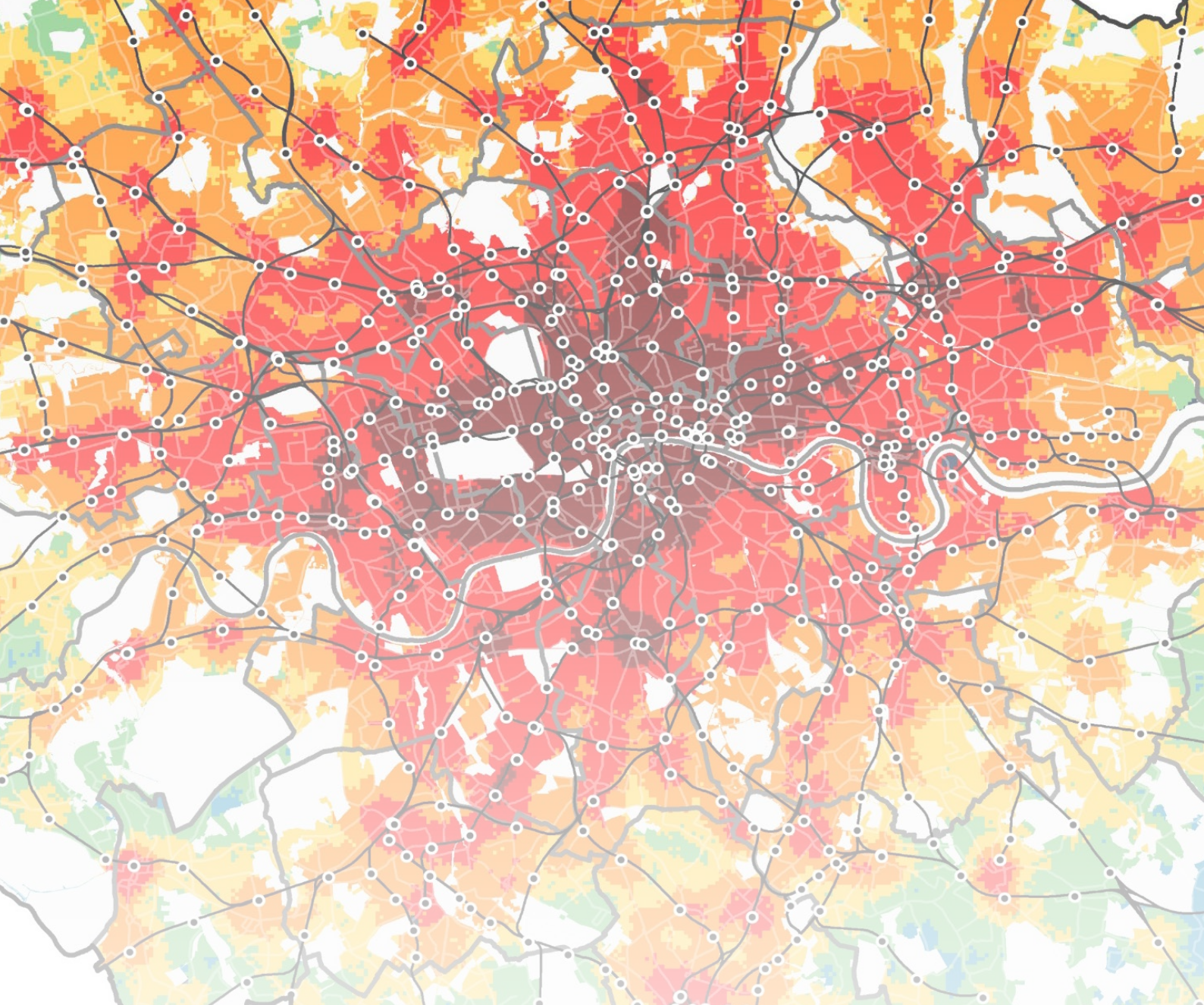




# The Sustainable Access Measure (SAM)

## Methodology Summary Report

VI July 2026

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## Executive summary

**The Sustainable Access Measure (SAM) is a new combined measure of whole journey times to various destinations by public transport and walking** (with cycling to be considered for future updates – see sections 1.5 and 4.2). This report outlines the rationale behind SAM and its methodology as of July 2026. The measure – including aspects of its methodology – may be updated in future, including in response to feedback given via the public consultation on the draft London Plan.

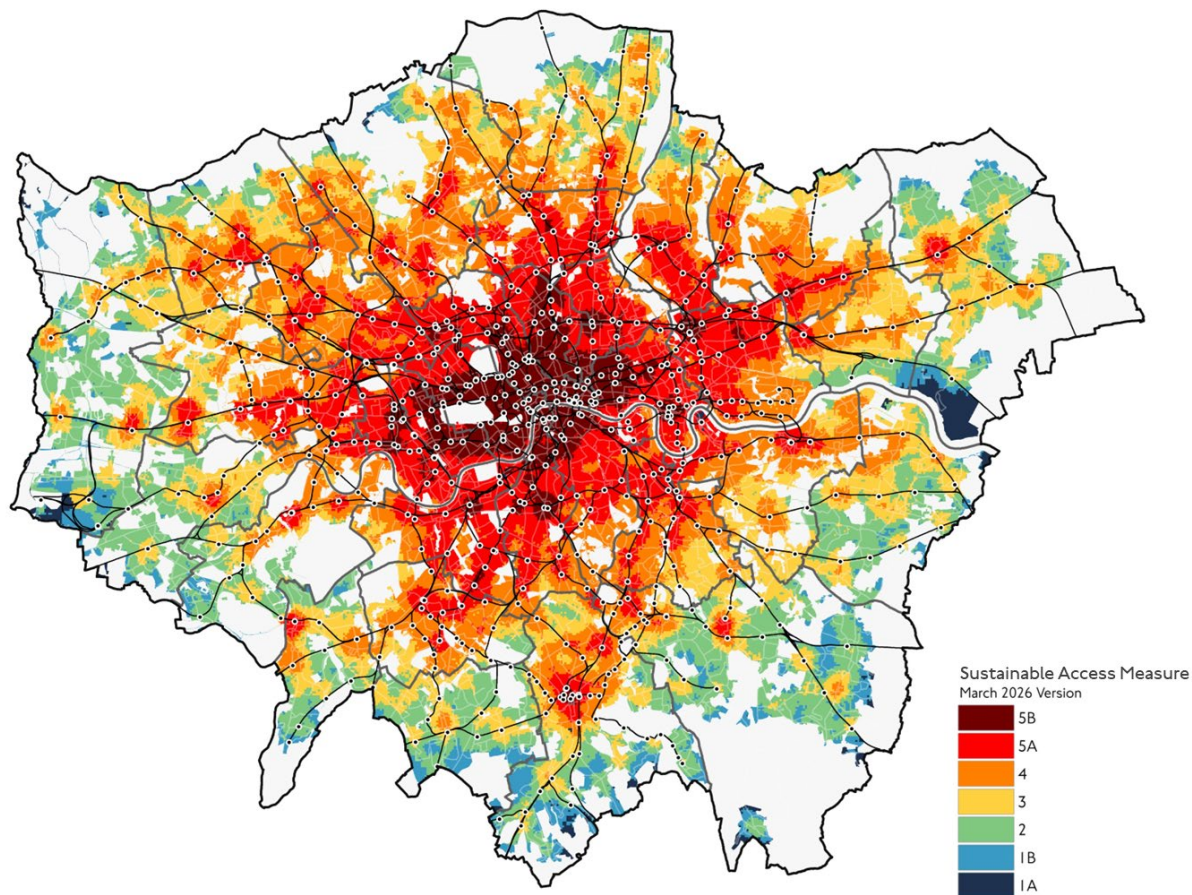
SAM was developed to inform how best to locate new homes and jobs in London and to more deeply integrate this process with planning of transport improvements. It is weighted to try to represent the ability of a typical Londoner living in any given location to meet their regular travel needs by sustainable modes alone. It complements Public Transport Access Levels (PTAL), TfL's existing connectivity metric which provides a more localised picture of public transport access by measuring walk and wait time.

**SAM is a core part of the 'making best use of land' chapter of the draft London Plan.** It is used in the process of calculating borough housing targets, informs the approach to development density in different locations and is used for setting car parking standards across London.

SAM is calculated on the same geographic basis as PTAL: every 100m × 100m grid square within Greater London. For each 'origin' square, a score is calculated by:

- **Assessing which 'destination' squares in London (and beyond) can be reached** within:
  - i. 60 minutes by public transport
  - ii. 30 minutes by public transport
  - iii. 10 minutes by walking
- **Summing up all the relevant destinations for each of the three catchments** within the area that can be reached within the defined travel time. The precise approach varies by catchment:
  - For the 60-minute catchment, the number of jobs within the area is measured. This also serves as a broader proxy for access to other destinations served by 'city-wide public transport' connections e.g. highly specialist or world-class institutions in central London
  - For the 30- and 10-minute catchments, a variety of destinations are counted, weighted by the frequency Londoners travel to them by public transport or walking respectively
- Once each catchment score is calculated, they are put onto the same standardised scale and then **combined into a single score by multiplying each by a weighting factor** before summing. The weighting factor is established through analysis comparing the catchments to car ownership levels, once other factors such as income are controlled for. This is to ensure the measure is tied to an observable spatial pattern (levels of car ownership) that links to both transport and land use planning

- Finally, **the underlying score is grouped into one of five bands**, each representing 20 per cent of London's area i.e. a score of 5 means the location has one of the top 20 per cent of scores



# **I The role of transport connectivity in London's growth**

## **I.1 Introduction**

This report outlines the methodology and rationale behind the Sustainable Access Measure (SAM), a new connectivity metric produced by TfL to support the new London Plan. It describes the methodology as of July 2026 and has been produced to support the consultation on the draft London Plan. The measure – including aspects of its methodology – may be updated in future, including in response to feedback given via that consultation.

Frequently asked questions about SAM can be found in Appendix I, with large-scale maps of SAM and its component layers in Appendix 2. The list of destination types is in Appendix 3, with summary maps of where in London destination points are concentrated in Appendix 4.

## **I.2 Background: the need to make the best use of land**

London's population has grown considerably over the past 25 years. It has increased from slightly over 7 million in 2001 to over 9 million today, overtaking its previous peak before the Second World War. The number of jobs in London has grown even more rapidly over the same period, which is a large part of why many people across the UK and beyond chose to move to London.

While this is in many ways a success story, particularly compared to the period where London's population was falling, it has brought many pressures. The supply of new homes has not kept up with jobs or population. Housing costs have increased drastically and at a much faster rate than incomes have risen. One thing that cannot grow is the total amount of land within London. As London's needs (both housing and economic) increase over time, it is imperative that the planning system ensures that new developments make the best use of the land they are built on.

Transport has a major effect on how land is used. As such, it needs to be at the forefront of informing the design and location of developments that support new homes and jobs. In addition, it is important to try to speed up the planning system to support the delivery of new homes. The rest of this chapter aims to articulate how transport relates to making the best use of land and the role of the right metrics in providing the clarity needed to streamline aspects of the planning process.

## **I.3 The role of space-efficient connectivity in making the best use of land**

Transport affects how efficiently land is used in a variety of ways. How 'dense' a development is (e.g. how many homes per hectare of land) depends on factors that include the degree to which:

- Surrounding public transport has enough capacity to accommodate higher densities
- Transport contributes to conditions where denser forms of development are viable to build
- The site is 'well connected' through the transport network

Public transport capacity and land values are well defined concepts with established means of quantifying. However, the idea of being ‘well connected’ can be harder to pin down. Whether a place feels well connected or not can depend on who is travelling, where they are going and when they depart.

Transport connectivity is essentially about people’s ability to reach the destinations they want to go to. In a London context, this typically relates to whether Londoners can reach a good choice of destinations within a reasonable amount of time and effort.

Connectivity can also be considered through modes of transport, as the distance that can be travelled within a reasonable time and effort will vary by how the person is travelling. However, modes cannot be viewed in isolation. For instance, cars provide connectivity but, crucially, require significantly more space per person to do so. This makes them essential for many people in rural areas but, in dense urban areas, the theoretical connectivity is undermined by the road capacity they very quickly use up. Journeys that might be quick for one person to drive become slow when everyone tries to drive on the same roads. London is disproportionately congested within the UK, with Department for Transport statistics showing that 21 of the 26 English local authorities with the highest rate of average road delay are within London.<sup>1</sup>

In contrast, the connectivity provided by walking, cycling and public transport requires significantly less space. Estimates vary, but buses, walking and cycling can often move around five times as many people per hour as a lane of car traffic, while frequent rail can reach over twenty times as many. This makes the way connectivity operates by these modes fundamentally different, as generally more people can use them without reducing the connectivity of those around them. They are also a critical part of how the city already functions.

In the context of planning for new homes and jobs, this means greater connectivity by space-efficient modes enables more new homes and jobs for the same amount of scarce land (all else being equal). It is generally harder to add more new homes if connectivity by public transport, walking and cycling is poor because:

- If lots of car parking is provided, even if building heights are increased, effective density across all the land used is reduced by using land for parking rather than housing
- If lots of driving is required for regular trips, housing densities and numbers must be limited to avoid having unacceptable impacts on the surrounding road network

In addition, public transport, walking and cycling are sustainable modes. Compared with cars, they generate significantly less road danger, severance, air pollutants and carbon emissions per person travelling. As such, the Mayor’s Transport Strategy sets the aim of 80 per cent of trips in London to be made by these modes by 2041. Planning around these modes is part of delivering that strategy. It also accounts for the nearly half of London households who do not own a car (with lower levels of car ownership seen among lower income households).

This means that in the London context, the measurement of transport connectivity must focus on sustainable, space-efficient modes. This is discussed more below.

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<sup>1</sup> Figure 8, [Travel time measures for local 'A' roads: January to December 2022 report](#).

## 1.4 How to measure connectivity and the role of metrics

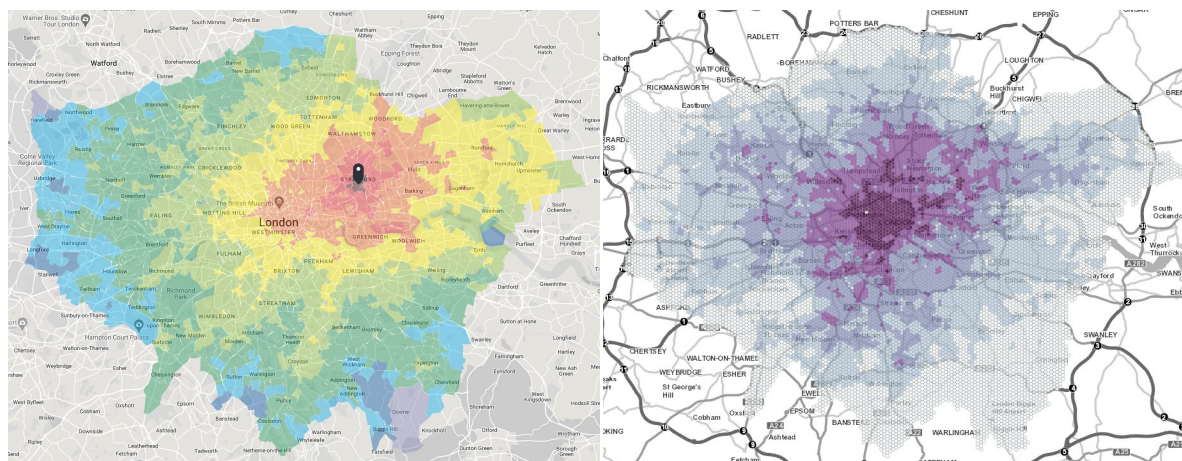
Because of the central role of sustainable, space-efficient modes, the connectivity they provide is a core part of planning for new homes and jobs as cities grow. In London, this principle is embedded through the London Plan, the Mayor's 'blueprint' for what sort of new buildings and spaces should be built and where.

To implement this concept in practice, we need metrics that quantify the degree of connectivity in different places. These can provide an objective basis for steering new homes and businesses to better connected places.

TfL has a suite of connectivity tools, including:

- **Public Transport Access Levels (PTAL):** PTAL has been the most well-established measure of transport connectivity in London. This measures how long it takes to walk to and wait for a bus or a train and the number of routes provided. It has various advantages, as well as some limitations:
  - The advantages of PTAL include the fact it provides a single connectivity score for every part of London at a very high level of granularity (100m × 100m grid), which makes it easy to apply. It is also well established and understood within the planning industry and is quick to calculate.
  - Its limitations relate to exactly what it measures: walk and wait time to public transport stops/stations. This means PTAL does not consider: the type of destinations that can be reached; what walking or cycling on their own can offer; or overall journey times. In some cases, this limits which types of transport improvements lift scores. It does consider the number of routes provided, but does not directly measure the volume of final destinations available.
- **Travel Time Mapping (TIM) and catchments:** these aim to directly complement the limitations of PTAL by considering whole travel times to destinations. These come in two distinct formats:
  - Access from a single location to different travel time bands (see left of Figure 1 below). Different destination types (e.g. jobs, town centres, etc) within these bands could be summed
  - Access from each location within London to a single type of destination within a single travel time catchment (see right of Figure 1 below). For instance, a heat map could be produced with access to jobs within 45 minutes

**Figure I –Travel time mapping (left) and travel time catchments (right)**



Different connectivity metrics have been used to different degrees in different use cases. For the current London Plan, PTAL informed housing targets for boroughs, development densities and car parking provision. In some cases, it has been used in combination with other indicators e.g. access to stations, inner vs outer London.

Connectivity also plays an important role in planning transport schemes, which has used PTAL but also other metrics such as access to jobs. However, these metrics are less integrated in the planning system, in part due to their lack of a clear, single set of 'scores'. In the past TfL has also developed other connectivity metrics, such as ATOS (Access To Opportunities and Services). These added new insights but were similarly difficult to apply in practice compared to PTAL.

While all of these use cases have merit, they present an overall picture that was often complex and sometimes varied. Travel time mapping in particular was too difficult to apply in practice to complement PTAL effectively within the planning system. As noted above, there has been a growing need to simplify the planning process to better support the faster delivery of new homes.

These factors gave rise to the development of a new connectivity metric to better complement PTAL, create more clarity as to how connectivity should be considered at a strategic level in London, and strengthen links between planning of transport and planning of new homes and jobs. This is explored below.

## **1.5 Developing a new measure of connectivity**

Given the fundamental relationship between sustainable, space-efficient modes and making the best use of land, the rationale behind the new metric was to focus on how easy it is to get around by public transport, walking (and cycling, although this is not currently in the measure as explained below), rather than using a car.

We wanted the measure to recreate aspects of PTAL that have driven its success, particularly providing a single score at a granular level. At the same time, we wanted a measure that balances out PTAL's limitations. The travel time mapping and catchment tools described above achieved this to a certain degree, but both failed to provide a single, easy-to-apply score. There was an opportunity to combine these two tools together into a measure which would provide a score for every location in London across

different travel times, different destinations and different modes of transport (rather than being limited to a single starting location or a single travel time threshold).

Given this new metric would measure access to destinations enabled by sustainable, space-efficient modes, it is called the Sustainable Access Measure, or SAM. The overarching objective for SAM is to:

Provide a granular, pan-London metric which reflects the ability of a typical Londoner living in a given location to meet their regular travel needs by sustainable, space-efficient modes alone

Ultimately, there is no perfect way of measuring connectivity. For instance, there are hundreds of different types of destinations that people travel to, and no connectivity measure can capture the individual nuances of all of these. And while connectivity can depend on who is travelling, it is generally unknown who will live or visit a new development.

Our aim for SAM is to provide a robust, objective measure that captures the broad extent of opportunities to rely on public transport and walking for regular personal travel for the 'typical' Londoner. On this basis, SAM can be a powerful tool to inform the design and location of developments. SAM will continue to be developed and there is potential for different versions of SAM to serve different purposes in future to capture the travel needs of different people. This is discussed further in section 4.2 below.

Beyond the overall conception of the measure, there are various technical objectives we had for the final metric. Specifically, we wanted the metric to:

- Use the same 100m × 100m grid as PTAL to allow precise application, particularly for assessing individual proposals for new developments
- Be based on end-to-end journey times to various destinations, not just walk and wait time as per PTAL
- Be responsive to a wider range of transport improvements compared to PTAL
- Provide opportunities for deeper integration with TfL's transport planning e.g. bus service design and major scheme case-making, including through use of TfL models in calculations of journey times
- Be designed to provide a more holistic answer to the specific question of 'how well connected is this location compared to other parts of London?', with the intention of combining with other information as required (e.g. information about existing built form, land values, transport capacity, etc).

Early scoping work during 2022 considered questions such as which destinations to include, what travel time by which modes, and how to weight the various components into a single score. Initial optioneering also considered different ways of devising a metric, such as measuring the average journey time to every other location in London. This was ultimately rejected in favour of more clearly distinct 'layers' combining different travel times, destinations and modes, which aligned more to existing travel time tools. This helped to make the calculation more transparent, intuitive and easy to explain.

Finally, as cycling is a space-efficient mode and also therefore helps drive more efficient use of land, our aim is to incorporate cycling into SAM. It is not currently included

because at this stage it cannot necessarily be assumed as an option that the typical Londoner in all parts of the city can and will use. This is partly because in some areas of London, cycle infrastructure is poor quality, limited or missing altogether.

Assuming cycle access in all locations without accounting for the availability of cycle infrastructure could therefore risk overstating connectivity compared to the reality on the ground. However, given the connectivity benefits of cycling and as cycling uptake continues to grow and infrastructure improves, we are aiming to include it in future updates. In the meantime we discuss other potential ways of accounting for cycling in section 4.2 below.

## 2 Technical overview of SAM

### 2.1 Overview

SAM is made up of three distinct 'layers', each representing the sum of all the destinations of a defined type, within a defined travel time, by a defined mode. These are also known as travel time 'catchments'. The three catchments are:

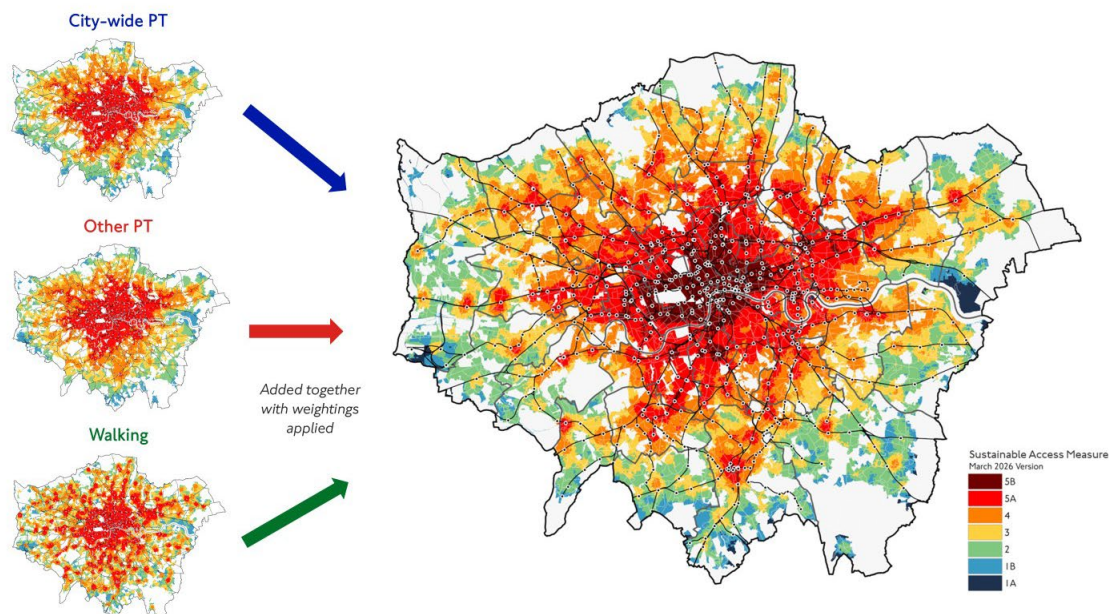
- **City-wide public transport access** to employment within 60 minutes (which also acts as a proxy for all destinations people tend to travel furthest to e.g. highly specialist or world-class institutions in central London)
- **Other public transport access** to a variety of destinations that Londoners regularly travel to within 30 minutes
- **Walking access** to the same set of destinations within 10 minutes

For other public transport and walking access, the variety of destinations includes education, leisure, shopping and other destinations, weighted based on mode specific trips rates from the London Travel Demand Survey (LTDS).<sup>2</sup> These are explained in more detail in the (3.2).

The time thresholds were determined through a combination of:

- LTDS analysis to compare typical journey durations by purpose and mode
- Regression analysis (see section 2.4) to test which catchment sizes were better predictors of lower car ownership
- Spatial analysis to test if each layer was sufficiently distinct from the others

Figure 2 – The 'layers' that make up SAM: three travel time catchments



<sup>2</sup> TfL's annual survey of circa 8,000 households, asking about the travel respondents made over the course of the previous day.

Once the ‘access’ to destinations generated by the three catchments are calculated, each is given a weighting that is combined into a total underlying score:

$$\text{SAM} = (\text{Weight}_{\text{CityPT}} \times \text{Access}_{\text{CityPT}}) + (\text{Weight}_{\text{OthPT}} \times \text{Access}_{\text{OthPT}}) + (\text{Weight}_{\text{WALK}} \times \text{Access}_{\text{WALK}})$$

The weightings are equivalent<sup>3</sup> to:

- City-wide Public Transport: 43 per cent
- Other Public Transport: 16 per cent
- Walk: 41 per cent

The approach to defining these weights is described in section 2.4 and the model producing these figures is set out in Table 3. While the weights do have an important bearing on the score, the biggest overall influences on the score are the geographic ‘shape’ and service patterns of the public transport network and the distribution of destinations. The impact of the weighting on the relative ranking of places across London is typically more marginal in comparison.

The underlying scores are then banded into one of five scores (1 being lowest, 5 highest), which are referred to in the London Plan for different policy applications.

## 2.2 Destination data and groupings

SAM measures access to a range of destinations relevant to regular personal travel (including those beyond the Greater London boundary). Data on these destinations was compiled from four different sources:

- **Employment data** – used to represent workplace opportunities within the city-wide 60-minute public transport catchment. LSOA-level employment estimates are spatially disaggregated to individual workplace locations using the Ordnance Survey AddressBase commercial address data, enabling a point-based representation of employment opportunities.
- **Ordnance Survey (OS) Points of Interest (POI)** – the primary source of destination data for the 30-minute other public transport and 10-minute walking catchments. The raw dataset contains over 500 detailed destination sub-types, of which around 200 that were relevant to personal travel were selected, including retail, leisure, community, health, cultural and other services.
- **Get Information About Schools (GIAS) (formerly Edubase)** – used to represent education destinations within the other public transport and walking catchments. The dataset includes primary schools, secondary schools, nurseries, and further education institutions.
- **GiGL Open Space dataset** – used to represent access to parks and other green places to visit within the other public transport and walking catchments.

A full list of destination types used is set out in Appendix 3.

Once destination data had been sourced, the next design question was how important each destination point should be. The simplest approach would be to sum the raw count of destination points within a given travel time catchment. This would risk being overly

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<sup>3</sup> The precise percentages in any one location will vary significantly depending on the relative score for each catchment.

simplistic, for example equating a very frequently used destination such as a supermarket with infrequently used, niche services. Equally, it is difficult to calculate the 'correct' relative importance of completely different destinations (though even if this were possible, it would have a more minor impact on the spatial pattern of scores than the shape of the public transport network and where destinations are located).

To strike the right balance, some adjustment has been made to how much each destination point counts towards the score based on travel frequency, while doing so in a way that keeps the approach relatively simple. This is achieved by using data from the LTDS by:

- Grouping the 200 or so categories of data into the nearest equivalent of the 11 journey purposes from LTDS
- For each journey purpose, taking the average number of trips per day Londoners make by each mode, for that purpose (e.g. Londoners make on average 0.083 food shopping trips by foot per day)
- Converting each trip rate into a percentage reflecting the proportion of trips made for that purpose compared to all purposes by that mode (e.g. 0.083 food shopping trips equates to 25 per cent of all walk trips for the relevant purpose)
- Finally, this percentage is converted into an easier to interpret form using a scaling factor. This has no influence on the spatial distribution of scores but means a 'point weight' of 0.5 means a point is worth half as much as it would be if all destination points were simply added together without any weighting, while a point weight of 2 counts twice as much. This factor is calculated so that the weighted sum of all destination points equals the unweighted total of summing all destination points.

Tables 1 and 2 below set out the precise point weights and underlying trip rates by purpose for the other public transport and walking catchments respectively.

**Table I – Destination data and point weights for other public transport catchment**

| Description of trip purpose aligned to LTDS       | Destination data equivalents                         | Destination count | Average PT trips per day | % of total | Point weight per destination point |
|---------------------------------------------------|------------------------------------------------------|-------------------|--------------------------|------------|------------------------------------|
| Education as student (II+)                        | Secondary, higher/further education, most vocational | 3,695             | 0.008                    | 6%         | 0.53                               |
| Education as student (<II)                        | Primary / nursery education                          | 1,895             | 0.024                    | 18%        | 1.59                               |
| Health                                            | Health                                               | 13,082            | 0.005                    | 4%         | 0.36                               |
| Food shopping                                     | Food retail                                          | 18,558            | 0.018                    | 14%        | 1.22                               |
| Other shopping                                    | Clothing, household etc retail                       | 22,382            | 0.019                    | 14%        | 1.26                               |
| Personal services                                 | Personal, consumer, financial, animal services       | 21,706            | 0.006                    | 5%         | 0.41                               |
| Other social (e.g. pub/restaurant)                | Eating and drinking                                  | 35,424            | 0.023                    | 18%        | 1.59                               |
| Entertainment/recreation                          | Entertainment, libraries, community centres          | 4,206             | 0.016                    | 12%        | 1.07                               |
| Participate in sport                              | Sports, outdoors, related vocational                 | 7,057             | 0.007                    | 5%         | 0.49                               |
| Leisure trip – going for a walk etc for enjoyment | Green spaces to visit                                | 3,832             | 0.005                    | 3%         | 0.31                               |
| Worship or religious observance                   | Places of worship                                    | 3,600             | 0.003                    | 2%         | 0.20                               |

**Table 2 – Destination data and point weights for walking catchment**

| Description of trip purpose from LTDS             | Destination data equivalents                         | Destination count | Average walk trips per day | % of total | Point weight per destination point |
|---------------------------------------------------|------------------------------------------------------|-------------------|----------------------------|------------|------------------------------------|
| Education as student (II+)                        | Secondary, higher/further education, most vocational | 3,695             | 0.028                      | 9%         | 0.81                               |
| Education as student (<II)                        | Primary / nursery education                          | 1,895             | 0.019                      | 6%         | 0.55                               |
| Health                                            | Health                                               | 13,082            | 0.003                      | 1%         | 0.08                               |
| Food shopping                                     | Food retail                                          | 18,558            | 0.083                      | 25%        | 2.36                               |
| Other shopping                                    | Clothing, household etc retail                       | 22,382            | 0.030                      | 9%         | 0.85                               |
| Personal services                                 | Personal. consumer, financial, animal services       | 21,706            | 0.008                      | 2%         | 0.23                               |
| Other social (e.g. pub/restaurant)                | Eating and drinking                                  | 35,424            | 0.048                      | 15%        | 1.37                               |
| Entertainment/recreation                          | Entertainment, libraries, community centres          | 4,206             | 0.014                      | 4%         | 0.41                               |
| Participate in sport                              | Sports, outdoors, related vocational                 | 7,057             | 0.018                      | 6%         | 0.53                               |
| Leisure trip – going for a walk etc for enjoyment | Green spaces to visit                                | 3,832             | 0.073                      | 22%        | 2.07                               |
| Worship or religious observance                   | Places of worship                                    | 3,600             | 0.006                      | 2%         | 0.16                               |

## 2.3 Measuring travel time catchments

Once the destinations are in the right format, the three travel time catchments can be calculated, i.e. how many jobs can be reached within 60 minutes and how many of the relevant destinations can be reached within 30 or 10 minutes respectively.

The process starts with each individual 100m × 100m grid square (of which there are over 150,000 within London) and treats it as the ‘origin’ of a journey.

For walking, all of the ‘destination’ squares are identified by calculating those reachable within a 10-minute walk using the Ordnance Survey Multimodal Walk Network. This network provides a detailed representation of pedestrian infrastructure and is used to compute shortest-path walking routes based on the underlying network topology. The number of destination points (weighted by the point weights in Tables 1 and 2 above) is summed to give a total walking score for that origin grid square. This process is repeated for all other grid squares, i.e. over 150,000 times.

For the two public transport catchments, the process is fundamentally the same, but with different catchment cut-offs (30 minutes and 60 minutes), and, in the case of city-wide public transport, a different destination dataset (employment). However, it involves additional steps, as each public transport journey includes a walk stage at either end. The calculation is made using shortest-path algorithms, both:

- Within the public transport network, using journey times from TfL's strategic transport models
- Across the entire walk-public transport-walk chain, meaning it is not necessarily the nearest bus stop or rail station that defines the score. This is calculated using a bespoke process created for SAM

Origin squares are only included within the Greater London area, as that is where SAM is intended to be applied. However, travel times to destinations outside Greater London are also included, albeit at a lower spatial granularity than within London (reflecting the lower density of public transport network and population in the surrounding areas).

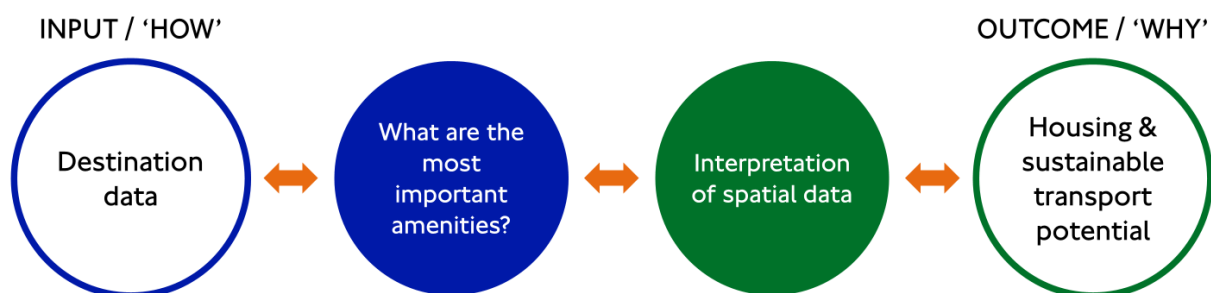
## 2.4 Weighting catchments into a single score

When combining different elements into a single score, an implicit judgement is made about the relative importance of those different elements. Counting each catchment equally would be the simplest approach but still would entail a judgement that they are equally important. An approach to weighting the different catchments is instead used (although, as noted above, this is by no means the largest factor in determining a location's score).

This process is ultimately about how we get from an input (destination data) to an outcome score. This presents two broad approaches to consider:

- **Input-first:** one option would be to start with the different destination data, make a judgement as to how important each amenity type is and weight according to that, creating the spatial pattern of scores. For instance, trip frequency by purpose from LTDS could be used to imply importance
- **Outcome-first:** the alternative is to consider the process in reverse. Start with the outcome to be informed, identify spatial data that aligns with that outcome and infer how important different destinations are

Figure 3 – Relationship between inputs and outcomes



Due to the large numbers of destination types within the walking and other public transport layers, an input-first approach has been taken within these layers, as described in section 2.2.

However, for the relative importance of the three layers, an outcome-first approach is preferred. While it adds some additional complexity, it creates a more meaningful link to how SAM is intended to be used. For instance, while frequency of travel is a useful indicator, it does not always equate to *importance* of travel. Access to employment, for instance, is a relatively low share of Londoners' daily travel (less than 25 per cent). However, commuting for most Londoners is less discretionary than other trips and can have an outsized influence on life decisions such as where to live and whether to own a car. Weighting by frequency alone would risk over-weighting local amenities accessed by foot and underweighting London's rail network, which has very strong association with sustainable transport outcomes, development density and development viability.

Helpfully, there is an analytical technique to test the relative importance of different catchments. If a related transport or land use outcome is selected, multi-linear regression analysis can be used to indicate how strong or weak different catchments are at predicting that outcome, once other influences are controlled for. This analysis cannot answer every question or give a single 'correct' weighting. However, it is considered a robust basis for ensuring SAM has a meaningful link to a real-world spatial pattern that better aligns it to the travel experiences and housing choices of Londoners.

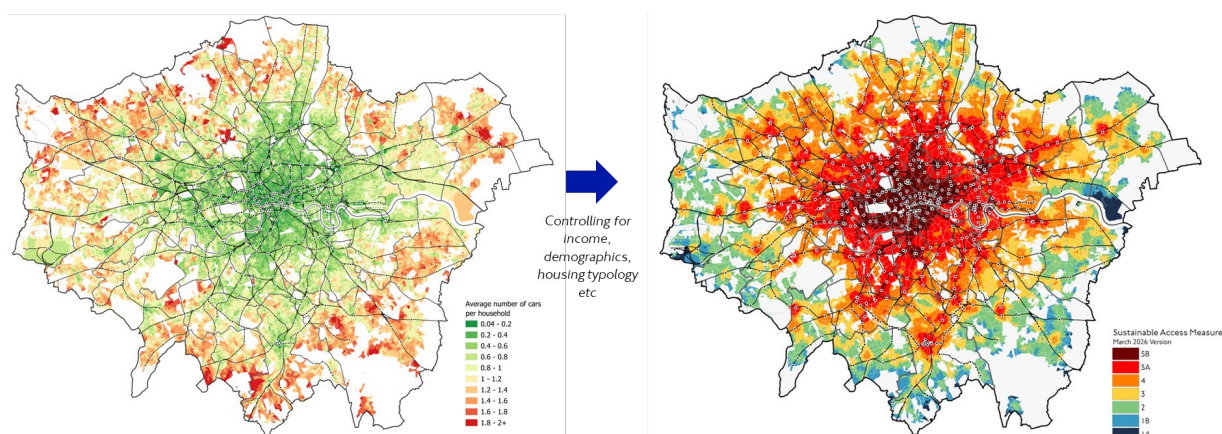
Broadly speaking, the following process is used:

- Start by choosing a target (or 'dependent') variable for the analysis to predict (e.g. car ownership). The pattern of this characteristic across London then becomes tied to what SAM represents
- Test a series of different factors that we think will help predict the chosen target variable across London (or 'independent variables'). In the case of SAM, these are the travel time catchments above and a series of controls that influence the target but are not related to travel time (e.g. income)
- The analysis then makes a prediction of the target variable by giving each of these factors a weight (or 'coefficient'), so stronger predictors have more influence over the final outcome
- This is achieved through a formula such as  $Y = W_1X_1 + W_2X_2 + W_3X_3$ , where Y is the prediction of the target variable, the Xs are the factors being considered and the Ws are the weights given to each. Each W is chosen as a single fixed number and is calculated so that the overall gap between the prediction and the real values are minimised (referred to as model 'fit' and measured by something called R squared or  $R^2$ )
- The weights produced for the catchments are then used as the basis for creating a final weighting system for SAM

Various target variables were considered, including development densities, land values and sustainable mode share. These were ruled out on the basis of issues of data availability or their use elsewhere in the analysis informing the draft London Plan.

The variable selected instead was car ownership from the 2021 Census at the output area level. This provides both a highly granular level of data (with over 26,000 output areas within London) and a strong conceptual link to both transport and land use (as described in section I.3). Figure 4 highlights the similar spatial patterns seen in levels of car ownership across London to the final SAM map.

Figure 4 – Census car ownership data (left) and final SAM map (right)



After initial work on the regression analysis in-house, TfL commissioned the consultancy Jacobs to run the final regression analysis to ensure the approach was sufficiently robust. Their work included:

- **Establishing statistical robustness:** peer review of TfL's original model, diagnostic testing to assess its statistical validity, including tests for heteroskedasticity, spatial autocorrelation and multicollinearity, and, where applicable, proposed remedies
- **Identifying the correct set of controls:** systematic assessment of socio-demographic and built-form variables leading to some being retained and others removed
- **Testing sensitivity and making final recommendations:** comparison of catchment coefficients to alternative assumptions, conclusions and final model specification

Table 3 lists the set of statistically significant variables included in the final model specification. Variables with a positive value were associated with higher car ownership e.g. areas with higher incomes have higher car ownership levels. Those with a negative value had the inverse relationship e.g. areas with higher public transport access have lower levels of car ownership. The larger the value, the stronger the association (negative or positive) with car ownership.

Table 3 – Final model results from SAM car ownership regression testing

| Variable                                    | Final model | Equivalent weighting in SAM |
|---------------------------------------------|-------------|-----------------------------|
| (Intercept)                                 | -1.4106     | -                           |
| City-wide Public Transport                  | -0.0700     | 43 per cent                 |
| Walking                                     | -0.0662     | 41 per cent                 |
| Other public transport                      | -0.0262     | 16 per cent                 |
| Income (log-scale)                          | 0.1052      | -                           |
| Population arriving in London after 2010    | -0.0141     | -                           |
| Ethnicity                                   | 0.0053      | -                           |
| Housing stock made up of flats              | -0.0039     | -                           |
| Households with children                    | 0.0069      | -                           |
| Households with two adults                  | 0.0061      | -                           |
| Households with a second address            | 0.0039      | -                           |
| Households in socially rented accommodation | -0.0025     | -                           |
| Individual borough dummy variables          | Various     | -                           |

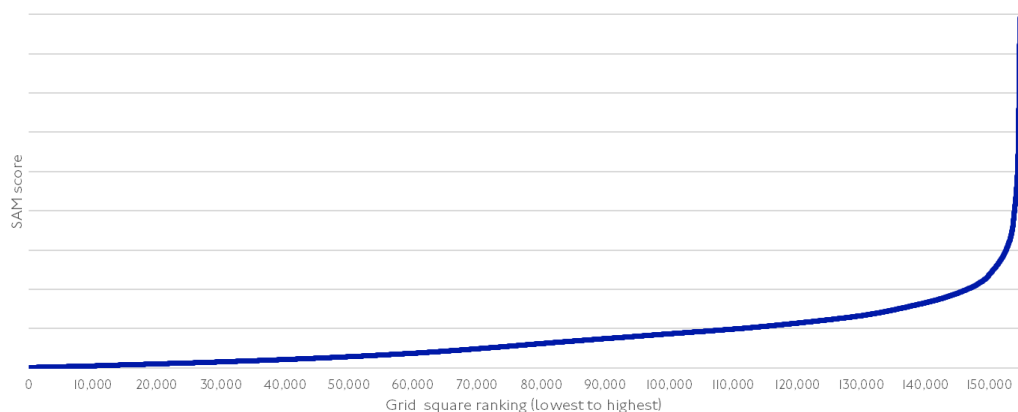
## 2.5 Final measure and scoring system

The final set of underlying scores can now be calculated using the three travel time catchments and the respective weighting for each:

$$SAM = (0.43 \times Access_{CityPT}) + (0.16 \times Access_{OthPT}) + (0.41 \times Access_{WALK})$$

Before they are combined, each of the three travel time catchments are standardised on to the same scale (using 'Z-score' normalisation). This creates an underlying score for each of the more than 150,000 grid squares in London. When plotted, SAM exhibits a 'long-tailed' distribution, as shown in Figure 5. This involves a smooth, continuous distribution, rather than clear distinctions between different levels of connectivity. The exception to this is at the high end, where connectivity starts to jump up to much higher levels in locations that are sometimes referred to as 'hyper-connected' (i.e. generally within or with excellent access to central London).

**Figure 5 – Distribution of underlying SAM scores across London**



To apply SAM in practice, the underlying scores need to be grouped into easy-to-apply bands, as with PTAL. Because (outside of the top end of the distribution) there are no 'jumps' in connectivity levels, there are no 'natural' places to set thresholds between these bands. Because SAM aims to provide a London-wide comparison between how well-connected different locations are compared to all other parts of London, the scale was chosen to highlight this comparison.

This approach sees the underlying SAM scores grouped into five main bands. The bands are based on quintiles of the count of grid squares in each band. As each grid square has the same area (one hectare), this means that initially the same physical area is captured by each band (unlike PTAL, where some bands cover significantly more area than others). For instance, a banded SAM score of 5 means that the grid square is in the top 20 per cent of best-connected grid squares, a banded score of 1 means it is in the bottom 20 per cent. These bands will form a fixed baseline to compare future improvements against i.e. transport schemes may shift the proportions of area within each band.

Beyond the main five bands, both the top and bottom bands are split into 'A' (lower) and 'B' (higher), for slightly different reasons. At the top end, SAM 5B captures the start of the jump in underlying scores seen at the very high end of the distribution seen in Figure 5 above. This split in band 5 is used in the draft London Plan's 'Optimisation Framework' in Policy MBUL2 that informs development densities.

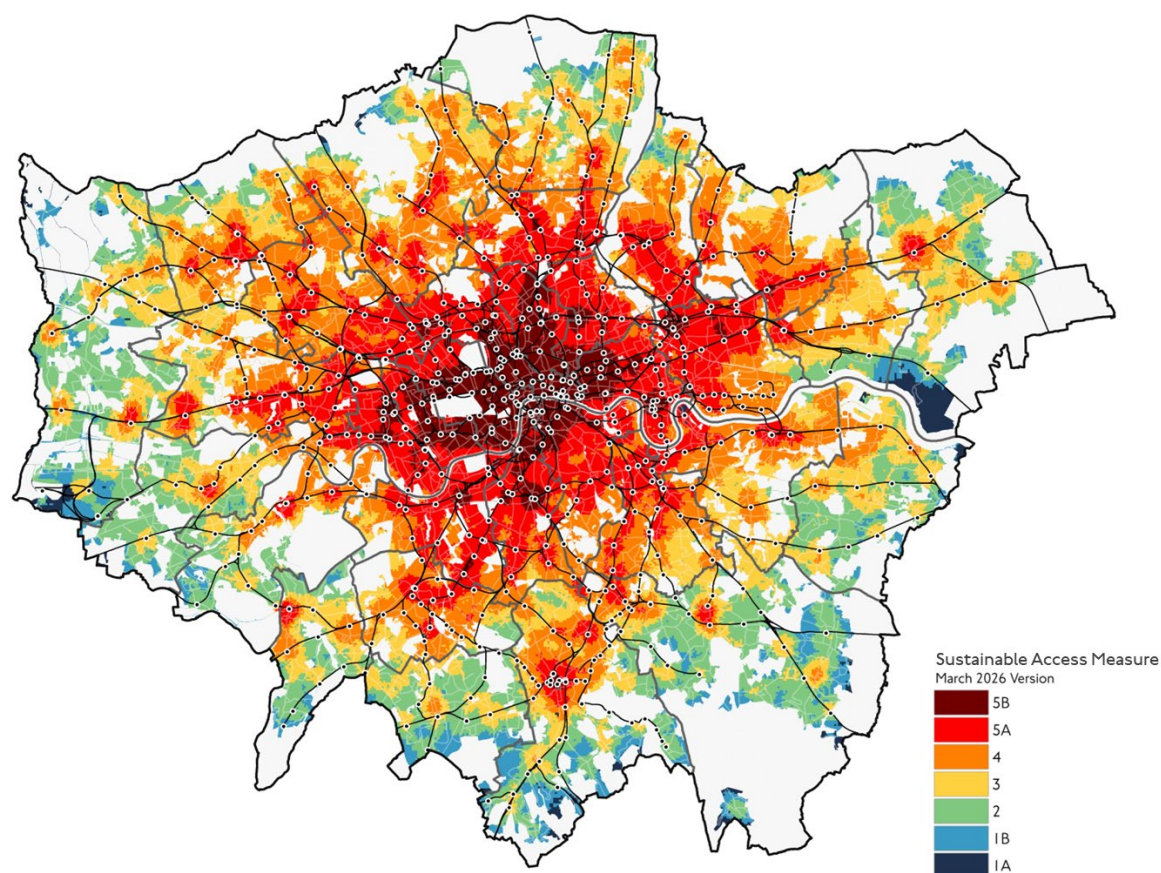
At the bottom end, SAM IB approximately covers the least well-connected parts of London's existing urban footprint (which typically have at least some regular bus offer), while SAM IA approximately covers areas of Green Belt and large parks, where there is no or very limited bus service.

The relationship between banding and percentile rank of the grid squares within that band is shown in Table 4. Figure 6 shows how this scale creates the five bands of scores across London, as it appears in the draft London Plan. Further maps showing the individual layers of SAM are shown in Appendix 2.

**Table 4 – SAM bands and percentile rank of grid square**

| Band | Percentile |
|------|------------|
| 5B   | 95+        |
| 5A   | 80-94      |
| 4    | 60-79      |
| 3    | 40-59      |
| 2    | 20-39      |
| IB   | 10-19      |
| IA   | <10        |

**Figure 6 – Sustainable Access Measure (March 2026 version)**



## 3 Applying SAM in practice

### 3.1 Use in land use planning and transport planning

SAM has been designed with its utility in mind, particularly in the selection of the 100m × 100m grid. In this regard, SAM is appropriate to use in many of the ways PTAL has been for years. We recognise that SAM is a new metric, and welcome discussion and feedback on what upfront support would best help its use in practice, both across land use and transport planning.

In a land use planning context, SAM can be used for:

- **Plan-making:** SAM is a tool for boroughs to better understand the nature of existing connectivity across their borough and to identify areas where better connections or a greater mix of land uses could be beneficial (e.g. when planning social infrastructure or commercial uses in under-served areas).

We would welcome feedback on how to use SAM in the context of planning large growth areas that are likely to support transport improvements and provide non-residential destinations directly, both of which influence SAM scores

- **Decision-making:** SAM should directly inform the density of a site and how much car parking is permitted, as per the draft London Plan.

We would welcome feedback on how to use SAM in the context of planning for larger, mixed-use developments and, alongside PTAL, for how this is integrated with transport improvements

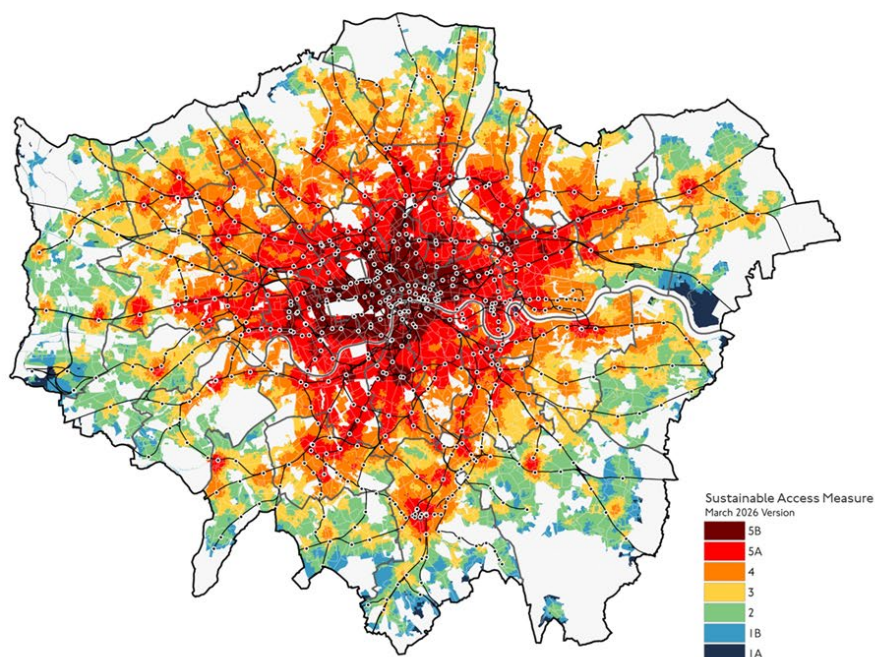
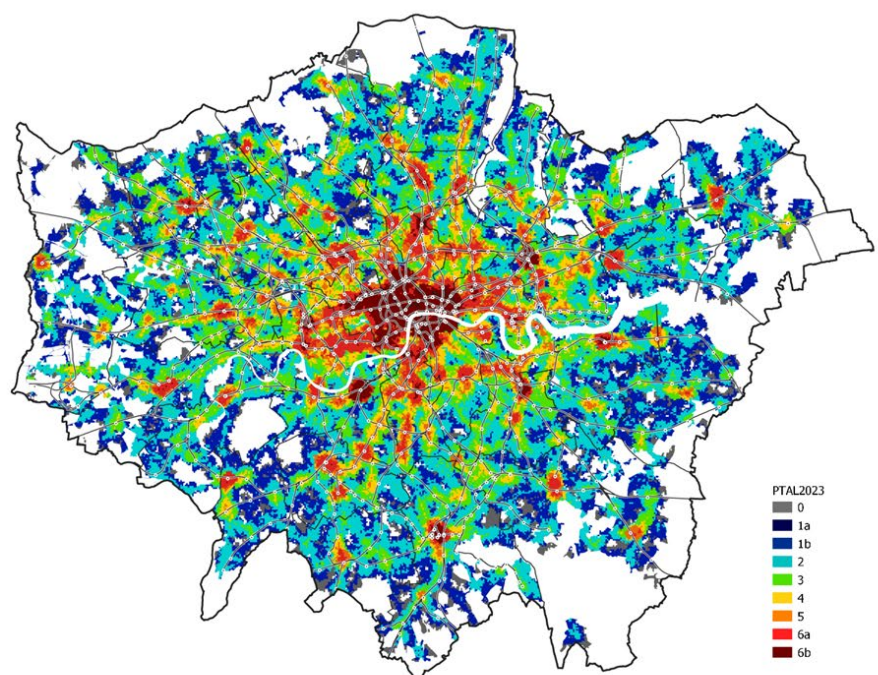
In a transport planning context, SAM can be used for:

- **Planning transport schemes:** SAM has the potential to help identify transport schemes, inform public transport service planning and carry out optioneering as part of this. TfL will explore the technical feasibility of these opportunities and how best to realise them to integrate land use and transport planning in London more deeply than ever before
- **Case-making for transport schemes:** As part of broader case making and assessment of benefits, SAM has the potential to directly quantify the connectivity benefit of a variety of transport schemes. As SAM informs the London Plan housing targets (via the assessment of housing capacity called the Strategic Housing Land Availability Assessment or 'SHLAA'), this also provides a means of identifying how much additional housing capacity for London different types of schemes would enable.

### 3.2 Comparison with other connectivity metrics

SAM was designed to complement London's existing connectivity metric, **Public Transport Access Level (PTAL)** – available online [here](#)). As discussed above, PTAL is a measure of how long it takes to walk to and wait for public transport to 'access' the public transport network, whereas SAM reflects whole journey times to various destinations, and includes travel by walking only.

Figure 7 – PTAL (top) and SAM (bottom)



While there are areas of overlapping higher or lower scores, PTAL and SAM produce some different spatial patterns. This gives rise to areas of:

- **Higher SAM, higher PTAL:** areas very close to rail and bus hubs offering fast, high-frequency links to a high density of destinations
- **Higher SAM, lower PTAL:** areas that are slightly further away from high-frequency rail (e.g. a longer walk or needing a bus to access rail) but that provide excellent connections to a high density of destinations once accessed
- **Lower SAM, higher PTAL:** areas, particularly in outer London, that have a frequent bus service but that service does not reach a high density of destinations within the travel time catchments
- **Lower SAM, lower PTAL:** areas with both low frequency connections that do not connect to a high density of destinations within the travel time catchments, and a low concentration of destinations available within walking distance. To lift scores, these areas may need better public transport, or changes in land use and new local services, or both.

Overall, this leads to high PTAL scores concentrated around transport hubs which then decay quickly, based on walking distances alone. This also creates a relatively even pattern in outer London (with PTAL 2 representing the largest area).

In contrast, SAM follows a more gradual decay, with scores following major rail corridors more strongly. Time spent walking influence the score as one of several components of overall journey time while making a public transport trip. At the same time, there is much greater differentiation between areas of outer London with high-frequency Tube services and those with infrequent rail services.

This creates a divide in functionality:

- **SAM is a London-wide comparator:** it shows how well connected a housing site is compared to all others in London, or how car-reliant a neighbourhood may be compared to all others in London. It should be used to inform the overall density of a housing site and how much car parking is permitted. It can also be used to identify where better public transport links and/or a greater density of non-residential destinations are needed to enable sustainable travel
- **PTAL is a local comparator:** it shows how good access to the public transport network is compared to other parts of the local area. It can be used to inform in which parts of a housing site higher density development is focused (e.g. concentrating taller elements nearest to public transport access). It can also be used to quickly test how the distribution of public transport access changes within the local area with changes to the walk network or running additional bus services.

Because of fundamental differences in what PTAL and SAM are measuring, the scales for each are not directly comparable. The 6-point PTAL scale is based on even intervals of effective walk and wait time. In practice, this has been combined with other geographies, such as splitting PTAL by inner and outer London. In contrast, the 5-point SAM scale is designed to provide a genuine London-wide comparison on a continuous scale without needing to differentiate between inner and outer London. The 'heatmap' colours are maintained for ease of understanding, but the colours and numbers are not equivalent e.g. PTAL 4 and SAM 4 are measuring different things.

As well as PTAL, there are other connectivity measures available. One notable example is the [Department for Transport \(DfT\) Connectivity Tool](#), calculated for the whole of England and Wales. Both SAM and the DfT Tool are based on similar principles: measuring whole journey times to various destinations within certain travel times, displayed on a 100m × 100m grid. They are both aimed at better steering development to the right locations and produce some similarities in spatial patterns, though there are some important differences in certain types of locations.

SAM, which is calibrated on London-specific data, is the most appropriate strategic measure of connectivity for use within London (and is embedded in the draft London Plan accordingly). The DfT tool is designed to reflect national average travel patterns, based on the National Travel Survey. London is an outlier in terms of travel patterns compared to the rest of England and Wales, seeing significantly longer travel distances, greater shares of commuting and greater use of public transport, which needs to be accounted for in a tool used in London.

As SAM is calculated using TfL transport models, it is also the only connectivity metric of end-to-end journey times that offers the potential for integration with TfL public transport planning (i.e. one that could enable TfL to test how different transport improvements could lift scores). The DfT Connectivity Tool also offers a 'propositional' function, but at present this is for a limited physical area and can only be entered as an additional service, rather than a change to or extension of the existing network. The DfT tool does offer some functionality that SAM currently does not, particularly the ability to isolate specific destination types and modes. In a London context, this may be useful for planning specific uses, e.g. where new education or health facilities may be needed.

Finally, [connectivity for planning urban extensions and New Towns](#) is a particularly challenging task. SAM, PTAL and the DfT tool all face challenges where there is little to no existing walk network, few if any local amenities and often a very limited bus network. The approach in the draft London Plan focuses on stations, with higher connectivity assumed where the quality and frequency of rail services is higher and walking distances would be lower. As noted above, one advantage of PTAL is its ease of calculation. Given that the starting point is the connectivity provided by the local station, 'future' PTAL could continue to play an important role in masterplanning new walk networks and bus routes. This should be used to test how the reach of the station is expanded by such improvements and could inform effective densities, site layouts, etc.

## 4 Future Development of SAM

### 4.1 Draft London Plan Consultation and future development timeline

This methodology note has been published alongside the draft London Plan. Respondents are encouraged to consider the role and application of SAM when reviewing the draft Plan, and to include any comments on this methodology within their wider consultation response.

The draft London Plan consultation commenced on 16 July 2026 and will run until 15 October 2026. TfL will continue to work to refine and enhance the SAM methodology. This will include responding to feedback received through the consultation process and continuing internal review. Possible areas for future development of SAM are explored below.

### 4.2 Areas for possible future development or additional versions of SAM

Areas for future development may include:

- **Inclusion of accessibility metrics, such as through a step-free version:** TfL is intending to develop analysis and metrics that capture the importance of physical accessibility of public transport. This could include a step-free version of SAM. The outputs of this version would build on existing metrics showing the journey time differential between the full public transport network and the step-free only network. As part of this development, TfL will consider the findings and recommendations set out in Transport for All's report 'Accessibility Review of the PTAL Index'.<sup>4</sup> SAM offers a more promising avenue to better capture accessible transport options compared to a step-free PTAL (which could give a misleading picture due to only measuring walking and waiting time at the origin end of a trip, but not the destination where step-free access is also needed).
- **Cycling:** As noted earlier, cycling is not incorporated at this stage. TfL recognises the importance of cycling in both London's transport system and supporting higher density growth. There are some technical challenges to overcome, but one option could be to develop a 'cycle-on' version of SAM, which could be turned on as an optional layer and would show the connectivity benefit of high-quality cycle infrastructure where it exists or is planned. It could also be used in places where cycling rates are higher than elsewhere in London. In the meantime, where high-quality cycle infrastructure is already available, this could be taken into account when interpreting SAM scores in a local context and potentially justify higher density development than the SAM score alone would suggest.
- **Uplift scenarios:** A key benefit of SAM scenarios is the ability to assess how connectivity might change with changes in land use or transport. TfL will continue to explore this as well as opportunities to integrate SAM more widely into its transport planning. This will include ways of reducing calculation time so it is easier to run more scenarios. In the meantime, PTAL can offer a quicker way of testing changes within a local context, as noted in section 3.2 above.

Suggestions for areas for future development of SAM are also welcome as part of the London Plan consultation.

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<sup>4</sup> January 2024, available at [transportforall.org.uk/wp-content/uploads/2024/11/Public-transport-accessibility-level-review.pdf](https://transportforall.org.uk/wp-content/uploads/2024/11/Public-transport-accessibility-level-review.pdf).

## Appendix I – Frequently asked questions

### How will SAM be used in the London Plan?

SAM is used in various policies in the draft London Plan, including development density (optimisation framework), industrial land policy and car parking. It is also used to inform the calculation of housing targets. We encourage readers to respond to the public consultation, including with any feedback on the use of SAM or the design of the metric itself.

### How were the travel time catchments decided?

As per section 2.1, the time thresholds were determined through a combination of:

- LTDS analysis to compare typical journey durations by purpose and mode
- Regression analysis (see section 2.4) to test which catchment sizes were better predictors of lower car ownership
- Spatial analysis to test if each layer was sufficiently distinct from the others

### Why does SAM look different to PTAL?

SAM is fundamentally measuring a different thing: how well connected each location is compared to all other locations in London in terms of access to destinations. PTAL measures how good access to public transport services (i.e. walk and wait time) in each location is, which works best in a local context. The PTAL map is not 'wrong' but is showing something different to SAM.

### Is a SAM score the same as a PTAL score?

No, as above they are measuring different things and are on different scales. As a result, they are not directly comparable.

### Is SAM replacing PTAL?

No, as above, SAM complements PTAL as they measure different things. SAM is now fulfilling some functions that previously were performed by PTAL (e.g. housing densities, car parking) but PTAL continues to have important applications (see section 3.2).

### Should SAM be used in London rather than the DfT Connectivity Tool?

Yes. SAM is calibrated on London-specific data and is integrated with TfL models and is the most appropriate measure of connectivity for use within London for most use cases (see section 3.2).

### Has SAM considered the travel needs of different people?

What 'well connected' looks like in practice will vary to some degree from person to person. In the case of new homes, there is no way of telling who will live there ahead of time. SAM therefore aims to capture broad differences in connectivity that apply to most of the population. However, for some people, their experience will vary more significantly

e.g. if they require step-free access. For these use cases, TfL would like to explore different versions of SAM to more precisely capture these differences in connectivity (see section 4.2).

### **Why doesn't SAM give more prominence to X type of destination?**

As above, SAM tries to capture broad differences in connectivity that apply to most of the population. We have tried to avoid making the measure too sensitive to any one precise destination type. This is partly because it is very difficult to accurately capture the nuances around each individual destination type and combine it into a single measure. It also reflects the realities of the planning system e.g. premises in use class E can switch from office, to café, to shop without planning permission, which should not necessarily generate significant changes in scores.

### **Does SAM consider destinations outside of London?**

Yes. SAM is calculated at the 'origin' end only within Greater London, as that is where the London Plan applies. However, those scores are informed by access to destinations both inside and beyond the Greater London administrative boundary.

### **Why doesn't SAM consider cycling?**

As discussed in section 1.5, cycling is not currently included at this stage. This is because it cannot necessarily be assumed as an option that the typical Londoner in all parts of the city can and will use. However, cycling is a space-efficient mode and also therefore helps drive more efficient use of land. As cycle uptake continues to grow and infrastructure improves, we are aiming to include it in future updates. In the meantime we discuss other potential ways of accounting for cycling in section 4.2 above.

### **Does SAM consider walk quality?**

At this stage, SAM only considers distance of movement along the walk network. This is aligned to the real-world street layout, but does not consider crossing times, traffic levels, topography, etc. While some of these aspects could be computationally challenging, it is an area of future development for SAM that we would be keen to explore.

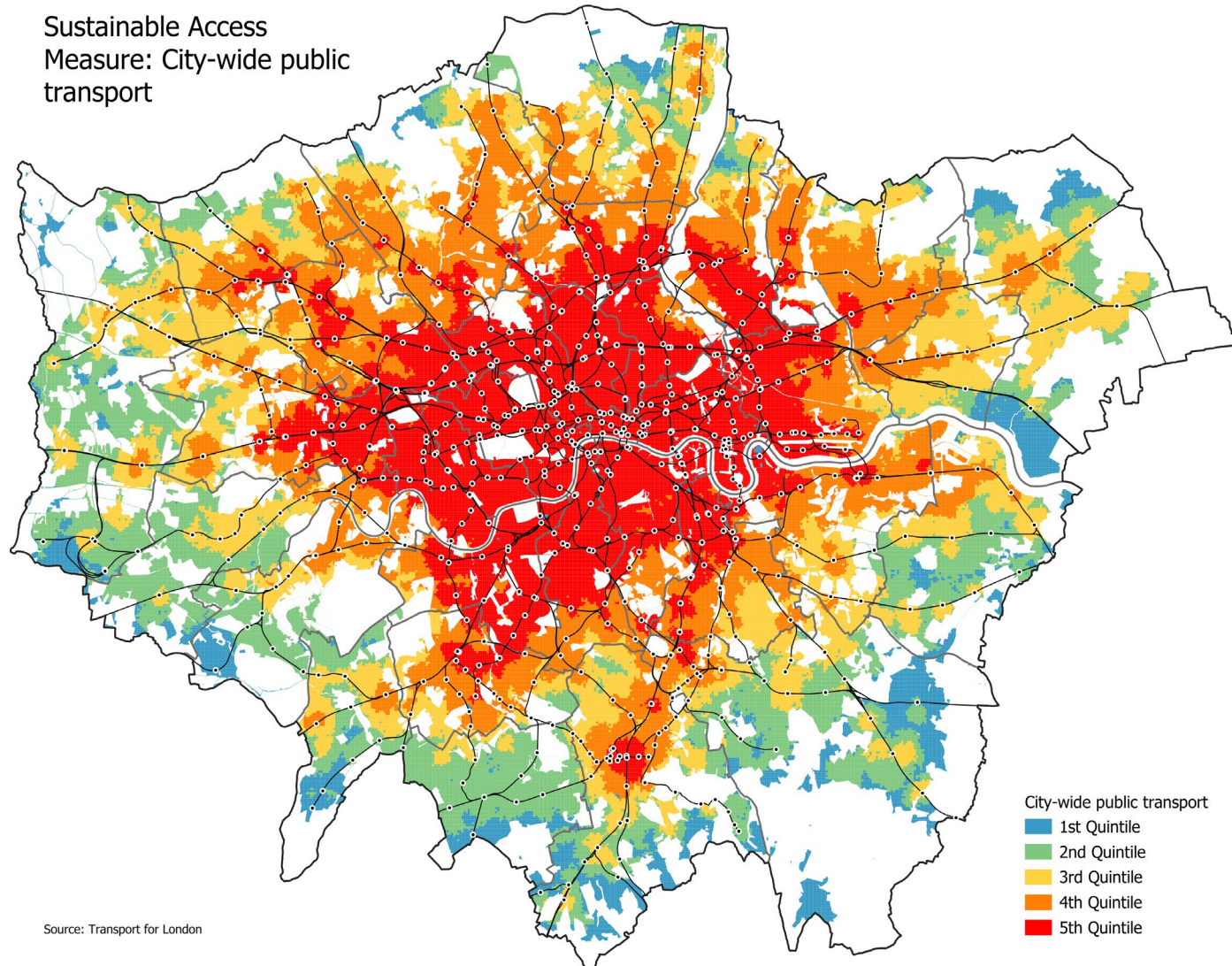
### **Will users be able to add transport schemes and assess the impact on SAM scores?**

We are building further functionality to assess uplifts of SAM scores following transport improvements (and changes in land use). Any changes to London's public transport will be made upon an already intricate network of rail, tram and bus services. Due to both the nature of existing services, and the analytical tools needed to calculate SAM, this analysis is currently likely to have to be done on a case-by-case basis within TfL. However, we are keen to explore opportunities and priorities with stakeholders.

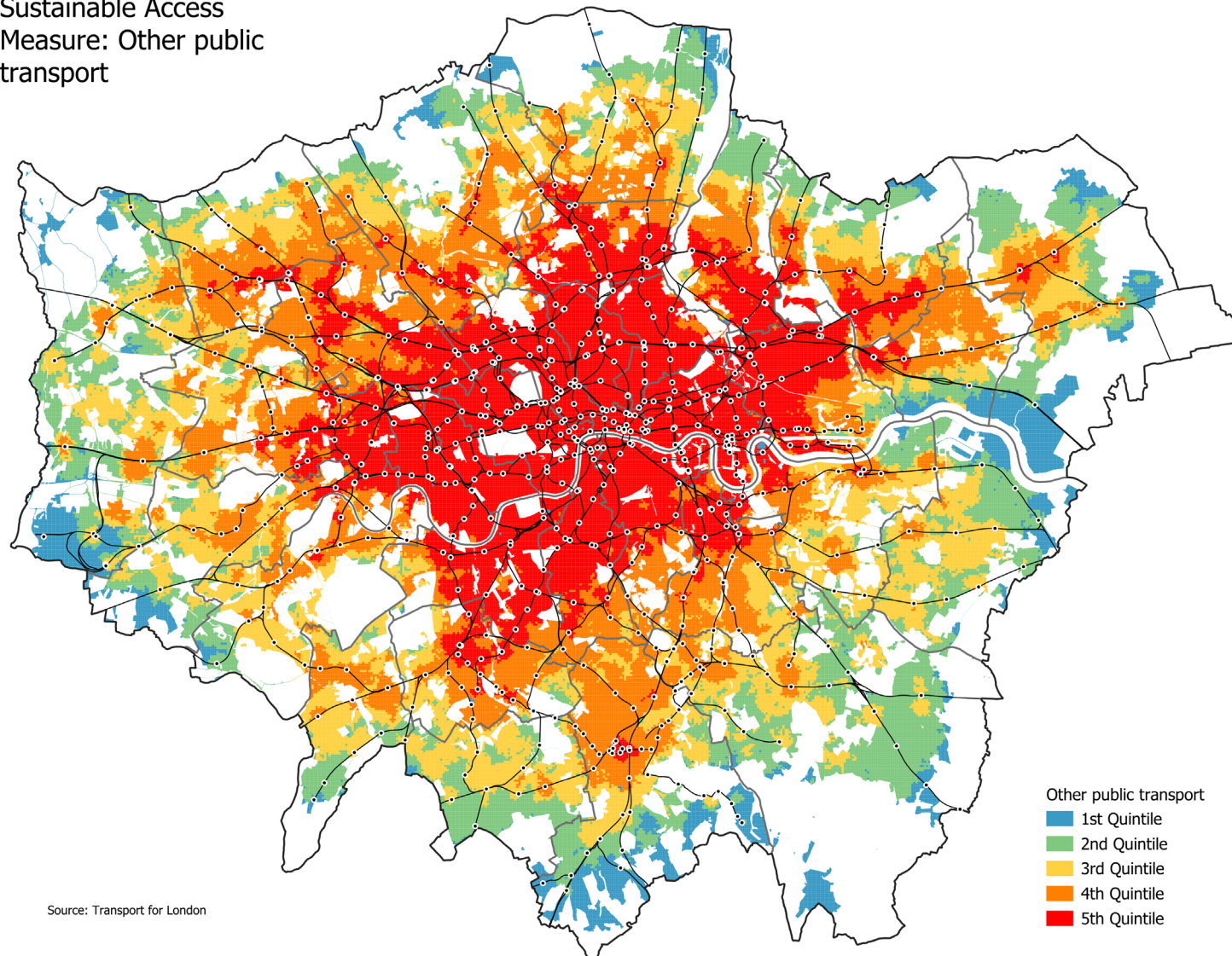
As described in section 3.2, PTAL can still offer functionality for some use cases.

## Appendix 2 – Individual ‘layer’ maps

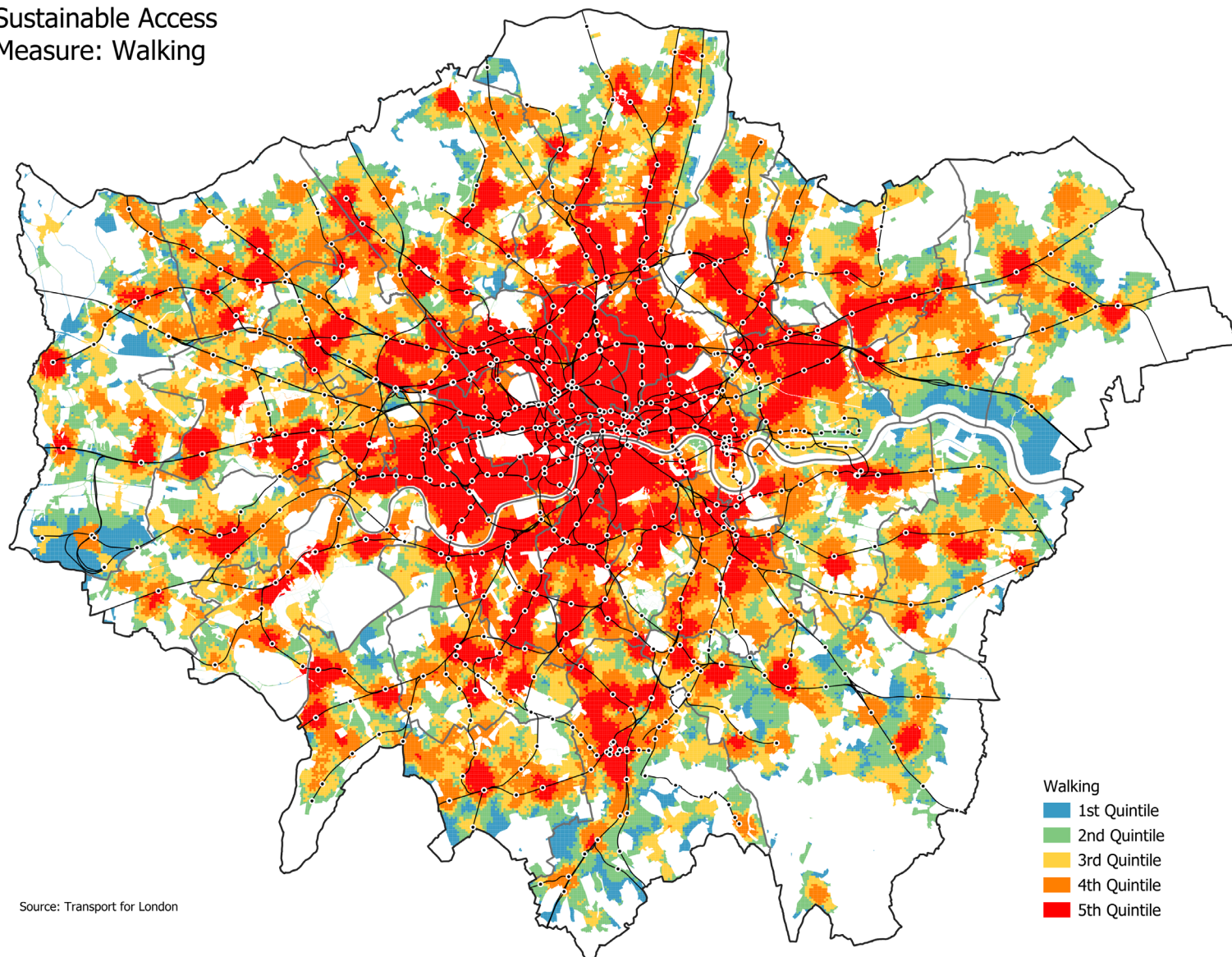
Sustainable Access  
Measure: City-wide public  
transport



## Sustainable Access Measure: Other public transport



## Sustainable Access Measure: Walking



Source: Transport for London

## Appendix 3 – List of destinations used

| Journey purpose aligned to LTDS | Points of Interest 'group' (or alt. data source) | Points of Interest 'category'           | Points of Interest 'class'              | Count |
|---------------------------------|--------------------------------------------------|-----------------------------------------|-----------------------------------------|-------|
| Education as student (<II)      | Primary schools (from GIAS)                      | N/A                                     | N/A                                     | 1895  |
| Education as student (II+)      | Secondary schools (from GIAS)                    | N/A                                     | N/A                                     | 875   |
| Education as student (II+)      | Education and Health                             | Recreational and Vocational Education   | Training Providers and Centres          | 2925  |
| Education as student (II+)      | Education and Health                             | Recreational and Vocational Education   | Ballet and Dance Schools                | 606   |
| Education as student (II+)      | Education and Health                             | Recreational and Vocational Education   | Music Teachers and Schools              | 498   |
| Education as student (II+)      | Education and Health                             | Recreational and Vocational Education   | Drama Schools                           | 469   |
| Education as student (II+)      | Education and Health                             | Recreational and Vocational Education   | Language Schools                        | 241   |
| Education as student (II+)      | Education and Health                             | Recreational and Vocational Education   | First Aid Training                      | 156   |
| Education as student (II+)      | Education and Health                             | Recreational and Vocational Education   | Beauty and Hairdressing Schools         | 77    |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Dental Surgeries                        | 3376  |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Chemists and Pharmacies                 | 3052  |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Clinics and Health Centres              | 3011  |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Alternative, Natural and Complementary  | 2642  |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Physical Therapy                        | 2405  |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Doctors Surgeries                       | 2285  |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Optometrists and Opticians              | 1540  |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Mental Health Centres and Practitioners | 983   |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Foot Related Services                   | 574   |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Day and Care Centres                    | 375   |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Hospitals                               | 308   |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Dental Technicians                      | 284   |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Surgeons and Cosmetic Surgeries         | 237   |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Dieticians and Nutritionists            | 229   |

| Journey purpose aligned to LTDS | Points of Interest 'group' (or alt. data source) | Points of Interest 'category'           | Points of Interest 'class'                              | Count |
|---------------------------------|--------------------------------------------------|-----------------------------------------|---------------------------------------------------------|-------|
| Health                          | Education and Health                             | Health Practitioners and Establishments | Homeopaths                                              | 111   |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Accident and Emergency Hospitals                        | 66    |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Speech Therapists                                       | 56    |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Parenting and Childcare Services                        | 45    |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Dental and Medical Laboratories                         | 31    |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Walk-In Centre                                          | 18    |
| Health                          | Education and Health                             | Health Practitioners and Establishments | Midwifery                                               | 5     |
| Health                          | Education and Health                             | Health Support Services                 | Counselling and Advice Services                         | 1665  |
| Health                          | Education and Health                             | Health Support Services                 | Pregnancy Related Services and Help Centres             | 89    |
| Health                          | Education and Health                             | Health Support Services                 | Blood Transfusion Service                               | 18    |
| Health                          | Education and Health                             | Health Support Services                 | X-Ray Services                                          | 9     |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Convenience Stores and Independent Supermarkets         | 15212 |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Grocers, Farm Shops and Pick Your Own                   | 3061  |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Bakeries                                                | 2553  |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Alcoholic Drinks Including Off Licences and Wholesalers | 1646  |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Supermarket Chains                                      | 1576  |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Butchers                                                | 1350  |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Delicatessens                                           | 799   |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Organic, Health, Gourmet and Kosher Foods               | 776   |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Confectioners                                           | 629   |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Frozen Foods                                            | 419   |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Cash and Carry                                          | 350   |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Fishmongers                                             | 309   |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Markets                                                 | 268   |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail       | Tea and Coffee Merchants                                | 151   |

| Journey purpose aligned to LTDS | Points of Interest 'group' (or alt. data source) | Points of Interest 'category'         | Points of Interest 'class'                                | Count |
|---------------------------------|--------------------------------------------------|---------------------------------------|-----------------------------------------------------------|-------|
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail     | Green and New Age Goods                                   | 65    |
| Food shopping                   | Retail                                           | Food, Drink and Multi Item Retail     | Herbs and Spices                                          | 24    |
| Other shopping                  | Retail                                           | Clothing and Accessories              | Clothing                                                  | 7332  |
| Other shopping                  | Retail                                           | Clothing and Accessories              | Jewellery and Fashion Accessories                         | 3054  |
| Other shopping                  | Retail                                           | Clothing and Accessories              | Footwear                                                  | 1037  |
| Other shopping                  | Retail                                           | Clothing and Accessories              | Baby and Nursery Equipment and Children's Clothes         | 565   |
| Other shopping                  | Retail                                           | Clothing and Accessories              | Lingerie and Hosiery                                      | 203   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | DIY and Home Improvement                                  | 5147  |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Hobby, Sports and Pastime Products                        | 1954  |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Charity Shops                                             | 1866  |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Post Offices                                              | 1814  |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Travel Agencies                                           | 1742  |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Cosmetics, Toiletries, Perfumes and Hairdressing Supplies | 1497  |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Carpets, Rugs, Soft Furnishings and Needlecraft           | 1438  |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Telephones and Telephone Cards                            | 1228  |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Florists                                                  | 1004  |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Pets, Supplies and Services                               | 921   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Gifts and Cards                                           | 897   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Discount Stores                                           | 770   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Furniture                                                 | 723   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Art and Antiques                                          | 646   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Stationery and Office Supplies                            | 596   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | General Household Goods                                   | 593   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Garden Centres and Nurseries                              | 503   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Books and Maps                                            | 492   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Mail Order and Catalogue Stores                           | 484   |

| Journey purpose aligned to LTDS | Points of Interest 'group' (or alt. data source) | Points of Interest 'category'         | Points of Interest 'class'                                       | Count |
|---------------------------------|--------------------------------------------------|---------------------------------------|------------------------------------------------------------------|-------|
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Cycles and Accessories                                           | 429   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Electrical Goods and Components                                  | 416   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Domestic Appliances                                              | 337   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Department Stores                                                | 334   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Computer Shops                                                   | 253   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Craft Supplies                                                   | 220   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Leather Goods, Luggage and Travel Accessories Including Handbags | 218   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Garages, Garden and Portable Buildings                           | 217   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Fuel Distributors and Suppliers                                  | 189   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Garden Machinery and Furniture                                   | 175   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Party Goods and Novelties                                        | 170   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Musical Instruments                                              | 169   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Photographic and Optical Equipment                               | 157   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Lighting                                                         | 152   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Secondhand Goods                                                 | 144   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Computer Supplies                                                | 118   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Music and Video                                                  | 103   |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Camping and Caravanning                                          | 79    |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Potteries                                                        | 36    |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Surplus Goods                                                    | 30    |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | China and Glassware                                              | 26    |
| Other shopping                  | Retail                                           | Household, Office, Leisure and Garden | Comics Bookshops                                                 | 23    |
| Personal services               | Commercial Services                              | Legal and Financial                   | Banks and Building Societies                                     | 2277  |
| Personal services               | Commercial Services                              | Legal and Financial                   | Currency Conversion and Money Transfers                          | 999   |
| Personal services               | Commercial Services                              | Personal, Consumer and Other Services | Hair and Beauty Services                                         | 22333 |
| Personal services               | Commercial Services                              | Personal, Consumer and Other Services | Photographic Services                                            | 2129  |
| Personal services               | Commercial Services                              | Personal, Consumer and Other Services | Funeral and Associated Services                                  | 1385  |

| Journey purpose aligned to LTDS    | Points of Interest 'group' (or alt. data source) | Points of Interest 'category'         | Points of Interest 'class'               | Count |
|------------------------------------|--------------------------------------------------|---------------------------------------|------------------------------------------|-------|
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Lock, Key and Security Services          | 1345  |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Detective and Investigation Agencies     | 971   |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Slimming Clubs and Services              | 777   |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Tattooing and Piercing Services          | 742   |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Tailoring and Clothing Alteration        | 701   |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Wedding Services                         | 634   |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Spas                                     | 443   |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Personalisation                          | 306   |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Sculptors, Wood Workers and Stone Masons | 224   |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Introduction and Dating Agencies         | 220   |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Party Organisers                         | 171   |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Astrologers, Clairvoyants and Palmists   | 96    |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Trophies and Engraving Services          | 95    |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Event Ticket Agents and Box Office       | 71    |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Hotel Booking Agencies                   | 44    |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Customer Service Centres                 | 33    |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Cv Writers                               | 31    |
| Personal services                  | Commercial Services                              | Personal, Consumer and Other Services | Printing On Garments                     | 8     |
| Personal services                  | Education and Health                             | Animal Welfare                        | Veterinarians and Animal Hospitals       | 1067  |
| Personal services                  | Education and Health                             | Animal Welfare                        | Animal Clipping and Grooming             | 496   |
| Personal services                  | Education and Health                             | Animal Welfare                        | Kennels and Catteries                    | 317   |
| Personal services                  | Education and Health                             | Animal Welfare                        | Dog Training                             | 128   |
| Personal services                  | Education and Health                             | Animal Welfare                        | Veterinary Pharmacies                    | 14    |
| Other social (e.g. pub/restaurant) | Accommodation, Eating and Drinking               | Eating and Drinking                   | Restaurants                              | 16312 |
| Other social (e.g. pub/restaurant) | Accommodation, Eating and Drinking               | Eating and Drinking                   | Fast Food and Takeaway Outlets           | 14571 |
| Other social (e.g. pub/restaurant) | Accommodation, Eating and Drinking               | Eating and Drinking                   | Cafes, Snack Bars and Tea Rooms          | 11723 |
| Other social (e.g. pub/restaurant) | Accommodation, Eating and Drinking               | Eating and Drinking                   | Pubs, Bars and Inns                      | 9018  |

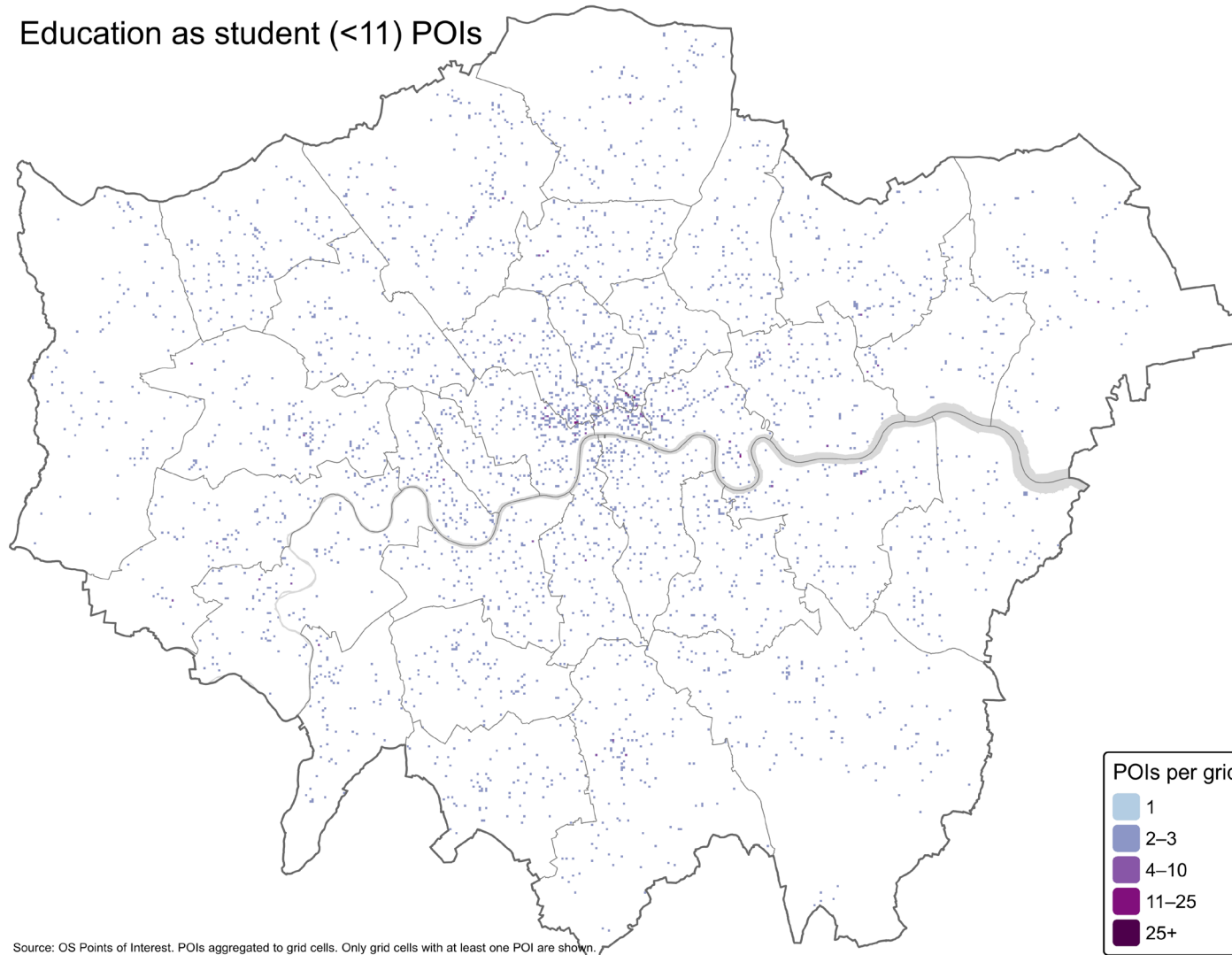
| Journey purpose aligned to LTDS    | Points of Interest 'group' (or alt. data source) | Points of Interest 'category'            | Points of Interest 'class'                             | Count |
|------------------------------------|--------------------------------------------------|------------------------------------------|--------------------------------------------------------|-------|
| Other social (e.g. pub/restaurant) | Accommodation, Eating and Drinking               | Eating and Drinking                      | Fish and Chip Shops                                    | 1933  |
| Other social (e.g. pub/restaurant) | Accommodation, Eating and Drinking               | Eating and Drinking                      | Banqueting and Function Rooms                          | 544   |
| Other social (e.g. pub/restaurant) | Accommodation, Eating and Drinking               | Eating and Drinking                      | Fast Food Delivery Services                            | 262   |
| Other social (e.g. pub/restaurant) | Accommodation, Eating and Drinking               | Eating and Drinking                      | Internet Cafes                                         | 172   |
| Entertainment/recreation           | Attractions                                      | Botanical and Zoological                 | Horticultural Attractions                              | 227   |
| Entertainment/recreation           | Attractions                                      | Botanical and Zoological                 | Zoos and Animal Collections                            | 73    |
| Entertainment/recreation           | Attractions                                      | Botanical and Zoological                 | Bird Reserves, Collections and Sanctuaries             | 56    |
| Entertainment/recreation           | Attractions                                      | Botanical and Zoological                 | Farm Based Attractions                                 | 31    |
| Entertainment/recreation           | Attractions                                      | Botanical and Zoological                 | Aquaria and Sea Life Centres                           | 2     |
| Entertainment/recreation           | Attractions                                      | Historical and Cultural                  | Historic Buildings Including Castles, Forts and Abbeys | 524   |
| Entertainment/recreation           | Attractions                                      | Historical and Cultural                  | Art Galleries                                          | 463   |
| Entertainment/recreation           | Attractions                                      | Historical and Cultural                  | Museums                                                | 246   |
| Entertainment/recreation           | Attractions                                      | Historical and Cultural                  | Battlefields                                           | 7     |
| Entertainment/recreation           | Attractions                                      | Historical and Cultural                  | Historical Ships                                       | 2     |
| Entertainment/recreation           | Attractions                                      | Tourism                                  | Railways (Heritage, Steam and Miniature)               | 57    |
| Entertainment/recreation           | Attractions                                      | Tourism                                  | Laseria, Observatories and Planetaria                  | 35    |
| Entertainment/recreation           | Attractions                                      | Tourism                                  | Theme and Adventure Parks                              | 14    |
| Entertainment/recreation           | Public Infrastructure                            | Infrastructure and Facilities            | Halls and Community Centres                            | 3796  |
| Entertainment/recreation           | Public Infrastructure                            | Infrastructure and Facilities            | Libraries                                              | 707   |
| Entertainment/recreation           | Sport and Entertainment                          | Sport and Entertainment Support Services | Children's Activity Centres                            | 216   |
| Entertainment/recreation           | Sport and Entertainment                          | Venues, Stage and Screen                 | Social Clubs                                           | 1048  |
| Entertainment/recreation           | Sport and Entertainment                          | Venues, Stage and Screen                 | Theatres and Concert Halls                             | 445   |
| Entertainment/recreation           | Sport and Entertainment                          | Venues, Stage and Screen                 | Nightclubs                                             | 262   |
| Entertainment/recreation           | Sport and Entertainment                          | Venues, Stage and Screen                 | Cinemas                                                | 224   |
| Entertainment/recreation           | Sport and Entertainment                          | Venues, Stage and Screen                 | Conference and Exhibition Centres                      | 180   |

| Journey purpose aligned to LTDS | Points of Interest 'group' (or alt. data source) | Points of Interest 'category'         | Points of Interest 'class'                            | Count |
|---------------------------------|--------------------------------------------------|---------------------------------------|-------------------------------------------------------|-------|
| Participate in sport            | Education and Health                             | Recreational and Vocational Education | Sports and Fitness Coaching                           | 891   |
| Participate in sport            | Education and Health                             | Recreational and Vocational Education | Martial Arts Instruction                              | 430   |
| Participate in sport            | Education and Health                             | Recreational and Vocational Education | Flying Schools                                        | 55    |
| Participate in sport            | Education and Health                             | Recreational and Vocational Education | Diving Schools                                        | 27    |
| Participate in sport            | Education and Health                             | Recreational and Vocational Education | Sailing Schools                                       | 18    |
| Participate in sport            | Sport and Entertainment                          | Outdoor Pursuits                      | Riding Schools, Livery Stables and Equestrian Centres | 268   |
| Participate in sport            | Sport and Entertainment                          | Outdoor Pursuits                      | Combat, Laser and Paintball Games                     | 106   |
| Participate in sport            | Sport and Entertainment                          | Outdoor Pursuits                      | Outdoor Pursuit Organisers and Equipment              | 103   |
| Participate in sport            | Sport and Entertainment                          | Outdoor Pursuits                      | Watersports                                           | 80    |
| Participate in sport            | Sport and Entertainment                          | Outdoor Pursuits                      | Angling and Sports Fishing                            | 65    |
| Participate in sport            | Sport and Entertainment                          | Outdoor Pursuits                      | Paragliding and Hang Gliding                          | 6     |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Sports Grounds, Stadia and Pitches                    | 5220  |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Gymnasiums, Sports Halls and Leisure Centres          | 4944  |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Tennis Facilities                                     | 4438  |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Bowling Facilities                                    | 745   |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Golf Ranges, Courses, Clubs and Professionals         | 434   |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Swimming Pools                                        | 185   |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Shooting Facilities                                   | 182   |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Athletics Facilities                                  | 175   |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Snooker and Pool Halls                                | 82    |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Motorsport Venues                                     | 81    |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Racecourses and Greyhound Tracks                      | 42    |
| Participate in sport            | Sport and Entertainment                          | Sports Complex                        | Ski Infrastructure and Aerial Cableways               | 23    |

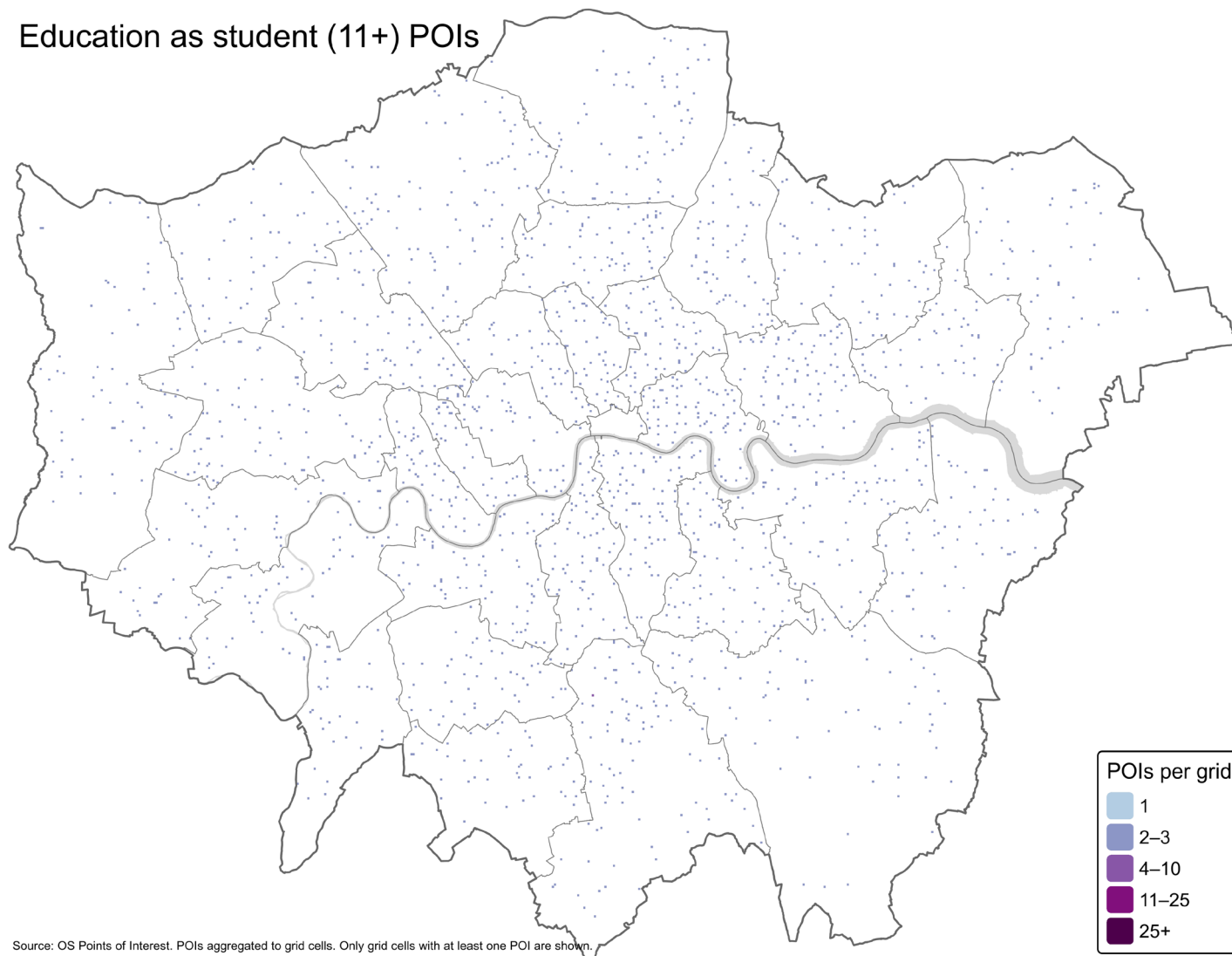
| Journey purpose aligned to LTDS                        | Points of Interest 'group' (or alt. data source) | Points of Interest 'category' | Points of Interest 'class' | Count |
|--------------------------------------------------------|--------------------------------------------------|-------------------------------|----------------------------|-------|
| Participate in sport                                   | Sport and Entertainment                          | Sports Complex                | Squash Courts              | 11    |
| Participate in sport                                   | Sport and Entertainment                          | Sports Complex                | Climbing Facilities        | 7     |
| Participate in sport                                   | Sport and Entertainment                          | Sports Complex                | Ice Rinks                  | 7     |
| Participate in sport                                   | Sport and Entertainment                          | Sports Complex                | Velodromes                 | 2     |
| Leisure trip – Just going for a walk etc for enjoyment | Greenspace information for Greater London (GIGL) | N/A                           | N/A                        | 3835  |
| Worship or religious observance                        | Public Infrastructure                            | Infrastructure and Facilities | Places Of Worship          | 7612  |

## Appendix 4 – Spatial distribution of destinations used

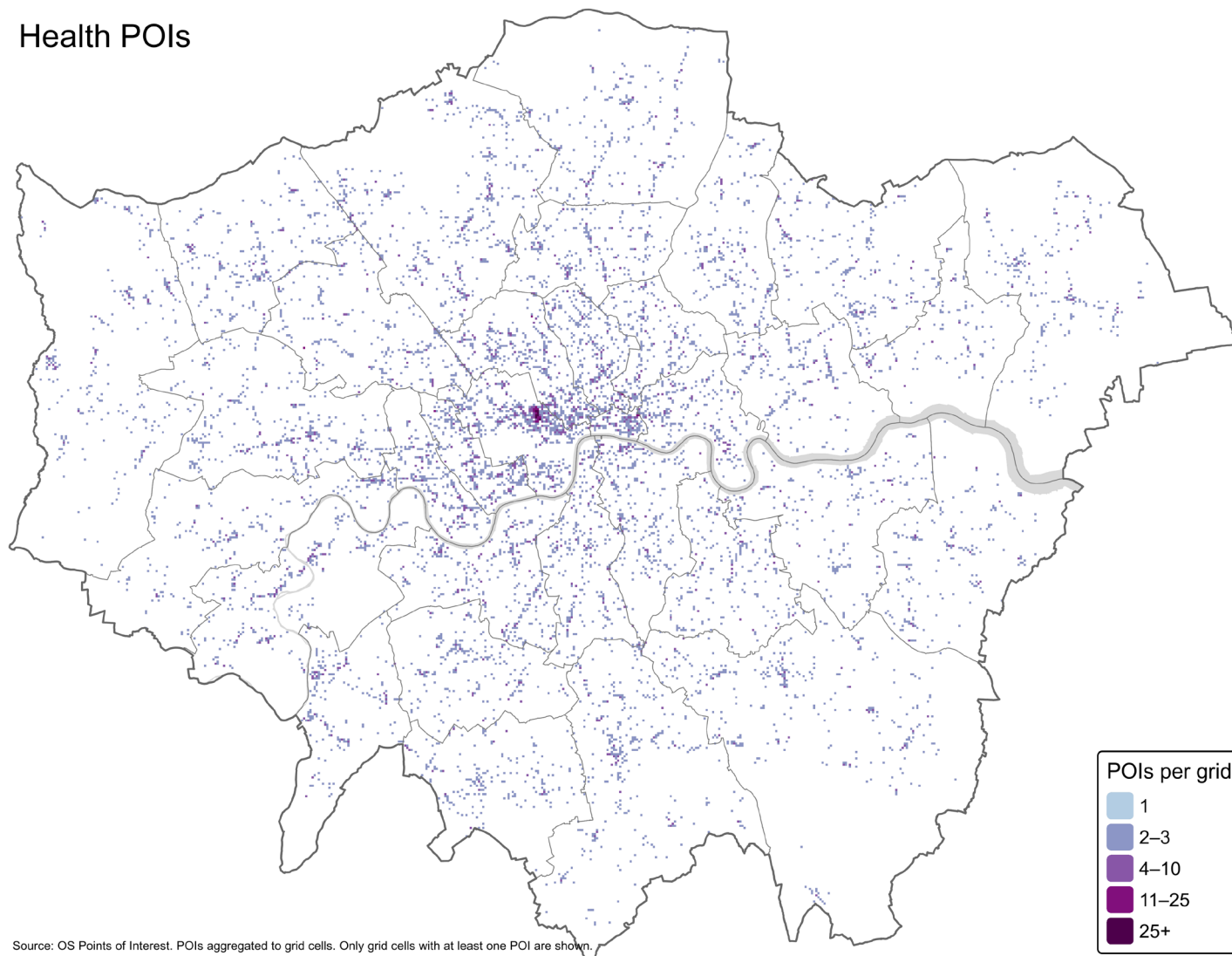
### Education as student (<11) POIs



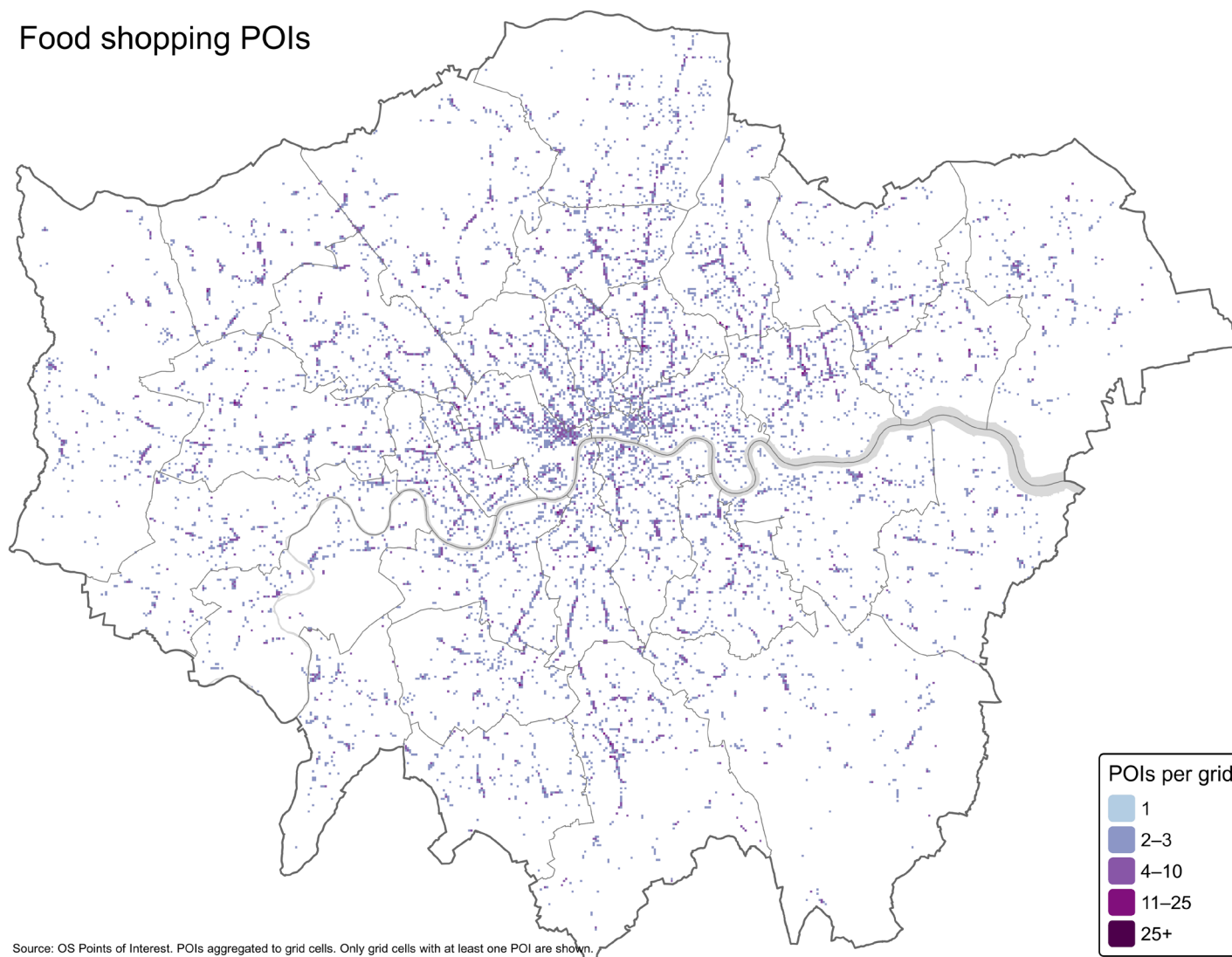
## Education as student (11+) POIs



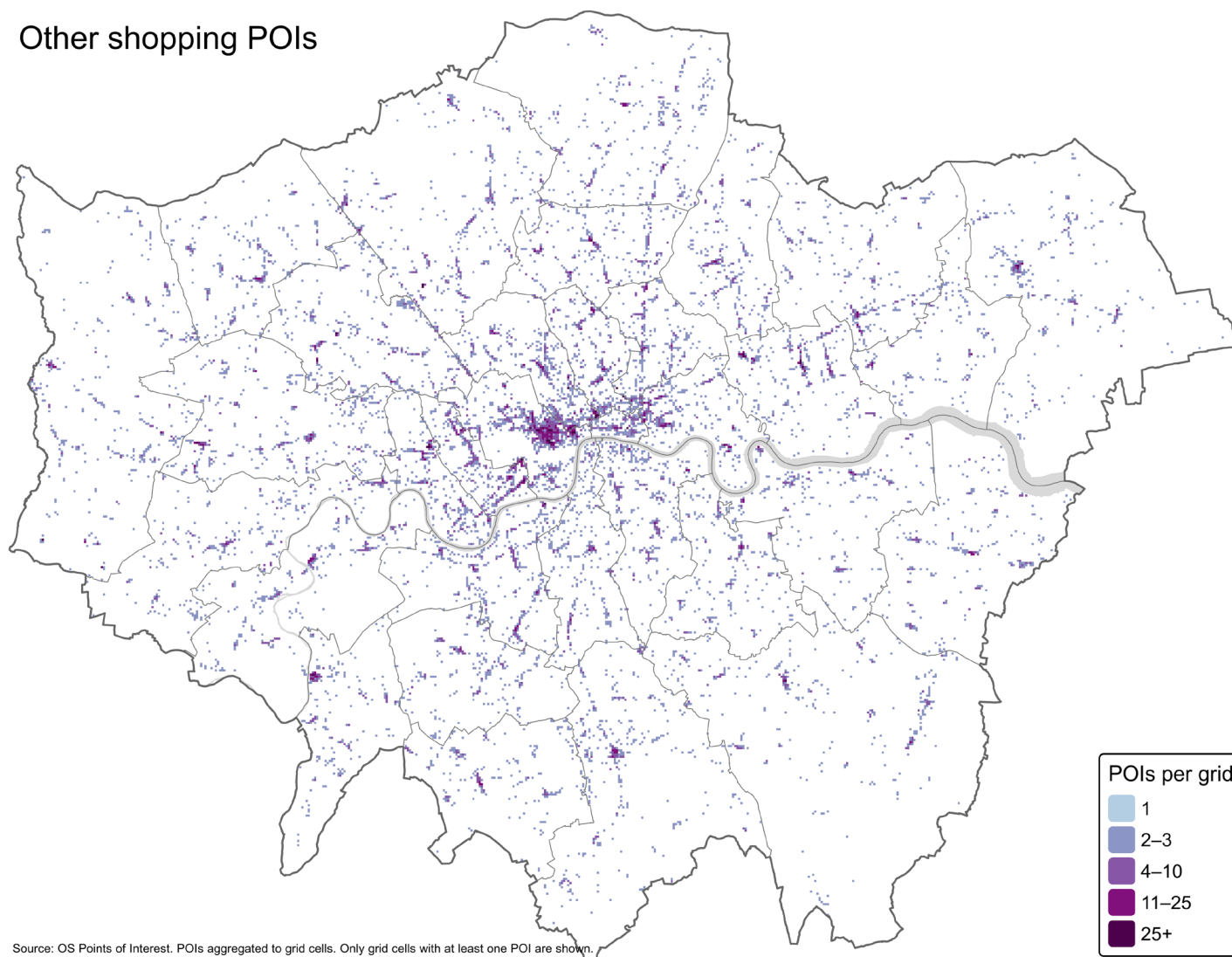
## Health POIs



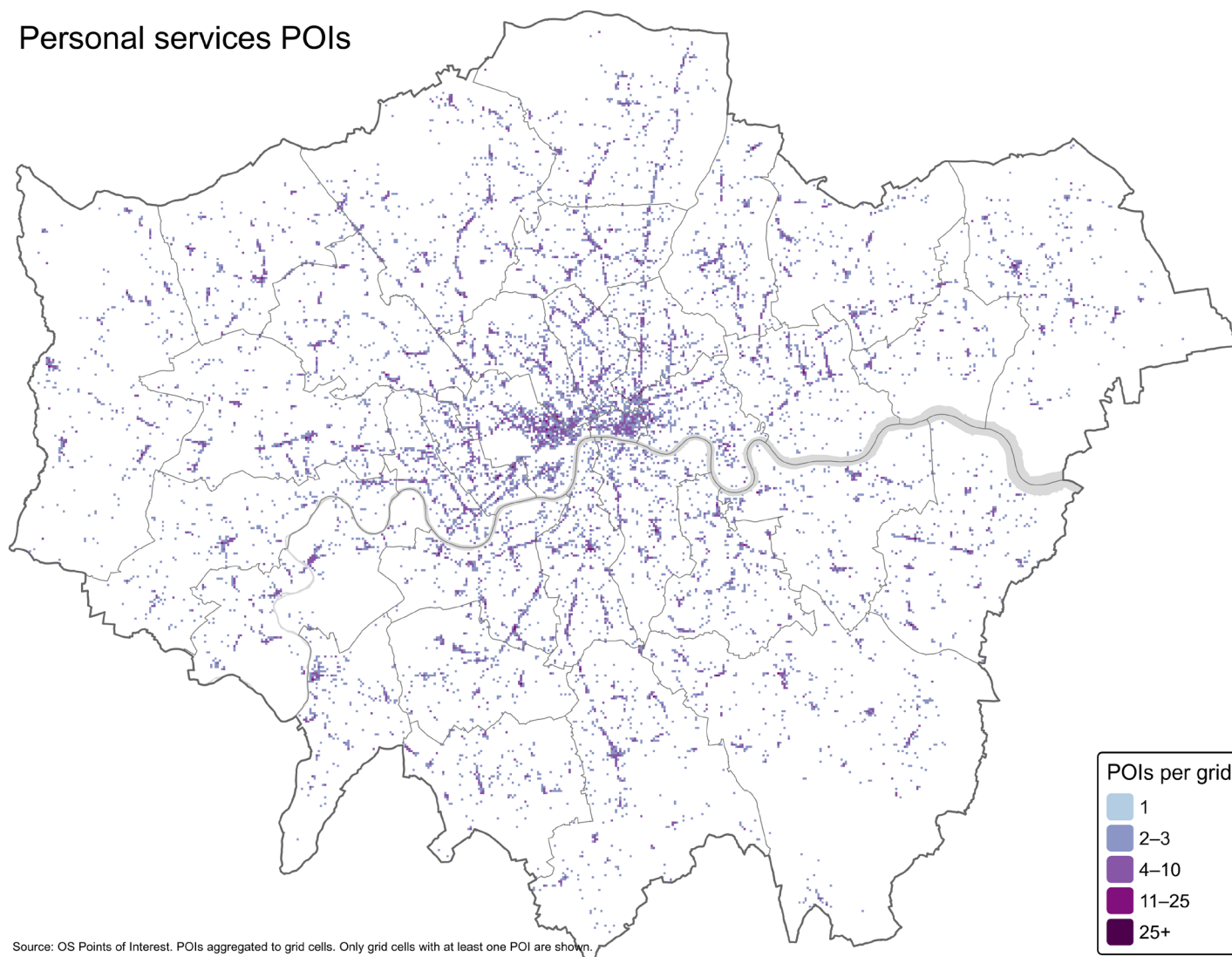
## Food shopping POIs



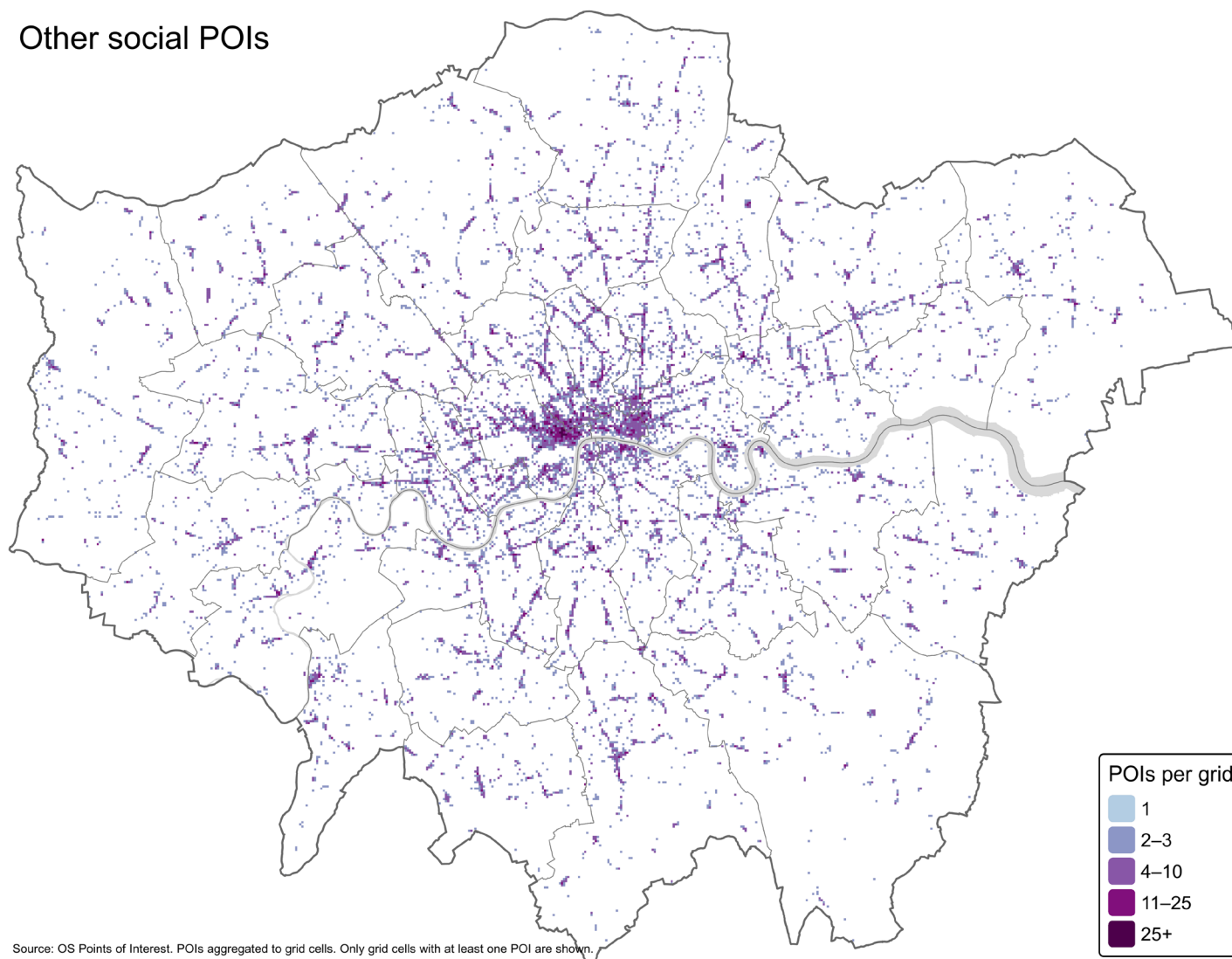
## Other shopping POIs



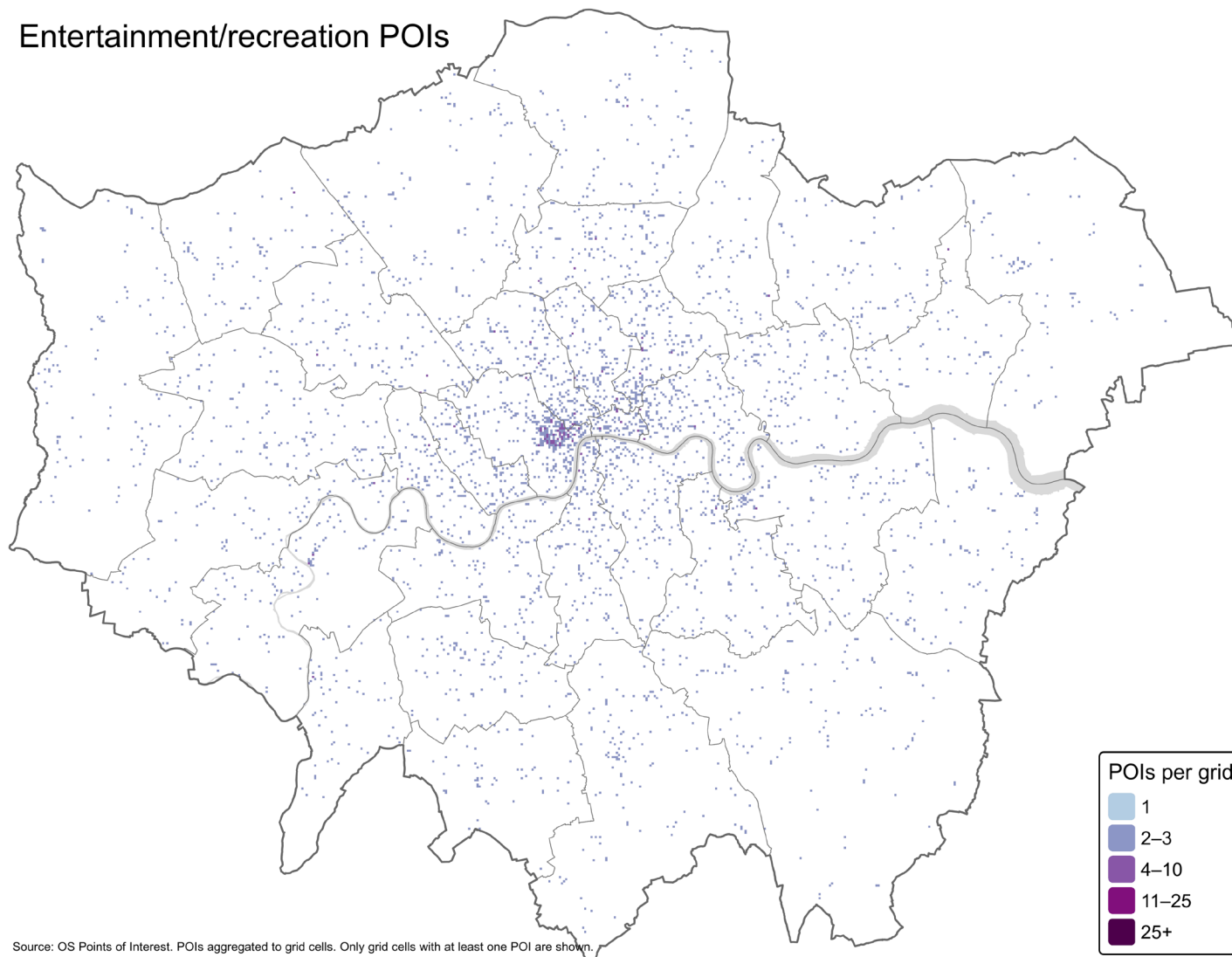
## Personal services POIs



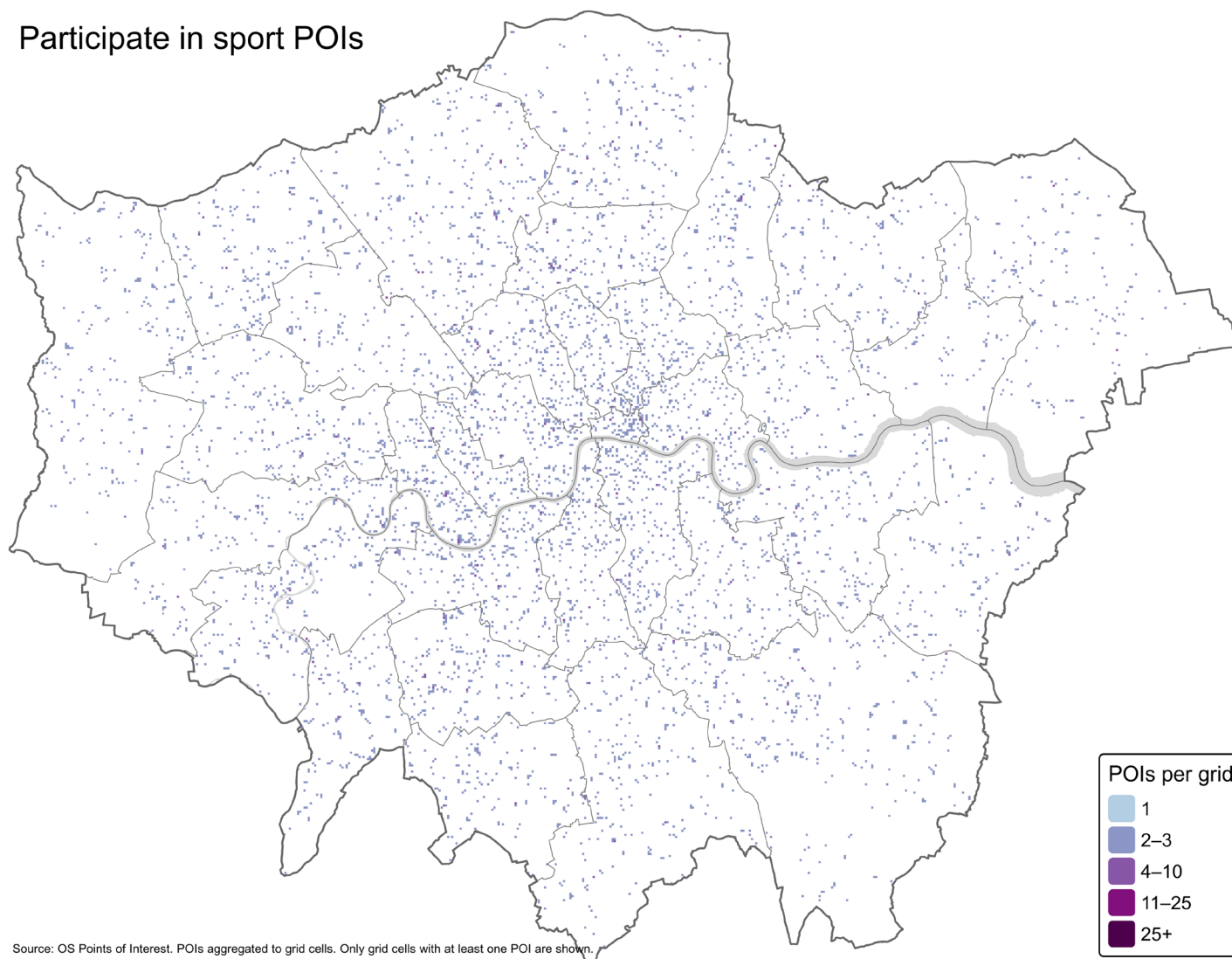
## Other social POIs

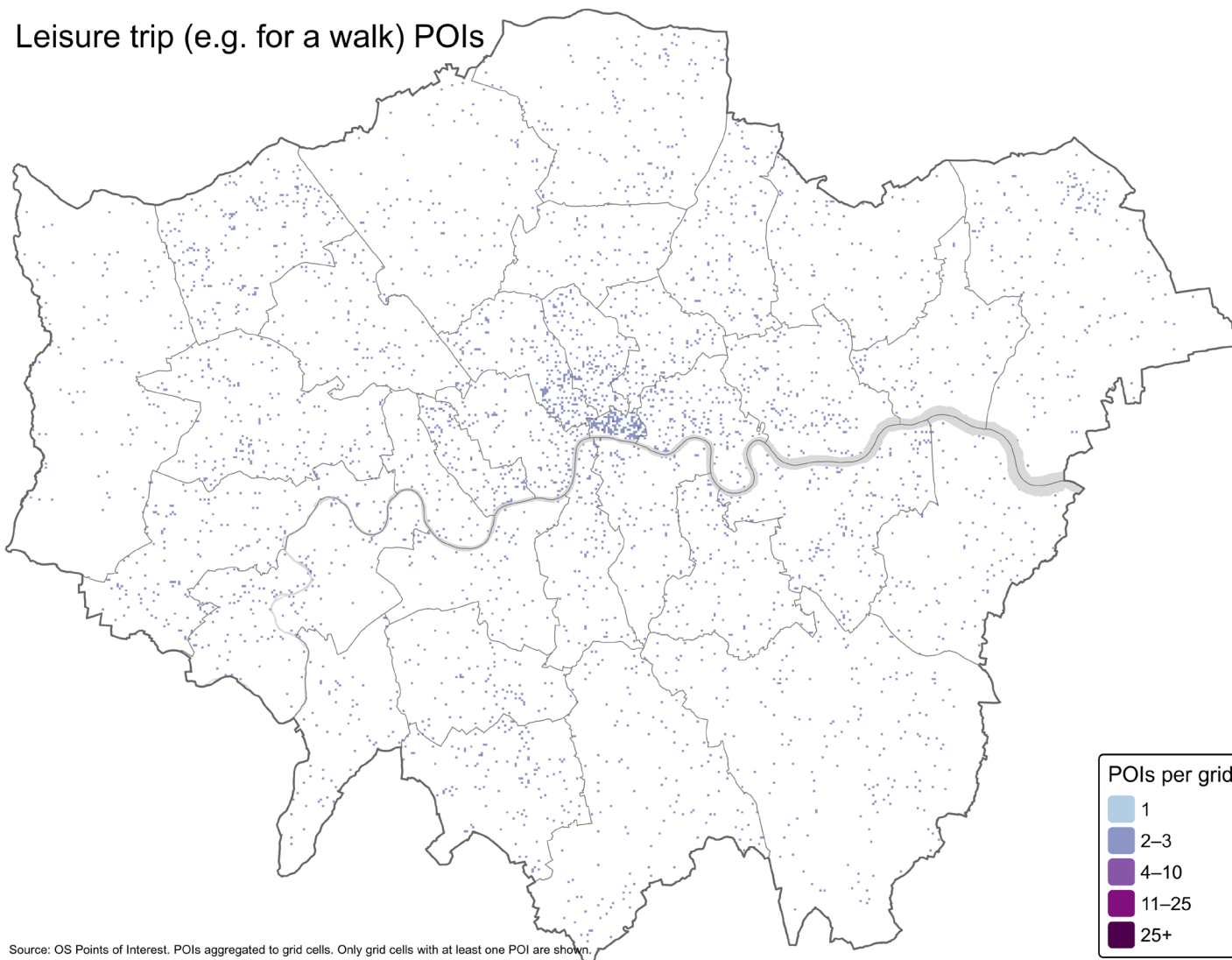


## Entertainment/recreation POIs



## Participate in sport POIs





## Worship POIs

