

Cambridge Centre
for Housing &
Planning Research

Validation of an objectively assessed housing need (OAN)

January 2015



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Key findings

- The re-projected housing need for West Oxfordshire over the period from 2011 to 2031 is 520 to 596 units p.a.
- The range appears modest, compared with the OAN in the SHMA, which is 635 to 686 units p.a.
- Without addressing an arguable upward bias in the demographic projection part of the OAN, the re-projection could have a range of 602 to 638 units p.a.
- Each of the four stages of the re-projection observed pieces of evidence on West Oxfordshire's socio-economic trends – for example, the recent housing completion boom around 2005 to 2007 increased, mainly, net migration for 20 to 64 year olds.
- From 1991 to 2011 (a period of average UK GDP growth at 2.46% - the level is nearly equal to the mid-term forecast), full-time employees residing in West Oxfordshire increased by 0.61% p.a. while the job density (i.e, a ratio of full-time employees to population) remained almost the same at around 0.61.
- With the upper quartile level of the annual social housing completions in the last three decades, an extra 15 concealed households can become independent units.
- The vacancy rate in 2011 (5.17%) was, perhaps, at historically high levels, compared particularly with 4.23% in 2001.

Validation of an objectively assessed housing need for West Oxfordshire

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1 Introduction

- Along with the other four councils in Oxfordshire, West Oxfordshire Council commissioned GL Hearn Limited (GH) to carry out a Strategic Housing Market Assessment (SHMA). One of the key aims of the SHMA is to quantitatively project an objectively assessed housing need (OAN) in each of the five local authority areas over the period from 2011 to 2031.
- The final report of the SHMA (GH, 2014a)¹, states that the OAN for West Oxfordshire has a range of 635 to 685 homes p.a. over the projection period.
- The methodology of the OAN creation, which is outlined in the SHMA report, reflected demographic estimates, economic forecasts and possible changes of some other sub-regional fundamentals, which appeared fairly reasonable and in line with the National Planning Practice Guidance.² Some of the datasets used for the assessment were obtained from the public domain, notably DCLG's 2011 Household Projection (henceforth, 2011 PROJ), while the detailed econometric model for the job growth forecast is not revealed – which is understandable in that such models are often the private intellectual property of the model creator.
- Albeit fundamentally content with the OAN processes in SHMA, West Oxfordshire Council is concerned with a possible upward bias in the local area's household projections set out in 2011 PROJ, which is the key information for the OAN creation. 2011 PROJ was based on the trend analysis mainly for the most recent five years – a period when West Oxfordshire saw a significant increase in house completions with the consequence of an irregular rise in net migration.
- In this circumstance, West Oxfordshire Council commissioned Cambridge Centre for Housing and Planning Research (CCHPR) to independently evaluate the OAN by re-projecting the local housing need up to 2031.

¹ GH (2014a) *Oxfordshire Strategic Housing Market Assessment – Final report*.

² DCLG (2014) *Planning Practice Guidance -Housing and Economic Development Needs Assessments*. On-line: planningguidance.planningportal.gov.uk/blog/guidance/housing-and-economic-development-needs-assessments/. Accessed in December 2014.

2 Background and Evaluation Approach

- The OAN creation procedure in the SHMA was well documented not only in its summary report ³ but also in Woodhead (2014). ⁴ This study ,thus, did not reiterate the content, while supporting the validity of the procedure in that it appeared in line with the National Practice Guidance, which suggests several key points for OAN creations, notably:
 - Demographic projection;
 - Job change in the local economic context; and
 - Affordable housing need and market signals
- Arguments in evaluations of the OAN by independent consultants as well as within the local government are, so far, concerned (a) mainly with treatment of a possible upward bias in 2011 PROJ, which is a key ingredient of the OAN creation, and,(b) to a lesser extent (yet critically) with interpretation of job growth over the projection period.
- With this background, this validation report re-projected housing need in West Oxfordshire over the SHMA projection period (2011 to 2031), following the same procedure albeit drawing on an alternative approach at each stage of the re-projection. The approaches are summarised in the table below

Table 2.1 Stages of OAN re-projection

stage	OAN in SHMA	this re-projection
household projection	based mainly on 2011 PROJ	bias-addressed household projection
job increase associated with local economic development	bottom-up approach under the committed economic growth scenario	top-down approach
affordable housing & market signal	affordable housing demand	Impact of social housing provision on concealed households
vacancy allowance	2011 level	Lower bound (2001) & Upper bound (2011)

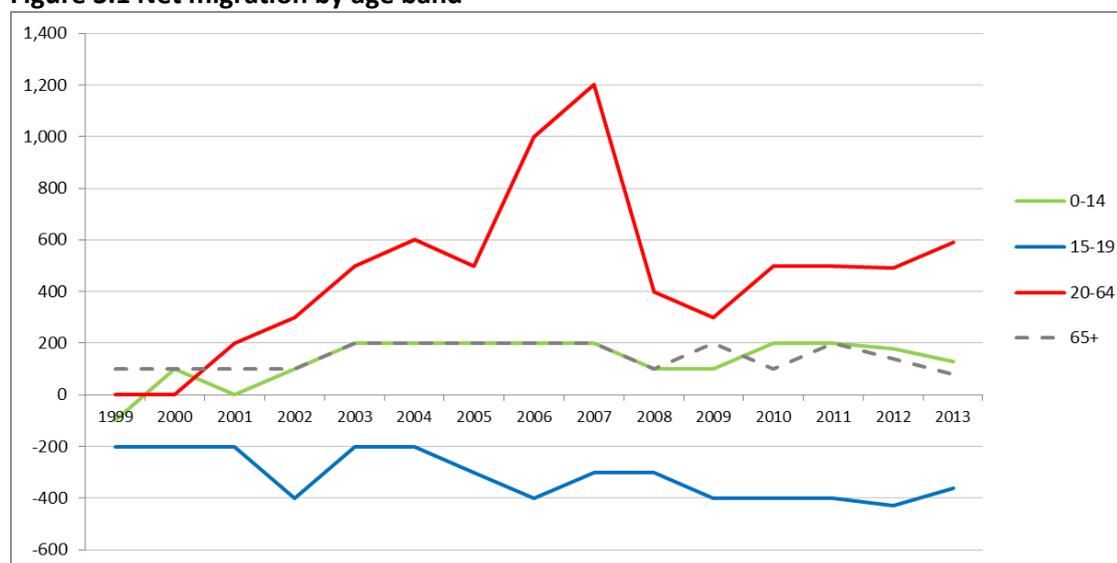
³ GH (2014b) *Oxfordshire Strategic Housing Market Assessment – Summary Report*.

⁴ Woodhead, K. (2014) *An analysis of West Oxfordshire’s future housing requirement (2011-2029)*. West Oxfordshire Council.

3 Household projection

- The starting point of the housing need re-projection is a household projection which minimises a possible upward bias in 2011 PROJ, which is based mainly on the preceding five year demographic trend. West Oxfordshire saw significant increases in house completions for a brief period around 2005 to 2007 with the consequence of irregular rises in net migration and the number of households .For the relevant statistics, see Woodhead (2014).
- To mitigate the shock, this study re-projected household counts employing the following two types of population projections except for the first three years ⁵:
 - ONS 2012-based Sub-regional Population Projection (henceforth, 2012 SNPP);
 - 2012 SNPP partially adjusted by forecast drawing on long-term (over the last three decades) population trends - this population projection is termed as ADJ SNPP, henceforth (for information on the adjustment, see Table 8.1 and Table 8.2 in Annex) .
- The reason for employing the second option is that 2012 SNPP could still contain a possible upward bias, albeit to a much lesser extent. It referred to the local population in 2007 – the final year of the recent house completion boom. ADJ SNPP, however, did not fully modify 2012 SNPP with the modification target being on population aged 25 to 64 years. This is because only a working age cohort saw a migration upsurge during the intense house completion period (Figure 3.1), implying the group was mostly likely to contain an upward bias in its population projection.

Figure 3.1 Net migration by age band



Note: Figures from 1999 to 2010 were rounded to the nearest 100 while those for the rest years to the nearest 10.
Source: ONS *Moves within the United Kingdom; Local Authorities, Government Office Regions in England, and Wales*.

⁵ For the first three years, the both datasets used population reported in 2011 PROJ (for 2011) and ONS Mid-year Population Estimate (for 2012 and 2013).

⁶ Due to the availability of the headship age band, which is set out below, the lowest age for the adjustment is 25 years in lieu of 20.

- With respect to the conversion of total population to resident counts outside communal establishments, both population projections used the likelihood multipliers obtained from 2011 PROJ (set out as in Table 8.3 in Annex).⁷
- The projected populations aged 15 years or more outside communal establishment are in the first two columns of Table 3.1.⁸ For reference, the table includes the equivalents used in 2011 PROJ on the last column. As expected, the figures for 2011 PROJ appear the greatest, followed by those in 2021 SNPP and then ADJ SNPP, except the first several years.

Table 3.1 Projection of population aged 15+ years outside communal establishments

	2012 SNPP base	ADJ SNPP base	2011 PROJ
2011	84,926	84,926	84,926
2012	86,138	86,138	85,653
2013	87,101	87,101	86,441
2014	87,402	87,630	87,156
2015	87,977	88,072	87,905
2016	88,511	88,100	88,598
2017	88,988	88,030	89,237
2018	89,546	88,249	89,948
2019	90,116	88,465	90,707
2020	90,650	88,723	91,458
2021	91,237	89,042	92,256
2022	91,897	89,502	
2023	92,546	89,982	
2024	93,158	90,453	
2025	93,787	91,037	
2026	94,405	91,704	
2027	94,991	92,407	
2028	95,506	93,080	
2029	95,994	93,715	
2030	96,468	94,308	
2031	96,960	94,855	

Source: CCHPR analysis for 2021 SNPP and ADJ SNPP bases. DCLG for 2011 PROJ.

- By multiplying the headship rate in 2011 PROJ (Table 8.4 in Annex) 9, the population projections were translated into the household re-projection as in Table 3.2. The annual average household increases were re-projected to be 380 and 319 on the 2012 SNPP and ADJ SNPP bases respectively. For reference, the equivalent from 2011 PROJ is 527.

⁷ The multipliers were calculated up to 2021, for the rest years of the re-projection period, use the multiplier in 2021.

⁸ Due to the age categorisations in the used datasets, the youngest age was not 16 years.

⁹ The approach set out in Footnote 7 was taken.

Table 3.2 Household projections solely by population projection

	2012 SNPP base	ADJ SNPP base	2011 PROJ
2011	43,508	43,508	43,508
2012	44,260	44,260	44,095
2013	44,756	44,756	44,656
2014	45,154	45,257	45,210
2015	45,558	45,577	45,754
2016	45,994	45,741	46,315
2017	46,378	45,840	46,813
2018	46,754	46,030	47,319
2019	47,089	46,186	47,807
2020	47,435	46,396	48,297
2021	47,769	46,601	48,782
2022	48,158	46,894	
2023	48,562	47,207	
2024	48,933	47,491	
2025	49,296	47,814	
2026	49,626	48,146	
2027	49,928	48,488	
2028	50,225	48,856	
2029	50,512	49,210	
2030	50,800	49,548	
2031	51,113	49,884	
average increase p.a.	380	319	527

Source: DCLG 2011 Household Projection and CCHPR analysis drawing on DCLG 2011 Household Projection & 2012-based SNPP.

4 Adjustment by Job Growth

- The goal of this process is to adjust the re-projected household counts by job growth in the context of future local economic development. This approach is line with the National Practice Guidance, which states the importance of likely changes in job numbers, based on past trends and/or economic forecasts, in housing need assessment.
- The local economic forecast for the West Oxfordshire area was carried out by Cambridge Econometrics (2014), broadly speaking, by a bottom-up approach.¹⁰ This study did not duplicate the approach but alternatively took a top-down approach - i.e., firstly examined the national economic forecast and then applied it to the local labour market context.
- The UK GDP forecasts were recently updated and compiled by the Office for Budget Responsibility (OBR) as in Table 4.1, which shows, on balance, the mid-term growth rate will be at around 2.4 to 2.5%. This study refers to the level as the national economic forecast over the re-projection period.
- Looking back at past national economic trends, growth at around the reference level was observed during the period from 1991 to 2011 with an average of 2.46% p.a. (Table 4.2).¹¹

Table 4.1 UK GDP forecasts (%)

	OBR	IMF	OECD	EC	NIESR	OE	BoE	average [†]
2014	3.0	3.2	3.0	3.1	3.0	3.0	3.5	3.1
2015	2.4	2.7	2.7	2.7	2.5	2.6	2.9	2.6
2016	2.2	2.4	2.5	2.5	2.0	2.5	2.6	2.4
2017	2.4	2.4			2.3	2.6	2.6	2.5
2018	2.3	2.4			2.3	2.5		2.4

Note: † Simple average calculated by CCHPR. NIESR (National Institute of Economic & Social Research), BoE (Bank of England) and OE (Oxford Economics). Source: OBR, *Economic and Fiscal Outlook*, December 2014. Table 3.4 (p. 91).

Table 4.2 UK real GDP (£ trillion)

	£ trillion		average growth rate (% p.a.)
1991	0.923		
2001	1.290	2001-2011	1.53
2011	1.502	1991-2011	2.46

Source: Office for National Statistics.

- Table 4.3 sets out the changes in the workforce residing in West Oxfordshire from 1991 to 2011. People in employment increased by 0.96% p.a., and full-time (FT) employees aged 16-64 years rose by 0.61% p.a. The job density (measured as a ratio to population in the age cohort) increased 0.76 to 0.82 for people in employment, whereas that for FT employees remained almost stable at around 0.51 to 0.52.

¹⁰ Cambridge Econometrics (2014) *Economic Forecasting to Inform the Oxfordshire Strategic Economic Plan and Strategic Housing Market Assessment*.

¹¹ The national output had not consistently increased for the period with the peak of £ 1.553 trillion in 2007 – the immediately previous year of the recent recession. The bottom year was 2009 with £1.4614 trillion. The facts indicate that the 2011 figure was not extreme – i.e, neither the highest nor the lowest point of the macroeconomic cycle.

Table 4.3 Workforce and job density from 1991 to 2011 (aged 16-64 years)

	count		change 1991-2011			job density †	
	1991	2011	count	p.a.	% p.a.	1991	2011
FT - employee	30,322	34,245	3,923	196	0.61	0.51	0.52
PT - employee	7,556	11,285	3,729	186	2.03	0.13	0.17
self-employed	6,872	8,596	1,724	86	1.13	0.12	0.13
total in employment	44,750	54,126	9,376	469	0.96	0.76	0.82
population	59,147	66,050	6,903	345	0.01		

Note: † job density = no. of person in employment / 16-64 yo population. % p.a. is on the compound base.

Source: Census 2011 and CCHPR calculation.

- As work-related residential mobility is most likely to be observed among FT employees (for example, see the national pattern in Table 8.5 in the Annex), the job related adjustment for housing need used information on this type of workforce with the following assumptions:
 - The FT employee's job density in 2011 (0.52) will be maintained up to 2031. With the two population projections in the previous section, this assumption gives the estimated numbers of FT employees up to 2031.
 - On the other hand, to achieve local economic growth which corresponds to the national economic growth at around 2.4 to 2.5% p.a., FT employees need to increase by 0.61% p.a. inferred from the pattern from 1991 to 2011).¹²
 - Where the estimated numbers drawn from the first assumption underperform the requirements drawn from the second assumption, the gaps indicate numbers of additional FT employees required for the local economy.¹³
- Based on 2012 SNPP, the number of additional FT employees required was 189 p.a. (on the bottom row in the first column of Table 4.4). That based on ADJ SNPP was 240. For reference, the equivalent based on 2011 PROJ was 78.

¹² Including out-commuter allowance.

¹³ These assumptions are on the condition that a capital and technology increase will be at the same pace as that from 1991 to 2011.

Table 4.4 Cumulative additionally required FT employees by population projection

	2012 SNPP base	ADJ SNPP base	2011 PROJ
2011	0	0	0
2012	-198	-198	-546
2013	-131	-131	-326
2014	263	149	-126
2015	506	458	56
2016	693	899	234
2017	850	1,330	364
2018	1,050	1,697	493
2019	1,209	2,031	577
2020	1,359	2,317	695
2021	1,529	2,618	778
2022	1,722	2,907	
2023	1,869	3,136	
2024	2,019	3,355	
2025	2,217	3,573	
2026	2,442	3,772	
2027	2,670	3,940	
2028	2,929	4,121	
2029	3,226	4,343	
2030	3,505	4,563	
2031	3,774	4,805	
p.a.	189	240	78

Note: Excluding FT employees required in communal establishments.

- These FT employee requirements, were then, translated into additional housing need. The process was carried out by multiplying a ratio of FT employees per household, which was 1.2 in 1991 and 1.1 in 2011 and 2011 (Table 4.5). The results were a range of 158 to 172 homes p.a. on 2012 SNPP base and 218 homes p.a. on ADJ SNPP base (Table 4.6).
- With these job-related additional factors, the lower bound of housing need increased to 519 p.a. (on the mid row in the second column of Table 4.7), and the upper bound to 552 p.a. (on the bottom row in the first column). The equivalents based on 2011 PROJ are 592 and 598.

Table 4.5 Ratio fo FT employee per household

	FT employees aged 16-64	HHs whose RP aged 16-64	ratio (FT employees per HH)
1911	30,322	25,844	1.2
2011	34,245	30,997	1.1

Source: CCHPR calculation based on the 1991 and 2011 Censuses.

Table 4.6 The number of additionally required homes p.a.

	2012 SNPP base	ADJ SNPP base	2011 PROJ
FT employees to be additionally required	189	240	78
Homes additionally required (ratio = 1.2)	158	200	65
Homes additionally required (ratio = 1.1)	172	218	71

Table 4.7 Housing need with job growth adjustment: p.a.

	2012 SNPP base	ADJ SNPP base	2011 PROJ
HH projections by pop projection (from Table 3.2)	380	319	527
+ lower addition (from the previous table)	538	519 †	592
+ upper addition (from the previous table)	552 ††	537	598

Note: † the lower bound of the household projection at this stage. †† the upper bound.

5 Adjustment by affordable housing provision

- The goal of this process is to adjust the outcomes at the previous stage by affordable or social housing provision taking account of deliverability in the local property market.
- Some relevant literature derived affordable housing need from backlogs or the length of a local authority's waiting list. ¹⁴This adjustment process, however, did not use this approach, because:
 - Taking into account of the chronic shortage of the social housing (see Table 8.6 in Annex), the backlog of demand is unlikely to be fully met even in long term.
 - The estimate drawn from a waiting list could include housing need from already independent households. Even if such households obtain affordable housing, this does not necessarily mean an increase in housing stock en masse, as the relocation is accompanied by the release of a private home.
- This work, instead, firstly projected social housing completions drawing on the statistics from 1981/82 to 2013/14 (the first column in Table 5.1), and then examined how many concealed households can become an independent unit by the projected social housing delivery.

The econometric test, which explored to what extent social housing completions in a specified year were explained by those in the preceding years drawing on the last three decades' data, failed to show a significant relationship between them (the graphic test results are Figure 8.1 in Annex). This suggests that over the past three decades the annual social housing completions have changed almost randomly¹⁵, and sends a limited message for the forecast – the past average (74 units p.a.) would be the most predictable level for the projection period (Figure 3.1).

- Based on the finding and the key statistics on social housing completions (Table 5.2), three scenarios were prepared for future social housing completions: the baseline (following the previous average), the lower (e.g. property market conditions will reduce social housing provision) and the upper (e.g. social housing demand will increase social housing provision above the previous average):
 - Baseline – 74 units p.a.
 - Lower – 40 units p.a. (the lower quartile in the past)
 - Upper – 100 units p.a. (the upper quartile in the past)

¹⁴ For example, DCLG treated a backlog as un-met housing need and estimated overall housing need by adding new demand on it (DCLG (2010) *Estimating Housing Needs*).

¹⁵ This does not mean that the social houses had been built arbitrarily in West Oxfordshire, but the previous social housing outputs which reflected various factors at that time appeared too variable to hold a specific pattern or cycle.

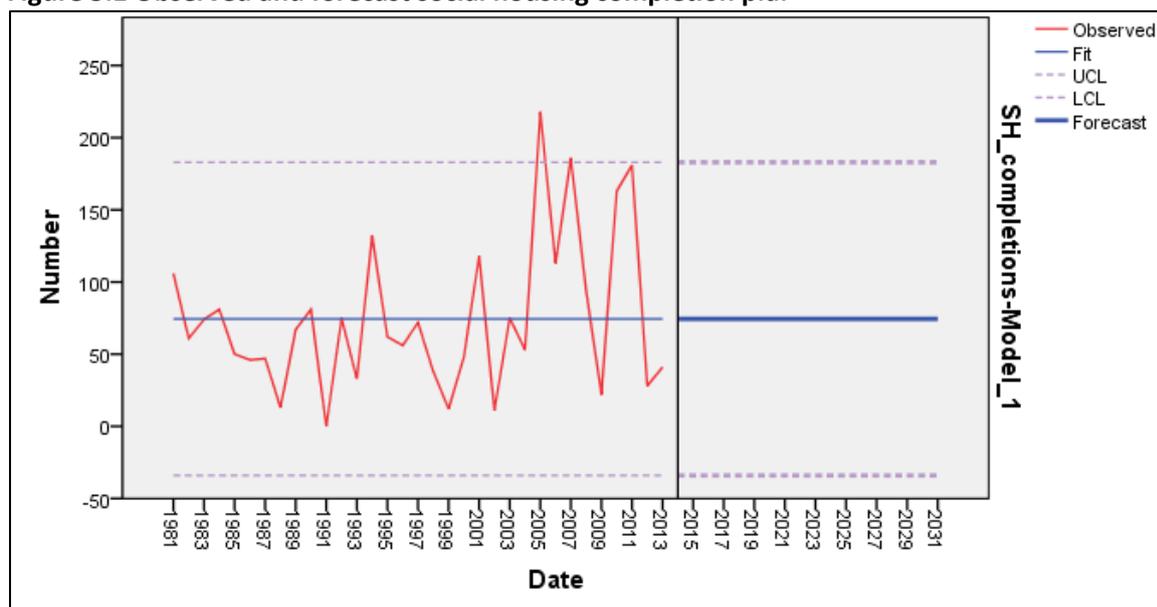
Table 5.1 Social housing completions & previously concealed households into the sector

	social housing completion (units)	previously concealed households †
1981/82	106	
1982/83	61	
1983/84	74	
1984/85	81	
1985/86	50	
1986/87	46	
1987/88	47	
1988/89	13	
1989/90	67	
1990/91	81	
1991/92	0	
1992/93	75	
1993/94	33	
1994/95	132	
1995/96	62	
1996/97	56	
1997/98	72	
1998/99	38	
1999/00	12	
2000/01	48	33
2001/02	118	84
2002/03	11	97
2003/04	75	110
2004/05	53	103
2005/06	218	183
2006/07	113	161
2007/08	186	121
2008/09	94	144
2009/10	22	139
2010/11	163	119
2011/12	181	153
2012/13	28	97
2013/14	41	

Note:† New social tenant households who were previously homeless or living with family/friends; and shared ownership purchaser households who were previously living in a temporary accommodation or with family/friends.

Source: West Oxfordshire Council for the social housing completions. CCHPR's analysis drawing on DCLG Continuous REcording for Letting.

Figure 5.1 Observed and forecast social housing completion p.a.



Note: Date unit is a fiscal year.

Table 5.2 Key statistics of annual social housing completion from 1981/82 to 2012/13

Average	Median	Lower quartile	Upper quartile	N
74	62	40	100	33

Source: CCHPR calculation drawing on data from West Oxfordshire Council.

- Next, the number of households which had been previously concealed but became independent by entering the social housing sector (the last column of Table 5.1) was regressed by the social housing completions to obtain the relationship between the two variables. Amongst the several exercises, the equation below appeared the most fitting (for the test results, see Table 8.1 in Annex).

$$HHPC_t = 0.324 * SHC_t + 0.261 * SHC_{t-1} + 60.142,$$

where

HHPC : Number . of previously concealed HHs that became in the social sector;

SHC : Social housing completions

t : year (2000/01 to 2012/13)

- With the equation and the three social housing provision scenarios, the number of concealed households that can be independent through social housing provision was projected. This is shown in the first column of Table 5.3.
- The number of households becoming independent under the baseline scenario was deemed to have been already incorporated in the demographic projection process, as the scenario followed the past average. Thus, the adjustment factors in the social housing context were given as the difference of each of the upper and lower scenarios' outcomes from the baseline result, which was 15 and -20 households respectively (the last column in Table 5.3).
- With the lower and upper adjustments, the re-projected housing need is in a range of 499 to 567 units p.a. (the bottom row of Table 5.4). The reference equivalent base on 2011 PROJ was 572 to 613 units.

Table 5.3 Projected HHs to become independent by social housing completions

SHC scenario	concealed to independent HHs	HHs to be added on the demographic projections
baseline (74 p.a.)	103	0 (already reflected in the demo proj)
upper (100 p.a.)	119	15 (= 119-103)
lower (40 p.a.)	84	-20 (= 84 -203)

Table 5.4 Housing needs with social housing adjustments (units p.a.)

	lower	upper	reference based on 2011 PROJ
housing needs in the previous section (from Table 4.7)	519	552	592 ~ 598
social housing adjustment factor (from the previous table)	-20	15	
housing needs adjusted by social housing provision	499	567	572 ~ 613

6 Adjustment with a vacancy allowance

- Finally, the re-projected housing need was adjusted with a vacancy allowance. Comparing the three vacancy rates from the recent three Censuses (Table 6.1), the rate was the highest in 2011 (5.17%) and the lowest in 2001 (4.23%).¹⁶ With the observation, it was assumed that the vacancy rate was high enough in 2011 and the level can be an upper limitation over the projection period. For the lower limitation, the 2001 level is used.

Table 6.1 Vacancy rates (%)

1991	2001	2011
4.39	4.23	5.17

Source: CCHPR calculation & analysis based on the Censuses.

- The assumption gave the final re-projected range of housing need over the projection period as **520 to 596 units** (the bottom row in Table 6.2). The reference equivalent based on 2012 PROJ was 602 to 638 units.

Table 6.2 Lower and upper bounds of housing need with vacancy allowance (units p.a.)

	lower	upper
bound after Affordability adjustment from Table 5.4 (x)	499	567
vacancy rate (z)	4.23%	5.17%
bound with vacancy allowance ($x * (1 + z)$)	520	596

¹⁶ The alternative information on vacancy dwelling - DCLG, Live Table 615 "Vacant dwellings by local authority district" cautions the under-reporting figures by noting:

Up until April 2013 dwellings undergoing major structural repairs for up to 12 months and those vacant for less than 6 months were eligible for a council tax exemption (Class A and C respectively). In April 2013 these exemptions were replaced with a new flexible discount which applied to all empty properties. Local authorities are now entitled to apply any level of discount from 0% to 100% to all empty properties. Where local authorities award zero discounts for empty properties there is less incentive for owners to report their property as empty. This could have led to some under reporting of some empty properties.

7 Implications and Conclusions

- This work re-projected housing need for West Oxfordshire up to 2031 using the following four steps:
 - Household projections, which addressed a possible upward bias embedded in 2011PROJ;
 - Adjustment by job increase to achieve local economic growth;
 - Adjustment by social housing provision taking account of deliverability; and
 - Adjustment with a vacancy allowance.
- The re-projection result was a range of 520 to 596 units p.a., which appeared moderate in comparison with the OAN in the SHMA - 635 to 686 units.
- The OAN could be upwardly biased, partly because its demographic projection relied mainly on 2011PROJ, which was affected by a short house completion boom from 2005 to 2007.
- For reference, this work estimated housing need based on 2011 PROJ with other re-projection approaches being equal. The result was a range of 602 to 638 units. The upper part of the range marginally overlapped the lower part of the OAN, hinting that the OAN has other uplifting elements than the demographic projection bias – presumably, the job growth forecast. The Committed Economic Growth Scenario, which the SHMA employed, takes account both of factors that can be expected to stimulate ‘above trend’ growth in employment in Oxfordshire as well as factors which might depress growth.¹⁷
- The discrepancy, however, does not necessarily mean that the OAN is less informative for local housing and planning purposes. Rather, it contains a wealth of bespoke evidence for planning information and possible impacts on the local housing market. For example, the Committed Economic Growth Scenario which reflects policy influences on economic growth such as planned development and initiatives related to Oxfordshire City Deal and other infrastructure plans.
- Presumably, therefore, the most effective way of referring to the package of rich information in the SHMA in West Oxfordshire’s housing planning context is not to focus solely on a conclusive number for future housing need but to flexibly employ pieces of the relevant information.

¹⁷ GH (2014a; p.188)

8 Annex

Table 8.1 Autoregression results for population by age band

age band	explanatory variable		Coefficient estimate	SE	
age_25to29-Model_1	Constant		6,277.162	606.363	***
	AR	Lag 1	0.861	0.108	***
	MA	Lag 1	-0.683	0.217	***
		Lag 2	-0.547	0.242	**
		Lag 3	-0.083	0.222	
age_30to34-Model_2	Constant		6,814.467	239.339	***
	AR	Lag 1	0.662	0.175	***
	MA	Lag 1	-0.610	0.203	***
		Lag 2	-0.534	0.220	**
		Lag 3	-0.502	0.197	**
age_35to39-Model_3	Constant		6,870.014	491.667	***
	AR	Lag 1	0.886	0.101	***
	MA	Lag 1	-0.271	0.201	
		Lag 2	-0.427	0.191	**
		Lag 3	-0.239	0.208	
age_40to44-Model_4	Constant		6,698.737	1,280.045	***
	AR	Lag 1	0.962	0.054	***
	MA	Lag 1	-0.548	0.196	***
		Lag 2	-0.437	0.211	**
		Lag 3	-0.364	0.198	*
age_45to49-Model_5	Constant		6,502.319	2,564.346	**
	AR	Lag 1	0.982	0.045	***
	MA	Lag 1	-0.939	0.192	***
		Lag 2	-0.463	0.251	*
		Lag 3	-0.374	0.196	*
age_50to54-Model_6	Constant		6,119.681	2,801.870	**
	AR	Lag 1	0.981	0.057	***
	MA	Lag 1	-0.774	0.201	***
		Lag 2	-0.438	0.244	*
		Lag 3	-0.230	0.199	
age_55to59-Model_7	Constant		5,515.583	1,462.142	***
	AR	Lag 1	0.974	0.049	***
	MA	Lag 1	-0.355	0.168	**
		Lag 2	-0.416	0.179	**
		Lag 3	-0.678	0.186	***
age_60to64-Model_8	Constant		4,807.498	1,124.051	***
	AR	Lag 1	0.967	0.051	***
	MA	Lag 1	-0.208	0.169	
		Lag 2	-0.364	0.164	**
		Lag 3	-0.535	0.188	***

Note: The data source is ONS Mid-year Population Estimate from 1981 to 2013. *** 1% significance level; ** 5% significance level; * 10% significance level. For the statistic model fit, see the following table.

Table 8.2 Autoregression model fitness for population by age band

Model	Model Fit statistics		Ljung-Box Q(18)			Number of Outliers
	Stationary R-squared	R-squared	Statistics	DF	Sig.	
age_25to29-Model_1	.925	.925	10.693	14	.710	0
age_30to34-Model_2	.877	.877	8.991	14	.832	0
age_35to39-Model_3	.856	.856	14.926	14	.383	0
age_40to44-Model_4	.891	.891	6.928	14	.937	0
age_45to49-Model_5	.909	.909	3.971	14	.996	0
age_50to54-Model_6	.899	.899	3.085	14	.999	0
age_55to59-Model_7	.940	.940	3.496	14	.998	0
age_60to64-Model_8	.949	.949	5.597	14	.976	0

Note: As the previous table.

Table 8.3 Proportion of population in private households

	15-24	25-34	35-44	45-54	55-59	60-64	65-74	75-84	85+
2013	0.9448	0.9170	0.9653	0.9750	0.9861	0.9972	0.9964	0.9976	0.9976
2014	0.9440	0.9130	0.9656	0.9753	0.9863	0.9972	0.9964	0.9977	0.9976
2015	0.9434	0.9096	0.9660	0.9754	0.9866	0.9971	0.9963	0.9977	0.9977
2016	0.9425	0.9056	0.9664	0.9754	0.9870	0.9970	0.9963	0.9977	0.9978
2017	0.9411	0.9035	0.9665	0.9754	0.9874	0.9969	0.9963	0.9978	0.9979
2018	0.9404	0.9029	0.9659	0.9756	0.9877	0.9968	0.9963	0.9977	0.9979
2019	0.9405	0.9018	0.9653	0.9758	0.9878	0.9969	0.9962	0.9977	0.9980
2020	0.9406	0.9009	0.9648	0.9760	0.9879	0.9969	0.9961	0.9977	0.9981
2021	0.9416	0.8995	0.9640	0.9762	0.9879	0.9970	0.9959	0.9977	0.9981
2022	0.9416	0.8995	0.9640	0.9762	0.9879	0.9970	0.9959	0.9977	0.9981
2023	0.9416	0.8995	0.9640	0.9762	0.9879	0.9970	0.9959	0.9977	0.9981
2024	0.9416	0.8995	0.9640	0.9762	0.9879	0.9970	0.9959	0.9977	0.9981
2025	0.9416	0.8995	0.9640	0.9762	0.9879	0.9970	0.9959	0.9977	0.9981
2026	0.9416	0.8995	0.9640	0.9762	0.9879	0.9970	0.9959	0.9977	0.9981
2027	0.9416	0.8995	0.9640	0.9762	0.9879	0.9970	0.9959	0.9977	0.9981
2028	0.9416	0.8995	0.9640	0.9762	0.9879	0.9970	0.9959	0.9977	0.9981
2029	0.9416	0.8995	0.9640	0.9762	0.9879	0.9970	0.9959	0.9977	0.9981
2030	0.9416	0.8995	0.9640	0.9762	0.9879	0.9970	0.9959	0.9977	0.9981
2031	0.9416	0.8995	0.9640	0.9762	0.9879	0.9970	0.9959	0.9977	0.9981

Source: CCHPR calculation based on DCLG 2011 Household Projection.

Table 8.4 Headship rate by age band

	15-24	25-34	35-44	45-54	55-59	60-64	65-74	75-84	85+
2013	0.0769	0.4138	0.5284	0.5821	0.5681	0.5829	0.6329	0.7507	0.8852
2014	0.0770	0.4109	0.5303	0.5850	0.5666	0.5792	0.6280	0.7466	0.8822
2015	0.0771	0.4084	0.5333	0.5885	0.5652	0.5751	0.6226	0.7418	0.8784
2016	0.0774	0.4059	0.5361	0.5921	0.5643	0.5715	0.6177	0.7376	0.8751
2017	0.0777	0.4034	0.5393	0.5959	0.5633	0.5675	0.6125	0.7330	0.8711
2018	0.0781	0.4011	0.5427	0.5999	0.5626	0.5637	0.6075	0.7286	0.8672
2019	0.0785	0.3987	0.5453	0.6036	0.5621	0.5603	0.6031	0.7248	0.8639
2020	0.0789	0.3963	0.5481	0.6076	0.5618	0.5569	0.5986	0.7209	0.8604
2021	0.0794	0.3939	0.5509	0.6116	0.5617	0.5536	0.5943	0.7172	0.8570
2022	0.0794	0.3939	0.5509	0.6116	0.5617	0.5536	0.5943	0.7172	0.8570
2023	0.0794	0.3939	0.5509	0.6116	0.5617	0.5536	0.5943	0.7172	0.8570
2024	0.0794	0.3939	0.5509	0.6116	0.5617	0.5536	0.5943	0.7172	0.8570
2025	0.0794	0.3939	0.5509	0.6116	0.5617	0.5536	0.5943	0.7172	0.8570
2026	0.0794	0.3939	0.5509	0.6116	0.5617	0.5536	0.5943	0.7172	0.8570
2027	0.0794	0.3939	0.5509	0.6116	0.5617	0.5536	0.5943	0.7172	0.8570
2028	0.0794	0.3939	0.5509	0.6116	0.5617	0.5536	0.5943	0.7172	0.8570
2029	0.0794	0.3939	0.5509	0.6116	0.5617	0.5536	0.5943	0.7172	0.8570
2030	0.0794	0.3939	0.5509	0.6116	0.5617	0.5536	0.5943	0.7172	0.8570
2031	0.0794	0.3939	0.5509	0.6116	0.5617	0.5536	0.5943	0.7172	0.8570

Source: DCLG 2011 Household Projection.

Table 8.5 Reference person's employment status for relocating households: England 2012/13

	count	%	valid %
FT employee	545,974	80.0	87.0
PT-employee	25,418	3.7	4.0
self-employer	56,393	8.3	9.0
rest or n.a.	55,025	8.1	
total	682,810	100.0	100.0

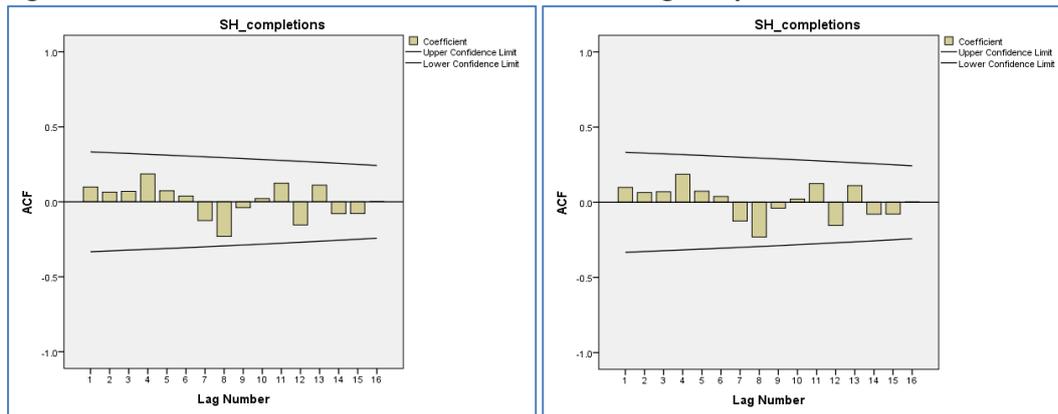
Source: CCHPR analysis based on English Housing Survey 2012/13.

Table 8.6 Households on Waiting List

	HHs on Waiting List	annual change
1997	1,140	
1998	1,480	340
1999	1,453	-27
2000	1,241	-212
2001	1,234	-7
2002	1,710	476
2003	2,078	368
2004	2,494	416
2005	2,847	353
2006	2,228	-619
2007	2,149	-79
2008	2,131	-18
2009	1,996	-135
2010	2,085	89
2011	2,107	22
2012	2,092	-15
2013	1,999	-93
2014	992	-1,007

Source: DCLG Live Table 600.

Figure 8.1 Autocorrelation of the annual social housing completions



Note: If the social housing completions in a specified year were related to those in the preceding years (i.e. existence of autocorrelation), the bars in the charts could not have remained the zones shown by the solid lines. The charts indicate no autocorrelations – the social housing completions were unlikely to be explained by those in the preceding years.

Table 8.7 Test result for no. of HHs which became independent

The model: $HHPC_t = \beta_1 * SHC_t + \beta_2 * SHC_{t-1} + C$, (t takes 2000/01 to 20012/13)

	Coefficient		(standard error)
C (Constant term)	60.142	**	(22.154)
β_1	0.324	*	(0.141)
β_2	0.261	*	(0.110)

Note: As the sample size is small ($N=13$), 1,000 bootstrap samples were used. Adjusted $R^2 = 0.436$; F -value = 0.023 **;
 ** 5% significance level; * 10% significance level.



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