

DECEMBER 1, 2023

ROAD POLLUTION SOLUTIONS TOOL

Maidenhead to Teddington & Surrey Catchment

Undertaken in partnership with Middlesex University, independent researchers from Imperial College London and the British Geological Survey.



ZARA VISANJI
EVIDENCE PROJECT MANAGER
Thames21

Table of Contents

1. Introduction	2
2. The Project Team.....	2
3. Changes to Methodology.....	3
3.1 Road Data	3
3.1.1 Datasets	4
3.1.2 Limitations	5
3.2 Road Widths	5
4. Key Findings	6
References.....	7

1. Introduction

The addition of the Road Pollution Solutions Tool into the Maidenhead – Teddington and Surrey Catchment (Figure 1) acts as an extension of the original work carried out in the Greater London. For a detailed description of the original works carried out please refer to the ‘Project Summary’ and ‘Technical Report’.

This document ‘Maidenhead to Teddington and Surrey Catchment’ outlines the changes that were made to the decision support tool to allow for the inclusion of a further catchment area.

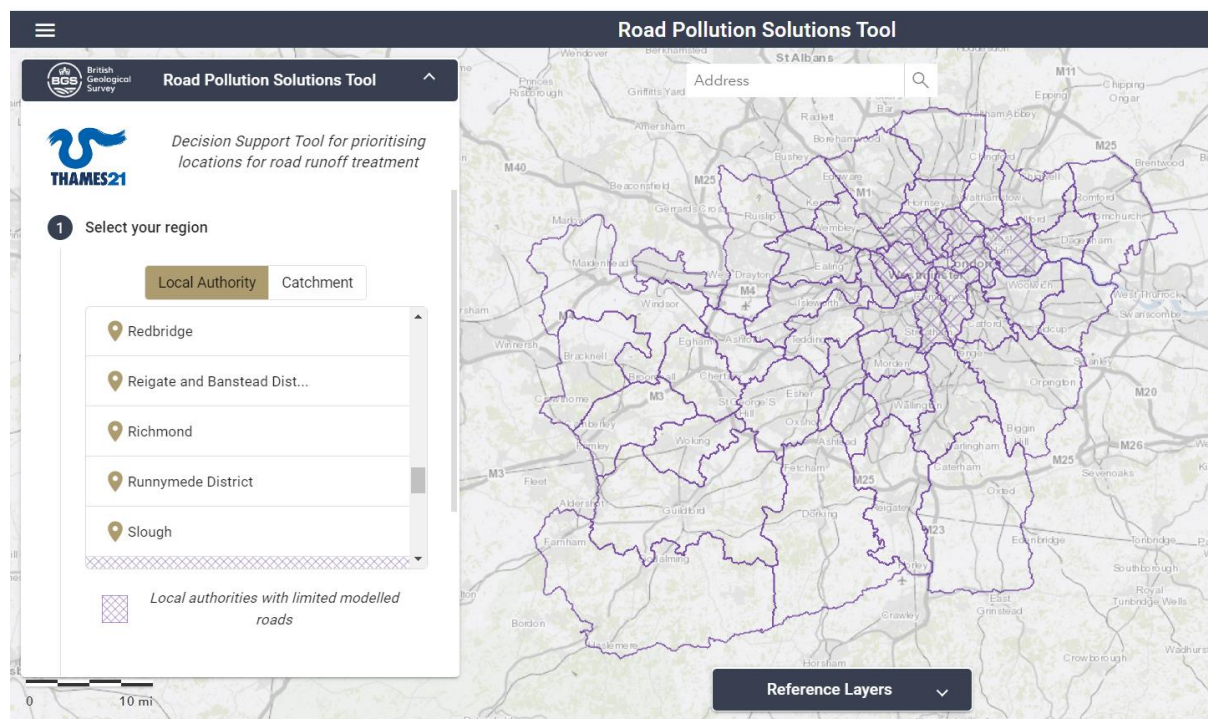


Figure 1: A screenshot of the Road Pollution Solutions Tool and the addition of the Maidenhead to Teddington and Surrey area.

2. The Project Team

The initial work underpinning the methodology of the tool for Greater London was funded by Environment Agency, Zoological Society of London (ZSL) and the Mayor of London. They funded Thames21 and Middlesex University to develop the Road Pollution Solutions Tool: a new road runoff risk characterisation and SuDS decision- support model.

A consortium of three water companies (SE Water, Thames Water and Affinity Water) commissioned Thames21 to evaluate the feasibility of developing the road runoff model in their area of interest: the Lower Thames catchment, from Maidenhead to Teddington (Figure 1), with a view to then delivering the model as a second phase of works. This first (scoping) phase assessed data availability and gaps in order to estimate costs to deliver the model; and engaged local authorities to gauge their willingness to implement model outputs. During this engagement process, Surrey County Council expressed interest in commissioning

extension of the road runoff model to cover their entire area – only a small portion of the county falls within the Maidenhead-Teddington catchment area.

South East Water, Surrey County Council and the Environment Agency went on to fund the model to be produced for the catchment and county area.

The British Geological Survey, supported by the as part of the UKRI NERC-funded Community Water Management for a Liveable London (CAMELLIA) programme, have played a vital part in bringing the underpinning model to life and developing the online visualisation for a user friendly, decision support tool. Researchers from Imperial College London were commissioned to develop an annual average daily traffic model for the catchment area of Maidenhead – Teddington and Surrey.

3. Changes to Methodology

The methodology underpinning the tool was developed by Middlesex University and has been adopted here to determine the relative risk posed by road runoff to receiving waters across Greater London and Maidenhead to Teddington and Surrey to identify which types of sustainable drainage systems (SuDS) treatment options may be suitable for addressing those risks.

For a full detailed description of the data layers underpinning the tool and the methodology used to create the Road Pollution Solutions Tool please refer to the Project Summary and Technical Report that can be found within the tool.

3.1 Road Data

The model provides estimates of annual average daily traffic (AADT) by vehicle type and fuel type for individual streets across the Maidenhead-Teddington and Surrey road network. The total AADT for all motor vehicles at a particular street is estimated using a machine learning model with a comprehensive spatial dataset. The dataset covers over 900 location-specific features, including demographics, economy, road attributes, car ownership, public transport supply, and geographical location. To further segment the AADT by vehicle and fuel type, conversion factors are derived and applied to the estimates of total AADT for all motor vehicles. These conversion factors are determined through the aggregation of data from road traffic statistics and vehicle fleet composition projections. The types of vehicles explored within the model are outlined in Table 1. The AADT estimates at specific road segments are then converted to vehicle kilometres travelled with road length data to estimate the road runoff in subsequent steps.

Table 1: Different vehicle types and fuel types modelled in the AADT.

Vehicle Type	Fuel Type
Motorcycle	-
Taxi	-
Car	Electric
	Petrol
	Diesel
Light Goods Vehicle	Electric
	Petrol
	Diesel
Rigid Axle Heavy Goods Vehicle (2 axles, 3 axles, 4 axles or more)	-
Articulated Heavy Goods Vehicle (3 to 4 axles, 5 axles, 6 axles)	-
Buses	-
Coaches	-

3.1.1 Datasets

A full list of input dataset is provided as follows. Data is available under the terms of the Open Government Licence.

- Road traffic – The AADT data for England and Wales in 2021 was obtained from the Department for Transport (2021).
- Road network and road attributes – The geographical information and road attributes for all road segments within England and Wales are from the Ordnance Survey Open Roads (Ordnance Survey, 2021).
- Geographical location features – Rural/Urban classification is available from the Department for Environment Food & Rural Affairs (2021). The boundary of build-up areas, major towns and cities, and functional urban areas are from the Office for National Statistics (2023a, 2023b, 2022f).
- Transport infrastructure – Location of UK airports and major ports are from Borsetti (2023) under the MIT Licence and the Department for Transport (2023b), respectively. Their associated demand in 2021 are from the Civil Aviation Authority (2023) and the Department for Transport (2023b), respectively. Location of UK public transport stations are from the National Public Transport Access Nodes database (Department for Transport, 2023a).
- Car ownership – Number of registered vehicles by body type in 2021 Quarter 4 are from the Department for Transport & Driver and Vehicle Licensing Agency (2023).
- Business counts – Business counts by industry and employment size band in 2021 are available from the Office for National Statistics (2022e).
- Earnings – Earnings by workplace and resident in 2021 are sourced from the Annual Survey of Hours and Earnings (Office for National Statistics, 2022b, 2022a).

- Employment – Employment by industry in 2021 are sourced from the Business Register and Employment Survey (Office for National Statistics, 2022c).
- Population and household – The total population, number of household, and population density are sourced from the 2021 UK census (Office for National Statistics, 2022d). Population by age group is derived from the midyear population estimates in 2020 (Office for National Statistics, 2021).
- Vehicle fleet composition projections – available in National Atmospheric Emissions Inventory (2023).

3.1.2 Limitations

The current model exhibits lower predictive performance for minor roads compared to major roads. This is partly due to limited availability of AADT observations for minor roads.

3.2 Road Widths

Similar to the Greater London area of the project, the road widths were manually measured in metres using Google Earth. The differences between the road widths across the two project areas are shown in the table below.

It should also be noted that the original project area of Greater London considered the direction of flow of traffic so the widths displayed are for single road directions, whereas for Maidenhead to Teddington and Surrey the roads were modelled considering the road as a whole and not as separate lane directions.

Table 2: Differences in road widths across the two project areas.

Road Type	Road Widths (metres)	
	Greater London	Maidenhead/Teddington & Surrey
A	10m	18m
B	9m	12m (urban roads) 9m (rural roads)
C	8m	6m (urban roads) 3m (rural roads)

4. Key Findings

To support use of results, predicted road runoff pollutant concentrations were allocated to one of four categories as follows:

Table 3: Priority classification and the number of road sections, and total length of roads within each category.

Priority Classification	Definitions	Colour in online 'Road Pollution Solutions Tool'	Number of Road Sections	Total Length of Road Sections
High Priority	roads with concentrations that fell into the top 5% of predicted concentrations	Red	856	328.1
Moderate Priority	roads with concentrations that fell into the 6 - 15% of predicted concentrations	Pink	4,275	437.7
Lower Priority	roads with concentrations that fell into the next 16 - 40% of concentrations were	Orange	1,710	164.9
Lowest Priority		Teal	10,261	1451.1

The regions that contain roads with the highest concentration of 'predicted' pollutants are listed below. This data correlates to road sections that are receiving high volumes of traffic.

- Guildford District (120 road sections)
- Windsor and Maidenhead (114 road sections)
- Spelthorne District (107 road sections)
- Bracknell Forest (98 road sections)
- Slough (96 road sections)

References

Borsetti, M. (2023) airportsdata. [Online]. 2023. Available from: <https://github.com/mborsetti/airportsdata> [Accessed: 19 September 2023].

CIRIA, 2015. The SuDS Manual, London: s.n.

Civil Aviation Authority (2023) Annual airport data 2021. [Online]. 2023. Available from: <https://www.caa.co.uk/data-and-analysis/uk-aviation-market/airports/uk-airport-data/uk-airport-data-2021/annual-2021/> [Accessed: 19 September 2023].

Department for Environment Food & Rural Affairs (2021) 2011 Rural Urban Classification. [Online]. 2021. Available from: <https://www.gov.uk/government/statistics/2011-rural-urban-classification-lookup-tables-for-all-geographies> [Accessed: 19 September 2023].

Department for Transport (2023a) National Public Transport Access Nodes. [Online]. 2023. Available from: <https://beta-naptan.dft.gov.uk/> [Accessed: 19 September 2023].

Department for Transport (2023b) Port and domestic waterborne freight statistics. [Online]. 2023. Available from: <https://www.gov.uk/government/statistical-data-sets/port-and-domestic-waterborne-freight-statistics-port> [Accessed: 19 September 2023].

Department for Transport (2021) Road traffic statistics. [Online]. 2021. Available from: <https://roadtraffic.dft.gov.uk/downloads> [Accessed: 28 September 2022].

Department for Transport & Driver and Vehicle Licensing Agency (2023) Vehicle licensing statistics. [Online]. 2023. Available from: <https://www.gov.uk/government/statistical-data-sets/vehicle-licensing-statistics-data-files> [Accessed: 19 September 2023].

National Atmospheric Emissions Inventory (2023) Emission factors for transport. [Online]. 2023. Available from: <https://naei.beis.gov.uk/data/ef-transport> [Accessed: 14 August 2023].

Office for National Statistics (2022a) annual survey of hours and earnings - resident analysis. [Online]. 2022. Available from: <https://www.nomisweb.co.uk/datasets/asher> [Accessed: 26 April 2021].

Office for National Statistics (2022b) annual survey of hours and earnings - workplace analysis. [Online]. 2022. Available from: <https://www.nomisweb.co.uk/datasets/ashe> [Accessed: 26 April 2021].

Office for National Statistics (2023a) Built Up Areas (2022) GB BGG. [Online]. 2023. Available from: <https://geoportal.statistics.gov.uk/datasets/ons::built-up-areas-2022-gb-bgg/about> [Accessed: 19 September 2023].

Office for National Statistics (2022c) Business Register and Employment Survey. [Online]. 2022. Available from: <https://www.nomisweb.co.uk/datasets/newbres6pub> [Accessed: 30 April 2021].

Office for National Statistics (2023b) Major Towns and Cities (Dec 2015) Boundaries V2. [Online]. 2023. Available from: <https://geoportal.statistics.gov.uk/datasets/ons::major-towns-and-cities-dec-2015-boundaries-v2/about> [Accessed: 19 September 2023].

Office for National Statistics (2022d) Population and household estimates, England and Wales: Census 2021. [Online]. 2022. Available from: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationandhouseholdestimates/bulletins/populationandhouseholdestimatesenglandandwales/census2021unroundeddata> [Accessed: 19 September 2023].

Office for National Statistics (2021) Population estimates - small area based by single year of age - England and Wales. [Online]. 2021. Available from: <https://www.nomisweb.co.uk/datasets/pestsyoaoa> [Accessed: 26 April 2021].

Office for National Statistics (2022e) UK Business Counts - local units by industry and employment size band. [Online]. 2022. Available from: <https://www.nomisweb.co.uk/datasets/idbrlu> [Accessed: 1 May 2021].

Office for National Statistics (2022f) Urban Audit FUA (Dec 2016) Full Extent Boundaries in the UK. [Online]. 2022. Available from: <https://geoportal.statistics.gov.uk/datasets/ons::urban-audit-fua-dec-2016-full-extent-boundaries-in-the-uk/about> [Accessed: 19 September 2023].

Ordnance Survey (2021) OS Open Roads. [Online]. 2021. Available from: <https://osdatahub.os.uk/downloads/open/OpenRoads> [Accessed: 28 September 2022].

Revitt, D. M. et al., 2022. Development and application of an innovative approach to predicting pollutant concentrations in highway runoff. *Science of the Total Environment*.