



Census 2001 Review and Evaluation

Northern Ireland Census Geography: Executive Summary

Project Objective

The overall objective of the NI 2001 Census Geography project was to implement and maintain an integrated, accurate and timely geographical service to all aspects of the Census, with regard to the Census geography information, data, advice and support.

This included the implementation and operation of the Northern Ireland Census Area Planning System (NICAPS), and the provision of geography data and support services to the other Census projects.

The project sought to minimise data redundancy and duplication of effort by establishing and maintaining a central database of Census geography information; and by ensuring, as far as was cost effective and practicable, that the various strategies for meeting Census geography requirements were brought together and implemented in an integrated manner.

Background

Although only responsible for Northern Ireland Geography the project took cognisance of geography developments in GB by liaising closely with the Office for National Statistics (England and Wales) and the General Register Office for Scotland (Scotland) and participation in the UK Census Geography Co-ordination Group. Doing this ensured that any systems developed took account any national differences.

The aims of NI Census Geography were to ensure that:

- enumeration areas were created which facilitated the efficient and accurate distribution and collection of census forms by enumerators, whilst attempting to equalise workloads;
- a central geography database and systems were in place to assist in the processing of census forms by resolving queries and ensuring that all records had an accurate an valid postcode and grid reference assigned to them; and
- a separate geography for output, based on grouping postcodes, was created and made available to users.

Methodology

The main change for the 2001 Census was the introduction of major automation in the design of Enumeration areas and subsequently in the creation of the Output Areas (OAs).

Advances in affordable computer processing power, Geographical Information System (GIS) software and digital data from the Ordnance Survey of Northern Ireland (OSNI) – Northern Ireland’s national mapping agency, made this possible.

The use of GIS at the front end allowed the enumeration areas to be split from the areas used for the release of census output. This was a crucial; and innovative advance. Enumeration areas and Output Areas serve two very different purposes and previously the same building block had to be used for both purposes, which gave a sub-optimal solution for output.

Enumeration Area Planning

An automated Northern Ireland Census Area Planning System (NICAPS), developed jointly with OSNI and a private sector company Geosolutions Ltd (the GIS software supplier) was used to plan the enumeration areas. NICAPS effectively automated the majority of the tasks previously done manually and allowed the operation to be completed in a shorter timescale with a quarter of the staff.

The requirement for a smaller field force for the 2001 Census, due to the use of post back of census forms meant that NICAPS could be used to plan enumeration areas that were larger than those used during the 1991 Census.

NICAPS made extensive use of OSNI digital maps, boundaries and the Computerised Point Address Service (COMPAS – address database). Outputs from the system meant that enumerators were provided with customised maps and lists of addresses pre-printed into their Enumeration Record Books (ERBs).

Processing of Census Forms

Northern Ireland Census forms were processed along with the other forms from the rest of the UK. A geography database created as part of the enumeration area planning exercise was used extensively during the processing of census forms to check the validity of postcodes and allow grid references to be added. Postcode and address queries raised during the process were passed to the NI geography team for resolution and various automated and manual systems (collectively known as the Lockheed Martin Address System (LOMAS)) were used to ensure the final census database contained accurate and valid postcodes and associated grid references.

Output Geography

Another first for 2001, was the separation of the collection geography from the output geography. This was again facilitated by the combined use of a GIS, digital boundaries and the fully grid-referenced census database. An automated zoning system for output purposes (Output Area Production System (OAPS)) was used. This was developed jointly by ONS and Professor David Martin, then from the University of Southampton, whose expertise was invaluable in developing theory into a working system.

Output Areas were created by grouping together postcodes and part postcodes on an Electoral Ward basis, thus allowing better integration between geographical information referenced by Census and postcode geographies. All Output Areas were created above confidentiality thresholds, with population sizes standardised, internal social homogeneity maximised and irregular geographical minimised.

Assessment and Lessons learnt

Geography is crucial to the census operation, being present at all stages. The successful development and implementation of the 2001 geographical system is all the more impressive given that it was a key innovation. Innovation always carries risk, in this case the risks were well managed and contained. The detailed lessons learnt during that process are described below.

Although in live running the geography systems worked well, overall, the geographical aspects of each stage of the census process were not always considered sufficiently at the design and development stage. Geography therefore needs to assume a higher profile and become more integrated in the overall conduct and management of a future census. Geography 'experts' need to be involved, from the beginning, in the design of any systems that will make the use of geography data.

System development was helped greatly by input from OSNI staff, who were skilled in GIS technology. The more widespread use of GIS and database software within NISRA should make in-house system development easier to achieve.

Enumeration Area Planning

Overall this can be considered as a success with enumeration areas planned in an extremely cost effective way. Enumerators were also provided with better, more up to date maps and the labour intensive task of writing addresses into their record books was largely removed. NICAPS was also flexible enough to allow for late changes to be incorporated or to produce ad-hoc specialised maps for certain field staff.

The principle lessons learned can be summarised as follows:

- the specialised nature of GIS systems meant that difficulties were encountered in finding suitably qualified staff to develop the systems needed. This was overcome by using staff from OSNI, but this must be addressed in any future exercise with system requirements identified at an early stage of the census project and development progressed as soon as possible thereafter;
- the task of ensuring that boundary data sets were consistent and suitable was very time consuming and sufficient resources should be made available in future at an early stage; and
- the printing of field maps and documentation was very time consuming and appropriate testing should be set up well in advance to ensure live running meets requirements and materials are made available to field staff when needed.

Processing of census forms

Although far more records than originally planned were passed to geography for query resolution, the flexible nature of the systems meant that they could be adapted to cope and ensure that crucial end dates were still met. The principle lessons learnt can be summarised as follows:

- Experience gained this time will prove invaluable in designing systems for any future census and should enable quicker turn around time for query resolution; and
- Careful consideration must be given to the balance between the need for timeliness and the need for total accuracy against a fit for purpose solution especially in regard to postcode and grid reference allocation, as this has a significant impact on time and resource.

Output Geography

The creation of Output Areas was another success which has created building blocks ideally suited to the presentation of census statistics as they are smaller than enumeration areas and, being constructed from postcodes allow other data to be easily referenced to them. Initial reaction from customers has been favourable, seeming to meet most of their needs.

A few users have commented that they would have liked more input into the physical design of the Output Areas but this was not possible due to time constraints and the need to retain uniformity over all of Northern Ireland. Some users have also indicated that the Output Area boundaries are in effect too accurate and that a slightly generalised version would have sufficed. Users were consulted about the principles governing the creation of the Output Areas and were presented with examples to illustrate the implementation of those principles. If development work were completed earlier in a future census, it would be possible to build on this aspect and allow a greater degree of involvement.

Another indicator of success is the fact that OAs have been adopted as the single small area building brick for National Statistics and have been used in NI's Neighbourhood Statistics.

The principle lessons can be summarised as follows:

- Output Areas were created in a very cost effective manner over a short space of time to be fit for the purpose of disseminating 2001 Census statistics. The boundary sets produced are very accurate and take cognisance of major topographical and residential features on OSNI's large scale mapping database. It may be possible to refine the boundaries to integrate them further with OSNI's mapping database and to produce more generalised versions for customers not requiring datasets which take full account of underlying geometry;
- the Output Area Planning System was developed within ONS with little input from NISRA. Although specific NI requirements were incorporated into system design, in the future, if a similar development methodology is followed, NISRA staff will need to become more involved during the development stages of the project; and,
- policy dictated that Output Areas were designed within wards in existence at the end of 2002 - (1992 Ward boundaries). A boundary review was due around 2002 / 2003. If this had progressed there would have been obvious implications for the OA boundary dataset production. Cognisance must be taken of the timing of the introduction of new geographies and the impact on outputs agreed at an early stage in the policy formulation.