New Developments in LINSIG for Windows

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Introduction

LINSIG for Windows has been one of the most widely used traffic signal design software packages in the UK for many years. It differs from many other design packages in that it closely models the way in which a signal controller actually works, with much of the input data being directly obtainable from the signal controller specification sheets. Although specifically designed to uncompromisingly model the detail of UK specification traffic signals, it has also found significant use overseas, often in countries where UK specification equipment is in widespread use.

The software has been progressively developed over the past 20 years introducing new features as signal controllers have developed, new techniques as signal design best practice has evolved, and exploiting the increasing power of personal computers by introducing more sophisticated user interfaces and graphics.

This paper looks at the latest developments to LINSIG which are currently being worked upon and are planned to be included in the next update of the software which will be released in the next few months. It is not intended to be a detailed specification of the software but to provide some tasters of the new features and changes which it is planned to introduce.

History

LINSIG started its life on DOS based PC's in 1985 and was designed to run on a computer with as little as 64k of memory!! It used a newly developed controller model which closely followed the operation of the new microprocessor based traffic signal controllers, and a traffic model based around the manual calculation model developed by Webster and Cobbe. The use of Webster & Cobbe allowed easy checking of LINSIG's results against hand calculations which has been important in the software gaining its widespread acceptance.

The software was substantially rewritten in 1993 to take advantage of the improving display and printing capabilities of computers. The software remained a DOS program as the uptake of MS Windows at this time was limited. The underlying controller and traffic models within LINSIG were essentially unchanged except for minor additions to both models.

The next and most recent major change to LINSIG was its move to the Microsoft Windows platform in 2000. MS Windows had become increasingly dominant and as the speed of computers and graphics facilities had continued to grow rapidly it was decided to again completely rewrite LINSIG to take advantage of this, providing many new graphical features and also ensuring compatibility with more recent computers and office networks. The controller and traffic models were again kept essentially the same to provide continuity of model results whilst users were adapting to a radically new user interface design. Many tasks in LINSIG were made easier and quicker to carry out by the extensive use of dynamic graphics and the use of the mouse to interactively carry out operations such as editing signal times by dragging stage change points.

New Developments

Over the four years since the last major update to LINSIG, the Windows version has gained widespread acceptance and is now in use in the majority of Local Authorities throughout the UK as well as a high proportion of consultants. Over this time JCT have received much feedback and many comments on the software and have merged these with its own ideas for LINSIG to move forward to the next major version of the software. This next version will build both on the previous version, which was designed to be easily extensible, and on other JCT software products, such as TranEd Version Two, which are designed to be modular, sharing similar functionality with other products wherever possible.

Major new features which are likely to be in the next version are:

- A new traffic model which introduces new features whilst retaining compatibility with the existing model
- A completely new Report Generator including printed graphics
- Explicit support for parallel-stage streams
- Stored signal plan libraries
- A multi-step Undo system
- Grid based rapid data entry views
- Pedestrian links and time distance diagrams
- A graphical phase based design system
- Calculated traffic flow groups
- Controller model changes to support Republic of Ireland specific signalling

As well as the above changes a long list of more minor but still useful improvements will also be carried out, many of them being suggestions from users.

The Traffic Model

As discussed above the LINSIG for Windows traffic model has for many years been based on the Webster and Cobbe traffic model, mainly for reasons of simplicity and available computing power. Whilst it is not intended to completely abandon this time served model, a number of updates and enhancements will be built into the LINSIG model to model more complex scenarios such as peak periods with variable flow profiles and also to allow more detailed analysis and interpretation of queuing.

Report Generator

The current version of LINSIG for Windows includes a HTML based report generator which although being able to produce detailed text based reports of junction performance has not proved as flexible as originally intended. The two main problems were:

- HTML Documents are comprised of multiple computer files for each graphic and text item. This makes HTML reports containing both graphics and text difficult for both LINSIG and users to handle. For this reason the reports in LINSIG were restricted to being text and table only reports. This did not provide best use for one of LINSIG's best assets, that is, its extensive graphics.
- Although many low cost or even free HTML editing tools exist, many users of LINSIG did not own or know how to obtain and use them. This meant that in situations where users wished to customise the layout or structure of reports this was difficult to do for someone who was not familiar with HTML.

For the above reasons it was decided whilst developing TranEd Version Two that a new common report generator would be developed which would in time be incorporated into all JCT software products. The key features of the report generator are:

- Rich Text (RTF) based output which can be opened in MS Word, WordPerfect or most other modern word processors.
- The RTF format allows the inclusion of a much wider range of report components such as tables and graphics as well as allowing a more complex layout.
- As the report can be opened in most word processors the user can use their favourite word processing software for viewing and printing the reports. Free viewers are available for anyone who does not have a word processor.
- Using a word processor the user can make cosmetic changes to the report, for example, to bring the fonts and colours into line with company standards, or to include part of the LINSIG report into an engineering report.

Parallel Stage Streams

As traffic signal designs have become more complex multiple parallel stage streams are often used to create a more flexible signal controller design, or to run two closely spaced junctions from a single controller. Although the current version of LINSIG can handle designs involving multiple stage streams it does not do so by design and requires a number of specialist techniques to be used to successfully model a junction using parallel stage streaming.

The new version of LINSIG will include explicit support for parallel stage streams in its controller model allowing complex controller designs to be more closely modelled and more comprehensive error checking to be carried out.
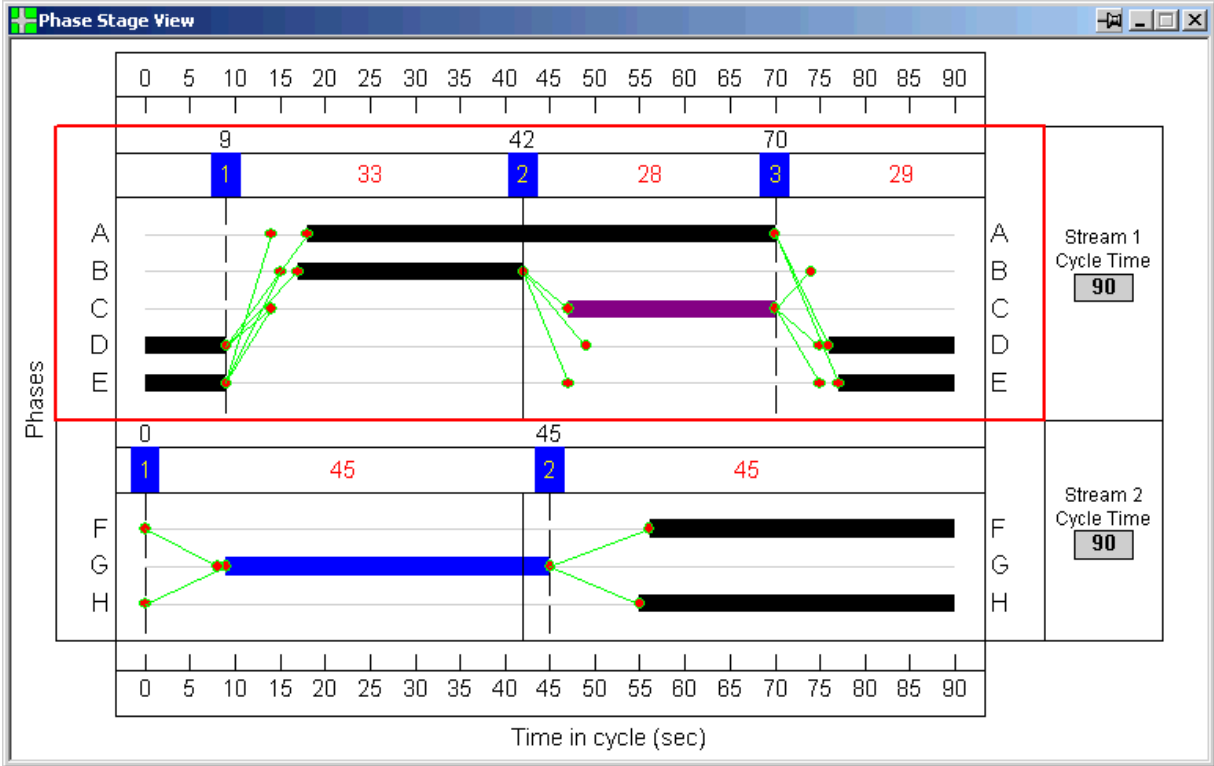

Figure 1 : Multi-Stage Stream Phase-Stage View

Signal Plan Libraries

In the current version of LINSIG a single stage sequence is specified defining the order of stages and stage durations to analyse. If a different stage sequence is required the defined stage sequence is edited to form the new stage sequence. Although using LINSIG's graphical editor this is relatively straightforward it becomes tedious when swapping between two long stage sequences and would become even more so with the advent of parallel stage streaming where each stage stream would require its own stage sequence to be defined.

To address this, the new version will introduce a system of signal plan libraries which allow the user to build up a series of signal plans each of which contain the stage sequence and times for each stage stream. This will allow complex multi-stream signal plans to be easily switched between allowing easy comparison of their effect on the LINSIG traffic model of the junction.
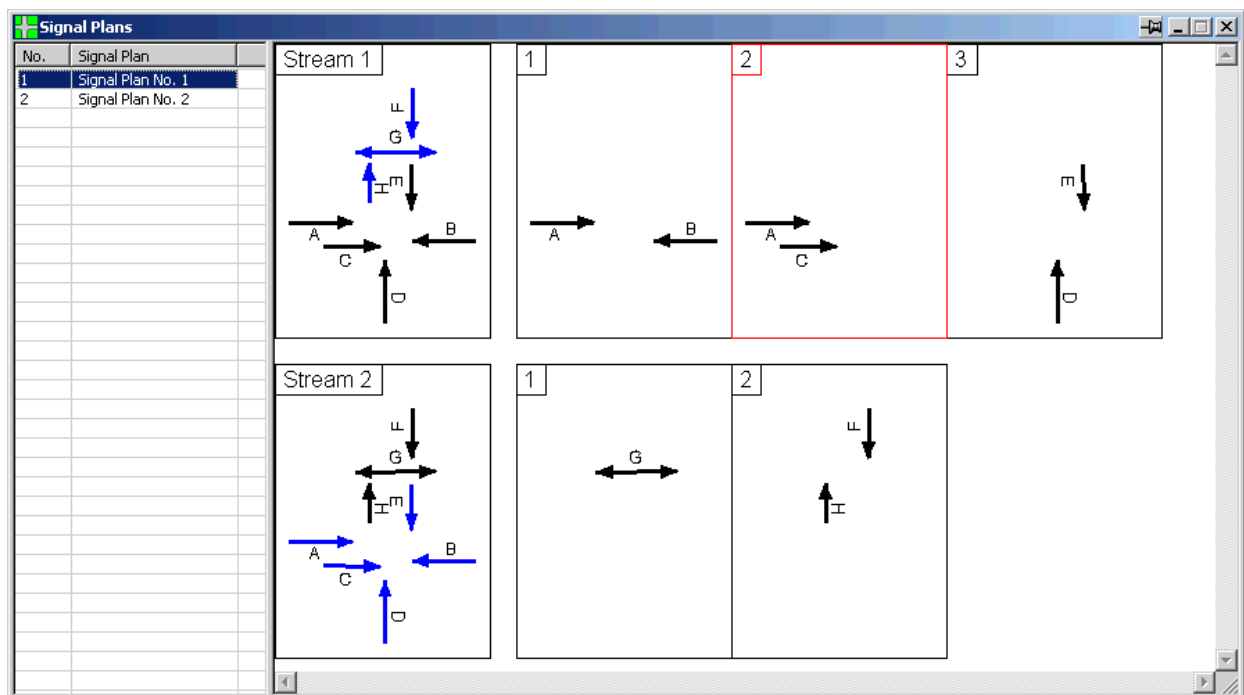

Figure 2 : Signal Plan View

Multi-step Undo

This feature is one of the most requested features in LINSIG and although not a new technical capability will significantly help with editing LINSIG models. The concept is straightforward: At any point the user can choose to step back through up to 100 previous editing actions in the model undoing them to return the model to a previous state. This also helps with learning LINSIG as new users can experiment with different designs undoing back to a previous point if the design doesn't work out.

Grid Based Rapid Data Entry Views

The new grid based views are designed to supplement existing graphical views and allow frequently edited data to be edited using spreadsheet like grid views. This allows, for example, all the saturation flows on links to be updated simply by changing values in one column of cells in a grid in a similar manner to a spreadsheet. Although this may seem like a regressive step when compared with the more 'modern' graphical interface currently in LINSIG it is a much requested feature by advanced users who know exactly what they are doing and wish to make bulk changes to data. The more intuitive graphical interface is of course still available and is recommended for new users and for making more complex changes.

Users of TranEd Version Two may have experience of using the Card View which is based on a similar concept to the above.

Pedestrian Links

Currently LINSIG only models traffic links with pedestrians purely as timing constraints on the traffic. A basic pedestrian model which will allow pedestrian walk times and time distance diagrams to be estimated will be included to help ascertain whether a junction design which is good for traffic is also good for pedestrians.

Graphical Phase Based Design System

Phase based design involves initially designing the controllers signal timings considering only phases and phase intergreens. When an efficient timing pattern has been developed stages are then defined from this timing pattern rather than the more common sequence whereby stages and interstages are designed before being combined to calculate phase times. It has been found over the years that phase based design can often lead to more efficient and flexible staging arrangements especially for more complex junctions.

A new graphical design system is being integrated into LINSIG which will allow a phase based design to be developed without the constraints of stages, before using the phase design to create stages within the LINSIG model.

Calculated Flow Groups

Often traffic flow groups are built up from a series of components, for example, base traffic plus a growth factor plus one or more of a number of development traffic options. Currently each combination of traffic flows must be calculated manually before entering into LINSIG. The new traffic flow group system will allow flow group components to be combined in different combinations. One key benefit of this will be that when a flow group component is changed all dependent flow groups will be updated, greatly reducing the amount of editing required and the potential for errors to be introduced.

International Controller Model Support

Some regions, for example, the Channel Islands and the Republic of Ireland use traffic signal systems very similar to the UK but with a number of minor differences unique to each region. Wherever possible it is planned to incorporate support for region specific controller features in the next version of LINSIG. More comprehensive support for non-UK features is planned in subsequent versions for which a much more sophisticated controller model is being developed. If you know of any such differences which would be of use please let us know so can look at the feasibility of including these in LINSIG.

Other More Minor Improvements

The above discusses a number of more significant improvements for LINSIG. As well as these the new version will also include a number of more minor updates and new features. These include:

- Interstage Diagram Printing
- Improved Junction Layout View Data Display
- Customisation of text sizes and screen colours
- Toolbars
- Grid and Ortho facilities for constructing neater diagrams
- More scaling and display customisation options
- Stage Maximum constraints
- Improved Phase Stage View showing Intergreens

The above list is certainly not exclusive and many additional items will make it into the next version.

Availability

Many of the above features have already being integrated into LINSIG and many are still to be added over the next few months. It is currently anticipated that the next version will be available around the end of February 2005 however this will depend on a number of decisions still to be taken such as the complexity of the new traffic model and any changes to the planned feature set which may bring forward or (more likely) delay the release date. As always anyone desperate for a copy of the new software to evaluate will be able to request a Beta copy from around Christmas onwards. Anyone with an urgent need to use the new software on real work may also be able to obtain a release candidate copy of the software before its formal release. A release candidate is essentially complete from a software development and testing point of view but often is without documentation which takes a significant time to write in its own right. Beta and Release Candidate software is of course free of charge.

Conclusions

This paper and its accompanying presentation have discussed some of the new features planned for the next version of LINSIG for Windows. These will not only include a large number of new features to carry out new tasks but also a large number of changes to improve and refine existing features. A number of the major new features have been demonstrated and their use explained.

One purpose of this presentation is to encourage feedback from users. Obviously not all ideas can be incorporated immediately but many ideas are relatively straightforward to design into LINSIG at this stage and all users are requested to send any suggestions or grumbles about LINSIG to support@jctconsultancy.co.uk. Many users have already done so and many of their suggestions have already been incorporated in LINSIG and other JCT Software products.