

# THE TROUBLE WITH S-STOCK

by John Hawkins

It's just too long! There is now talk of delivering new Metropolitan Line trains as seven-car rather than eight, presumably because of the time required to work the new longer trains into short reversing roads, delaying following trains. This could be overcome by simply shortening the production trains to the length of the trains they replace. To provide an additional margin, they could be easily shortened a further metre, speeding line clearance at tight locations.

The current A Stock was built to maximum LU gauge – even the handrails are recessed into the body sides. Metronet chose an even larger standard train for the SSL network with the promise of higher income through improved passenger capacity for the life of the stock. The cross-section has already been reduced to that of C Stock to avoid costly tunnel widening at tight spots. Now is the time to also shorten the train design before the production run starts. With Metronet again in the public sector, income levels are no longer relevant.

The pre-production trains are around two metres longer than the current A Stock they are intended to replace. But the only available reversing roads at both Baker Street and Aldgate are already very tight for current trains. This will mean even slower berthing of reversing trains, delaying following trains and reducing the maximum possible train throughput.

I must make clear that I have no inside information on the S Stock programme. I am only considering what could be behind emerging rumours, on the principal that there is no smoke without fire! There must be some source behind published leaks, although that doesn't mean they will all be adopted. It is always management's responsibility to evaluate all possibilities.

## SHORTER METROPOLITAN TRAINS

Shortening the pre-production S stock design to A Stock length would only require about 40mm narrower stand-back areas at each side of doorways on the production trains. This could mean that new trains berth as quickly as the current ones. If an improvement is sought, the trains could be cut further by just removing one seat from the wheelchair section of the middle MS cars. This would shorten each train by another metre, losing only 4 seats per train. At this area a non-standard window is already fitted, so two could be fitted either side.

This may avoid the need for costly 'infrastructure improvements' and for initial S7 replacements, so providing higher capacity from first introduction. With tight reversing bays it is to be hoped that S Stock braking is as responsive as that on A Stock, for if it is as lax as C Stock it will be difficult to achieve the necessary accurate stops at tight locations.

Such modification would leave the two pre-production trains longer than the fleet, but they might end up as S7 trains on the District Line, where their extra length is less critical. They might be formed up as S8, S7 or S6 trains during testing. Of course, for service on the District Line they will need transverse seating replaced by longitudinal, but being wall mounted this is not difficult. Perhaps we will now need to differentiate between trains with Metropolitan seating and those with totally longitudinal seats as S7M and S7L. This came about because Amersham man was

concerned about reduced seating on new trains, and made a case that it was foolish to provide the same seating as on Circle Line trains. This must have struck a cord with LU, who amusingly cut seating on shorter trains, meeting the point whilst not pleasing their customers. This took away the promised 'inter-operable fleet', not seen as a problem since S8 trains are not easily shortened to S7. But if we are to see S7M and S7L fleets, inter-operability is only restricted by seating layouts.

Tight berths have been a problem since terminal protection was provided in the short reversing roads at the south end of the Metropolitan. No other regular reversal roads are available, so line capacity is limited by these pinch points. Additional running time was provided since trains enter these roads even slower than before, occupying the junction points longer and therefore reducing the frequency of trains that can be run. Now with plans to increase service frequency this berthing time becomes crucial. And with new trains longer than current ones, berthing time will grow. Ideally a greater safety margin should be provided at these platforms by introducing shorter trains.

Although it was only on 1 April 2008 that TfL confirmed the order with Bombardier, perhaps the date was significant. It appears that a current solution for tight reversing roads is interim delivery of S7M trains, over 16 metres shorter than the S8 formation, but with an eighth less capacity. Still, some may believe "7-cars good, 8-cars better" but it ain't necessarily so!

The discarded plan to extend Metropolitan Line trains to Barking had the advantage of reversing shorter Hammersmith trains at Aldgate, with swifter junction clearance for following trains. Perhaps it led to the proposal to shorten all Metropolitan Line trains. For S7M trains to provide the same S8 capacity, the service must operate  $\frac{1}{7}$ th more trains. So a 30tph S7M service would match 26.25tph S8 service, reducing the service interval from 137 seconds to 120 seconds. For this to be achieved, the shorter trains would need to save 17 seconds berthing in the bay roads.

Observation of current A Stock reveals that the final car takes only 9 seconds to enter the terminal platforms. So a 30tph S7M service would free up maybe 135 seconds each hour at both Baker Street and Aldgate compared with a similar S8 service. S Stock cars are longer than A Stock, but with an S7M train having berthing space to spare and in-cab VDU making accurate stopping less important, such an improvement could be exceeded. However, this looks sufficient to operate only two or three additional trains which would not fully compensate for the shorter trains.

It should be pointed out that the current 21tph A8 seating of 448 per train provides 9,408 seats an hour. The planned 33tph S7M service, each with 268 seats, will offer 8,844 seats, or 6% less after the full upgrade. It would need to operate an unlikely 35tph to match the current A8 seating, although with additional standing room the total capacity will offer nearly a third improvement.

Of course a 33tph S8 service, each with 306 seats, would offer 10,098 seats if it could be reversed, which would be a 7% improvement. Regular travellers may have some doubt about the sustainability of such an intense service over a complex track layout, and any less than 31tph would result in a cut in current seating levels.

## **AUTO-OPERATION AT TIGHT LOCATIONS**

These short bay roads will be a problem for auto-drive operation, leaving little safety margin, and it has been suggested that manual driving may need to be retained only

at such locations. But it seems unlikely that the most difficult locations will be reserved for manual operation, when staff will be unpractised to drive at tight locations. Firstly, drivers are likely to take a cautious approach, and therefore cause undesirable delays in throughput. Secondly, a stops collision will be blamed on lack of practice, and any enquiry report is sure to demand auto-operation. Perhaps this is a reason for considering S7M operation, providing 14 metres of additional overrun protection for automatic trains compared with current stock. In the long term S8 operation could be introduced when these roads have been extended somehow. Perhaps at Baker Street the terminal roads can tunnel into the building basements across their stops. At Aldgate I am unclear how such length can be achieved short of the District Line tracks.

In the past train guards were qualified as emergency motormen, equipped to drive a train at times of trouble, passengers usually being detrained at the first opportunity. That is similar to the current position of 'drivers' on the Central and Victoria lines. They lack regular practice of driving, and so a manually driven train cannot keep up with the performance of automatic trains. The same will be true on all lines after a period of automatic operation.

Another point from the past. Since Westinghouse equipped trains depend on that brake for emergency operation, regulations require that it be used for the last but one station stop, so ensuring it remains in working order despite disuse, and providing drivers with practice. If drivers are to stop their train by manual control at the terminal bay platform, shouldn't they first attempt such a stop at the preceding station? This would further delay the service, losing the advantage of consistent automatic operation.

## **C STOCK BEFORE A STOCK?**

When the SSL upgrade was planned nearly ten years back, it seemed logical to replace rolling stock in age order. When London was awarded the Olympics there must have been consideration of replacing C Stock first, but by then the S7 plan required the two extra years to provide longer stabling roads and platforms. With a suggested reversion to S6 trains there may be no obstacle to replacing C Stock first.

This would bring many advantages, some of which have arisen during the life of the project. The Olympics will bring added traffic to West Ham, to be promoted as serving the stadium to reduce the crucial importance of Stratford. It will also bring more visitors to central London, but will have negligible effect on Metropolitan Line traffic. Of course we would like to show visitors our latest trains, especially when they have had time to settle in. They would replace less reliable C Stock and offer additional capacity, so helping to clear crowds. They will also allow introduction of the T-cup service as originally planned with the first S Stock deliveries. This scheme, which turns the Circle Line into a Hammersmith to Edgware Road service to improve reliability, requires additional trains for the enhanced Hammersmith service. These were originally to be released by introduction of Metropolitan Line trains to Barking.

There would also be advantages in delaying the replacement of A Stock, now the planned signalling upgrade is postponed. The new S Stock offers less seating than current trains, to be compensated by more frequent services. The original plan would have seen new signalling commissioned north from Baker Street before the first production train arrived in early 2011. Whilst a new resignalling scheme has yet to be announced, the replacement of C Stock first would leave an additional year for

works to be undertaken. Perhaps then A Stock could be reserved for the longer peak trips until resignalling is completed to Amersham. In the meantime A Stock is performing well and passengers are in no hurry to see it go. Closure of the East London Line has released additional spare trains, and most of this stock is likely to see its 50th birthday. The original PPP promise was to complete the northern SSL upgrade by 2014, so any reversal of stock replacement plans will not affect this.

I was a little surprised at the suggested reversion to S6 deliveries, with the possibility of later adding a car. Older members would recall that C69 stock was delivered in 2-car units so that it could easily form 8-car trains when platforms had been extended. (The guard would have ridden at the rear of the 6th car to remain within the platform). However today with growing demand for services perhaps money would be found for later lengthening works. This is easier at open air platforms than tunnel stations, so the Hammersmith & City service might become S7L once works are completed at Baker Street.

If these extensions allowed for S8L operation, interworking on the north side of the Circle Line with its S6 trains would provide the equivalent of S7L trains on both without the need to lengthen further tunnel stations. This might release funds to provide a deep level eastbound platform at Baker Street, suggested earlier by Piers Connor, eliminating the flat junction there and making room for a reversing siding east of Edgware Road to allow cross-platform interchange with terminating T-cup trains. This would replace the proposed Metropolitan trains to Barking, and the longer S8L trains could then also boost the service to Upminster in preference to some S7L District line trains.

An S6 train will be nearly half a car longer than C Stock, which makes many current stabling sidings inadequate. I thought this was the main reason that replacement with S7 had a good economic case: new sidings are required anyway with S6, so they may as well be constructed to S7 length. The cost of platform lengthening is high, as was found in the 1960s when such works were in progress on the District Line. All doors of an S6 train will be within the length of a C Stock train, and they could berth at platforms with both cabs in the tunnel, or with the front cab in the platform and the rear pair of doors cut out. A cab mounted VDU will allow platform monitoring from the tunnel. It is unlikely to be acceptable for an S7 train to berth with its last car in the tunnel, so they would probably have to berth with both ends of the train in the tunnel and two pairs of doors cut out at each end, leaving only one set open on each end car. (I can recall District Line 8-car trains berthing with the entire rear car in the tunnel, passengers using the guard's doorway to exit). This will lengthen such station stops, which may be acceptable with a lower frequency service than on trunk sections of line. No doubt announcements would prepare passengers at such locations. This could postpone indefinitely expensive platform lengthening.

The reconstructed Neasden depot and Wembley Park sidings could absorb displaced C Stock replacements, although at some distance from their current homes, by the time they are delivered. Hammersmith terminus will be more easily adapted to reverse S6 rather than S7 trains, work which can probably be completed more quickly and cheaply. This may be a major factor in achieving C Stock replacement before the Olympics. However, there will be additional costs in adapting infrastructure for S6 now and again for S7 train lengths later. If preparations for S6 trains cannot be completed before the first production trains arrive, a compromise could be to commission early S Stock on the Metropolitan until infrastructure is in place to commence C Stock replacement, later eliminating

remaining A Stock. Production plans would have to be adjusted accordingly for the two types of train.

A return to the S6 plan would again raise the question of how the Hammersmith branch is to be de-iced, since shorter trains do not include a de-icing equipped car, and the terminus cannot reverse an S7 train. Perhaps a few C Stock de-icing equipped units can be retained to form a couple of 4-car trains, providing a maintenance spare, although this will require staff training to continue on the old stock. These could be kept on sidings too short for S6, such as those at Edgware Road.

The proposal to extend Metropolitan Line trains to Barking in place of Hammersmith trains was dropped when it was found that S8 capacity was little more than S7L capacity. Maybe this case should be revisited with the reversion to S6 trains. S8 would offer over a fifth more capacity than S6, and a similar seating increase over S7L out to Upminster. Based on current A Stock operation, S6 trains reversing at Aldgate would save around 15 seconds each, freeing 112 seconds each hour for service recovery. Again with berthing space to spare and in-cab VDU making accurate stopping less important this should be easily achieved. However, if Metropolitan trains are formed as S7M they will offer little improvement over S6 trains.

A programme of S6 and S7M trains will result in a build of 112 fewer cars, which could perhaps be added later to the production of D Stock replacement trains. This is equivalent to 16 less S7 trains, which gives a measure of the effect on passenger capacity. Perhaps the two pre-production S8 trains may be the only such trains seen for some time.

Additional central London stabling may be found on railway land. At South Kensington there remains room to replace the old eastbound and westbound platform roads and sidings, although this would be a complex layout to relay and difficult to integrate with the existing obsolete signalling system. A cheaper alternative may be to find a few roads in Lillie Bridge depot. In the City a low cost solution could be to connect through the short Farringdon sidings to the abandoned Thameslink lines to Moorgate. These could be cheaply electrified for low-speed empty stock moves, with a self-contained shunt signalling system allowing perhaps four trains on each road. Signalling for bi-directional moves would avoid the possibility of a defective train blocking in others. Railway land around Paddington is probably required for Crossrail construction works. Perhaps room can be found around Wimbledon Park for the new longer trains displaced from Parsons Green and Triangle Sidings.

## **WILL D STOCK REPLACEMENT BE POSTPONED?**

The line upgrade programmes were to be funded by private capital raised through the PPP process. The collapse of Metronet means that TfL now have to finance the SSL upgrade and station renewals. They were already bound to pay for the resultant traction current upgrade, the additional costs of seven-car C Stock replacement, and any station reconstructions required.

TfL can therefore be expected to closely consider the timing of all major projects. It is only a matter of time before questions are raised over the wisdom of replacing D Stock within 8 years of refurbishment. The SSL project is currently scheduled for completion by 2015, although it was originally promised for 2018. D Stock

replacement could therefore be delayed by three years without compromising this target.

There are many projects that could fill this window, including 1992 Tube Stock replacement rather than refurbishment, 1995/96 Tube Stock refurbishment, earlier replacement of unreliable 1972 Tube Stock with provision for a Watford Junction service, or additional Northern Line rolling stock for a split service.

With the need for so many new trains within a ten year period, perhaps a new standard tube stock will emerge in 7- and 8-car formations. A shortened form of 2009 Tube Stock could probably fit all lines, with the central bay of each car reduced by one seat. This would provide a train with seating equal to 1992 Tube Stock, and in 7-car form ten higher than 1973 Tube Stock. Hopefully the small saloon windows of the Victoria Line trains will not be repeated. It may be necessary to contract more than one supplier for such a large order.

Whilst the PPP contract still binds Tube Lines, the Metronet commitments could even be revised now they are within LU. The recent loss by Bombardier of the maintenance contracts removes their incentive to produce a train designed and manufactured for optimal whole-life running costs. We run the risk of returning to a 1992 Tube Stock build, which will pass commissioning trials but soon deteriorates with high maintenance needs. However, with a change of Mayor this decision could perhaps be revisited. Tube Lines also now has a stronger chance of finding its contract confirmed at the first quarterly review, due by mid-2010, rather than also being absorbed 'in house'.

## **RESIGNALLING PROGRAMME**

SSL resignalling is an ambitious project, based on past experience. Stanmore to Aldgate resignalling took 17 years from 1984 to 2001. Excluding a 10 year standstill, this was 7 years to achieve 21 commissioning stages. The now defunct Westinghouse plan had 41 commissioning stages within 6 years, with 13 signal control rooms transferring to the new control centre. Where will sufficient skilled staff be found for such a programme, especially as all other resignalling projects are scheduled concurrently? The entire LU network is to be resignalled within the same time span, except the Bakerloo project which will have commenced, and the Central which is currently unscheduled. Still, the current economic downturn may release similarly skilled persons elsewhere suitable for retraining.