THE 67s AND THE VICTORIA LINE
1 – EARLY DAYS
by Piers Connor

THE 67s ARE GONE

On 30 June this year, the last train of 1967 Tube Stock ran in public service on the Victoria Line, finishing its final trip at Seven Sisters at 19.45 (about 15 minutes late after the failure of one of the replacement 2009 Tube Stock trains earlier in the afternoon) before trundling off up into Northumberland Park Depot for the last time. The withdrawal of the 1967 Stock marked the end of over 43 years of service since the first 4-car unit began working on the Woodford – Hainault shuttle on 21 February 1968. It also marked the end of the first fleet of trains in the world built exclusively for automatic train control (ATC) on a new line built also exclusively for automatic operation. Now, to mark the end of the stock, I'm writing this series on the story of the development and use of the "67 Stock", as we usually called it.

As is normal with my articles, I have no idea how long this series will go on but in it, I will try to cover as much detail as I can, so that we end up with a record of the life of the stock and of how and why things were done with it and to it. Naturally, the story of the 67s is tied up with the story of the Victoria Line and with the development of ATC on the Underground, so I must include some of those stories too.

In this series I will include in the text references to sources, something I haven't been too diligent about in the past but I will also, as I have always done, make clear what is conjecture and anything that has uncertain provenance.

THE PLAN

The Victoria Line was many years in the planning[1]. It first appeared in outline in proposals for new lines put forward in the late 1930s as a line running generally south west to north east across London passing through Victoria and Finsbury Park on the way. The southern and northern termini varied in different versions as plans were revised and refined but the general direction remained firm. Although some planning continued, things slowed down somewhat during the Second World War (1939-45) but, even before hostilities were over, studies for new lines likely to be needed in post-war London were revived and several further versions of the line appeared. They still all covered the heavily trafficked Victoria – Euston – King's Cross alignment and thence north eastwards via Finsbury Park to Tottenham and Walthamstow[2]. In the south west, Brixton was in all the proposals and some schemes went as far south as East Croydon.

By the mid 1950s, things had changed a bit. The route north of Victoria was pretty much agreed but the southern extension was now expected to be towards Wimbledon. It was agreed that parliamentary powers to build the line would be applied for within the British Transport Commission Act of 1955 but only for the Victoria to Walthamstow section. It was at this time that "Victoria Line" first came up as a suitable name for the route.

SOCIAL BENEFITS

The financial justification for the Victoria Line was an early example of the inclusion of social benefits created by a new project, rather then just a straightforward commercial analysis. Although fairly narrow in its coverage by today's standards, it included reductions in traffic congestion and improvements in comfort and convenience for passengers. It also involved the calculation of time savings for passengers both on and off the Victoria Line.

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1 For an excellent history of the planning for the Victoria Line, you could do no better than read Mike Horne's "The Victoria Line", Capital Transport Publishing, 2004, ISBN 185414 281 X.

2 Speaking in the discussion on "Preliminary Planning for a New Tube Line Across London", by F. Turner, Proc. Inst. Civil Engineers, Volume 13, Issue 4, August 1959, pages 566-580. R.M. (Michael) Robbins, then Secretary to the LT Executive, said that it was expected that the Victoria Line would carry 32,000 passengers per hour per direction. In the end, the designed capacity was considerably less. Eventually though, his figure was reached in the late 2000s.

Of course, as always, money was a problem. In 1955, the cost was estimated at £5million a mile, including the costs of trains, equipment and overheads. This equates to about £110million today, which is cheap at half the price of the Jubilee Line extension but, when viewed in terms of value to the economy, it was worth much more. This argument was to become an important factor in eventually getting the line authorised financially. In the meantime, the Underground (in the shape of London Transport, as it was then part of) was authorised to start detailed planning in December 1956.

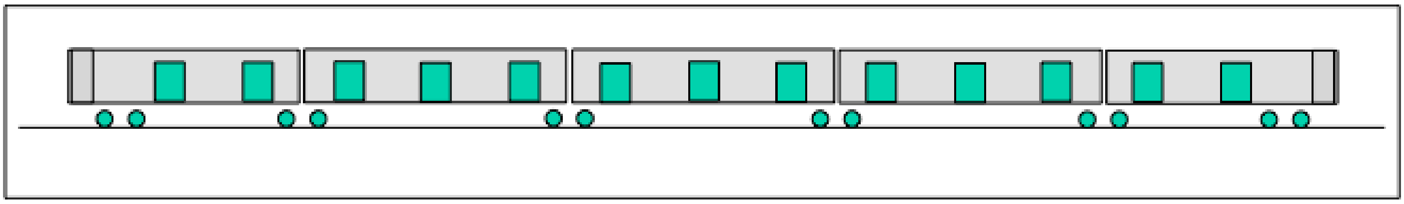

Figure 1: Schematic of what a 5-car articulated unit might have looked like if the proposal for articulated trains for the Victoria Line had been adopted. The door openings are all equal and their positions are placed at even intervals along the train to allow more efficient boarding and alighting. The difficulties of coupling over powered bogies and the sharp curves on existing tube lines soon killed the idea in favour of a traditional 4-car unit.

Things moved very slowly but, by late 1959, there was sufficient confidence that the authorisation of the Victoria Line would become a reality that work was begun on trial tunnelling north of Finsbury Park, principally to test new boring machines and tunnel linings. Work on two tunnels was completed by May 1962, just a few months before the government announced, on 20 August 1962, that the new line could proceed. The authorisation was largely based, for the first time in a major project, on a socio-economic cost benefit analysis that showed the wider benefits to London as a whole. In simple financial terms though, the government was to loan the money to LT and LT would put up fares to pay the interest. Surprisingly sensible when you think about it. Now the detailed engineering could get under way.

EARLY STOCK PROPOSALS

By the mid-1950s, outline plans for train services for the Victoria Line had crystallised into the form of an ultimate capacity of 40 x 8-car trains per hour (tph) at peak times but, for the opening, the service was to start with 32 x 7-car tph between Victoria and Seven Sisters and 16 tph beyond to Walthamstow. Stations were to be built to take 8-car trains. Off-peak trains were to be shortened to 3-car or 4-car units.

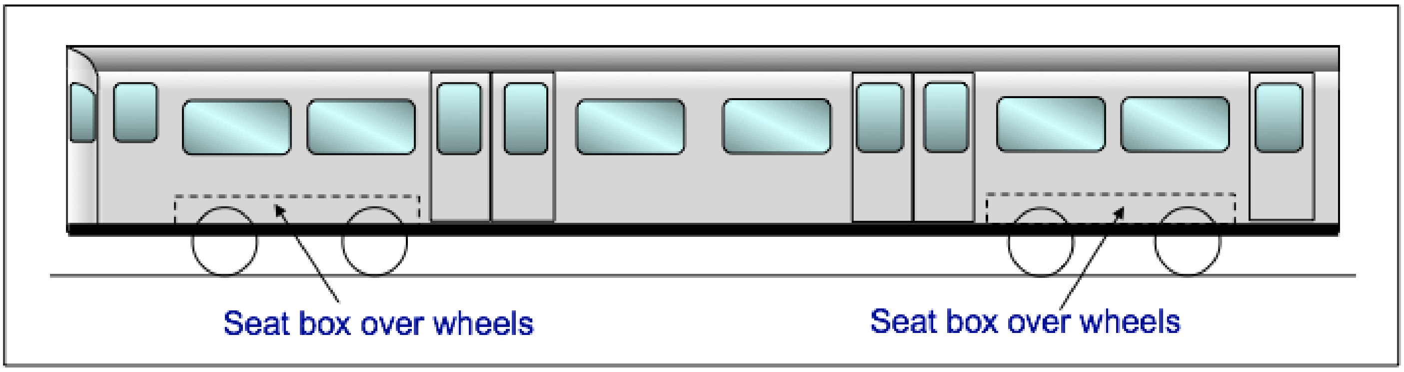

Figure 2: Schematic of a conventional tube car body showing the positions of the wheels and how they protrude through the car floor. This feature dictates the positions of the longitudinal seats and the doorways and has remained a constant in tube car design since 1890. Whilst smaller wheels might seem to solve the problem, they create issues of their own in that they reduce the room available for traction motors and the guidance capability of the wheels, particularly though switch and crossing work.

Towards the end of the 1950s, there was a shift to an articulated design (Figure 1). Here the cars were to be shorter than the then standard 52 feet and were to be formed into two 5-car units to make a 10-car train. The idea was for the cars within units to share bogies. Having the bogies at the car ends would have allowed a better distribution of doorways than the present design, which is restricted by the need to cut holes in the car floor to accommodate the bogies (Figure 2).

The articulation idea was driven by both the efficiency benefits expected from the more even distribution of doors and the desire to reduce costs by having fewer bogies. The idea resurfaces from time to time but, as A.W. (Joe) Manser, London Transport's Chief Mechanical Engineer reported to the Institution of Civil Engineers as part of a discussion on Victoria Line planning on 3 February 1959[3], it is defeated by the engineering difficulties involved in coupling two car body ends closely over a single bogie and getting the pair to negotiate the sharp curves found on the older tube lines. Then there is the need to ensure an unobstructed passage through the conjoined cars over a bogie fitted with all the usual paraphernalia associated with traction motors, brake units and suspension systems. Also, Manser reported problems with the door spacing and in finding space under the short cars for all the equipment. Even today, more than 50 years on, no one has come up with a workable solution that will fit within the restricted tube tunnel profile.

For the Victoria Line, with its planned gentle curves, articulation might have been possible but these were the days of standardisation and of centralised train overhaul, and the need to get the cars round the bends at Holborn and South Kensington on the Piccadilly Line on their way to Acton Works for overhaul finally killed the idea so, it was back to conventional formations. Although, as we saw above, 7-car trains had been proposed a few years earlier, it was soon realised that the uneven 3-car/4-car formation wasn't really sensible for a new tube line, so a 4-car + 4-car formation was eventually settled on in 1958[4].

BIGGER TUNNELS AND TRAINS

Manser didn't give up his attempts to get a better train design and, at one point, suggested having bigger tunnels and bigger trains, even if this meant overhauling the Victoria Line stock at Northumberland Park (as was to happen eventually). He was told by the civil engineers that the cost of bigger diameter tunnels was proportional to the square of the diameter, making even a modest increase unacceptably expensive. Manser was later incensed to find that they had incorporated a modest increase in diameter just to get longer sleepers to ease track maintenance. He also discovered that the "square of the diameter" cost figure was totally untrue – only the cost of muck removal has this characteristic, and the cost of station to station tunnels is a lot smaller when compared to station and junction costs. This inevitably leads us to the conclusion that the savings produced by not including the two junctions with the Piccadilly Line could have been used to pay for larger running tunnels and to allow larger trains.

TRAIN PERFORMANCE

The preparation work for the first new tube line in London since the 1905-07 construction boom, when the initial sections of the Bakerloo, Hampstead and Piccadilly lines were opened, provided a golden opportunity for a "clean sheet" approach to many aspects of the Victoria Line's design. One crucial area was in train performance, where the physical profile of the line, the location of stations and the train design were all closely linked. Much work was done during the years before construction began in 1963 in an attempt to ensure integration between the design of the route and the trains expected to use it. Train performance, and the costs/benefits of various options, were considered in detail. David Catling, who was then Traction Engineer in the Underground's Development Division at the time, wrote of the work done in a paper presented to the Institute of Civil Engineers in 1966[5].

David described how the studies were designed to find the right combination of motor size and number of powered axles and to consider how this would be affected by the service frequency and the design of the line, in particular, the gradients into and out of stations. It would also give the energy requirements and therefore the power supply required, the substation locations and their equipment and the cable sizes. It was a complex task and much of the work was done by manual calculation but there was a train performance computer available at English Electric and this was used to calculate the run times, energy consumption and speed-distance curves for the signalling

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3 ibid.
4 ibid.
5 Catling D, Principles and Practice of Train Performance applied to London Transport's Victoria Line, Proceeding of I Mech. E, 1966-67, Vol. 181, Part 3G.

layouts. Trains with all axles motored, 75% motored and 50% motored were tested against various station gradient profiles to determine the optimum combination and run time.

The options for station gradient profiles were based on the long understood idea that stations should be built on “humps”. This scheme had first been put into practice on the original Central London Railway between Shepherd’s Bush and Bank where stations were built on a “sawtooth” profile. The humps had an uphill gradient of 1 in 60 on the approach and a downhill one of 1 in 30 on the exit of each platform, where possible, so that trains were assisted to stop and helped to accelerate on their way out of the station. For the Victoria Line, a consistent 1 in 50 gradient was chosen, after some tests, as the best basic profile. In the end though, it proved impossible to achieve this anywhere along the line, especially since there were so many interchange stations, existing tunnels and changing ground conditions to take account of.

The motored axle configuration finally chosen was perhaps, a foregone conclusion, since the 4 + 4-car option had, as we have seen, already been confirmed in 1958. Although an all-motored solution offered the best acceleration and therefore the fastest station clearance times, the choice became a compromise between acceleration, energy consumption and overall cost. As a result, it was decided to go for the 50% motored axle solution and to use the half motor car, half trailer car combination that had already been chosen as the ideal solution for the Underground’s future stocks.

Figure 3: Official photo of 1960 Tube Stock, the prototype for the Central Line that never made it into production but which eventually became the prototype for the Victoria Line. The units had a 4-car M-T-T-M formation with new motor cars and refurbished Standard Stock trailers.
Photo: LT Museum

THE 4-CAR UNIT

The choice of the 4-car unit as the basis of the Victoria Line 8-car train was, in the light of what was going on in the late 1950s, both sensible and inevitable. The design was based on the new standard train formation being adopted for the Metropolitan Line’s replacement stock, the A60 Stock, and the 1960 Tube Stock units intended as prototypes for the Central Line replacement stock. The formation was a simple, symmetrical Motor car – Trailer car – Trailer car – Motor car (M-T-T-M) arrangement with a driver’s cab at each end and guard’s door control panels at the inner end of the motor cars. Two units would make up an 8-car train, which could be split into two 4-car units for off-peak working, if required. Uncoupling was, in those days, still a regular feature of Underground operations and it continued on the tube lines until 1960-61. It wasn’t finally eliminated from the Metropolitan Line until 1982 so, in the early days of planning for the Victoria Line, it was incorporated in the design.

The Central Line’s 1960 Stock prototype trains were used as the basis for the Victoria Line car design and, as we shall see, they were to be used to test their automatic operation too. As built, they were made up of new motor cars and refurbished Standard Stock trailers. This arrangement was intended for the Central Line replacement programme. In the event though, the poor condition of the Standard Stock and the consequently high expense of refurbishing them led to the abandonment of the 1960 project and the introduction of 7-car 1959 Tube Stock trains originally intended for the Piccadilly Line but with a car added to give 8-car trains. This was followed by an order for 1962 Tube Stock, the proper 8-car version of the 1959 Stock, and this was to be the Central Line’s replacement stock. There then followed a complex cascade of trains and cars between the lines which ended in 1964 with the complete replacement of Standard Stock on the Central and Piccadilly lines by the 1962 and

1959 Stocks respectively. The 1960 Stock, comprising 6 x 4-car units, was relegated to work on the Woodford – Hainault shuttle service, where it soon became further involved in the Victoria Line story.

At the time, the 1960 tube car body design was mostly conventional but incorporated several improvements (Figure 3), including larger side windows, complete with interior double glazing that provided continuous door pockets, stand-back spaces at each door to reduce the obstruction caused by passengers looking for a quick exit, a more stylish front end where the cab front sloped back slightly above waist level and equally spaced axles on each bogie, each axle being driven by a traction motor. Most of these features were to appear in the Victoria Line's new stock too.

AUTOMATION

While the rolling stock design was being considered, some of the more forward thinking engineers on the Underground were looking at the idea of automation. The thinking was that, with many of the functions of train operation already automated, why not automate the driving too. Trains had automatic acceleration, train braking was automatically controlled by mercury retardation controllers (at the upper end of the braking rate at least), protection was automated (by the trainstop/tripcock system) and route signalling was in the process of being automated by the introduction of programme machines. It seemed a logical next step to automate the driving too. There was also the prospect of the reduction of the train crew from two to one (or even none, eventually) and the kudos of opening a new line in London with automatic trains – the first such project in the world.

Figure 4: The Underground's Victoria Line rolling stock design team at Acton Works in 1963. From left to right, Gerry Orsman, the drawing office engineer whose son, Mark, was to become known as the designer of the LU red, white and blue corporate livery; Michael Lockhart, who later became Inspecting Officer of Railways for the Isle of Man; Ian Arthurton (a future Operations Director of the Underground and now co-ordinating the Q Stock restoration); David Catling; Bill Maxwell (at the head of the table, with pipe) who would also become a Chief Operations Manager for the Underground; Sylvia Evans, taking minutes; Keith Ware; Fred Rutty (who I worked with in Los Angeles) and Terry Lowe.

There were, of course, a whole lot of questions to answer. Was the technology available? Was it do-able within the Underground's environment? Would the authorities be comfortable with it? Would it cost too much? Would the benefits repay the investment? How would the staff react to it? Was there enough time to get it working for the opening? All had to be answered one way or the other and a considerable amount of work had to be done to get the answers.

Manser decided to set up a special team to look at the train design issues in detail, lead by W.W. (Bill) Maxwell, who was later to become the Underground's Chief Operating Manager. The team included David Catling, mentioned earlier, and D.K. (Keith) Ware, one of the Underground's development engineers who was selected for the team as he had already been looking at the possibilities for train automation from the rolling stock point of view. Keith, now retired, kindly offered to help with background information for this series and, in the course of our correspondence, he sent me a photograph (Figure 4) of the team as constituted in 1963[6]. Manser wisely told the team that everything they used on the automatic system had to be tried and tested in passenger service first[7].

REVISION ON ACRONYMS

Just in case the plethora of initials I'll use in this series gets confusing, I've added this list to cover the main ones.

ATC: Originally the Great Western Railway's "Automatic Train Control" system, which was the forerunner of AWS. Now, ATC is a catchall term for an integrated ATS, ATP and ATO system. In the UK, we sometimes use ATO to mean ATC.

ATP: Automatic Train Protection – the basic safety system that prevents over-speeding and train collisions without having to rely on the driver to do it.

ATO: Automatic Train Operation – does the driving and braking without driver participation. Sits on top of ATP.

ATS: Automatic Train Supervision – a system which can, if properly designed, help controllers and signallers make the right choices in train service management. Usually works better if the controllers and signallers don't fiddle with it. Sits on top of ATP and ATO.

PRINCIPLES

Of course, the principal design issues related to automation were based on two areas; the requirement for the train to respond to signalling commands and the need for it to stop in the right place at stations. In both of these, it was replacing the driver's "Mark 1 Eyeball", not a simple task for an automated system. There would be a need for a vital (called "fail safe" in those days) signalling and transmission system and for a system capable of monitoring the train's speed as it decelerated towards a station stop.

The Underground's Chief Signal Engineer at this time was Robert Dell. He was, in many respects, a forward thinking engineer and he was convinced that automation was possible and desirable and that his team could design a suitable system. His ultimate goal was fully automatic, unmanned trains and, for a while at least, eyes were turned towards a trial on either the (now closed) South Acton or Aldwych branches. Unmanned operation was really a step too far then but it was to re-appear from time to time and some tests were actually carried out in the 1970s over the Central Line between Woodford and Hainault.

Dell had started ATC development work in 1958 and, early in 1962, he went to see Robert Arthurton (Ian Arthurton's father and then head of LU's Design Division) to discuss the project. Keith Ware was invited to the meeting. He writes that Robert Dell was very surprised to find that Acton had been thinking about ATC at the same time as his Signal Department and "all of us were surprised to find that the two approaches were compatible." So, the die was cast and work on ATC started in earnest.

There were actually three separate areas that needed to be considered to allow a move from a manual, two-man train to an automatic one-man one. First was the safety regime, which required the signalling system to advise the train of the state of the road ahead and which had to include the means to transmit the messages to the train. Second, was the need for a system to stop the train at

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6 Keith wrote a paper, "Robert Dell's Development of the Automatic Driving Systems for the Victoria Line" in a book, "London Transport Railway Signalling, Papers on the Life and Work of Robert Dell, 1900-1992", Nebulous Books 1999. ISBN 0 9507416 5 5. This describes many interesting details of the early development of ATC on the Underground.

7 Manser was "Mr. Reliability". He had worked at Golders Green Depot during the introduction of the 1938 Tube Stock just before the Second World War and the early unreliability of the stock, its many innovations and the hundreds of modifications it needed to get it reliable made him very cautious about anything new for the rest of his career.

a station platform in the right place, regardless of its weight and approach speed. And the third was what additional equipment would be needed by a single "driver" at the front of the train, now that there was no one at the back in the form of a guard, to help him. The safety system was to be designed as a separate system from the others and the equipment for it required on the train was to be contained in a "Safety Box". This, Dell insisted, was to be the property of the Signal Department and they were to be responsible for it. Even though it was on the train, the CME wasn't allowed to fiddle with it. Dell obviously didn't trust the "oiks" from the CME Department with it and doubtless, the "oiks" were glad not to have to worry about it.

The driving part of the system – which stopped the train in the right places – was called the "Auto Driver Box" or ADB. This was the property of the CME. Both it and the Safety Box were, in their production versions, just able to each fit under a transverse seat in the passenger saloon.

THE ADB

The Automatic driving requirements consisted of motoring, coasting and braking the train and these were to be provided by the ADB. The ADB didn't have to be vital because safety was enshrined in the Safety Box but it did have to be reliable and capable of stopping the train in the right place.

Motoring and coasting were simple. Since acceleration was automatic, all you had to do was switch on motoring to get the train moving and switch it off to coast. Braking was more complex and required a means of monitoring the train as it slowed down to ensure that it didn't stop short or overrun its stopping point.

There also needed to be a means of transmitting commands to the train when it was required to coast or brake. This was done by providing "Command Spots" at suitable locations. The "spots" were actually audio frequency currents injected into a 3m section of one of the running rails. A second set of pick up coils on the train detected the spot to give the ADB the appropriate command. A 15kHz spot would switch off motoring and a 20kHz spot initiated a signal brake command. Station brake commands were to be activated by a range of spots between 5.5kHz and 0.8kHz[8].

Figure 5: Coded track circuit tests being carried out on the South Ealing test track in December 1962 as part of the development for ATC on the Victoria Line. The testing team is using a Wickham trolley, presumably to provide a shunt for the track circuit. It looks like the circuit is being tested by the two technicians holding low-voltage connectors to the running rails to see how well it performs. Photo: LT Museum.

TRAIN PROTECTION

The Safety Box provided what, today, we would call Automatic Train Protection (ATP). The signalling was to be based, like the rest of the Underground, on the use of track circuits but, for ATP, they would contain a code to indicate the safe speed to the train. Three speeds were selected, full speed, which was up to 50 mph, the planned line speed limit; 25 mph, used for controlling a train following another into a station, and zero. The codes would be detected through induction by pick-up coils on

8 A full description of the ADB functions and how the train responded can be found in "The Underground Electric Train, 34 – Automatic Trains on the Underground", which appeared in *Underground News* No.556, April 2008.

the train and these would allow the train to continue as long as the correct code was received. If the code was lost, or the train was going too fast for its received code, it would be forced to make an emergency brake application.

After some indoor experiments, outdoor trials of the proposals were carried out on the South Ealing test track late in 1962 using a Wickham-built trolley (Figure 5).

The concept of coded track circuits was not new. It was already well established in the US, where the Pennsylvania RR had first tried them in 1934[9] as part of a scheme to provide cab signalling and other railroads subsequently adopted versions of them on some busier routes. The company that supplied PRR, the Union Switch & Signal Co., had a working relationship with the Westinghouse Brake & Signal Co. in the UK so Westinghouse was asked to work with the Underground on the ATC signalling, and they introduced the same code principles.

SPECIAL ON-BOARD REQUIREMENTS

Automatic operation brought with it some special requirements for the train. To begin with, it was generally accepted that the crew would be reduced from two persons to one. The one person, the "driver", was not doing much driving – only into and out of depots and sidings was the plan – so he was to be called an ATO, Automatic Train Operator. This title lasted until the mid-1980s, when all drivers were reclassified as "Train Operators" or T/Os. Since signal linemen became reclassified "Technical Officers" or T/Os, everyone soon realised that the usual railway skill for providing confusing initials continued unchecked.

The "operator" of the automatic train was to operate the doors. Although automatic door opening was (and still is) perfectly possible, it would have added another complication and it was thought that, since forcing the operator to supervise door closure was a safety requirement, making him open the doors too was sensible. Full door controls were therefore to be mounted in the cabs.

It was decided that for ATO, the door closed detection should be interlocked with the train starting command. Trains were to be started when the operator pressed a pair of "Start" buttons on the control desk and, provided the door interlock circuit was complete and a full speed 420 code was received, the train could start. There were other requirements too but we will consider these later.

VICTORIA LINE SAFETY CODES

CODE	PERMITTED SPEED
420	Full speed.
270	Restricted speed up to 25 mi/h, remotoring allowed if required to maintain speed above 22mph.
180	Restricted speed up to 25 m/h, no motoring allowed because the train should be braking to zero.
120	Not detected by the train. "You shouldn't be here". Used for signalling circuit purposes only. If a train gets this far it has overrun a stop signal and will get an emergency brake application.

Another feature regarded as essential was a communications system that allowed the operator to speak to the controller whilst on the move. In the absence of a suitable radio system, it was decided to adopt a "carrier wave" system. This took the form of a signal of between 130 and 150Hz injected into the current rails. The signal was designed to allow two-way communication between train and control. It was tested first on the Woodford – Hainault shuttle in April 1964 and was subsequently installed on the Victoria Line[10].

Another issue to be tackled was handbrakes. Traditionally, trains were provided with manually operated handbrakes fitted at driving positions. These were operated by a wheel or lever in the cab and generally applied to one axle or bogie on the car. In order to secure a train, all handbrakes had to be applied on the train and the guard and driver would share the work involved.

For single-manned operation, it was decided that the driver should not have to leave the cab to secure the train, so a special, hydraulically-powered system was devised. It was to be driven by an electrically driven pump, activated by a switch in the cab. It was intended provide enough pressure to hold a loaded train on the steepest gradient.

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[9] Report "Automatic Train Control in Rail Rapid Transit", Office of Technology Assessment, US Congress, May 1976.

[10] There's a lot more on the technical side in the paper by D.J. Norton and V. David, "Speech Communication with Trains", Proceedings of the Institution of Railway Signal Engineers, 1966-67.

Another operational issue driven by the change from two to one person operation was the question of push-outs. If a failed train could only be moved by another train assisting from the rear, some means of asking the train to draw up was required. This was in the days where there was no train radio and breakdowns often meant that communications could be lost too. The traditional method was for the guard of the failed train to go to the rear cab and wave a handlamp from side to side to let the driver of the following train know he should draw up close. With no guard, our ATO driver needed a way of asking for a following train to draw up.

The solution was a “calling on” light on the end of the train, operated by a switch in the front cab. An orange light was suggested because red is used for the tail lights and, anyway, it means stop and green is not suitable because it means go at normal speed – not desirable under these circumstances.

These features covered most of the operational issues generated by the switch to ATO but there was one more that was to prove rather troublesome over the years. That was the elimination of side doors for the cab. It was thought that, with nothing to do between stations, a driver might wander around the cab and, if a cab door was open, he could fall out. I suppose the idea of sliding cab doors, interlocked with the starting circuit, as introduced on the C Stock just a couple of years later, wasn’t thought of early enough to get into the final Victoria Line design[11]. So, the side doors were eliminated and this forced the driver to enter through the saloon/cab door, known as J door.

Interestingly, in view of what was to happen many years later, someone considered the problem of changing the driver during a trip when the saloon was packed with commuters. Should he have to persuade the punters to move their bags/feet/person away from the route to the door and how was he to get through them in a reasonable time? Could something better be done? Apparently, the answer was yes and a proposal was illustrated in a model made in 1964 showing how the new trains might look (Figure 6). It included steps and handrails across the cab front to help the driver get to the cab from the platform through the front door (M door). For some reason, it wasn’t done for the trains as built but constant problems with cab access over the years eventually led to the system being retrofitted in the 1990s. Then, somewhere, someone must have said, “I told you, I told you”.

Figure 6: A model of the proposed Victoria Line train showing the thinking in 1964. The lack of side doors and the expected problems for drivers trying to access the cab from the passenger saloon while the train was in service, led to a suggestion to fit footsteps and handrails on the front to allow the driver to access the cab directly from the platform. For some reason, the idea was not pursued and the fittings had to be added much later in the stock’s life. Photo: LT Museum.

Amanda Day

11 There’s more on the Victoria Line design process in Paul Moss’s excellent book, “Underground Movement”, Capital Transport Publishing, 2000, ISBN 185414 226 7.