ATOC Response to NR Consultation on dc losses & regen braking – Nov 2012

DC Losses Report – TPD-NST-021-LOSS-REP-0012

Response to Chapter 7 - Recommendations:

15% markup supported as the current loss factor for the Southern dc network. 10% markup supported as the current loss factor for the Merseyrail dc network. 10% proposed as the CP5 target for NR for the Southern dc network given that they have shown that they can deliver this today with the Merseyrail dc network.

Combining the projected traffic increase during CP5, whilst maintaining the current dc loss levels during the whole of CP5 and offering this as an efficiency target is not accepted – real network efficiencies should be delivered

The current concept in CP4 whereby metered operators rejoin the volume washup arrangement once metered consumption in any single ESTA goes over 90% in any year should not be continued in CP5 for the dc ESTAs – continuation of this concept would act to protect NR from any financial risks associated with errors in their losses calculations and thus remove any incentive to improve network efficiency

Detailed Comments:

1.2 - Scope

The report confirms that of the 18 non-exclusively dc ESTAs, there are some predominantly ac ESTAs which include dc traction electricity feeds (eg Euston – Watford, Drayton Park – Moorgate). ESTAs should be reorganised and metered so that they are exclusively dc or exclusively ac from a losses and charging viewpoint – this reorganisation does not necessarily have to mean that they would also be technically disaggregated from a grid feeding viewpoint

2.1 - Electrification system dc network

Table 1 neatly summarises in columns 2 and 3 the difference when comparing losses from an infrastructure feeding viewpoint, or from a train consumption viewpoint – it is the same loss in MWhr in both cases. This differentiation is not clearly maintained in the text of the rest of the report.

3 - Assumptions/Methodology

4 – I assume that you mean that the +-2% will have **no** net effect on losses ?

5 – if regen energy is injected into the 3rd rail, then locally the third rail voltage could rise above its normal off-load level and certainly will rise above its normal on-load level – surely this means that static losses associated with insulator leakage will rise during periods of regen energy injection ?

10 – can we see some statistics supporting this assumption of 50% polymeric vs ceramic insulators ?

4 - ESTA Analysis

Why have the North London and ECML South dc networks been assumed to be similar to the Southern dc networks, rather than the Merseyrail dc network ?

What exactly are the features of the Merseyrail network taht enable it to deliver less losses tody than the Southern dc network ?

4.1 Extrapolation of DC Variable (I2R) losses

Will you complete the Wessex model and can we see the results ?

4.1.2 Mersey Rail

You should confirm that these figures are losses viewed from the infrastructure (rather train) viewpoint. You do not seem to take Mersey PTE aspirations to procure a new (most likely more energy intensive) fleet and run more 6 (9) car trains during CP5 ?

Do these loss figures take into account actual line voltages seen and do they take into account the late CP4/early CP5 plans to raise all line voltages to 750Vdc nominal (ie these losses are likely to increase) ? Please confirm that these loss figures as seen from the infrastructure or from the train

5 CP5

last line of page 15 – do you mean 1% or 1 percentage point – these are quite different in size ?

Regen Braking Report – TPD-DGN-021-LOSS-REP-0013

Response to specific questions and conclusions:

A – 15% regen braking discount for modelled bill dc operators should be retained

B – agree with the proposal to treat losses for supplied power and regen power identically with a single net energy markup

C – further work should be done during CP5 to form the basis of any proposal for CP6, or not to separate supplied and regen power loss factors

D – the concept whereby metered operators in ESTAs with 90% metered consumption per year revert back into the volume washup would act as a disincentive to NR to improve their network efficiency and should not be continued for the dc ESTA for CP5

Detailed Comments:

3 Background

Modern trains are equipped with 2 types of braking system; conventional friction brakes with brake discs and brake pads fitted to all axles and electric dynamic braking fitted to axles equipped with motors only. Dynamic braking systems can, in most cases, also optionally be configured to act in a regenerating mode, whereby electrical energy generated as a consequence of braking is re-injected back into the external power supply system, rather than wasted as heat in on-train resistor banks.

Not sure that the bicycle analogy is needed or useful

3.1

The relatively low coefficient of friction (compared to a car or bus) between a steel train wheel and a steel rail means that trains are relatively vulnerable to sliding (compared to a car or bus) when any form of braking which relies on this wheel/rail interface are used. Dynamic electrical braking systems on trains (including when in the regen mode) are typically even more vulnerable to slipping under conditions of low adhesion than friction braking systems as each braking wheel is typically being asked to deliver 40-60% more braking effort to stop the train when in dynamic vs friction braking mode to achieve the same whole train braking effort.

As a train begins to slide when braking, this is detected by the wheel slide protection system (WSP). If the train is in the dynamic braking mode, it may attempt to control the slide initially by rapidly releasing and re-applying the electrical brake, or it may immediately suppress electrical braking and hand over to full friction braking. If anything more than a small amount of slide for a small amount of time continues the WSP will suppress electrical baking and handover to full friction braking.

Per train service and per train type the fraction of regen energy compared to total consumed energy will be predictable and consistent over time. Alterations to train service pattern, train type etc can alter this fraction to some extent. On a day to day basis, particularly during the autumn and winter seasons, regen fractions on individual services are not predictable due to dynamic braking suppression feature under conditions of low adhesion mentioned above.

Table 1

Should concentrate on what impacts on regen fraction, not what impacts on total regen energy

driving style once service pattern and train type are fixed does not impact much on regen fraction – it may impact on total regen energy, similarly timetable optimisation

number of electrically braked wheels will not impact on regen fraction much under conditions of normal adhesion

train braking control logic could impact on regen fraction, but OEMs are incentivised to call for max regen braking whenever it is possible, as it reduces brake disc and pad wear and thus reduces operating/maintenance costs

line design will not impact much on regen braking fraction

4 The Regen braking discount

It is not expensive to install regen braking on a new train – it is expensive to retrofit it to a train which was not designed with it as an option

The level of suppression of regen braking during autumn/winter does not detract from the current 15% assumption for dc regen energy fraction

5 Regenerative Braking & Effect on Losses

Although regen energy which is injected into the dc third rail might not be used locally by another nearby motoring train, this energy (which results in heat) does serve a useful locally valid purpose, in that it reduces the amount of energy drawn from the national grid to drive standing 3rd rail losses – thus, assuming that no additional action is taken to reduce these losses by NR, this effect of reducing the external energy draw can be regarded as a low loss, productive intervention. Thus it could be argued that regen energy should be considered with a lower loss (or zero) markdown factor than externally supplied energy as most of its value, whether helping to drive a motoring train or reducing external energy supplied to drive losses is very local.

NAO/1c/5.12.12