Finish dates and provides a similar result if there is NO relationship between the activities.



8 Leveling without Positive Float

The following picture displays the schedule unleveled:

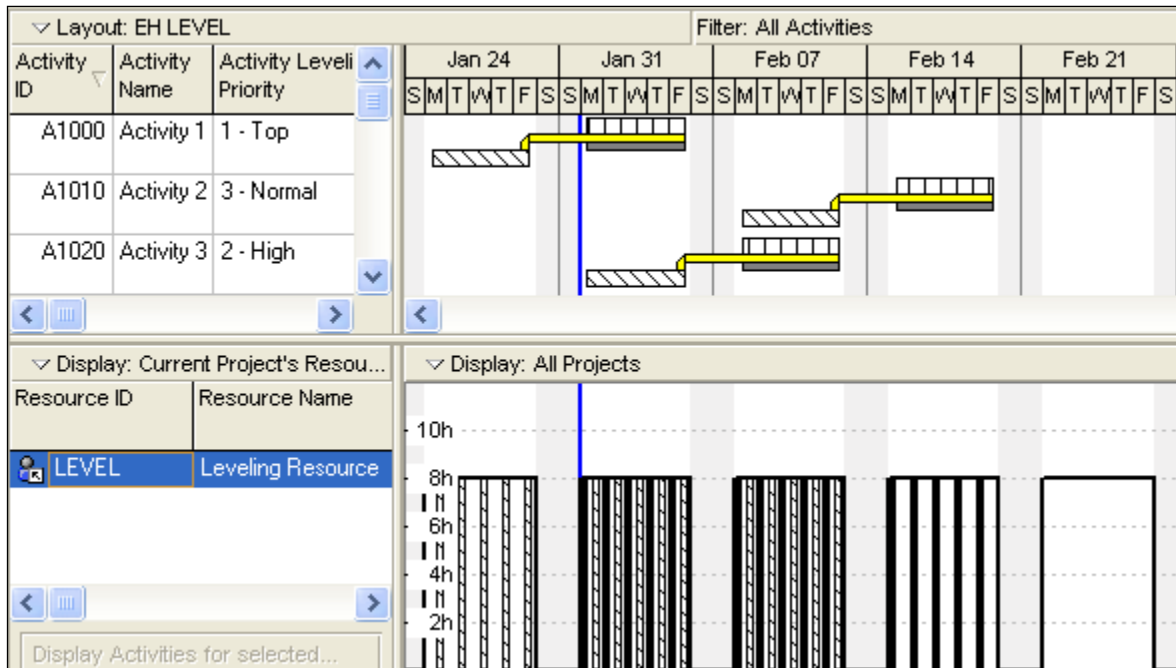
- A project **Must Finish By Date** of 13 Feb has been set.
- The histogram shows both the Early and Late resource histogram are overloaded.





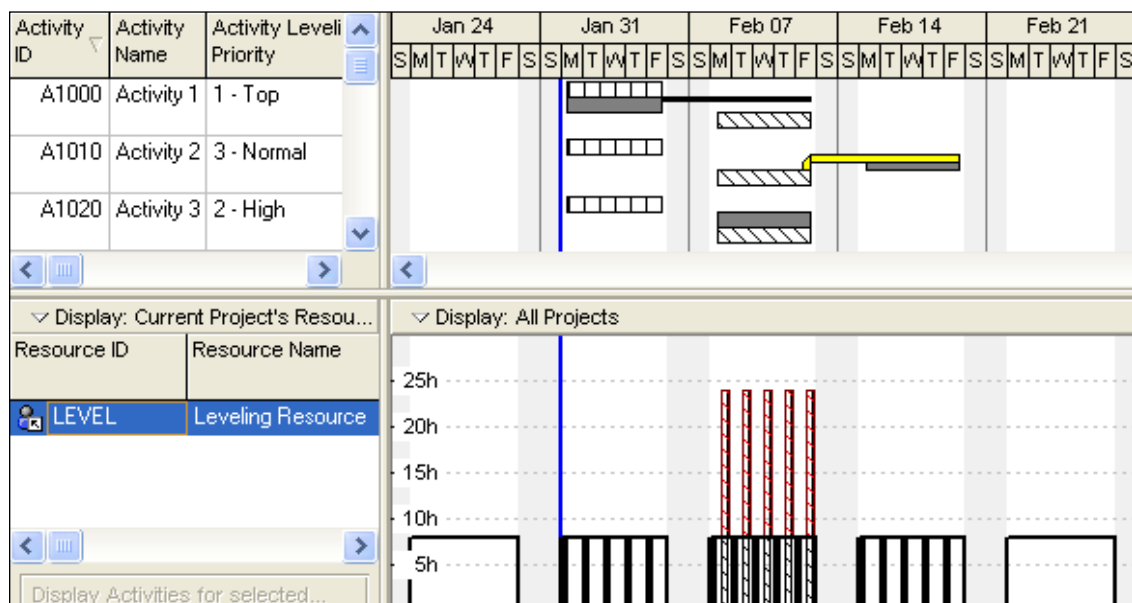
After Leveling with all the options off except the **Select Resource...** option:

- Early and Late leveling has taken place and the Early and Late histogram is leveled.
- The Early and Remaining Bars have the same dates and are leveled and Negative Float developed.
- The Total Float is the difference between the Late and Early Finish and provides a similar result if there is a relationship between the activities.



With **Preserve scheduled early and late dates** option checked:

- Early leveling has taken place and the Early histogram is leveled.
- Late leveling has NOT taken place and the Late histogram is NOT leveled.
- The Early and Late Bar have NOT been leveled.
- The Remaining Bar has been leveled and Negative Float developed.





With Preserve scheduled early and late dates and the Level resources only within activity Total Float option checked:

- Early leveling on the Remaining dates has taken place as much as possible without creating Negative Float.
- Activity 2 with the lowest priority has been left on the Data Date.
- Late leveling has NOT taken place and the Late histogram is NOT leveled.
- The Early Bar has NOT been leveled.

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