Layer3 SYSTEMS

System Simulation and Display

CustardWare V6.5

Victoria Line Signalling System Simulator.

www.CustardWare.com

System Simulation and Display

CustardWare is designed to be adaptable and easy to deploy.

- Cost effective.
- Efficient, powerful and intuitive operation.
- Flexible and highly customisable.
- Managed service reduces hidden staff costs.
- Fast delivery and excellent support

"CustardWare provided the key tools needed to cost effectively preserve an important piece of technology for the future " Chief *Financial Officer – Preservation Charity*

Layer3 Systems Limited's Paul Sweetland, our senior network and systems engineer, has for many years been involved in electric railway preservation. As a member of the Electric Railway Museum he has played a key role in looking after many electric railway vehicles. He has also been heavily involved in preserving the original Victoria Line Signalling System.

In 2011 London Underground offered Paul the entire de-commissioned control room for preservation. It had to be restored to working condition and convince the control room that trains are still running despite the fact it was no longer connected to any railway infrastructure.
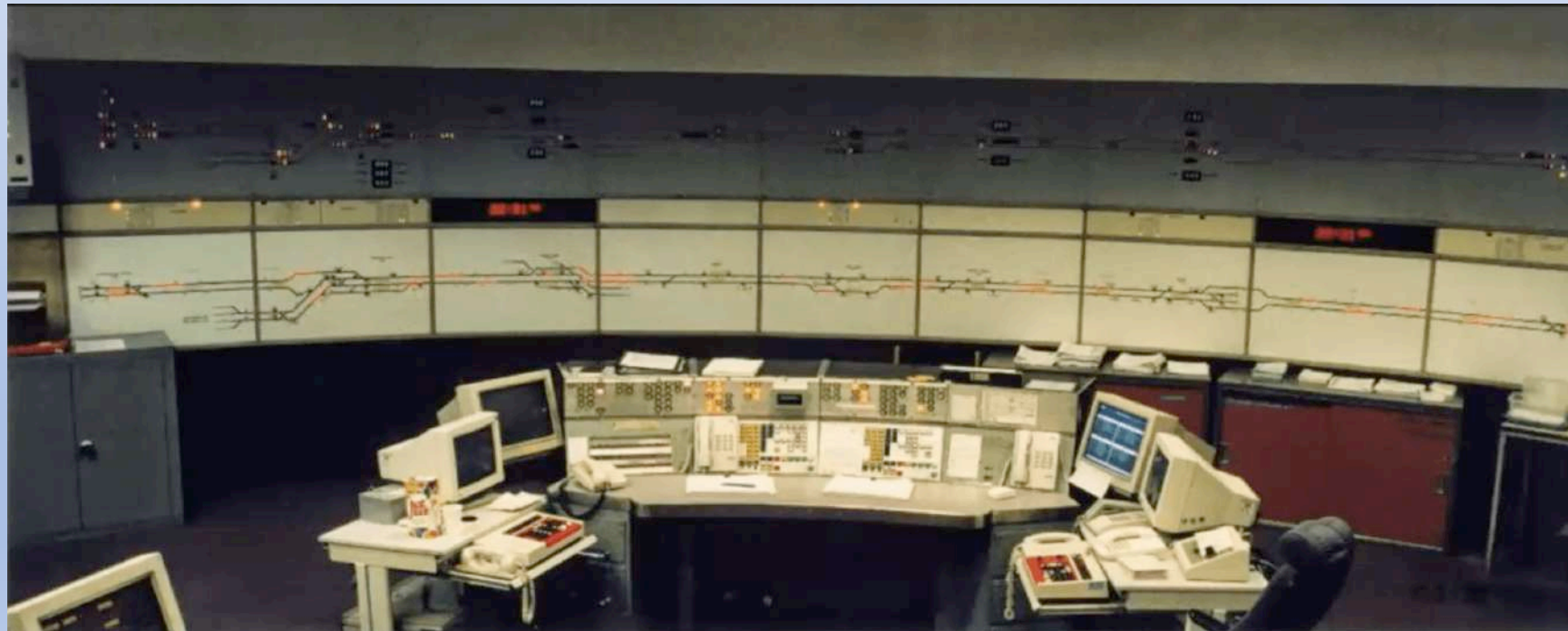
The Victoria line opened in 1968 as the world's first full sized, fully automatic passenger railway. All trains, signalling and scheduling, were fully automated. Operationally the driver opens and closes the doors and presses a start button. The control desk and panel are supervisory and they're able to override the automation by means of connections to nine large automated signal boxes.
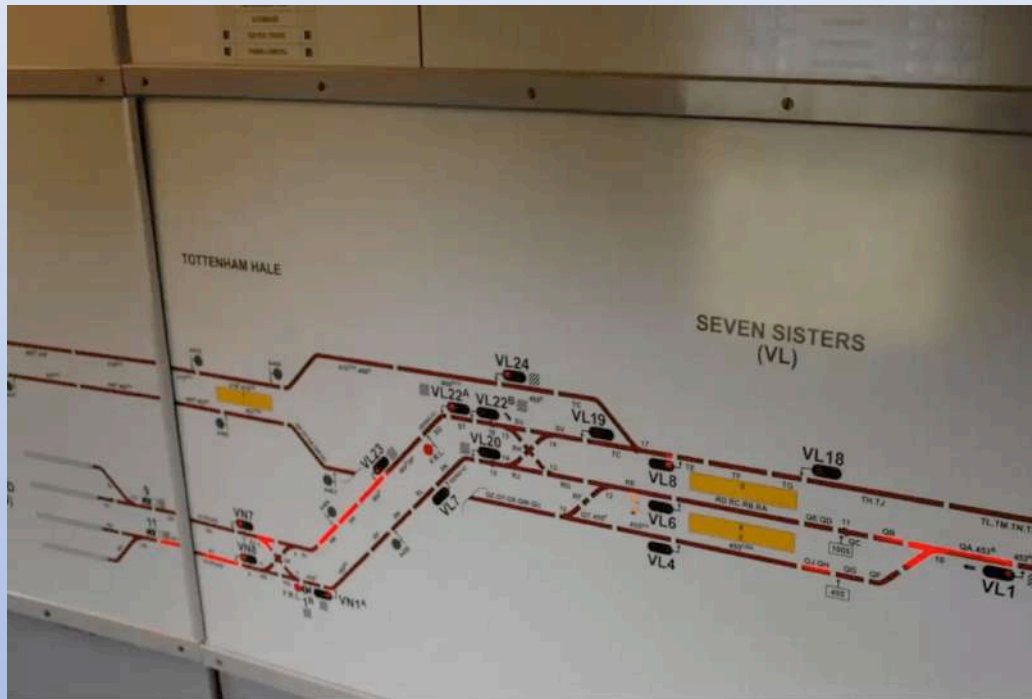
There are no computers in the system. It is a mixture of electro-mechanical and electro-pneumatic and very early digital electronic operations.

The system uses punch hole rolls to define the the timetable schedule.

A simulator was developed to simulate not only the trains, but also every relay contact, each signal lever and every punch hole.

In total some 60 leather bound volumes of London Underground Circuit diagrams were converted into software logic. The control room desks required virtualising on to touch screens to preserve the original switches, and display screens for presentation to the public.

A large computer interface was built, comprising of 260 inputs and more than 1500 outputs, to interface with the control room, desk and display panels. This allowed for the creation of the museum exhibit showing operation of the physical system to the public, and would make it possible to put the whole demonstration online as a website to illustrate how the system worked. What was needed was a mechanism to tie the simulator, the displays and the control panels together in way that modelled full operation.

This is where a CustardWare came in. The ability to write CustardWare plugins that communicate with the devices in the real world gave the ability to quickly deploy CustardWare to interface between the simulator and the interface hardware for both input and output. CustardWare is passed every last piece of information from the simulator and is then able to display anything we wish on screen in pretty much any conceivable way - even modelling the original displays used on the Victoria Line.

The simulator also displays the movement of trains as would be seen by people at stations.
This works for both the museum exhibit and for the online website model.

The Victoria Line signal boxes have been carefully modelled using the original design artwork.

This includes simulating the signal levers which, unlike a traditional signal box that move backwards and forwards as they're pulled, move from right to left under electro-pneumatic operation.

This means that instead of using delicate original equipment, we provide an on screen display like this model of the Seven Sisters signal box. This animates the levers moving in response to the train movements.
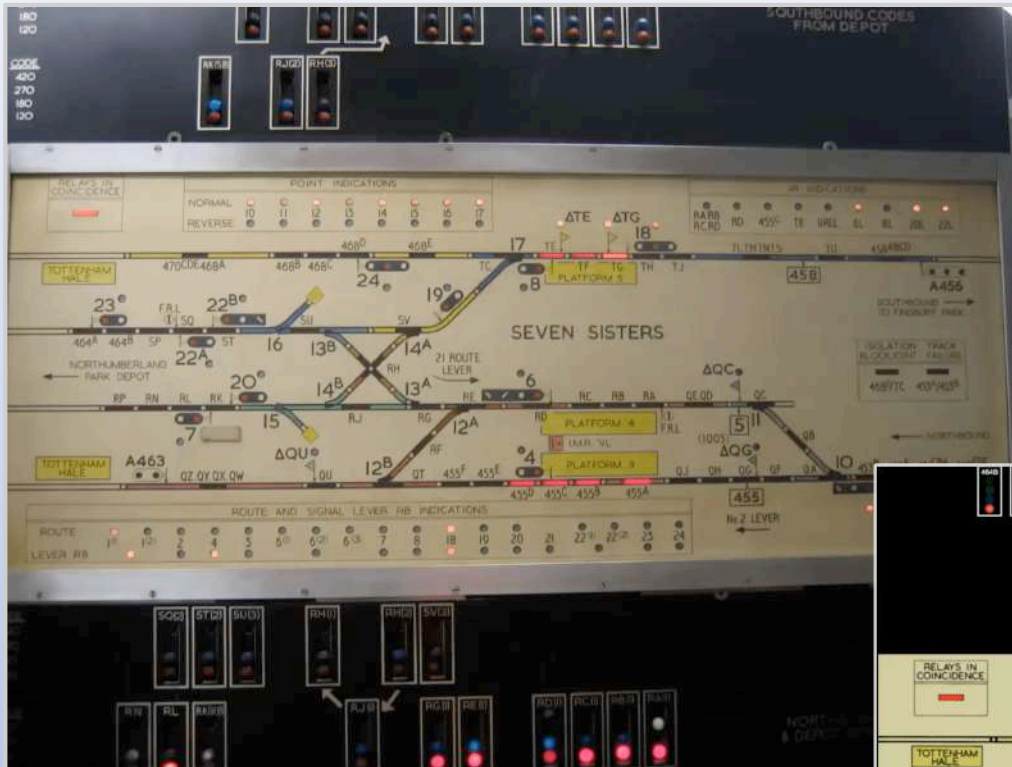
This is a picture of the original physical Seven Sisters tube station and signalling area display.

This is managed and driven by the simulator and interfaced via CustardWare.
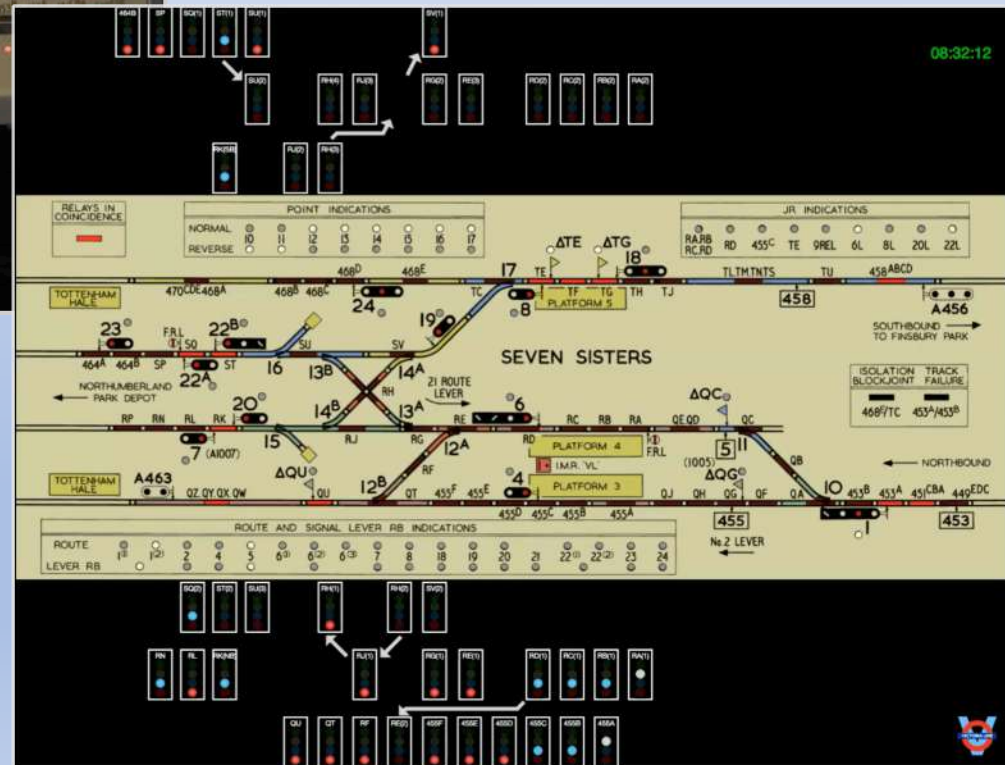
This is a picture of the on-screen Seven Sisters tube station and signalling area diagram created from the original artwork.

This is managed and driven by the same simulator and interfaced via CustardWare.

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The image on the right shows the punched hole rolls used to drive the scheduling of trains on the Victoria Line.
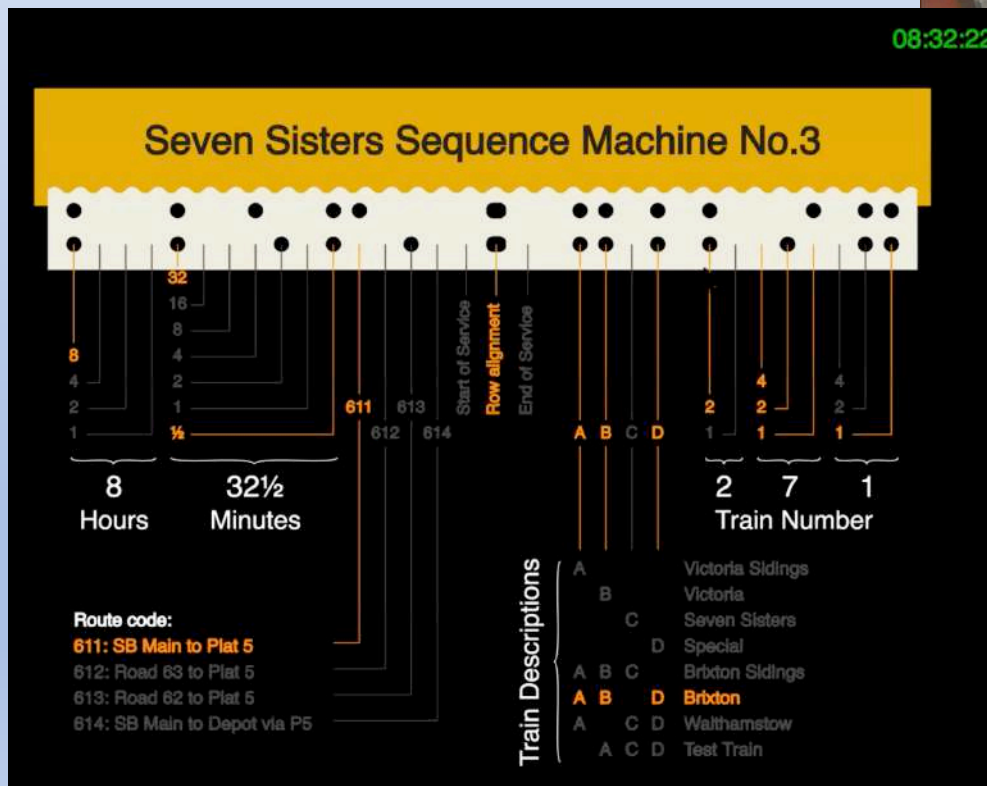
The image on the left shows the CustardWare simulation of the punched hole rolls. The model provides a decoded explanation of each row of holes as they appear

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The original push button control panels on the Victoria Line tube system can be used to override the automated system. These mechanical buttons and the internal bulbs are prone to wear and ageing.

The virtualised control panels preserve the physical components and allow the system to be made available online via a browser.

A view of the fully virtualised control system prior to deployment to the permanent museum site.

A close up of one of the virtual displays showing the clock and simulator status board for the control system.

Any Questions?

- We would be pleased to answer questions and explore possible use cases:
  - email vivg@layer3.co.uk
  - or call 0208 769 4484.

- Please contact us directly if you have more in depth questions or would like to discuss requirements or ideas in more detail.

- Demonstrations can be arranged at your request…

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