

# Time Chainage Charts

**A Management Guide**

*pcf*

## Contents

What are Time Chainage Charts? .....	3
A Simple Example.....	3
Product History.....	4
Technical Overview	
Defining Chainage Points.....	5
Key Activity Types .....	5
Advanced Topics.....	7
Integration with Existing Systems.....	8
Output.....	8
What PCF Provides	
Software .....	8
Consultancy.....	8
Training and Support.....	8

## What are Time Chainage Charts?

The Time Chainage Chart (also known as the Time Distance Chart) is a simple extension of the ubiquitous Bar Chart (Gantt Chart) familiar to all users of planning systems.

A Bar Chart uses the X-axis of the chart to represent time, so that it displays each activity as a horizontal line, as shown in Figure 1 below.

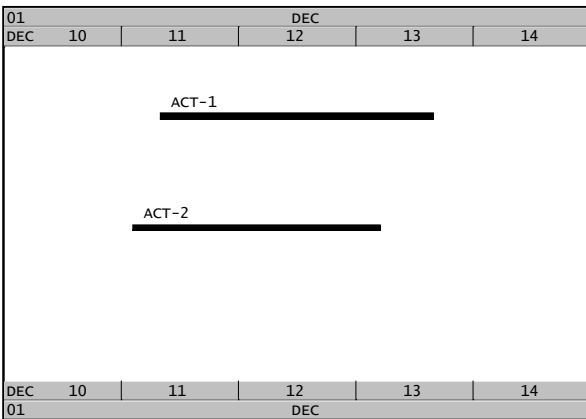


Figure 1

This format provides basic information about the relative timing of activities, but gives no indication of where they take place, or any possible conflicts that might exist. This is a potentially serious problem for those working on projects involving restricted (usually linear) work sites, such as

- roads
- railways
- tunnels
- pipelines
- transmission lines

To resolve these problems Time Chainage Charts use the Y-axis of the Bar Chart format to reflect the physical location of an activity. This is a simple concept providing key additional location-related information required by management and planners to tackle the complexities of linear projects. Why then are these charts not used more often, when the idea behind these charts has been around for a long time?

One probable reason is that this type of chart is not generated by any of the “industry standard” planning tools such as Primavera P3 or Microsoft Project. As a result, users have over the years attempted a variety of methods to generate them, including:

- hand drawing
- drawing using a CAD system
- colouring grid cells in spreadsheets

These are all obviously extremely labour-intensive, especially since by its very nature the project data from which the charts derive requires frequent updating.

To reduce the burden these methods impose, a few software suppliers have developed computer systems to produce Time Chainage Charts. These systems combine a file containing activity data exported from a project management system with a file of location data to automatically generate a chart. However, the user has little or no control over the contents or layout of the chart, and once generated it is simply a snapshot of the state of the project that can be printed out or otherwise distributed. There is no way for example that a user can use such a chart interactively to resolve any problems it might highlight, in the way that he could drag bars around in his project management system to eliminate resource overloads.

We at PCF believe that for Time Chainage Charts to become a useful day to day planning tool and a critical information system for management they must be

- Easily generated from existing data
- Fully interactive
- Configurable to meet the needs of individual projects

## A Simple Example

The following example demonstrates how a Time Chainage Chart provides additional information over a bar chart. The Y-axis represents physical locations between points L1 and L2. The activity has all the normal attributes of an activity such as start and finish dates and is drawn between these two dates.

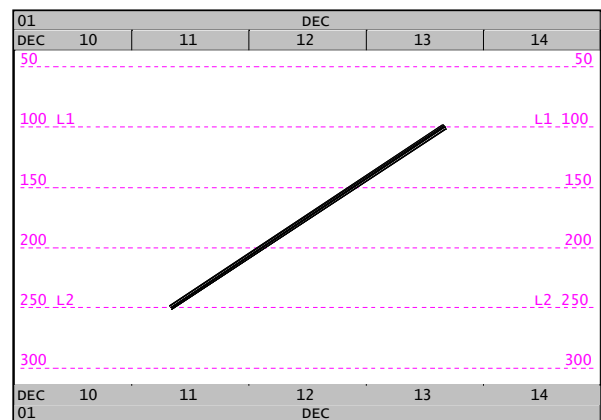


Figure 2

However, as the activity represents work that once started travels from point L2 to point L1 it is not drawn horizontally as in a normal bar chart but

at an angle to reflect the progress both in time and distance.

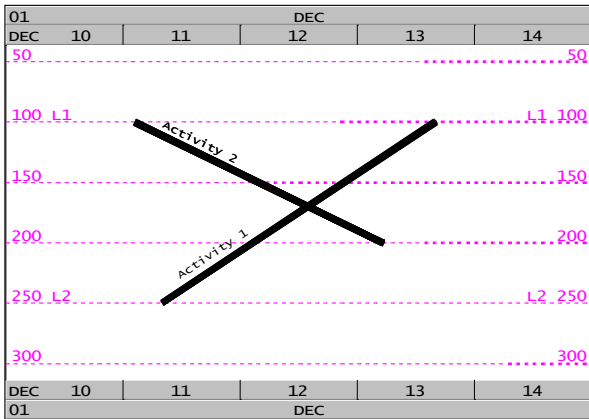


Figure 3

The benefits of such representations are significant and will be explored throughout this document, but by way of example Figure 3 above represents two inspection activities that progress towards each other and actually meet at location 170 at about 13:00 on 12<sup>th</sup> December. Clearly if heavy equipment is involved this may be impractical, and rescheduling of one or both of the activities should be considered.

Compare this with the bar chart representation of the same activities shown in Figure 1, which cannot identify this potential problem at all.

### Product History

In 1989 PCF were approached by Transmanche Link, the company responsible for the construction of the Channel Tunnel, to see if we could develop a computer based Time Chainage system for them. Following the development of a prototype based on our QEI graphical system we were awarded the development contract.

The Time Chainage system was used throughout the life of the project at all levels of management. Engineers could use it to display the effect of protection zones around particular activities, whilst company executives could present summary documents to explain important milestone events such as tunnel breakthrough and critical resource demands.

Figure 4 shows a Time Chainage Chart generated during the construction of the Channel Tunnel. Points to note are:

- The chainages (distances from datum) are displayed in metres along the left side of the chart.
- The bottom of the chart represents the French end of the tunnel, and the top shows a point about 19km out from the shaft at Sangatte which was the datum point. The negative chainages on the chart show work inland from the shaft towards the French rail terminal.

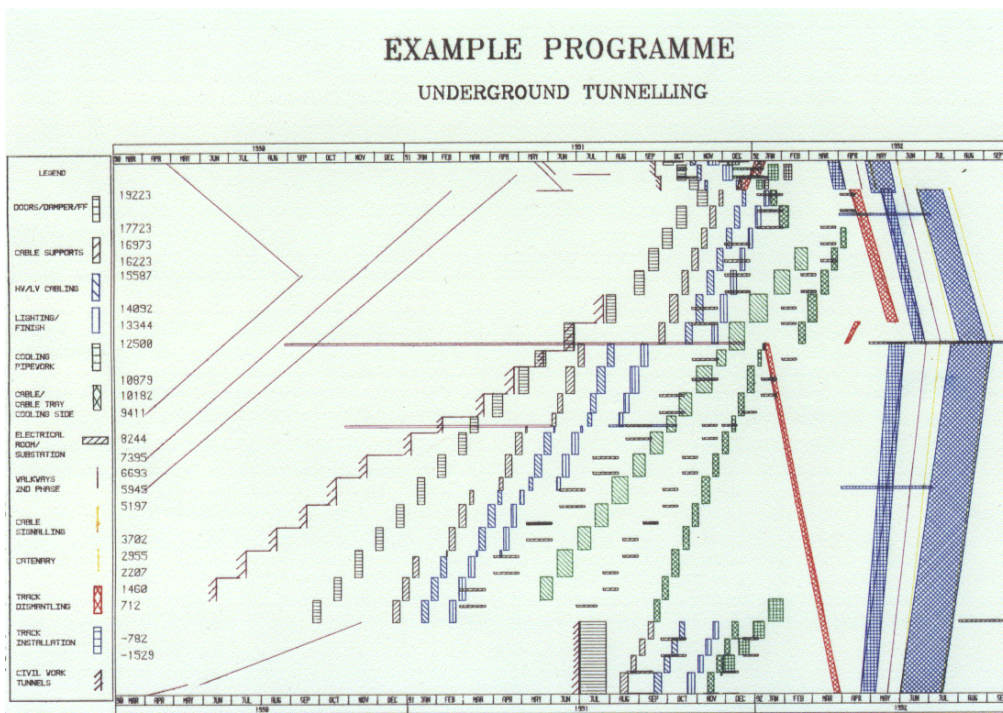


Figure 4

- Most work moves out along the tunnel from the coast - activities moving from bottom left to top right
- Some work can be seen moving back from the centre of the tunnel towards the coast – such as dismantling the construction-related railway tracks (red activities) – this appears as activities moving from top left to bottom right.

This initial system has now been developed continuously for over 11 years and has been further refined by feedback from its users.

### Technical Overview

The PCF Time Chainage System is implemented as an add-on module to our QEI Exec project planning system. This provides a solution 'out of the box', whilst retaining the flexibility to implement client-specific additional requirements.

While it is most likely that the system will operate on data generated by external systems, it is equally simple to use the system in a standalone fashion to create projects and their associated Time Chainage Charts.

The following sections present an overview of the core functionality, and some of the possibilities for enhancement.

### Defining Chainage Points

The key to a Time Chainage Chart is the definition of the chainage points that are used to determine the Y-axis of the chart. These represent distances measured from one or more datum points along the site of the project.

The standard system can manage chainage points measured from two datum points (for example, each end of a tunnel). It is a simple enhancement to extend this to allow for multiple datum points covering for example a road or rail network.

Given that different industries typically use different measurement units, the system lets the user define their own 'Ruler' for the chainage points. In the examples in this document kilometres are used, but the distances could equally well be in miles, yards – or even chains. A chain is an old English surveying unit equal to 1/80<sup>th</sup> of a mile, and the source of the term "Chainage Chart".

The chainage definition dialog allows the user not only to enter the key points but also to enter

descriptions of significant locations. These are then saved in a file that is read into the system when a Chainage Chart is created. Many such chainage files can be produced, which can be used to provide varying levels of chainage detail when charts covering different distance spans are generated.

Figure 5 below shows the input dialog displaying the chainage data that was used to create the example charts.

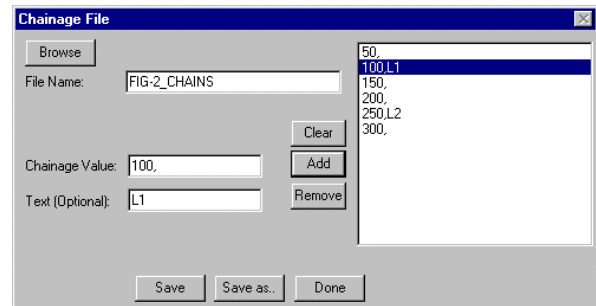


Figure 5

The macro functions within QEI Exec mean that it is a simple enhancement to the standard system to hold the chainage data in other ways such as spreadsheets or external databases if required

Having decided on the area of chainage to be used, activities of various kinds can be created. The following covers the default types provided with the system.

### Key Activity Types

#### Single location

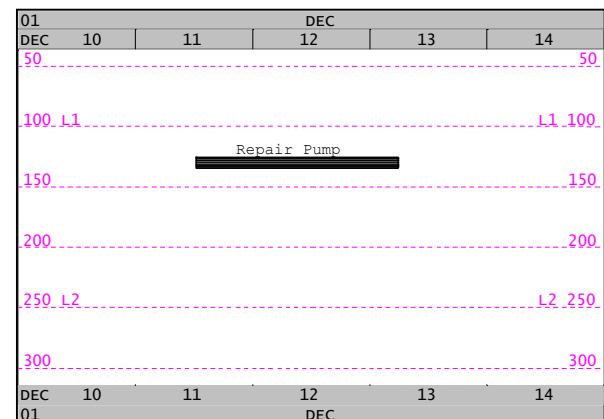


Figure 6

The simplest type is an activity that exists at just one location such as a signal gantry or a pumping station. As in any planning system the dates can either be input or selected using the cursor, additionally the single chainage point required by

this type of activity can also be input or selected using the cursor.

Note how the chosen chainage value of 130 does not need to lie exactly on the values of the chainage map – the Y-axis is scaled by the system based on the visible chainage span and the correct position for the activity then calculated.

**Activities between Chainage Points**

These types of activity are the most frequently used in the system and relate to such activities as tunnelling or pipelaying.

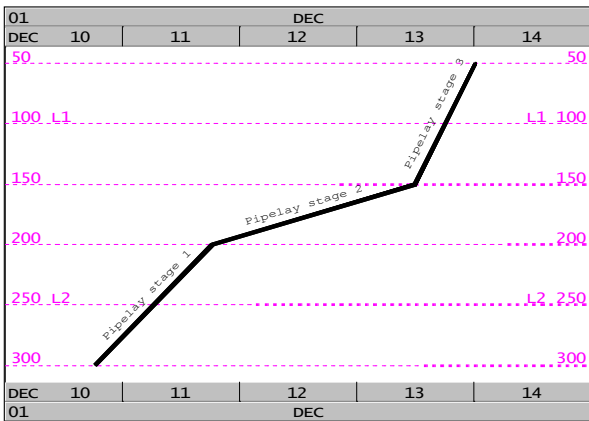


Figure 7

In Figure 7 above the pipelaying has been broken down into three separate stages to represent different progress rates. In fact it is possible to enter a start date and a progress rate, allowing the system to calculate the finish date. The activities have automatically been linked together so that any change in an activity may cause the related activities to also move. This movement can most easily be achieved by selecting the activity with the cursor and simply dragging it to a new position.

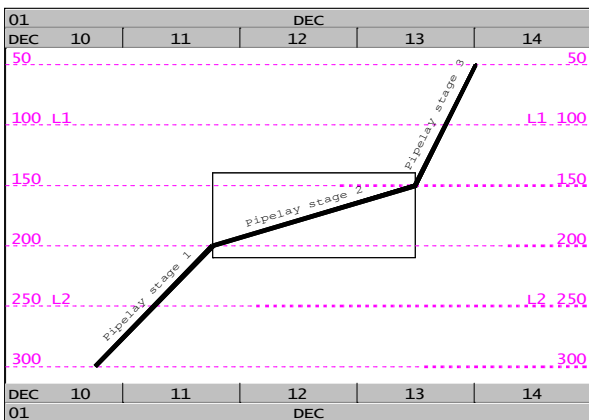


Figure 8

Sometimes activities require a protection zone around them for the whole period of the work.

This is easily represented in the Chainage System as shown in Figure 8. Here the protection shown for Stage 2 covers an expanded area between positions 210 and 140.

**Permanently Protected Activities**

Hazardous activities such as cable laying in a tunnel always require protection and can be displayed by a third representation (a shaded block) as shown in Figure 9 below.

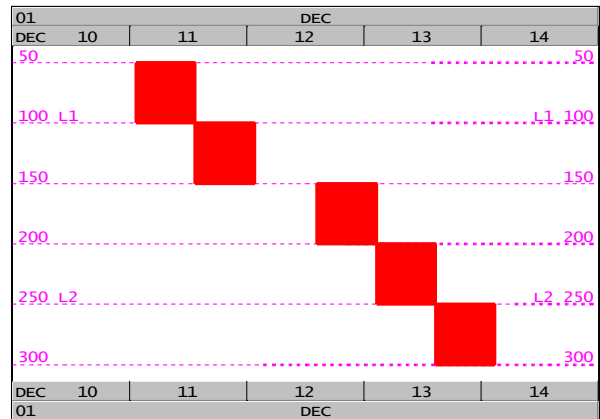


Figure 9

The system allows the user to define different colours and shading or fill patterns for different types of activities. This can be seen in Figure 4, which contains about 12 different activity types.

**Complex Zones**

As a final example, complex zones of work can also be represented. The zone in Figure 10 could represent the “no entry” zone around an area of concrete laying where the work gets progressively quicker.

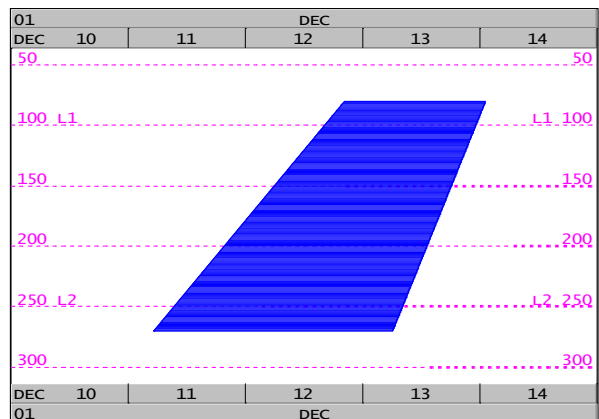


Figure 10

## Advanced Topics

### Clash Management

The system allows the user to develop macros to carry out particular functions. For example, on a chart containing a large number of activities it can be difficult to determine whether activities are clashing for possession of space or not. A macro could therefore be written such that upon a single button click the system determines those activities that clash and colours them red, thus enabling the user to detect them easily and determine an appropriate course of action.

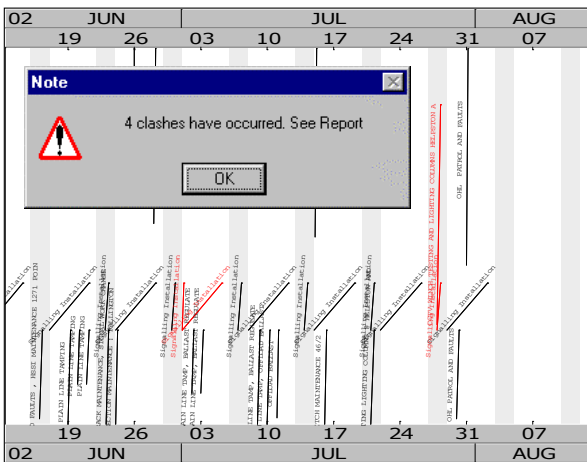


Figure 11

Macros of this kind can very quickly allow the user to develop an information and planning system tuned to their specific needs.

### Resources

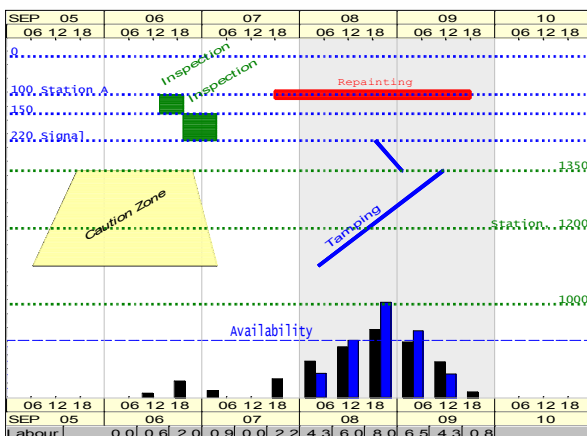


Figure 12

Activities nearly always have resources associated with them and it can be extremely useful to display chosen resource loads at the same time as the activities. In Figure 12 above two resource loads are displayed along with the

availability for one of them. If activities are re-scheduled or moved with the cursor these resource loads will automatically be re-calculated and the display altered.

It should be noted that as the Time Chainage System is an add-on to QEI Exec, all of the resource and earned value functionality of the standard product are available for use in Time Chainage Charts.

### Graphics and Annotation

QEI Exec provides user with a large range of graphics objects that can be added to charts to improve their readability or to provide additional information. The following example indicates one common way to improve the “look and feel” of a Time Chainage Chart.

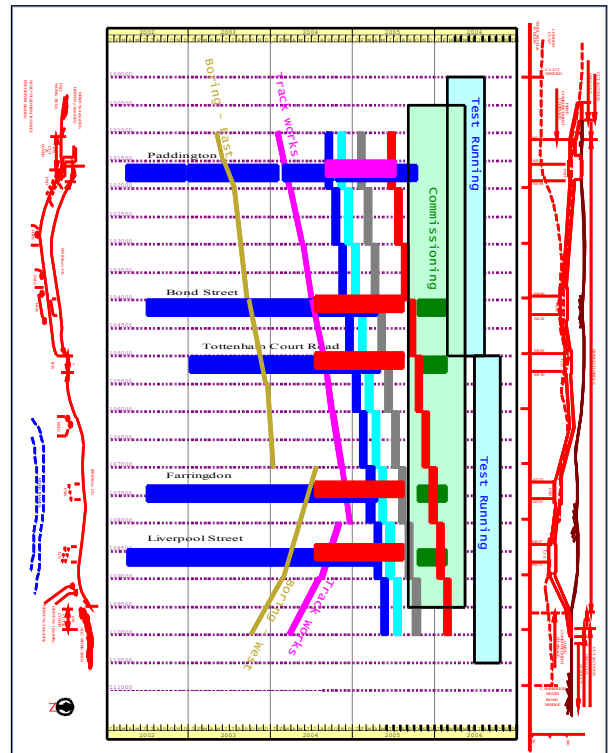


Figure 13

In this example the plan view and cross section of the physical location involved in the work have been added to the chart to improve the level of information. Diagrams like these can be drawn into the system by hand using QEI Exec’s graphics functions, or imported in vector form from a CAD or graphics package.

The example chart also contains text annotations identifying the work at the various stations. Additional functionality within QEI Exec allows users to define these (or any other graphical annotations) as hyperlinks (“hotspots”) on charts.

These can be used for many purposes, including

- creation of menu systems
- navigation between charts
- hot links to external project related documents
- buttons to run macros or external applications

### **Integration with Existing Systems**

Although the Time Chainage System can be used completely standalone it is fully capable of operating in conjunction with other systems via the interface functions of QEI Exec. These offer the import and export of project data (calendar, activity, resource, relationship) in the following formats:

- Fixed width ASCII files
- Delimited ASCII files (eg CSV)
- Microsoft MPX
- dBase (DBF)

Graphics data can be imported in HP-GL or AutoCAD DXF formats.

The system can also exchange data with other applications via ODBC or DDE, and the macro functionality means that many additional means of communication are possible.

The simplest typical scenario would involve importing chainage data from a spreadsheet or database, activity and resource data from a project management system, and graphics such as a site map or company logo from a drawing package.

A more comprehensive scenario might involve developing an additional custom menu item in the planning package that would automatically export the required data and invoke the Time Chainage System to generate a chart. On exit from the Time Chainage System any changes made would be exported back into the planning package.

More advanced integration can also be provided - for example, if one had a GIS system covering a railway network, then clicking on an area of the map could automatically create a Time Chainage Chart showing any planned maintenance for the selected area.

### **Output**

Having created the chart required it is just as important that the right output can be generated. QEI Time Chainage Charts can be plotted on any graphical device supported by Microsoft Windows,

enabling the production of anything from a simple A4 overview through to a 2 metre long wall chart.

Standard document templates can be created by the user, which may include keys, signoff and copyright blocks and company logos.

In addition to printed output, the system allows the user to

- copy charts or sections of charts to a metafile format suitable for inserting into other documents without loss of detail
- publish charts in HTML format so that they can be accessed via an intranet or across the Internet.

### **What PCF Provides**

PCF has been developing advanced graphical solutions to project-related problems across industry for over 15 years. Our QEI Exec software is the basis for many innovative systems, including:

- Manufacturing control in the challenging world of Formula One motor racing
- 'Digital Dashboard' project control in defence manufacturing
- Time Chainage Chart based possession management in the railway industry.

### **Software**

QEI Exec is designed to have the flexibility of a CAD system for display, with the underlying functionality of an advanced project management system. Please consult the product data sheet and other literature for full details.

The standard product functionality can be further extended or modified via the user-programmable macro language. This gives users unparalleled opportunities to develop an environment tailored specifically to their own requirements.

### **Consultancy**

PCF can provide consultancy and programming services to develop advanced QEI Exec based solutions that maximise the value of the data held in existing corporate systems.

### **Training and Support**

A wide range of product training and support services is available. Bespoke training courses can be developed to suit individual client requirements.



pcf

PCF Limited, 41 Marlowes, Hemel Hempstead, Hertfordshire HP1 1LD, UK  
Tel: (+44) 1442 355100 Fax: (+44) 1442 355001 Email: [info@pcf ltd.co.uk](mailto:info@pcf ltd.co.uk)

[www.pcf ltd.co.uk](http://www.pcf ltd.co.uk)