

# 2001-based Travel-To-Work Areas

## Methodology

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The 2001-based Travel-to-Work Areas (TTWAs) are defined using origin-destination data on which disclosure control protection had not been applied. This dataset covers the whole of the UK using 41,773 small areas, termed “zones” below: these are Lower-Layer Super Output Areas in England and Wales, data zones in Scotland and Super Output Areas in Northern Ireland. The 2001-based TTWAs are created without being constrained to national boundaries.

The algorithm to be applied to these data uses the number of work journeys between zones. It groups the zones into areas in such a way that most workers living in an area also work in the same area and most people who work in an area also live there. We define two measures of self-containment for an area:

- Supply side self-containment is the number of people living and working in an area divided by the number of residents in the area;
- Demand side self-containment is the number of people living and working in an area divided by the number of jobs in the area.

There is no single theoretically correct algorithm for grouping zones to meet this objective. The algorithm was therefore developed by testing various alternatives. The current algorithm develops the one devised by CURDS for previous definitions which has been used, with slight adaptations, in numerous other countries. The process for deciding on the current algorithm and settings of key parameters is documented separately.

To measure the strength of the commuting link between two areas requires a formula which takes account of journeys in both directions. A decision as to whether to attach a Zone to a particular area should depend not only on the number of people who commute from the Zone to the area concerned, but also on the number who commute in the opposite direction.

The formula needs to take account of the size of the areas concerned; if a choice is being made to attach a Zone to one of two areas, a simple comparison of the numbers of journeys involved would tend to favour the choice of the larger area. This consideration is particularly important in arriving at an algorithm which produces a substantial number of TTWAs without needlessly combining distinct areas, especially in the areas surrounding large cities.

In calculating the formula, the flow from area A to area B is measured as a proportion of the residents in area A and also as a proportion of the jobs in area B and these two proportions are multiplied together to give a measure of the “importance” of that flow for the areas concerned. The full formula is the sum of the “importances”, measured in this way, of the flows in each direction between the two areas. Algebraically the formula is:

$$\frac{F_{a,b}}{R_a} * \frac{F_{a,b}}{W_b} + \frac{F_{b,a}}{R_b} * \frac{F_{b,a}}{W_a}$$

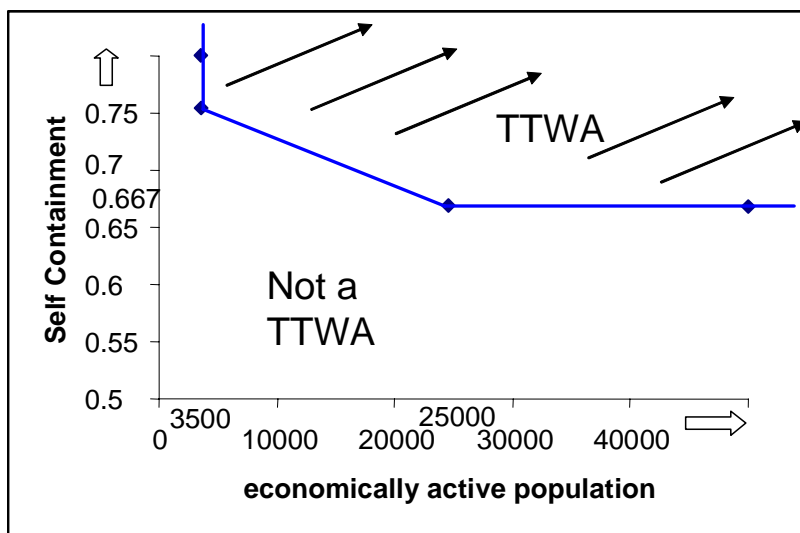
Formula 1.

Where  $F_{a,b}$  is the number of journeys to work from area A to area B;  $R_a$  is the number of workers who live in area A; and  $W_a$  is the number of people who work in area A.

We also need a function which assesses whether a grouping of zones comprises a viable travel to work area. This function is required to have the following properties:

- (i) An area with self-containment - on both supply and demand side - exceeding 75 per cent and at least 3,500 workers living in the area should be accepted.
- (ii) An area with self-containment - on both supply and demand side - exceeding 66.67 per cent and at least 25,000 workers living in the area should be accepted.
- (iii) An area in which fewer than 3,500 workers live should be rejected.
- (iv) An area with self-containment – on either supply or demand side - of less than 66.67 per cent should be rejected.
- (v) For areas where between 3,500 and 25,000 workers live, the minimum self-containment required - on both supply and demand side - for acceptance as a Travel-to-Work Area should progressively decrease from 75 per cent for the smallest areas to 66.67 per cent for the largest.

The chart below shows schematically how TTWAs are considered viable based on the area’s economically active population and its self-containment. Self-containment, in this plot, refers to the lower of the supply side or demand side self-containment.



**Figure 1 Determining valid Travel to Work Areas**

Creating TTWAs is a process of considering the zones in the area which is furthest from being a TTWA (note this may be a single zone initially, or a group of zones at a later stage in the process) and reassigning the elements with other zones, or groups of zones, using Formula 1.

In practice, the algorithm starts with 41773 zones which are all deemed potential TTWAs. These zones are assessed against Figure 1 and selects the zone which is furthest from being valid – call this area A. Area A is then assessed against all other zones to find the one which has the most important commuting flows using Formula 1 above. The zone with the most important commuting links to Area A is the one Area A is grouped with. This grouping now leaves 41772 potential TTWAs which are assessed to see which is furthest from being a valid TTWA. Assuming, as is likely, that this again will be a single zone, it is assessed against each of the remaining areas to determine the most important commuting links. Note that now the remaining areas comprise the 41771 other zones and the previously-joined zone pair.

After several iterations joining together individual zones, the area which is furthest from being a TTWA will be a previously joined grouping (pair of zones or more). When this happens, this grouping of zones is split up and each individual zone is joined to an area with the most important commuting flows.

The process stops when all groupings are viable TTWAs.

### **Differences compared with the methodology for the 1991-based TTWA**

1. 2001 Origin-Destination tables are available for the entire Census working population as opposed to a 10% sample which was available for 1991 data.
2. Zones are used rather than wards. This provides a finer resolution for defining boundaries, particularly in areas (such as Herefordshire) where wards are very large.
3. The algorithm for joining the zones has been simplified to remove the no longer needed set of initial stages to form ‘proto-TTWAs’ before the main TTWA definition process is applied.
4. National boundary constraints have not been imposed so TTWAs now cross the England-Wales and England-Scotland borders.
5. The function for being a viable TTWA has changed slightly. The 75% self-containment and economically active population of 3500 remains the same. 1991 based TTWAs used a second threshold of 69.5% with an economically active population of 20,000. This has been changed to a threshold of 66.67% but with an economically active population of 25,000.