London's major roads are putting children at risk of developing asthma

Environmental Defense Fund Europe methodology

Method: Defining the area of Red Route roads.

Transport for London (TfL) publish a GIS shapefile of the boundary of the Red Route network[1]. However, this file does not include the boundary for the A13 section, which comes under TfL authority but is not maintained by them. A freedom of information request was made to obtain GIS data for this road section, and TfL provided a shapefile detailing the road centre lines[2]. The road data for the A13 section was selected and a buffer of 10 metres created around it to match the scale of the boundary in the original boundary data. The resulting buffer polygon was then merged with the original Red Route boundary data to create a total boundary definition which includes an estimate of the A13 boundary. GIS software (QGIS) was used to calculate the total area of this boundary: 18.3 km^2.

Method: Defining the area where NO^2 pollution from the Red Routes is >=4 $\mu g/m^3$.

The modelled pollution from Red Routes data was created by Cambridge Environmental Research Consultants(CERC) using the air dispersion model ADMS-Urban. Emissions data from the London Atmospheric Emissions Inventory (LAEI)[3] was plugged into the ADMS-Urban model to estimate pollution concentrations in high-resolution across London, taking into account meteorology variations, street canyon geometry, chemical reactions and urban canopy effects. This work used 'LAEI 2013', which was published in 2016, has a base year of 2013 and includes projections for 2020. It used annual average values for 2019, obtained by interpolating between the base year values and the projections for 2020[4].

Road sections in the LAEI 2013 emissions data include a Red Route classification, which meant the model could be run with and without Red Route emission sources. CERC produced an estimate of the pollution solely from Red Routes by subtracting the output of a model run without Red Route emission sources from the output of a model run with all emission sources; the result was an estimate of the annual average NO_2 concentration from Red Routes at a 10m resolution across Greater London.

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[1] https://tfl.gov.uk/info-for/open-data-users/our-open-data#on-this-page-4

[2] https://tfl.gov.uk/corporate/transparency/freedom-of-information/foi-request-detail?referenceId=FOI-2117-2021

[3] https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory-2013

[4] See Appendix 6 of the Breathe London technical report: https://www.globalcleanair.org/files/2021/02/BL-CERC-Final-Report.pdf

This model data was then used by EDF Europe to define the area greater than 4 µg/m^3. All 10m grid cells with a modelled concentration greater than 4 µg/m^3 were extracted from the model data and then merged into a single polygon shapefile. GIS software was used to calculate the total area: 127.2 km^2.

Finding: Levels of 4 µg/m3 NO_2 and higher – just from the Red Routes – covers an area seven times bigger than that of the roads themselves.

The area where NO_2 pollution from the Red Routes is >=4 µg/m^3 is 127.2 km^2, 7 times larger than the 18.3 km^2 covered by the Red Route boundary area (including the estimated A13 area).

Finding: We estimate 9% of London children live in the area with at least 4 µg/m^3 of extra NO_2 pollution from the Red Routes.

Population counts by age at the Lower Layer Super Output Area (LSOA) level were obtained from the Office for National Statistics[5]. To estimate the population of each LSOA that falls within the area of >=4 µg/m^3 NO_2 pollution from the Red Routes (increased risk area) a GIS polygon defining the increased risk area, minus the red route road area, was intersected with a GIS polygon of all LSOAs. From this the fraction of each LSOA covered by the increased risk area could be calculated. For each LSOA the total under-18 population was multiplied by the LSOA coverage fraction to give an estimate of the under-18 population within the coverage area (see figure below).

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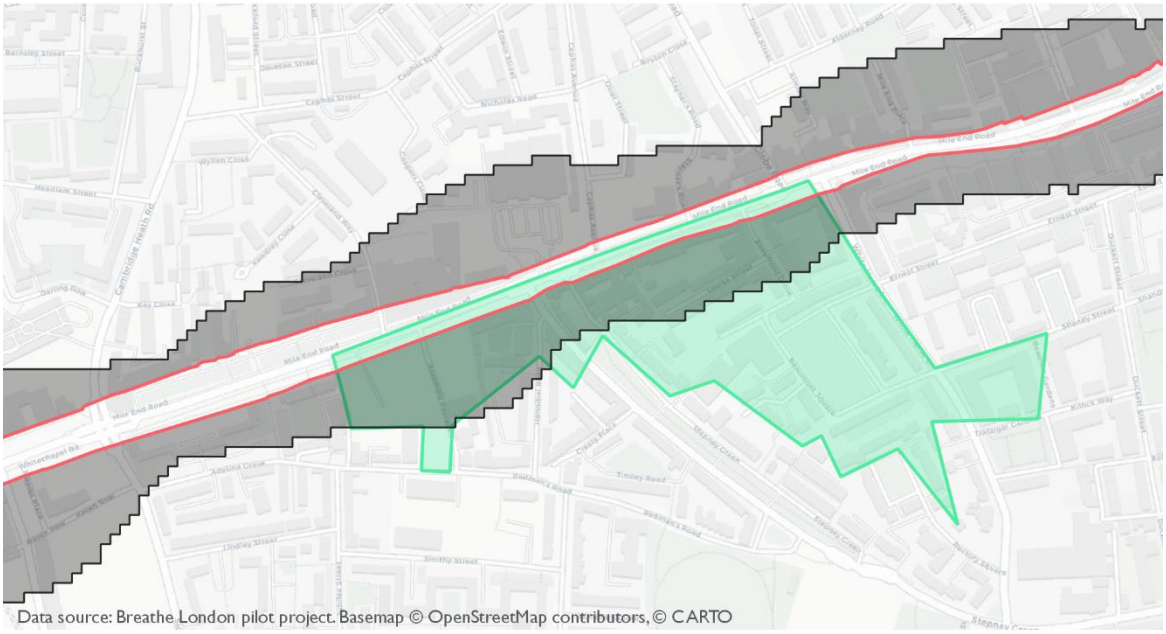
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/lowersuperoutputareamidyearpopulationestimates

Population estimate method example



LSOA code: E01004290
Coverage fraction: 0.37
Total 0-18 population: 476
Adjusted 0-18 population: 176.1

Red Route NO2 <= 4 µg/m3 (minus Red Route area)
LSOA area
Red Routes boundary

The sum of each of these estimates for all LSOAs is 173,801, which is 8.5% of the 2,032,427 total for all under 18 year-olds in London.

Due to the lack of population data at a spatial resolution below LSOA level, this method necessarily assumes an equal distribution of the population throughout the non-Red Route area of LSOAs. It should therefore be treated as an estimate of the true affected population.