census 2021

Consultation

Census 2021 Output Geography Policy, products and services

November 2020

Contents

Background

This document sets out the latest plans by the Office for National Statistics (ONS) for Census 2021 in England and Wales. It covers geography outputs policy, products and services. This follows on from a previous consultation in February 2018 entitled 'Initial View on 2021 Census Output Content Output Design'.

The consultation in 2018 gave us an insight into user interest and importance of different geographies for 2011 Census information. Users indicated the most important listed geographies were, in order:

1. local authorities
2. wards
3. Lower Layer Super Output Areas (LSOAs)
4. Output Areas (OAs)
5. counties/upper tier local authorities
6. regions
7. parishes
8. Middle Layer Super Output Areas (MSOAs)
9. countries
10. postcodes

We're committed to disseminating census outputs on a range of geographies to reflect user needs.

A key feature of census outputs for wards (divisions in Wales) and parishes from the 2001 and 2011 Census is that they were derived by aggregating census information for component OAs. This method is described as OA best-fit. It's also used to produce census outputs for higher level geographies and features as part of a geography policy for the Government Statistical Service (GSS).

The OA best-fit approach is well established. It's helped produce and disseminate census statistics for different geographies over the past 20 years. However, we're aware that boundary changes over this period have created some issues where wards and parishes have changed. This consultation sets out options for producing outputs for wards and parishes, including a refinement to the OA best-fit approach.

After the 2001 Census, we created OAs with target population and household thresholds that were designed to nest within wards and parishes. Aggregations of these OAs then formed LSOAs, and aggregations of these LSOAs in turn formed MSOAs. This hierarchy of OAs, LSOAs and MSOAs together formed the statistical small area geography hierarchy, each with their own target population and household thresholds.

The hierarchy now supports collection, analysis and dissemination of official statistics by providing a stable geographical referencing base. This base is unaffected by the frequent boundary changes that can affect administrative

geographies. The hierarchy is well established and widely and routinely used in statistical analysis and research and in the public, private and academic sectors. It's now the official policy of the GSS that the hierarchy is used to make sure that published small area statistics are consistent and comparable for all geographical elements. This approach has proven popular with many users over time.

For the 2011 Census, outputs for wards and parishes were produced by aggregating statistics for component OAs. In some situations where there had been ward and/or parish boundary changes since the 2001 Census, OAs no longer neatly aligned with the ward and/or parish boundary. In such cases, whole OAs were assigned to wards and parishes based on the location of the OA population-weighted centroid. This reflects the current OA best-fit policy, which was followed when producing 2011 Census outputs. These outputs were based on the principle of OAs being used as building blocks to produce census statistics for most other geographies. National parks were an exception where there was a strong user case for census information on the exact geography rather than derived from best-fitting of OAs.

In 2007, we ran a public consultation to inform whether the small area geography hierarchy should be maintained for the 2011 Census. This consultation showed strong support for the hierarchy to remain as stable as possible, to provide consistent time series and comparisons between different statistical topics.

In 2010, we ran an output geography consultation that identified strong support for producing a new geography. It's known as "Workplace Zones" and nests within the OA/SOA hierarchy for the dissemination of business and workplace-related statistics. This new geography is now established and covers the whole of the UK.

The recommendations from both consultations formed the basis of the 2011 Census Output Geography Policy. **We intend to keep the Census 2021 Output Geography Policy relatively unchanged from the one formed in 2011, based on user feedback. However, users can express their views on the Census 2021 Output Geography Policy as part of this consultation**.

One planned change for the Census 2021 Output Geography Policy is a targeted realignment of some OA boundaries. This is to overcome some of the degradation between OA boundaries and ward or parish boundaries over time. Degradation occurs from the frequent boundary changes for wards and parishes. Other options have also been considered for improving the quality of ward and parish outputs. We will set out these options in this consultation document and welcome any user comments.

This document:

- sets out the proposed Census 2021 Output Geography Policy

- sets out a proposed list of publicly available geography products and services from Census 2021
- allows users to comment on any aspect of the policy and proposed products and services before the finalisation of plans for disseminating census outputs

We welcome your comments on this consultation, which can be made through the online consultation.

2. Summary - Census 2021 Output Geography Policy

(the full policy is discussed in Appendix 1)

1. The ONS will maintain the principle of stability of OAs and SOAs between 2001, 2011 and 2021 to allow comparability of census information and to support the GSS Geography Policy.

OAs/SOAs will be redesigned only where:

1.1 they have undergone significant population or household change following the 2011 Census (when OA changes were last made)
1.2 improvements to census outputs for wards and/or parishes have been identified that can be achieved through targeted OA boundary realignment

2. The total number of changes allowed under any of the circumstances above will be limited to less than 5% of the England and Wales OA/SOA hierarchy.

Where OAs/SOAs are redesigned they will:

2.1 not normally align to ward and parish boundaries that have changed since 2003, unless they are also further redesigned (see 1.2)
2.2 not necessarily align to real-world features
2.3 not contain only a single, large communal establishment
2.4 not contain fewer than 100 persons or 40 households
2.5 not contain more than 625 persons or 250 households except in a small number of cases

3. OAs/SOAs split by local authority boundary changes since the 2011 Census will be aligned to the changed local authority boundaries.

4. Digital boundaries for geographies, suitable for use within a geographic information system (GIS), will be freely available, subject to agreement with third parties.

5. OAs/SOAs will be coded to bring them in line with the coding and naming policy that forms part of the GSS Geography Policy.

6. **Geography boundaries, products and services will be updated following Census 2021.**

7. **Census 2021 statistical outputs will be produced in line with the GSS Geography Policy.**

8. **We will continue to provide lookup products between postcodes and the OA hierarchy.**

3. Census 2021 output geography – products and services

The following are a list of products we intend to make available as geographic outputs from Census 2021. These are reference information products and do not have any associated Census 2021 statistics. The Census Outputs and Dissemination team will hold a separate consultation on proposed statistical tables and outputs from Census 2021 in due course.

Nomenclature
OAs were created in 2003 from 2001 Census information and constrained to the 2003 administrative boundaries current at the time of their creation. These are referred to as 2001 OAs. The set of LSOAs and MSOAs, built in 2004 from 2001 OAs, are referred to as 2001 Super Output Areas. The OAs produced in 2013 following the 2011 Census are referred to as 2011 OAs. The set of LSOAs and MSOAs, last updated in 2016 from 2011 OAs, are referred to as 2011 Super Output Areas**.** Workplace Zones produced following the 2011 Census based on 2011 Census information are referred to as 2011 Workplace Zones (WZs)**.**

3.1 Digital boundaries

Product description	Full resolution	Generalised (20 m resolution)	Super generalised (200 m resolution)	Extent of the realm	Clipped to the coastline
2021 OA boundary	✓	✓		✓	✓
2021 LSOA boundary	✓	✓	✓	✓	✓
2021 MSOA boundary	✓	✓	✓	✓	✓
2021 WZ boundary	✓	✓		✓	✓

Digitised boundaries for OAs, LSOAs and MSOAs will be available free to download for different resolutions and for both extent of the realm and clipped to the coastline boundaries.

ONS Geography will also provide digitised boundaries for a range of administrative, electoral and health geographies.

In line with the move to open formats in both the OS OpenData and the Public Sector Mapping Agreement (PSMA), boundaries will be available in the open format of Keyhole Markup Language (KML).

3.2 Lookups

Product ref	Product description
1	2011 OA to 2021 OA to 2021 LSOA to 2021 MSOA
2	2021 OA to 2022 Ward
3	2021 OA to 2021 LSOA to 2021 MSOA to 2021 Local Authority (LA)
4	2021 OA to 2021 WZ
5	2021 OA to 2021 LA to 2021 Region (England)
6	2021 WZ to 2021 MSOA to 2021 LA
7	2021 Postcode to 2021 OA to 2021 LSOA to 2021 MSOA to 2021 LA
8	2021 Postcode to 2021 WZ

These lookups may not be necessarily offered as separate products and we may choose to combine them into a few composite products. This could mean, for example, combining products 3, 4 and 5.

ONS Geography also routinely provides lookups for older census OAs, for example:

- 2001 OA/SOA to a number of current geographies, annually
- 2011 OA/SOA/WZ to a number of current geographies, annually

In addition, in line with OS OpenData and the PSMA, lookups will be available in Comma Separated Variable (CSV) format.

3.3 Other Census 2021 geographical products

There are also two planned statistical products that contain Census 2021 population counts or percentages. However, as these would be produced at the unit postcode level, we will only publish them if we're satisfied that they will not be disclosive.

Both these products will support users to maintain the link between postcodes and the OA/SOA hierarchy. This link has been steadily degrading since OAs were first created in 2003 (see policy 1.2 in Appendix 1).

Product ref	Product description
9	Residential unit postcodes live at Census 2021 – population and household counts.
10	2021 unit postcode to 2021 OA – where a unit postcode is split across one or more OAs, the percentage of the unit postcode's population in each of the OAs it's split across is shown.

4. Comment on Census 2021 Output Geography Policy, products and services

We welcome comments on the Census 2021 Output Geography Policy and on the proposed geography products and services supporting Census 2021. If you'd like to comment on any aspect of the policy, or the proposed products and services, please reference your comments to the consultation question numbers below.

Census Output Geography Policy

Q1. Do you have any comments on the proposed maintenance plans for OAs and SOAs?

These plans are set out in Appendix 1.

Q2. Do you support our recommendation to continue to publish ward and parish outputs using an OA best-fit approach, but additionally aligning some OA boundaries to wards and/or parish boundaries?

If not, it would be helpful if you could please provide comments as to why. Do you, for example, prefer an alternative option or have any issues or concerns with the recommendation? Please provide any examples if appropriate.

This recommendation and consideration of other options is set out in Appendix 2.

Q3. Do you have any other comments on the proposed policy?

Census products and services

Q4. Are there any products or services, in addition to those mentioned in section 3 of this document, which you would find useful?

Q5. We will be producing census counts for 1km grid squares. Would you like to be kept informed about our plans for doing this?

Q6. Would the creation of a comparable UK small area geography be of interest to you?

If so, please also respond to question 7.

The possibility of creating a comparable small area geography for the whole of the UK is under consideration. This could be done by creating an additional Scottish OA level that has comparable population and household thresholds as OAs for the rest of the UK. This could also be done by creating a geography for Northern Ireland and Scotland comparable with the MSOA geography in England and Wales.

You may find it helpful to refer to Appendix 3 for population and household thresholds for different small area statistical geographies within the UK.

Q7. Do you have any thoughts on how this could be best achieved?

Appendix 1 – Proposed Census 2021 Output Geography Policy

1. The ONS will maintain the principle of stability of OAs and SOAs between 2001, 2011 and 2021 to allow comparability of census information and to support the GSS Geography Policy.

The Census 2021 Output Geography policy is intended to retain a high degree of stability, both at the OA and SOA level. This is to support comparability between census information from 2001, 2011 and 2021, and also from other national and official statistics collected using the OA/SOA hierarchy.

OAs/SOAs will be redesigned only where:

1.1 they have undergone significant population or household change following the 2011 Census (when OA changes were last made)[1]

Changes to OAs and SOAs will be made by mergers and splits. There are upper targets of 625 people and 250 households for OAs. Where these upper targets are exceeded, OAs will be split. OAs with a population below the threshold of 100 people or 40 households will be merged with a neighbouring OA contained within the same LSOA.

1.2 improvements to census outputs for wards and/or parishes have been identified that can be achieved through targeted OA boundary realignment

Some wards and/or parishes will contain split OAs resulting from ward/parish boundary changes since 2003. Where this occurs, census counts for split OAs will either be wholly attributed to the ward or parish, or instead attributed to a neighbouring ward or parish. This will be done by considering which ward or parish the OA population-weighted centroid falls within. The quality of census outputs for some wards and parishes containing split OAs will be improved by realigning some OA boundaries.

2. The total number of changes allowed under any of the circumstances above will be limited to less than 5% of the England and Wales OA/SOA hierarchy.

Where OAs/SOAs are redesigned because of population and household threshold breaches, the OAs/SOAs will:

[1] These changes will be managed through an automated zoning procedure previously developed for the 2011 Census as part of a joint project with Southampton University, more details of which can be found at www.census2011geog.census.ac.uk/

2.1 not normally align to ward and parish boundaries that have changed since 2003, unless they are also further redesigned (see 1.2)

Where wards or parishes have changed between censuses, not all OAs are periodically redesigned to align them. This is due to the sheer number of ward and parish changes during this period. It's also because of the need to support the policy for a stable output geography that is unaffected by electoral and administrative geography changes. Notwithstanding policy 1.2, it's important that the small area geography used as the statistical building brick for statistics for higher geographies remains stable.

2.2 not necessarily align to real-world features

OA/SOA boundaries will not necessarily be designed to align to real-world features. OA/SOAs are synthetic statistical boundaries and, outside of the populations they're created around, do not need to align to real-world features to serve their purpose. Realigning the boundaries to real-world features would also mean that, as the boundaries were derived from real-world feature datasets, their licensing terms would change. This would make them more expensive and their use more restrictive for users.

Some 2011 OA boundaries run through non-residential buildings. Only buildings where census households were located were considered in the OA zoning algorithm when OAs were created following the 2001 Census. In 2021, there may be circumstances where an OA boundary is unchanged, but where residential buildings have been built since 2001 that now straddle the OA boundary.

2.3 not contain only a single, large communal establishment

For redesigned OAs, we will keep the policy preventing census counts for any OA being wholly attributable to residents within a single, large communal establishment. This is to safeguard their confidentiality. To prevent this occurrence, an OA containing a single communal establishment will also have to include at least 40 other surrounding households.

2.4 not contain fewer than 100 persons or 40 households

Where an OA falls below the threshold of 100 persons or 40 households, it will be merged with an adjacent OA within the same LSOA. This is to maintain comparability of OAs nationally in terms of their population and household size. This also means no unpopulated OAs can be created. It has previously been questioned whether large unpopulated areas could be taken out of larger rural OAs. However, we produce annual standard land area measurements for each OA/SOA to enable population densities to be calculated.

In addition, if there were unpopulated areas not covered by an OA, it is conceivable that over time these areas could become populated. There would then be no equivalent OA-level geography to cover these residents for any non-census statistics.

2.5 not contain more than 625 persons or 250 households except in a small number of cases

For continuity and comparability with 2001 and 2011 OAs, where an OA falls above the threshold of 625 persons or 250 households, it will be split to form two or more OAs. Each of these must fall within OA population and household thresholds.

There may be cases where an OA intentionally has a population above 625. This may occur where the OA contains a large number of residents from a single communal establishment supplemented from at least 40 other households (see policy 2.3).

Where OAs/SOAs are redesigned because of targeted OA realignment to ward or parish boundaries, the policies 2.2, 2.3, 2.4 and 2.5 above will also apply.

3. OAs/SOAs split by local authority boundary changes since the 2011 Census will be aligned to the changed local authority boundaries.

By design, an OA, LSOA or MSOA cannot be split between local authorities. However, this can happen to OAs, LSOAs and MSOAs during an intercensal period as a result of local authority boundary changes. Following Census 2021, the boundaries of any affected OAs and SOAs will be redrawn to align them with the changed local authority boundaries. Where necessary, resulting OA and SOA fragments will be merged with neighbouring areas within the same local authority.

4. Digital boundaries for geographies, suitable for use within a geographic information system (GIS), will be freely available, subject to agreement with third parties.

The ONS will take every possible step to make sure that digital boundaries for all geographical boundaries supported by census outputs will be made freely available to end users. We will make every effort to ensure licensing is kept as simple as possible for all types of sharing and distribution. We will also seek to continue with existing licensing terms, which cover commercial use of boundaries.

As well as providing OA/SOA boundaries drawn to the extent of the realm, as was the case for the 2001 and 2011 boundaries, a separate set of OA/SOA boundaries reflecting mean high water will be also be provided.

This separate set will offer more familiar coastlines for visualisation and mapping.

5. OAs/SOAs will be coded to bring them in line with the coding and naming policy that forms part of the GSS Geography Policy.

All OAs and SOAs will be allocated geography codes, in keeping with the 2009 ONS Coding and Naming policy[2]. The purpose of the policy is to make codes for statistical geographies consistent and resilient to future changes. OAs in 2021 will therefore have a simple nine-character alphanumeric code. These codes will also remain unchanged where OAs are stable from 2011.

Lookups will be provided to link any superseded 2011 OAs and their codes to new 2021 OAs. Lookups will also be provided to link OAs and SOAs redesigned in 2021 to their constituent 2011 OAs/SOAs. This will support comparison of 2011 and 2021 OA/SOA information.

OAs are currently not labelled with names and SOAs are simply labelled reflecting the local authority name in which they nest.

6. Geography boundaries, products and services will be updated following Census 2021.

We may use administrative data to supplement census information when creating bespoke geographies and work with external partners to update them. This is only in cases where it's thought it may improve quality and where it's clear census confidentiality will not be compromised.

We intend to update the following geography boundaries and products:

1. Area Classifications (UK – OAs, SOAs, Health Areas and LAs)
2. Built-up areas and sub-divisions (England and Wales)
3. Major Towns and Cities (England and Wales)
4. Rural Urban Classifications (England – LAs, Parliamentary Constituencies, OAs, LSOAs and MSOAs)
5. Travel to Work Areas (UK)
6. Workplace Zones (UK)
7. Workplace Zone Classification (UK)

All these geographies may be subject to review in light of the outcome of the census or to reflect changing policy needs.

We also intend to release some census outputs for 1km grid squares across the whole of England and Wales and for smaller nested grids for more heavily populated areas. The exact grid sizes for the nested grids,

[2] https://geoportal.statistics.gov.uk/search?collection=Document&sort=name&tags=all(DOC_POL_CAN)

population and household thresholds, and type of census outputs that could be released, are still to be determined. This will be done based on discussions with colleagues working on statistical disclosure control.

We see great potential in the use of census information for 1km grid squares. For example, this will support our commitments to the UN's Sustainable Development Goals and will allow the easier combination of demographic and environmental data.

In addition, other products will be updated to reflect new Census 2021 geographies. This will include digital boundary files, lookup files, names and codes listings, postcode directories and standard area measurements.

7. Census 2021 statistical outputs will be produced in line with the GSS Geography Policy.

The policy sets out the governing principles for how geographic information is used to produce and disseminate statistics. It has been adopted by the GSS to cover all national and official statistics. The policy makes sure statistics are referenced and output consistently and that they're more easily compared on a common standard geographical base.[3]

Census 2021 will comply with the policy in the following ways:

- it will continue to use the established standard nine-character codes for all statistical geographies (policy 5 above)
- all 2021 tables and outputs will be produced on a standard currency of the output geography used, for example ward, local authority etc[4]
- households will be located accurately using the same address register used for census enumeration, based on the Ordnance Survey AddressBase Premium product, and used flexibly by us to create Census 2021 outputs

8. We will continue to provide lookup products between postcodes and the OA hierarchy.

2001 OAs were created using unit postcode polygons as building blocks. These were then aggregated to population and household target numbers of 300 and 125 respectively. Where 2021 OAs/SOAs are redesigned and need to be split, they will be similarly maintained using postcode building blocks.

It's recognised that since the 2001 OAs were created, the strong relationship between postcodes and OAs has gradually declined. This is because new addresses for which new postcodes have been introduced may straddle OA

[3] The GSS Geography Policy is at https://gss.civilservice.gov.uk/policy-store/gss-geography-policy-2/

[4] The currency of each geography for Census 2021 outputs will be 2021 and will contain all instances of that geography that were operational as of 31 December 2021, though in some cases (eg for wards) may reflect any changes in geography introduced after December 2021 but in place at the time of dissemination of census outputs.

boundaries. There are also some postcodes that existed in 2001 that have been terminated and subsequently reused and reassigned in different locations. In addition, 2001 OAs did not take account of workplace postcodes. This means that by creating Workplace Zones, it's likely a number of postcodes at the edge of OA boundaries will be split between two or more Workplace Zones.

ONS will continue to provide lookups between postcodes, OAs and Workplace Zones, recognising the importance of postcodes to locate, reference and classify the population.

Appendix 2 - Review of options for producing ward and parish census outputs

A key aspect of the Census Output Geography Policy is the need for statistics for any geography to be built from statistical building blocks, typically OAs, on a best-fit basis. This can be done using a lookup from OA to the higher-level geography, which is determined by where most of the OA's census population falls, based on OA population-weighted centroids.

The need for higher geography statistical outputs to be best-fit from OAs, is to make sure that any census outputs will be consistent and comparable to other national and official statistics. Creating best-fit outputs from OAs, or from the lowest level of SOA available for a statistic, is the basis for statistical production and dissemination across the GSS.

However, it's recognised that the OA best-fit method does not always work well when the target geography is another small area geography, such as wards or parishes. This is also increasingly the case when boundaries are no longer closely aligned with OA boundaries because of ward and parish boundary changes. Consequently, census counts derived from an OA best-fit method may not be a good reflection of the 'true' census counts in certain cases.

While this situation can also arise for higher-level geographies created from OA or SOA best-fit, the impact will be greatly reduced. This is because the proportion of OAs covering the higher-level geography but not wholly falling within it will generally be smaller than for small area geographies.

We've undertaken a review to see if there are any viable alternative options for specifically producing census outputs for wards and parishes. The option to continue with the existing best-fit policy remains, but three other options have also been identified. These options considered, among other factors, the need for geography maintenance, table production and disclosure control.

Following this review, we recommend that a refinement is made to the OA best-fit approach whereby there's a targeted alignment of some OA boundaries so that they align with ward and/or parish boundaries (option 2). The benefit of this approach is that it will improve the quality of census output for wards and parishes targeted in this way, while keeping the principle of OA best-fit for generating statistics for other geographies.

These are the four best options identified as part of this review:

1. **OA best-fit (as used following the 2001 and 2011 Census)**

   Census counts will reflect the sum of OA counts for those where an OA population-weighted centroid spatially falls within the ward or parish. No census statistics will be released for wards or parishes that contain partial OAs but do not contain an OA population-weighted centroid.

As a result of annual ward and parish boundary changes, the alignment of these boundaries with OAs has deteriorated over time. In multiple cases, census counts for the whole of an OA may be allocated to a single ward or parish, whereas in reality the OA may cover two or more wards or parishes. This may result in overestimating or underestimating census counts for those wards and parishes affected in this way.

2. OA best-fit with targeted OA realignment

Option 2 is similar to option 1 but with a targeted realignment of a relatively small number of OA boundaries to align with ward and/or parish boundaries. As a result, census outputs for wards and parishes containing OAs with their boundaries adjusted in this way would be able to consist of whole OAs, rather than additionally including any split OAs. This would improve the overall quality of the census statistics for these wards and/or parishes. If targeted this way, it could also reduce the number of parishes for which there are no census statistics available because they do not contain an OA population-weighted centroid.

Around 1.5% of addresses are allocated to the wrong ward using OA best-fit. Around 2.4% of wards have an address count net error of more than 10% of their address count. We only need to target 0.88% of OAs, a total of 1,600 OAs, to fix these wards.

Around 2.5% of addresses are allocated to the wrong parish using OA best-fit. Around 18% of parishes have an address count net error of more than 10% of their address count. We only need to target 0.72% of OAs, or a total of 1,421 OAs, to fix these parishes.

3. “Exact-fit” counts

Some users have previously requested “exact-fit” counts for electoral wards and divisions, and parishes. This would mean us using unit-level information and allocating it directly to relevant boundaries, producing the best possible count for each area. A concern from 2011 Census users was that the best-fit census counts were not always suitably accurate where ward and parish boundaries did not reflect a whole single OA or multiple OAs. In such cases, the published census counts may differ from “true” counts, causing a lack of confidence in the results for some wards and parishes. We received feedback saying that users wanted each individual person and household to be allocated directly to the ward or parish, not by its OA.

When OAs were created in 2003 from 2001 Census information, they nested exactly within the ward or division and parish boundaries existing at the time. Since then, there have been many ward and parish boundary changes that now split OAs.

It’s possible that non-disclosive census counts at both ward or division and parish could be produced. A fundamental problem with this approach is that statistics released on different geographical bases can expose small populations through “differencing” the geographies.

Our methodologists have devised a method of protecting exposed populations. They aim to do this through targeted record swapping and cell-key perturbation using a flexible dissemination tool. However, this two-stage approach to statistical disclosure control does need careful consideration with small counts that may arise from differencing of small area geographies.

In undertaking this type of statistical disclosure control, the level of swapping and perturbation would have to increase considerably to protect the population within these small slivers and could adversely affect the quality of other census outputs. In addition, the timing and scope of outputs that could be produced from Census 2021 may be adversely affected.

4. OA apportionment

With this method, census counts at OA level are distributed to any partial wards or parishes covering the OA based on the distribution of residential addresses and communal establishments within it. In this way, proportions of the OA population can be derived for any partial wards or parishes and then applied to all the census counts. For example, an OA with one quarter of residential addresses within ward X and three quarters within ward Y would have residential population census counts for the OA allocated to wards X and Y using the proportions 0.25 and 0.75 respectively. Any communal establishment residents would be assigned to the ward or parish in which the communal establishment falls geographically.

Any chosen option for producing census statistics for wards or parishes will affect how census tables are produced and the level of detail available within census outputs. This is summarised as follows:

1. OA best-fit (as used following the 2001 and 2011 Census) **and** **2. OA best-fit with targeted OA realignment**	The ONS provides best-fit counts for a full set of 2011 Census tables for larger wards and parishes (defined in terms of population and household size) and a reduced set of variables and tables for smaller wards and parishes.
3. Exact-fit counts	The ONS provides exact-fit counts for a core set of Census 2021 tables for most wards and parishes, which may be subject to more stringent disclosure control measures. For wards or parishes with small populations and/or household numbers, it may be necessary to limit the number of variables or tables published. However, users could have more confidence in the quality of the counts than if they were produced under any of the other options.
4. OA apportionment	The ONS provides a core set of Census 2021 tables for most wards and parishes, which may be subject to less stringent disclosure control measures. For wards or parishes with small populations and/or household numbers, it may be necessary to limit the number of variables or tables published. However, users could have more confidence in the counts than if they were produced under the OA best-fit options.

Some of the pros and cons, together with some key statistics relating to each option, are set out in the following tables:

Pros to different options for producing census outputs for wards and parishes[5]

Option 1 **OA best-fit**	**Option 2** **OA best-fit with targeted OA realignment**	**Option 3** **Exact-fit**	**Option 4** **OA apportionment**
• This method works well for most wards or parishes. • Not all areas have been affected by boundary changes. • There's no discontinuity, and it allows comparability with previous census outputs for wards and parishes that are unchanged. • It's simple to do and a full range of census tables can be produced. • This method is unaffected by previous and any future ward or parish boundary changes.	• It addresses the uncertainty over accuracy of census outputs, particularly for smaller wards and parishes. • It helps to address the issue of no statistics for a small number of wards and around 10% of parishes.	• It's consistent with the method used for generating census outputs for OAs and national parks. • It will generate census counts for all wards and parishes, regardless of population size. • It addresses user concerns over "missing" parish information and the accuracy of outputs.	• It produces census counts for all wards or parishes. • It has good overall accuracy with census counts.

[5] Typically, cities and larger urban areas do not contain parishes.

Cons to different options for producing census outputs for wards and parishes

Option 1 **OA best-fit**	**Option 2** **OA best-fit with targeted OA realignment**	**Option 3** **Exact-fit**	**Option 4** **OA apportionment**
• There's user uncertainty over accuracy of census outputs, particularly for smaller wards and parishes.	• It may have a knock-on effect for LSOA and MSOA boundaries. • It will increase the number of OA changes and we'd need to keep changes below 5% for all OAs. • It does not future proof against subsequent ward or parish boundary changes.	• It may need to vary the level of detail or number of variables with outputs. • There are potential statistical disclosure issues by differencing, although it may be possible to overcome these. • It'd represent a change to the GSS Geography Policy.	• It may give rise to local authority total inconsistencies. • It will complicate table production. • It will need additional work for OA creation.

Key statistics and implications post Census 2021 for producing statistical outputs for wards

- Number of wards in 2020 (7 May) England and Wales – 7,999 (England – 7,147, Wales – 852).
- Ward population size (mid-2018) – smallest 158 (St. Martin's, Isle of Scilly), largest 36,945 (St Michael's, Coventry), average size 7,140.
- Average number of ward changes per year (2003 to 2018) – 314.
- Number of wards in 2011 containing no OA population-weighted centroid – 18 (0.2% of all wards).
- Percentage of 2003 wards, when OAs were first created to fit within wards, expected to have changed by 2021 – c. 71%, around 29% therefore unchanged.

Further ward changes after 2021 will result in increasing misalignment between OAs and wards. Other than census statistics, very few statistics are published at ward level by government, with population statistics being one such example. The preferred geography across government for publishing small area statistics are LSOAs and MSOAs (GSS Geography Policy).

Implications for ward statistics and the OA-ward relationship post Census 2021 if any of the options become part of ongoing geography policy

Option 1 **OA best-fit**	**Option 2** **OA best-fit with targeted OA realignment**	**Option 3** **Exact-fit**	**Option 4** **OA apportionment**
• Statistics for wards produced from OA information may be subject to quality concerns. • No issues as such with implementation of the method. • Only a small number of wards are affected by having no OA population-weighted centroid. This is confined to the City of London and Isles of Scilly only.	• Future OA boundary changes may need to be considered to address future misalignment between OA and ward boundaries as a result of ward boundary changes. • This method is resource intensive to apply if regular maintenance of OA boundaries is done to align OAs to ward boundaries.	• Unless source information is available at address or postcode level, this method is difficult to replicate for producing ward-level outputs. • For wards comprising only whole OAs, OA best-fit could still be used to produce statistics.	• For the method to work well, it's necessary to have updated information on communal establishment residents, which is likely to be problematic and an ongoing issue with this method. • The method allows statistics for all wards to be produced, including those with no OA population-weighted centroid.

Key statistics and implications post Census 2021 for producing statistical outputs for parishes

- Number of parishes in 2020 (1 April) England and Wales – 11,348 (England – 10,471, Wales – 877).
- Parish population size (2011 Census) – smallest 0 (23 parishes), largest 75,964 (Weston-super-Mare, North Somerset), average size 2,093.
- Average number of parish changes per year (2011 to 2018) – 83.
- Number of parishes in 2011 containing no OA population-weighted centroid – 1,140 (10% of all parishes).
- Percent of 2003 parishes, when OAs were first created to fit within parishes, expected to have changed by 2021 – c. 13%, around 87% therefore unchanged.

Further parish changes after 2021 will result in increasing misalignment between OAs and parishes. Other than census statistics, no statistics are published at parish level by government. The preferred geography across government for publishing small area statistics are LSOAs and MSOAs (GSS Geography Policy).

Implications for parish statistics and the OA-parish relationship post Census 2021 if any of the options become part of ongoing geography policy

Option 1 **OA best-fit**	**Option 2** **OA best-fit with targeted OA realignment**	**Option 3** **Exact-fit**	**Option 4** **OA apportionment**
• Statistics for parishes produced from OA information may be subject to quality concerns. • There are no issues as such with implementation of the method. • Around 10% of parishes are affected by having no OA population-weighted centroid.	• Future OA boundary changes may need to be considered to address future misalignment between OA and parish boundaries as a result of parish boundary changes. • This method is resource intensive to apply if regular maintenance of OA boundaries is done to align OAs to parish boundaries.	• Unless source information is available at address or postcode level, this method is difficult to replicate for producing parish-level outputs. • For parishes comprising of only whole OAs, OA best-fit could still be used to produce statistics.	• For the method to work well, it's necessary to have updated information on communal establishment residents, which is likely to be problematic and an ongoing issue with this method. • The method allows statistics for all populated parishes to be produced, including those with no OA population-weighted centroid.

It’s important that users appreciate the risks, advantages and disadvantages with each option.

There are pros and cons to all the approaches identified. We’ve considered:

- the degradation over time with boundaries between OAs and both wards and parishes
- the statistical disclosure considerations for each option
- the considerations for producing census outputs through the flexible table builder for each of the options
- the geography considerations for maintaining OAs

As a result, we’re recommending the use of option 2, which is the OA best-fit with targeted OA realignment, and that it should become part of an updated Census Output Geography Policy.

Appendix 3 - Small area statistical geographies in the UK by country

2011 Census population and household counts by statistical geography

Country and small area geography	Number	Population			Households		
		Minimum	Average	Maximum	Minimum	Average	Maximum
England and Wales: Output Areas[1]	181,408	91	309	4,140	23	129	817
England and Wales: Lower Layer Super Output Areas[2]	34,753	983	1,614	8,300	304	672	1,405
England and Wales: Middle Layer Super Output Areas[3,4]	7,201	5,003	7,787	16,342	2,003	3,245	6,100
Scotland: Output Areas	46,351	50	114	2,081	20	51	126
Scotland: Data Zones	6,976	147	759	2,901	36	340	817
Northern Ireland: Small Areas	4,537	98	399	3,072	59	155	988
Northern Ireland: Super Output Areas	890	364	2,035	4,574	200	790	1,698

[1] Target was for a minimum of 100 and a maximum of 625 people, and a minimum of 40 and a maximum of 250 households.
[2] Target was for a minimum of 1,000 and a maximum of 3,000 people, and a minimum of 400 and a maximum of 1,200 households.
[3] Target was for a minimum of 5,000 and a maximum of 15,000 people, and a minimum of 2,000 and a maximum of 6,000 households.
[4] Minimum figures exclude the MSOA covering the whole of the Isles of Scilly, which had much lower population and household counts.

Please note - the need to include communal establishment residents within the smallest output geographies (Output Areas/Small Areas) may result in maximum population thresholds not being achievable for some areas. In such cases the upper target population threshold will intentionally be breached.

For each country, the small area geographies are hierarchical:
For England and Wales, OAs nest within LSOAs, LSOAs nest within MSOAs, and MSOAs nest within local authorities.
For Scotland, OAs nest within Data Zones, and Data Zones nest within council areas.
For Northern Ireland, Small Areas nest within SOAs, though neither Small Areas nor SOAs wholly nest within the current district council areas, but did for the district council areas as constituted at the time of the 2011 Census.