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Intelligence Unit

West Oxfordshire Demographic Projections

November 2010

GLA Intelligence Unit

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Projection Assumptions and Summary of Outcomes

These projections were designed to show the populations resulting from an assessment of local housing needs between 2016 and 2026. The approach taken was:

- to incorporate the planned development at district and ward levels as far as 2016
- to prepare 'natural change' projections (ie fertility, ageing and survival only) to 2026 for the district broken down to its three towns (Carterton, Chipping Norton and Witney) and the remainder of the district
- to assess the additional number of households that would be formed in each of the four areas in 2016-21 and 2021-26 by the natural change population
- to assume this level of new housing would be supplied in each of the four areas, with actual locations based on the distribution of households at 2016, and
- to prepare a 'with migration' population projection, as described in Annex 3, using these building rates.

Table 1: Summary of Projection Results (thousands)

	Population	Households	Labour Force
2010	**105.5**	**44.0**	**55.1**
2010-11 Change	**0.7**	**0.4**	**0.1**
2011	**106.2**	**44.3**	**55.2**
2011-16 Change	**2.9**	**1.5**	**-0.3**
2016	**109.2**	**45.8**	**55.0**
2016-21 Change	**3.5**	**1.5**	**-0.6**
2021	**112.6**	**47.2**	**54.4**
2021-26 Change	**3.8**	**1.4**	**-0.5**
2026	**116.5**	**48.6**	**53.9**
2011-26 Change	**10.2**	**4.3**	**-1.3**

The projections are based on the Office for National Statistics (ONS) population estimate for 2001 and incorporate completed developments as monitored by the district up to 2010. Between 2010 and 2016 the projections are led by the district's anticipated annual net housing completions of 0.4 thousand in 2010-11 and 1.5 thousand in 2011-16.

The resulting population of 109.2 thousand in 2016 has then been aged and survived to 2026 and additional births calculated. The resulting 'natural change' population in 2026 is 114.1 thousand and would generate the formation of an additional 2.8 thousand households – 1,500 in 2016-21 and 1.4 thousand in 2021-26. Therefore, assuming no change in vacancies, second homes and sharing, there is

a need to supply an additional 4.3 thousand homes between 2011 and 2026. Note that all of the projection calculations are carried out to the unit but this report rounds to the nearest 100.

The projections are completed by assuming that the development scenario after 2016 is as implied by the 'natural change' population. In completing the projections the process reverts to the methods used between 2001 and 2016 and assumes that the population is not closed to migration but that the normal flow of people into and out of the district continues with residents leaving and newcomers occupying available housing. Thus the final projections of population by age and gender together with households by type and the resident labour force are all 'with migration'.

Analysis of Results

The population of the district was estimated at mid-2010 to be 105.5 thousand with 26 per cent in Witney, 15 per cent in Carterton and 6 per cent in Chipping Norton. It is estimated by the district council that between 2010 and 2016 an additional 1.8 thousand homes will be built in the district, bringing the total number of households up to 45.8 thousand, assuming no changes either in the numbers of vacant and second homes or in the small numbers of sharing households. By 2016 the population is projected to be 109.2 thousand of which 55.0 thousand are likely to form the resident labour force, defined as those economically active aged between 16 and 74.

The natural change projection uses the same fertility and survival rates as does the district population model, except that the birth rates are adjusted in each town area to reflect the number of births in 2016-17 as shown by the ward model. The essence of the natural change projection is that every 2016 resident surviving to 2021 and 2026 remains resident in the same part of the district while ageing-on five or ten years. As no new migrants enhance the population and no residents leave, the age-profile in 2016 can be seen reflected in 2021 and 2026 at older ages.

Chart 1: Natural Change Population Projection for West Oxfordshire

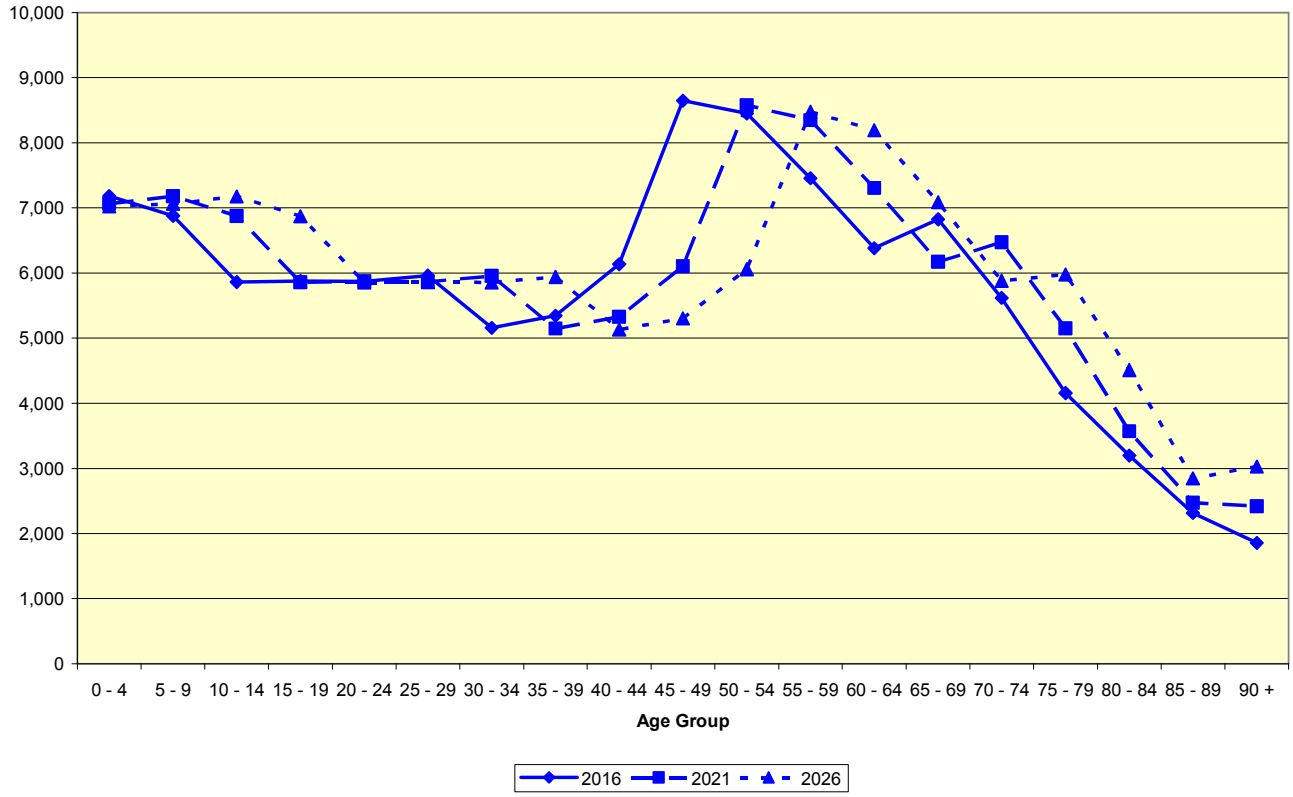
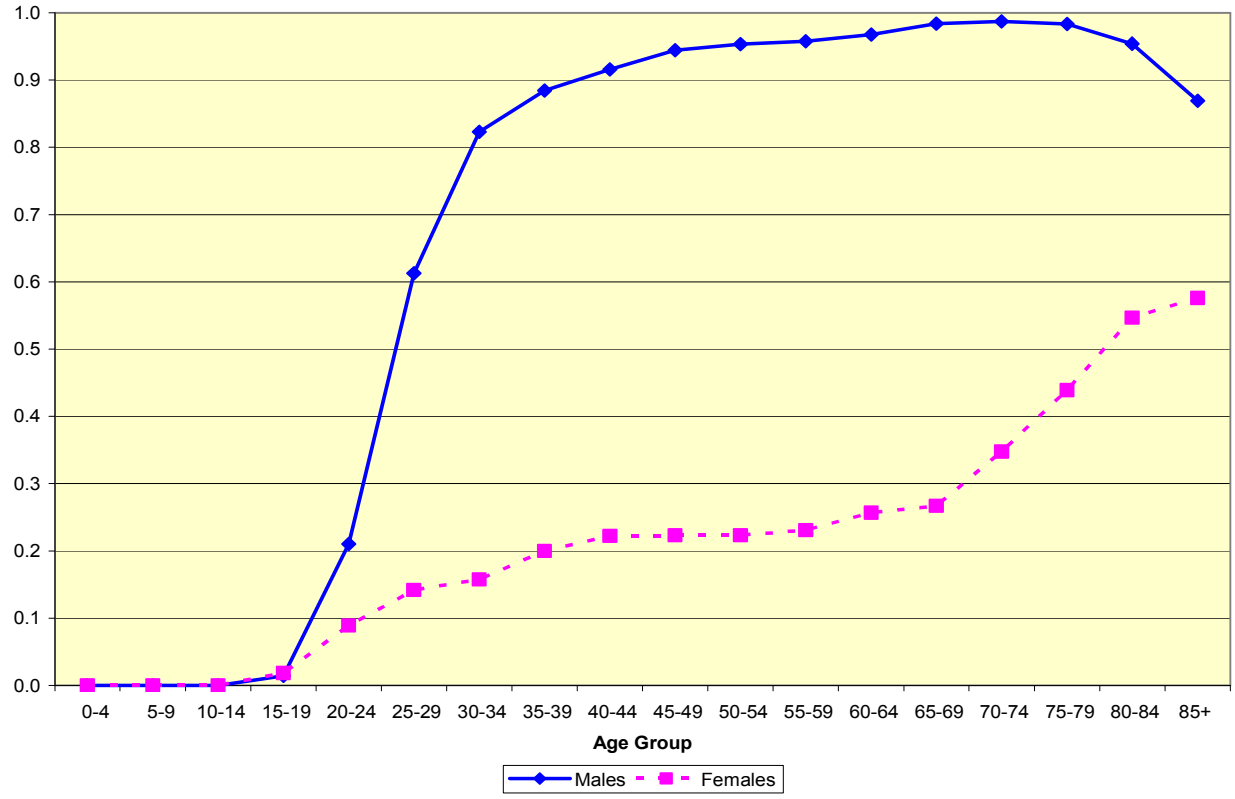


Chart 1 shows that in 2016 the district is expected to have a population bulge at ages 40-69, partly reflecting families who moved into the district in years of rapid development. The bulge in population has moved on to 50-79 by 2026 leaving relatively few residents in their 30s and 40s. In the ten years there would be a 24 per cent growth in the population aged over 60, including a 63 per cent increase in those over 90. As the household representative rates, shown in Chart 2, are already very high for males in the district the main change is of increasing rates for elderly women. Therefore the housing need of the ageing natural change population would be dominated by small households for the elderly, and hence show a reduced average household size.

Chart 2: Household Representative Rates: West Oxfordshire: 2016 (Source: CLG 2006-based household projections)



If building was to proceed to meet the need between 2016 and 2026 of 2.8 thousand new homes there would be no ring-fencing and all residents of the district would be free to move within and beyond the district and all available new and second-hand market sector homes would be able to attract immigrants from outside the district. The impact of this is demonstrated in the 'with migration' projection from 2016 to 2026. Chart 3 shows the resulting age structure. It shows some reductions of the population over 80 compared to the natural change projection. It also shows fewer people in their 20s, due to student movement away from the area, and more children and adults in their 30s and 40s due to immigration. Overall the legacy of previous development is still shown in an age structure dominated by older persons, who, as a group, are less likely to move than persons in their twenties and thirties.

Chart 3: 'With Migration' Population Projection for West Oxfordshire

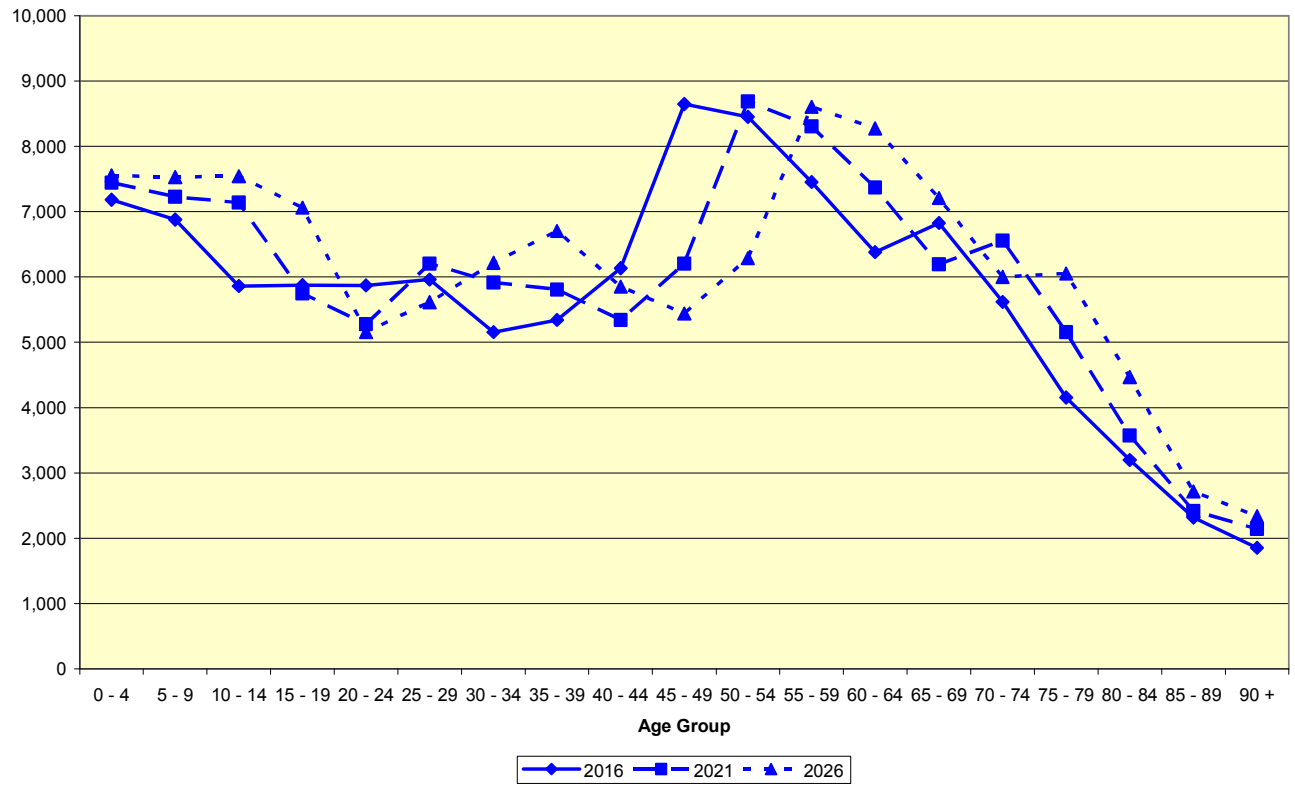


Table 2: Projection of Households by Type (thousands except average household size)

	2001	2006	2011	2016	2021	2026	Change 2016-26
Married Couples	21.8	22.0	22.1	21.5	21.0	20.6	-0.8
Cohabiting Couples	3.4	4.0	4.8	5.3	5.8	6.1	0.7
Lone Parents	1.7	1.9	2.0	1.9	1.8	1.8	-0.1
Other Households	2.0	2.1	2.3	2.5	2.6	2.7	0.3
One Person Households	9.6	11.3	13.1	14.6	16.0	17.3	2.8
Total Households	38.5	41.3	44.3	45.8	47.2	48.6	2.8
Household Population	93.7	97.8	103.9	106.7	110.1	113.7	7.1
Average Household Size	2.43	2.37	2.34	2.33	2.33	2.34	na
Total Population	95.7	100.0	106.2	109.2	112.6	116.5	7.3
Institutional Population	2.0	2.2	2.4	2.5	2.6	2.7	0.3

The resulting change in households is seen in Table 2. Between 2016 and 2026 the number of couple households is virtually unchanged, although there is a shift from marriage to cohabitation. The main growth is in one person households and as Table 3 shows the majority of these will be formed by persons aged over 60. There is also projected growth in the 'Institutional' population that reflects the increase in residents aged over 75.

Table 3: Projection of One Person Households by Age and Gender (thousands)

		15-29	30-44	45-59	60-74	75+	Total
2016	**Males**	0.4	1.1	1.8	1.4	1.3	6.0
	Females	0.4	0.8	1.9	2.3	3.2	8.5
	Persons	0.8	1.9	3.7	3.7	4.5	14.6
2026	**Males**	0.4	1.5	1.7	1.9	1.9	7.4
	Females	0.3	1.0	1.8	2.8	4.0	9.9
	Persons	0.7	2.5	3.5	4.7	5.8	17.3
2016-26	**Males**	0.0	0.4	-0.1	0.5	0.6	1.4
	Females	0.0	0.2	0.0	0.5	0.7	1.4
	Persons	0.0	0.6	-0.1	1.0	1.3	2.8

Table 4: Projected Economically Active Population by Age and Gender

	2016			2021			2026		
	Activity Rate (%)	Popu-lation (000s)	Econ. Active (000s)	Activity Rate (%)	Popu-lation (000s)	Econ. Active (000s)	Activity Rate (%)	Popu-lation (000s)	Econ. Active (000s)
Males									
16-17	39.8	1.3	0.5	37.4	1.3	0.5	37.4	1.7	0.6
18-24	84.5	4.3	3.6	84.1	3.8	3.2	84.1	3.9	3.3
25-29	92.6	2.9	2.7	92.3	3.0	2.8	92.3	2.7	2.5
30-34	94.2	2.5	2.3	93.9	2.8	2.6	93.9	2.9	2.8
35-39	94.9	2.5	2.4	94.6	2.8	2.7	94.6	3.2	3.1
40-44	94.2	3.0	2.8	93.9	2.5	2.3	93.9	2.8	2.6
45-49	94.4	4.3	4.0	94.2	3.0	2.8	94.2	2.5	2.3
50-54	93.3	4.1	3.8	93.5	4.3	4.0	93.5	3.0	2.8
55-59	88.6	3.6	3.2	89.0	4.0	3.5	89.0	4.2	3.7
60-64	74.1	3.1	2.3	74.9	3.6	2.7	74.9	3.9	2.9
65-69	29.5	3.3	1.0	30.4	3.0	0.9	30.4	3.4	1.0
70-74	11.9	2.6	0.3	11.6	3.0	0.4	11.6	2.8	0.3
16-74	**77.4**	**37.4**	**28.9**	**76.6**	**37.0**	**28.3**	**75.6**	**37.0**	**28.0**
Females									
16-17	46.0	1.2	0.5	44.2	1.1	0.5	44.2	1.4	0.6
18-24	80.1	3.9	3.1	80.3	3.5	2.8	80.3	3.6	2.9
25-29	85.1	3.0	2.6	85.5	3.2	2.7	85.5	2.9	2.5
30-34	80.1	2.7	2.2	80.6	3.1	2.5	80.6	3.3	2.6
35-39	78.4	2.8	2.2	78.7	3.0	2.4	78.7	3.5	2.7
40-44	83.6	3.2	2.7	83.7	2.9	2.4	83.7	3.1	2.6
45-49	86.4	4.4	3.8	86.6	3.2	2.8	86.6	2.9	2.5
50-54	86.3	4.4	3.8	87.6	4.4	3.9	87.6	3.3	2.9
55-59	76.6	3.8	2.9	78.6	4.3	3.4	78.6	4.4	3.5
60-64	46.0	3.3	1.5	50.3	3.8	1.9	50.3	4.3	2.2
65-69	17.5	3.6	0.6	18.3	3.2	0.6	18.3	3.8	0.7
70-74	5.3	3.0	0.2	5.3	3.5	0.2	5.3	3.2	0.2
16-74	**66.5**	**39.2**	**26.0**	**66.3**	**39.3**	**26.1**	**65.2**	**39.8**	**25.9**
Total	**71.8**	**76.6**	**55.0**	**71.3**	**76.3**	**54.4**	**70.2**	**76.8**	**53.9**

The impact of an ageing population is also demonstrated by the projected number of economically active persons – the resident labour force – defined as those either working or seeking work aged between 16 and 74. Reductions are projected in workers aged in their 20s, 40s and early 50s. For males this is due to a combination of falling population and falling activity rates, however for females the activity rates are projected to rise at most ages (partly linked to the equalising of the state pension age by 2020), hence the reduction in potential workers is due to the decline in the resident population at these ages.

Output

The following detailed output is available.

District

Population by single years of age (to 90+) and gender for each year 2001 to 2026.

Households by type and by five-year age groups, marital status and gender of representative for 2001, 2006, 2011, 2016, 2021 and 2026.

Economically active population by age groups and gender for each year 2001 to 2026.

Wards and Towns

Population by single years of age (to 90+) and gender for each year 2001 to 2026.

Households for each year 2001 to 2026.

Annex 1: Data used in the District projections

Base Populations

Total population by age/gender: Office for National Statistics (ONS) MYE: 2001 (revised September 2003)

Secondary Populations

Total population by age/gender: ONS MYE 1991-2000 (revised September 2004), 2002-08 (revised May 2010)

Fertility Data

2001 Births by age of mother: ONS

2001-08 total annual births (mid-year to mid-year): ONS

ONS 2008-based Total Period Fertility Rate projection for England: 2008-09 to 2025-26

Mortality Data

2001-08 total annual deaths (mid-year to mid-year): ONS

ONS 2008-based projected deaths and survival rates for England: 2008-09 to 2025-26

Household Data

Annual net new homes: actual and forecast from mid-2001 to mid-2016: District

Population in communal establishments, marital status and household representative rates: Communities and Local Government (CLG) 2006-based household projections

Economic Activity Data

Economic activity by age/gender: 2001 Census Standard Tables

Projection of the UK Labour Force to 2020: *ONS Labour Market Trends*, January 2006

Annex 2: Data used in the Ward projections

Base Populations

Total population by age/gender: 2001 Census, adjusted to mid-2001 District population

Population in communal establishments: 2001 Census, adjusted to mid-2001 District population

Fertility Data

2001-08 total births by gender (mid-year to mid-year): ONS

Mortality Data

2001-08 total deaths (mid-year to mid-year): ONS

Migration Data

Inflows and outflows by age and gender: 2001 Census

Household Data

Annual net new homes: actual and forecast from mid-2001 to mid-2016: District

Households and Average Household Size: 2001 Census, adjusted to mid-2001

Annex 3: District Level Methodology

Population Projections

Migration/Mortality

Transition rates are the ratios of the population aged (x+1) in year (y+1) to the population aged x in year y, that is they reflect the combined impacts of mortality and net migration on a cohort aged x over the following year. Annual transition rates by single years of age and gender from the ONS mid-year estimates for the periods 1991-1992 to 2000-2001 are calculated. The rates run from ages 0=>1 to 83=>84 and 84+=>85+. Rates also show the transitions from births in the previous year to infants aged 0 at mid-year. After 2001 the rates can be calculated for single years from 0=>1 to 88=>89 and 89+=>90+. In the projections the average rates for ages 84=>85 to 89+=>90+ are based on the averages for years 2001-02 to 2007-08. For all other (younger) ages the data are drawn from years 1991-92 to 2000-01.

The annual transition rates at ages below 85 were averaged over two time periods: 1991-2001 and 1996-2001. There were differences between the two sets reflecting, in part, different average levels of development-led migration. The average transition rates for 1996-2001 rates were adjusted for the improvement in survival rates as used in the ONS 2008-based projection for England. **They were then used to prepare a 'Standard' trend-based projection based on the 2001 mid-year estimate.** In this way initial populations aged 1+ by gender were developed.

The average transition rates for 1996-2001 were adjusted by the average difference across all ages and both genders with the 1991-2001 rates. **Using these rates produced an 'Alternate' trend-based projection.** These rates were also adjusted for the improvement in survival rates as used in the ONS 2006-based projection for England.

This methodology means that it is not necessary to either develop age-specific inflow and outflow migration schedules or to adopt the use of a life table for age-specific survival rates.

Fertility

Initial single year age-specific fertility rates (ASFRs) were selected by comparing the total period fertility rate (TPFR) in the district to the TPFRs in a London borough in 2001-02 and selecting the best match, Barking and Dagenham. Previously calculated and smoothed ASFRs for that borough were used in the projection in years 2001-08, when actual births occurrences were known. The results of the annual fertility calculations using the ASFRs were compared with recorded births and the ASFRs were then scaled to match actual births. The adjusted ASFRs calculated for 2007-08 were used as the base for all the following projection years. The actual ASFRs used in each year after 2007-08 were adjusted according to the ONS projected trend in the England total period fertility rate. This process projected birth totals that were split into males and females according to recently observed sex ratios and then survived to age 0 according to the transition rates. The model then linked the projected 0-year olds to 1-year olds according to the transition rates for subsequent years.

This completed the two initial trend projections to 2026 by single years of age and gender.

Household Projections

Incorporating Development Information

The main generator of the household projections at district level was based on the Communities and Local Government's (CLG) 2006-based household projections together with the 'standard' and 'alternate' trend-based population projections and the development data supplied by the District.

The results of the CLG projection were converted to a model such that when a new population by age/gender was introduced to it the following calculations were made at years 2001, 2006, 2011, 2016, 2021 and 2026:

- At each five-year age/gender group the total population was converted to the household population by taking away the communal establishment population, which had been calculated as being a constant number up to age 74 or a constant proportion thereafter.
- The household populations at ages 15+ were apportioned into married, widowed, divorced and single statuses in each five-year age group.
- The disaggregated household populations were then multiplied by the household representative rates relating to five household types – married couples (represented by married males), cohabiting couples (represented by males of all marital statuses), lone parent households, one-person households and other all adult multi-person households.

The result was not only a conversion of the trend-based population into households by type but also estimates of the communal establishment population and the average household size. These outputs are used to create the development-based projections starting with the 'standard' trend-based population projection. The ratio of the total population to the private household population and the average household size were interpolated for every year between the values for 2001, 2006, 2011, 2016, 2021 and 2026.

Development information enabled calculations of the additional numbers of occupied household spaces at mid-year. It was assumed that the annual net additional homes were equivalent to a net increase in households and, therefore, that the implied household space vacancy level at mid-2001 would remain constant throughout the projection. Vacancy is assumed to include all household spaces not used as a primary residence and so includes second homes and holiday accommodation. The annual net additional homes were added to the number of households at mid-2001, as generated using the CLG household model, to estimate households each year.

Using the annual estimate of households as a starting point, a capacity population can be estimated by multiplying by the average household size and then grossing up the household population to account for the communal establishment population. This part of the process is illustrated in Table A1. The resulting capacity population has no age structure. To create an age structure the capacity total was compared to the totals of the two trend-based projections. A weighted average of the two trend-based populations at each single year of age was created. This new population was introduced to the CLG rates model and revised outputs were checked to confirm that the projected households matched the change in households from the development data. This process is repeated and quickly iterates to the solution – a population by age and gender that matches the development and incorporates the characteristics of the migrants arriving into and leaving the district..

Table A1: Example of Capacity Modelling for West Oxfordshire

	New Homes	Households	Average Household Size	Private Household Population	Total/ Hh. Pop. Ratio	Communal Population	Total Population
2001		**38546**	**2.430**	**93683**	**1.022**	**2018**	**95701**
2002	***392***	38938	2.418	94137	1.022	2043	96180
2003	***448***	39386	2.405	94716	1.022	2072	96787
2004	***567***	39953	2.392	95568	1.022	2106	97674
2005	***629***	40582	2.379	96553	1.022	2143	98696
2006	***733***	41315	**2.366**	97768	**1.022**	2187	99954
2007	***810***	42125	2.362	99492	1.022	2231	101723
2008	***865***	42990	2.357	101339	1.022	2278	103617
2009	***578***	43568	2.353	102502	1.023	2310	104813
2010	***384***	43952	2.348	103205	1.023	2332	105537
2011	***374***	44326	**2.344**	103881	**1.023**	2354	106235
2012	***377***	44703	2.341	104647	1.023	2381	107028
2013	***448***	45151	2.338	105576	1.023	2413	107990
2014	***252***	45403	2.336	106046	1.023	2435	108480
2015	***227***	45630	2.333	106456	1.023	2455	108910
2016	***150***	45780	**2.330**	106685	**1.023**	2471	109156

Bold – output direct from CLG household model
Bold Italics – data supplied by West Oxfordshire District Council

Labour Force Projections

Once the final population projection was available it was converted to the resident labour force – the economically active residents - by a two-stage process. The base was the 2001 Census rates of economic activity by age groups and gender. These rates were improved annually by reference to the trends at each age group for the UK rates projection published by ONS in 2006. The projected rates were applied to the total population at each age group to create the labour force projection.

Annex 4: Ward Level Methodology

Setting the Ward Populations for mid-2001

The 2001 Census used the definitions of the wards that came into being in May 2002. The Census ward populations by age and gender were split as between private household populations and communal establishment populations. The private household element was then grossed up at each single year of age so that the sum over all wards matched the 2001 mid-year estimate for each District, having first subtracted the District's Census communal establishment population. This creates both the overall base population for each ward as well as the communal establishment population, which is assumed to alter throughout the projection period in line with the District trends at older ages.

Fertility

The age-specific fertility rates for the District, described in the previous section, are assumed to apply to each ward. They are multiplied by the female populations by age in each ward to obtain a first estimate of ward births. However, for 2001-02 to 2007-08 the actual births, by gender, are known for each ward. Therefore it is possible to calculate a ward level fertility adjustment factor, ie the factor needed to scale the District age-specific fertility rates in order to calculate the actual number of births. These scaling factors are then used in subsequent years to provide a local differential from the District fertility rates.

Population Growth

Small area population estimates and projections are critically dependent upon good local input data, particularly actual and expected housing developments; therefore, the District has provided annual net housing completions incorporating new build, conversions, changes of use and demolitions. The actual and forecast net completions have been provided by ward for 2001-02 to 2015-16. These data summed to the District have been used in the preparation of the projections for the District as described above.

The housing data does not contain information relating to vacancy rates. The 2001 vacancy levels have been held constant in this model.

Model Processes

The basis of the ward model is to distribute the District population projection while reflecting all known differences. The key differences are:

- Age structure
- Special populations, particularly students and other communal establishment populations
- Average household size – which is associated with differences in age structure
- Future development levels

The basic annual steps in the model are:

- Age on and survive the starting population by one year using survival rates from the ONS 2008-based projection for England
- Apply district age-specific fertility rates (with ward adjustments based on years with known births), split the resulting birth totals by gender and survive to the end of the projection year

- Apply out-migration probabilities by age and gender based on the 2001 Census data on outflows from each ward
- Calculate a target population for the ward based upon the assumed number of households (ie 2001 households plus annual development), the average household size and the communal establishment population
- Add sufficient in-migrants using the 2001 Census age/gender profile of migrants to the ward to reach the target population in each ward
- Constrain the sum of all ward projections by single years of age and gender to the district totals for the projection year.

Annex 5: Commentary on Projection Methodology

The methodology employed by the GLA for the districts has a number of advantages and some drawbacks. This Annex lists them and discusses the main features.

Advantages

- The model is simple to use in that it does not require detailed knowledge about migration and mortality rates
- Uses known births and deaths data
- Linked to local development
- Detailed age structure
- Linked to changing propensities of population regarding the communal establishment population at ages over 75, marital status and household formation
- Households by type as well as age, gender and marital status of the representatives
- Different to ONS mid-year estimates and projections for years after 2001

Drawbacks

- Relies heavily on accuracy of 1991 to 2001 ONS mid-year estimates
- Range between 'standard' and 'alternate' district trend projection totals may not encompass future capacity based projections
- With few exceptions, does not use migration and mortality data post mid-2001 and does not directly estimate future annual deaths or net migration, though these are calculated after the main modelling has been completed
- Does not directly incorporate any known changes in local communal establishment populations
- Does not link size of new homes (ie by numbers of bedrooms) to potential population
- Different to ONS mid-year estimates and projections for years after 2001

The main advantages are that the model is simple to use, as it does not require detailed information about the size and structure of migration flows. Migration data, apart from those based upon the 2001 Census are not totally reliable, particularly information about international flows. Therefore the model does rely heavily upon the accuracy of the ONS mid-year estimates. The ONS estimates used in the model to generate profiles of change have been linked to the Census results at both 1991 and 2001 as well as having excellent inputs as regards births and deaths. The drawback with the ONS

estimates is the accuracy of the migration estimates built into them. However as cohort changes between 1991 and 2001 have been 'anchored' to the Census results at the end points the resulting estimates are as reliable as can be prepared.

A further major advantage is the link to the results of the CLG household projections. These projections use an analysis of the past four censuses to create the projected household representative rates by age, gender and marital status of the representatives as well as five household types. The modelling that creates the CLG projections is considered to be 'gold standard' even if the ONS population projections upon which the CLG's own household projections are based may be suspect. The link between the CLG structural results and the local development data is a great strength for the GLA model outcomes.

One feature is both a drawback and an advantage – the differences with the ONS estimates and projections since mid-2001. It is an advantage because any inherent faults in the changes in the ONS estimates between mid-2001 and mid-2008 are not being followed – unless they occur in the population aged 85 and over and impact the transition rates used in the GLA model. The ONS estimates since 2001 are contextually different from those between 1991 and 2001 as there is no independent end-point estimate such as the Census to steer a correct path. This can only be established after the results of the 2011 Census have been analysed. Therefore the GLA estimates offer an independent estimate based on development rather than modelled and estimated migration flows. However, it is still a disadvantage for two reasons. First, differences need to be explained to users and, second, as ONS projections are based on the mid-year estimates, there will be further diversion in the future. It should not be forgotten that local authority finance is to a certain extent based on ONS projections for local authority areas.

There is one technical drawback to the projections. The two trend-based district projections may not provide a future range that encloses the capacity based population in all years. This means that when a weighted average is taken to approximate the capacity population one of the weights may be negative. This is not a serious problem as the transition rates used to produce the projections have been created such that they will not produce negative populations for any age groups when weights are applied. Further, as the capacity based populations that fall outside the range are still close to the trend-based range there is little risk of producing projections with deviant age structures.