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Resource Planning for Primavera Enterprise

By Andrew Dick

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+61 4 3455 9156

andrewdick@optusnet.com.au

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SCOPE

This document establishes basic schedule benchmarks which will allow for the construction of schedules and subsequent analysis of scheduled resource requirements at various levels of an organisation using Primavera Enterprise version 5.0 SP3.

BACKGROUND

In the modern project environment it has become increasingly important to monitor the progress and costs of projects, also, the quantity of resources available to an organisation executing projects is of great importance to not only provide an indication as to the success of projects currently being executed, but for future business and potential capacity for the organisation to take on more work.

Resource leveling is the process that ensures resource demand does not exceed resource availability, by moving activities in time, preferably without breaking the inherent logic, therefore enabling the organisation to predict the level of work they can comfortably bid and tender for in the future based on their incumbent resource pool.

The approach to resource leveling will depend on whether resources are dedicated to a particular project or shared across several projects and whether there is a need to keep all resources fully utilised.

Resources include the personnel and equipment that are used to execute work on activities across all projects. Personnel resources are generally reused between activities and/or projects, and as such can become critical to the performance of certain activities due to conflict on their usage.

Disregarding factors such as economic considerations, if sufficient resources are available so that supply always exceeds demand then, we should have no problem. However, the most likely scenario is that, at some point, demand will exceed supply.

The process of scheduling resources based on availability provides the following benefits:

- If project delay is unacceptable, it allows sufficient time for considering alternatives such as cost-time trade-offs and changing of priorities.
- Provides information to prepare time-phased work package budgets within the current resource availability of the organisation.
- Enables project managers to determine their options regarding resource availability and the effect on project outcomes.

Another key benefit of resource leveling, is realised when the project is considered to be of a parallel nature, where similar activities can be run in parallel but require the same resource, like common assembly steps performed by a finite labor type. The resource leveler will reschedule the dates of these activities so that the resource loading is maintained within the capacity of the group.

The pool resource scheduling process can also provide diverse levels of visibility of the current and future capacity of an organisation to execute projects. Using the basic schedule structures in this document it will be possible for the planners to provide information relating to resource availability tailored to suit the following organisational levels;

- GM/COO
- Marketing/Sales
- Divisional Operations
- Project
- Departmental

OBJECTIVES

Section 1 will cover a set of basic benchmark structures to enable both schedule development & resource scheduling. Further development of these ideas can be carried out by the individual Planner/Scheduler to suit their own project environment.

Section 2 will provide a basic set up & description of the process for Resource Leveling in a Primavera Enterprise version 5.0 SP3 project environment, discussing system settings related to both time critical and deadline critical resource analysis.

SECTION 1

SCHEDULE FOUNDATION STRUCTURES

Project schedules require certain underpinning structures on which they are built. These structures provide the necessary foundation for the remainder of the schedule data. They also provide the appropriate structures from which to both monitor & control the project during its lifecycle.

WBS – Work Breakdown Structure

Is a, “Product-oriented ‘family tree’ division of, hardware, software and services to be accomplished during performance of a program”.

The WBS subdivides the total work scope into units of work, and provides a common basis for reporting.”

The Contracting authority usually delivers a summary or CWBS, (Contract Work Breakdown Structure), which is detailed to a level that meets their needs for visibility into the bid price and eventually performance reporting.

The Prime contractor can do one of the following with this;

1. Accept this structure as the basis for the PWBS (Project Work Breakdown Structure), or
2. Propose changes to the CWBS,
3. Map to the CWBS but build an independent PWBS for internal use, &/or,
4. Assign an element of the WBS to a partner/subcontractor for their further action.

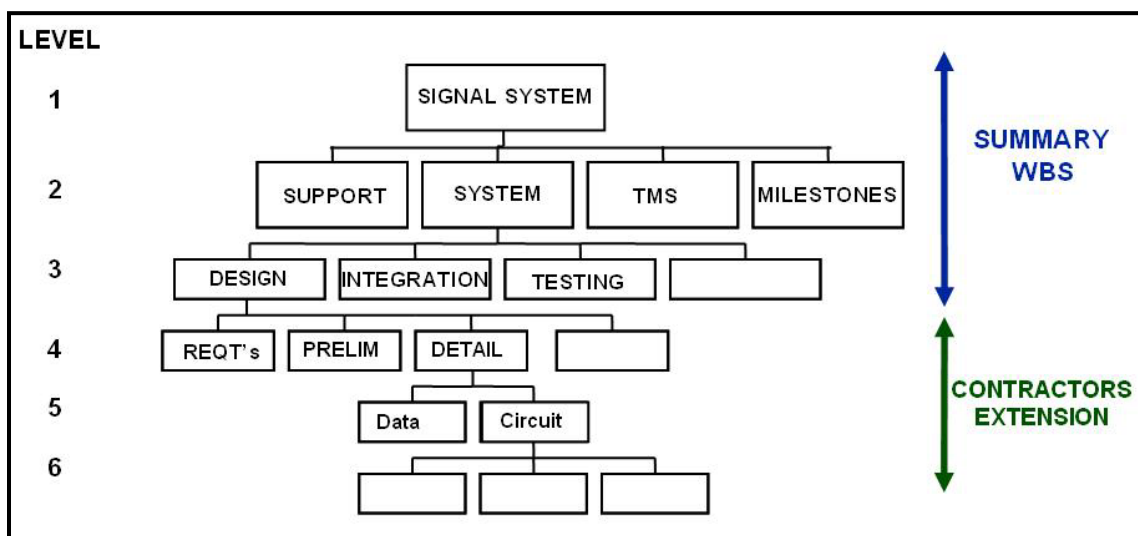


Figure 1 – Work Breakdown Structure

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OBS – Organisational Breakdown Structure

An OBS is defined as a 'hierarchical tree-structure' representational of the organisation responsible for executing the project.

The 'branches' of the OBS are extended until there is a single organisational unit or manager that can be assigned to the elements of the WBS. This is the point where the Control Accounts are created.

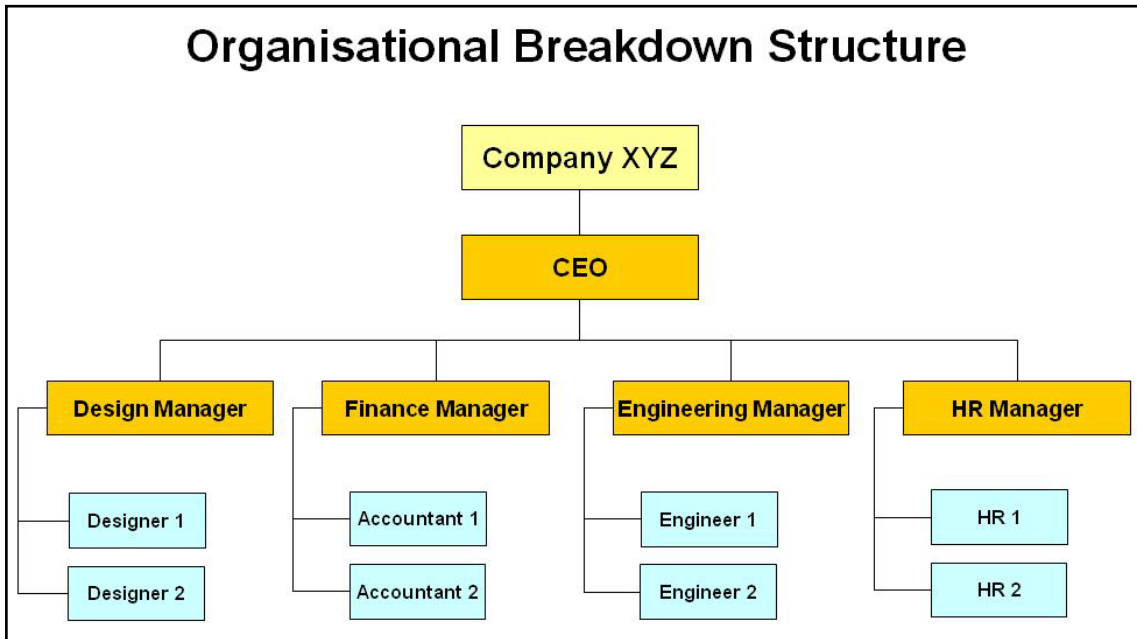


Figure 2 – Organisational Breakdown Structure

Control Accounts

Control Accounts are derived from the use of a matrix created from the WBS and the OBS. See Figure 3.

The control accounts are used to provide summing points at which an individual manager or department may control & monitor both project costs & project performance.

Control Accounts once established, are further broken down into Planning Packs during the initial planning on a project, and then these Planning Packs are broken down into Work Packs during the detail planning phase of a project. This method is especially prevalent where rolling Phase or Rolling Wave Planning is used to progressively elaborate the work scope of a project.

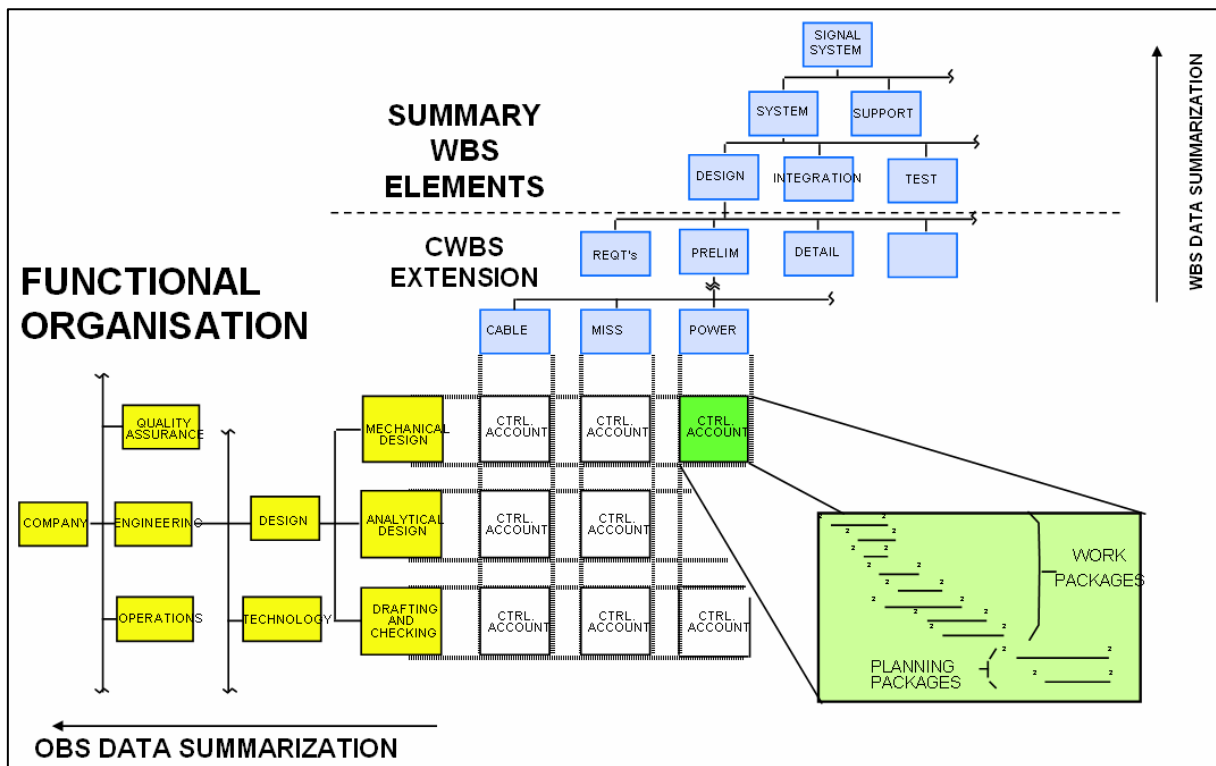


Figure 3 – Control Account Matrix

RAS – Role Assignment Structure

Primavera has both resources and roles as part of its foundation structures. While resources are the physical people and consumables used to execute the work, roles are used as a method of separating like resources, to allow for different individual skills or protocols to be assigned to those resources.

If you consider the structure of the RAS in correlation with that of the RBS you can essentially build both structures in synergy.

When constructing the initial project schedule, the Planner/Scheduler may assign roles to activities based on the resource type or skill set that will be required to execute the work, this is especially beneficial when it is not known who the person or department is that will execute the work

When considering the structure of the RAS, it is suggested that you build it based on a hierarchical structure, which can be grouped by department and then broken down into the skills required to execute the project. This method will allow Primavera to sum the role availability for display on the histogram views.

Figure 4 portrays a basic RAS.

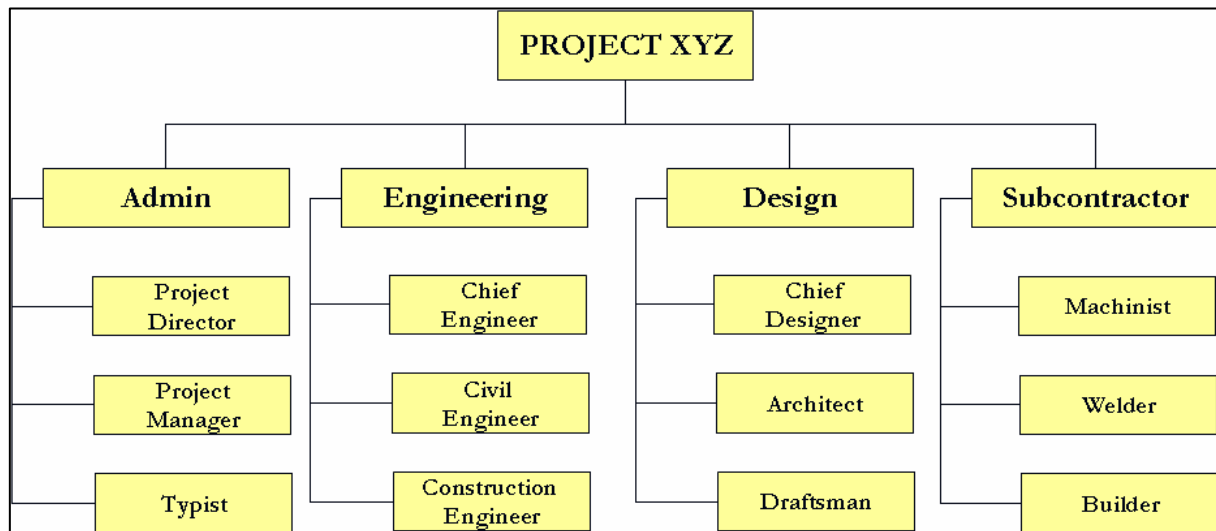


Figure 4 – BASIC RAS

NOTE – When assigning roles to resources the availability line displayed for the Role Histogram is equal to the summed total of the availability of all resources which have that role assigned; this will include pool resources if they have these roles assigned.

If it is the intention to fully utilise Pool Resources in future planning, by using the 'Assign By Role' function, it may be prudent to assign roles to the pool resources so that this function will be operable. *This method however, will cause the availability line on the role histogram view to portray inconsistent data due to it also including pool resources in its calculations.*

RBS – Resource Breakdown Structure

The Resource Breakdown Structure (RBS) is defined as;

- A standardised list of personnel resources related by function (role) and arranged in a hierarchical structure.
- The Resource Breakdown Structure standardises the departments' personnel resources to facilitate planning and controlling of project work.
- It defines assignable resources such as personnel, from a functional point of view; it identifies "who" is doing the work.

The summed total of the resource pool defines the Top Level, and each subsequent level is a subset of the resource category (or level) above it. *E.G. – If you have 5 engineers, the resultant engineer pool resource will have a summed availability of 500%.*

Each descending (lower) level represents an increasingly detailed decomposition of the resource pool, and can also be assigned as a more detailed pool resource once a greater understanding of the requirements of the activity is understood.

Pool resources can be used to resource level the schedule and provide predictive analysis of the resource loading required to execute the project.

Figure 5 outlines a basic RBS for a company executing projects across 3 divisions. For simplicity only one divisional leg has been broken down to a basic depiction.

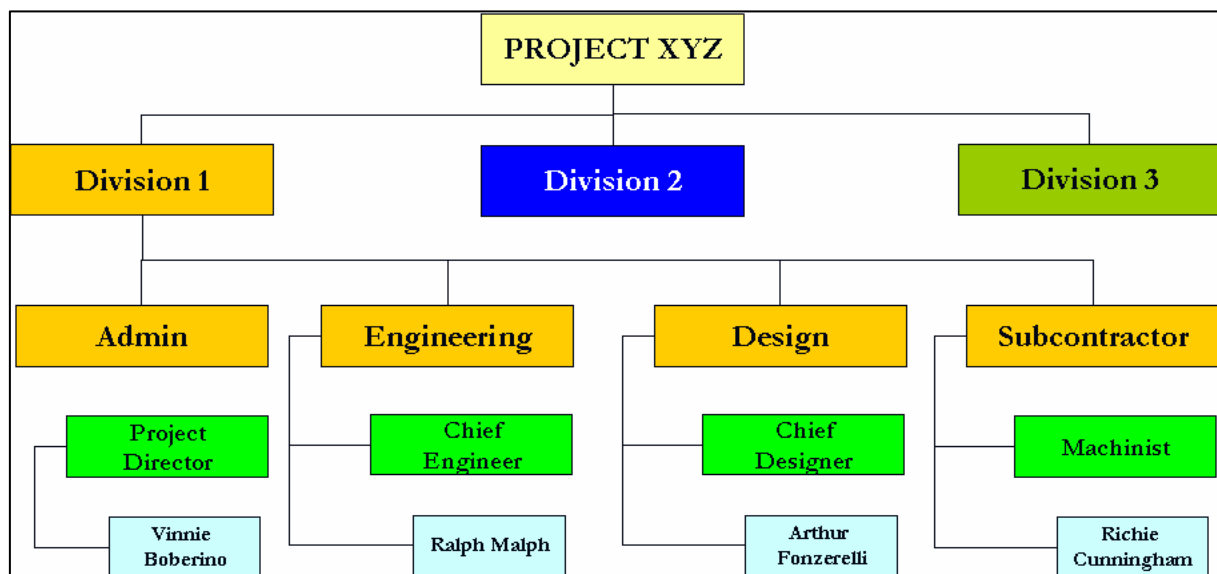


Figure 5 – Basic RBS

It is also recommended that you create a standard generic or planning set of resources to enable you to modify the resource Max Units/Time whilst carrying out predictive resource analysis.

*These generic planning resources should be created as Non-Labour resources, and created on a separate node of the RBS. (NOTE – Planning resources should be replaced by pool resources at the conclusion of initial resource analysis prior to the commencement of the project, and should **not** be included in the Performance Measurement Baseline, PMB.)*

SECTION 2

RESOURCE LEVELING

Resource leveling is described as; a project management process used to examine a project for an unbalanced use of resources (usually people) over time, and for resolving over-allocations or conflicts.

The ideal scenario is to have a structured workforce being shared across several projects and the workload is then smoothed to be reasonably consistent against time with respect to the current resource availability.

When using specially designed project software, leveling typically means resolving conflicts or over allocations in the project plan by allowing the software to calculate delays and update tasks automatically. Project management software leveling requires delaying tasks until resources are available, usually at the expense of one of the traditional triple constraints (time, cost, scope).

The most difficult piece of information a planner/scheduler will ever have to explain is that due to resource leveling a later project finish date may be the result if the tasks affected are in the critical path. Project Management is innately unsympathetic to hearing this information and as a result they often tend to reject these cold hard facts.

With this in mind consideration needs to be given to the type of leveling that you will carry out on your project. It is also recommended that you document your assumptions and all decisions that are made so that you can benchmark the process that is chosen for leveling all future projects.

General resource leveling considerations

The 2 basic methods of resource leveling are;

1. **Deadline Critical Leveling**

In this case emphasis will be placed on completing the project within a specified time. This time will usually have been determined by network analysis. Adjustments in the timing of any activity, and the resources required at a given time, must be undertaken within the activity float available. *N.B. There can be no adjustment of activities which are on the critical path.*

2. **Resource Critical Leveling**

In this case the project must be completed with the resources available even if this means extending the project duration. If the total resource demand exceeds the resource availability at any time then some of the activities must be delayed until there is sufficient resource availability.

Primavera Enterprise Considerations

Primavera Enterprise Resource Leveller

As a result of the standard operating method of the Primavera Resource Leveling Engine, the initial effort of analysing a schedule for resource loading can become somewhat cumbersome, especially if individual (people) resources are assigned to activities.

To enable progressive elaboration of the resource requirements on a project, the use of Parent (*Pool*) Resources is recommended; so as to provide for an adaptive schedule which, when used in conjunction with *Rolling Wave Planning Techniques*, will provide a robust framework in which to carry out future planning and control of project resources.

Schedule Elaboration

Utilising the RAS and the RBS during the initial construction of a project schedule the planner can initially apply roles (skills) to the activities in the schedule. Ongoing stages of schedule planning will allow the application of resources either manually or by using the 'Assign by Role' function.

Resources should initially be applied at the highest level of the relevant RBS branch, & during the ongoing phases of schedule elaboration, pool resources will be assigned at ever increasingly lower levels of the RBS, with the ultimate goal of reaching the lowest level of the RBS.

This process of progressive elaboration can be achieved using 'Rolling Wave' planning theory.

The Rolling Wave Planning technique is explained as follows;

Rolling Wave planning is a form of progressive elaboration of the project schedule where by the work to be accomplished in the near term is planned in detail at a low level of the WBS, while work in the far term is planned at a relatively high level of the WBS. The detailed planning of the far term work is progressively accomplished within two or three reporting periods of the current date. See Figure 6 below.

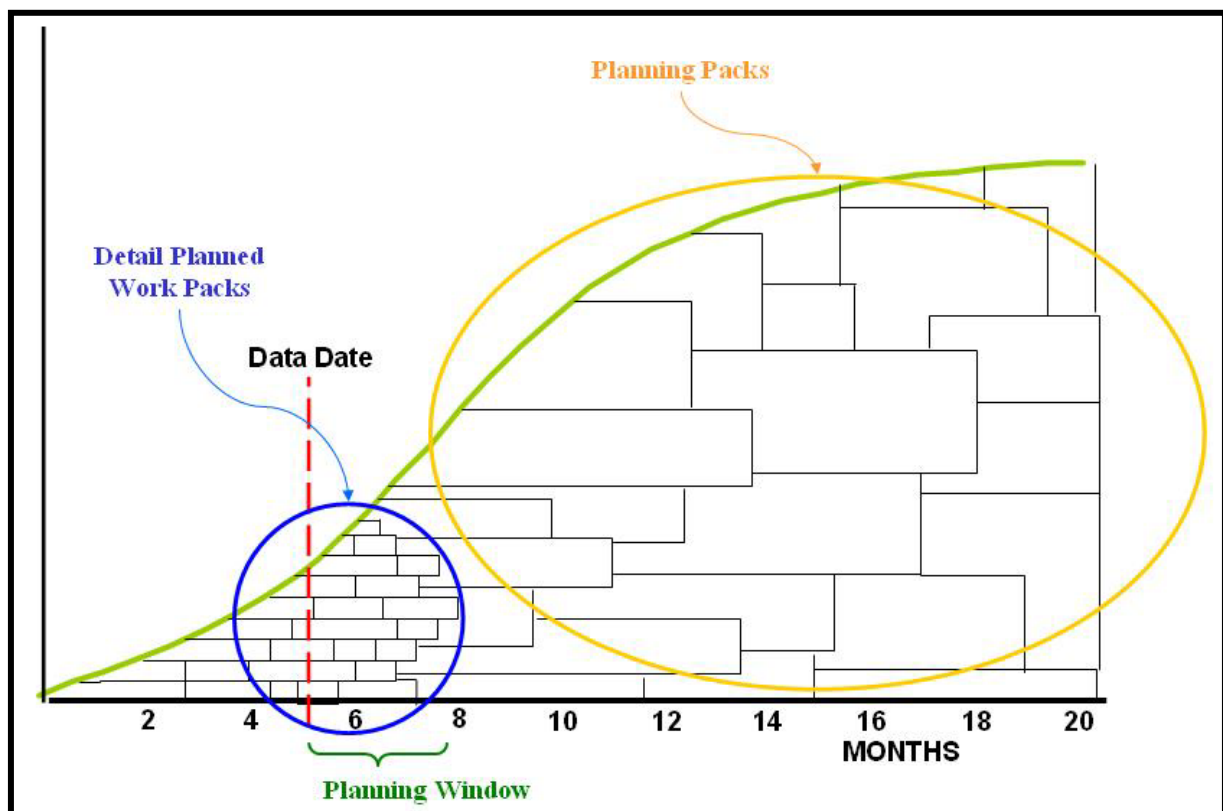


Figure 6 – Progressive Elaboration of PMB

Each project should have a documented planning window, which represents the planning threshold for the detailed planning to be carried out. This 'Planning Window' can be set at the discretion of the project manager, but it is recommended that a planning window as represented in figure 7 be adopted.

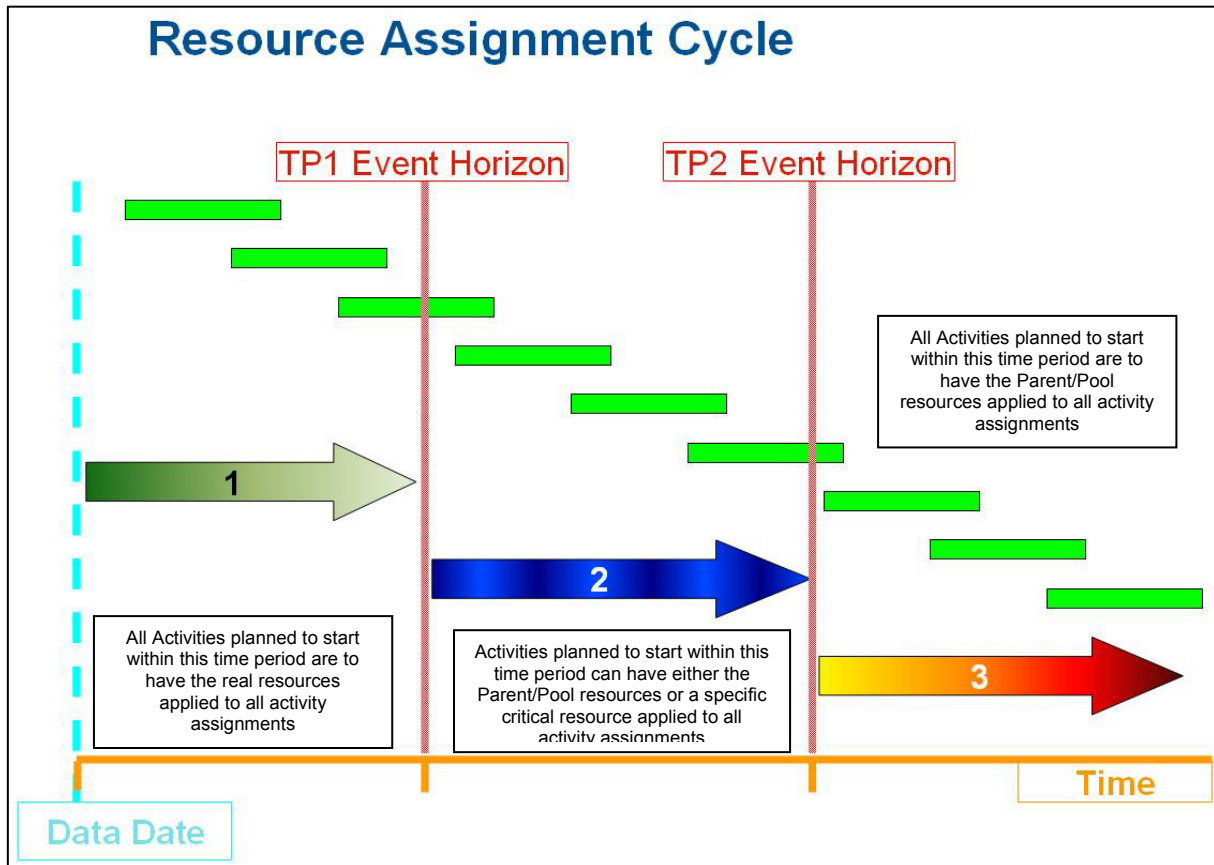


Figure 7 – Rolling Wave Window

BASIC PRIMAVERA SETUP

Once you have these basic structures set up you need to generate a layout & bar set to monitor this information.

The following information will provide a basic layout and bar set to assist you in this task.

Layout

Figure 8 shows a basic layout for resource monitoring.

Layout: Resource Review					Filter All:				
Activity ID	Activity Name	Original Duration	Activity % Complete	Total Float	Early Start	Early Finish	Remaining Early Start	Remaining Early Finish	

Figure 8 – Basic Layout

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Bar Set

The Bar Set for resource analysis will require the comparison of 3 sets of Gantt Bars, being, Baseline Dates, Early Dates & Planned Dates.

Figure 9 depicts the Bars Set-up which can be used on the Gantt view

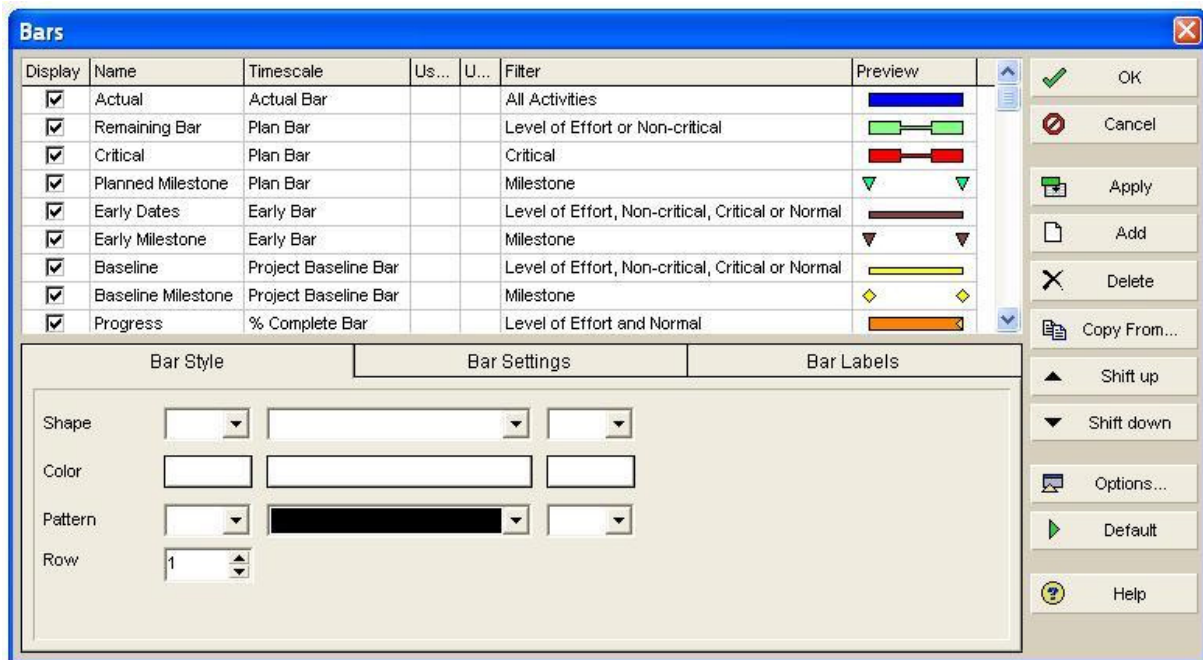


Figure 9 – Bar Set-up

Project activity set up for resource planning

The choice of Activity type, duration and percent complete type can have a bearing on the resultant information you will obtain during the lifecycle of your project. The selection of these parameters will depend on your particular project environment and the type of controls you wish to place onto your projects and how they will be monitored.

Activity Type Selection

For resource assignments to a project there are 2 main types of activity that you can use;

1. Task Dependant

For a task dependent activity, assigned resources schedule according to the activity's calendar rather than according to their designated resource calendars.

Use task dependent activities when multiple resources assigned to the same activity need to work together.

2. Resource Dependant

Resources assigned to this type of activity are scheduled to work according to the resources' calendars rather than the activity's calendar. The activity's duration is determined by the availability of resources to work on the activity.

Use resource dependent activities when multiple resources assigned to the same activity can work independently.

Activity % Complete Type Selection

The activity percent complete type selected for your project will determine what type of information you will be required to collect during project status reporting.

The selections for Primavera Enterprise are as follows;

Physical Percent Complete – *In this case, Activity % Complete = Physical % Complete, and represents an objective assessment of the physical work performed up to the status date.*

Duration Percent Complete – *In this case, Activity % Complete = Duration % Complete*

Units Percent Complete – *In this case, Activity % Complete = Units % Complete*

Activity Duration Type Selection

Fixed Units/Time – Used when you want the resource units per time to remain constant when the activity duration or units change. This type is used when an activity has fixed resources with fixed productivity output per time period. You most often choose this duration type when you are using resource dependent activities.

Fixed Duration & Units/Time – Used when you want the activity duration to remain constant and the remaining units to change. This type is used when the activity is to be completed within a fixed time period regardless of the resources assigned. You most often choose this duration type when you are using task dependent activities.

Fixed Units – Used when you want the activity units to remain constant when the duration or resource units per time change. This type is used when the total amount of work is fixed, and increasing the resources can decrease the activity duration. You most often choose this duration type when you are using resource dependent activities.

Fixed Duration & Units – Used when you want the activity duration to remain constant and the units/time to change. This type is used when the activity is to be completed within a fixed time period and the total amount of work is fixed. You most often choose this duration type when you are using task dependent activities.

Dependant on the type of activity and initial planning methods employed, the type of activity duration selected can vary as a result of how you wish to calculate remaining effort.

E.g. During initial planning a LOE activity type will be set as a 'Fixed Duration & Units', however once the project is baseline it would be beneficial to have the LOE activity set to 'Fixed Units/Time', this will allow the automatic calculation of remaining units to be carried out as a resultant of project scheduling.

RESOURCE LEVELING PROCESS

To achieve resource leveling in Primavera Enterprise version 5.0 SP3, it is necessary to understand the relevant settings and their effect on the resultant outcome.

The planner must also consider how he or she will display the resultant information; Consideration should be given to both the known requirements of the project and the customer and internal requirements for monitoring and reporting.

Earlier in the section a basic setup for the presentation of this information was covered. This information is not meant to be the only method of presentation for schedule information, but should provide sufficient clarity to those concerned to understand the effects of resource leveling.

Resource Leveling Options

Primavera Enterprise has many options available to the planner for conducting resource leveling. It is recommended at all stages of resource leveling that the planner make notes on which settings provide what answers, as there can be an array of outcomes from the same information based on the settings chosen.

Let us now step through the various options & selectable parameters of the resource leveller in Primavera Enterprise.

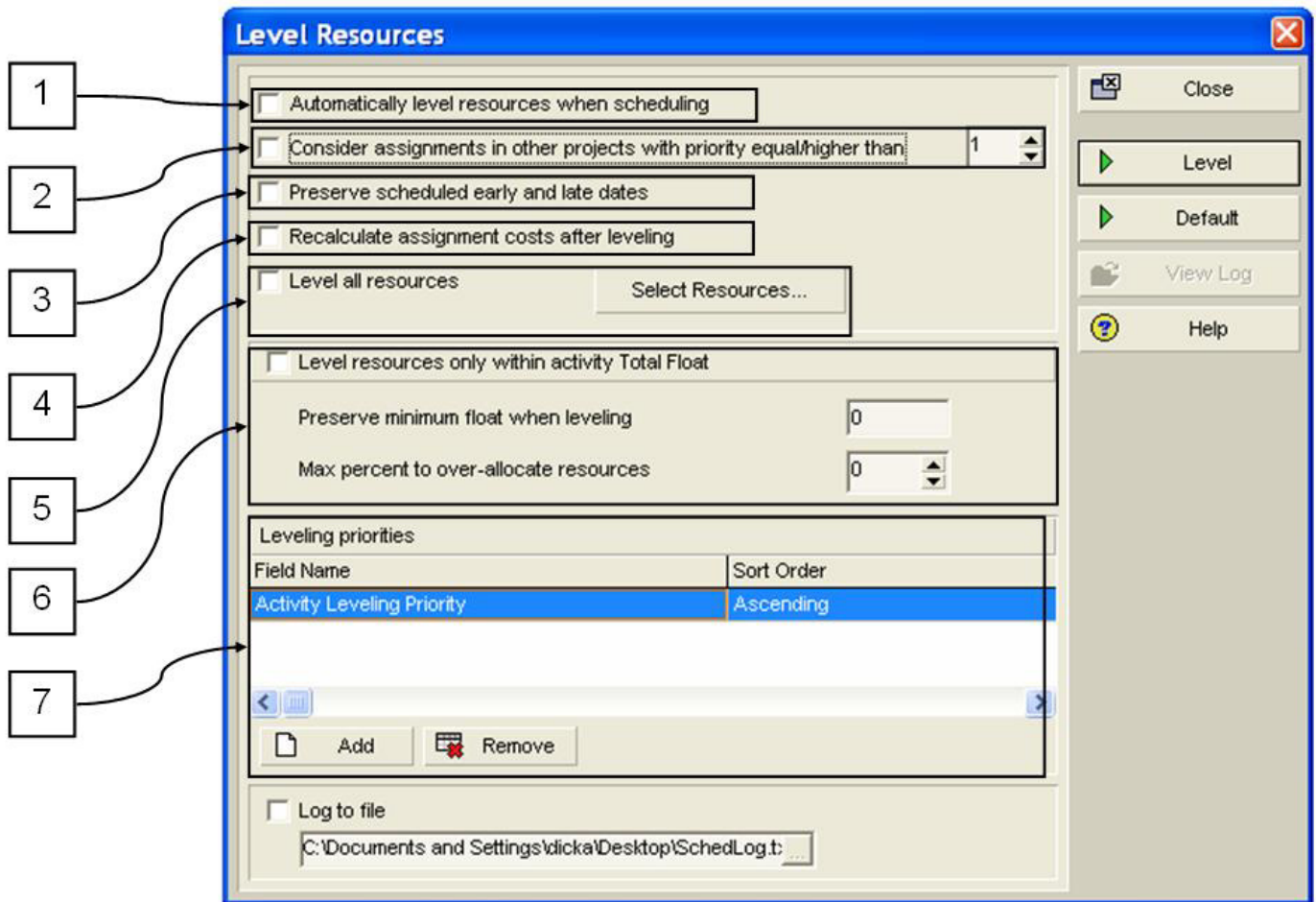


Figure 10 – Resource Leveler Options Box

1. Automatically level resources when scheduling;

If this check box is ticked you will level resources each time you run a schedule on your project, there is a similar check box in the 'Schedule Options' pop up.

2. Consider assignments in other projects with priority equal/higher than – 'X'

Use this feature if you're leveling across multiple projects and wish to assign priorities to your individual projects.

3. Preserve Scheduled early and late dates

Use this feature to preserve the 'Time Analysis' early & late dates when resource leveling. This is handy for comparison with the remaining dates as it will show the delta between your current resource availability and what would be possible should there be an unlimited supply of resources. *(The bar set displayed at figure 9 allows for this)*

4. Recalculate assignment costs after leveling

This function will be important to the planner who is monitoring costs based on resource costs in their program. In particular when conducting a resource level the dates of an activity may change as a result of resource availability, the costs associated with a resource, if modelled against a forward escalation profile, may in fact, increase or decrease summed costs against certain activities as a result of the actions of the leveller.

5. Level all resources

This function allows the selection of individual resources, or subsets by using the 'Select Resources' button. When individual resources are selected for leveling all unselected resources are ignored.

6. Level resources within activity total float

This function will conduct resource leveling based on the activities total float, and will not delay an activity beyond the selected number of days total float. You can also choose to over allocate your resources to a pre-selected percentage. This will allow the compression of the schedule by allowing resources to be allocated to more activities than they could normally work in the defined calendar work cycles.

7. Leveling Priorities

This function allows for activities competing for the same resource to be prioritised by the selected parameter/s. If after all prioritised parameters are exhausted with no outcome, then the competing activities are prioritised by the activity ID. *N.B. It should be noted as to which setting is used – Ascending or Descending, as this will effect the result of the analysis.*

Resource Leveling Sample Project

We shall now examine the difference in scheduled outcomes based on the selection of some of the scheduling options.

Project outline;

- 2 Resources, Person 1 & Person 2 (both resources have 8H/d Default and Max Units/Time).
- 1 Start Milestone, 1 Finish Milestone.
- 5 Activities,
 - Activity 1 – 5 Days Duration - 80 Hrs Budgeted - 2 Res @ 40Hrs Ea
 - Activity 2 – 10 Days Duration - 160 Hrs Budgeted - 2 Res @ 80Hrs Ea
 - Activity 3 – 5 Days Duration - 40 Hrs Budgeted - 1 Res @ 40Hrs
 - Activity 4 – 5 Days Duration - 80 Hrs Budgeted - 1 Res @ 40Hrs
 - Activity 5 – 5 Days Duration - 80 Hrs Budgeted - 2 Res @ 40Hrs Ea
- Activity Type – Resource Dependant
- Duration Type – Fixed Duration and Units/Time
- Calendar – Standard 5 Day
- Data Date – 01JUL07
- Basic Schedule Options – Refer Figure 11

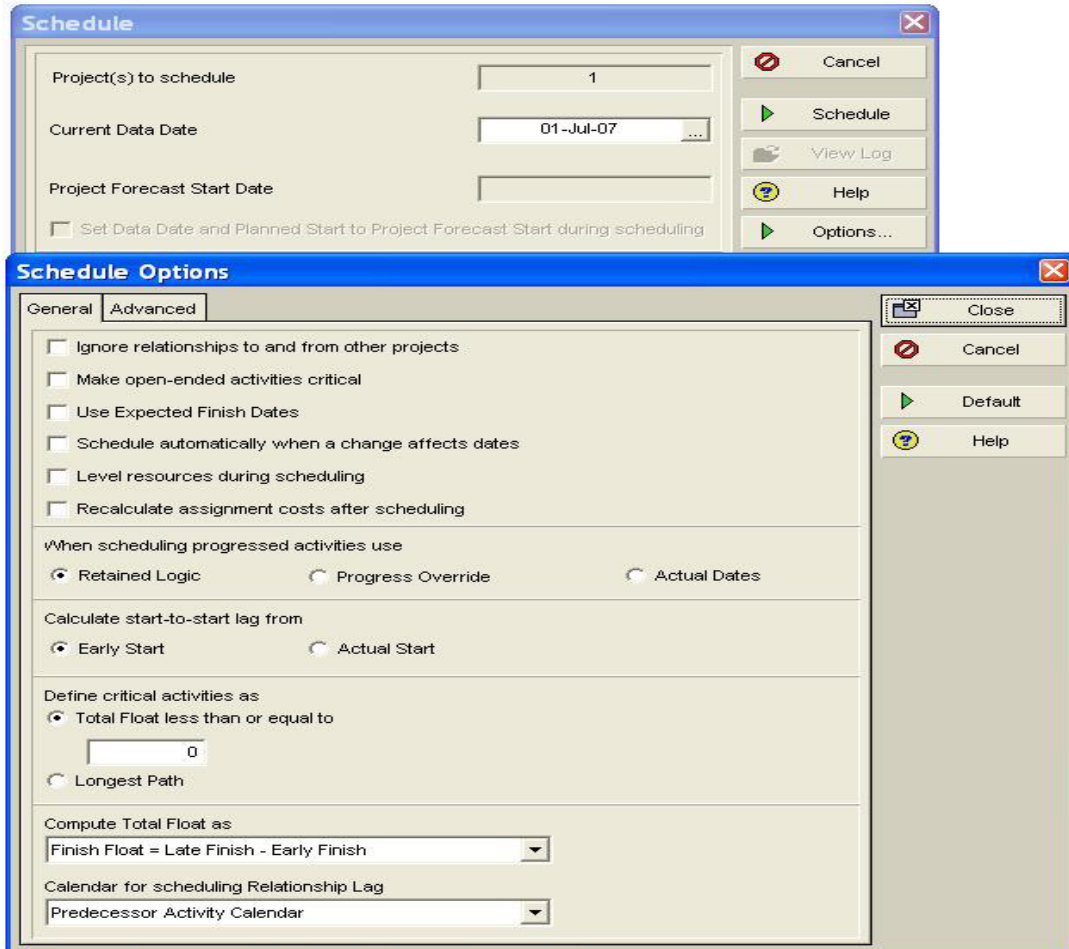


Figure 11 – Basic Schedule Options
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Project Early Dates

Figure 12 displays the sample project, scheduled using the basic settings, not resource levelled. I.E. *Early Date Representation*

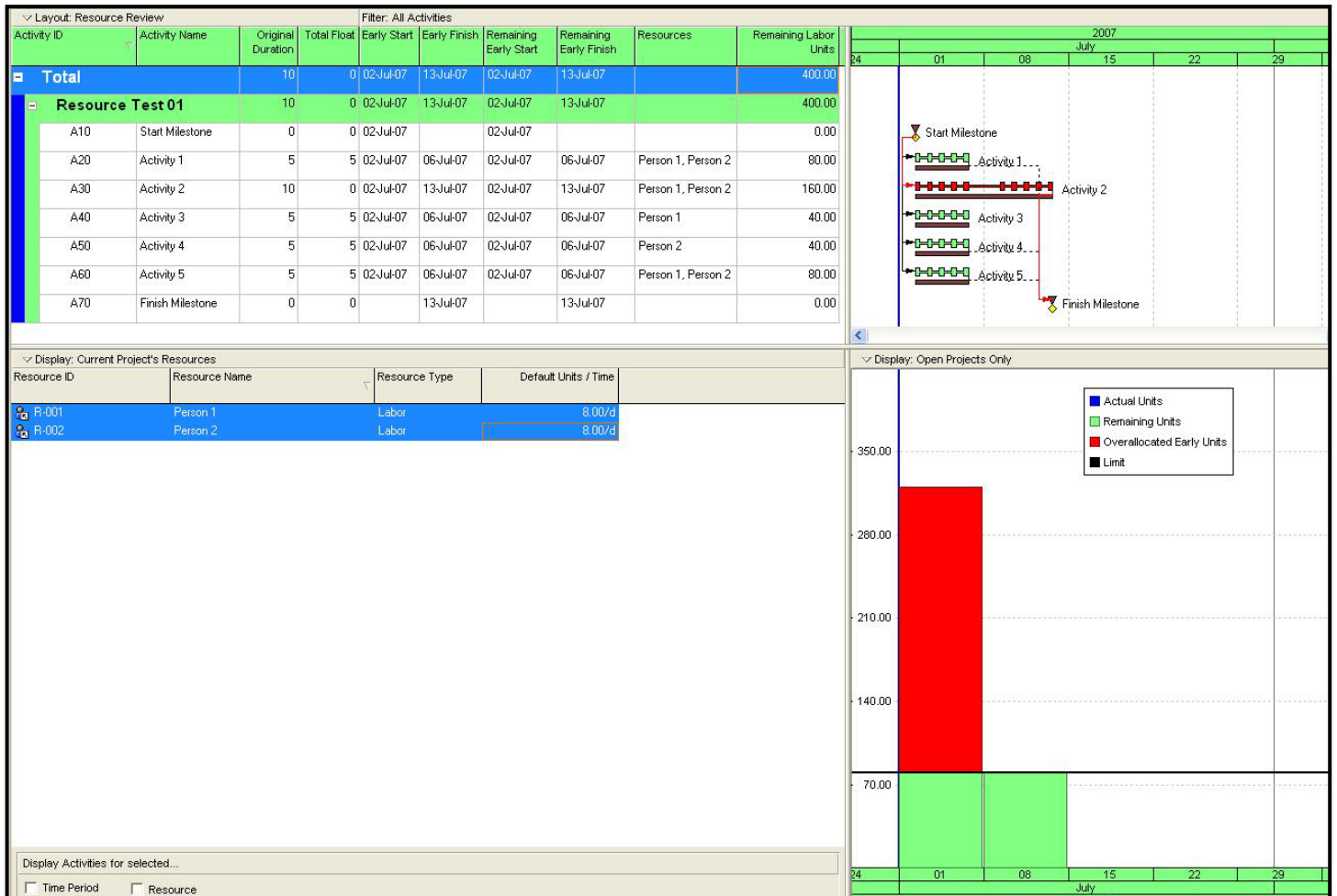


Figure 12 – Sample Project Early Dates

Resource Level Outcomes

The following series of figures (13 thru 23) will display the different selections of the resource Leveler based on the project displayed at figure 12.

In each instance the resource Leveler options box will be displayed to identify the settings used.

Basic Resource Level

In this example, the 'Preserve Early Dates' function has been selected and these dates have been portrayed by the brown bar on the Gantt.

The schedule has been leveled to accommodate the resource availability, and the project is now 25 days in duration.

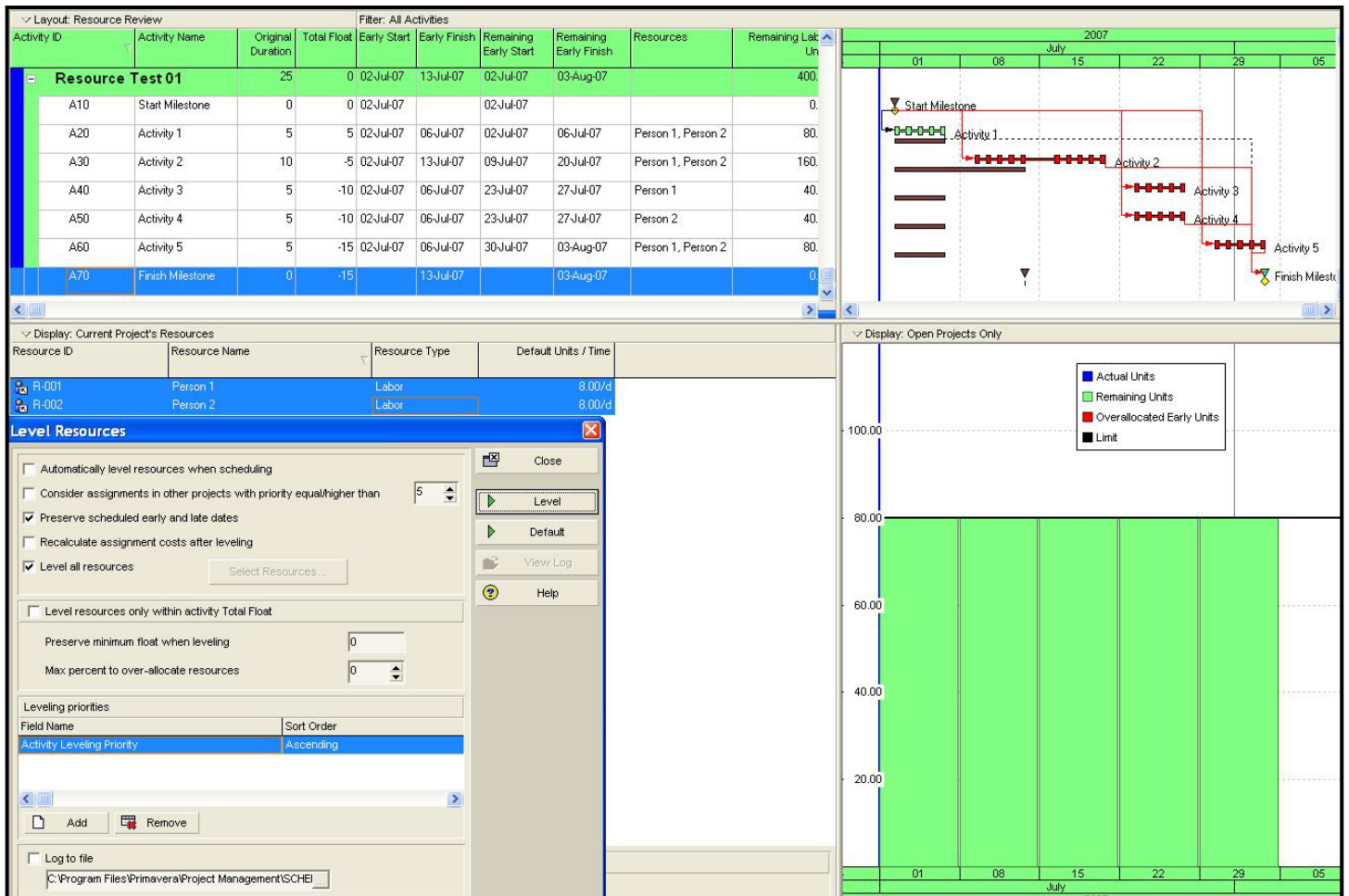


Figure 13 – Basic Resource Level

Selected Resource Level

In this example the resource 'Person 1' was chosen to be leveled and resource 'Person 2' was not. As can be seen the Leveler has ignored Person 2 and overloaded them by leaving Activity 4 on its early dates.

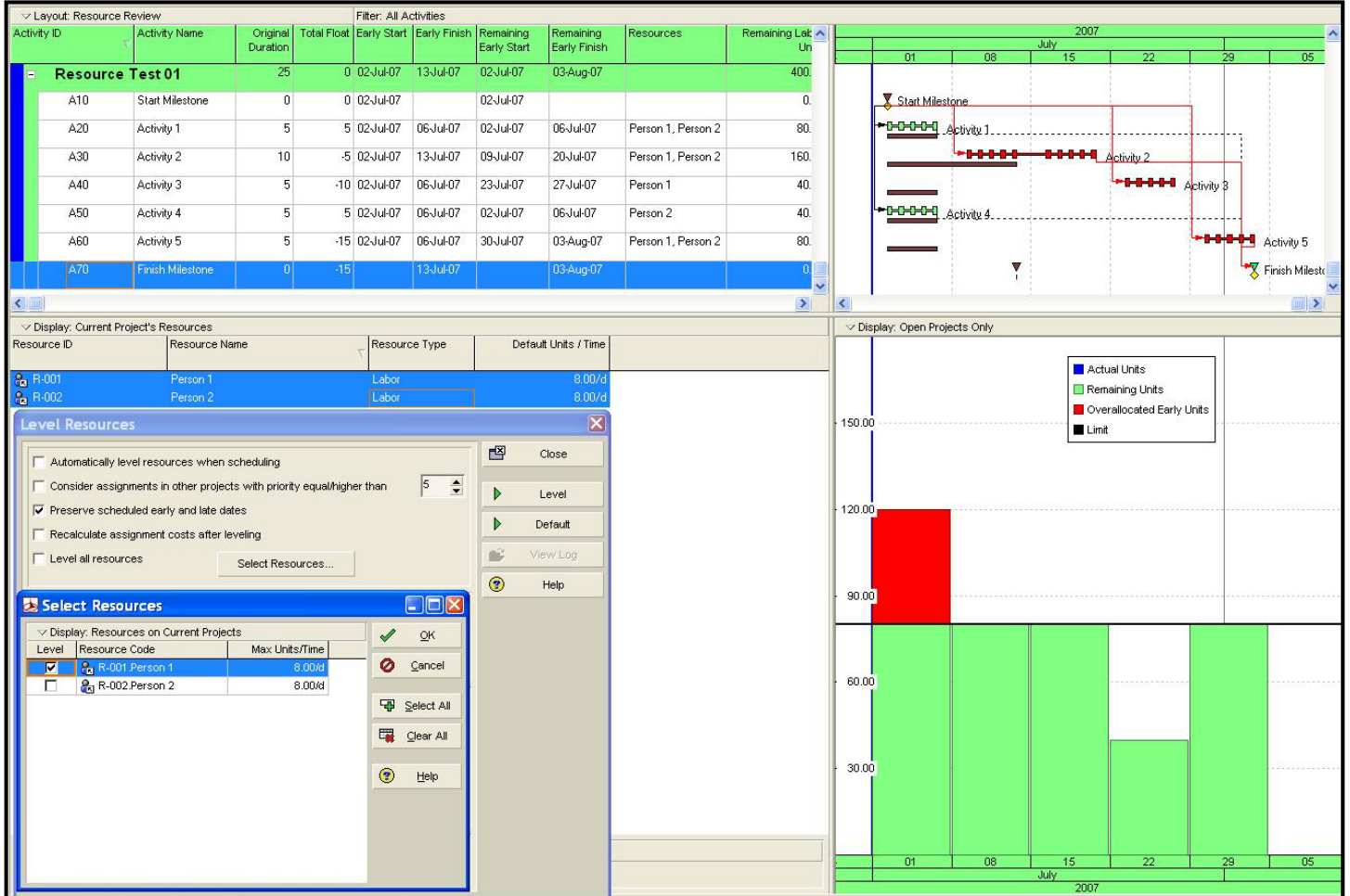


Figure 14 – Selected Resource Level

Delayed Resource Availability

In this example resource 'Person 1' has had their availability changed to show that they are not available to the project until the 16th of July. As can be seen all activities requiring Person 1 have been delayed to commence after the 16th of July and have then been levelled per the normal availability of the resource from that date.

Activity 4 has been scheduled to occur on its early dates as the resource Person 2 is available to the project on the activity early dates, however you will note that each subsequent activity which requires both resources has been delayed until Person 1 becomes available to the project, thus providing a gap in the resource histogram for Person 2.

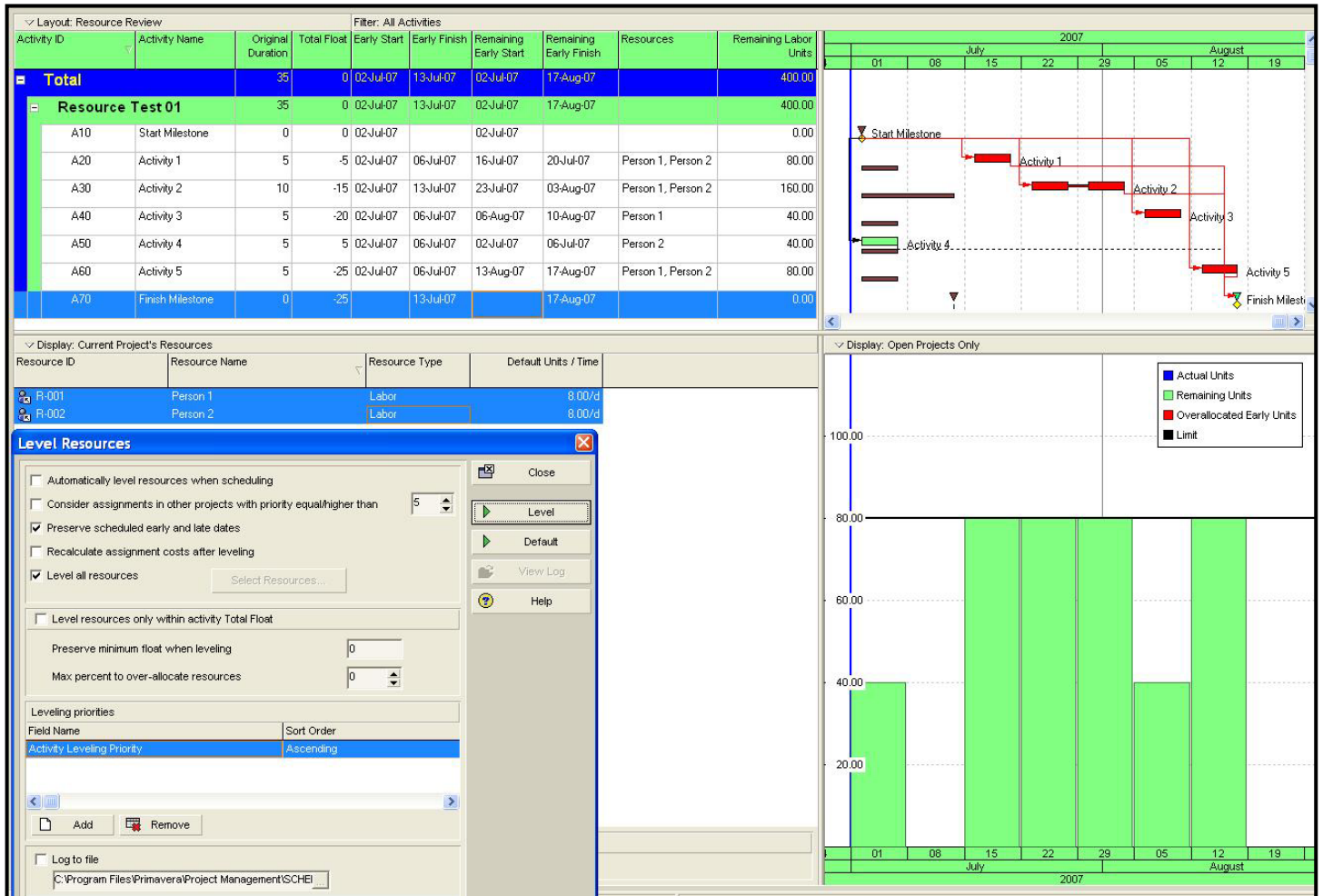


Figure 15 – Delayed Resource Availability

Allowable Resource Overload

In this example the 'Level Resources within activity total float' function has been selected. The desired activity total float has been set at zero, but the resources have been allowed to be overloaded by 100%.

By doing this we are assuming that we have twice as many resources available to us for the project. You can see that activity 1 and 2 are able to both commence on their early dates given the perceived doubling of resources. The second half of activity 2 is set to be worked in parallel with activities 3 & 4, for the same reasons.

However activity 5 has been placed on its early dates because this option will not allow negative float to be scheduled into the project and as the max units/time cannot be raised high enough due to the over allocation setting the Leveler places the activity on its early dates by default and places an entry into the schedule log.

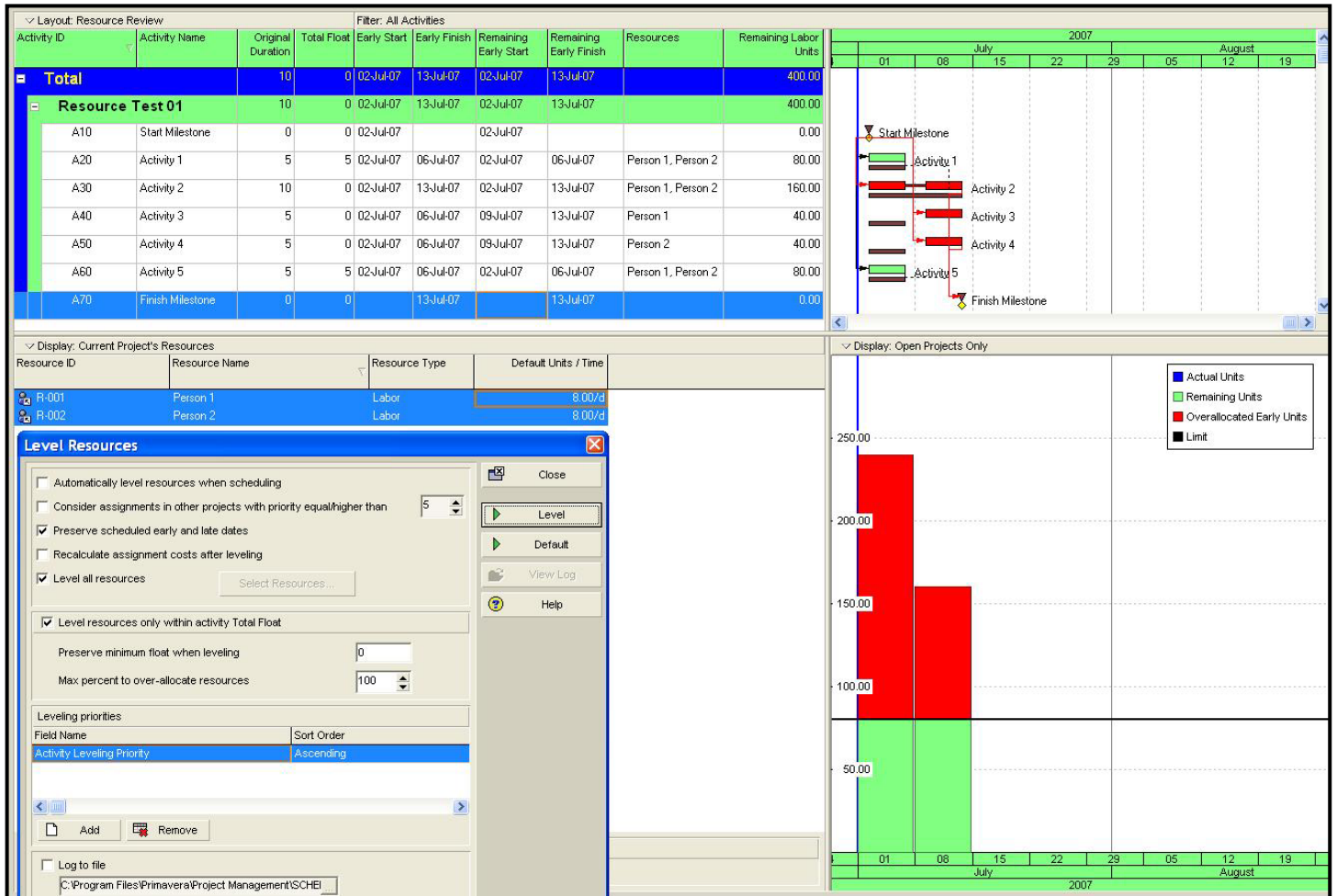


Figure 16 – Allowable Resource Overload

Resource with insufficient daily availability

In this example resource 'Person 1' has had both their default units/time and max units/time set at 7h/d. As each activity requires a resource to work at a rate of 8h/d there is insufficient availability of Person 1. The leveler will therefore place all activities that have Person 1 assigned on their early dates and place an entry into the scheduling log to indicate that these activities were unable to be leveled.

You will note that activity 4 has been leveled due to the availability of Person 2.

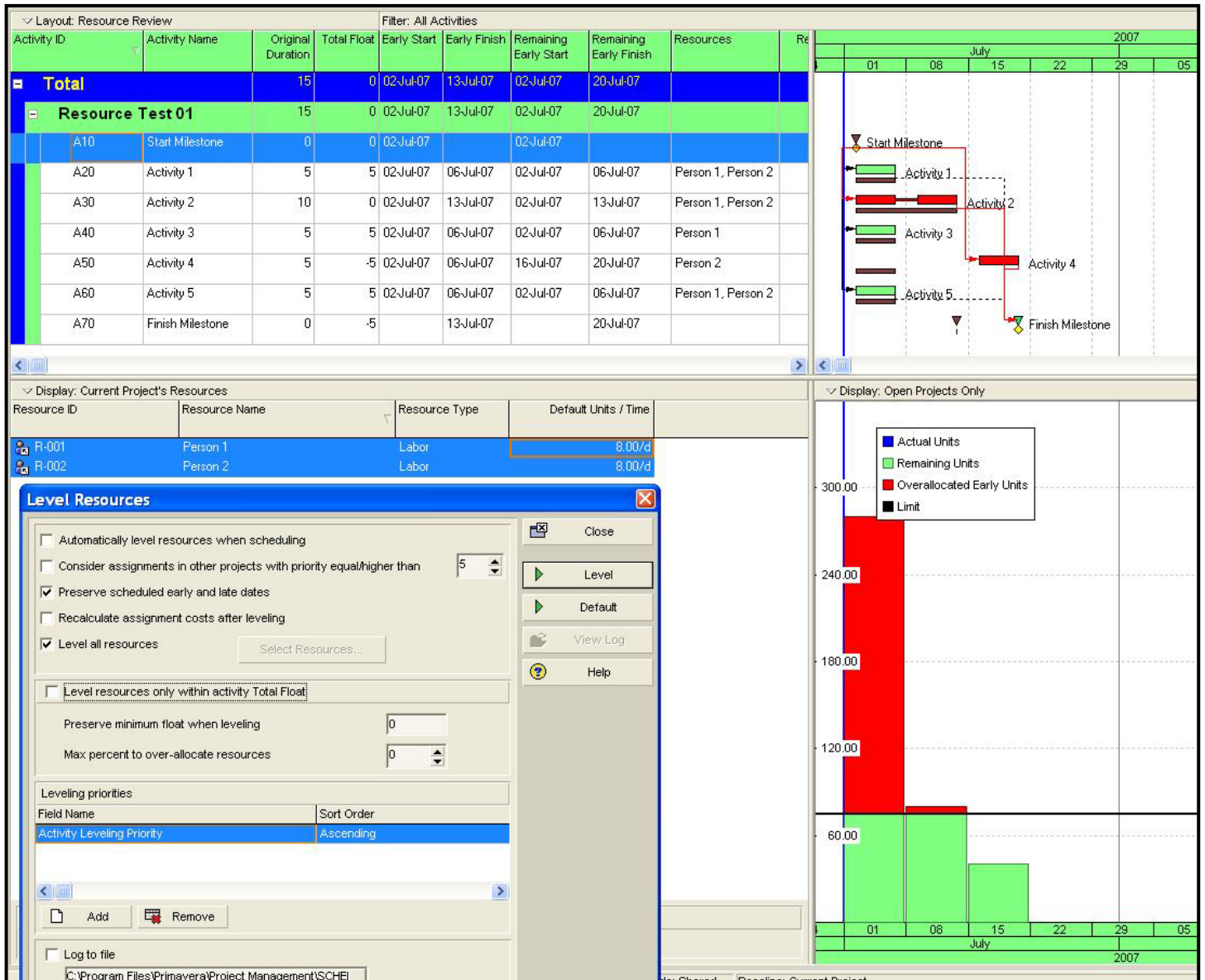


Figure 17 – Resource with Insufficient Daily Availability

Activity Leveling Priorities

We shall now examine the effect of the 'Leveling Priorities' to the schedule. Over the next few slides the project will be scheduled using the same basic settings from figure 13; however there will be a different Leveling Priority chosen in each instance. You will also note that the sort order will play a part in the resultant outcome and shall be indicated as either ascending or descending in each example.

For simplicity only the top half of the screen will be shown.

Early Start Date – Ascending

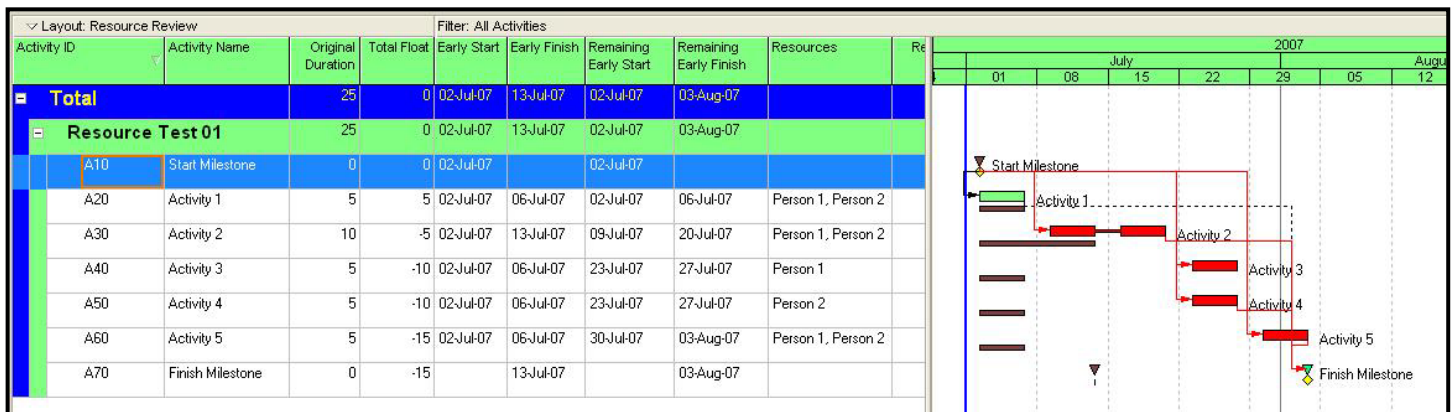


Figure 17 – Early Start Ascending

Early Finish – Ascending

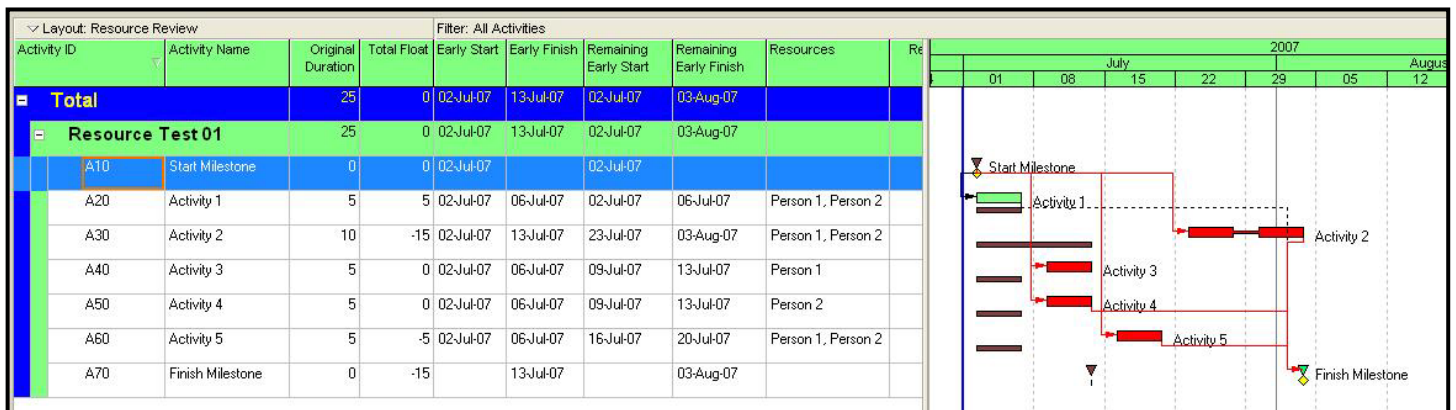


Figure 18 – Early Finish Ascending

Early Finish – Descending

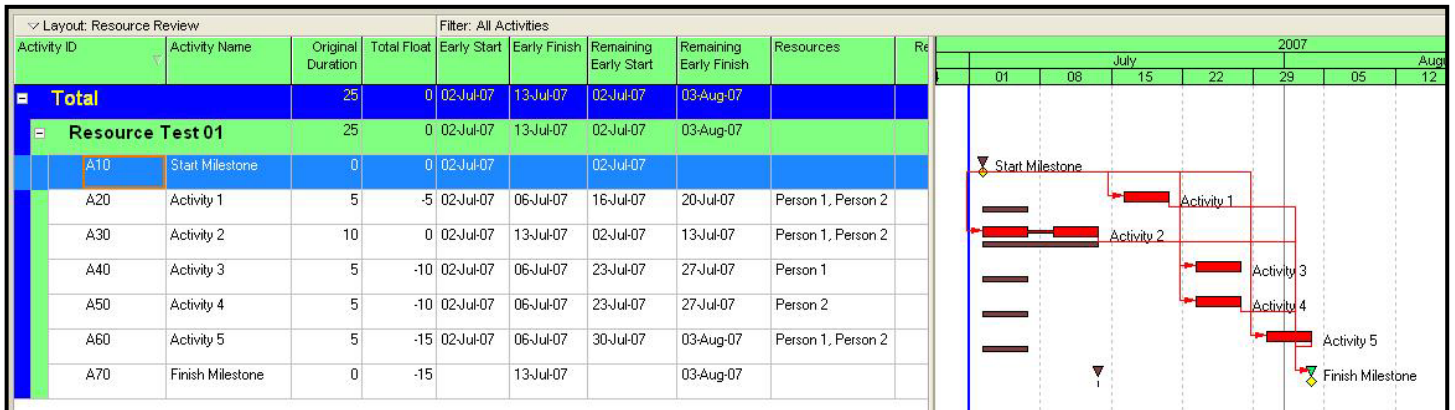


Figure 19 – Early Finish Descending

Total Float – Ascending

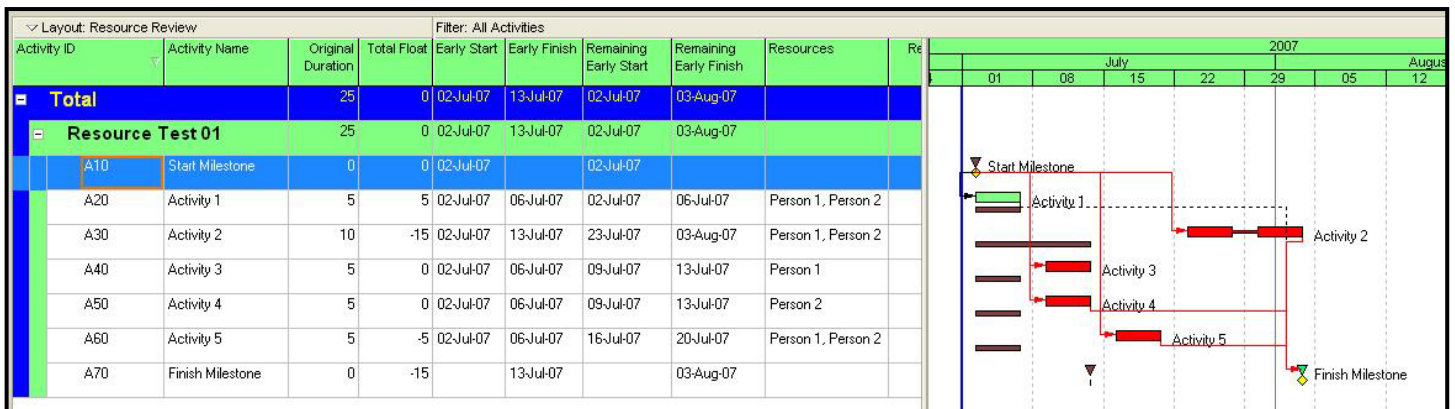


Figure 20 – Total Float Ascending

Total Float – Descending

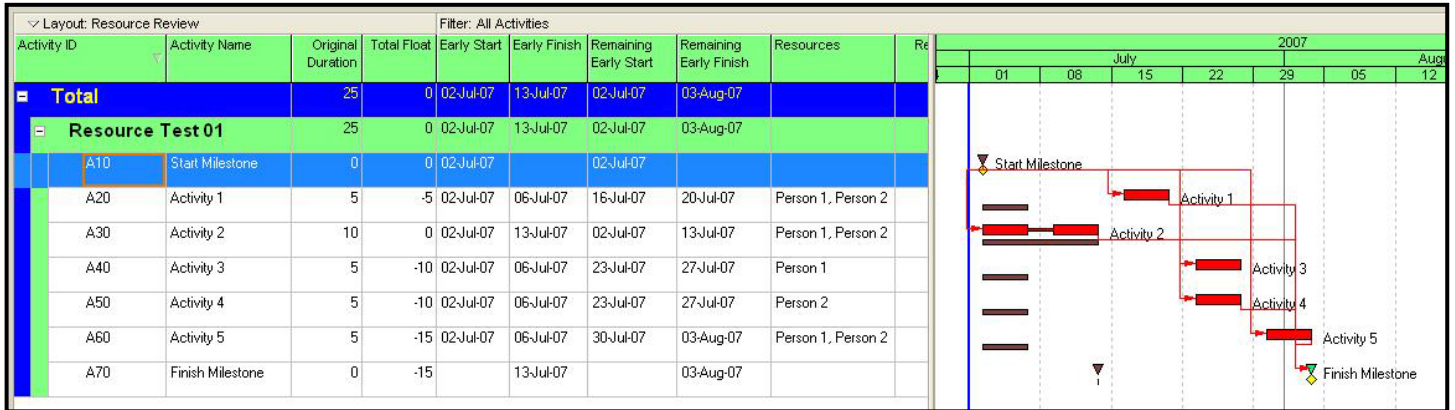


Figure 21 – Total Float Descending

Activity ID – Ascending

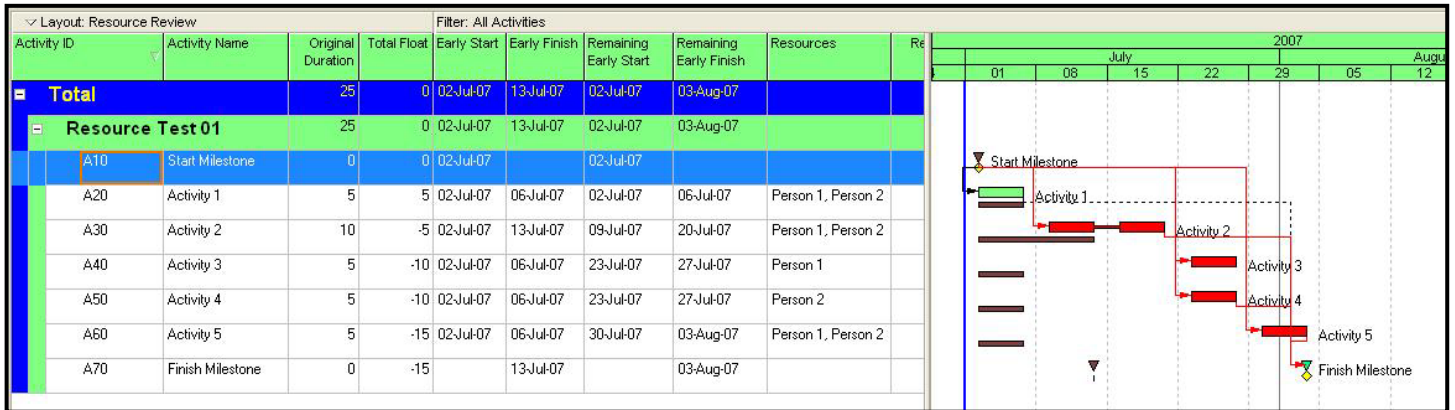


Figure 22 – Activity ID Ascending

Activity ID – Descending



Figure 23 – Activity ID Descending

As can be seen the Leveling Priority can have a marked effect on the outcome of the resource leveler. You can also use a UDF (User Defined Field), to prioritise the activities in your schedules. One that I have used to success is a code field which separates various portions of work based on geographical location.

PREDICTIVE RESOURCE ANALYSIS

We have previously discussed the use of *Generic Planning Resources* to aid in the predictive analysis of resource requirements for a project; let us now elaborate on this theory in the following paragraphs.

What is Predictive Resource Analysis?

In most, if not all organisations executing projects, out of the 3 traditional constraints of, Time Quality & Cost, Time is the thing that gets the most airplay. This is possibly due to the lack of understanding of how resource availability can affect a project.

One of the key issues that is most often overlooked, is the actual resource requirements to enable the project to conclude in sufficient time to meet any deadlines imposed on it.

Therefore Predictive Resource Analysis relates to the effort involved to carry out manipulation of a set of *Generic Planning Resources created* within Primavera Enterprise, to understand the quantity of resources required to complete a project by a specific date; Deadline Critical Analysis.

Considerations for Predictive Resource Analysis

I recommend that you create a special set of non labour planning resources on their own branch of the RBS. If these resources are created as a mirror of the project or enterprise RAS you will be able to carry out predictive analysis of the future skill sets that you require to execute the projects this analysis is carried out on.

You must also ensure that the Budgeted Units/Time and the Remaining Units/Time, are both maintained at the predetermined company standard for all resource assignments on projects where you intend to use Pool or Planning resources to conduct this type of analysis.

To enable optimisation of the available resources the planner will need to manually manipulate the generic resources 'Max Units/Time' to simulate differing levels of resource availability.

Another key thing to realise is that if you are to apply this type of analysis to existing projects, I strongly recommend that you create a 'What If' copy of your project/s on a separate EPS node.

The utilisation of both planning resources and pool resources will require the setting for resource application to activities on the resources tab of the project details to be selected to allow resources to be assigned to an activity more than once.

Example Project for Deadline Critical Analysis

The following examples will show the effect of adjusting the Max Units/Time of the planning resources applied to the project to gauge the effect on the scheduled project end date.

In figure 24, the sample project has been scheduled with respect to time critical analysis, where the calculated dates represent the earliest dates possible for all activities without consideration to any resource constraints.

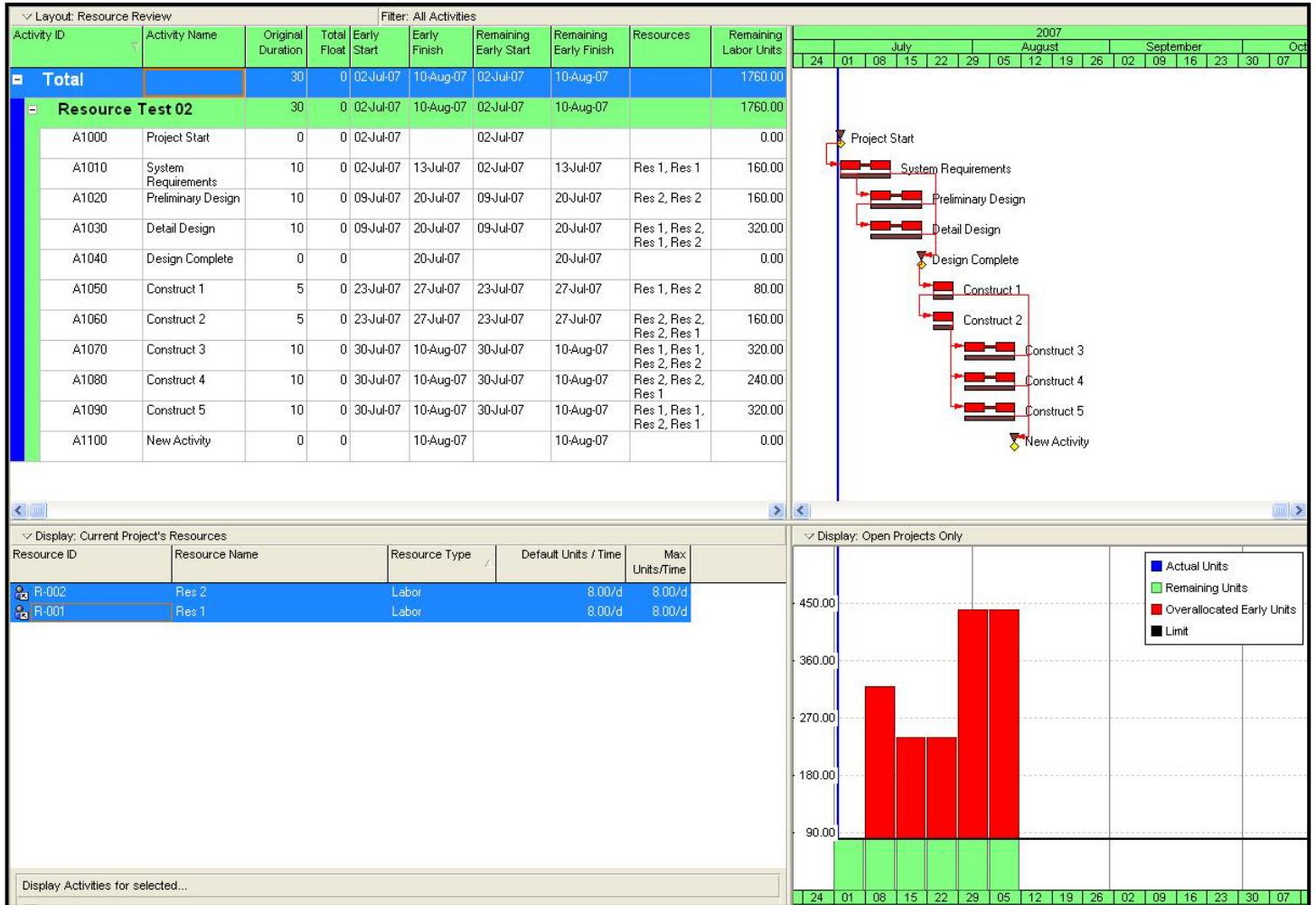


Figure 24 – Time Critical Analysis

In figure 25, the sample project has been resource leveled, & you will note that as the resource Max Units/Time for both resources is set at 8h/d, the resource leveler, by default, cannot find sufficient resource availability to assign resources to the activities as planned, therefore the leveler defaults to place all the activities on their early dates.

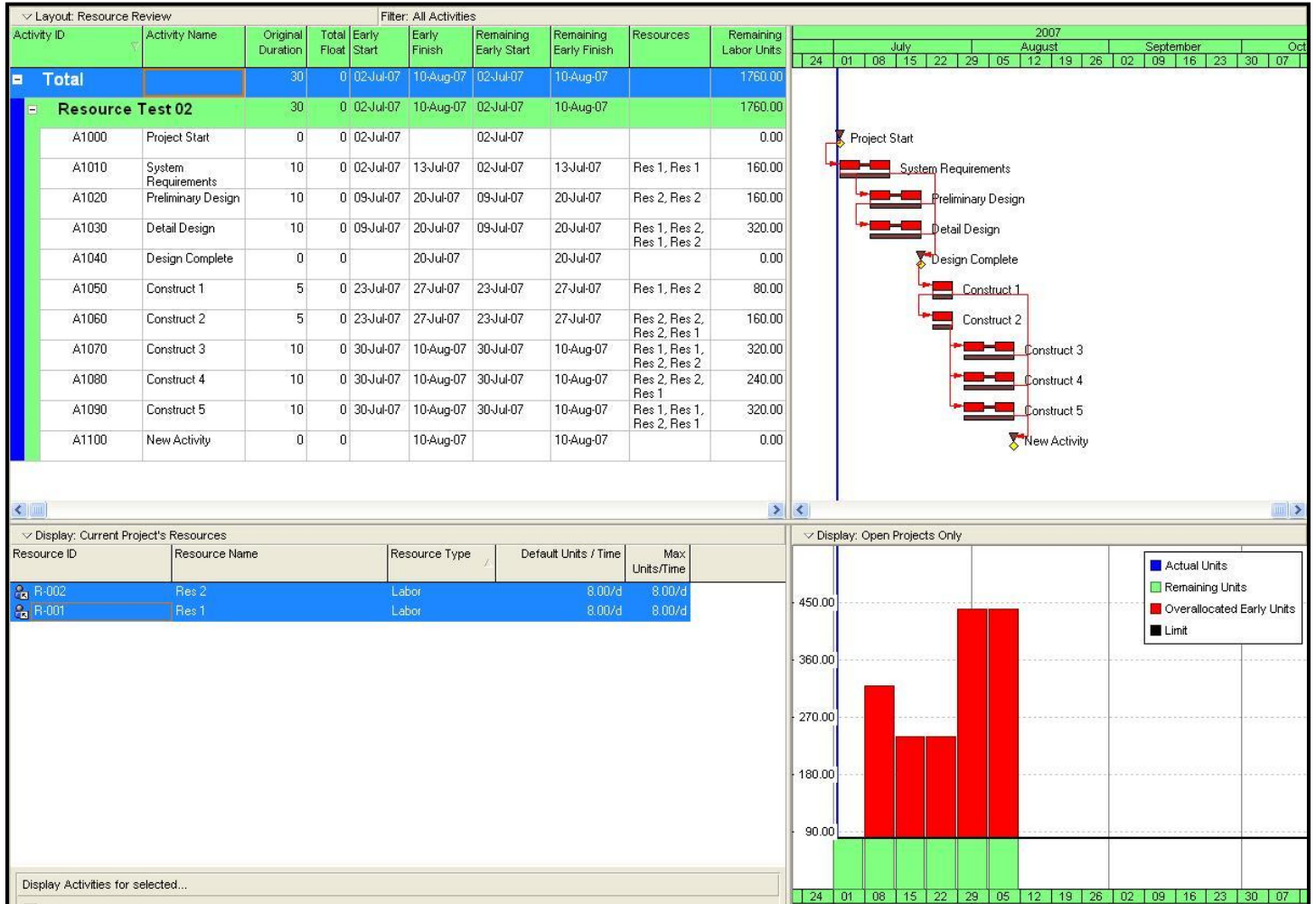


Figure 25 – Resource Level Max U/T 8h/d

In figure 26, the sample project has been resource leveled, & you will note that as the resource Max Units/Time for both resources is set at 16h/d. As you can see the leveler has started to take into account the new maximum availability of Res 2, allowing it to be rescheduled. You will also note that although there has been an increase in the max units/time of Res 1, there is still not enough availability to allow for the leveler to assign the resource and allow the activities to be rescheduled; as a result the activities with Res 1 assigned at more than the prescribed availability are maintained on their early dates.

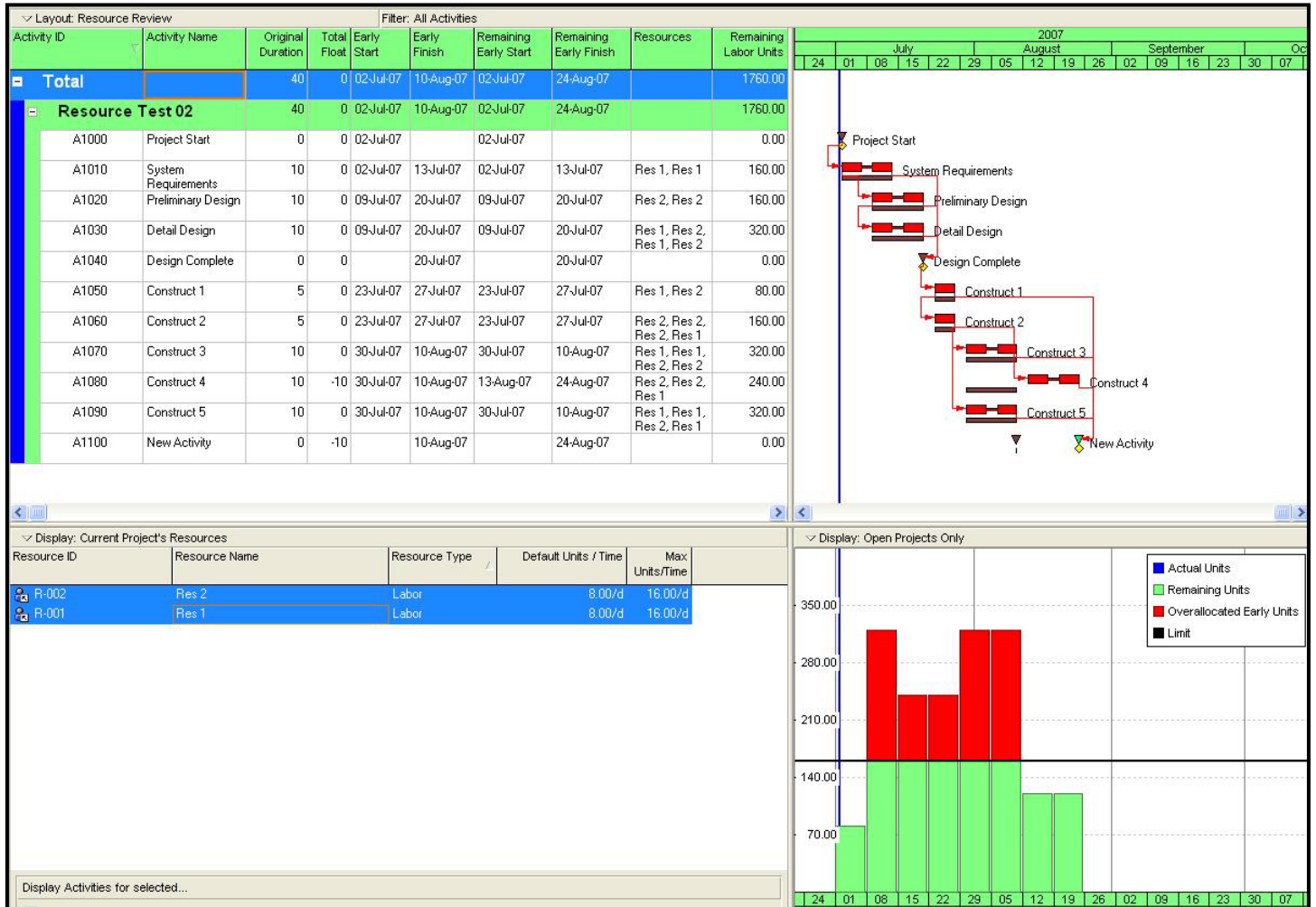


Figure 26 – Resource Level Max U/T 16h/d

In figure 27, the sample project has been resource leveled, & you will note that as the resource Max Units/Time for both resources is set at 24h/d. In this example you can see that the leveler has been able to schedule the project within the availability of both resources. Figures 28 & 29 will show the same resourced schedule but they will show the histograms for each of the resources as highlighted.

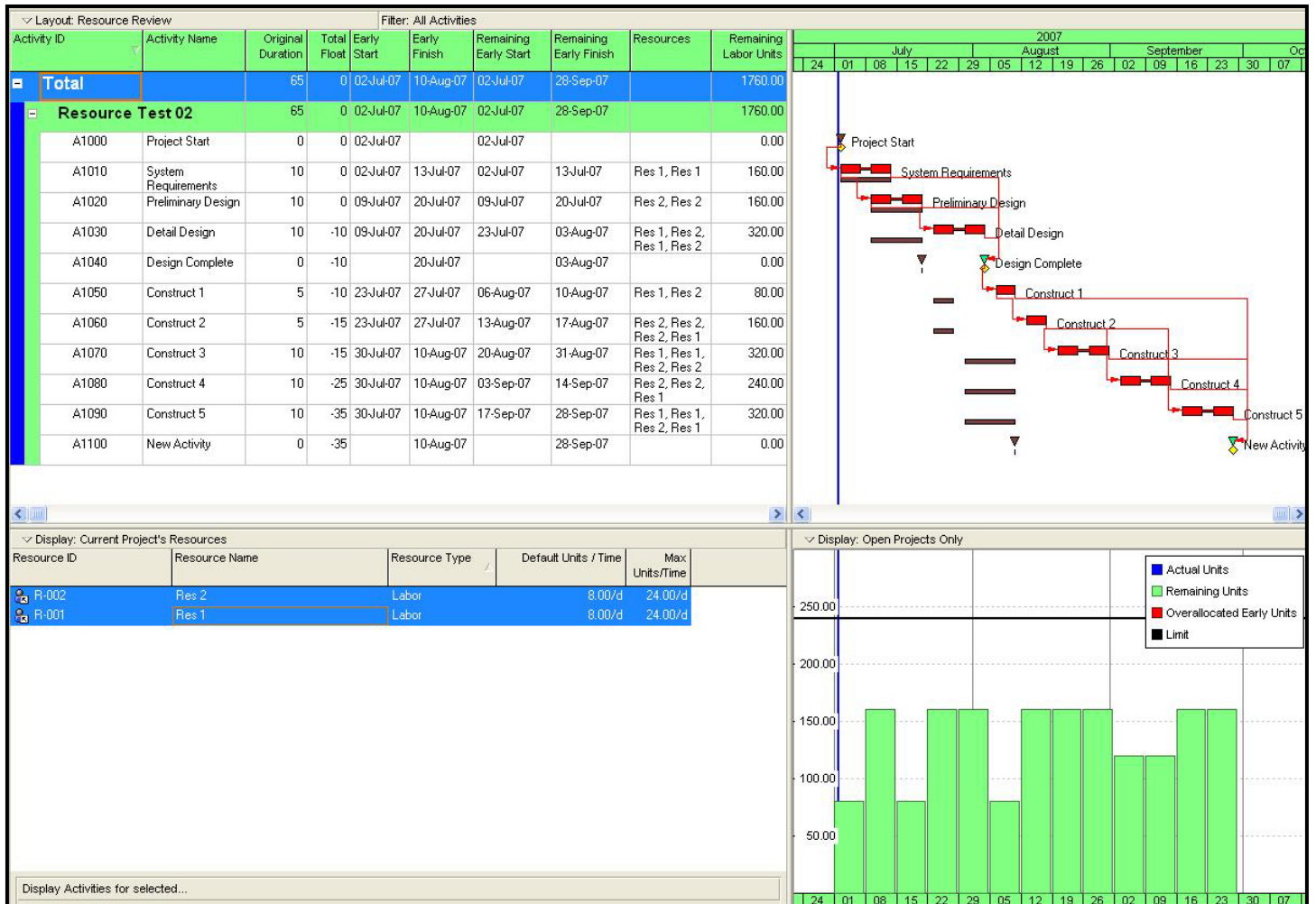


Figure 27 – Resource Level Max U/T 24h/d

In figure 28, you can see the resource requirements for Res 1, who's required at a maximum availability of 300% (120 Hrs/Wk) on activity Construct 5.

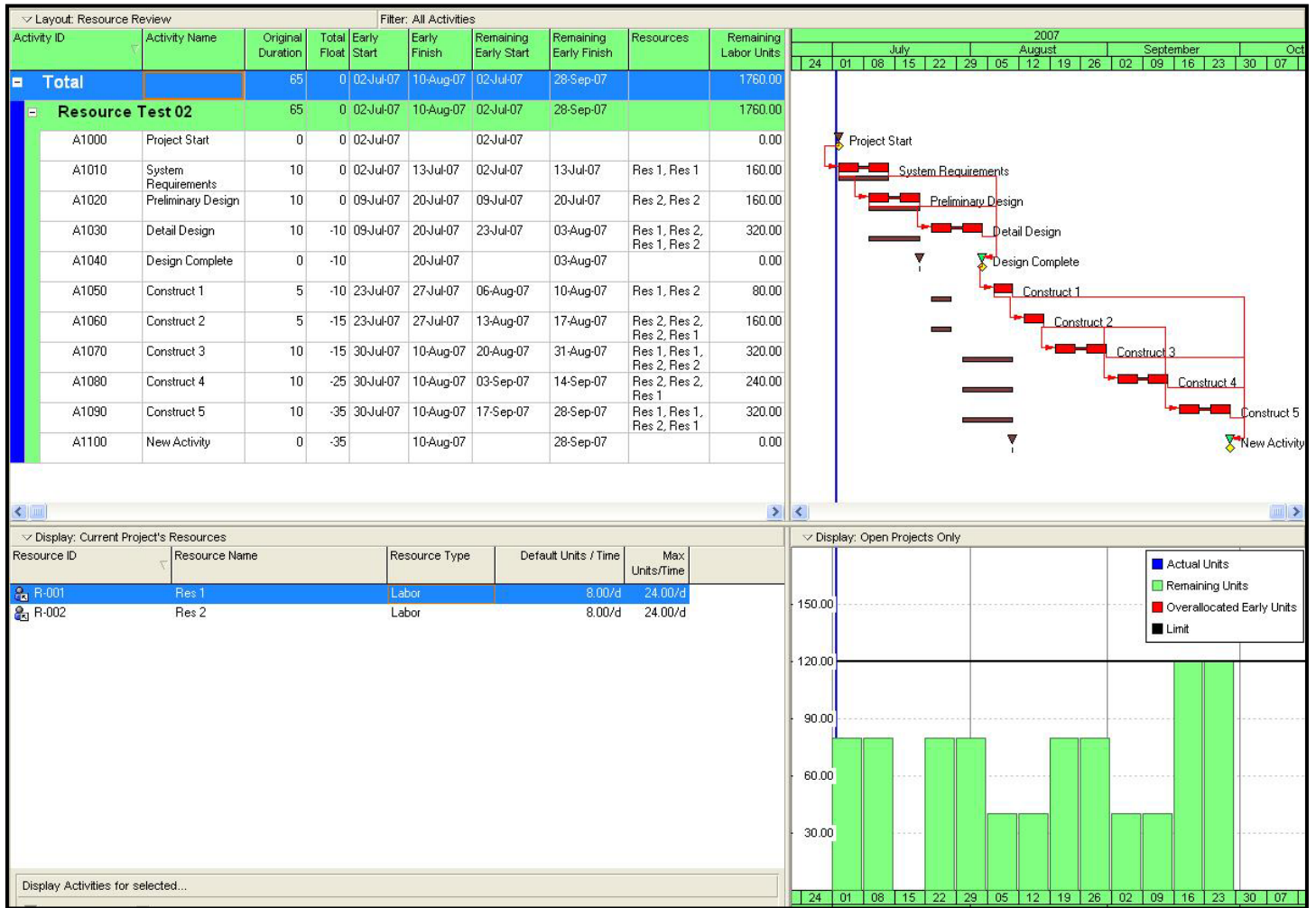


Figure 28 – Resource Level Showing Res 1 Profile

In figure 29, you can see the resource requirements for Res 2, who's required at a maximum availability of 300% (120 Hrs/Wk) on activity Construct 2.

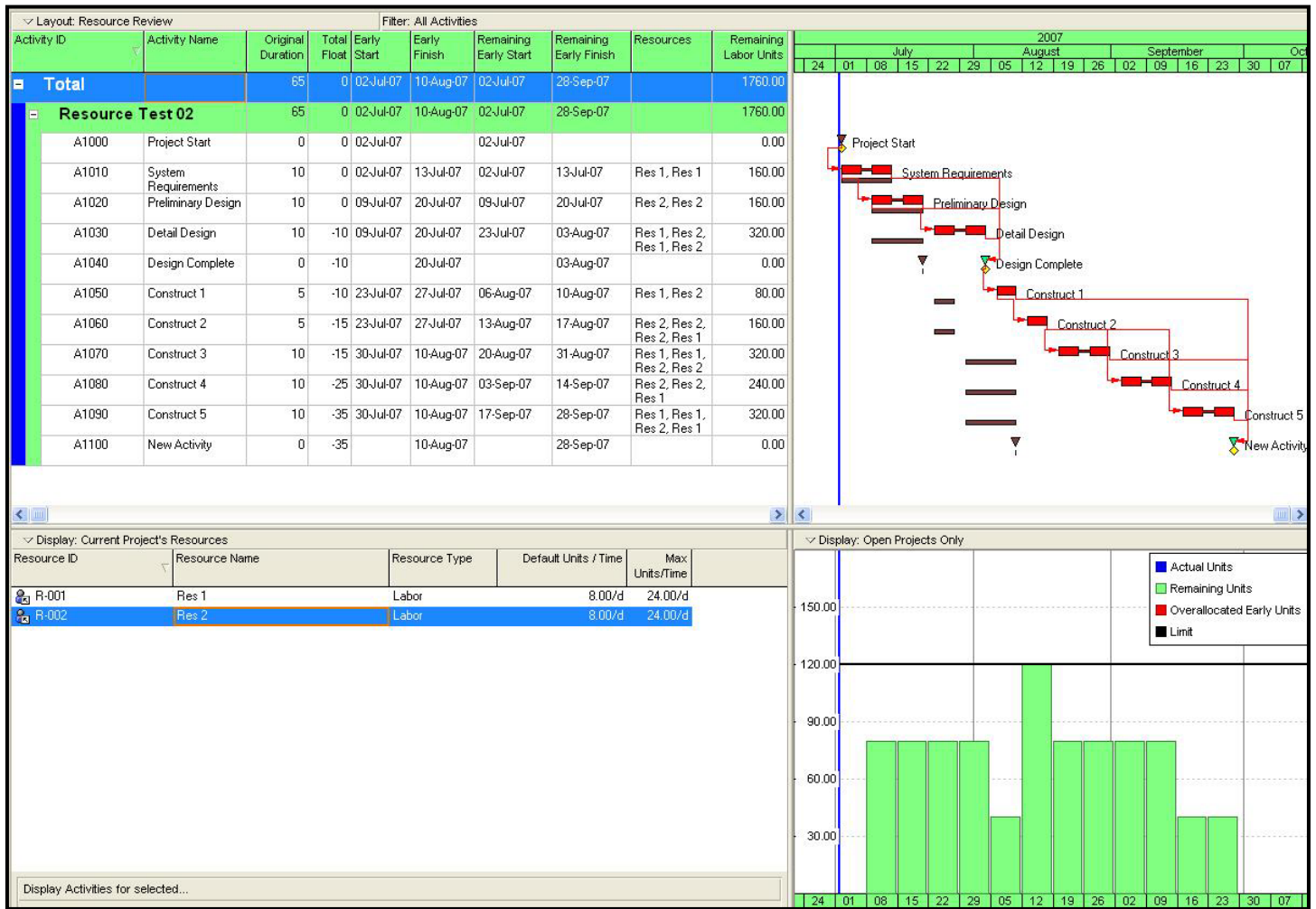


Figure 29 – Resource Level Showing Res 2 Profile

As can be seen by these previous examples it is possible to modify the Max Units/Time of the resources applied to the schedule to obtain information and analysis on the peak loading requirement on those resources.

If we required the project to finish on an earlier date than that shown, we would need to continue to increase the Max Units/Time until such time as the project finished within the desired deadline end date.

The following few examples will show the effect on the project end date with further increases on the resource Max Units/Time.

In figure 30, the sample project has been resource leveled, & you will note that as the resource Max Units/Time for both resources is set at 32h/d. As you can see the project end

date has been rescheduled approximately 1 month earlier than that in Figure 27. The leveler is also now able to assign resources to activities in a parallel fashion as we have set the new Max Units/Time of 32h/d.

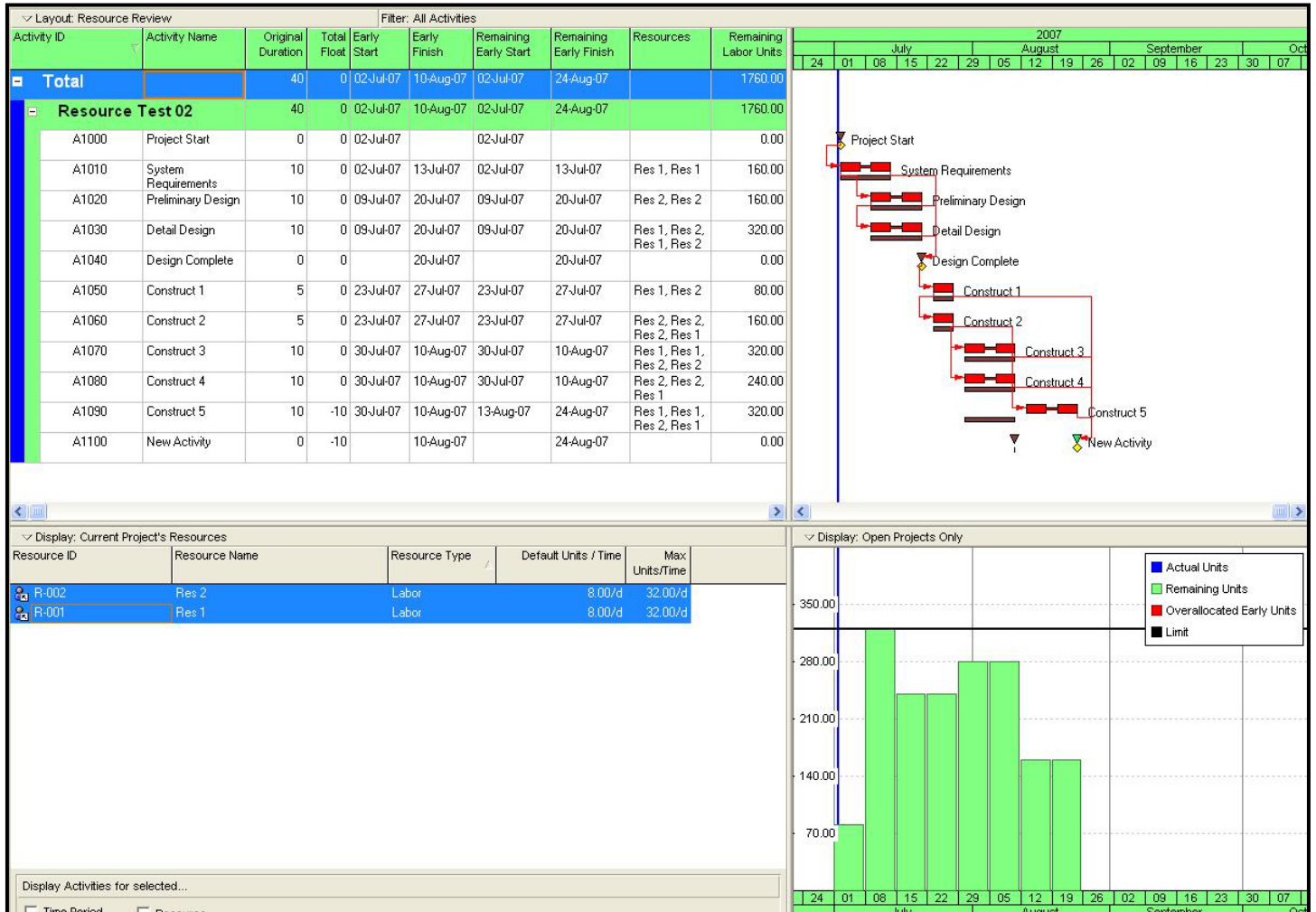


Figure 30 – Resource Level Max U/T 32h/d

In figure 31, the sample project has been resource leveled, & you will note that as the resource Max Units/Time for both resources is set at 40h/d. You may also notice that the

project leveler has not made any further adjustments to the project resource requirements or end date to that shown in Figure 30, this is due to there not being a sufficiently large enough increase in resource availability to have any effect.

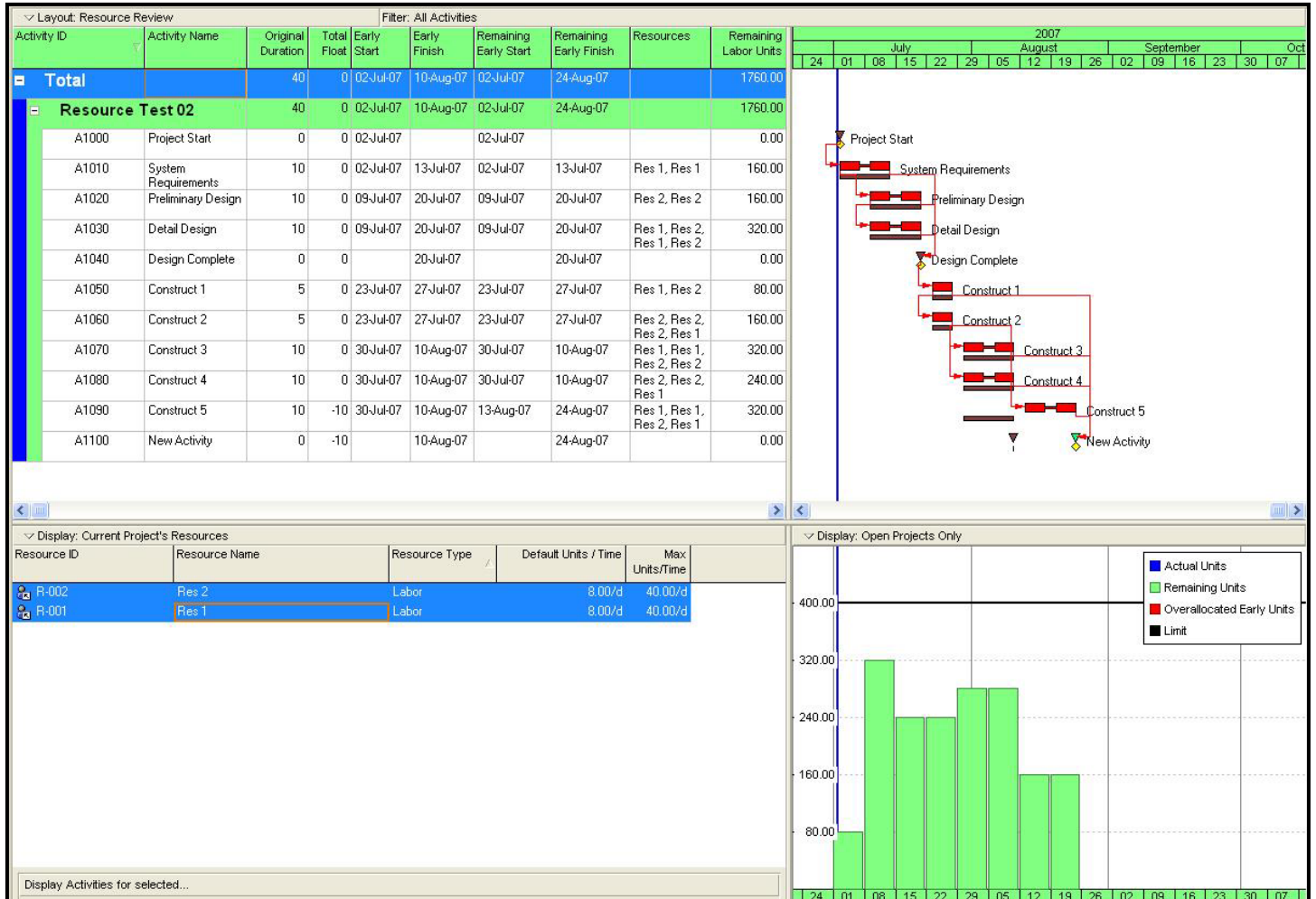


Figure 31 – Resource Level Max U/T 40h/d

In figure 32, the sample project has been resource leveled, & you will note that as the resource Max Units/Time for both resources is set at 48h/d. You can see that with this level of

resource availability, the project can be scheduled on its early dates, which is the fastest the project can possibly be completed with the underlying activity durations and technical dependencies.

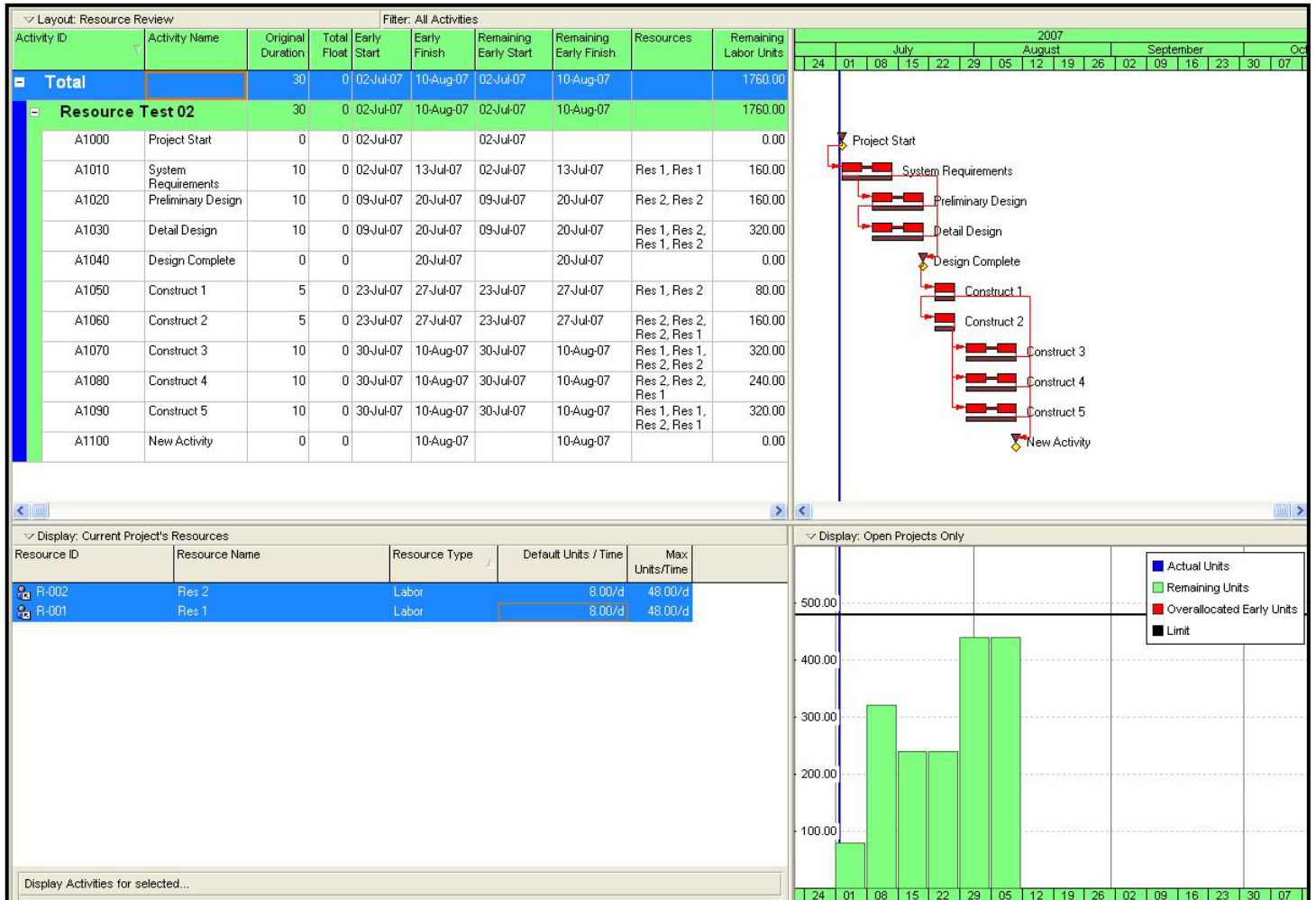


Figure 32 – Resource Level Max U/T 48h/d

As you can see from Figures 30 – 32, the project can be analysed on an iterative cycle with adjustments being made to the resource Max Units/Time.

This covers the basic theory of predictive resource analysis (Deadline Critical Scheduling).

The next thing that we need to cover is the inclusion of constraint dates on the project and how you will need to interpret the data displayed.

The following examples will endeavour to give a quick outline to show how constraint dates can be used in the schedule.

For ease of explanation I shall constrain the project end milestone using both hard (mandatory) and soft (Finish On) constraints to the 31st of August.

Here in Figure 33 we can see that the project has been scheduled without regard to resource leveling and that the finish milestone has been constrained to 'Finish On' the 31st of August. You will also note that the resource profile is reflective of the early dates as in Figure 24.

Please take note of the total float available to each activity from this point as this will provide information for analysis of the resource loading as well.

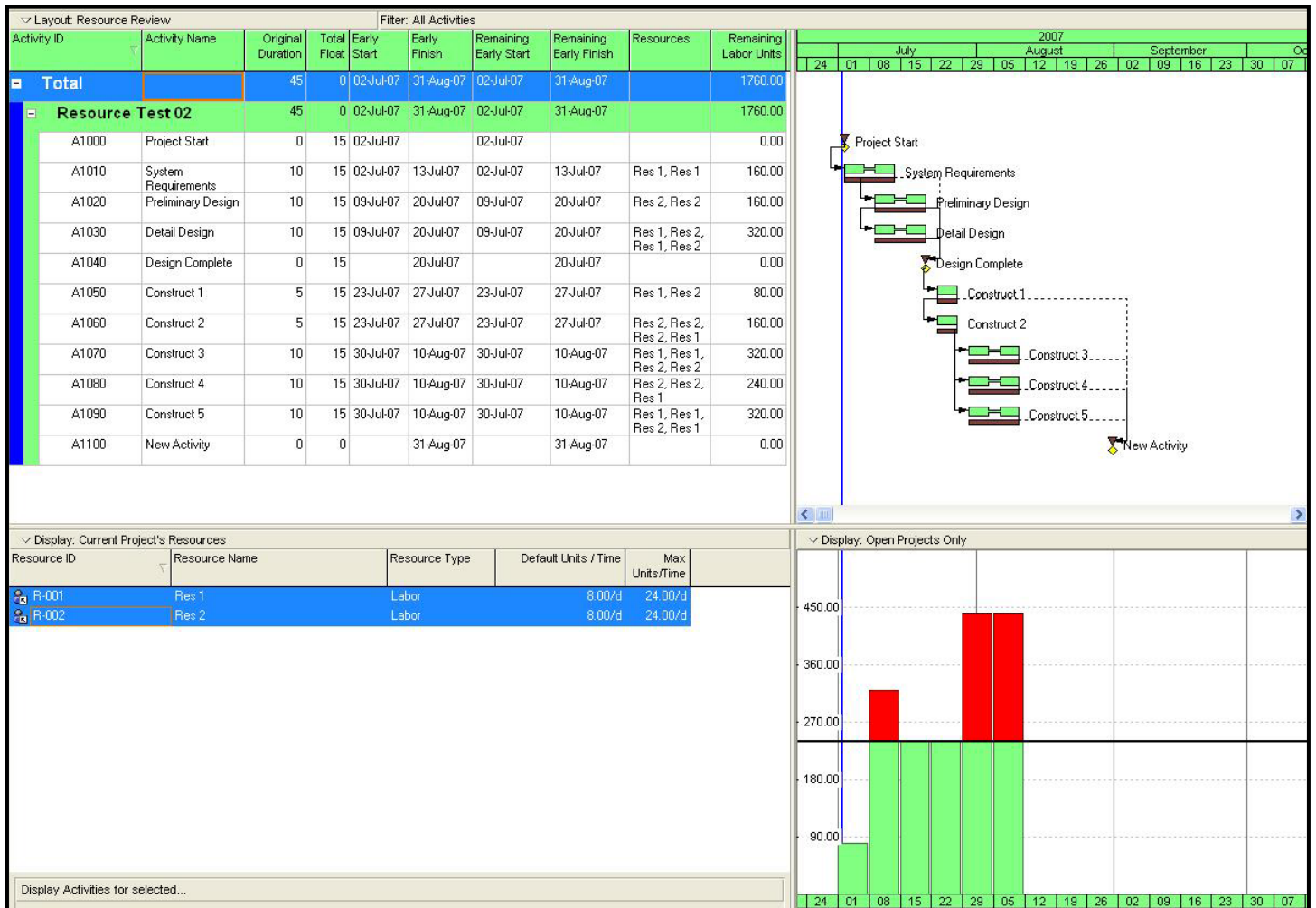


Figure 33 – Early Dates 'Finish On' 31AUG

In figure 34, the sample project has been resource leveled, & you will note that as the resource Max Units/Time for both resources is set at 24h/d, equal to that which was displayed in Figure 27.

If you now examine the total float you will notice that there is negative 20 days placed on the critical path due to the constraint, including the project end milestone, due to the use of a soft constraint. *I.e. – Preceding logic has been honoured.*

It would be at this time that we would conduct the predictive resource analysis to determine how many resources would be required to meet the constraint date. In this case there would need to be peak availability for both resources of 4 each, in order to meet the required date.

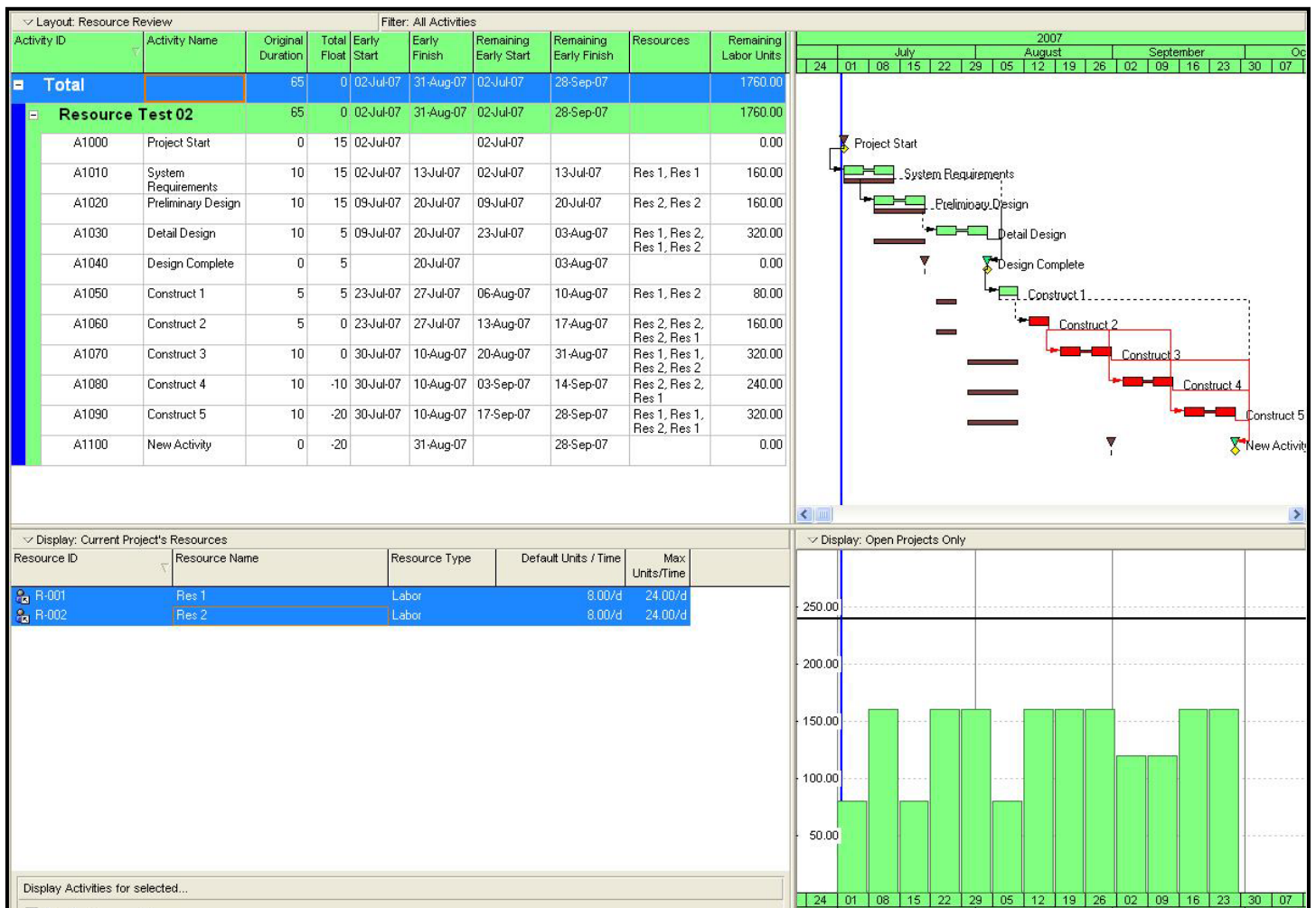


Figure 34 – Resource Leveled 24hd Ea ‘Finish On’ 31AUG

Figure 35 below will show the same project parameters as figure 34, except that the soft constraint will be exchanged for a hard constraint (Mandatory Finish).

As can be seen the mandatory constraint has indeed held the project finish milestone to the selected date, however you can see that the preceding activities to the finish milestone have ignored the activity logic in lieu of the resource availability, and overrun the finish milestone

If you now examine the total float you will notice that there is negative 20 days indicated on the critical path due to the constraint, however as a hard constraint has been used the milestone shows zero days float.

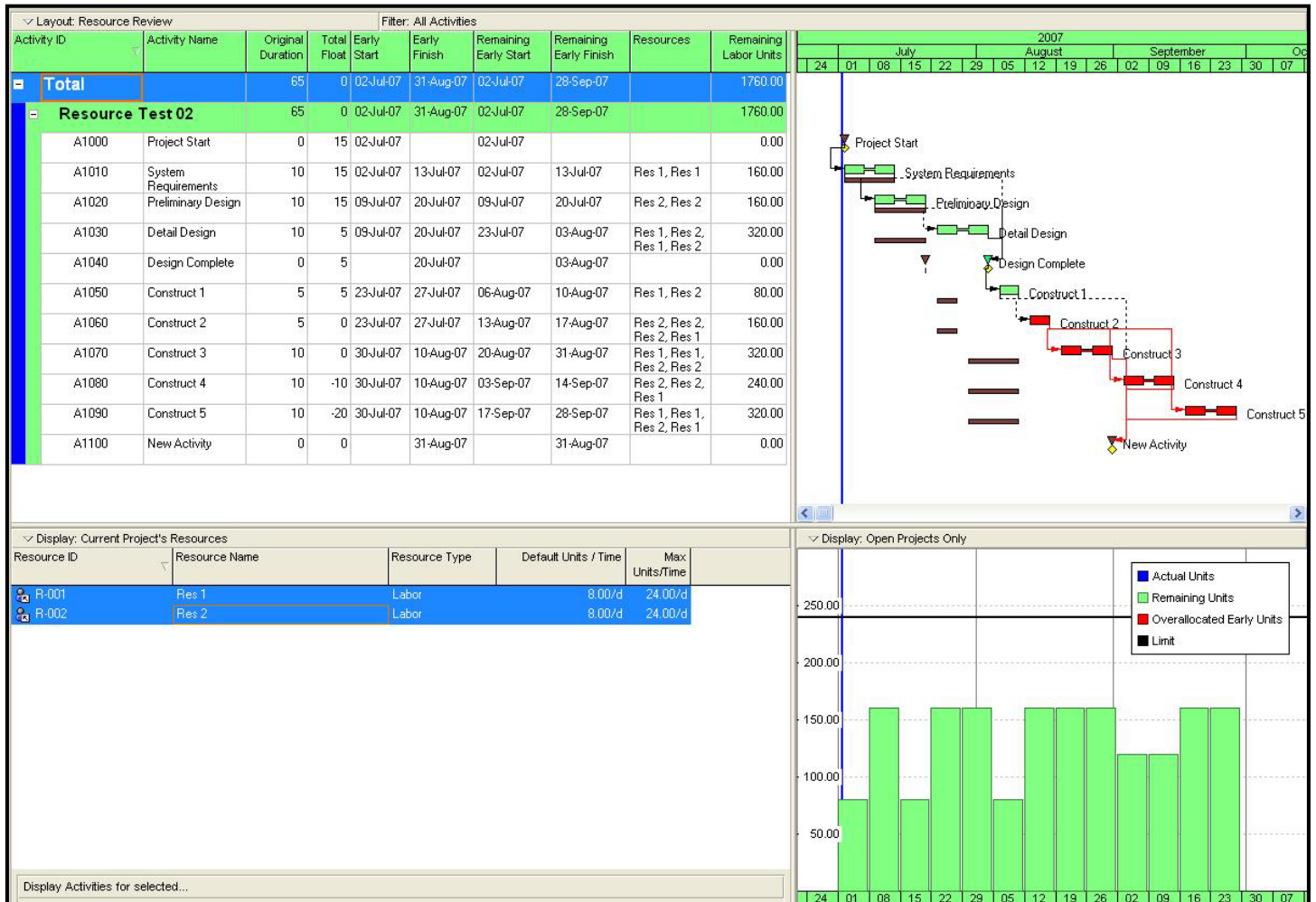


Figure 35 – Resource Levelled 24hd Ea ‘Mandatory Finish’ 31AUG

The use of constraint dates should be very carefully controlled, as can be seen from Figures 34 & 35. I recommend only the use of soft constraints as the software will still honour the activity logic and this will provide a better foundation for analysis of the resource requirements.

CONCLUSION

Why Resource Plan

As planners we are employed to provide our project managers with information on their projects. This information can be both good and bad, but none the less they require it to make decisions about the project.

We all remember the definition or characteristics of a project;

- It's Temporary
- It's Unique
- It uses Resources

The list could probably go on, but, the thing that we would most like to know is, **How long & How much?**

To answer this we must therefore know **who** will be doing the work and **when** they will be doing the work, as this will have a direct bearing on **How long & How much**.

To understand **How long** a project will take we must look further than the simple task durations and logic, we must look deeper than the roles or skills of the people who will execute the tasks. We must know **when** these specific resources are available to carry out the individual tasks to which they have been assigned.

As you will now be aware there are many settings and options at your disposal to accomplish resource leveling in Primavera Enterprise.

Always remember to write down your assumptions and above all if you can't understand the answer you have been presented by the software, you won't be able to explain it to your project manager.

How Do I Resource Plan

If one was to ask "Where should I start?" I would recommend that the basic setup displayed in figure 11 for the time based scheduling and the settings displayed in figure 13 for resource leveling would be an acceptable benchmark to further develop your own requirements.

As can be seen by the example shown in this paper, resource leveling can be somewhat difficult with many options available, with this in mind you should document the process you intend to use on the project so that there can be an understanding & acceptance of the answers obtained.

To enable predictive planning to take place there should also be consideration given to the use of 'Planning Resources' which will provide a method of adjusting the Max Units/time to allow for Deadline Critical Analysis.

Analysis of the applicable resource histogram will allow for planning of peak resource requirements across the project lifecycle.

What has been covered in this paper should provide you with a basic understanding of the process and some of the tools and structures available to you in your quest to provide a resource leveled schedule to your project manager.

Due to the nature of projects, each planner will have unique requirements on each and every project they work on, so I hope those of you who have read this paper will find at least one thing that you can use at least once.

ACKNOWLEDGEMENTS

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www.eh.com.au

REFERENCES

Primavera Project Planner (P3ec) Version 5.0 software by Primavera Systems, Inc., Three Bala Plaza West, Bala Cynwyd, Pennsylvania.

ATTACHEMENTS

You can detach these files and import them into your database to confirm my theory.

Theta Planning Project 1.XER



Theta Planning Project 2.XER

