Amey

NLC Carbon Baseline Report

Live Labs 2 – Centre of Excellence for Decarbonising Roads

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1. Introduction

1.1. Main Scheme Background

NLC and Amey have developed a carbon emission baseline on NLC's roads service for financial year 2022/23 which followed the Future Highways Research Group's standardised approach for creating an inventory-based carbon baseline. This approach took place over a 3-4 month period; future baselining exercises should be swifter as the process is streamlined.

NLC's roads service is delivered through an internal client based in Motherwell Civic Centre, predominantly supported by a term maintenance partnership with Amey Public Services LLP. Local contractors are also used to assist in delivering the capital programmes for roads and street lighting.

1.2. Report Outline

One of the key exercises as part of the Live Labs 2 project is to create a carbon baseline for North Lanarkshire's roads service. Baselines enable identification of carbon hotspots on the operations resulting from service delivery. The baseline is also key to be able to measure the carbon impact that low carbon interventions have on the carbon footprint. North Lanarkshire Council (NLC) has declared a climate emergency along with the majority of other local authorities to identify sources and key contributors to the overall emissions profile.

2. Overview of Service Demonstration Gaps

Trials are carried out in various service level categories, each with its unique methodology and data collection template. These trials serve both benchmarking and experimental purposes. Data for carbon baselining and evaluation is collected during both winter and summer seasons.

The initial service activity tested was pothole repair, with trials conducted in February and April. During these winter trials, data was gathered for both innovative materials and traditional (Business as Usual) materials. The results will be published after full verification of carbon profiles created in Carbon Analyser in partnership with the Future Highways Research Group, alongside accelerated life testing conducted by the University of Nottingham and Aston University. Trials have also been undertaken for a rejuvenator, a push-off asphalt trailer technology, and a low-carbon binder which will be progressing with further analysis and evaluation.

The next trials due to take place will be line-marking and surface materials. Line marking trials have already begun on some sites, with the remaining due for completion by the end of September. Surfacing materials are set to be trialled in Summer 2025.

3. Overview of Approach to Carbon from the SOBC & delivery of commitments

As part of the Strategic Outline Business Case (SOBC published on the ADEPT Live Labs 2 website), the NLC Live Lab committed to a number of approaches to carbon baselining, measurement and management throughout the duration of the programme and its five-year monitoring and evaluation period. This includes the completion of a full carbon baseline of North Lanarkshire road services, ongoing carbon measurement of all solutions trialled in NLC, carbon data management requirements, and a continued partnership with the Future Highways Research Group, aligning with the Carbon Calculation and Accounting Standards (CCAS).

The table below demonstrates the original commitments to carbon in the SOBC, the NLC Live Lab progress against these commitments, upcoming activities within the constituent parts of carbon evaluation and management, and the overall alignment or divergence from the SOBC.

THEME	COMMITMENT IN SOBC	PROGRESS TO DATE	UPCOMING STEPS	ALIGNMENT / DIFFERENCES WITH SOBC
Carbon Baseline	Undertake carbon baselining to demonstrate and quantify the effectiveness of proposed interventions, using the FHRG Carbon Analyser and CCAS guidance.	The project team have completed a full carbon baseline of NLC road maintenance for financial year 2022-23, with the FHRG Carbon Analyser tool and aligned to the CCAS guidance.	NLC intend to conduct regular carbon baselining of its road maintenance services to track and optimise carbon reduction activities, as a result of Live Labs 2 and other decarbonisation efforts. Following completion of carbon profiles for trialled materials, the Live Lab team will create experimental profiles on Carbon Analyser to model future, service-level carbon savings should the solutions be scaled to business-as-usual.	The full carbon baseline fulfils the commitments outlined in the SOBC.

Carbon Measurement	Usage of the FHRG tools to assess and baseline interventions, as well as OneClick LCA where appropriate. Workshops to understand carbon challenges and changes needed to support decarbonisation. Materials will be compared against a common baseline. Material data will be stored in the CoE database. Each trial will have a data management plan, sense checked with contractors.	Following trials, the Carbon Lead and the FHRG have drafted full carbon profiles for materials trialled to date on the FHRG. OneClick LCA has supported initial pre-trial carbon analyses to inform the innovation scorecard and post-trial to source embodied carbon data from the OneClick database if otherwise unavailable. All carbon profiles have incorporated a local and sector-wide baseline material to benchmark carbon savings. For example, initial pothole trials have compared materials against HRA and a standard cold-mix asphaltic repair material. The project team has hosted meetings with the NLC team and other stakeholders to understand carbon challenges, as well as focus groups as part of the behavioural change research and a local authority questionnaire. For all trials, the trial designs have included data management plans, shared with the TMC provider (Amey) to ensure data is collected in a consistent manner.	The project team and FHRG will continue to develop full carbon profiles of every solution trialled as part of the project, compared against standard benchmarks. All evaluations will be published on the online CoE database when it is launched (end of 2024 and beyond).	Aligns to SOBC commitments. Additional research has been undertaken than originally outlined to understand carbon challenges (e.g. interviews as part of the behavioural change research and a LA questionnaire).
Residual Emissions	All carbon emissions will be calculated as the sum of capital, operational and end-of-life emissions. Data sources have been outlined for embodied carbon, transport of equipment and materials, fuel use, carbon sequestration, and disposal of waste.	The carbon evaluations for each material include whole lifecycle assessments, which take into consideration: • Embodied carbon • Transportation emissions of materials and people • Operation of plant and equipment during construction period • Operational electricity, fuel and water emissions • Maintenance, repair and replacement emissions • End of life emissions including deconstruction and waste processing	Future carbon evaluations of solutions will follow the same approach outlined in the SOBC and adopted to date by the project team.	Aligns to SOBC commitments. No data has yet to be required for carbon sequestration as a result of changes to landscaping maintenance regime, as no verge maintenance solutions have been trialled.
Academic Partners	We will use FHRG CCAS and Carbon Analyser, including a project carbon framework for ongoing measurement of whole life carbon.	We have partnered with FHRG to conduct full verified carbon evaluations, carbon baselining, and experimental profiles for all solutions trialled as part of the project.	We will continue to leverage our partnership with FHRG to complete and validate any carbon evaluations for the project.	Aligns to SOBC commitments.

4. Carbon Baselining Approach

The method undertaken for this baseline follows the Carbon Calculation and Accounting Standards (CCAS) process developed by the Future Highways Research Group (FHRG). The UK local roads sector consists of a diverse array of Local Highway Authorities (LHAs), operating models, supply chain partners, and carbon analysis capabilities. To address this diversity and complexity, the guidance recommends an Inventory-Based Carbon Accounting approach, with the option to include Activity-Based Carbon Analysis.

1. **Inventory-Based Carbon Accounting Method** This method calculates carbon emissions by creating inventories of all significant emission sources, including both directly owned or controlled resources and emissions from supply chain partners.
2. **Activity-Based Carbon Analysis Method** This method calculates carbon emissions based on the highways activities undertaken and completed during the reporting year. It can be applied to all activities within the service or to specific activities that require closer examination and redesign.

Amey recorded the data using the FHRG's Carbon Analyser tool using the following steps:

1. **Study boundary:** The initial step is to define the reporting boundary and selecting a baselining year. It is key to ensure that the carbon data is available for this year. For identifying all relevant emissions sources, a decision on the significant thresholds is also taken to allow for focus to be properly applied on gathering data of significant magnitude, rather than "chasing decimals" – or seeking excessive detail which do not contribute significantly to overall outcomes. The following step is to create a schedule of highways functions and activities, then to identify which of these fall within the carbon footprint boundary. This is achieved with active engagement with the Local Authority ("LA") and supply chain stakeholders. It is also a requirement to identify the responsible party for each function, activity, and delivery partner.

2. **Premises and sites:** This step represents the first data collection activity. For this Amey and NLC identified which sites and depots were directly owned or controlled on the contract. Electricity and gas usage quantities were then sourced for those sites from energy bills and purchase records.

3. **Staff and contractors:** This combines emissions directly related to staff and contractors, primarily from commuting to work. For this inventory, Amey and NLC undertook a staff survey for both the local authority staff and Amey staff. This involved collection of data on commuting distances, commuting methods and number of work from home days over the year. In order to get an accurate picture of commutes, a statistically-significant percentage of responses are required. These responses are tabulated to get the average commute distance/method and is applied to the remaining staff who did not respond to the survey.

4. **Vehicles and Plant emissions**. For this category an inventory of all NLC or Amey own/controlled vehicles and plant used primarily to deliver services on the maintenance contract was created. To create a fleet inventory, reports from both North Lanarkshire's and Amey's fleet management telematics systems were collated. The key information required from these is vehicle types, fuel type and annual fuel usage/mileage. Amey also reached out to the supply chain to get an inventory of plant hired and fuel usage.

5. **Purchased products and services:** These items comprise the largest contributors of carbon emissions. This category included purchased materials and treatments, purchased transportation, purchased waste treatment, and purchased services. For this exercise the Commercial and Operations teams kept a complete schedule of materials and services purchased on the contract which allowed this inventory and quantities to be readily input into the carbon model. An additional key input for this category was the street lighting energy use and installed columns. This data was sourced from energy purchase figures held by the council and works orders.

6. **Reporting:** The remaining step is to collate the data and build the report. This includes checking correct carbon factors have been applied to each item and verify the datasets for all in-scope highways functions and activities. For the carbon factors selection, the National Infrastructure Carbon Schedule (NICS) provides the industry-standard emissions factors that will be applied to the data to calculate

total carbon emissions. For this, Amey worked closely with the FHRG to select the correct factors to apply to each line item in the baseline.

5. Overview of the contractors and subcontractors in each local authority

The majority of the road maintenance in North Lanarkshire Council for the 2022-23 period has been provided by Amey. The following framework contractors have also provided services for road maintenance in North Lanarkshire for 2022-23:

C/W Contractors

- Hillhouse Quarry Group
- JH Civil Engineering Ltd
- John McGeady Ltd
- Luddon Construction Ltd
- MacLay Civil Engineering Ltd
- Newlay Civil Engineering Ltd
- Tarmac Trading Ltd

F/W Contractors

- Hillhouse Quarry Group
- JH Civil Engineering Ltd
- John McGeady Ltd
- Luddon Construction Ltd
- MacLay Civil Engineering Ltd
- Newlay Civil Engineering Ltd

Lighting Contractor

- Lightways

6. Progress, Challenges and Learnings

6.1. Challenges with Carbon baselining and Evaluation within WMCA

There were some challenges that had to be overcome when building the baseline. These generally revolved around determining which carbon factors to use or blockers to collecting the underlying data.

When determining the energy use for the Civic Centre in North Lanarkshire, due to the venue's mixed use, determining the proportion of energy usage that could be allocated to the roads maintenance contract was necessary. An appropriate method was selected which was to calculate the share of energy usage for the building based on the number of available desk spaces and the number of work days that roads client staff utilised them over the course of the year.

When trying to collect information it became clear that key plant suppliers did not record the information needed. Most of these cases only had minimal impact on the overall baseline and could be estimated based on adjacent data; others proved more challenging to address. This was particularly the case with the Hired Plant emissions. During data collection, it became clear that our primary plant supplier did not collect data on energy use or usage time as part of the hire process. In order to overcome this block, a generic carbon factor was applied to the bulk fuel purchases for the depots to approximate the carbon emissions of those plant. This highlights the need for early engagement of supply chain to ensure that the necessary data is being collected for future years.

One of the aims of the Live Labs 2 programme is to effectively contextualise results for the local environment where the carbon profiles are being calculated. One of the largest impacts this has on the carbon emissions baseline is in determining the appropriate carbon factor for electrical energy consumption. Scotland has a higher percentage of renewable energy in its overall supply mix compared to the rest of the United Kingdom; therefore, it was decided that a local energy carbon factor should be used. Whilst a North Lanarkshire emissions factor was unavailable, a Scottish Government energy carbon factor was used.

A key point which the process highlighted is the number of data sources required to feed into the baseline model. While most of the data was readily available some of the necessary data was not accessible through the normal reporting process and required additional time and resource to collect. It highlights the potential to significantly streamline the baselining process in future years if carbon data reporting is built into the normal monthly/quarterly reporting process.

6.2. Insights & limitations to the carbon baselining of the authorities of WMCA

Regular baselining will be key to tackling climate change and meeting shared decarbonisation goals in the future. Carbon reporting is also becoming mandatory for all public contracts and for major companies.

The collection of appropriate, justifiable data is key to completing an accurate baseline. The completed baseline will also be used as a tool to help model the impact of any strategic change options on future carbon baselines. This will utilise the carbon profiles built up using materials trials data from those trials being currently undertaken by the Centre of Excellence for Decarbonising Roads, as well as the function and activity profiles created as part of the CCAS process.

6.3. Carbon Baseline Summary

Calculating the carbon baseline requires the multiplying of quantities of each line item in the baseline by the correct carbon factor in the NICS database to give a Carbon Dioxide equivalent emissions quantum ($kgCO_2e$) for each source. Totals are aggregated to provide an overall baseline, representing current emissions during standard service delivery. The totals of the baseline are summarised below:

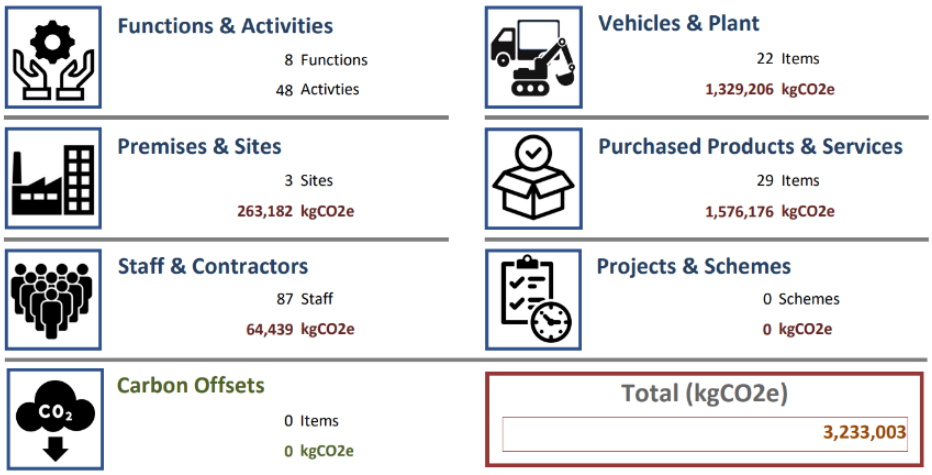

Figure 1 - Baseline Summary Figures

The baseline shows for this contract, that Vehicles and Plant and Purchased Products and Services make up the largest parts of the carbon baseline. Plant and fleet accounts for around 41% of the total carbon while Products & Services accounts for around 49%.

A granular review of the Purchased Products & Services emissions gives more insight into hotspot materials used on the contract:

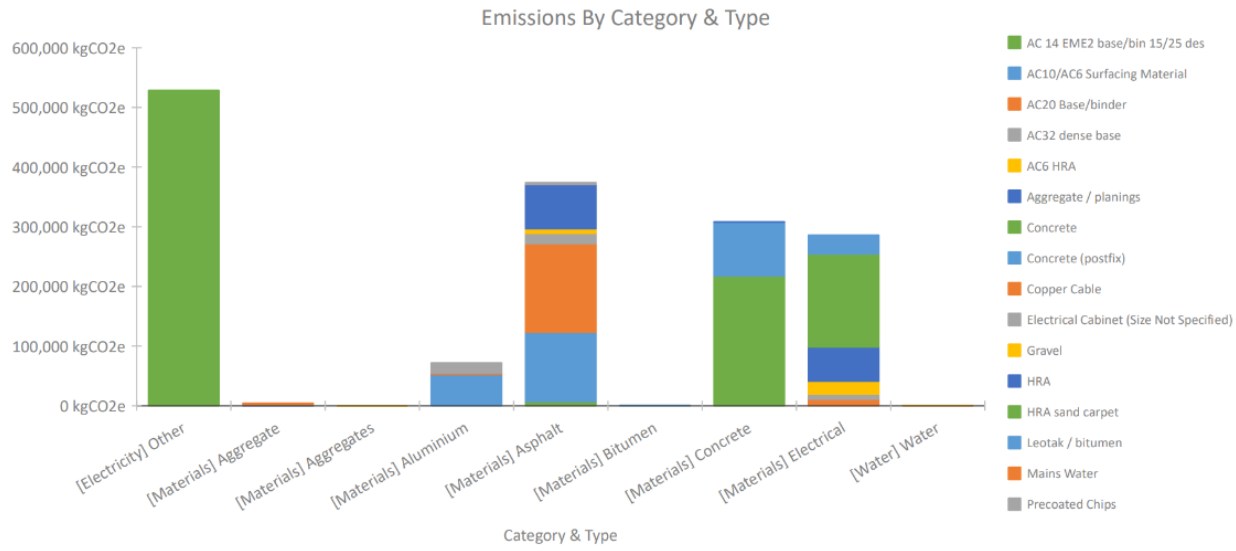

Figure 2 - Breakdown of Products and Services emissions

Within Products and Services, the largest contributor is street lighting. Energy usage alone for street lighting contributes 528,919 $kgCO_2e$ or 16% of the total carbon of the roads service (using the Scottish governments energy carbon factor).

Asphalt and concrete are the remaining high emitters, making up 374,080 (11.5%) and 308,519 (9.5%) $kgCO_2e$ of the total baseline, respectively.

7. Conclusion

7.1. Main Takeaways

This baseline serves several purposes for NLC:

- NLC have declared a climate emergency and have made upcoming carbon reporting mandatory; therefore, it provides a starting point to track future progress towards emission reduction targets.
- An accurate baseline is key to identifying major emission sources and prioritising interventions to reduce carbon.
- Incorporating carbon emissions baselining into our proposals demonstrates commitment and capability on sustainability.
- Street lighting energy usage is the greatest emitter within purchased products and services in North Lanarkshire, further highlighting the decarbonisation potential of solutions and processes to reduce this energy consumption.
- The highest emitting materials are asphalt and concrete, underlining the need to assign adequate resource, time and energy to the identification, trial and evaluation of low-carbon alternatives as part of the Centre of Excellence.

7.2. Going Forward

Regarding future work, Amey will liaise closely with NLC stakeholders and set in place a process to gather data and update emissions baseline data annually. This will build an emissions profile over time, allowing for quantification of the impact of interventions. It establishes a process for expansion across NLC's services, contributing to council-wide decarbonisation as the council works collaboratively to reach its climate goals.

The baseline report and figures aim to inform the effective evaluation of the carbon impact of the materials being trialled. This baseline serves as a reference point, and by comparing the baseline with the emissions data from the new materials, carbon savings achieved through the trials can be quantified. Utilising the experimental profile feature on Carbon Analyser, potential carbon savings are modelled both locally in North Lanarkshire and at scale. This comprehensive approach helps in understanding the broader implications of adopting these new materials, providing insights into their environmental benefits and supporting data-driven decisions for wider implementation. Through this method, sustainable materials that can significantly reduce carbon emissions are identified, contributing to North Lanarkshire's environmental goals and setting an example for scalable climate action as part of the wider objectives of the Centre of Excellence for Decarbonising Roads.

8. Appendices

2024.07.31 NLC Baseline Data.pdf