Further Information about the School Roll Projections Methodology

GLA Population Projections

The following GLA Population Projections options available to the local authority for the school roll projections to be based on:

• **A central projection:** This projection uses ten years of past data to project migration trends. The GLA considers this to be the best available projection for strategic planning purposes.
• **A short-term projection:** This projection uses five years of past data to project migration trends. This projection produces higher populations for London boroughs and is closest to the ONS SNPP in methodology.
• **A long-term projection:** This projection uses 14 years of past data to project migration trends. This projection produces lower populations for London boroughs.

The projections based on the three migration scenarios are referred to as the central, short-term and long-term variants. In each case, mortality and fertility methodologies are the same but the assumptions regarding migration differ.

The trend projections are produced using a cohort component projection model. Projections are produced from the starting point of the most recent ONS Mid-Year Estimate (2014).

Each subsequent year's population is generated by the same process, taking the previous year's projected population as the start point. For mid-year to mid-year periods when the total numbers of births, deaths and net migrants are known, the results may be better described as base period estimates.

The cycle of events that takes an initial local authority population and generates a projection of the subsequent year's population is described below.

1. The cycle begins with the initial local authority populations by single year of age (0 to 90+) and sex. For the first year, this is the base population, for subsequent years this is the projected population at the end of the previous cycle.

2. The starting population is aged-on and survived to the end of the year by application of age-specific mortality rates.

3. Births are calculated by applying age-specific fertility rates to the female population. As births occur throughout the projection year they are calculated using a combination of the starting and the aged-on and survived female populations at the end of the year.

4. Survival rates are applied to births to project the number that will reach 'age 0' at the end of the projection year.

5. International out-migration is calculated by applying age and sex specific rates to the population and subtracting the result.

6. Numbers of in-migrants from overseas are projected from the historic record of international migrants and a constant age and sex distribution of the totals.

7. A domestic migration matrix is calculated by applying age and sex specific out-migration probabilities to the population. The matrix includes flows (by age and sex) between all local authorities in England as well as Northern Ireland, Scotland and Wales.

Local authority-level in and out migration are calculated by summing the inflows and outflows for each authority.

8. The final population for the projection year is fed back into step 1 as the initial population for the next projection year.

The model outputs estimated and projected population by single year of age and sex from 2011 to 2050. Additional reporting outputs are also produced, including: births, deaths, total fertility rates, life expectancy at birth, and gross migration flows.

GLA Housing-led projection methodology

The revised housing-led methodology can be broken down into a two-stage process.

In Stage 1 the GLA trend model is run and produces a set of rates and constraints consistent with the 2015-based central trend projection.

In Stage 2, for each year of the projection, an initial trend population is calculated by applying the rates calculated in stage 1 to the population at the start of the year. The resulting population is then reconciled with a target population based on available housing supply. Finally, the populations, and components, are constrained to be consistent with the outputs from Stage 1 of the process at the Housing Market Area (HMA) level. The definition of the HMA is set by the user and in the case of the 2015-based projection is simply an aggregation of the 33 London boroughs.

Stage 1
The GLA trend model is run from a starting point of the most recent ONS Mid-Year Estimate (2015). The model parameters are set to be consistent with those used to produce the 2015-based central trend projection. The model then runs forward to 2050 as described in the GLA trend methodology update (2016-02[3]).

The outputs from this model are local authority level populations, components of change (births, deaths and migration), and rates of fertility, mortality and migration all at single year of age (0 to 90+) and sex for the entire projection period. The housing-led model retains these outputs for use in Stage 2 of the modelling process.

Stage 2
The second stage of the model produces the housing-led population projections. As with stage one, the projections are produced from a starting point of the most recent ONS Mid-Year Estimate (2015).

Each subsequent year's population is generated by first calculating a population based on past trends and then adjusting domestic migration in order that the total population is consistent with the forecast of available housing stock. The total population for the HMA is then constrained to the Stage 1 projection.

1) The cycle begins with the initial single year of age (0 to 90+) and sex population for local authorities. For the first year this is the ONS MYE, for subsequent years this is the projected population at the end of the previous cycle.

2) A trend-based population (single year of age by sex) is calculated by applying the fertility, mortality and migration rates obtained in Stage 1. The methodology for this as described in Update 2016-02.

3) The number of births, deaths and the international in and out migration components (by sex and single year of age) are constrained so that, at the level of the HMA, these components are consistent with the outputs from Stage 1. This is achieved by calculating and applying a set of age/sex-specific scaling factors to the components.

4) The trend-based population is recalculated by summing the constrained components and the original domestic migration flows. This process creates a Trend population which can be compared to available housing.

5) A Target population which is consistent with the available housing stock is calculated for each local authority. This is arrived at by multiplying the total forecast households from the input trajectory by an LA-specific average household size (AHS). The process of determining AHS is described separately below. The LA institutional population is added into the target population to arrive at a total target population. The target has no age/sex structure it is simply a total population figure.

6) The difference between the Target population and the Trend population is calculated. If the Trend population is lower than the Target population then the difference is added to the domestic in-migration component of the Trend projection. If the Trend population is higher than the Target population then the difference is added to the domestic out-migration component of the Trend projection.

7) The revised domestic flow is then divided by the original to obtain a scaling factor. This factor is then applied to the age structure of the original flow.

8) The age/sex structure of the population is calculated by summing the amended components. The projection total populations are now consistent with the Target projection populations at the local authority level.

9) The projected populations for each local authority within a defined HMA are constrained to the overall HMA trend-based population. Age/sex-specific scaling factors are applied to the populations in order that the population of the HMA is consistent with the output from the Stage 1 process.

10) Following the constraining process the components no longer sum to the total population[4]. Domestic net migration (at single year of age and sex) is calculated as a residual from the total population and components. This is compared to the existing domestic migration. If the new net migration is higher than the existing value then the difference is added to the existing domestic in-migration component of the projection. If the new net migration is lower than the existing value then the difference is added to the existing domestic out-migration component.

11) The final population by single year of age and sex for each local authority is fed back into step 1 of the process as the initial population for the next year.

The model outputs estimated and projected population by single year of age and sex from 2011 to 2050. Additional reporting outputs include detailed components of change and inputs into other GLA models such as the small area model and ethnic group model.

Borough Preferred Option Population Projections

The model and methodology are identical to that to produce the 2015-based housing-led projection. The only difference is the housing trajectory input data which is provided by the borough.

This model uses projections of the overall borough-level population from the GLA's trend-based cohort-component model. The overall population is independent of the assumed housing trajectory. Ward level projections are constrained to match the overall borough-level population, but the distribution of population between the wards is determined by the housing data input by the user.

This model is most useful in areas where recent population change has occurred largely independently of changes in available housing stock. In areas where recent population growth outstrips planned housing development, the model results will imply increasing household size.

School Roll Projections detailed methodology

This section sets out the detailed methodology for the SRP model for 2016.

Ward to school proportion

In each ward, children of the same age are likely to attend different schools especially at secondary level. For example, of all 12 year olds resident in ward *a*, 10 per cent attend school *z*, 20% attend school *y* and 70% attend school *x*.

The proportion of children by ward by age and sex attending each school is calculated by dividing the number of children of the same age resident in the ward and attending a set school by the number of children of the same age resident in the ward (the base population).

$$\text{Pupil ward to school flow proportion} = \frac{\text{home ward population at that school}}{\text{base population}}$$

This calculated proportion is carried forward as the children age so that the proportion for a 6 year old living in ward *a* in 2016 and attending school *z* is the same as the proportion for a 7 year old living in ward *a* and attending school *z* in 2017.

As no proportions are calculated for children under the minimum age of the school, the proportion at the minimum age is held for the new cohort at that age. For example, in a primary school where pupils enter at 4 years old, no proportion exists for 3 year olds to roll forward to 4 year olds. Therefore both next year's 4 year olds and 5 year olds are allocated the same proportion as the previous year's 4 year olds age.

At age 11 (start of secondary school/year 7) and age 16 (start of sixth form/year 12), changes in proportions are expected and so children of this age also take the proportion from the previous year's children of the same age.

Some wards will not have pupils attending a school at the school minimum age. For example a ward may have some 6 year olds and a 9 year old attending a primary school for ages 4 to 10. In this case when the cohort is aged, new pupils at the minimum age of the school (for example age 4) are added with a proportion which is a fraction of the total proportion of all ages going from that ward to that school. This ensures that the contribution of a ward to a school does not disappear as the original cohort ages out of the school. A scaling factor is then applied to that proportion, with the scaling factor calculated from the previous year's NPD data scaled to match the current year's school roll data after being aged by one year. This is to protect against over or under-counting in the new cohort proportions.

Base population projections

The base ward populations are taken from the projections provided by each local authority for their own area, and from the GLA's 2015 round SHLAA-capped AHS population projections for

all other areas. For areas outside of London, GLA short-term migration scenario local authority level population projections are used.

The number of state school children in 2015 by ward, age and sex is calculated by aggregating the NPD. This number is compared to the projected 2015 population. When the total population is bigger than the state school population this difference is assumed to be children taking up alternative provision such as independent schools. When the state school population is bigger it is assumed that the population projection has underestimated, and the difference is added to the projections for all future years.

Projected ward to school flow
The number of children by age resident in each ward and attending each school in the future is calculated by multiplying together the ward to school proportion detailed above with the adjusted population projection for the ward.

The results of this are then aggregated to school, planning area and borough level. Custom aggregations are also possible.

Pupil level vs school level methods
When data is provided at pupil level, the method described above is used. When school level roll data is provided, the following modification is used.
The pupil home postcode data is taken from the 2015 NPD. This data is then aged by one year following the method outlined above. The number of pupils from each ward attending each school by age and sex is then scaled so that when aggregated the totals match the 2016 actual school roll data provided by the local authority. This aged and scaled pupil level dataset is then used as the starting point for the method outlined above.

Variables that may impact the school roll projections
There are many variables that could potentially have an impact on a LA's school roll projections, such as development; births; migration; cross-border mobility; capacity constraints and new schools/school closures. Explanations regarding the first three are listed below.

Cross border mobility
Not all children will go to school in their LA of residence. This is particularly the case in London where the geographic size of local authorities is relatively small and where excellent transport networks mean that children can travel further afield easier than in other parts of the UK. Additionally for children who live close to a boundary, their closest school may in fact be in a neighbouring authority.

A school's popularity may affect parental preference when applying for schools. This may mean that some schools will see changes in applications and attendance from children outside of the authority resulting in increasing cross border mobility.

The new SRP model explicitly takes into account cross border mobility as pupil level data is used that gives both home and school locations.

Capacity constraints
The current projection models are unable to explicitly account for school capacity. If strong growth in pupil numbers was previously projected in an area, but the necessary capacity to accommodate them was not put in place, then it is likely that this will lead to lower projected rolls for that area in future.

New schools/school closures

The opening of a new school and/or closure of a school could also affect a LA's roll projection. If a new school attracts pupils from outside the authority, then it will cause a net increase in current and projected numbers of children on roll.