EC4T consumption rates: Methodology for new and re-routed rolling stock

Background

1. ORR's Final Determinations confirmed that, due to concerns over the revised EC4T rates proposed by Network Rail, the existing TRATIM-based consumption rates would be retained for passenger stock during CP4. However, ORR also required Network Rail to develop a methodology to produce rates for new rolling stock coming onto the network and existing stock where particular concerns arise. Importantly, this methodology needed to be broadly consistent with the TRATIM-based approach.

2. In line with these conclusions, the following instances are identified as requiring the application of new consumption rates for billing purposes:

    - New stock entering service on the network including:
        - Class 395 on HS1;
        - Class 350/2 on the London Midland Route;
        - Class 378 on London Overground.

    - Existing stock where it is moved to operate on a wholly new route e.g. Class 377s on Thameslink.

3. More generally, whilst the importance of deriving accurate and consistent rates is acknowledged, work is ongoing to introduce on-train metering across the entire electric fleet during CP4. As such, the existing modelled system will be progressively replaced by billing based on metered consumption, potentially by the end of CP4. The application of new consumption rates is therefore envisaged as being a temporary solution.

TRATIM approach

4. It is not possible to identify all of the assumptions that underpinned the original TRATIM modelling as the relevant information is not available. However, in general, the approach taken was to model 'representative' journeys and stopping patterns which were then used to generate rates (kWh per train mile) for each combination of train service code and train consist. The rates derived also included an element for auxiliary energy consumption and energy consumed during station dwell and terminal layovers. Distribution losses and energy consumed during stabling were not included and have historically been dealt with through the wash up. Similarly, energy reductions from regenerative braking were not included in the TRATIM approach.

New methodology

5. The proposed methodology for new or re-routed stock is therefore an attempt to mirror the TRATIM approach as closely as possible (as requested by ORR) while avoiding some of the main problems identified in Network Rail's original 2008 consultation for the Periodic Review. The principal steps are as follows:

Step	Action
1.	A service pattern is selected as 'representative' of the service code for which a new consumption rate is required. The service pattern is selected on the basis of it being the most frequent i.e. containing the most trains.[*]
2.	The selected service pattern is modelled in Railsys to derive mechanical energy at the wheels. This is derived using the following assumptions: • Trains modelled are based on the timetable period during which they are running; • Maximum braking rate of 1m/s^{2}[**]; • Trains are run flat out and weighting factors of 5% and 8% energy reduction are applied to AC and DC traction respectively to reduce the line energy consumption. (This is to take into account the effects of operational and engineering allowances etc.)[∞]
3.	The mechanical energy is converted into electrical energy. In doing so, the auxiliary load while in traffic is calculated and added.[#]
4.	To reflect energy consumed during station dwell time and terminal layovers the final numbers are uplifted by 10%.[‡]

[*] Note: where there is more than one service pattern in a service code with the same number of trains, an average of the most frequent service patterns is taken.

[**] Note: A braking rate of 1 m/s^{2} is identified as appropriate as this value is commonly used as a standard maximum for new rolling stock types derived from Railway Group Standards. (It is understood this is slightly lower than some of the braking rates that were applied in TRATIM however it is regarded as being more representative of the likely maximum braking that would be applied in real-world operating conditions).

[∞] This is consistent with the original approach followed under TRATIM.

[#] Data on the electrical characteristics of individual trains is taken from OSLO.

[‡] Note: TRATIM numbers were uplifted to take account of this consumption however there is no specific value identified in the assumptions. The 10% estimate is based on best available advice from Network Rail.

Note that distribution losses for both AC and DC operation are not included in the rates calculated. This is consistent with the existing TRATIM methodology. Similarly the impact of regenerative braking is not included. However, a discount is applied to those TOCs operating regenerative braking by Network Rail through the wash up.

7. From this process a consumption rate (kWh per train mile for multiple unit operation, kWh/gross tonne-mile for loco-hauled operation) can be derived for the following level of detail:

- Train operating company;
- Train service code and;
- Rolling stock type.

In addition, in line with the TRATIM methodology, rates can be derived for coupled multiple units (e.g. where two 4-car multiple units are operated together) by multiplying the single MU rate by existing published uplift factors.[1]

[1] Uplift factors are 192% for 2x1MU, 285% for 3x1MU and 389% for 4x1MU.

Comparison with TRATIM

8. While a comparison between the new rates and TRATIM rates cannot be used as a test of accuracy, it is useful as a means of demonstrating consistency between the two approaches. As such, a validation exercise was undertaken to compare the rates derived for selected types of rolling stock/route against the existing TRATIM rates. The results are shown in the attached table. This indicates that, in most cases, the rates derived using the new methodology are within 5-6% of the TRATIM rates. It is therefore believed that the new rates are as consistent as reasonably possible with those derived using the original TRATIM approach.

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