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Implementation of the Environmental Noise Directive in Wales

Project technical note – electrification of railways
in South Wales

December 2013

PROJECT TECHNICAL NOTE

PREPARED FOR: **WELSH GOVERNMENT**

PROJECT: **IMPLEMENTATION OF THE ENVIRONMENTAL NOISE DIRECTIVE
(END) IN WALES – NOISE MAPPING AND ACTION PLANNING FOR
MAJOR ROADS, RAILWAYS AND AGGLOMERATIONS**

OUR REF: **P043 TASK 016**

TITLE: **ELECTRIFICATION IN SOUTH WALES**

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Reviewed by: Nigel Jones (Director)

Status: Final

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1. INTRODUCTION

- 1.1. The Network Rail Strategic Business Plan for Control Period 5 (CP5), as set out in the High Level Output Specification (HLOS), published in July 2012, presents the investment priorities for Network Rail to deliver in the next investment period (2014 - 2019). This HLOS includes plans for the electrification of the South Wales Main Line (SWML) to Swansea and the wider Cardiff Valleys network.
- 1.2. Extrium has been asked by the Welsh Government to provide an indicative assessment of pre and post electrification noise levels, through the design and implementation of an inter-comparison exercise. This study has been facilitated with the input and guidance of the railway industry (provided by members of the railway Noise Policy Working Group: RSSB and Network Rail).
- 1.3. The study consisted of two objectives:
 1. to agree an approach with the railway industry to assess and compare noise levels before and after electrification, and
 2. to complete the assessment and comparison of existing and post-electrification levels.
- 1.4. This technical note provides a summary of the approach agreed with the rail industry, the methodology adopted, the results obtained and draws conclusions from the study.

2. METHODOLOGY

Approach agreed with input from the rail industry

- 2.1. In advance of undertaking the assessment, the scope and methodology for evaluating pre and post electrification scenarios were discussed and agreed with the rail industry¹. It was agreed that the assessment should examine changes from a baseline pre-electrification scenario derived from 2011 rail traffic movement information utilised in 'round 2' strategic noise mapping, completed in 2012.
- 2.2. At this early stage in the electrification process, no detailed or timetabled movement projections were available beyond the headline statistics available in the route plan and business plan. It was therefore agreed that this study would consider changes due to two factors:
 1. A projected increase in passenger vehicle movements.
 2. The substitution of existing rolling stock with projected replacement stock.
- 2.3. The Network Rail 'Wales Route Plan' for CP5 forecasts that the commuter sector will see growth of up to 50% in passenger numbers from 2005 to 2026.
- 2.4. For the purposes of providing a high-level post-electrification scenario, it was therefore agreed to assume a 50% increase in the number of post-electrification passenger vehicle movements, relative to current levels. This 50% increase attempts to reflect both an increased service frequency and the introduction of longer trains, although it is not specific to either.
- 2.5. For the post-electrification scenario, it was agreed that all vehicles would be re-assigned to an electrified vehicle class.
- 2.6. Electrification may result in the ability for increased freight movements, however it was thought that it would be impossible to predict any changes in freight at this point. It was therefore agreed that freight movements would not be examined as a variable and are assumed to be constant.
- 2.7. Network Rail indicated that line speeds will not change post-electrification, while any journey time reductions will be due to faster acceleration/deceleration. It was therefore agreed that line speeds would not be examined as a variable and are assumed to be constant.
- 2.8. It was agreed that, given the nature of input information, the analysis would provide a headline comparison in emission levels at source, for an annual average daytime period (06:00-24:00).

¹ Welsh Government, RSSB and Network Rail noise action planning meeting minutes (31 January 2013)

Assessment of baseline and post-electrification scenarios

- 2.9. Source emission levels were calculated for a baseline pre-electrification scenario utilising vehicle movement data provided by Network Rail. This data was derived from the Network Rail ACTRAFF (ACTual TRAFFic) system operated by DeltaRail.
- 2.10. In order to provide a post-electrification scenario, 'passenger' vehicle movements from ACTRAFF were inflated by 50% from the baseline scenario and re-allocated from existing stock to projected post-electrification vehicle stock.
- 2.11. The re-assignment of rolling stock has been based upon acoustic proxies for named rolling stock classes. It is not presumed that these specific vehicle classes will necessarily run post-electrification. A summary of the assumptions made in allocating existing stock to 'electrified' stock is set out in Table 1 below.

Table 1. Acoustic substitution of rolling stock post-electrification

Current rolling stock	Post-electrification acoustic proxy
20 m Class 150/153 DMUs	Modern 20 m Class 350 EMUs (comprising 50% motor and 50% trailer units)
23 m British Rail Mk III passenger coaches	IEP post-electrification. IEP must meet TSI requirements and will have distributed power, so assume all post-electrification vehicles equivalent to modern 23m Class 380 EMU motor vehicles.
Class 43 HST power cars	assuming they are not used post-electrification and are replaced by IEP
23 m Class 165/170/175 DMUs	Modern 23m Class 380 EMUs (comprising $\frac{2}{3}$ motor and $\frac{1}{3}$ trailer units)
23 m Class 220/221 DMUs	Modern 23m Class 380 EMUs (comprising 50% motor and 50% trailer units)

- 2.12. Following completion of the rolling stock projections, source emission levels were also generated for the post-electrification scenario.

3. RESULTS

- 3.1. Annual average daytime (06:00-24:00) source emission levels for both pre and post electrification scenarios have been derived from ACTRAFF movement statistics for all rail corridors that are planned to be electrified.
- 3.2. In order to allow for a direct comparison between the baseline pre-electrification scenario and the post-electrification projection, rolling and diesel emissions have been combined for both scenarios and the post-electrification emission level has been subtracted from the pre-electrification baseline level.
- 3.3. The results indicate that, post-electrification, no increase in noise levels can be expected across South Wales by applying the projected 50% increase in 'electrified' passenger vehicle movements. Figure 1, below displays the estimated reduction in noise source emission levels across South Wales.
- 3.4. In summary, the results indicate that the SWML could expect reductions of less than 2 dB in noise levels at source as a result of electrification, while the valley lines could expect to receive greater reductions of 2-5 dB for the Cardiff valley routes and in excess of 5 dB for the Newport valley line.
- 3.5. The results shown in Figure 1 indicate that a reduction of greater than 5 dB could be expected in central Swansea. In this location, movements on the rail network will consist of new electrified stock in addition to rolling stock on non-electrified routes. It is likely, in instances such as this, the projected reduction is an overestimate as the substitution process has re-assigned new electrified rolling stock that is unlikely to change following electrification.

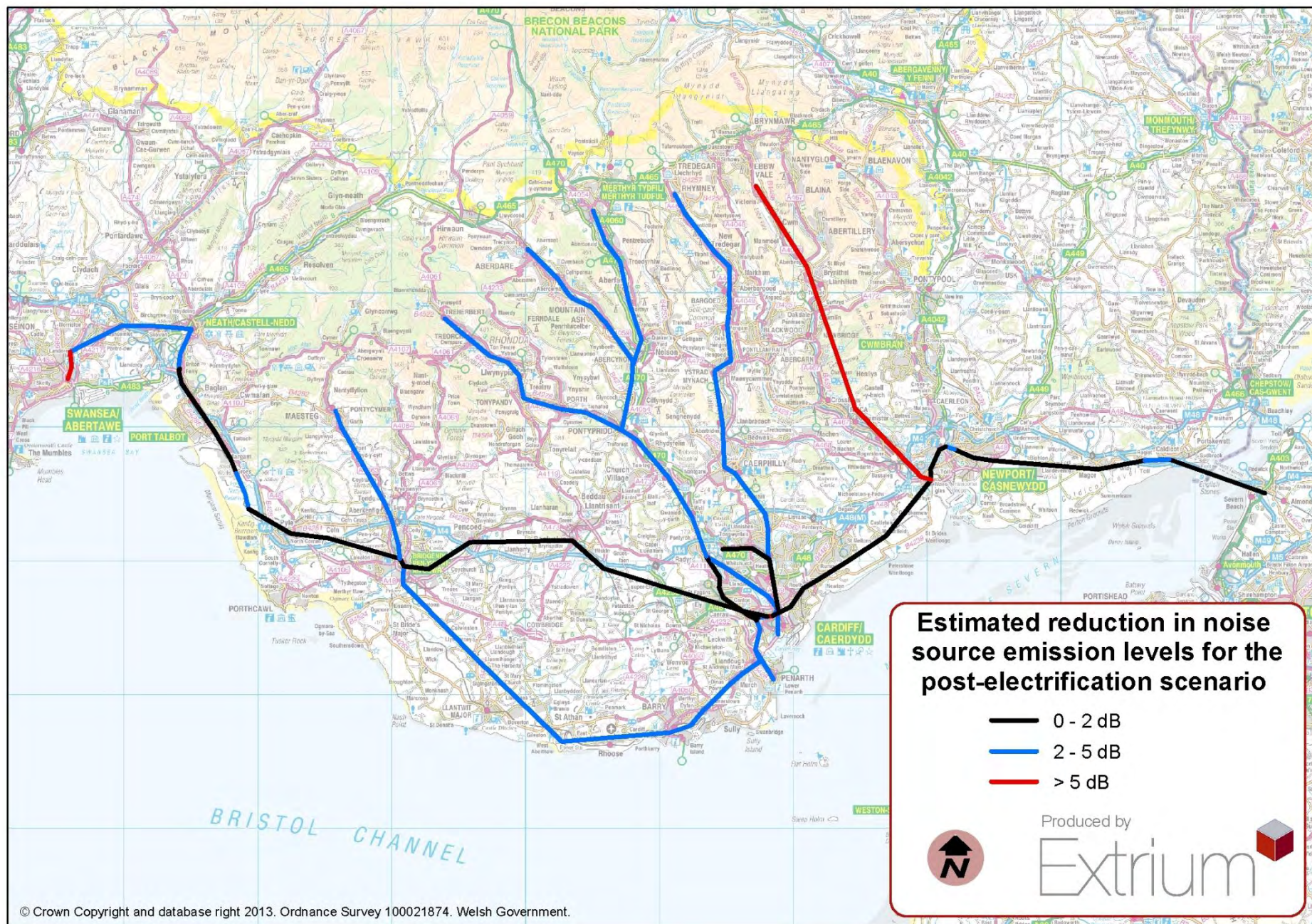


Figure 1. Map showing the estimated reduction in noise source emission levels for the projected post-electrification scenario compared to the baseline pre-electrification scenario

4. CONCLUSIONS

- 4.1. This study has indicated that following electrification, no increase in noise levels at source can be expected following a 50% increase in 'electrified' passenger vehicle movements.
- 4.2. It is important to note that this study has provided an indicative projection of the impacts of electrification on source emission levels. At the time of completing this study, information detailing the number of vehicle movements, and nature of rolling stock post-electrification was not available. This study has therefore been based upon agreed high-level assumptions about movements on the electrified network.
- 4.3. As further information is made available about the projected nature of the movements on the rail network after electrification, it is suggested that this information is compared against the assumptions used in this study to monitor the validity of this exercise and its outcomes.
- 4.4. The availability of more detailed information may provide the opportunity to predict the likely impacts of electrification more accurately (including for different times of the day) and understand the impacts upon the population of South Wales at individual dwelling locations through the completion of noise propagation calculations and population exposure assessments.

QUALITY STATEMENT

Extrium has completed this note with all reasonable skill and care and with an understanding of the aims, objectives and scope of the work as made available to Extrium at the time of preparation.

This note is issued in confidence to the Welsh Government and Extrium cannot accept any responsibility to any third party to whom this note may be circulated, in part or in full, or for any matters arising which may be considered outside the scope of works. Any such parties rely on the contents of this report solely at their own risk.

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