Investment Information

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NetworkRail

What's happening?

Best practice by SRA

Application of the Industry Rail Carbon Tool in a Signalling Context: at the Corporate and Project (TLP KO2) level

This case study relates to two separate but related research projects. The first looks at the development of baseline carbon emission datasets for selected signalling equipment using the industry-wide Rail Carbon Tool (RCT). The second research project seeks to pilot the application of some of these datasets on the Thameslink project. **The purpose of this case study is to outline initial work undertaken to pilot the RCT on specific equipment at a Corporate and Project level. Subsequent calculations and research should not use the data contained in this case study until it has been validated.**

Research Project 1: Carbon emissions and signalling equipment - creating a database in the Rail Carbon Tool

This research was coordinated by the Siemens Rail Automation (SRA) corporate Sustainability Team, with internal support from a SRA Graduate Engineer (Kevin Maingi) and an Engineering Intern (Sophie Myers) with external technical support and peer review from Atkins Global (c/ Jon Casey). It built on a previous embodied carbon calculation pilot undertaken by SRA on its ATP and relay equipment, and which was delivered as part of the Thameslink programme (refer TLP Best Practice Case Study dated July 2014). This latest project aimed to build a more extensive library of product-related carbon datasets, specifically through using the industry-wide RCT. Two different databases were created:

- A "Products" database which include a list of 'whole products' (e.g. a fully populated location case) – see Figure 1 below for example; and
- A "Product Options" database which included a list of different options that could be combined as needed to form a bigger product, depending on the requirements of the project (e.g. UTX – under track crossing: polyvault - different dimensions vs. multi-duct - 4, 6 and 9-way) – see Figure 2 below for this example.

Type 1	1	Nr	16,085	16,085	16,085
REB Housing	1	Nr	7,225	7,225	7,225
REB step	*1*	*Nr*	*53*	*53*	*53*
Foundation	1	Nr	2,280	2,280	2,280
Steel mesh wire	1,000	Nr	0.02	21	21
Fencing	1	Nr	1,198	1,198	1,198
Troughing	1	Nr	119	119	119
Internal components	2	Equiv. Loc case	428	857	857
Operational energy usage	2	Equiv. Loc case	2,166	4,331	4,331

Figure 1: left – Sample Database for a 'whole' Type 1 REB; right – picture of an REB

Product options					
Signal			3,277	3,277	3,277
UTX/ URX			5,031	5,031	5,031
PolyVault			4,962	4,962	4,962
Multiduct			69	69	69
Level Crossing - FB			152	152	152
Level Crossing - AHB					

Figure 2: Sample Database for 'Product Options' – in this example an Under Track Crossing (UTX)

A number of signalling products were evaluated, including REBs, Location Cases, PSPs, Point Machines, Signals and Under Track Crossings. After establishing the products that would be part of the database, a number of suppliers (internal and external) were engaged and data was obtained from them to inform the analysis.

Specifically, the analysis looked at:

- Embodied Carbon emissions – covering the extraction, processing and manufacture of the product and included both the product housing and internal components. However, a number of assumptions were made about the internal components due to the complexity and varying nature of each product.
- Civils emissions – covering the installation of the product including foundations and associated structures (e.g. fencing, troughing, etc).
- Operational emissions – covering emissions associated with the use of the product over yearly intervals.

Finally, comparisons were made both within and between products with respect to the relative carbon intensity of each phase (i.e. embodied, civils and operational related emissions). Refer Figure 3 and 4 for selected details for a Type 6 REB.

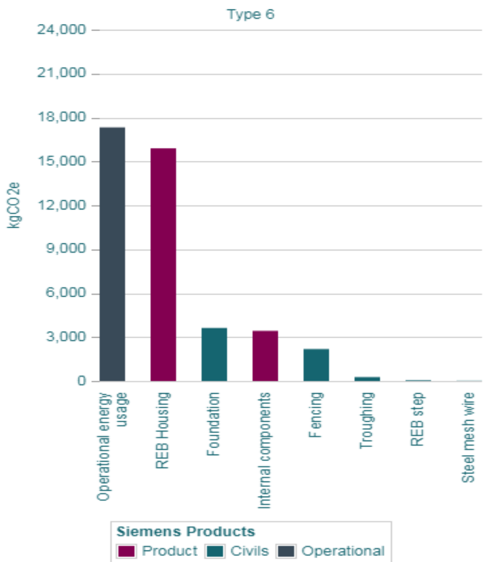

Figure 3: Type 6 REB – selected carbon breakdown (including embodied, civils and operational elements)

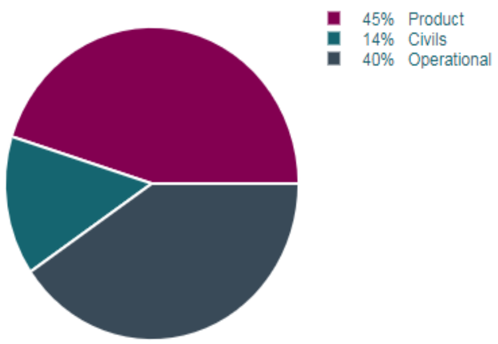

Figure 4: Type 6 REB – high level summary of embodied (product), civils and operational elements

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Research Project 2: Applying the findings to Thameslink (Low Level Platform REBs)

The REB databases created in the RCT as part of the above research project were subsequently piloted on the Thameslink programme (TLP). This provided an opportunity to apply the results of the desktop research on a 'live' project with the signalling element of TLP at a good stage for this as REB types and number had been (largely) confirmed, procured and installed. The purpose of this exercise was not to valid or interrogate the data generated from Research Project 1, but rather to pilot it on a 'live' project and subsequently inform future project applications. **Key outputs are provided below, however it is important to also note the Overall Findings (Benefits & Challenges) presented at the end of this case study.**

Information (numbers and types) of REBs installed on TLP were obtained from the SRA Project Engineers, with corresponding details input into the RCT.

Specifically, there were two types of REBs identified as being used on TLP:

- Trackside Functional Modules (TFM) – 'traditional' REBs
- Westrace Trackside System (WTS) – the newer technology of REBs

Information for REBs included in the RCT relate to TFMs (Types 1 through 9) – which were the predominant REBs in use within SRA at the time that the databases were being developed. On TLP, TFMs were installed on the lower level and WTSs were installed on the higher level. Therefore, due to availability of relevant information, 10 low level TFM REBs (and specifically Types 6, 8 and 9) have been included in the following analysis. Figure 5 shows the number and type of each TFM REB included, and Figure 6 shows the carbon footprint (including embodied, civil and operational emissions) per relevant REB type. Using the database information included by SRA in the RCT, the total carbon emissions from all 10 REBs was calculated to be **506,978kgCO_2e**, with the breakdown of this total by REB type shown in Figures 7 and 8.

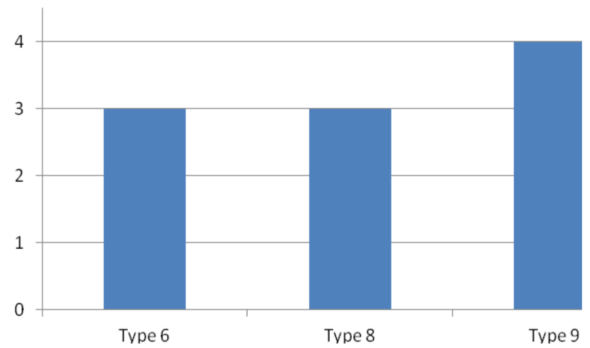

Figure 5: Number of TLP Low Level TFM REBs (by Type) included in the analysis

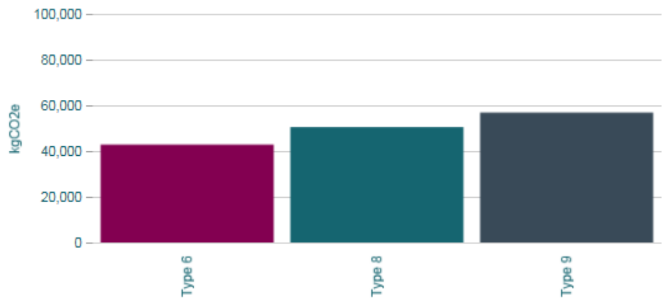

Figure 6: Carbon emissions for TLP Low level TFM REBs (1 no. by Type)

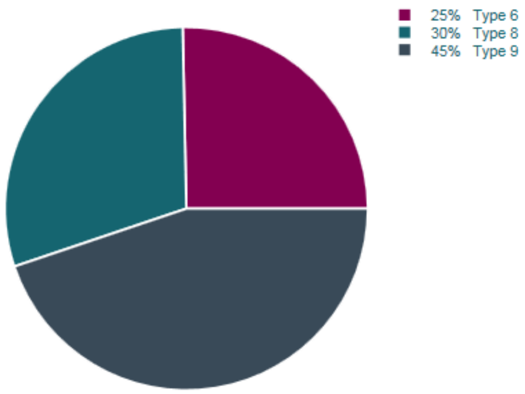

Figure 7: Proportion of carbon associated with TLP Low Level TFM REB (total by Type)

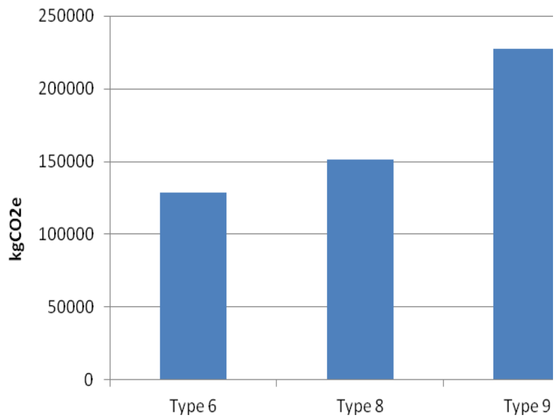

Figure 8: Carbon Emissions for all TLP Low Level TFM REBs (total by Type)

The data for low level TFM REBs on TLP was then broken down by source of carbon emission (i.e. embodied, civil and in-use) to show an indicative split per emission type and to gather further insight. Refer Figures 9 & 10 below for this breakdown.

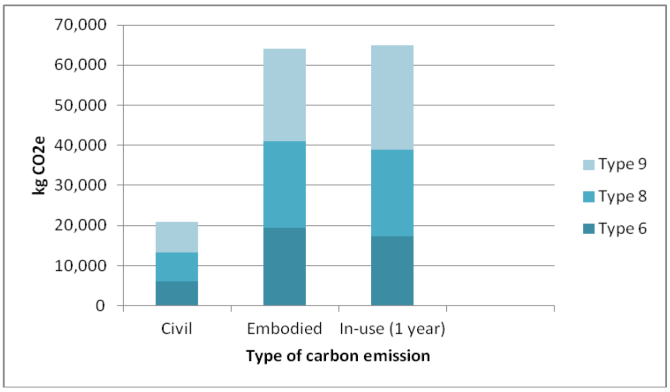

Figure 9: Sources of Carbon Emissions for TLP Low Level TFM REBs (for 1 REB of each type)

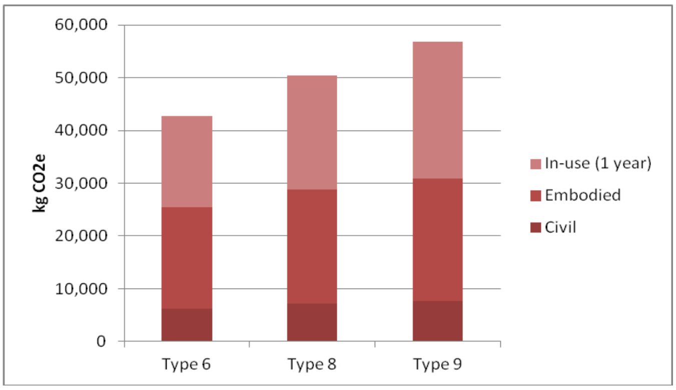

Figure 10: Carbon Emissions for types of TLP Low Level TFM REBs showing carbon emission sources (for 1 REB of each type)

Overall Findings (Research Projects 1 & 2)

Benefits:

- **Innovation & understanding**: first known analysis of its kind, which has helped inform use of the Rail Carbon Tool within a signalling context.
- **Future application**: databases developed could, in theory, be used for future signalling carbon emission assessments, and potentially be extended to include carbon (and cost) reduction initiatives.
- **Opportunity to pilot data**: enabled SRA to test baseline datasets on a live project.

Challenges:

- **Availability of data:** considerable time involved in retrieving required product information.
- **Assumptions required:** due to type and volume of components used in signalling products, combined with challenges around availability of data, a number of assumptions had to be made. This was particularly apparent for internal components (of for example, REB's, MEH's, PSP's, Location Cases, OC's, etc) and may impact the accuracy of the final datasets generated.
- **Business processes**: while there is interest from internal and external stakeholders (e.g. design engineers, construction teams, etc) to reduce carbon emissions in signalling projects, there are also opportunities to improve the integration of key considerations into existing business processes (from equipment research & development through selection, installation and operation).
- **No 'one-size fits all':** difficulty in creating a standard product baseline, even within a single product type (e.g. an REB, there is variation in size and components used).

Meeting the TLP objectives & targets:

For TLP specifically, these initiatives are aligned with the following TLP Sustainability Strategy Objective 15 to:

- 'Minimise the use of natural resources, water and carbon while increasing the life of materials and avoiding the generation of waste'

However, the two Research Projects detailed above also help inform SRA and wider industry learning on the application of the RCT in a signalling context