

Small Area Projections in Scotland using POPGROUP software

Guidance Part 2: Household projections using HOUSEGROUP

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Background

This guidance summarises a method used for making small area household projections in Scotland, and its practical implementation, as undertaken by the Centre for Census and Survey Research at the University of Manchester. The method has not been evaluated by the General Register Office for Scotland (GROS) in the same way as population projections (reported separately), but will be developed (further information below).

The software used to develop household projections for small areas, HOUSEGROUP, was designed to replicate methods developed in the 1980s for areas within England and Wales, undertaken now by the Department for Communities and Local Government (CLG). The household projections now undertaken by GROS use different categories and age groups, which required some approximation in this implementation using HOUSEGROUP ([section 3.3](#)).

For this reason, the guidance given here attempts to show the principles that apply and the practical steps required, whether using the current HOUSEGROUP software or the enhanced software due later in 2010.

The examples used in this document are taken from projections for the multi-member wards of Fife, funded by Fife Council, developed with Excel 2003, using POPGROUP and HOUSEGROUP version 3. The software functions equally with Excel 2007.

The approach described here is also used by Edge Analytics when providing a service to produce small area projections in Scotland. A similar approach is used for small areas in England or Wales, adapted to the different data available for those countries. The approach is likely to be developed as new data become available.

'Forecast' and 'projection' are used interchangeably in this guidance.

Future developments and revisions

During the year after preparation of this Guidance, it is likely that the following developments will take place that users may wish to incorporate in their practice. If possible, a revised version of this guidance will be issued.

1. 2008-based Council Area projections will be released by GROS.
2. A census commissioned table for each data zone will allow direct calculation of age-specific headship rates for each local area.
3. A new POPGROUP module for 'derived forecasts' will allow closer replication of GROS methodology than is possible with HOUSEGROUP.
4. Experience of local authorities and health authorities will be shared to provide improvements or alternative practices.

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1. Before starting

1.1. Pre-requisites

- (a) POPGROUP and HOUSEGROUP software, installed.
- (b) The POPGROUP and HOUSEGROUP reference manuals. This guidance assumes that the user is familiar with POPGROUP and HOUSEGROUP and that the reference manual will be referred to for help with basic usage.
- (c) A small-area population forecast prepared in POPGROUP, based on recent local experience of fertility, mortality and migration, for example prepared as described in [Guidance Part 1](#). The forecast will be for the small areas within a single local authority Council Area.

From GROS:

- (d) Population and Household projections for the Council Area. A version of these using HOUSEGROUP categories is available as 'GROS_2006-based_hhproj_HOUSEGROUP_format.xls'.
- (e) 2001 Census data for Output Areas ([Appendix](#)).

From the user's own resources:

- (f) A geographical conversion table ('lookup'), specifying how each 2001 Census Output Area is wholly or proportionately allocated to each of the user's small areas.

1.2. Which small areas?

[Guidance Part 1](#) discussed the nature of small areas that can be forecast using POPGROUP software.

To extend the population projections to households, detailed estimates of household characteristics for the Council Area as a whole will be adjusted according to the less detailed information for the small area that is published in the 2001 Census. For this reason, the small areas will normally cover the whole of one local authority Council Area in Scotland, without overlaps. It is possible to use the same method to make population and household projections for small areas that cover more than one local authority or parts of one or more authority; this involves more complex merging of information from different area scales which is not referred to here.

2. The strategy for these small area projections

The household projections follow a standard approach, the same as is used by GROS for Council Areas in Scotland.

1. Forecast the population by age and sex (achieved as described in [Guidance Part 1](#)).
2. Forecast the population not in households (those in institutions including homes, and hostels), by age and sex ([section 4.2](#)).
3. Forecast the headship rate for each type of household (the proportion of an age group who head a particular type of household; for example the proportion of 20-24 year olds who are lone parents) ([section 4.3](#)).

The software then calculates the projections:

4. Deduct the population not in households from the population, giving the household population.
5. Multiply the household population at each age by the headship rates for that age, giving the number of household heads for each type of household.
6. Add the number of household heads for each type of household across ages, giving the total number of households of each type.

The user requires information for small areas, about the population not in households and about headship rates (steps 2 and 3 above). In this strategy the information for small areas is estimated for the year 2001, by scaling Census data for small areas to the detailed estimates for the Council Area.

The population not in households is assumed to be constant in future years (a user may alter that assumption easily, by altering the input files).

The headship rates are projected forward into the future in line with GROS assumptions for the Council Area. For example when a greater proportion of young people are expected to be in one-person households in Fife, this is assumed to be also the case for each small area within Fife.

A household projection is first made based on the migration-led population projections. The population projection is then adjusted according to scenarios of planned development of housing. These may include a scenario of no development at all, as well as developments envisaged in plans devised locally. The results show in which areas and by how much the population is expected to be sensitive to housing plans.

Household projections

Steps in strategy	Summary of action or outputs for each small area	
1. Data allocated to each small area	Population not in households	Household types
2. Scaling to Council Area household projections	Detailed age-sex household population	Household headship rates
3. Projected number of households	Uses the migration-led projection to calculate the implied number of households	
4. Housing-led projection	Uses a housing development plan to adjust migration to fill the projected households	

3. HOUSEGROUP Model Set-up

3.1. HOUSEGROUP Model Set-up

Open, complete, run and save the hhset-up file, as in this example and the notes below.

(a) Sheet 'Labels'

HOUSEGROUP - Household Forecasts

Model Set-up Information

File header: 1

Base Year of headship data:

Directory in which to save the skeleton input workbooks: 2

Directory in which to save data workbooks: 2

Directory in which to save output workbooks: 2

POPGROUP workbook containing population group labels: 3

Get these POPGROUP labels

Labels for the total of all population groups.

Short Label (Up to 8 characters)	Long Label
Fife	Fife Council Area

Number of population groups:

The order given will be used on the input and output files, and printed reports

No.	Short Label (Up to 8 characters)	Long Label
1	BuckMeth	Buckhaven Methil and Wemyss Villages
2	BurntKin	Burntisland Kinghorn and Western Kirkcaldy
3	Cowdenb	Cowdenbeath
4	Cupar	Cupar
5	DunfCen	Dunfermline Central
6	DunfNor	Dunfermline North

Note: The short label is used for naming sheets in the input, model and output workbooks. It is also used for column headings throughout the system.

The long label is used for headings in

Notes:

1. The base year is 2001, to allow use of data from the 2001 Census.
2. The directory paths and names are at the convenience of the user.
3. The labels for areas can be taken from the POPGROUP file used to set up the population projections. Double-clicking this cell will bring a dialogue box to find the file. Once this file and its path have been entered, click the button below to 'Get these POPGROUP labels'.
4. The labels have been filled automatically from the POPGROUP file named in item 3.

(b) Sheet 'Options_Selected'

HOUSEGROUP - Household Forecasts

Model set-up: chosen age groups and household types

This is the set of age groups and household types for which the model will require data. It will also be the lowest level available for reporting on household forecasts, and associated output.

Age groups	Household types	Created from
15-24	1 person	<<Married couple>
25-29	1 adult 1+ children	<<Cohabiting couple>
30-34	2 person all adult	<<Lone parent>
35-44	2+ adult 1+ children	<<Other multi-person>
45-54	3+ person all adult	<<One person>
55-59		
60-64	Concealed family types	Created from
65-74	Not used	<<Concealed married couple> <Concealed cohabiting couple> <Concealed lone parent>
75-84		
85+		

If these groupings of age and household type are what you intended, click the button to generate the skeleton input workbooks.

This set-up workbook will be saved as:

Note: The name must not be hhset-up. It will be saved in your HOUSEGROUP directory

Notes

1. The age groups should be changed to these, on the 'Select_Options' sheet.
2. The labels for household types should be changed to these Scotland categories, on the 'Select_Options' sheet. Select 'Combine household types', and use the dialogue box to select just one type at a time, entering the Scotland category and clicking 'OK'.
3. The label 'Not used' for 'Concealed family types' is achieved on the 'Select_Options' sheet. Select 'Combine concealed family types', and use the dialogue box to select all three types, entering the label 'Not used' and clicking 'OK'. The rate for this type will be entered as zero in the input files.

3.2. Check the results

Running the hhset-up will create three folders as requested. One will have skeleton files, and the other two be empty, ready for input files and output files.

3.3. Software limitations and development

The limit of 5 household types in HOUSEGROUP means that the finer set of GROS types are amalgamated to five, as above.

In HOUSEGROUP the youngest age has to be 15; GROS uses 16-24 rather than 15-24. [Sections 4.2](#) and [4.3](#) use a file estimated from GROS Council Area projections with the HOUSEGROUP ages and household types entered in the set-up file as above.

HOUSEGROUP requires use of male and female headship rates separately, while GROS headship rates are for persons. The GROS rates will be entered for both males and females in HOUSEGROUP.

The 'Derived forecasts' module of POPGROUP expected later in 2010, will provide a more general facility for household projections which will allow full use of the age, sex and household type categories used by GROS.

4. Data preparation

4.1. Allocation of data to small areas

The Census data for Census Output Areas (COA) ([Appendix](#)) must be allocated to the small areas identified in the Model Setup.

The allocation will usually be not of whole COAs but in proportion to the overlaps of each COA with each local area, estimated through Geographic Information Systems (GIS) or postcode directories. The creation of a Geographical Conversion Table (sometimes called 'lookup table', or 'recasting proportions') is usually undertaken in-house because the composition of the local areas is best known locally. It is not provided by GROS.

4.2. Local population not in households

1. Copy from "GROS_2006-based_hhproj_HOUSEGROUP_format.xls" the Council area population not in households into the default sheet of HOUSEGROUP's POPHH.xls skeleton input file.
2. Save in your input folder as POPHH1.xls.
3. Use the first column of these Council Area data, which refers to 2001, to scale the 2001 Census data for small areas ([Appendix](#)).

For each age-sex group in the model:

- a. Sum the Census data on population not in households for each small area to its Council area total.
- b. Compute the ratio (Council Area population not in households) / (sum of small areas total).
- c. Multiply every small area's population not in households by this ratio.

The small area populations not in households will now sum to the Council Area total estimated by GROS.

4. The adjustment will be significant in some places, because GROS improved on the estimates of population not in households after consulting local authorities. The user may wish to check the estimates for each small area, and make assumptions about future change, if relevant local information is available.
5. Enter these small area population not in households into the small area sheets on POPHH1.xls.
6. Document the file, validate the file, check the messages and correct any errors, and save with the same name.

4.3. The headship rates for small areas, using a training scenario

1. Copy from 'GROS_2006-based_hhproj_HOUSEGROUP_format.xls' the Council area headship rates, into the default sheet of HOUSEGROUP's INRATES.xls skeleton input file. Copy the same rates in the Male and Female panels.
2. Enter zero in the rows labelled 'Not used'.
3. Document, save in your input folder as INRATEStraining.xls.
4. Validate, check the messages and correct any errors, save again. The validation will produce another input file, INRATEStraining-validated.xls.
5. Find the total number of each type of households in 2001 under the assumption that all small areas have the same headship rates, as follows (the discrepancy with the Census data for small areas will indicate how the common headship rates should be altered). To find this number, run HOUSEGROUP, preparing a scenario as follows, with ID 'Training':

HOUSEGROUP - Household Forecasts

Information for this scenario

RUN THE MODEL

Scenario identifier: Training

Contact details (to be included on all output files)

Organisation/Department Name: Fife Wards

Other information (e.g. contact details): xxx
xxx

Final year for this forecast: 2002

Double click to browse for directory or workbook names

Default directory for the input workbooks: C:\Forecast\Housegroup_v3\FifeWardsHh1_inp

Directory for the output workbooks: C:\Forecast\Housegroup_v3\FifeWardsHh1_out

Input workbook names (you do not need to give the .xls suffix for any workbook names)

Headship rates: INRATEStraining-validated

Population forecasts: C:\Forecast\Popgroup_v3\FifeWards1_inp\fore_mig.xls

Persons not in households: POPHH1

Annual household constraints (optional):

Output workbooks (named automatically from the scenario identifier)

Household forecasts HHForecast_Training

Population in, and not in, households HHPopout_Training

Household headship rates OutRates_Training

This scenario saved as: scenario_Training

last run on: 07/09/2009 at 12:20:56

Notes for this scenario, to be placed on the output files

Population not in households uses local information but maintain consistency with the GROS totals.
Population is migration-led, reflecting recent experience.
Headship rates are the same for all small areas, based on the Council Area from the 2001 Census.

Notes

1. Forecast to 2002 only.
2. Input directories as named when setting up the model (see above).
3. Headship rates for the district, prepared as above.
4. Population forecasts indicate the full path and file name of those that you have already produced, for example using [Guidance Part 1](#).
5. Population not in households as prepared above.
6. Document.
7. Run the scenario. You will next use one of the output files.

- For each small area, complete the following table. Use the Census data ([Appendix](#)), the output file HHForecast_training.xls, and compute the ratio of these two. For this ward in Fife, the headship rates are higher than Fife's average, particularly so for 1-person households.

Buckhaven Methil and Wemyss Villages	Households, from Census	Households, from Training scenario	Ratio Census / Training
1-person, pensioner age	1,472	1,369	1.08
1-person, not pensioner age	1,663	1,289	1.29
1 adult 1+ children	680	520	1.31
2 person all adult	2,506	2,630	0.95
2+ adult, 1+ children	1,604	1,793	0.89
3+ all adult	797	697	1.14
All households	8,723	8,299	1.05

- Calculate the small area headship rates for each age and sex, by multiplying the default set of rates in INATEStraining.xls by the ratios in the last column of this table. For example, the default rates at all ages for 1 adult 1+ children (lone parent) households, should be multiplied by the ratio in the table for that household type (1.31 in the example above). And all the default rates at pensioner age for 1-person households should be multiplied by the ratio in the table for pensioner age 1-person households (1.08 in the example above).
- Enter these headship rates in the column for 2001 on the small area sheets of the file INRATEStraining.xls, document and save as INRATES1.xls.
- Validate, check the messages and correct any errors, and save again as INRATES1.xls.

4.4. The relationship between Households and Dwellings

The relationship between households and dwellings is computed as a ratio of the census counts for these two indicators from the 2001 Census ([Appendix](#)). It will be used in later sections, with POPGROUP.

- Enter this ratio households/dwellings for each small area in the first column of the POPGROUP skeleton input file (not HOUSEGROUP) HHDwel.xls.
- If desired the relationship can be changed according to expectations of changing rates of second homes, vacant housing or households sharing the same household space (see POPGROUP reference manual).
- Document, validate, check the messages and correct any errors, and save in the POPGROUP input folder as HHDwel1.xls.

5. A household projection based on recent demographic experience

5.1. Prepare the scenario

Open the previous HOUSEGROUP scenario file Scenario_training.xls, and edit it to use the small area headship rates, using a scenario identifier 'Mig':

HOUSEGROUP - Household Forecasts

Information for this scenario **RUN THE MODEL**

Scenario identifier: Mig

Contact details (to be included on all output files)

Organisation/Department Name: Fife Wards
Other information (e.g. contact details): xxx
xxx

Final year for this forecast: 2026

Default directory for the input workbooks: C:\Forecast\Housegroup_v3\FifeWardsHh1_inp
Directory for the output workbooks: C:\Forecast\Housegroup_v3\FifeWardsHh1_out

Input workbook names (you do not need to give the .xls suffix for any workbook names)

Headship rates: INRATES1-validated
Population forecasts: C:\Forecast\Popgroup_v3\FifeWards1_inp\fore_mig.xls
Persons not in households: POPHH1
Annual household constraints (optional):

Output workbooks (named automatically from the scenario identifier)

Household forecasts	HHForecast_Mig
Population in, and not in, households	HHPopout_Mig
Household headship rates	OutRates_Mig

This scenario saved as: scenario_Mig
last run on: 07/09/2009 at 12:20:56

Notes for this scenario, to be placed on the output files

Population not in households and headship rates use local information but maintain consistency with the GROS totals.
Population is migration-led, reflecting recent experience.

Notes

1. Use the headship rates prepared to reflect local evidence from the 2001 Census.

5.2. Run the projection

When you have entered all the above information, run the scenario by clicking the button: **RUN THE MODEL**

6. The impact on housing of the population projection based on recent experience (migration-led)

This section repeats the population projection based on recent demographic experience, but additionally computes the households and dwellings that would be demanded by that projection.

HOUSEGROUP is run in the background. The POPGROUP output file comp_mig.xls will contain the number of households and the number of dwellings expected in each small area.

This section is running a previous population projection (migration-led) and in the background running the same household projection that was prepared in the previous section. The only new information will be the number of dwellings implied by this population projection.

6.1. Prepare the scenario

Open the POPGROUP input file 'scenario_mig.xls'. Edit it as follows and run it; it will be saved automatically as scenario_mig.xls in the input directory that was created when you ran the Model Setup.

(a) Sheet 'Run_Details':

You can leave this sheet unchanged, except to alter the documentation on this sheet to say that the housing impact is requested. The scenario ID can remain 'Mig', as it is the same population projection. The outputs will be the same, but contain housing information on the comp_mig.xls output file.

(b) Sheet 'Constraints_and_impacts':

In addition to the constraint of past population estimates, the household input files are also entered, and the relationship between households and dwellings.

Population Estimates and Forecasts	
<u>Constraints and impact on housing and labour force</u>	
Annual Constraints	<small>Double click to browse for workbook names</small> cons1
Housing	
Household headship rates	C:\Forecast\Housegroup_v3\FifeWardsHh1_inp\INRATES1-validated
Persons not in households	C:\Forecast\Housegroup_v3\FifeWardsHh1_inp\POPHH1
Dwellings-households conversion	HHDwel1
	Produce housing impact <input checked="" type="checkbox"/>
Labour Force	
Economic activity rates	
Students	
Employment-labour force conversion	
	Produce labour force impact <input type="checkbox"/>

6.2. Run the projection

When you have entered all the above information, run the scenario by clicking the button on the 'Run_Details' sheet: **RUN THE MODEL**

At the foot of the comp_mig.xls file is the impact on households and dwellings of this projection.

7. The impact on population of housing plans (dwelling-led forecasts)

7.1. Prepare the constraints file

As in section 6, this will be a POPGROUP forecast, running HOUSEGROUP in the background. This time, however, the migration taken from the POPGROUP input files will be altered to meet a number of dwellings entered on the constraints file.

The constraints are often the number of extra dwellings expected each year after the latest population estimate. These are the responsibility of the user, and often are given by planners or developers. An example constraints file with dwellings specified:

Population Estimates and Forecasts
Fife Electoral Ward Areas

Constraints to be applied to the annual forecasts
Buckhaven Methil and Wemyss Villages

Housing & Labour Force Constraints
Year Beginning July 1st

Options	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	201
Provide change in total households													
Provide change in total dwellings													
Provide change in total labour force													
Provide change in total employment													

Rules Double click any option you wish to choose for a year and then fill in the relevant data below

Data - year beginning July 1

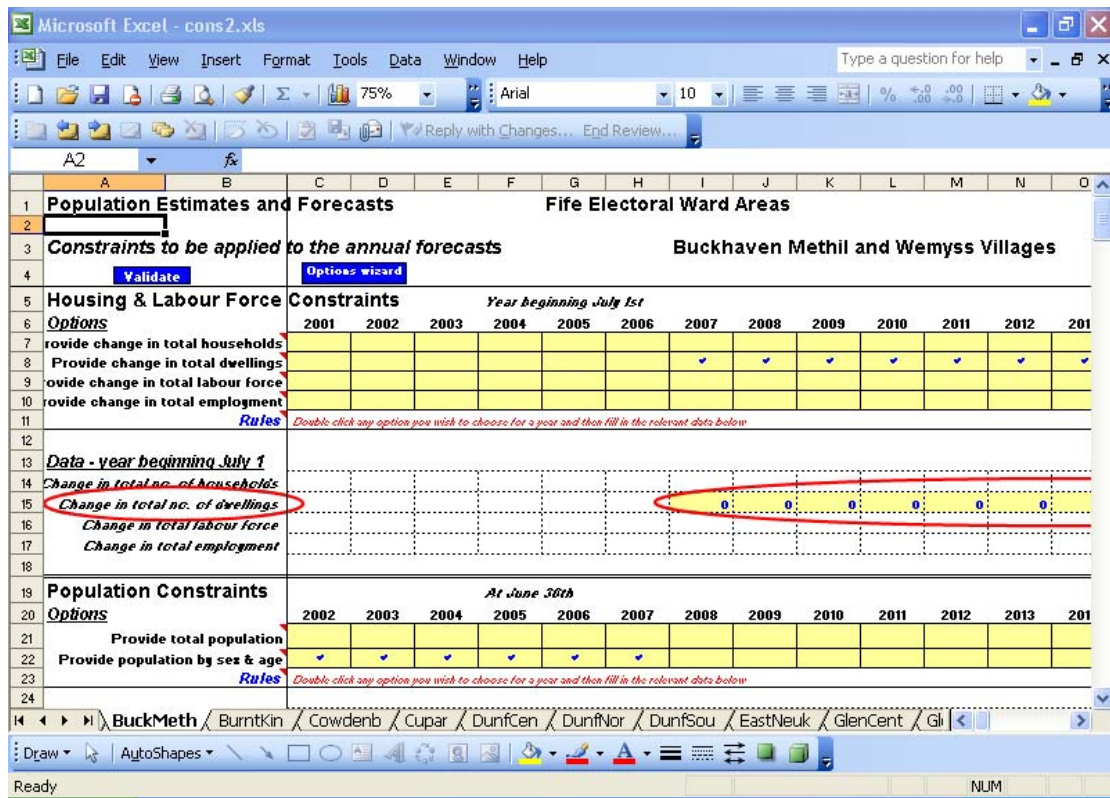
Options	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	201
Change in total no. of households													
Change in total no. of dwellings							53	55	64	17	112	112	
Change in total labour force													
Change in total employment													

Population Constraints
At June 30th

Options	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	201
Provide total population													
Provide population by sex & age													

Rules Double click any option you wish to choose for a year and then fill in the relevant data below

Sometimes, planners wish to know what the population might be if no dwellings were constructed. The constraints file would be as follows:



7.2. Prepare the scenario

The scenario file will be as prepared in Section 6 (migration-led) except that:

1. The Sheet 'Run_Details': enter migration weights under Housing, 50% on in-migration and 50% on out-migration.
2. The Sheet 'Run_Details' will have an ID referring to the housing scenario
3. The Sheet 'Constraints_and_impacts' will contain the name of the constraints file with housing constraints added, and
4. The Sheet 'Run_Details' will be documented to this effect.

7.3. Run the projection

When you have entered all the above information, run the scenario by clicking the button on the 'Run_Details' sheet: **RUN THE MODEL**

The output file comp_ID.xls (The ID from the scenario) will contain at its foot the Housing constraints. The population will not be the same as in the migration-led scenario, but will reflect the migration required to fill the housing specified.

The details of how POPGROUP alters migration are given in the POPGROUP manual.

Appendix: 2001 Census data

The following 2001 Census data were used when preparing the Fife household projections.

Population not in households: CAS001. Cells for the age-sex groups used in the Model set-up, for every Census Output Area:

	Males	Females
15-24	99+129	100+130
25-29	159	160
30-34	164	165
35-44	169+174	170+175
45-54	179+184	180+18
55-59	189	190
60-64	194	195
65-74	199+204	200+205
75-84	209+214	210+215
85+	219+224	220+225

Household types: UV066. Cells for household types, for every Census Output Area:

1-person, pensioner age	3
1-person, not pensioner age	4
1 adult 1+ children	6
2 person all adult	7+9
2+ adult, 1+ children	8+10
3+ all adult	11

Household/Dwellings ratio: UV53 and UV55. For use in file HHDwel, for every Census Output Area:

POPGROUP allows the relationship between households and dwellings to be specified in HHDwel either as the ratio between households and dwellings from the above two indicators, or in more detail as three rates of shared dwellings, vacancy, and second homes. To allow these to be explored and altered, for example if the vacancy rate at the time of the census is thought to be in error or changing over time, obtain the following cells, for every Census Output Area:

Total dwellings	UV55 cell 1
Unshared dwellings	UV55 cell 2
Shared dwellings	UV55 cell 3
Occupied household spaces	UV53 cell 2
Unoccupied household spaces	UV53 cell 3
Second home household spaces	UV53 cell 4
Vacant household spaces	UV53 cell 5