## Appendix E  Resource Levelling

Resource levelling is one if two special algorithms that project management systems perform, the other is scheduling.

When scheduling was discussed in the course the arithmetic was discussed in full. A command of base 10 addition and subtraction is required to understand it.  Resource levelling is a non-parametric polynomial incomplete problem.  That is far enough removed from adding up and taking away as to make any explanation suitable only for a mathematics journal.

This gives us two problems:

Performance - this problem has been resolved by the sheer horsepower available in modern computers. Resource levelling requires an iterative approach, many alternatives are usually tested and this requires a lot of CPU power. Resource levelling 10,000 activities on an 80286 based computer was an overnight run!

Trust - You can check the schedule by hand.  If you tried to verify the results of a resource levelling run by hand the project would be over before you got through the first pass of the maths.

The Trust issue is compounded by the Two Great Untruths of resource levelling:

Resource levelling is P6 doing the planning for you – This is no more true than Scheduling is doing the planning for you,  the planning STARTS after you have levelled – it is just another tool, like scheduling, that helps THE PLANNER make decisions.

Once you start Levelling, you are stuck with it - this was true for some early versions of MSP.  In every version of Primavera software pressing F9 to schedule the plan is a complete "Undo" for levelling.

Resource overloads in a project are at best expensive, and in an offshore environment if the resource that is overloaded is Beds - an overload is illegal.  They are unquestionably bad business. We should have none in our plan. We want to align the Projects Controls department to the business needs of the company, and be seen as good for business, not an overhead.

Open the project  ACS New One-Levx and open the layout ACS Resource levelling.
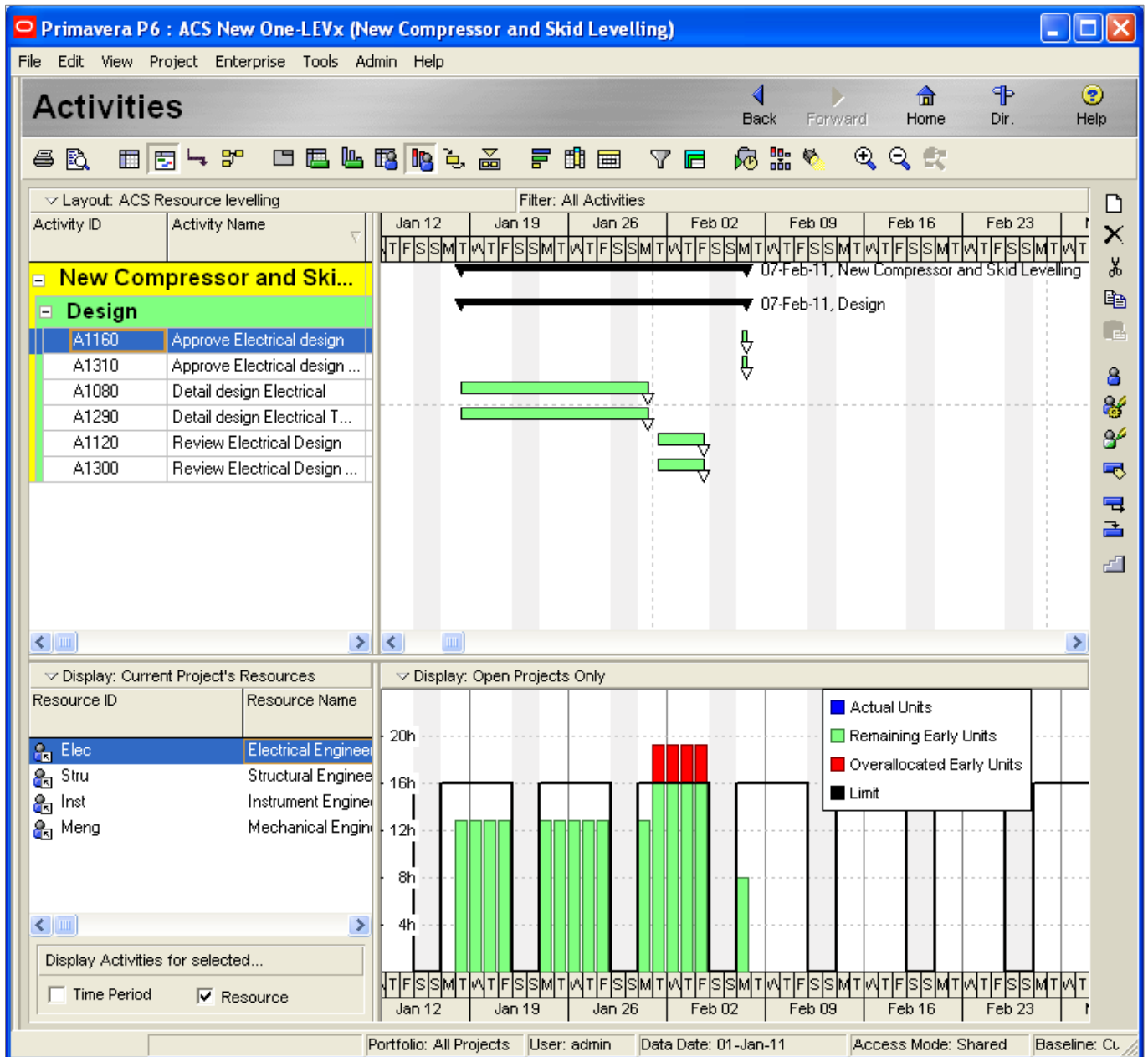


The Resource check box is ticked at the bottom left of the screen, so only the Activities that use Electrical Engineers are filtered

The Group and Sort dialogue has Hide if Empty ticked, so we do not see empty WBS bands in the columns area.

The timescale is set to Week/Day1 – this allows us to see the overload. Set the timescale to Month/Week and the overload "disappears". This illustrates an important point about granularity. How granular we examine resource requirements over will vary from project to project, and largely by our classical type of project. For example – in a turnaround if I need 24 electricians between midnight and one o'clock and none for the rest of the day, my daily average requirement is one, and there may be no "red bits" on the histogram. However if we viewed the histogram by hour rather than day we would have a very different picture.

We need to be complete clear about where the availability line in the above histogram comes from. There are two components from the Resource Dictionary that together set the availability of every resource:

Chose Enterprise : Resources. Select Electrical Engineers, and click the details Tab:
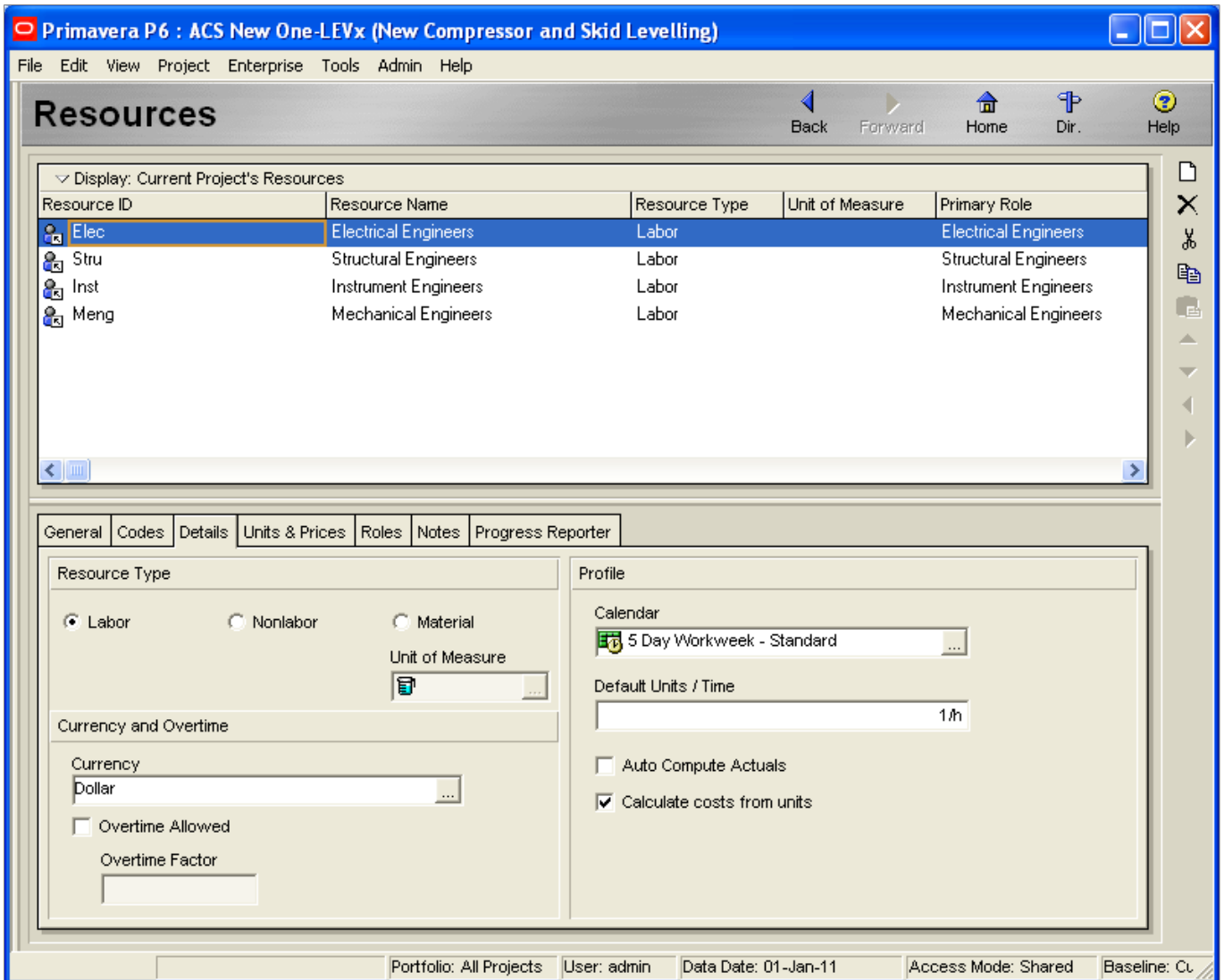


The Resource Calendar – here the standard 5 day Workweek – defines which time periods of the week the resource is available. The Units and Prices Tab:
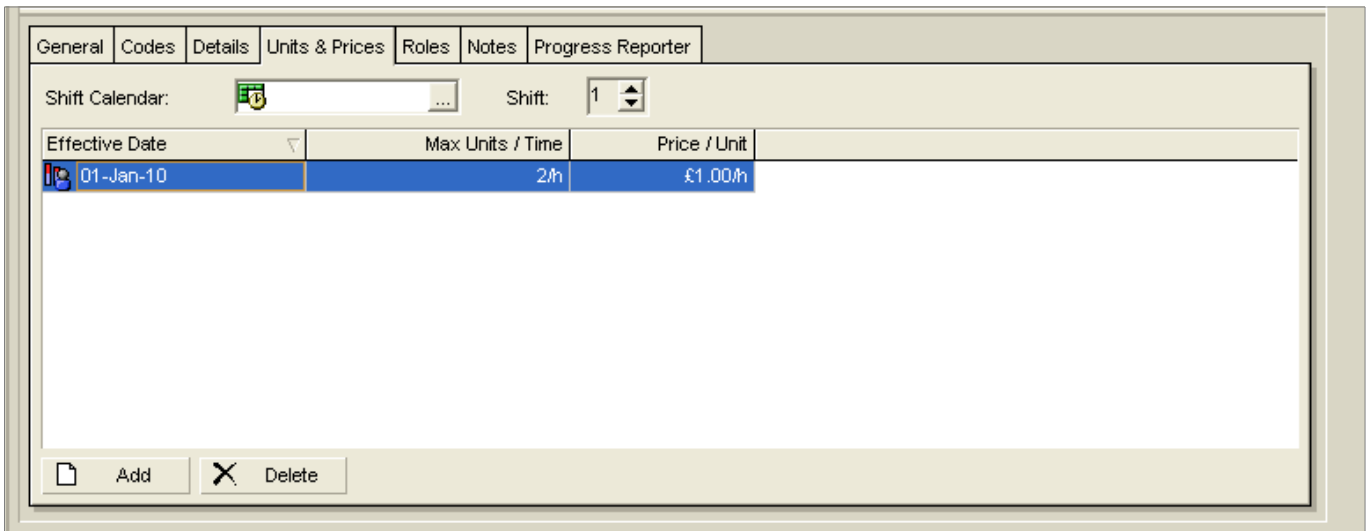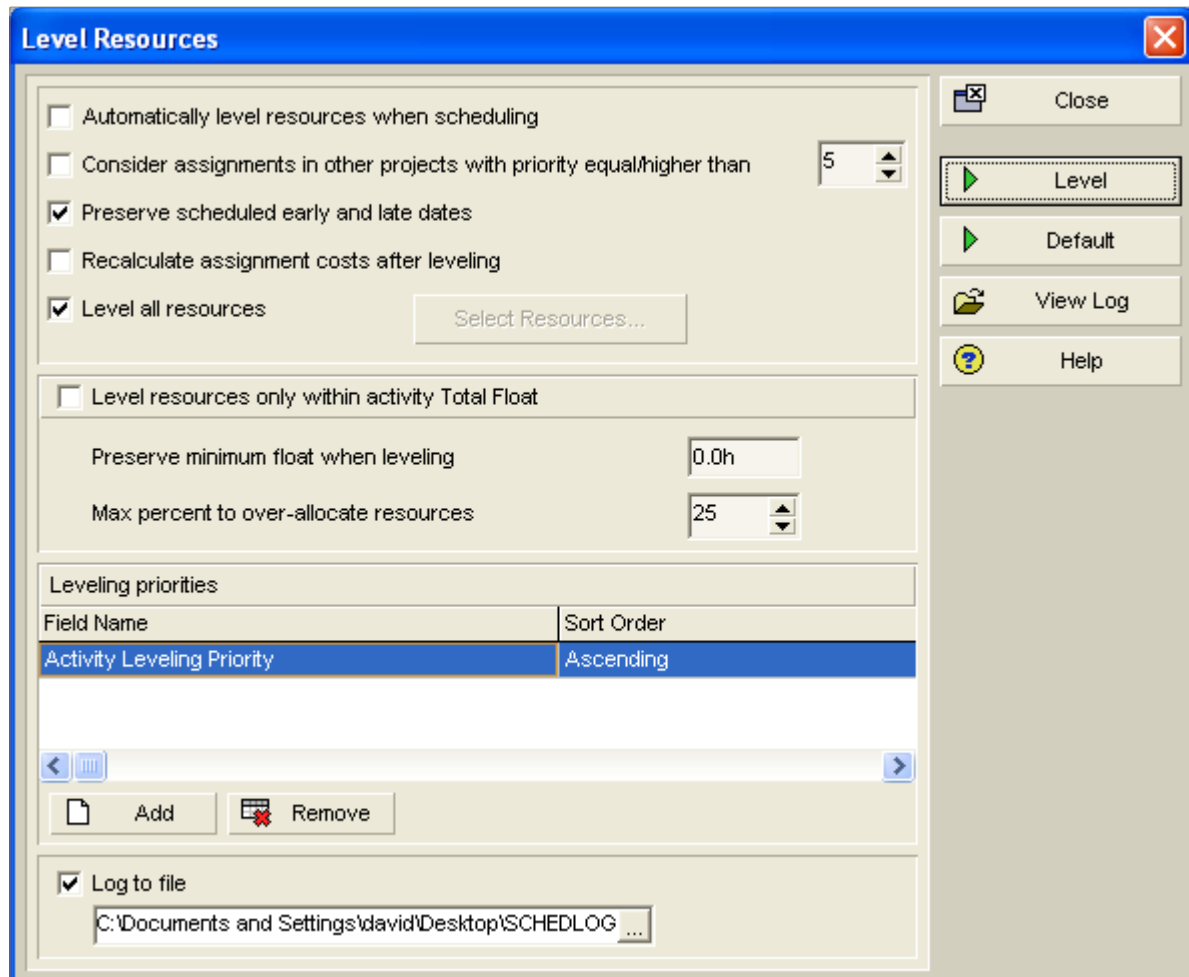


Defines how much of the resource is available.

So every hour we have 2 Electrical engineers available, for those hours that the calendar describes as Working.

Hence the value of 16h on the left hand axis of the histogram.

In order to Level the Resources, select shift-F9, or select Level under the Tools menu:



**Automatically Level Resources when Scheduling.**

Most planners leave this off.  It can be useful if the project is very large, and the corporate infrastructure very slow – if it takes P6 two minutes to schedule, ten five minutes to write the data back to the server, two minutes to level and then another five minutes to write the data back to the server it is very tempting to tick this box and only read and write the data once.

**Consider assignments in other projects with priority equal/higher than**

This is a most interesting and potentially challenging question. We have a single resource dictionary that fulfils the resource requirements for all projects, and we currently have only one project open. What about the other projects that need Structural Engineers?

The offshore environment provides the simplest solution – open all the projects that are happening on a single offshore location, and level them together there will be practically no resources shared with other locations, so this question has practically no impact.

The onshore design office FEED project environment is more demanding here. We may have fifty projects for several clients and a not-quite-dedicated  group of engineers servicing each

client/project. This is more of a political than technical issue if we open ALL of the projects that use an exclusive subset of our single resource dictionary, and level them together.

If we have projects not open, that use some of the resources that we need and those projects are selected for consideration by the priority criteria, then the resource assignments in those projects act as a debit from the resources availability. i.e. the closed projects have absolute priority for the resources. The priority value is on the General tab of the Projects screen.

### Preserve Scheduled Early and Late dates

Hard to imagine any circumstances that I would not want this option checked. With this option checked the dates that the levelling process updates are the Remaining Early Start & Finish plus the Remaining Late start & Finish.

### NOTE

**Date based filters e.g. the next 90 days, should be based on Remaining Early dates, NOT Early dates. This makes the filter work for projects that are scheduled or levelled.**

### Recalculate assignment costs after levelling

If an activity has been delayed by the levelling process, and that makes it more expensive, it is hard to imagine why this would not be essential information. This box should be checked.

### Level all resources

Hard to make a definitive call here. Maybe not, for example if we have materials that we are installing as a resource, there is no real penalty if we install 200m of cable one day, none the next, and 200m the day after.  I can probably hire equipment by the day so I might not level non-labour resources. But if all our resources are labour it is easy to make an argument for levelling them all.

### Level resources only within activity Total Float

This is the big button.  If we tick this option, then the levelling process can only move an activity by the amount of total float it has. Effectively we are saying that the project finish data calculated by the scheduling process cannot be exceeded, even if that means there are still resource overloads.

If we leave this tick box unchecked, then an activity can be placed beyond its late finish date.  If any activity is placed beyond its late finish date then the project will finish beyond its calculated early finish date. The levelling process does not change the topological order of the relationships.

Many planners characterise these two choices as "Resource Limited" and "Time Limited"

**Note: In a world where we are not given enough time and not given enough resource to complete the work scope, typically nether of the above options gives us the answer the Boss would like! Many iterations may be required to get an acceptable answer. A popular technique is to only run the time limited option (i.e. tick the Level resources only within activity Total Float box) BUT change the project-must-finish-by date in the Projects screen under the date tab and reschedule. That changes how much float the resource levelling process has to play with.**

**Preserve minimum float when levelling + Max percent to over allocate**

These option only apply in a time limited level.

**Levelling Priorities**

If there is not enough resource available for all of the activities that could be started, these are the rules that determine which activity starts and which are delayed.

There is a field Activity Levelling Priority in P6 which has five values. But any Project Code or Activity code can be used here. In the absence of an agreed coding structure the accepted standard is to use Late Finish, with a tie break of Total Float.
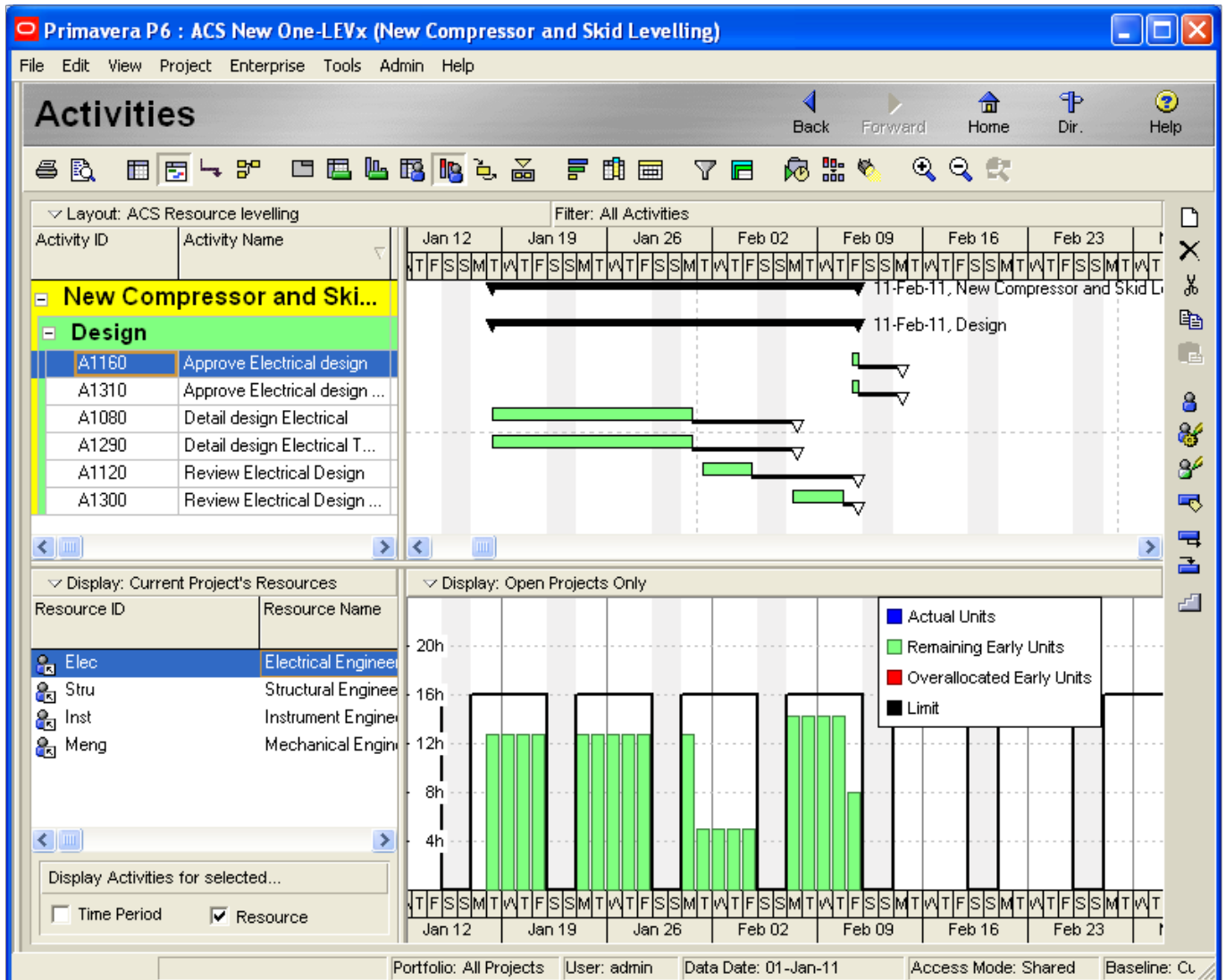
We should set our parameters as follows:

When we press level:



Remember, if you press F9 to schedule the plan, you completely undo all of the results of the levelling process. It is completely safe to try and level, and undo the results at any time by scheduling.