Class 323 v Class 319

Neil Williams, chair of Friends of Glossop Station, has asked me to jot down a few technical points arising from DfT's proposal to move Northern's allocation of class 323 electric multiple units (emus) to Birmingham, and to replace them with class 319 emus, formerly with Thameslink in London.

The three-car class 323 units were built by Hunslet in Leeds in the early 1990s. They featured a sophisticated traction package which included three-phase asynchronous motors. This sounds very technical, partly because it is! A dc (direct current) electric motor, such as is used on older emus, including the class 319, is bigger and heavier, and needs what is called a commutator to transmit the current to its windings. Commutators and their brushes need to be maintained regularly as they wear.

The more modern asynchronous three-phase induction motor is lighter, more powerful and needs no brush gear or commutator. It *does* need a gee-whizz bit of electronics kit called an inverter. The 25kV ac from the ohle (overhead line equipment) is transformed down to a manageable voltage, rectified to dc, and then re-converted into a variable frequency three-phase alternating current (ac). In essence the frequency of this ac is just ahead of the motor's speed, which produces the 'torque'. Bit of a simplification there, but that's the idea. Another big plus is that trains fitted with this drive can use regenerative braking: when slowing down, the train's motors can act as generators and put energy back into the overhead line (assuming that there is load on the line). This raises the train's 'green'

credentials, and in fact mean that Network Rail charges the TOC less for running these units than it would for trains not fitted. This technology has been used on most electric trains built since. So successful is it that SouthWest Trains is currently replacing the traction drive on its inner suburban class 455 with three-phase drives. The savings in energy and in maintenance (and probably reliability) costs justifies this capital expenditure.

Class 319s date from the 1980s. They use thyristor control of dc motors — more sophisticated than the tap-changer technology used in the 1950s and '60s, but not state-of-the-art now. They actually have a higher top speed than the 323s (100 mph as against 90 mph), but their acceleration is markedly worse. For a closely-spaced stationed, frequent-stop service such as Manchester to Hadfield, which has a 60 mph line limit anyway, this would mean, I understand, that these units would not be able to sustain the present timetable. The difference would, presumably, be less marked on Stoke and Crewe services. One solution would be to regear the units: in other words alter the final drive gear ratio so that a given motor rotational speed corresponds to a slower road wheel speed. This would yield better acceleration, certainly, but a 75 mph unit would get in the way of Pendolini charging up the main line to Stoke. You can have either the acceleration or the 100 mph top speed, not both. That's where the 323s score: they *can* do both!

As the class 319 is a four-car train, they would need to have a carriage removed so that they would fit the three-car-length platforms (e.g. Godley and Flowery Field) on the Hadfield line. This is not as easy or as cheap as it sounds. An electric train has various bits of equipment such compressors, transformers, etc. distributed amongst the carriages. So taking a carriage out means some engineering to rehouse the displaced kit. Of course, taking out a trailer (non-motored) carriage would improve the acceleration. One idea is to go for the big-time option of replacing the traction drive with a 3-phase, and removing the excess carriage. Not cheap, but does the job. Would this be cost effective on a 1980s unit? I wouldn't know. Perhaps TfGM proposes to lengthen the platforms.

I was not able to find the nominal acceleration rates of either class 319 or 323 in any technical specifications available to me. These observations are, in any case, necessarily from my perspective as an amateur. Still, I believe that there are some grains of truth in the above scattered among the chaff. Replacing a popular, comfortable, modern, zippy unit with something more ploddy, less comfortable and less 'green' is simply a retrograde step for the North West.

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Since writing the above, one or two other considerations have arisen. The Manchester to Glossop/Hadfield timetable is quite tightly diagrammed. Units spend very little time at Manchester, which is just as well, since platform occupancy is at a premium there. During most of the off-peak day, a half-hourly service operates on the line. This tightens to roughly every 20 minutes in the peaks by running triangularly: Manchester – Glossop – Hadfield – Manchester or *vice versa*. The class 323s just manage this timetable; were a unit of inferior acceleration to be introduced, this would no longer be possible. The problem then arises of how to devise a regular 'clock face' timetable without either excessive layovers at Piccadilly, which would (a) necessitate more units and so be financially disadvantageous or (b) reducing the basic off-peak frequency to hourly which would be politically and economically unacceptable. Glossop is, after all, the third busiest station in Derbyshire. One idea, which has been mooted, is for trains to travel alternately from Manchester to Glossop ***or*** Hadfield, direct trains between these two being eliminated. This, too, would cause hardship: Glossopdale School has a split site, and many students need to travel between Hadfield and Glossop.

The present popular timetable is possible because of the 323 units. Removing them is really only a practicable proposition were they to be replaced with an emu of at least as good performance.

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