Office for National Statistics

# The 2021 Rural Urban Classification of Statistical Geographies, England and Wales

## Methodology

ONS, Defra, Welsh Government

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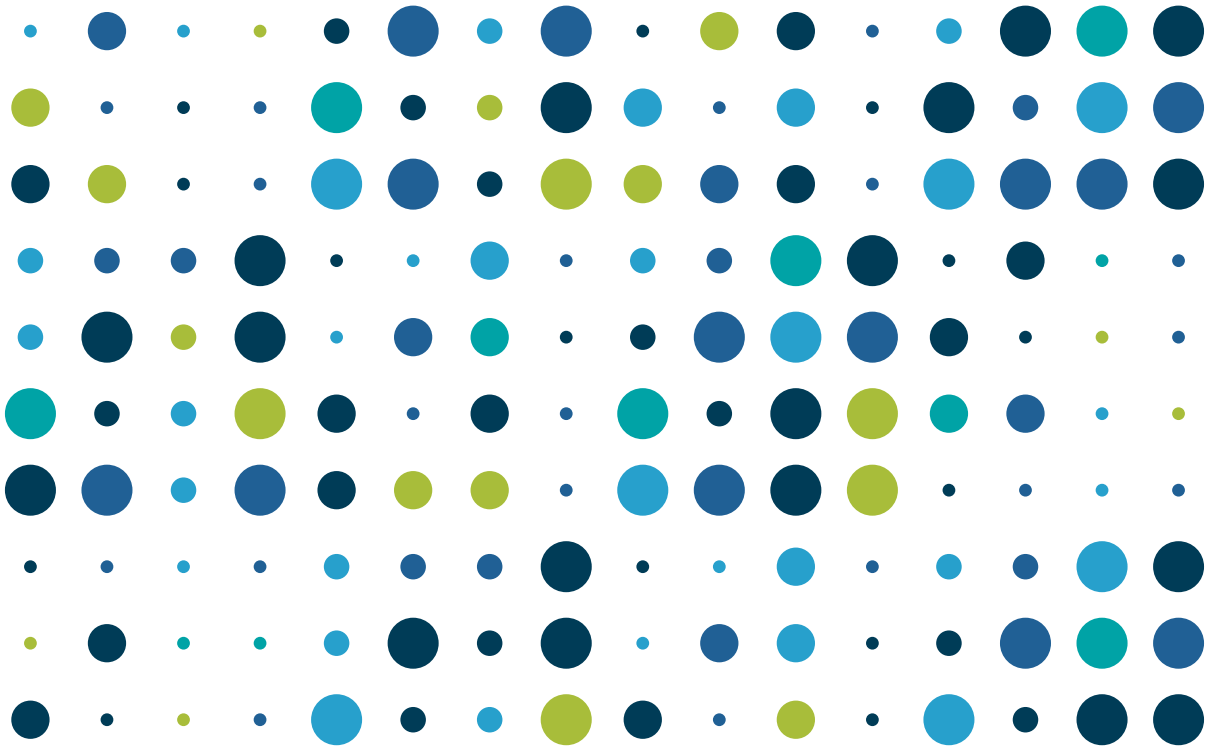

# Contents

# 1. Introduction, context and key changes:

The 2021 Rural-Urban Classification (RUC) is a statistical classification system used to categorise geographies based on the form and characteristics of the settlements present within them. It provides a consistent and standardised method for classifying areas as rural or urban based on address density, physical settlement form, population size and relative accessibility.

At its simplest, it aims to group together geographically close Built Up Areas (BUAs) into Amalgamated BUAs (ABUAs), and assign an ‘Urban’ category to those ABUAs with a population of 10,000 or more. ABUAs with a population of less than 10,000 are assigned a ‘Rural’ category. Output areas outside BUAs are mostly assigned solely by their density classification. However, the classification is more nuanced and uses residential address density, population size and intersection with a Built Up Area geography, and the addition of travel times relative accessibility as a crucial factor, to identify subdivisions of rurality.

The 2021 RUC is produced by the Office for National Statistics (ONS) with advice from the Department for Environment, Food and Rural Affairs (Defra), the Welsh Government and colleagues from the Government Geography Profession (GGP).

The purpose of the 2021 RUC is to enable analyses of statistical geographies by providing contextual information about the Rural or Urban context of settlements within those geographies. Each geography is categorised based on a standardised ruleset, with areas that are most similar to one another placed into the same Rural Urban Classification category.

Like the 2011 RUC before it, the 2021 RUC uses grid cells to enable the density of addresses at very small geographical scales to be measured. Address Density Profiles (measures of density at a range of distances) for grid cells are then used to assign Density Classifications to Output Areas (OAs), which in turn are used in the classification of larger statistical and administrative geographies. The classification is labelled ‘2021’ because despite using various data sources from several time points, the 2021 Census was the main source of statistical geographies, address and population information.

The 2021 update seeks to build upon the strengths of the previous methodology while incorporating significant enhancements. A key methodological change involves replacing the ‘sparsity’ element with updated estimates of ‘Relative Access’ to large urban centres. ‘Relative Access’ is assessed through estimates of travel time by car to urban centres with a population of 75,000 or more, a threshold used in previous analysis of “Major” towns and cities in “Towns and Cities, characteristics of built-up areas, England and Wales: Census 2021”. This facilitates more accurate and

pertinent analyses by providing additional contextual information regarding the relationships and accessibility between different settlements; a proxy for potential access to goods, services and employment. Furthermore, the resolution of the underlying geospatial data has been improved, transitioning from 100-metre grid cells to 50-metre grid cells, enhancing the accuracy of Address Density Profile calculations and increasing the number of small OAs that intersect with a grid cell.

These methodological advancements enable a more nuanced categorisation of statistical geographies, distinguishing between rural areas with access to a major town or city and those that are more isolated.

As with all previous iterations of the RUC, it is important to note that the classification system focuses exclusively on physical settlement characteristics and relative accessibility by road. It does not account for economic, social, historical, or cultural elements contributing to rural or urban identity. Users should be aware that the categories are a tool to enable statistical analysis of trends affecting geographies with similar urban or rural settlement morphologies and similar levels of Relative Access. This does not mean that all areas within each category are identical, nor is this intended to be a definitive classification. Finally, when using the classification, consideration should be given to the fact that density is a function of the scale of measurement. As such, RUC is most representative at the lowest levels of geography (OA). Classifications at larger geographies (LAD) may still have some uses but represent a wide range of settlement morphologies within them and the larger the geography the more likely an area is to be dominated by populations within Urban settlements.

# 2. Overview

The 2021 Rural Urban Classification (RUC) categorises Census Small Area statistical geographies (Output Areas - OAs, Lower Layer Super Output Areas - LSOAs, Middle Layer Super Output Areas - MSOAs) and certain administrative geographies (Local Authority Districts- LADs) as Rural or Urban based on settlement characteristics in a continuation from the previous classifications. The final classification for each geography is either:

- ‘Urban’- geographies dominated by dense settlements or ABUAs with populations of over 10,000.
- ‘Larger Rural Settlement’ – geographies with settlements in a rural context, small towns and low density fringes of conurbations, or dense ABUAs with populations of less than 10,000
- Or ‘Smaller Rural Settlement’- indicative of geographies dominated by smaller villages, hamlets and isolated dwellings

These are then complemented by a sub-category based on Relative Access to a Major town or city (75,000 people) within 30 minutes travel by road. These are:

- ‘Nearer to a Major town or city’ – A majority of the population in a geography within 30 minutes of a major urban settlement
- ‘Further from a Major town or city’ – A majority of the population in a geography further than 30 minutes of a major urban settlement.

These can be combined to form a 2 part classification for a geography – for example ‘Rural– further from a Major town or city’. This applies to OA, LSOA and MSOA geographies. Further detail can be found in Sections 2.2 and 2.3. LAD classifications are also a 2 part taxonomy but the categories differ slightly, as described in Section 2.4.

Each level of the Census Small Area geographies (OA, LSOA, MSOA) is designed to reflect a standardised population size for statistical purposes. More information on Census Geography design can be found in the ‘Census 2021 geographies’ article. Therefore, the geographies do not necessarily reflect differences in density of addresses. In contrast, RUC density classifications rely on assessing the address density within settlements, captured through calculation of Address Density Profiles at grid cell level. Aggregation of this information provides an overall Density Classification for each statistical geography. The RUC is therefore based on settlement form, address density and ‘Relative Access’ to Built Up Areas (BUAs) with populations of over 75,000, coupled with population thresholds as previously outlined in section 3.2 of the 2011 RUC methodology document. ABUAs are comprised of BUAs that are within 200m to one another and connected directly by the road network. These are similar in construction to the 2011 BUAs. For further detail refer to Section 3.2.2. A high level explanation of how each step in the RUC works is outlined below.

## 2.1 Grid Cells and Density Profiles

Density is a product of the scale at which it is measured. The 2021 RUC uses a 50-metre square grid, applied across England and Wales to enable these calculations. Each 50-metre grid cell has a Density Profile calculated for it, a count of residential addresses at various distances from its centre. The adoption of a 50-metre resolution marks an improvement in accuracy, compared to the 2011 RUC’s 100-metre grid cells. Density Profiles for each grid cell are compared against a standard address Density Profile schema (Figure 1) to ascertain the settlement type for each 50-metre grid cell, following the methodology developed for the 2011 RUC by Bibby and Brindley (2013) and Bibby and Shepherd (2004). Finally, grid cells are assigned a Density Classification of either: Urban (previously ‘Generalised Urban’), Larger Rural

Settlement ('Part of a Fringe' or 'Town' in the 2011 RUC) and Smaller Rural Settlement ('Village', 'Village envelope', 'Peri-Urban', 'Hamlet or Farmstead' in the 2011 RUC) which in turn are used to classify Census Small Area statistical geographies. Further details can be found in part 3.2 of this document.

## 2.2 Output Area RUC classification

Output Areas (OAs) are designated a Rural/Urban typology based on the Density Classification (see Section 3.1) of the majority of 50-metre grid cells within them, or, if they intersect with an Amalgamated Built Up Area (ABUA), their classification may be altered based on the ABUA population size. ABUAs represent combinations of BUAs that are within 200 metres of each other and are broadly similar to the 2011 BUAs in their design. An OA is considered intersecting if its population-weighted centroid (PWC) falls within an ABUA's boundary. PWCs are a single point within a geography that represent the spatial distribution of the majority of a geographies population. Where an OA does not intersect with an ABUA, it is assigned a classification based on its Density Classification. An illustrative map of the final 2021 RUC is included below (Figure 1).

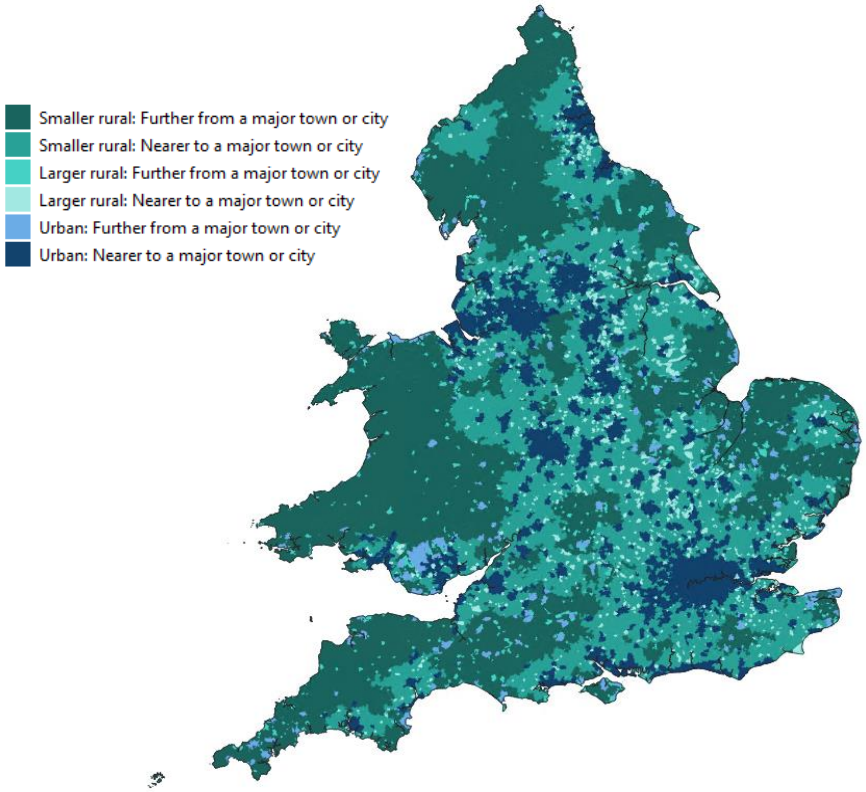


Figure 1: Map of the 2021 Output Area (OA) Rural-Urban Classification for England and Wales.

Both the 2001 and 2011 RUCs made use of population thresholds in the ‘Urban’ element of the classification. To maintain statistical reporting consistency, tracing back twenty years, the 2021 RUC utilises a similar method, assigning an ‘Urban’ classification to those OAs that intersect ABUAs with population of 10,000 and over. This was originally recommended in the ‘Urban and Rural Area Definitions: a User Guide’ from the Department for Communities and Local Government (2006) which made this suggestion on the basis that “…This carried forward a principle applied since 1981 and allowed for compatibility with other constituent countries of the UK”. Aligning with this definition allows for improvements to be made in the Density Classification element of the method, whilst providing an element of reliability.

OAs located within ABUAs (combinations of connected BUAs—see Section 3.2.2 for further technical details) with populations exceeding 10,000 are reclassified as ‘Urban’ regardless of their final Density Classification, as they form part of a larger urban area. Conversely, OAs with an ‘Urban’ Density Classification, but within ABUAs with populations under 10,000 are reclassified as ‘Larger Rural Settlement’ within the ‘Rural’ category. ABUAs with populations under 10,000 which are classed as ‘Larger Rural Settlement’ or ‘Smaller Rural Settlement’ depending on their dominant Density Profile category. Statistical geographies that do not intersect with an ABUA are classified on their address Density Profile.

The 2021 RUC removes ‘Sparsity’ from the official classification methodology. In previous versions of the RUC, Sparsity aimed to reflect the relative isolation of settlements by examining the surrounding area within a 10, 20, or 30 kilometre radius. In the past, this served as a proxy for access opportunities to jobs, goods and services. However, it was not possible to distinguish between settlements which were relatively isolated but with good access to major road infrastructure and those that were truly remote. For example, two villages could have the same density and population sizes, and both be in the ‘sparse’ category, but one may have been able to access a major town or city within 30 minutes, while the other may have been more than 2 hours away. The 2021 RUC provides the additional contextual information to assess these differences.

The 2021 RUC incorporates information on the Relative Access by road from each OA to a BUA with a population exceeding 75,000, corresponding to the population threshold used in the “Major Towns and Cities” geography (2015) and the Large or Major BUA categories as defined in the "Towns and Cities, characteristics of built-up areas, England and Wales: Census 2021" article. This allows more nuanced classification of rural and urban areas to assess their level of access to other BUAs relative to one another. While this does not directly measure access to jobs, goods and services, it provides more context about each OAs environment. These ‘Relative Access’ categories do not represent direct measures of the time taken for individuals

to travel from their home OA to a BUA but serve as relative indicator compared to those in other geographies. For further information, please consult Section 3.4. A detailed breakdown is available for expert users who might require further classification information for specific analyses (Figure 2). This includes an additional flag for Urban Areas with populations exceeding 250,000, ‘London’/’Non-London’ category flags and more detailed ‘Relative Access’ categories. A 2021 ‘Sparsity’ category based on the 2011 method is also included for analytical purposes. This can be found in the supplementary information accompanying this release.

## 2.3 Super Output Area (LSOA and MSOA) Classifications

Super Output Areas (LSOA and MSOA) are assigned the OA Density Classification and relative access category of the majority population that are resident within them. In the 2011 RUC, the allocation to LSOA or MSOA was based on majority count of OAs. OAs are designed to contain similar population totals, but this can vary. By using majority population classifications, resolution of ties is simplified. For example, an LSOA may contain five OAs, two of which with a ‘Small Rural Settlement’ classification and three with a ‘Larger Rural Settlement’ classification. Assume that 55% of the population of the LSOA live in the two ‘Small Rural Settlements’. In the 2011 RUC the LSOA would be classified as ‘Larger Rural Settlement’ based on a count of OAs with each classification – now, based on the majority of the population it would be a ‘Smaller Rural Settlement’ a more representative classification for those living within it.

In the 2011 RUC, there was a distinction between the OA and Super Output Area Rural and Urban domain classifications, with ten OA categories and eight categories for LSOA and MSOAs. All Super Output Area categories now share the same classification, meaning that is easier to follow the classification process from OA up to MSOA.

## 2.4 LAD level RUC classification

The Local Authority Districts (LAD) classification has also been simplified, leveraging the same datasets used to construct the Output Area RUC as outlined above. Most LADs are dominated by a few large towns and cities, for which the OA classifications are likely to be Urban. OAs are designed to capture similar population sizes, so there is an interaction between the area covered by an OA and its population size. Less dense Rural OAs are usually larger, while Urban OAs are smaller. LAD classifications are based on proportions of populations living within OA level classifications. If a direct majority population or OA count approach was taken, most LADs would be classified as Urban due to the interaction between population density

and OA size. LAD classifications are divided into four categories based on their populations:

1. Majority Rural: had at least 50% of their population residing in Rural OAs.
2. There are two intermediate classes representing LAD with diverse settlement contexts.
    a) Intermediate Rural: 35-50% rural population
    b) Intermediate Urban: 20-35% rural population
3. Urban: 20% or less of the population lived in rural OAs.

Each 2021 LAD category is split into one of two Relative Access categories, using the same data as the 2021 Output Area RUC. If more than 50% of a LAD population lives in ‘Nearer a Large Settlement’ OAs, it is deemed ‘nearer a Large Settlement’; otherwise, it is classified as ‘further from a Large Settlement.’ A notable benefit of the new 2021 LAD approach is its simplified classification structure, which mirrors that used in the 2021 Super Output Area and OA RUC. A map of the new LAD classification is shown in Figure 2.

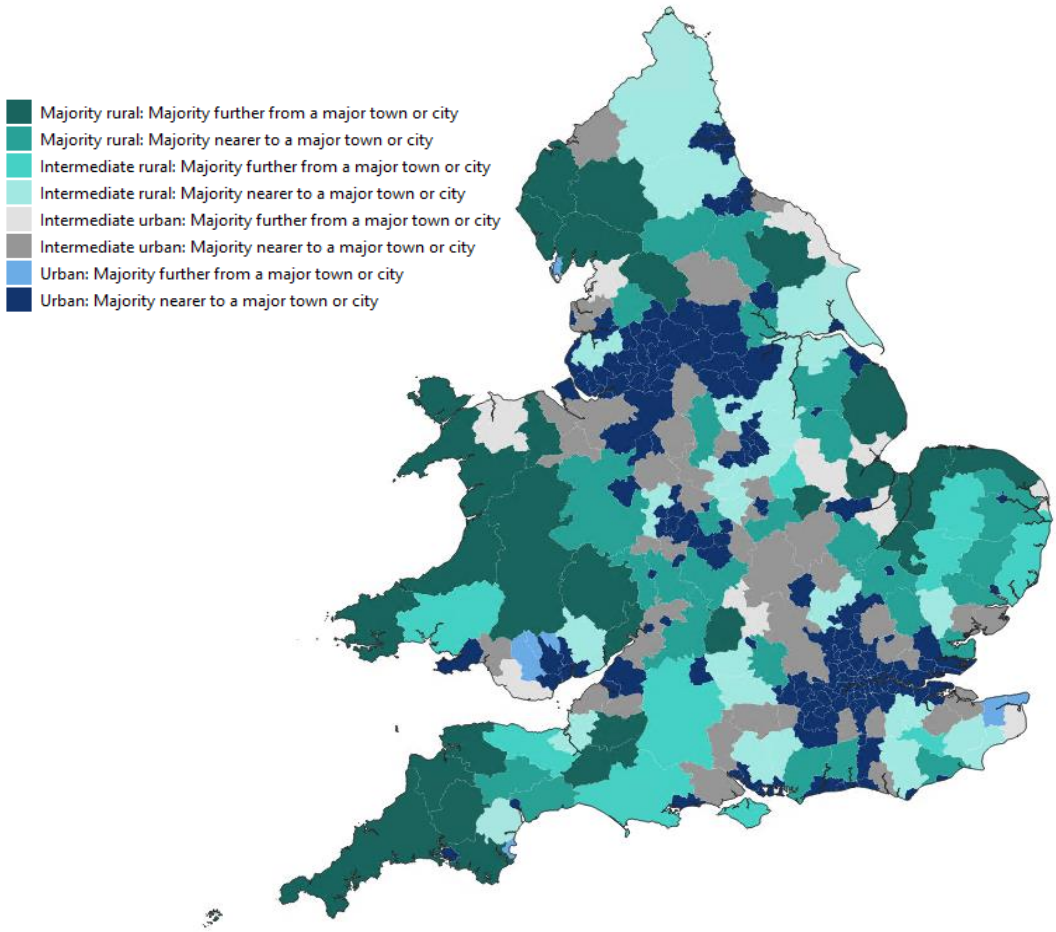


Figure 2: Map of 2021 Local Authority District Rural-Urban Classification for England and Wales.

The previous 2011 Super Output Area RUC and LAD RUC used separate methodologies to ensure that the rural characteristics of LAD were appropriately represented. The previous LAD RUC approach was complex, using the concentration of rural households, non-residential addresses and the portion of the population living in rural areas around a specific settlement to identify ‘Hub Towns.’ Hub Town classifications then determined if an otherwise ‘urban’ LAD should be considered ‘rural’ and was a proxy for populations residing in ‘rurally related’ environments or urban centres surrounded by rural areas. For more information on the 2011 method, please refer to the “2011 Rural-Urban Classification of Local Authority Districts in England: User Guide.”

It should be noted that the 2021 LAD RUC is designed primarily for statistical analysis and presentation of data using a standard national methodology for England and Wales. It is not intended for detailed policy design. We advise utilising LAD RUC classifications only when no suitable Super Output Area level RUC data sources are available for analysis.

The subsequent sections provide detailed technical information on the new 2021 methodology.

# 3. Detailed methodological steps

## 3.1 Identification of settlement morphology

Settlement morphology measures the density of addresses within a given area at a range of scales, with the resulting information recorded as a ‘Density Profile’. This distinguishes between those OAs which are part of a continuous densely urban area, scattered isolated dwellings and all other types of settlement format in-between. This is unrelated to population density, instead assessing the form of the built environment itself.

To enable the calculation of Density Profiles, a grid dividing England and Wales into 50-metre square cells has been created. This high resolution grid improves on the 100-metre grid utilised in the 2011 RUC. The 50-metre grid uses the British National Grid reference system (Ordnance Survey of Great Britain 1936; OSGB36), with the origin point located at coordinates (000000, 000000) just southwest of the Isles of Scilly.

Next, point address data from the Census Address Frame assesses the density of residential properties within each 50 square metre grid cell. Residential addresses are defined as:

"Properties that are or could be lived in. They are not solely commercial or derelict. These can be either private dwellings or communal establishments".

- (Output and enumeration bases: residential address and population definitions for Census 2021 - Office for National Statistics).

This includes communal establishment addresses such as university student accommodation, boarding schools, prisons, military bases and other communal establishments which were previously not included in RUC 2011 density calculations.

For each 50-metre grid cell in England and Wales with at least one residential address (4.7 million grid cells out of 67 million potential grid cells), the number of residential addresses within radii of 200, 400, 800 and 1,600 metres are counted. Density is calculated by dividing the number of address points by the area of land within each distance radius. This is referred to as the 'Density Profile' of a grid cell. Cells without residential addresses, such as agricultural lands, forests, or non-residential areas, are only included in the area calculation of Density Profiles for nearby cells containing residential addresses.

| | Density at 200 metres | Density at 400 metres | Density at 800 metres | Density at 1.6 kilometres |
|---|---|---|---|---|
| Cell 'X' | 7.7 | 6.5 | 3.3 | 0.8 |

Table 1 Illustrating a 'Density Profile' for an example 50-metre grid cell.

Grids in coastal regions have their Density Profiles calculated differently from the 2011 method. Specifically, density is now measured based on the total land area within each radius, defined as all land within the 2022 Countries Full Clipped (BFC) boundaries, trimmed to the coastline (Mean High Water mark). This refinement allows for a more precise assessment of coastal density, more accurately reflecting the nature of coastal settlements with extensive shorelines. The 2011 RUC included areas below the mean high-water mark (in the sea) in their calculations, which could cause densely populated coastal zones, urban centres, or ABUAs to appear less densely built due to the inclusion of surrounding coastal waters.

The new coastal density technique identifies 1,141 50-metre grid cells with addresses located just outside the England and Wales land boundary, typically marinas or moorings slightly offshore. The majority of these are reassigned to their nearest Output Area (OA) using the Full Extent boundary. The remaining ~60 50-metre grids are manually reallocated to their closest OA.

It is important to note that areas north of the Anglo-Scottish border are also omitted from Density Profile calculations due to the absence of Scottish addresses in the

Census Address Frame. Consequently, some small settlements within 1.6 kilometres of the border may exhibit a slightly lower or higher density than in the past. Quality assurance processes indicate that these areas continue to be classified as rural, owing to the very low density of addresses in this region. An exhaustive list of Settlements within 1.6 kilometres of the border are:

- Norham (E63000003 unaffected)
- Cornhill on Tweed (E63000006)
- Blackbank (E63000080 unaffected)
- Longtown (E63000074 unaffected)

The resulting Density Profiles for each grid cell are used to assign a Settlement Classification, based on the work of Bibby and Shepherd (2004). These are classifications of each grid cell based solely on the density profile information.

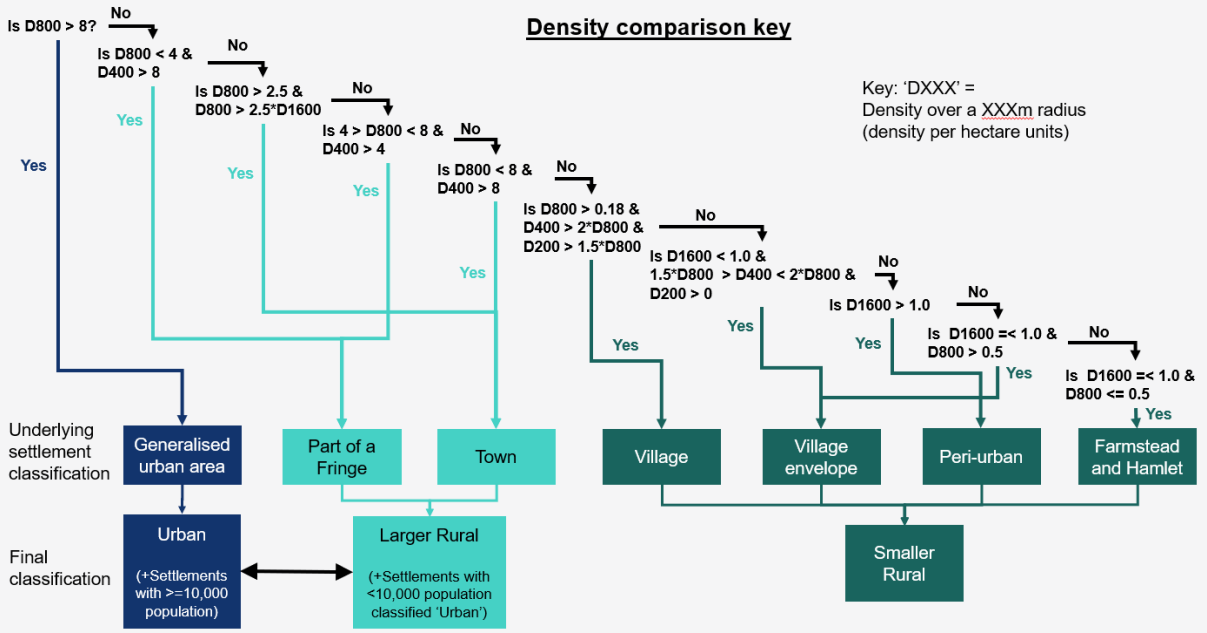


Figure 3: Density profiles for settlement types and their final Density Classification for RUC 2021.

To streamline the RUC, various settlement classification groups have now been merged into the final Density Classification, shown in Table 2 below. Several settlement types have similar properties or are assigned to small numbers of Output Areas. This means that it is difficult to produce statistics for these areas, as their population totals are so small. As a result, they are usually aggregated with other similar settlement classes. The final classification combines low density rural settlements into 'Smaller Rural Settlements', while larger market towns and suburban fringe areas with a medium density are 'Larger Rural Settlements'. Strictly speaking, smaller and larger are not determined by population size, but by their dwelling

density profiles. However, they are likely to be consistent with what people regard as smaller or larger settlements. High density areas remain ‘Urban’. To further refine the classification, this is combined with additional Built Up Area geographies and a ruleset based on a population threshold of 10,000 to ensure that where possible further contextual information is included. More detailed information can be found in Section 3.3.

| Step | Underlying classification rules for Density Profile | Underlying Settlement Classification | Final Density Classification |
|---|---|---|---|
| 1 | If the 800-metre density is greater than 8 residential addresses per hectare | ‘Generalised urban area’ | ‘Urban’ |
| 2 | If density at 800 metre (in hectares) is less than 4 residential addresses per hectare and the density at 400 metre is greater than 8 | ‘Part of a Fringe’ | ‘Larger Rural Settlement’ |
| 3 | The density at 800 metres is greater than 2.5 residential addresses per hectare and density at 800 metres is greater than 2.5 times the density at 1.6 kilometres | ‘Town’ | ‘Larger Rural Settlement’ |
| 4 | If the 800-metre density is between 4 and 8 residential addresses per hectare and the density at 400 metres is greater than 4 residential addresses per hectare | ‘Part of a Fringe’ | ‘Larger Rural Settlement’ |
| 5 | If the 800-metre density is less than 8 residential addresses per hectare and the 400-metre density is greater than 8 residential addresses per hectare | ‘Town’ | ‘Larger Rural Settlement’ |

| | | | |
|---|---|---|---|
| 6 | If the 800-metre density is greater than 0.18 residential addresses per hectare and the 400-metre density is greater than twice the density at 800-metre and the 200-metre density is greater than 1.5 times the 800-metre density | ‘Village’ | ‘Smaller Rural Settlement’ |
| 7 | If the 1.6-kilometre density is greater than 1 residential address per hectare and the 400-metre density is between 1.5 to 2 times than of the 800-metre density and the 200-metre density is greater than 0 residential addresses per hectare | ‘Village envelope’ | ‘Smaller Rural Settlement’ |
| 8 | If density at 1.6 kilometre is greater than 1 residential address per hectare | ‘Peri-urban’ | ‘Smaller Rural Settlement’ |
| 9 | If density at 1.6 kilometre is less than or equal to 1 residential address per hectare and 800-metre density is greater than or equal to 0.5 residential addresses per hectare. | ‘Village envelope’ | ‘Smaller Rural Settlement’ |
| 10 | If the 1,600-metre density is less than or equal to 1 residential address per hectare and the 800-metre density is less than 0.5 residential addresses per hectare. | ‘Hamlet or farmstead’ | ‘Smaller Rural Settlement’ |

Table 2 Density profile classification rules, underlying Settlement Classifications and Final Density Classifications

Each OA is assigned an overall underlying settlement Classification derived from the predominant Density Class of grid cells within it. An adjustment is made for the ‘hamlet or farmstead’ category to account for the low number of addresses but extensive number of grid cells they occupy. Grid cells in this category are assigned a

weight of 0.25 per cell, all other categories being assigned a weight of one. This necessitates four times as many grid cells classified as ‘hamlet or farmstead’ for an entire OA to be classified as such.

In some rare instances, typically in heavily built-up or densely populated areas, some output areas (OAs) do not intersect with any 50-metre centroids. This occurs where OAs are extremely small (e.g. densely populated tower blocks) but can also result from an OAs shape preventing it from intersecting with a 50-metre centroid. In such circumstances (n = 160), the OA is given an interpolated value based on the weighted average density of neighbouring OAs (see Figure 4). The average density was weighted using the proportional overlap of the surrounding 50m grids with the OA.

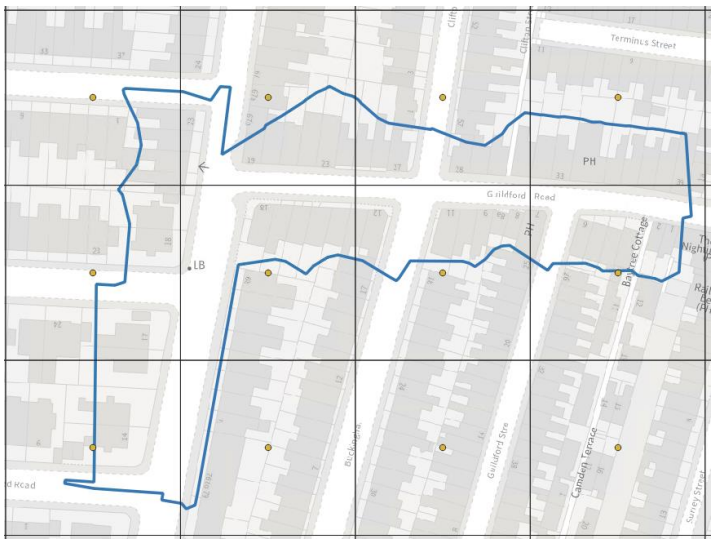


Figure 4: An example of an OA (blue boundary) which misses all surrounding 50m gid centroids (yellow dots) due to its shape. Weighted density figures using the proportional area overlap of the 50m grids with the OA are used to interpolate a density for the OA. Basemap: © Ordnance Survey

## 3.2 Settlement morphology classification

### 3.2.1 Identifying the Built Environment

Output Area Density Classifications are further refined using a ruleset that accounts for intersections with large areas of the built environment and the population sizes of those areas. This ensures consistency of method with previous RUCs, going back to 2001.

The 2022 Ordnance Survey Built-up Areas (BUAs) are an additional layer that may affect the final density classification. BUAs are urban extents based on topographic data, Land Use Sites and Settlement Named Areas data, and cover at least 20

hectares. For the 2021 RUC, BUAs are used to create 'Amalgamated BUAs (ABUAs)' similar to the larger 2011 BUAs. These represent urban environments and their wider conurbations. However, the new ABUAs represent an improvement to the 2011 BUA methodology, better characterising smaller elements of the built environment (due to the upgrades made by Ordnance Survey in their production of the 2022 BUAs), and in developments to the methodology used to combine those BUAs into larger ABUAs representing urban conurbations. Detailed information on the production of ABUAs can be found below in Section 3.2.2.

Key to this change is the use of the 2022 BUAs, which most closely represent the built environment during 2021, coinciding with the population data from Census 2021. 2011 RUC utilised the 2011 BUAs, which captured the broader conurbation of each built environment and represented the highest level of the OS classification. 2011 BUAs were then split into a secondary classification, called Built Up Area Subdivisions (BUASDs) which represented individual towns within a wider conurbation. The 2022 BUAs now focus on individual named communities, and the resulting boundaries are more akin to the 2011 BUASDs.

The 2022 BUA OS product is used as the basis of the 2021 RUC ABUAs and is accessible via the ONS geoportal as the Built Up Areas (December 2022) Boundaries GB BGG.

### 3.2.2 Amalgamated Built Up Areas (ABUAs)

The ABUAs of the 2021 RUC represent wider urban conurbations, collections of BUAs produced by ONS and are broadly analogous to the 2011 BUA geography. By producing the RUC using ABUAs, it is possible to minimise methodological discrepancies from the 2011 RUC. The ABUAs are built using the 2022 OS BUA product and a lookup detailing the relationship between 2022 BUAs and ABUAs is available in the Supplementary Information in the downloads section of the 2021 Rural Urban Classification page.

In an improvement to the method used in the production of BUAs in 2011, the 2022 BUAs that join to make ABUAs are linked if they are within 200 metres of one another and have an adjoining road. This prevents the combination of adjacent BUAs that are divided by rivers, motorways, railway lines and other geographic features that may prevent easy access.

To produce the ABUAs used in the 2021 RUC, two input datasets are used – the 2022 Built Up Areas geography and the Ordnance Survey Open Roads dataset (October 2022). To determine if two BUAs should be joined, the dead-ends or junctions from the Open Roads dataset are intersected with 2022 BUA geographies. Those portions of the network within BUAs are then removed to leave only

connecting portions of the road network. A point is then created to represent each road crossing a BUA boundary if the road links two BUAs. Convex hulls are created, which in essence, are the smallest area that outlines the points associated with each BUA that join to another BUA. The resulting BUA convex hulls are grouped if they are within 200 metres of one another, to produce the final ABUAs.

Fundamentally, this means that Built Up Areas are combined into an ABUA if they were within 200m of each other and have a direct road connection.

The exception to this is BUAs and OAs in London, given the substantial influence of the London metropolitan area and surrounding urban area. In these cases a single ‘London’ ABUA has been produced, which includes all BUAs and associated OAs within the London Region (E12000007).

Some additional adjustments have been made to the ABUAs in the 2021 RUC. Observations indicated that several 2022 BUAs were influenced by their proximity to High Speed 2 construction sites. In the 2022 BUA product, construction sites were included as part of the ‘built environment’, causing settlements within 200 metres of the HS2 construction site to be joined into several larger BUAs (see Figure 5). To account for this in the 2021 RUC, the HS2 feature was removed and the affected BUAs were split into distinct settlements. This change impacted approximately 33 BUAs and 24 ABUAs.

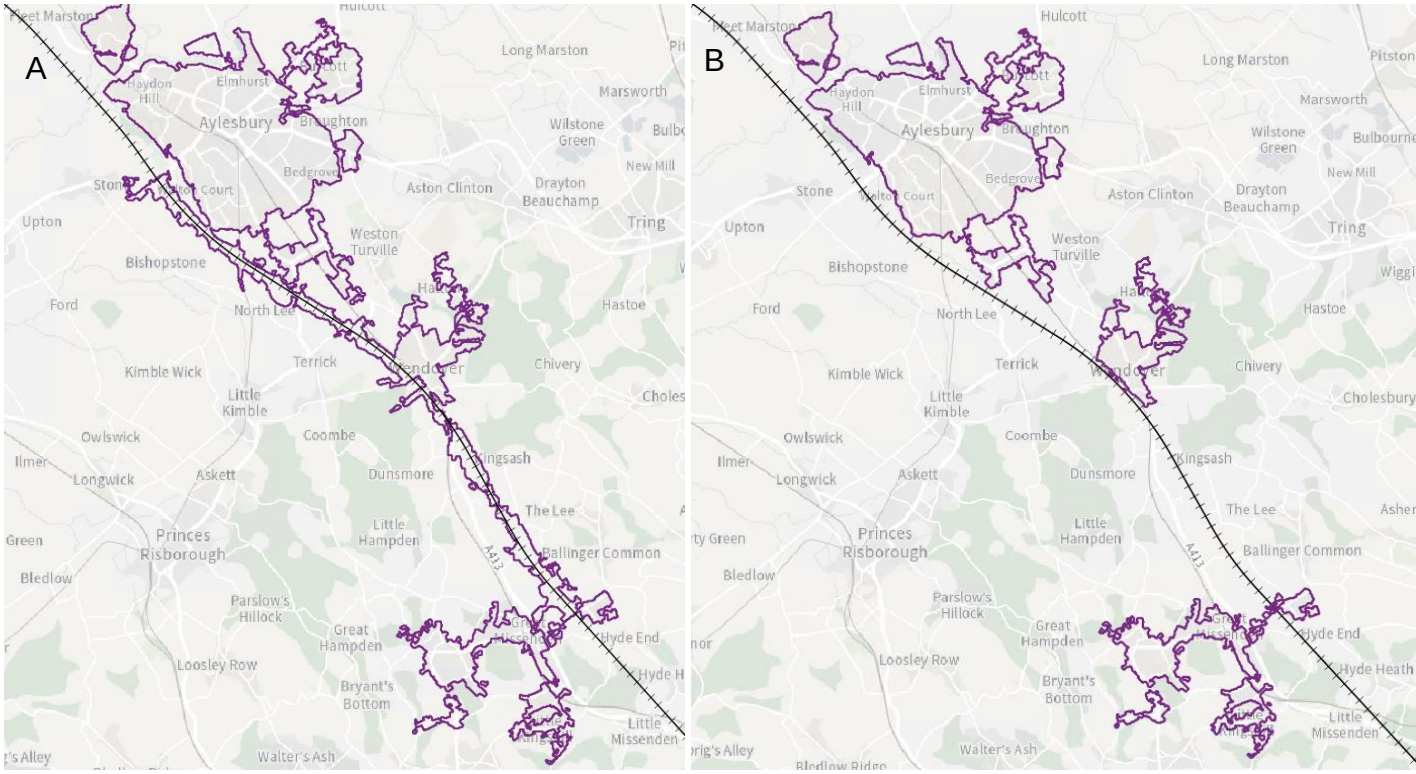


Figure 5: (A) Map showing HS2 construction joining the smaller rural settlements of Great Missenden and Wendover to the larger Aylesbury settlement as one Amalgamated BUA (ABUA). The ABUA boundary is shown in purple with the HS2 route in black. (B) Map showing the HS2 construction removed and the now separate ABUAs covering Aylesbury, Wendover and Great Missenden. Basemap: © Ordnance Survey.

## 3.3 OA allocation to ABUAs

To ensure alignment with the previous 2011 RUC methodology, each OA was assessed to determine whether it intersected with the built environment – in this case the ABUAs described above in Section 3.2.

ABUAs represent the physical built environment closest to the Census 2021 date, providing the most accurate population and location estimates at Output Area (OA) level. As described in Section 3.2, some ABUA represent combinations of BUAs, while others are a single unconnected BUA. The use of ABUAs in the 2021 Rural-Urban Classification (RUC) allows for broad comparability with the 2011 classifications.

The allocation of an OA to a ABUA utilises the ONS OA21 to BUA22 best-fit lookup. Each OAs is assigned to a BUA if its population-weighted centroid (PWC) falls within

a BUA's boundary. PWCs are a single point within a geography representing the spatial distribution of the population.

Where a PWC for an OA intersects with an ABUA, its Density Classification may be adjusted based on the ABUA's total population size. OA usual resident population estimates from Census 2021 are aggregated to produce a total population count for each ABUA. If an OA PWC intersects an ABUA with fewer than 10,000 inhabitants and its Density Classification is 'Urban' it is reclassified as a 'Larger Rural Settlement'. Conversely, if the OA PWC is located within an ABUA housing over 10,000 people, it is classified as 'Urban' irrespective of its Density Classification.

| **Settlement Population** | **Density Classification** | | |
|---|---|---|---|
| | Urban | Larger Rural Settlement | Smaller Rural Settlement |
| **NA** | Urban | Larger Rural Settlement | Smaller Rural Settlement |
| **<10k** | Larger Rural Settlement | Larger Rural Settlement | Smaller Rural Settlement |
| **>10k** | Urban | Urban | Urban |

Table 3 The effect of the Settlement 10k population rule.

In exceptional cases where an OA is adjacent to an ABUA, but does not have a PWC that intersects, there can be a significant Density Classification discrepancy. This is especially problematic when an ABUA classified as 'Urban' is downgraded to 'Larger Rural Settlement' due to having less than 10,000 residents (see Figure 6). Consequently, adjacent OAs may retain an 'Urban' classification due to their density, despite their proximity to a 'Larger Rural Settlement.', causing isolated 'Urban' islands, surrounded by OAs with 'Larger Rural Settlement' classifications.

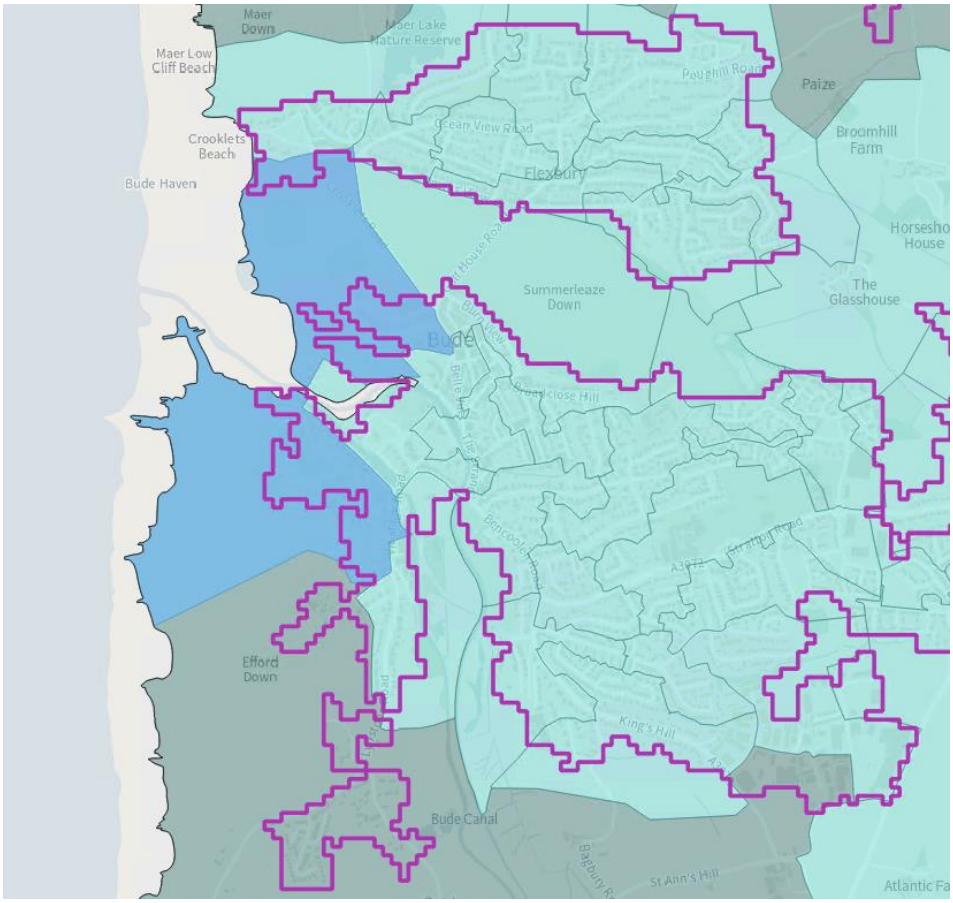


Figure 6: An example of an OA with a PWC outside of ABUA that was realigned based on where the majority of it's addresses were located. The OA (E00095637; shown in light blue) had an "Urban" Density classification, and its PWC falls outside of Bude ABUA (boundary shown in purple) in Cornwall. 50% of the OA addresses were in 50m grids within the Bude ABUA, so the classification was aligned assigned to 'Larger Rural' to align with the ABUA. Basemap: © Ordnance Survey

To address these anomalies, if more than 50% of addresses for an intersecting OA is in 50-metre grid cells which are within a single ABUA boundary, the OA is re-classified to the same category as the ABUA. This reallocation results in 836 OAs changing their classification as shown in Table 4 below.

| OA change due to 50% address rule | Number of OAs affected |
|---|---|
| **From 'Smaller Rural' to 'Urban'** | 374 |
| **From 'Smaller Rural' to 'Larger Rural'** | 212 |
| **From 'Larger Rural' to 'Urban'** | 193 |
| **From 'Urban' to 'Larger Rural'** | 49 |
| **From 'Larger Rural' to 'Smaller Rural'** | 8 |

Table 4: The number of OAs affected by the 50% address reallocation rule, split across the categories that they were reallocated to.

For OAs which do not intersect ABUAs, classifications are based exclusively on the Density Classifications outlined in Section 3.1, leading to the final OA level RUC.

## 3.4 Relative Access category calculations

The updated 2021 RUC has been enhanced by including Relative Access measures, which indicate how well any given OA or geography connects to other BUAs when compared with other geographies. This additional context emphasizes the potential access residents of these areas have to urban settlements. These measures are derived from the ESRI ArcGIS Pro 'Generate Service Areas' tool, using a dataset that incorporates network analysis of historical, live, predicted and modelled drive times. The data was extracted on March 12th, 2024.

Fifteen minute travel isochrones are calculated from each BUA PWC for up to an hour travel. Each isochrone represents how far you can get in each direction from the centroid within 15, 30, 45 and 60 minutes. Users should note that these are not precise measures of travel time to specific locations from a given address, but rather categories representing relative measures of access that indicate potential area reachable in a short period of time.

In previous RUC iterations, Sparsity served as the secondary classification element to capture a settlement's context in its broader environment. Density calculations are relative to their measurement scale; while densities at 200, 400, 800, and 1,600 metres are sufficient to understand a single grid cell's context within an ABUA, they cannot provide wider environmental context. Sparsity calculations assessed density at larger scales, evaluating addresses within 10, 20, and 30 kilometres of each grid cell to understand how the cell and its related settlement relate to others.

In the 2011 RUC, the 'Sparse' category only included the bottom 5% of OAs at each of the 10, 20, and 30 kilometres scales, equating to 1.9% of OAs overall. This meant that the majority of OAs overall (98.1%) were in the 'less sparse' category.

The new Relative Access measure is considered an improvement on the Sparsity measure for several reasons. Sparsity did not enable assessment of Relative Access – while a settlement may be isolated in terms of a geographic location, it may have easy access to several other large BUAs due to road infrastructure. Furthermore, the inclusion of 98.1% of OAs in the 'less sparse' category meant that the 2011 RUC was less able to describe relative differences in access to jobs, services and amenities within OAs for the majority of England and Wales. The implementation of Relative Access means that it is possible to understand that it is not only the most geographically isolated that may have lower levels of access to economic opportunity and amenities and can differentiate between Rural areas with nearby access to cities. These areas may have better access to goods, services and opportunity than similar rural places with comparably lower access to similar large urban areas. This relative location of rural OAs can influence the location and types of economic opportunity and access to amenities that are available to residents in rural OAs.

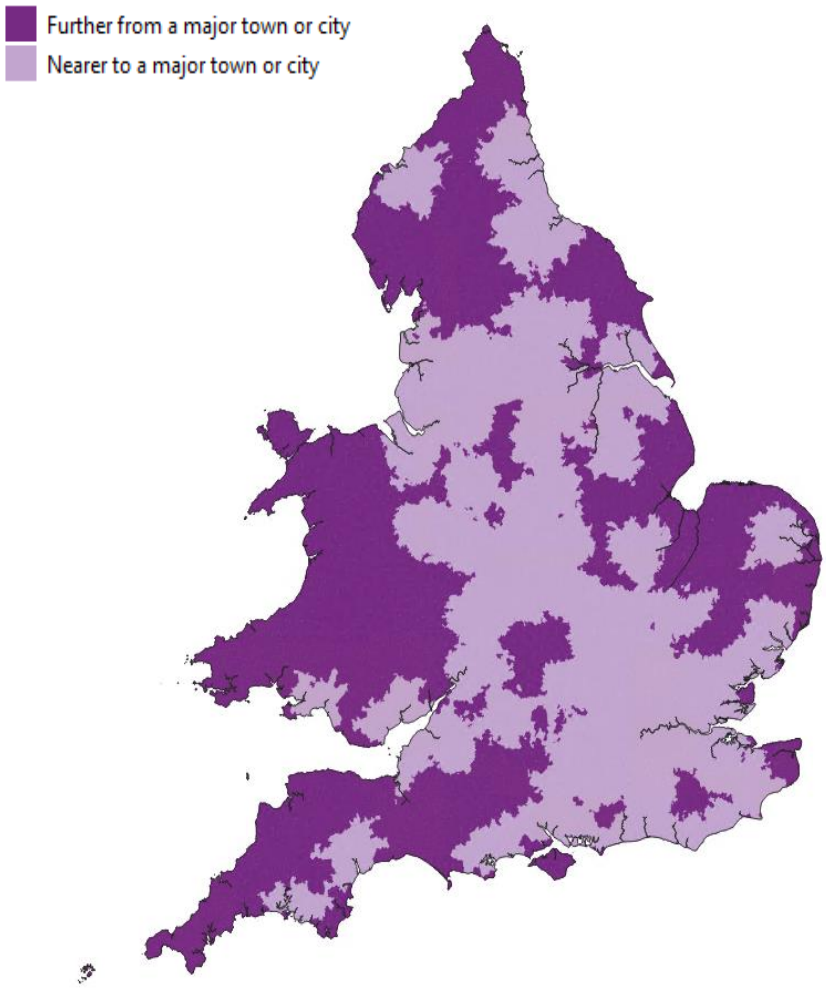


Figure 7: Map of Output Area 'Relative Access' classification. Areas 'nearer to a major town or city' are light purple and area 'further from a major town or city' are dark purple.

Inclusion of Relative Access measures allows users to distinguish between physically isolated settlements and those with close potential access by road or car to cities or larger towns (see Figure 7). Calculation of the Relative Access measure is based on travel times estimated from each BUA population-weighted centroid (PWC) with a population of at least 75,000 (akin to a large town or small city) and BUA or OA PWCs reachable within 30 minutes.

Each OA has a Relative Access estimate calculated, allowing it to be classified as 'Nearer' or 'Further' from a major town or city. First, the population-weighted centroids (PWCs), for each OA are determined. The PWC is a single point representing where the majority of the population are located. To approximate journey times, each OA is assigned to its nearest road within 200m. Where an OA PWC falls more than 200m away from a road (n = 26), this is extended to 500m. Where the OA PWC still does not intersect with a buffer (n=2), the OA is assigned the same journey time as its closest neighbouring OA. These points represent the nearest access to the road network for each OA. Journey time is calculated from all BUA PWCs with a population of 75,000 to their surrounding areas which are reachable within 30 minutes.

Those OAs that can access one of these BUAs within 30 minutes are classed as 'nearer' while those that cannot are 'further'. The tables in the RUC 2021 Supplementary information download include further cuts of the classification, which classify OAs by their access to places of 10,000 (Small urban areas) and 30,000 (Medium urban areas) people, as well as those OAs which cannot reach any BUAs with a population of 10,000 (Remote). This can be found in the downloads section of the 2021 Rural Urban Classification webpage.

Users should be aware that these estimates combine actual average historical travel times, live (four hours prior to 12:00pm on the 12th of March 2024), predicted (up to four hours after 12:00pm on the 12th of March 2024) and modelled data. While this average represents an average journey time, it does not precisely reflect door-to-door travel time. These measures serve as proxy indicators of access to services, goods, opportunities and jobs. Care should be taken not to overinterpret them; they illustrate comparative access between geographies rather than individual access. The method does not assess individuals' ability to utilise the available infrastructure, nor does it evaluate economic or time costs. Although the Relative Access classifications are dichotomous, they are based on the majority population within the geography and may not represent the experiences of all residents. It is theoretically possible to have a 'nearer to a major town or city' classification for a geography where almost half the population lives in 'further from a major town or city' area. This is especially apparent in higher level Super Output Area geographies, which contain greater variation in the OAs that they are composed of.

For the RUC 2021 Supplementary tables, additional groups were produced:

1. Nearer to a major town or city (75,000) within 30 minutes
2. Nearer to a medium urban area (30,000 people) within 30 minutes.
3. Nearer to a small urban area (10,000 people) within 30 minutes.
4. Remote – no access to urban areas of 10,000 people within 30 minutes.

Note that the “Nearer to a Small urban area” is independent of the “Smaller Rural Settlement” category from the density based classification. “Small urban areas” in the Relative Access class are those BUAs with a population of 10,000 and do not include any information on density.

When these additional Relative Access classifications are combined with Density 11 categories are produced for the Supplementary tables:

- Urban over 250k: Nearer to a major town or city.
- Urban: Nearer to a major town or city
- Urban: Nearer to a medium urban area
- Urban: Nearer to a small urban area
- Large rural settlement: Nearer to a major town or city
- Large rural settlement: Nearer to a medium urban area
- Large rural settlement: Nearer to a small urban area
- Large rural settlement: Remote
- Small rural settlement: Nearer to a major town or city
- Small rural settlement: Nearer to a medium urban area
- Small rural settlement: Nearer to a small urban area
- Small rural settlement: Remote

## 3.5 Super Output Area Rural Urban Classifications

LSOA and MSOA Density Classifications are derived from OA data using a majority population rule. Each LSOA or MSOA is classified according to the Density category of the majority OA Census 2021 population within it. For example, if an LSOA has 1800 people in ‘Urban’ OAs and 1200 in ‘Small rural Settlement’ OAs, it is classified as ‘Urban’. The same rule applies to the Relative Access category, whereby if the majority of the population resides in ‘Nearer to a major town or city’ OAs, the higher-level geography is designated as ‘Nearer to a mayor town or city’ and vice versa. The population majority rule for Density Classification and Relative Access categories are applied independently of one another.

## 3.6 Detailed Local Authority District (LAD) methodology

Classifications of LAD are slightly different to the method used for Output Areas and Super Output Areas. As the size of an OA is a function of the population size,

densely populated areas have higher numbers of smaller OAs. If the majority population rule classification method was used for LAD, almost all LAD would be classified as Urban. This is because the OA classification is still settlement based and is affected by the interaction between statistical geographies and population density (see Section 3.3). For an entire LAD to be classed as Rural using this method, it would need to contain very large numbers of Rural OAs or very low-density settlements.

### 3.6.1 LAD Density Classifications

In place of the population majority method used for smaller statistical geographies, an LAD (Local Authority District) is considered ‘Majority rural’ if the majority (i.e., 50% or more) of its population resides in OAs classified as ‘Rural’. Two intermediate categories exist: ‘Intermediate Urban’ and ‘Intermediate Rural’, which describe LAD with significant heterogeneity. ‘Intermediate Rural’ LAD have 35-50% of their population in Rural OAs, indicating a substantial minority proportion living in settlements with a rural character. These might include several small towns or large hinterlands around a single town or city. ‘Majority Rural’ and ‘Intermediate Rural’ form the ‘Rural’ part of the LAD classification. Conversely, ‘Intermediate Urban’ LAD consist of 20-35% of the population living in rural OAs, indicating that while the majority is Urban, there are notable pockets of rurality. Finally, an LAD is classified as ‘Urban’ if 20% or fewer of its population lives in rural OAs. These areas may have substantial Urban coverage with continuous urban sprawl, contain large ABUAs, or multiple smaller ABUAs separated by small patches of more rural character.

These categories differ from those used in the 2011 LAD RUC, but are now more internationally comparable. In 2011 it was necessary to define hub towns; urban places of between 10,000-30,000 population which could be providing key services to rural areas. The population in these hub towns were treated as ‘rural-related’ and counted towards the rural population even though they were urban in nature. In the 2021 LAD RUC, hub towns have been removed. This change has been made to simplify the method, ensure that lower-level geography classifications better align with the LAD classifications and to ensure that the urban population centres within these otherwise rural LAD are reflected accurately in the data. In 2011 the categories were defined as:

- Predominantly urban – greater than or equal to 74% of the resident population lives in urban areas. These included the categories:
    - Urban with major conurbation
    - Urban with minor conurbation
    - Urban with city and town
- Urban with significant rural – between 26 to 49% of the resident population lived in rural areas (including hub towns)

- Predominantly rural – greater than or equal to 50% of the resident population lives in rural areas (including rural-related hub towns)
    - Largely Rural – between 50% to 79% of the resident population lived in rural areas (including hub towns)
    - Mainly rural – greater than or equal to 80% of the resident population lived in rural areas (including hub towns).

The 2011 and 2021 LAD RUCs are not directly comparable due to methodology changes. However how the broad categories relate to each other between 2011 and 2021 can be found in Figure 8.

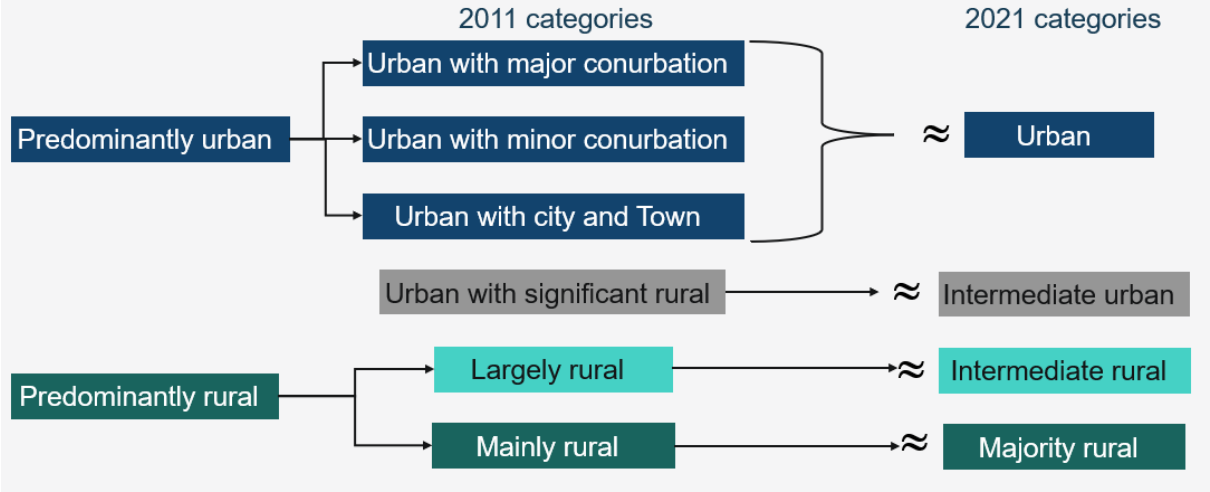


Figure 8: The broad comparisons between 2011 and 2021 LAD RUC categories. Please note that the categories are not directly comparable due to methodology changes.

The largest changes seen between 2011 and 2021 are in local authorities which had substantial hub towns. Typically these local authorities move from the ‘predominantly rural’ category in 2011 to the ‘Intermediate’ categories in 2021. Most LADs have remained unchanged (Table 5).

| LAD RUC change between 2021 and 2011 | Number of LADs | Percentage of LADs (%) |
|---|---|---|
| Stays Urban | 170 | 51.4 |
| Stays Majority rural | 38 | 11.5 |
| Stays Intermediate urban | 34 | 10.3 |
| Welsh LADs (no 2011 LAD classification) | 22 | 6.6 |
| Stays Intermediate rural | 20 | 6.0 |
| Intermediate urban 11 to Intermediate rural 21 | 13 | 3.9 |
| Urban 11 to Intermediate urban 21 | 13 | 3.9 |
| Intermediate rural 11 to Majority rural 21 | 12 | 3.6 |
| Majority Rural 11 to Intermediate rural 21 | 10 | 3.0 |
| Intermediate rural 11 to Intermediate urban 21 | 8 | 2.4 |
| Intermediate urban 11 to Urban 21 | 5 | 1.5 |
| Intermediate rural 11 to Urban 21 | 1 | 0.3 |
| Intermediate urban 11 to Majority rural 21 | 1 | 0.3 |
| Urban 11 to Intermediate rural 21 | 1 | 0.3 |

Table 5: Approximate change in LAD RUC classifications between 2011 and 2021. Please note that the 2011 and 2021 LAD RUC are not directly comparable due to methodology changes and boundary changes.

## 3.6.2 LAD Relative Access Categories

As with the Super Output area 2021 RUC, Relative Access replaces the ‘Sparsity’ measure of the 2011 RUC. The LAD Density Classifications are integrated with the Relative Access categories (see Section 3.4) to form a two-part LAD RUC. The Relative Access category of ‘near a major town or city’ or ‘further from a major town or city’ is appended based on whether the majority of population are able to reach a major town or city (those with populations of 75,000 or more) within 30 minutes. This adds context for users about potential access levels, which includes Relative Access to adjacent settlements in neighbouring LAD. Thus, LAD can be categorised as ‘Rural, near a major town or city’ if they are primarily rural but offer easy access to Urban areas in adjacent LAD. Conversely, Urban environments with lower levels of accessibility can also be identified.

Users should exercise caution when interpreting Relative Access categories, especially for higher-level geographies. Although the classifications are dichotomous based on the majority population within the geography, they may not represent the experiences of all residents. It is theoretically possible to have an ‘near a major town or city’ geography where almost half the population lives in ‘further from a major town or city’ areas. Larger geographies will contain more heterogeneity between the OAs

composing the geography. For this reason we recommend use of the super output area RUC versions where possible as they are more likely to be homogeneous.

# 4. Summary

The 2021 RUC enables the production of statistical analyses for geographies that share similar settlement morphologies. Using a standardised method which compromises improvements in methodology with consistency with previous RUCs, the 2021 RUC enables national comparisons between geographies across categories. In this way, users can aggregate data to understand the disparities between populations living in geographies characterised by Urban, Larger Rural or Smaller Rural Settlements. Those with specific research questions about the impact of Relative Access or ABUA population size differences can make use of the supplementary tables provided to define alternative cuts of the classification which may better suit their area or research aims.

The update represents a continuation of the 2011 methodology, with several improvements. Advances in geographic data over the past decade have increased resolution, ensuring that underlying Density Profiles are more accurate. Coupled with adjustments for coastal areas, density estimates for coastal settlements will have improved fidelity.

The streamlined taxonomy of the classification means that the same underlying data sources can be used to create Density Profiles and Relative Access classes for geographies from OA to LAD. In the past, the LAD level classification was extremely complex and calculated independently of the OA to MSOA classification. The simplified 2021 RUC method is consistent across geographies and is more accessible to users.

Replacement of Sparsity estimates with Relative Access should be particularly valuable. The Relative Access category provides additional context to the classification, enabling analysis of areas by their ability to reach a Major town or city. This represents the potential ability of those within communities to reach a wider range of goods, services and opportunities. The development of this metric improves understanding of the impact of remoteness on rural (and urban) communities and may shed additional light on some of the challenges faced by these areas.

While there are a range of improvements to the method, it is important that users of the taxonomy understand that these classifications should not be used in isolation. The RUC is not an effort to define geographies for specific policy, planning or land use needs and continues to be a classification for statistical analysis. The RUC does not assume that all areas within a category are the same, have equal levels of access or have identical urban or rural characteristics. Instead, the classification is an

effort to collate places that are most similar to one another into the same category. By aggregating data of interest by these categories, users can determine whether there are clear differences in the experience of populations within those categories, helping to elucidate challenges faced by rural and urban communities.

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