

# Gridded models in the UK: beyond the 2011 census

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# Presentation overview

- 2011 census review
- Geographical data developments
- Implications for gridded population modelling
- Population 24/7 project update
- *knowledgements: Samantha Cockings, Samuel Leung, ESRC Award RES-062-23-1811, ONS*

# 2011 census overview

## 2011 census

- UK coordination, but separate censuses with differences (England and Wales; Scotland; Northern Ireland)
- Census day 27 March 2011: conventional census with internet completion channel
- Mail-out (not Scotland) and mail-back, using address list
- Flexible enumeration effort focused on most difficult areas
- Extended imputation methodology
- First data July 2012: basic demographic statistics for local authorities, detailed data for small areas follow in autumn

Questions H7 to H8 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Office for National Statistics (GB) https://onlinepb2.census.gov.uk/questionnaire/restricted/questionnaire.do

Most Visited Latest Headlines

Questions H7 to H8

Accessibility Text size A A A Text colour A A A

# H1 - Household Questionnaire - England

[Help and information \(opens in new window\)](#)

## Your progress

**Household questions**

- H1 - H2 Done
- H3 Done
- H4 - H5 Done
- H6 Done
- H7 - H8**
- H9 - H10
- H11
- H12
- H13
- H14

**Individual questions**

**Visitor questions**

**Submission**

## Household questions

[Save and come back later](#)

**H7** What type of accommodation is this? [Quick help +](#)

**A whole house or bungalow that is:**

- ☒ detached
- ☐ semi-detached
- ☐ terraced (including end-terrace)

**A flat, maisonette or apartment that is:**

- ☐ in a purpose-built block of flats or tenement
- ☐ part of a converted or shared house (including bedsits)
- ☐ in a commercial building (for example, in an office building, hotel, or over a shop)

**A mobile or temporary structure:**

- ☐ a caravan or other mobile or temporary structure

**H8** Is this household's accommodation self-contained? [Quick help +](#)

This means that all the rooms, including the kitchen, bathroom and toilet, are behind a door that only this household can use

Yes, all the rooms are behind a door that only this household can use

☐ No

[Back](#) [Save and next](#)

Done

Secure Search

McAfee



*Photos: David Martin*



## How has it gone?

- Early days, but initial assessments are encouraging
- Response rate 94 per cent nationally and over 80 per cent in every local authority
- Most London boroughs (includes many of the hardest areas nationally) 5-15 percentage points better than in 2001; overall over 90 per cent
- Internet response disappointing: 16%, but quality is high

# What about 2011 data?

- Broadly comparable questionnaire content to 2001
- Broadly comparable set of data outputs planned (2001+)
- More questions on citizenship, place of residence
- New population bases possible – daytime, weekday, majority of time, non-term time, etc.
- High degree of geographical boundary stability, based on 2001 output areas (OAs) with only essential changes



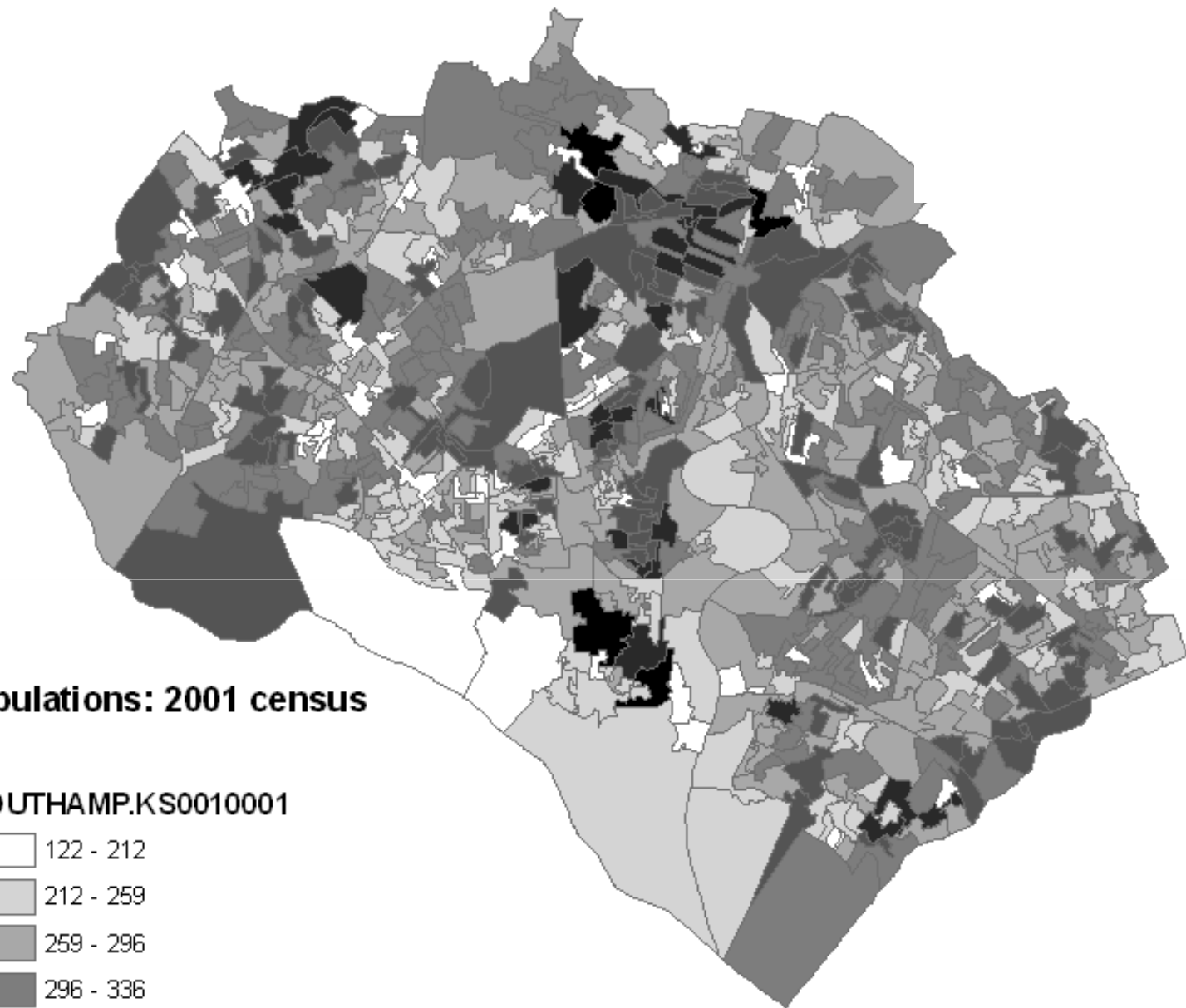
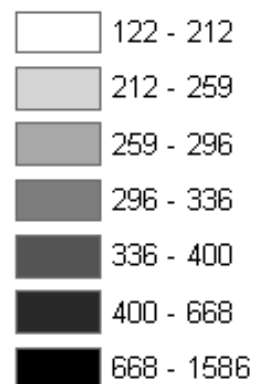
# Geographical data developments

## 2011 geographies

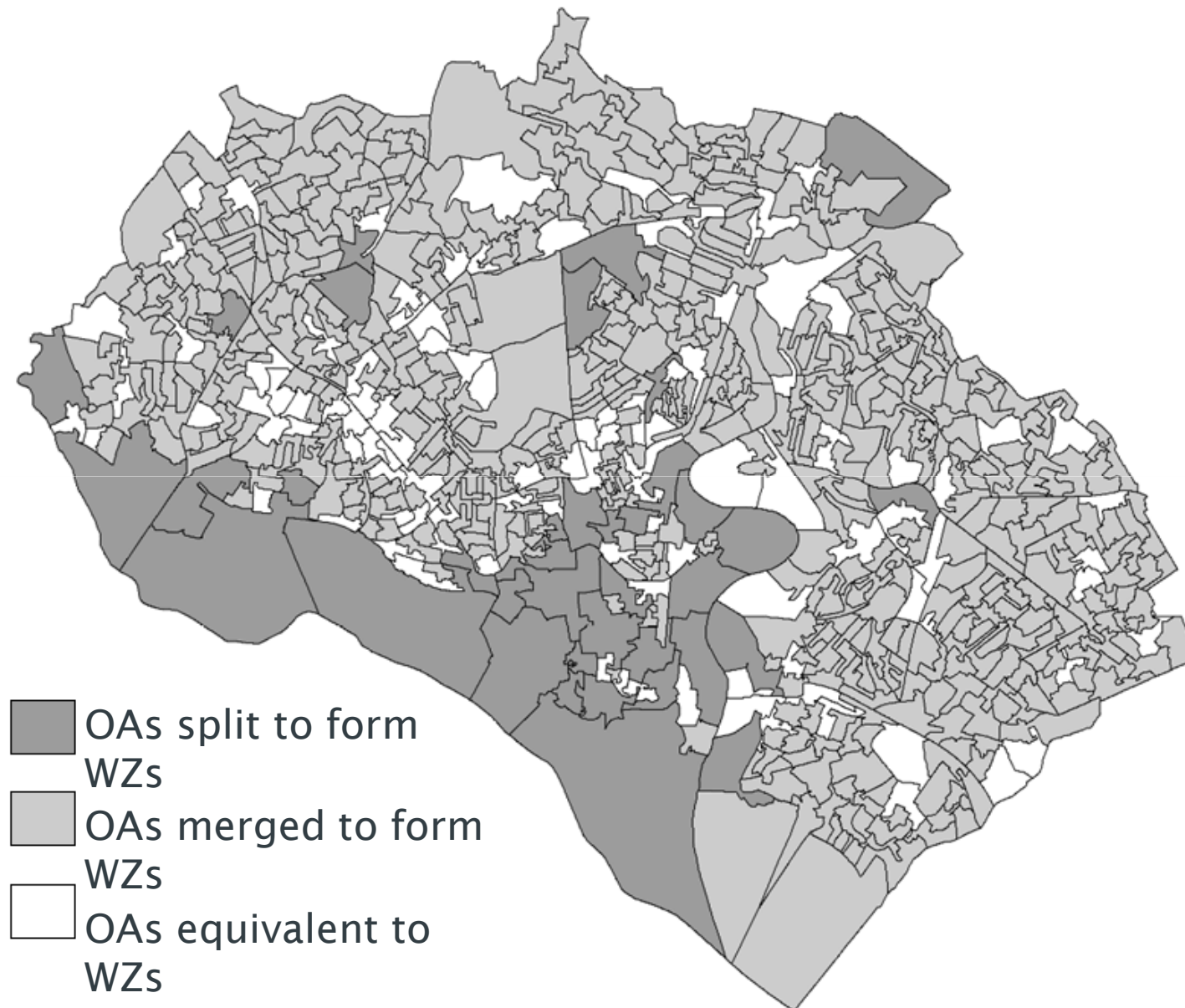
- 2011 census OA geography will preserve 95%+ of 2001 OA boundaries. Hierarchical splits and mergers only where required by major population changes or local authority boundary change
- New geography of workplace zones (WZs) based on hierarchical splits and mergers of 2011 OAs to produce WZs suitable for publication of workplace (“daytime”) data with much more detail than in 2001
- Boundaries, address-weighted centroids and lookup tables all included in census outputs products

**OA populations: 2001 census**

**SOUTHAMP.KS0010001**



## Southampton workplace zones – test data



## 2011 data products

- High level agenda for ‘Open Government’ promoting ‘Open Data’: all principal census outputs free at point of use under ‘Open Government Licence’
- Should include all the OA/WZ geographical boundaries and centroids
- Plans for user API-based access to data direct from ONS (alongside more conventional means of access)
- Indications of a much more open census user community, with richer web-based data access tools
- Practical example = InFuse! (University of Manchester)

Firefox
InFuse Data Wizard
http://infuse.mimas.ac.uk/infusewiz.aspx?cookie=Tk1FIJYGpEAAEmmcYYAAAAAM
mimas infuse
Home/Help | InFuse | Feedback | Glossary

# InFuse

Beta 1.1

Steps: 1 2 3 4
Start Again

## Topics

Show Guidance

### Filters

Clear filters

#### Topics

- ☐ Accommodation type (brief)
- ☒ Accommodation type (detailed)
- ☐ Adults, Number Employed in Household
- ☐ Adults, Number in Household
- ☒ Age
- ☐ Age of Family Reference Person (FRP)
- ☐ Age of Household Reference Person (HRP)
- ☐ Age of Students and Schoolchildren
- ☐ Amenities
- ☐ Armed Forces
- ☐ Bath/Shower and Toilet, use of
- ☐ Care (unpaid), Provision of

### 8 topic combination(s) found for topic(s) (Accommodation type (detailed), Age)

Page 1 of 1

First < 1 > Last

<ul style="list-style-type: none"> <li>Accommodation type (detailed)</li> <li>Age</li> </ul> <span>Select</span>	<ul style="list-style-type: none"> <li>Accommodation type (detailed)</li> <li>Age</li> <li>Sex</li> </ul> <span>Select</span>	<ul style="list-style-type: none"> <li>Accommodation type (detailed)</li> <li>Age</li> <li>Limiting long-term illness</li> <li>Population Type</li> </ul> <span>Select</span>	<ul style="list-style-type: none"> <li>Accommodation type (detailed)</li> <li>Age</li> <li>Lowest floor level</li> <li>Limiting long-term illness</li> <li>Population Type</li> </ul> <span>Select</span>
<ul style="list-style-type: none"> <li>Accommodation type (detailed)</li> <li>Age</li> <li>Children, dependent</li> </ul> <span>Select</span>	<ul style="list-style-type: none"> <li>Accommodation type (detailed)</li> <li>Age</li> <li>Population Type</li> </ul> <span>Select</span>	<ul style="list-style-type: none"> <li>Accommodation type (detailed)</li> <li>Age</li> <li>Limiting long-Term Illness, number of people with in household</li> <li>Population Type</li> </ul> <span>Select</span>	<ul style="list-style-type: none"> <li>Accommodation type (detailed)</li> <li>Age</li> <li>Lowest floor level</li> <li>Limiting long-Term Illness, number of people with in household</li> <li>Population Type</li> </ul> <span>Select</span>

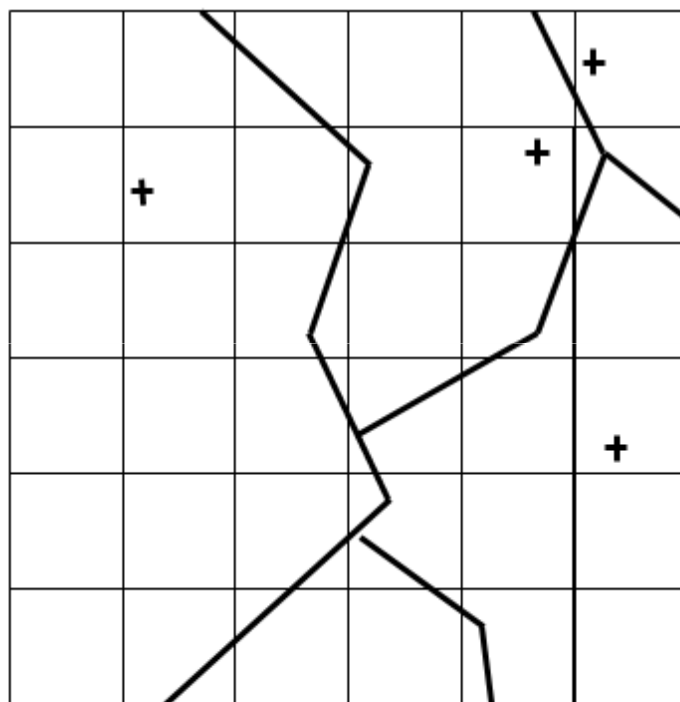
# Implications for gridded population modelling



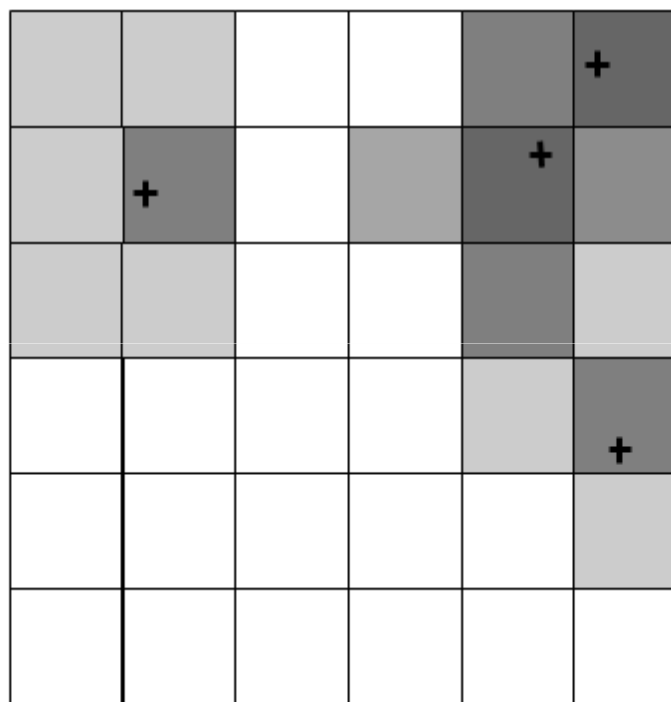
# Implications for gridded population modelling

- National Statistics geography policy based on one small area geography to avoid differencing
- No exact statistics published for any zones other than OAs, hence no gridded data in planned census outputs
- May be population counts for 1km grid map, but no firm commitment yet: will not be a census output
- Therefore... any gridded population models need to be generated from boundaries and centroids, as will not be directly aggregated from record-level data

# Centroids, boundaries and grids



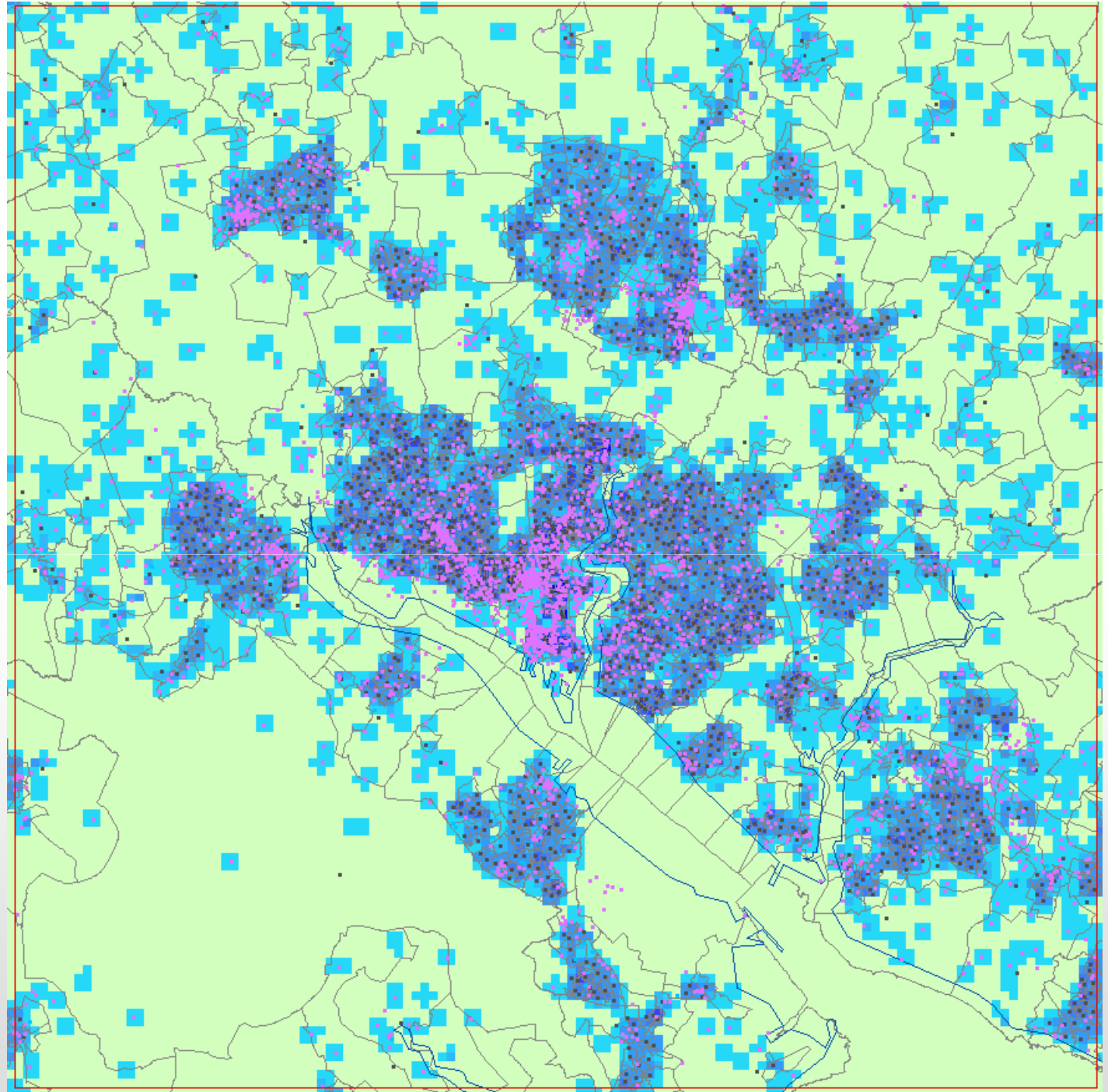
Centroid locations and boundaries



Centroid populations redistributed onto grid

# Centroid set

- Gridded surface (from postcodes)



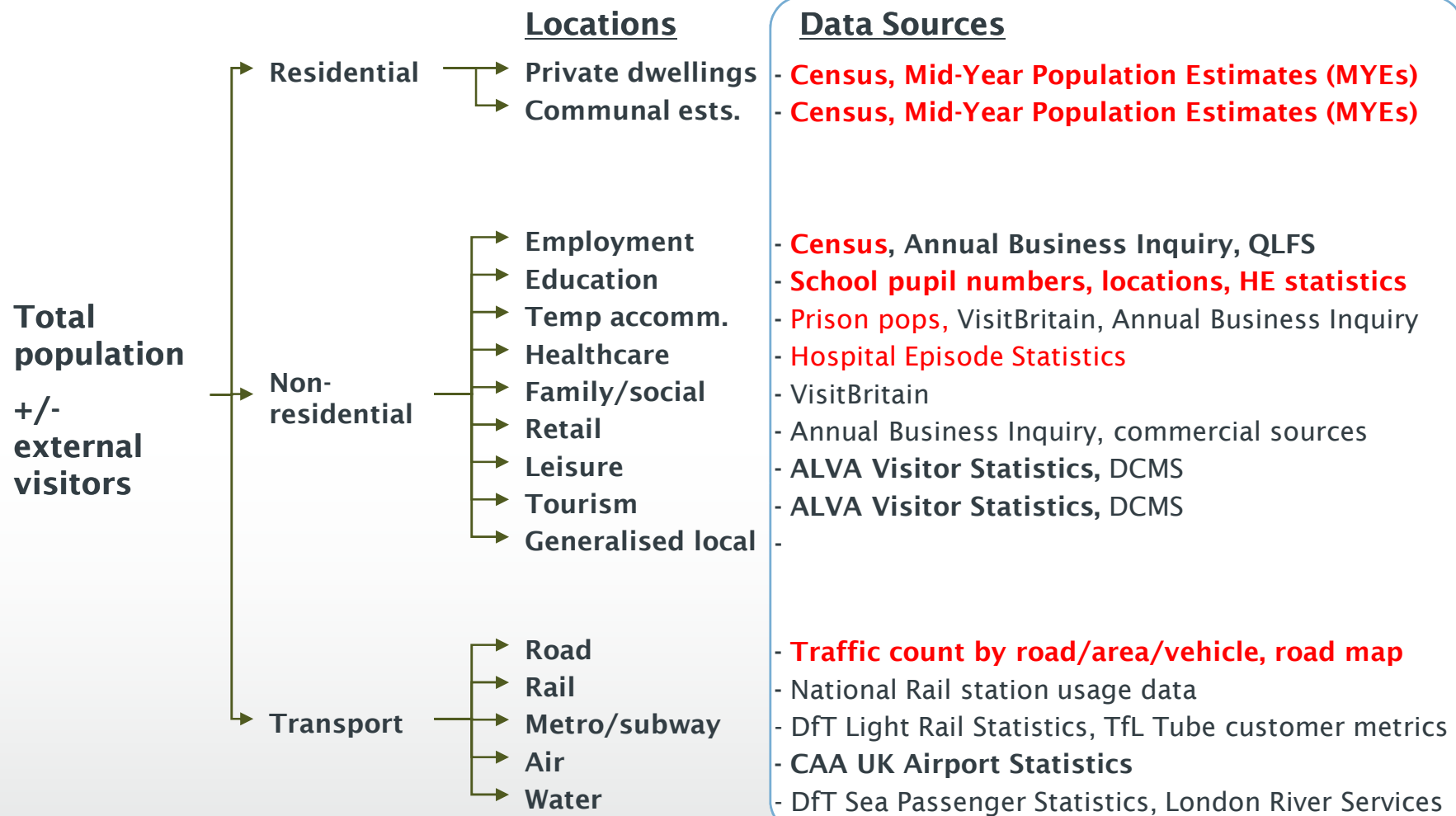
# Population 24/7 project update

# Mapping population over time

- Previously expressed interest in population distribution models for range of different timescales
  - Reflecting intercensal change, night time, day time, weekend, term time, etc. population movement cycles
- Applications in emergency planning, population risk modelling, catchment area planning, etc.
- Requires wide range of data sources, but census is key and many aspects of 2011 outputs are very promising, especially new population bases and WZ geography

# Space-time population modelling

- Gridded approach attractive for all time-based applications because basic spatial units do not change
- Have published first version of gridded population modelling tool SurfaceBuilder247
  - Uses library of time-profiled population centroid locations and generates gridded model for specified target date and time
- Demonstrator models using 2001 and 2006 datasets being prepared by University of Manchester (not yet based on open data licensing!)

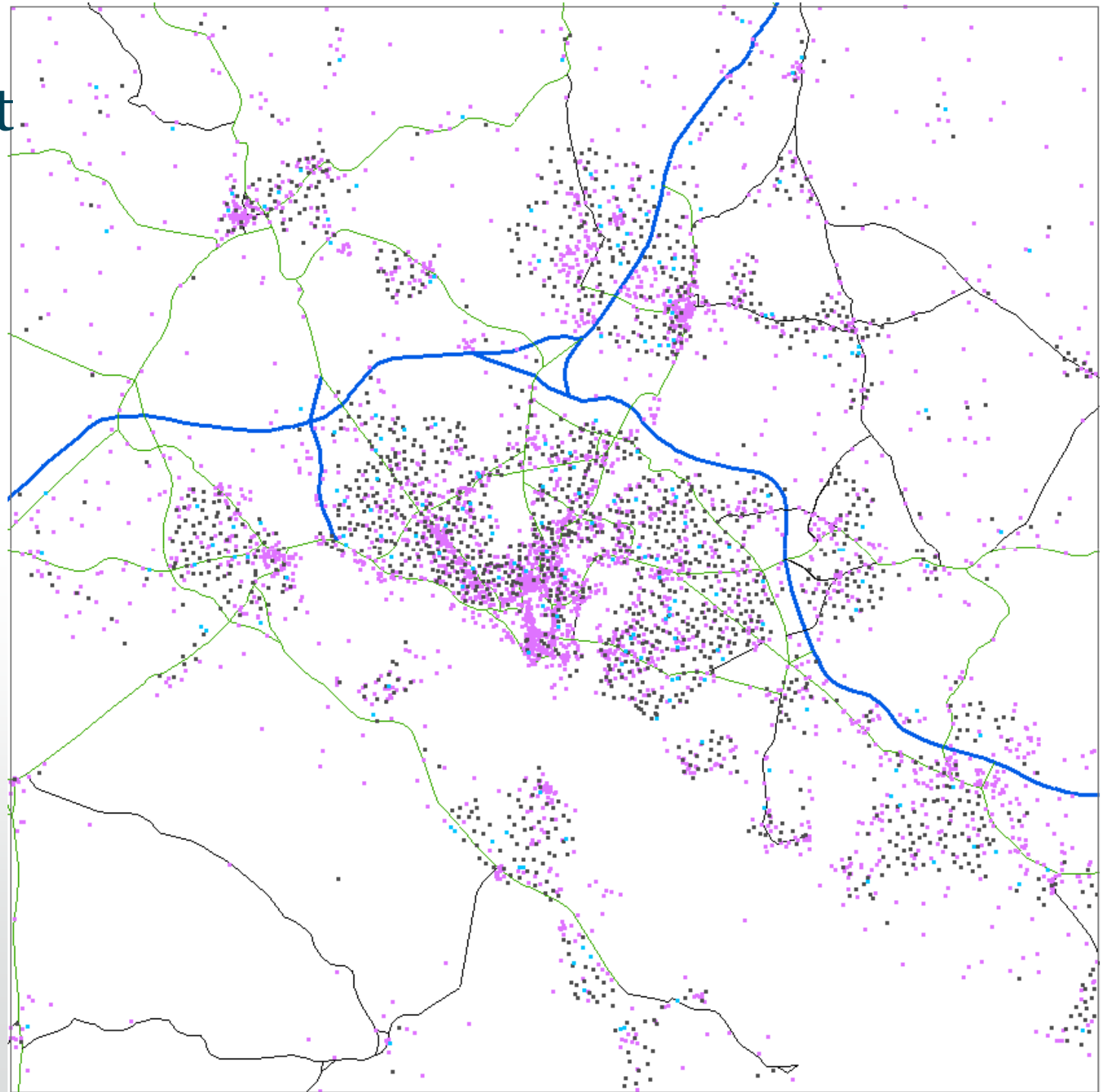


Acronyms: **QLFS** Quarterly Labour Force; **DCSF** Department for Children, Schools and Families; **HESA** Higher Education Statistics Agency; Survey; **DCMS** Department for Culture, Media and Sport; **ALVA** Association for Leading Visitor Attractions; **DfT** Department for Transport; **TfL** Transport for London; **CAA** Civil Aviation Authority



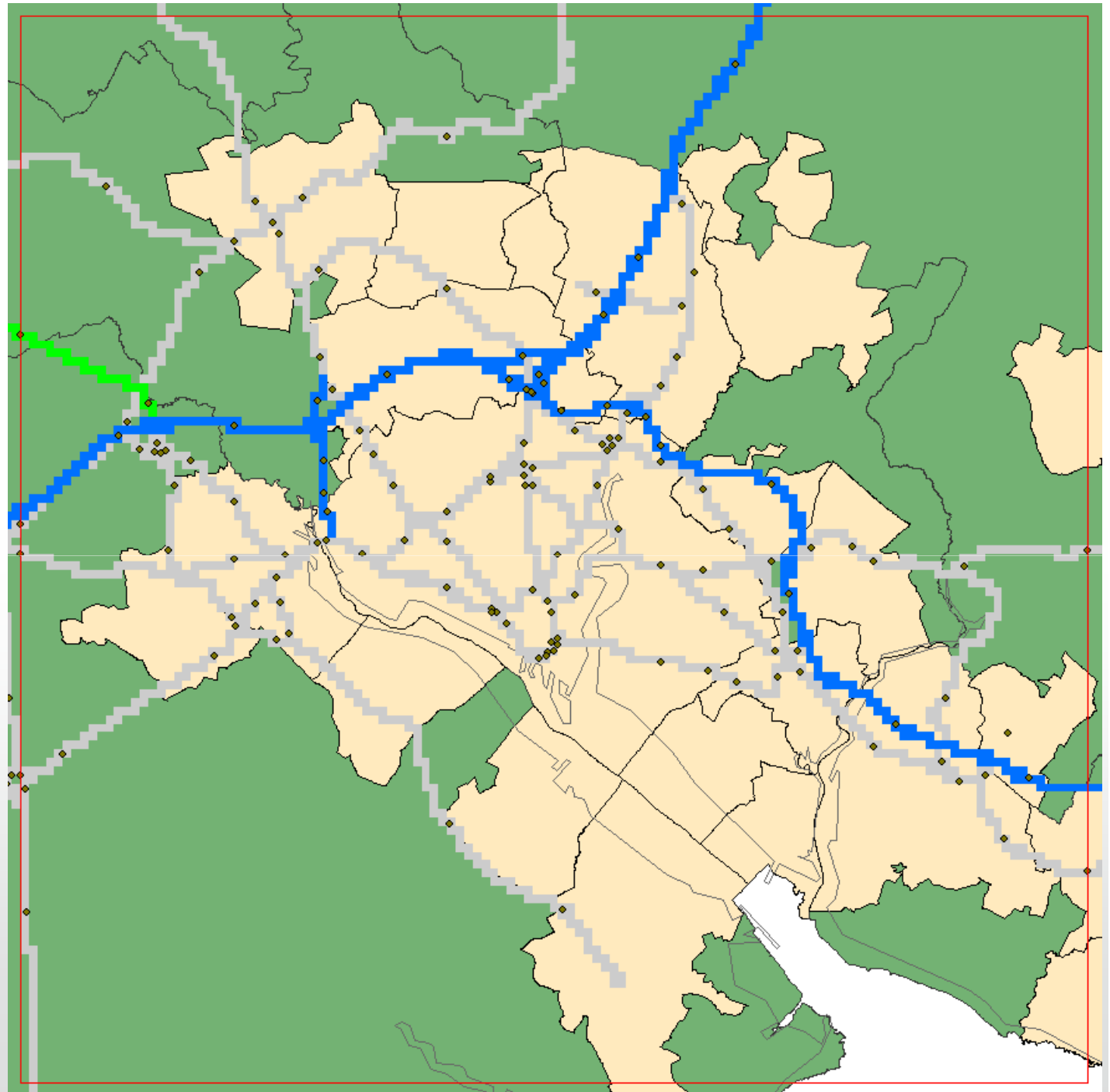
## Centroid set

- 1696 census OAs
- 3329 workplaces
- 211 schools and colleges
- 2 universities
- Hospitals, stations, airport, etc.



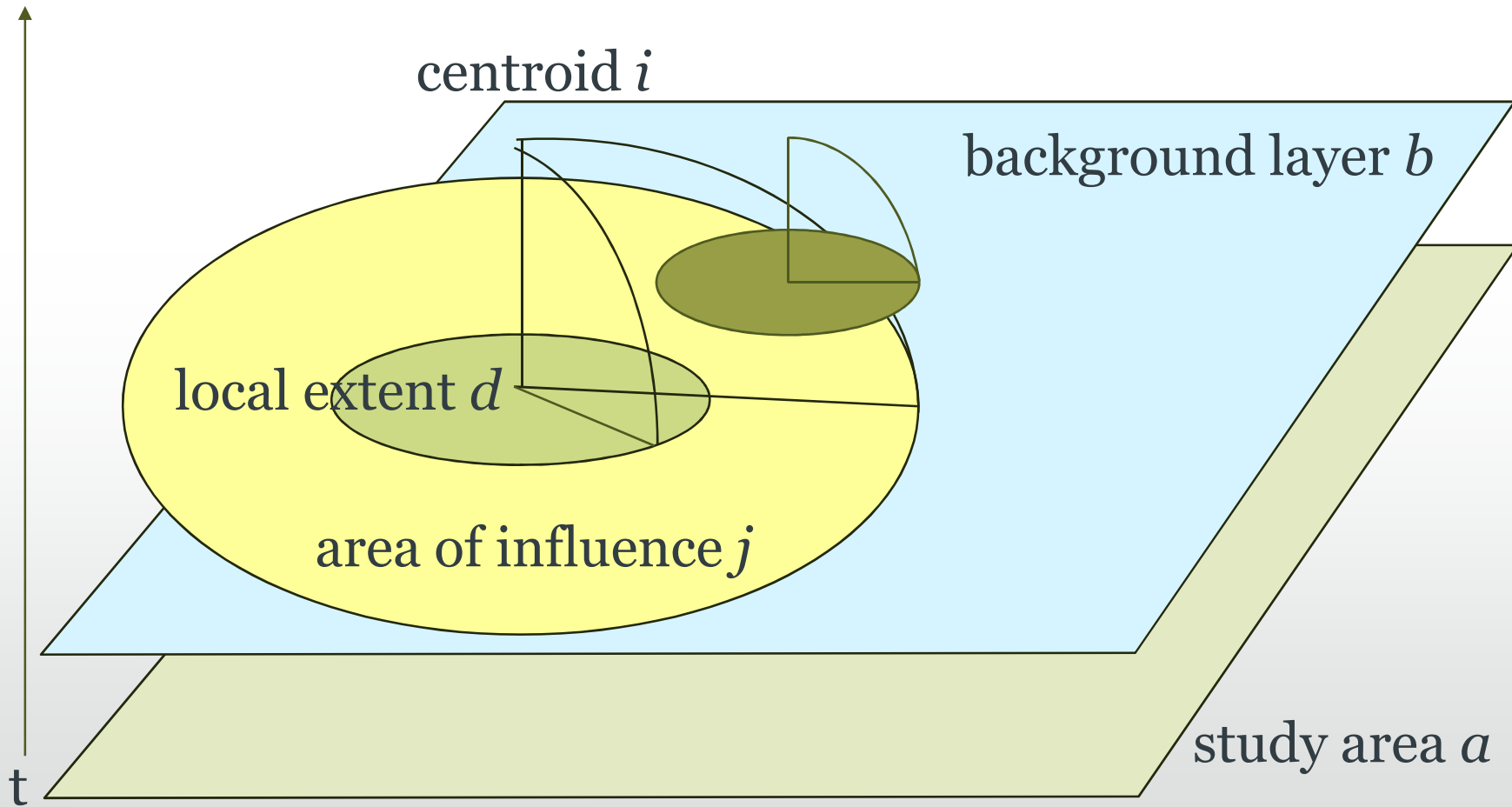
# Transport

- Rasterised road background layer  
Meridian™ 2 v1.1  
Release 2 2010
  - Motorway (blue)
  - Trunk A-Road (green)
  - Principal A-Road (grey)
- DfT NTM Area Type in the study area:
  - Rural (green)
  - Urban (peach)
- AADF Count Points (2006)



# Origin centroid within area of influence $j$

time



**Data selection**

Locate directory

Select bkgmd file

Analysis area  Buffer

Select time series file

- ☐ SICClustersTimeProfiles.xls
- ☐ TimeSeries1.xls
- ☐ TimeSeries2.xls
- ☒ TimeSeries3.xls
- ☐ TimeSeries4.xls

Select dest file

- ☐ Dests\_EN\_Secondary2005x0.csv
- ☐ Dests\_Solent\_Workplace2001.csv
- ☐ NFDests\_Solent\_Workplace2001.csv
- ☒ NFHighfieldTestDest.csv
- ☐ NFHighfieldTestDestJustUni.csv
- ☐ NFSolentExtraTestDest.csv

Select origin file

- ☐ CEN01TERM\_Origins\_EW\_PopIMMx0.csv
- ☒ NFSolentExtraTestOrigin.csv
- ☐ NFSolentExtraTestOriginAllZero.csv
- ☐ Origins\_EW\_CEN01TERM\_MOV.csv
- ☐ Origins\_Solent\_PopIMM.csv
- ☐ Origins\_Solent\_PopIMMx0.csv

**Validation**

Show validation log

**Read data**

Data session name

Show data log

Dests read

**Run parameters**

Run name

Choose dest pop band

Origin pop band used

Model Date

Model time

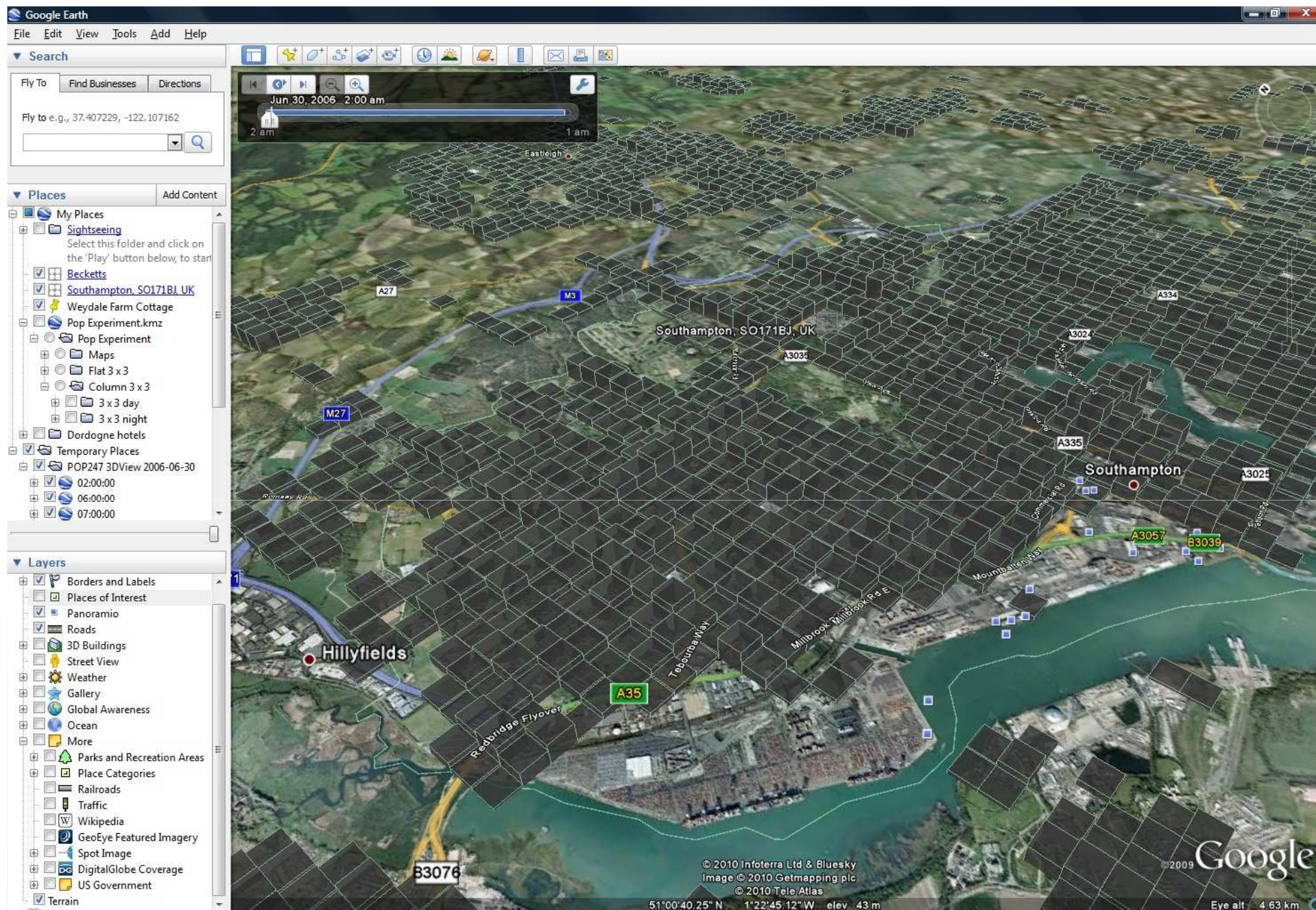
**Run details**

Elapsed Time: 37.3464

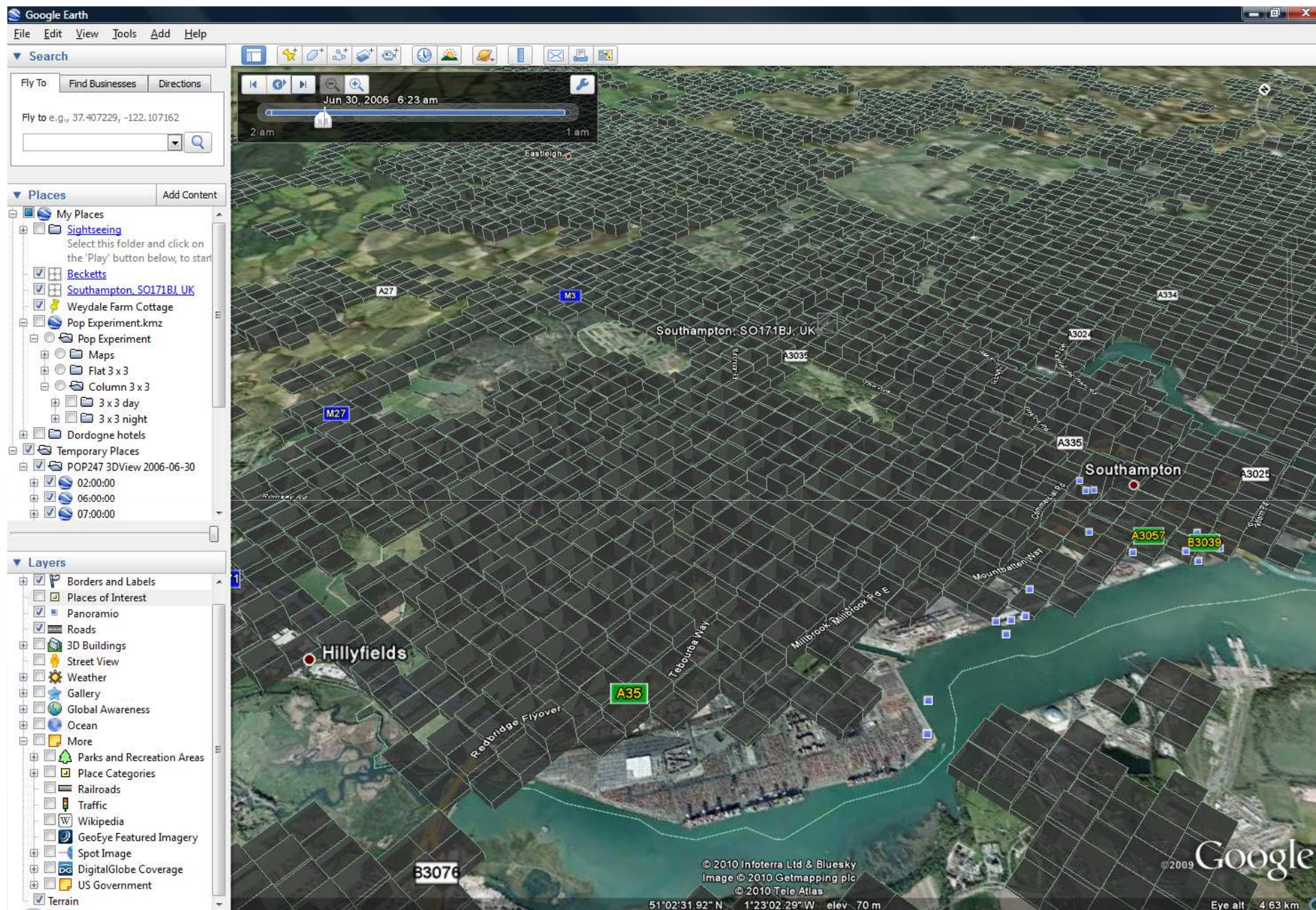
**Display results**

26

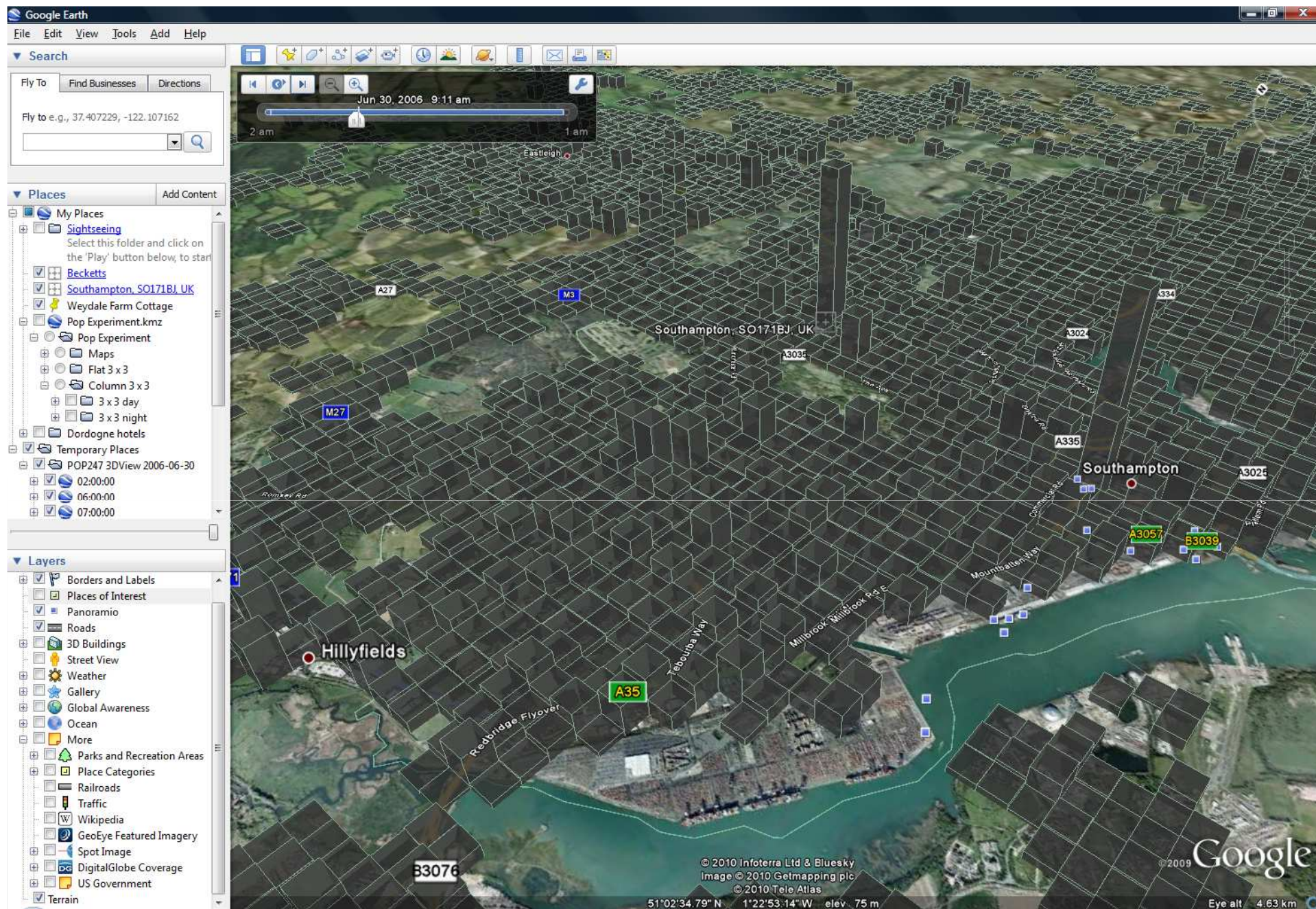














# Conclusion

- 2011 census on track for production of high quality new statistics,
  - including new population bases and geographical units
- BUT gridded outputs not to be produced as a direct output from the census
- Open Data agenda is making available further relevant georeferenced population centroid data
- SurfaceBuilder247 tool now available for use: discussion under way with potential research and policy users

# Acknowledgements

- ESRC Award RES-062-23-1811; Employee data from the Annual Business Inquiry Service, National Online Manpower Information Service, licence NTC/ABIo7-P3020. Office for National Statistics 2001 Census: Standard Area Statistics (England and Wales): ESRC Census Programme, Census Dissemination Unit, Mimas (University of Manchester). National Statistics Postcode Directory Data: Office for National Statistics, Postcode Directories: ESRC Census Programme, Census Geography Data Unit (UKBORDERS), EDINA (University of Edinburgh). Quarterly Labour Force Survey, Economic and Social Data Service, usage number 40023. Meridian™ 2 v1.1 Release 2 2010, Contains Ordnance Survey data © Crown copyright and database right 2010