2004 Living in Wales Grossing Technical Note – 29 March 2005

Before any weighting factors could be calculated, an estimate was needed of the population of eligible addresses in each Unitary Authority (UA) and thereby in Wales as a whole.

This was straightforward to calculate. For each UA, the estimate of the number of eligible addressees was estimated as:

(Issued addresses – Non-valid addresses) / (Issued addresses + Non-issued addresses) / Total addresses

where non-valid addresses are those where *all* of a3, a12 and a13 are either missing or coded as:

9 Suspected Second Home/Holiday Home
10 Confirmed Second Home/Holiday Home
11 Property vacant
12 Property derelict
13 Property demolished
14 Non-residential property
15 Institution only (no private households)
16 Property not found

In other words there had to be at least one valid outcome code as each address for the address to be considered to be valid.

For example in Blaenau Gwent we had the following figures:

Total addresses	32701
Sampled addresses	469
of which	
Issued addresses	450
Non-issued addresses	19
Non-valid addresses	36

So our estimate of the number of eligible addresses was calculated as:

(450 – 36) / (450 + 19) / 32701 = 28866

These figures gave us our best estimates of the number of *addresses* to gross up to.

The grossing weights for the household level data were established by the following process which involved four distinct steps:

Step 1 – calculation of grossing factors to account for probability of selection of addresses

For each UA, a grossing factor for the probability of selection of addresses (ie to gross sampled addresses up to total addresses) was developed (gf1). The was calculated as:

Eligible addresses (estimate) / (Issued addresses – Non-valid addresses)

In actual fact the sample was drawn in two stages, but to avoid creating excessive weights (resulting from the small numbers involved in the second stage), the grossing factors were calculated as if all addresses had been drawn in one go.

Step 2 – calculation of grossing factors to account for probability of selection of households within addresses

Where there were more than three households at an address, only a maximum of three were selected for interview. If, for example, there were four households found at an address, each one had a 3 in 4 chance of selection. The grossing factor to account for this (gf2) was set to 1 / probability of selection - in our example the grossing factor would be 4/3; otherwise it was set to 1 for all addresses with three or fewer households.

Step 3 – calculation of a response rate at household level

This was calculated at the household level separately for each UA within the following strata. These were the strata where we saw significant variation in response rates;

- property type = 'House' and condition = 'Good' or 'Not seen'
- property type = 'House' and condition = 'Bad' or 'Ugly'
- property type = 'Flat' or 'Other'
- property type = 'Not recorded'

The response rates were calculated for each cell as:

Households interviewed / Total valid outcomes at all valid addresses

The strata were chosen after careful consideration of the potential stratification variables. These were UA, property type and overall condition. It was natural to stratify by UA; it was then a question of which other variable(s) to use in conjunction with UA. Sample size was clearly a constraint, as in some UAs the sample comprised only around 300 addresses, hence we could not create too many cells within UA.

After examination of response rates, there was clearly a difference within UA between houses and flats/other. There was also a difference, but not as marked, between Good properties and Bad/Ugly properties within UA.

It was sensible then to create cells for houses and flats/other within each UA. There were also a substantial number of properties coded as “not recorded”, enough to be treated as a separate cell. Finally, houses within each UA were split into Good and Bad/Ugly as there was a significant difference in response rates between these two groups in a number of UAs (those ‘not seen’ were grouped with Good properties for pragmatic reasons).

As an example, let us consider Blaenau Gwent. The response rates were as follows:

Houses	68.5% (n=438)
Houses (Good/not seen)	*68.9% (n=399)*
Houses (Bad/Ugly)	*64.1% (n=39)*
Flats/Other	51.4% (n=35)
Not recorded	30.8% (n=26)

The figures show a significant difference in response rates between Houses and Flats/Other and a small difference between Good houses and Bad/Ugly houses (as stated this difference was more marked in other UAs).

Step 4 – calculation of a weight to adjust for response rate

This was calculated separately for each UA within the above strata and is simply 1 / resprate.

Step 5 – calculation of a final grossing weight

This is calculated as the product of the weights calculated at steps 1, 2 and 4.

That is,

- fingross = gf1 * gf2 * respwt

Step 6 – comparison with population figures & post-stratification

The distribution of age by sex from the grossed *person level* data was compared with the latest (mid-2003) population estimates. In percentage terms, the figures were close (within one percentage point) to the distribution indicated by the population figures.

The distribution of tenure from the grossed household level data was compared with data from the 2001 census:

	WHDS grossed		**Census 2001**	
	Frequency	Percent	Frequency	Percent
Owner occupied	851829	72.1	862293	71.3
Local authority	162330	13.7	166002	13.7
Housing Association	58670	5.0	50417	4.2
Private rented	108324	9.2	130214	10.8
Total	1181153	100.0	1209048	100.0

The total number of households was slightly smaller (98%) compared with the total census estimate. Overall levels of owner occupancy and households rented from local authority were very close (within one percentage point) to the proportions from the census. However, the proportion of households rented from Housing Associations was somewhat higher whilst the proportion of households rented privately was lower. There was also quite a lot of variation within UA (in the latter two categories) with some figures well below those indicated by the census.

For this reason it was decided that the (grossed) data should be weighted by tenure to correct for these differences. This weighting was carried out within UA using the numbers (rather than percentages) from the two surveys.

Two additional weighting factors were generated as a result of this:

- tenurewt – weighting factor for tenure within UA
- fingros2 = fingross * tenurewt

Fingros2 is incorporated in the household level data file as variable a18.

"There are a couple of issues that need highlighting:

Firstly, we are advising that all users should use the new versions of ALL 5 WAVES of financial derived variables. **They should never use a mixture of old and new versions**. This information needs to be given to users in a very prominent way! We suggest that is it included in some way in the email that gets sent out to users to advise them of the update.

Secondly, we have decided that it would be better to go back to the "beginning" and remove all version subscripts from the files. We are currently on version 2 of the Wave 1 variables and version 1 of the rest so I think it would be more confusing to go onto versions 3 and 2. The files are substantially different from before so there will be no danger that people can run old code on new files without realising something is wrong. I have added the date of creation to the files too and will do this on an on-going basis."

Zoe Oldfield, IFS

The good, the bad and the ugly: multiple stratified sampling in the 1986 Welsh House Condition Survey

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The Welsh Housing Surveys

The principal purpose of the Welsh Housing Surveys conducted in 1986 was to obtain up-to-date estimates for each of the 37 Welsh districts of the proportion of the Welsh housing stock which was unfit and to estimate total repair costs for those in disrepair. This article shows how these estimates were obtained in a cost-effective way using a multiple stratified sampling procedure. The reasons for employing this technique are discussed, followed by a detailed description of the method used and its advantages in the case of Wales.

Unfit houses are relatively rare in Wales (probably less than 10 per cent of the current stock) so that random sampling would give very little in-depth information on the details of disrepair and the associated social conditions. To overcome this problem the previous House Condition Survey in 1981 had been designed so that more precise estimates of unfitness and disrepair could be obtained for each county and, in addition, social data could be collected. This was facilitated by the use of an initial social survey to collect rough estimates of factors on which the sample for the physical inspection of properties survey could be stratified. The physical inspection survey involved professional surveyors collecting information on repair and fitness for human habitation. Since it was known that unfitness was highly correlated with age of property and with a measure of superficial external appearance, more precise overall estimates had been obtained in 1981 by stratifying the housing stock into groups where fitness and degree of disrepair were more similar than in the overall stock and by sampling proportionately more of these worst affected groups. The results were then grossed according to the proportions sampled in each group to provide representative estimates for the counties of Wales.

It was decided to follow similar principles in 1986. The problem was marginally complicated, however, by the need in 1986 for more detailed estimates by area and tenure, as results were to be provided for each of the 37 housing (local) authorities instead of the eight counties and needed to be analysed by tenure, split between private and public sectors.

Thus, the stratification method had to be refined and tenure to be included as a stratification variable so that a sufficient sample of council houses would be taken to provide useable estimates.

It was decided as is demonstrated below that the most effective combination of surveys and samples to provide additional social data as well as the estimates of physical condition was an initial social survey, the Welsh Inter Censal Survey (WINCS) providing rough estimates of three stratifiers viz condition (appearance), age of property and tenure, followed by a physical survey, the Welsh House Condition Survey (WHCS), sub-sampled from the WINCS addresses. A matrix was formed of cells, categorising the social survey addresses by these three stratifiers within each district. In 1981 older properties had been given greater weight within each condition category and houses in poorer condition were given greater weight within each age-group. In 1986 however, to overcome the problems of some small sample sizes condition and tenure became more important stratifiers than age.

A sample for the physical survey was thus designed which would, first, increase the accuracy of each district estimate by sampling a larger proportion of social addresses from some strata than others; secondly, would give adequate representation to sub-divisions of the housing stock, such as council houses, which were relatively small in numbers but of particular interest.

Finally, in order to make the House Condition Survey representative of Wales as a whole, the results were grossed up first on the basis of the variable sampling proportions within strata to the social survey sample, then to the district on the basis of the sampling fraction used in the social survey and, finally, to the Wales level.

A description of the method in detail follows.

Welsh House Condition Survey Sample

A total of 60,065 addresses were included in the Welsh Inter Censal Survey (WINCS). From these 18,500 were chosen to be included in the House Condition Survey, that is, equal sampling of 500 in each of the 37 Welsh Local Authority districts.

Date of construction was asked of all WINCS respondents but if it was unknown the interviewer had to estimate the date on the basis of instructions given at the briefing session and summarised in the Interviewer's Manual. The interviewers were also briefed and given written instructions on how to estimate the condition of 3 aspects of the house when viewed from the front viz:

i. External walls

ii. Doors and windows

iii. Roof and roof structure.

A rough categorisation of the overall condition of the property was determined as follows:

i. Additive values were assigned as:
No evidence of disrepair = 0,
Moderate disrepair = 1,
Major disrepair = 2,
Not visible = 8

eg. a house which had external walls in major disrepair, good doors and moderate roof disrepair would have a total score of 2+0+1=3.

ii. From the total of the values for the 3 building elements, the following descriptors were assigned:

Total value	Descriptor
0	Good
1	Bad
$\geqslant 2$ and < 8	Ugly
8 or over	Not visible (NV)

ie. the above example would be categorised as 'ugly'.

Each address in the Social Survey thus had estimates of date of construction and overall condition which was recorded as 'good', 'bad', 'ugly' or 'not visible' depending purely on the external appearance of the property. In this context 'not visible' means 'not visible from the front of the house'.

In the 1981 Survey a variable proportion, x, of the old (pre-1919) and 'ugly' properties had been sampled with a progressively smaller proportion of the newer and better condition properties being selected. This methodology, followed successfully in 1981, was used as a basis for the 1986 sample. Several scenarios using different cell sampling fractions were examined using a Social Survey district of average size. The following breakdown was expected to concentrate addresses in the poorer quality and older properties while maintaining a larger proportion of post 1945 council houses than of non-council houses of this age.

TABLE 1

	Ugly	Bad	Good
Before 1919			
Council*) Non-Council)	x	x^2	x^4
1919-1944			
Non-Council	x	x^2	x^4
1945-1964			
Council)	x	x^2	x^4
Non-Council)			x^6
Post 1964			
Council)	x	x^2	x^4
Non-Council)			x^6

* Also includes 1919-1944 Council as pre-1945 Council houses are few in number.

Other categories of WINCS addresses were sampled in the following proportions:

Not visibles	100 per cent**
Presumed second homes	50 per cent
Vacant/being converted/modernised	20 per cent
Non-contact after 4 calls	10 per cent
Other non-contacts	0 per cent
Mixed addresses	0 per cent

** The total number of these addresses sampled was restricted to a maximum of 50 in any one district.

The proportions of 'ugly' and 'bad' properties were the same throughout the age-groups, x and x^2 respectively, in order to sample sufficient properties in the more recent age-groups which were estimated as being in poor repair. It is perhaps worth stating the obvious here: with x being less than 1, $x^2 < x$.

The addresses from the social survey were tabulated by age, tenure and condition as in Table 1 for each district. In order to determine the sample for each cell, it was necessary first to construct and solve an equation for each district which was derived by combining the social address distribution as Table 1 together with the sample proportions in Table 1, ie:

(Number of social survey addresses, Before 1919 and Ugly * x)
+ (Number of social survey addresses, Before 1919 and Bad * x^2)
+ .....
+ (Number of social survey addresses, Post 1964 and Good* x^6)
= 500 - y

Here, y was that sample which was predetermined, viz the not visibles presumed second homes etc. The resultant equation was then solved for x and the cell proportions in Table 1 used to determine the sample numbers within each cell.

In Alyn and Deeside, the resulting equation was:

$$95x + 130x^2 + 343x^4 + 441x^6 = (500\text{-}80)$$

where 80 is the sum of the physical addresses which were 'not visibles' and in categories outside the matrix.

The samples for each cell were then randomly selected from an ordered list of Social survey addresses in that particular cell. Thus, for Alyn and Deeside, x was found to be 0.8158 so that 81.6 per cent of the social survey addresses in the 'ugly' categories were randomly sampled, 66.6 per cent (ie. x^2) of those in the 'bad' categories and so on.

The advantages of the stratification procedure can be seen in Alyn and Deeside. In this district, 31 out of 38 pre-1919/non-council houses were sampled. If no stratification had been included in the methodology, one would expect to sample 38 per cent of the WINCS addresses in each cell in Alyn and Deeside. With stratification, 82 per cent of the old and ugly addresses were selected but only 31 per cent of newer properties.

Another advantage can be seen if we examine the errors that result from a simple random sampling method and from a stratified random sampling method. In Alyn and Deeside, for illustrative purposes, let us assume that the distribution of unfitness is:

50 per cent in pre 1919 and ugly cell
10 per cent in other ages and ugly cells
10 per cent in pre 1919 and 1919-1944 and bad cells
0 per cent in all other cells.

Using random sampling, it is expected that only 13 unfit properties would be surveyed. With the stratified method explained above, however, 28 unfit properties would be surveyed. In order to see the power of the stratification used, estimates of mean and standard deviation of the proportion unfit were calculated as:

Random Sampling	Stratified Sampling
$p = 0.0260$	$p = 0.0260$
$\sigma = 0.0056$	$\sigma = 0.0017$

Thus, the stratification method gives a greater probability of including unfit properties and thus more precise measurements of unfitness.

Other methods of picking the strata could have been used. Strata could have been chosen on the basis of estimates of standard deviation of unfitness obtained from a pilot survey. However, this was not possible here since obtaining estimates of unfitness was not the single objective of the survey.

The effects of the stratification procedure on the complete sample for Wales, all tenures, can be seen in Table 2:

TABLE 2: Summary of percentage sampling of survey addresses stratified by sampling categories

Wales

Age group	Ugly	Bad	Good	Total
Pre-1919	73.4	58.6	34.4	46.7
1919-1944	74.4	60.6	31.2	41.6
1945-1964	77.7	62.6	25.6	36.8
Post 1964	83.9	71.4	24.5	30.4
All age groups	75.0	62.0	28.8	39.4

Not visibles	63.0
Presumed second homes	52.7
Vacant/being conv/mod	19.0
Non contact after 4 calls	11.5
Other non contacts	0.0
Mixed addresses	0.0

Overall, 29 per cent of addresses with 'good' markings from WINCS and 75 per cent of addresses with 'ugly' markings were taken into the House Condition Survey sample, so concentrating resources in the sector most likely to be in disrepair. Similarly, 47 per cent of the pre-1919 housing was taken into the sample but only 30 per cent of the post 1964 housing.

For Wales, in order to obtain the same precision with a simple random sample, it is estimated that approximately twice as many unfit properties in the sample would be needed which implies a total sample of at least twice the size. If each district physical sample was 1000 instead of 500, 18,500 additional addresses would have had to have been surveyed overall: because of scarce surveyor resources, this would have rendered the survey impracticable. In additional surveyor costs alone this would have been at least £600,000. Costs would also have been incurred for punching and processing the extra forms. The benefits of using stratification can be seen as the cost of the social survey was, by comparison, around £500,000. Thus, using this methodology, social information was gained not only for the 18,500 surveys included in the physical survey but also for an additional 41,500 addresses for less cost than the alternative extended physical survey.

In conclusion, therefore, the stratification methodology introduced into the conduct of the 1986 Welsh House Condition Survey provided the following benefits:

i. A larger base sample of social information for the districts of Wales.

ii. Greater precision in the estimation of unfitness.

iii. Lower overall costs.

iv. A smaller sample for the physical survey which made the survey practicable.