Oxfordshire County Council
Local Assessment of Aggregates Supply Requirements

January 2011

Plan Design Enable

ATKINS

Oxfordshire County Council

Local Assessment of Aggregates Supply Requirements

Final Report

January 2011

Notice

This report was produced by Atkins Ltd for Oxfordshire County Council for the specific purpose of undertaking a Local Assessment of Aggregates Supply Requirements.

This report may not be used by any person other than Oxfordshire County Council without its express permission. In any event, Atkins Ltd accepts no liability for any costs, liabilities or losses arising as a result of the use of or reliance upon the contents of this report by any person other than its Client.

Document History

JOB NUMBER: 5099329		DOCUMENT REF: OCC_Local_Assessment_of_Aggregate_Supply_Requirements_R0.doc				
Revision	Purpose Description	Originated	Checked	Reviewed	Authorised	Date
0	Final Report	AH/TSM	AH	ATF	AFT	Jan 2011

Contents

List of Tables

List of Figures

Appendices

Appendix A – Meeting Notes

Appendix B – Oxfordshire's Geology

Appendix C - Possible Indicators for Determining Future Aggregate Demand

Appendix D– Comparison of Primary Aggregate Sales with Past Performance of the Construction Industry

Appendix E - Details of Other Analysis Methods to Forecast Oxfordshire's Aggregates Supply Requirements

1. Introduction

Project Brief

1.1 Atkins Ltd. was commissioned by Oxfordshire County Council to undertake a local assessment of aggregate supply requirements for Oxfordshire.

1.2 The brief required:

- An analysis of current aggregates supply and demand in Oxfordshire, covering all types of aggregates: local land-won minerals; secondary and recycled materials; and materials sourced outside the county.
- An appropriate, transparent and robust methodology that can produce a forecast demand for aggregates in Oxfordshire over the period to 2030 that is related to anticipated economic activity.
- An assessment of the maximum practicable contribution that could be made from secondary and recycled aggregate sources.
- An assessment of the appropriate levels of movement of aggregates by type into and out of Oxfordshire that will be required over the period to 2030; and the implications, if any, for aggregates supply infrastructure requirements within Oxfordshire such as rail aggregate depots.
- A breakdown of the quantities of aggregates supply (in tonnes per annum) that will be required from the following sources in Oxfordshire over the period to 2030 (taking into account movements into and out of the county):
  - sand and gravel from quarries in Oxfordshire;
  - crushed rock from quarries in Oxfordshire;
  - secondary and recycled aggregates sites in Oxfordshire.
- A record of the process that the consultant has gone through to come up with their conclusions and recommendations, including a record of dialogue with third parties.

Purpose of the Assessment

1.3 The purpose of the assessment was to provide locally derived figures for use in the preparation of the Minerals Development Framework for Oxfordshire. The figures would be used in place of the nationally and regionally derived figures to calculate the amount of resources to be identified as available for extraction and the required processing capacity for alternative aggregates to contribute to total aggregate demand over the plan period (ie to 2030). During the plan period the figures for sand and gravel and crushed rock would be used as a measure of the adequacy of consented reserves to meet ongoing demand as expressed in the landbank, both in annual monitoring and to inform decisions on planning applications. The figure for alternative aggregate processing capacity would be used for similar purposes during the plan period.

1.4 Any locally derived figures are by definition subject to the availability and accuracy of relevant information. The report first sets out the available information about current aggregates supply and demand in Oxfordshire, including imports and exports of primary aggregates, and the maximum practicable contribution from alternative aggregates as required in the brief. It then goes on to consider the options available for a methodology to forecast demand for aggregates in Oxfordshire over the period to 2030 that is related to anticipated economic activity.

1.5 The results are used to produce a range of supply requirements for Oxfordshire, broken down between the main types of aggregates found in the county; ie crushed rock and sand and gravel. Areas of uncertainty and assumptions made are set out. It is very important that the sensitivity of

the resulting figures is recognised by building in contingencies, and that the resulting assessments of supply requirements are subject to review in the light of further information becoming available in future years.

1.6 It is also very important to understand that, whether nationally derived apportionments or locally derived aggregate supply requirements, the resulting figures are not targets for actual extraction of aggregates. There is no requirement that land identified as available for extraction must be put forward for planning permission before the end of the plan period. Equally there is no specification that annual sales should equal the calculated apportionment, or supply requirement.

Consultations

1.7 During the study, Atkins attended separate meetings arranged by Oxfordshire County Council with representatives from local action groups and mineral operators to obtain their general thoughts on the approach to the study. Notes of those meetings are provided in Appendix A. A briefing meeting was held with Members of the County Council's Minerals & Waste Plan Working Group during the study.

1.8 Comments from all consultees and from Members of the Working Group are gratefully acknowledged.

.

2. Background

The Managed Aggregate Supply System

2.1 Apportionment rates are a measure adopted within a national arrangement called Managed Aggregate Supply System (MASS). The purpose of the arrangement is to seek to ensure that there is an 'adequate and steady supply' of aggregate materials to the construction industry. This is as contained in MPS1 and the supporting Practice Guide. (See especially Annex 1 of MPS1 and Paras 60 et seq of the Practice Guide).

2.2 The methodology for deriving the National and Regional apportionment rates is described in Annex A of the Draft Revised National Guidelines for Aggregate Provision in England: 2005-2020. Further information about the model used is given in a Technical Paper published by the ODPM in 2006 called 'Forecasting Aggregates Demand: A technical summary'.

2.3 The system involves a national assessment of total aggregate needs for construction purposes, which takes account of changes in the ratio of aggregate use generally in construction as measured by tonnes used per £1,000 spend on construction projects.

2.4 The total aggregates need is then divided into the various elements of Primary Aggregates and Alternative Aggregates. This division takes account of recent trends in the supply and utilisation of alternative aggregates, and other factors, including forecasts of economic activity, the aggregates levy and other policy changes. Account is also taken of the potential supply of marine aggregates to meet a small shortfall in estimated overall supply from land based sources, particularly in the South East.

2.5 The Primary Aggregate element of the forecast is then divided regionally. The regional division takes account of differences in geology which broadly reflects the fact that there is very limited availability of hard rock in the south east and the historic patterns of movements of aggregates between regions as recorded in the four yearly aggregates movements survey reports, the latest of which was in 2005. The 2005 survey report is generally referred to as AM2005. The aggregates movements survey has been undertaken for 2009, but the results will not be available until spring 2011.

2.6 The regional division also takes account of historical and forecasted levels of demand for both Primary Aggregate and Alternative Aggregate in each region. The methodology notes that there is greater uncertainty about the regional division, because of the assumptions made.

2.7 The demand arising for total aggregates in each region is then projected for each year of the forecast period. The total figure is again broken down between the different elements of supply as available in each region, including assumptions about alternative aggregates, marine sand and gravel, and imports from outside England.

2.8 Each element of the guideline production figure is then divided by the number of years that the guidelines are to cover to give an average annual production over the period.

2.9 MPS1 advises that Sub-regional apportionments should not be regarded as inflexible. (Annex 1 para 3.8). The Practice guide provides guidance on management of the landbank in para 72, stating that this should be based on considerations of real need and real supply and suggests a list of factors to be taken into account. This includes, amongst other factors: the local apportionment; significant future increases in demand that can be forecast with reasonable certainty; and actual levels of production in recent years compared with average annual provision.

Recent National and Regional Apportionment Rates

2.10 National and Regional Aggregate Guidelines have been issued in 2003 and 2009. In the South East, the 2003 Regional guideline figures were sub-apportioned according to the relative proportion of average sales taken over the previous seven year period, with the highest and lowest figures eliminated.

2.11 The 2009 guideline figures for the south east were sub-apportioned according to a different methodology.

2.12 The South East England Regional Assembly (SEERA) as the Regional Planning Body (RPB) for the South East commissioned a study on sub-regional apportionment. The study looked at various factors that could be taken into account in seeking a 'more rounded and forward looking methodology' which did not rely solely on past sales.

2.13 The methodology identified four main criteria for which consistent information was available for all the MPA / counties in the South East. These criteria were Construction Demand, Past use (Sales); Unsterilized resource outside of international designations; and Unsterilised resource outside of international designations and outside national designations. The values for each MPA / county were then given different weightings to produce different options for determining the selected sub apportionment.

2.14 The option chosen was Option E, which was weighted to reflect 'demand and resource', with the weightings given to the selected criteria as indicated in the following table.

Table 2.1 – Criteria and Weighting Applied for Derivation of 2009 Sub-regional Apportionment

Criteria	Weighting
Criterion 1: Construction demand Sub divided as: Criterion 1a: Housing provision Criterion 1b: Existing population	40% 1 9
Criterion 2: Past use (sales)	10%
Criterion 3: Unsterilised resource outside of international designations (+250m buffer)	40%
Criterion 4: Unsterilised resource outside of international designations (+250m buffer) and outside national designations	10%

2.15 The resulting figures were included in the Secretary of State published 'Proposed Changes' to Policy M3 of the South East Local Plan, published in March 2010.

2.16 During the review, Oxfordshire County Council objected in particular to the proposed regional apportionment figure of 11.12 mtpa and the Oxfordshire sub regional apportionment figure of 2.1 mtpa for sand and gravel. The County Council believes the regional figure is too high and that the Oxfordshire sand and gravel apportionment is unnecessary, inappropriate and unacceptable.

2.17 This is demonstrated in the following table:-

Table 2.2 – Comparison of Oxfordshire's apportionments 2003 and 2010

	2003		2010	
	mtpa	%	mtpa	%
Oxfordshire sand and gravel	1.82	13.7	2.1	18.9
Oxfordshire crushed rock	1.0	45.5	0.66	45.8
South East sand and gravel	13.25	100	11.12	100
South East crushed rock	2.2	100	1.44	100

2.18 Following the announced revocation of Regional Spatial Strategies by the Coalition Government in July 2010, the Chief Planner at the Department for Communities and Local Government (CLG) advised that planning authorities in the South East should work from the apportionment set out in

the 'Proposed Changes' to the revision of South East Plan Policy M3 published in March 2010. However that guidance also stated that planning authorities "can choose to use alternative figures for their planning purposes if they have new or different information and a robust evidence base".

2.19 This study was commissioned in order to seek to derive such alternative figures.

3. Current Aggregate Supply and Demand

3.1 The following is an analysis of current aggregate supply and demand to examine the evidence available for a local assessment of future aggregate needs in Oxfordshire.

Geology

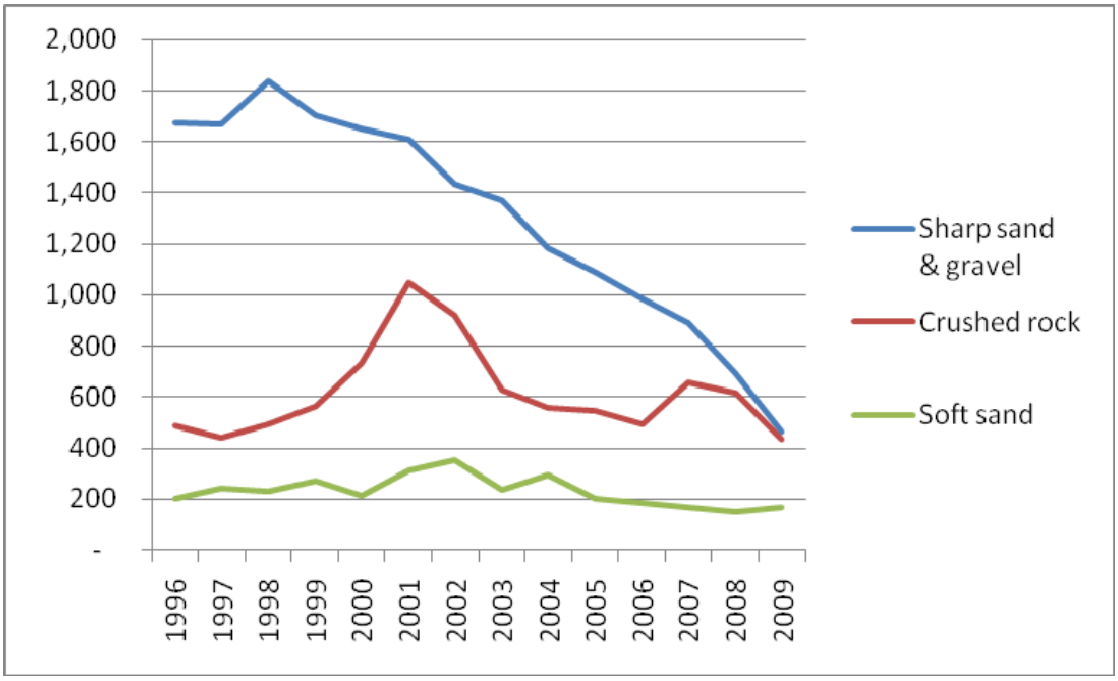
3.2 A summary of the geology of Oxfordshire is contained in Appendix B. The aggregate deposits in the county area are:-

- **Sharp sand and gravel,** sub-divided into river terrace and glaciofluvial resources: The principal uses of sand are as fine aggregate in concrete, mortar and asphalt. The main use of gravel is as coarse aggregate in concrete.
- **Soft sand** derived from poorly consolidated sandstone, and mainly used in the building industry for producing mortars and plasters and in the manufacture of asphalt and macadam.
- Extensive **limestone and ironstone** resources which are worked to produce crushed rock aggregate for general construction purposes and for building stone.

Primary Aggregate Sales

3.3 Sales of sand and gravel and crushed rock for Oxfordshire for the period 1995 to 2009 are shown in the following figure, with sand and gravel sales split between sharp s&g and soft sand.

Figure 3.1 – Sales of crushed rock, soft sand and sharp sand & gravel in Oxfordshire 1996 to 2009 (in 1,000 tonnes per annum)



3.4 Sales of crushed rock are variable over the period, but with a generally downward trend since 2001. Sales of soft sand were fairly constant, but clearly lower than either of the other aggregate types. Sales of sharp sand and gravel have fallen consistently since 1997 and the 2009 figure was less than half the level of sales in each of the years in the period 1996-2001. The fall between 1999 and 2009 is 68%.

3.5 There are some local factors influencing these sales figures. Firstly, crushed rock sales recorded before 2001 do not include ironstone, so are lower than actual sales for these years. This means that only figures from 2001 can be used with consistency.

3.6 As regards sand and gravel, sales since 2003 have been reduced from previous years because of the progressive depletion of permitted reserves at 3 sand and gravel quarries operated by Oxfordshire's previously largest producer. Together these 3 quarries had represented a significant proportion of the county's production capacity over the past 10 years.

3.7 The fall in sales of sand and gravel has been noted elsewhere as well. Nationally there has been a fall in sales of sand and gravel by 40% between 1999 and 2009. The comparable figure for the South East is 57%.

3.8 To some extent, sales of marine sand and gravel contribute to both overall national supplies and regional supplies. Nationally marine sand and gravel is 18% of total sand and gravel sales, up from 16% in 1999 (there was a brief period 2003-2004 when the proportion fell to 15.7%). In the South East, marine sand and gravel is now a significant proportion of total sand and gravel sales, rising from 33% of total sand and gravel sales in 1999 to 55% in 2009.

3.9 Oxfordshire does not benefit from imports of marine sand and gravel to compensate for diminishing sales in land-won sand and gravel. The information on primary aggregate consumption in Table 11 of the AM2005 Report shows that only 1,000 tonnes of marine sand and gravel was consumed in Oxfordshire and the adjacent county areas of Berkshire and Buckinghamshire (BOB) in 2005 (comprising only 0.02% of total primary aggregate consumption). The following considers the available evidence on exports to and imports from other Mineral Planning Authority areas and the role in overall supply in Oxfordshire.

Exports and Imports

3.10 Inter-regional movements of primary aggregates are surveyed nationally every 4 years. The last survey was in 2009, but the aggregated results will not be available until spring 2011. Earlier surveys were in 2001 and 2005.

Exports

3.11 AM2005 showed that the south east region is the largest exporter of sand and gravel of all regions. Figures from Table 9 for recorded source and destination movements for Oxfordshire and the surrounding county areas are given in the following table. Destination figures by individual county are not available; and destination data for Oxfordshire is combined with that for Berkshire and Buckinghamshire.

Table 3.1 - Sales of primary aggregates and principal destinations AM2005

Source MPA	Destination	Sand and gravel (1,000 t)	MPA %	Crushed rock (1,000 t)	MPA %
Oxfordshire	Berkshire, Oxfordshire and Buckinghamshire	304	24%	277	49%
	South East	418	32%	134	24%
	Elsewhere	550	43%	152	27%
	Unallocated	17	1%		
	TOTAL	**1,289**			

Table cont over

Source MPA	Destination	Sand and gravel (1,000 t)	MPA %	Crushed rock (1,000 t)	MPA %
Berkshire	Berkshire, Oxfordshire and Buckinghamshire	358	34%		
	South East	313	30%		
	Elsewhere	9	1%		
	Unallocated	375	36%		
	TOTAL	**1,055**			
Buckinghamshire & MK	Berkshire, Oxfordshire and Buckinghamshire	869	75%		
	South East	3	0%		
	Elsewhere	283	24%		
	TOTAL	**1,155**			
Gloucestershire	Gloucestershire	198	19%		
	South East	745	72%		
	Elsewhere	84	8%		
	TOTAL	**1028**			
Wiltshire	Dorset and Wiltshire	514	49%		
	South west	500	47%		
	Elsewhere	42	4%		
	TOTAL	**1056**			
Warwickshire	Solihull, Coventry & Warwickshire	503	55%		
	West Midlands	311	34%		
	Elsewhere	40	4%		
	Unallocated	70	8%		
	TOTAL:	**923**			
Northamptonshire	Northamptonshire	33	6%	157	41%
	East Midlands	460	79%	230	59%
	Elsewhere	89	15%		
	TOTAL	**581**		**386**	

3.12 Table 3.1 indicates that in 2005 Oxfordshire used some 304,000 tonnes of sand and gravel in county or in Berkshire and Buckinghamshire. This represented 24% of total sales. The remainder went either elsewhere in the South East, or Elsewhere in England (probably South West and London being the main destinations). Buckinghamshire was the largest contributor to the 3 county

group of Oxfordshire, Berkshire and Buckinghamshire, with 869,000 tonnes, and Berkshire contributed 358,000 tonnes.

3.13 Information on Oxfordshire's exports collected by Oxfordshire County Council for the AM2009 survey is indicated by the data in the following table on the destinations of aggregates produced in Oxfordshire.

Table 3.2 – Destinations of Aggregates Produced in Oxfordshire 2009

	Sand and gravel (including soft sand)		Crushed rock	
Destination	**Tonnes**	**%**	**Tonnes**	**%**
Oxfordshire	487,260	77.6	180,867	49.8
Berkshire	20,785	3.3	23,081	6.4
Buckinghamshire & Milton Keynes	13,663	2.2		
Rest of South East & London	15,565	2.5	0	0
Wiltshire & Gloucestershire	68,203	10.9	29,694	8.2
Northamptonshire & Warwickshire	4,993	0.8	118,788	32.7
Elsewhere	17,188	2.7	10,409	2.9
Total	**627,783**	**100**	**362,839**	**100**

3.14 This suggests that in 2009 Oxfordshire used 77.6% of its sales of sand and gravel, and just under 50% of the sales of crushed rock in county.

3.15 In 2009 significantly more of Oxfordshire's sand and gravel was used within Oxfordshire than that supplied to Oxfordshire together with Berkshire and Buckinghamshire in 2005. This indicates that the principal effect of the recent reduction of sand and gravel sales, principally sharp sand and gravel, has been a significant reduction in exports to neighbouring counties. See Table 3.3.

Table 3.3 - Destinations of Aggregates Produced in Oxfordshire 2005 and 2009

Source MPA	Destination	Sand and gravel (1,000 t) 2005	Sand and gravel (1,000 t) 2009
Oxfordshire	Berkshire, Oxfordshire and Buckinghamshire	304	520 of which 487.2 in Oxon
	South East	418	15.5
	Elsewhere	550	90.3
	Unallocated	17	0
	TOTAL	1,289	627.7*

*May not match sub totals due to varying categories

Imports

3.16 Imports of primary aggregates by sub region are shown in AM2005 Table 10. The relevant entry for BOB is shown in Table 3.4.

Table 3.4 – Primary aggregate imports to BOB from AM2005

Sub region	Land won sand and gravel	Marine sand and gravel	Crushed rock	Total primary aggregates
Berkshire, Oxfordshire and Buckinghamshire	640	1	2,185	2,825

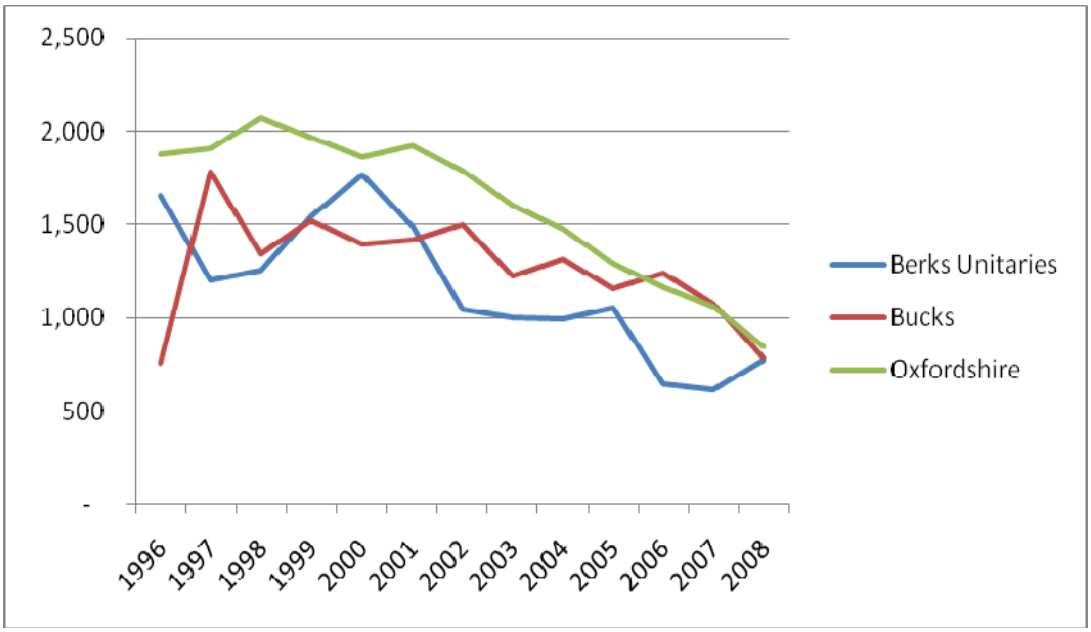
3.17 This indicates that in 2005 BOB imported a total of 2,825,000 tonnes of primary aggregates, most of which was crushed rock.

3.18 Equivalent data for 2009 will not be available until the aggregated results are published in spring 2011.

3.19 An analysis was then undertaken for sales of sand and gravel in neighbouring counties in the South East Region and then for neighbouring counties elsewhere. This was to see whether there was evidence that Oxfordshire's recent decline in sand and gravel sales had led to an increase in imports. The analysis was done first for neighbouring counties in the South East, and then those elsewhere. All figures are to 2008.

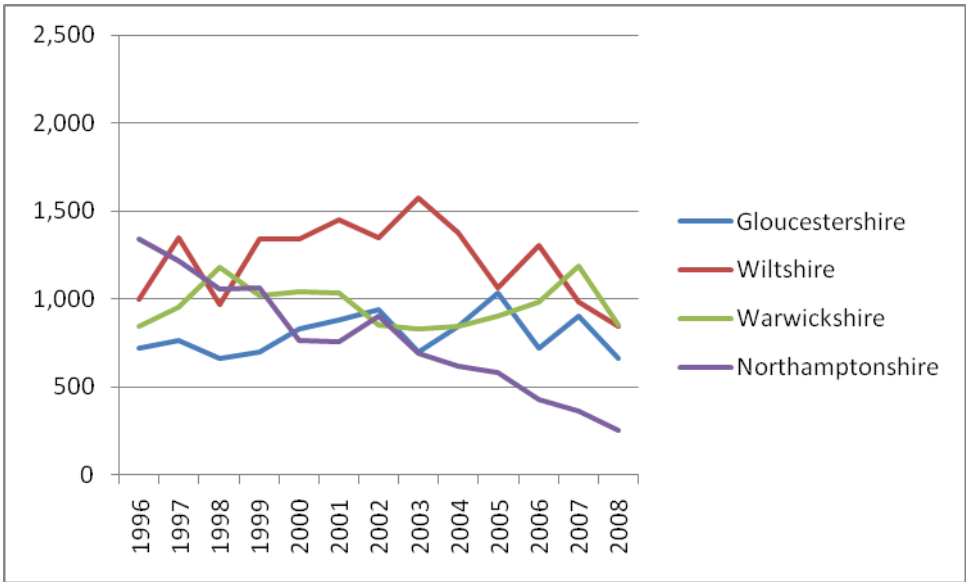
3.20 The profile of sales of sand and gravel for neighbouring counties in the South East is given in the following figure. Buckinghamshire's sales show a steep increase followed by a gradual decline to the same level as the historic low at the beginning of the period, Berkshire sales are variable in the early years of the period covered, but show a stepped decline to 2007, with a small recovery in 2008.

Figure 3.2 – Sales of sand and gravel in Oxfordshire, Berkshire and Buckinghamshire (in 1,000 tonnes per annum)



3.21 Total sales from all the neighbouring counties outside the south east are shown in Figure 3.3.

Figure 3.3 - Total sales of all sand and gravel of neighbouring counties outside the SE (in 1,000 tonnes per annum)



3.22 This shows a patchy picture between different counties, in particular sales in Gloucestershire and Warwickshire remain relatively level, varying by only 0.4mt between the highest and lowest sales; whereas sales in Wiltshire rose in the latter years of the 1990s but have fallen off in the last 5 years to levels recorded I the early 1990s. During this period, Wiltshire's highest level was 1.6 mt in 2000 and the lowest was 0.8 mt in 2008. Northamptonshire's sales of sand and gravel have fallen from a high of 1.6 mt in 1995 to a low of only 0.2 mt in 2008. Possible explanations for this steep decline should be sought.

3.23 Overall the comparison between Oxfordshire's pattern of sales of sand and gravel with that of neighbouring counties indicates that the relatively constant levels of sales in Buckinghamshire, Gloucestershire and Warwickshire might be due to contributing in at least some small measure to demand in the other counties where the levels of sales of sand and gravel have fallen more.

Overall primary aggregate 'balance of trade'

3.24 A balance of 'trade' in primary aggregates is in order to render the profile of types of aggregates available to the construction industry in Oxfordshire more in line with the profile of types of aggregates that the construction industry needs. This 'trade' takes place in all counties in England (and elsewhere) because the available geology means that no single county area produces exactly the profile of types of aggregate in the exact amount consumed therein.

3.25 There is no 'right' or 'wrong' position with regards to the balance between imports and exports (or of sales v consumption). Certainly it would not be realistic for each MPA to seek to achieve parity in this. For example it would be impossible for any metropolitan MPA to produce the same amount of primary aggregate as it consumes. Therefore by implication, the less urbanised MPAs that have primary aggregate resources are net contributors to the overall primary aggregate supply.

3.26 Information from AM2005 was considered as a possible indicator of the position. Map 9 of the AM2005 shows the comparison of consumption against sales on a regional basis for 2005, and shows that the level of consumption in the South East region as a whole is higher than its sales (including marine sand and gravel).

3.27 Table 11 from the AM2005 Report provides figures for Consumption of primary aggregates for the year 2005. Data is provided by sub regions, whereby the South East is divided into 4 groups. Oxfordshire is grouped with Berkshire and Buckinghamshire. Total consumption is given for each

sub region, plus a total 'unknown' consumption tonnage. The 'unknown in the South East' tonnage is some 19.7% of total South East consumption. The 'unknown' tonnage was distributed amongst the 4 sub regions according to their relative population size. A similar redistribution would have been derived from using their relative construction GVA values.

3.28 Oxfordshire's tonnage of consumption or primary aggregates as a proportion of BOB's resulting tonnage was estimated by a similar disaggregation exercise, using population proportion. Using construction GVA would have produced a similar figure. So the average was used = 29.5%. The AM2005 Total consumption figures for BOB + redistributed element of the 'unknown' tonnage, the resulting disaggregation using a proportion of 29.5%, Oxfordshire's total aggregate sales for 2005 and the resulting position on the 'balance of 'trade' are presented in Table 3.5 – Calculation of Oxfordshire's Balance of Trade from AM2005.

Table 3.5 – Calculation of Oxfordshire's Balance of Trade from AM2005

		Total primary aggregates
A	BOB consumption	5,726
B	Oxfordshire's consumption estimated by factor of 29.5% of BOB consumption	1,689
C	Oxfordshire's Total Aggregate sales 2005	1,835
D	Balance of net imports(-) and net exports(+)	+146
E	Overall position on net 'balance of trade (C/B)	1.09
Notes: Values in rows A-D are in 1,000 tonnes. E is a factor.		

3.29 This shows that in 2005 for every 1.000 tonnes of primary aggregates consumed in Oxfordshire, sales were 1,090 tonnes, suggesting that Oxfordshire was a net exporter in 2005.

3.30 An alternative method of looking at the 'balance of trade' in Oxfordshire was derived from an estimate of per capita consumption of total primary aggregates. National per capita consumption of total primary aggregates was derived from a comparison of the national population statistics and national primary aggregate consumption. The resulting figure was applied to Oxfordshire's population figures for the years 2001-2009 and the result compared against Oxfordshire's total primary aggregate sales for those years. The results are shown in Table 3.6.

Table 3.6 – Comparison of consumption per head with total aggregate sales in Oxfordshire 2001-2009 to give ratio of sales to consumption

Year	England primary agg sales	England Popu-lation	Tonnes Primary agg per head	Oxford-shire Popu-lation	Estimated Oxfordshire primary agg consumption	O'shire primary agg sales	Ratio of sales/ consum ption
2001	169,202	49138831	3.44	607300	2091	2975	1.42
2002	158,967	49652000	3.20	610600	1955	2710	1.39
2003	153,342	49866000	3.08	616700	1896	2235	1.18
2004	160,135	50111000	3.20	621100	1985	2037	1.03
2005	151,431	50466000	3.00	627500	1883	1835	0.97
2006	152,757	50762900	3.01	629600	1895	1661	0.88
2007	150,059	51092000	2.94	632300	1857	1714	0.92
2008	136,848	51456500	2.66	635500	1690	1398	0.83
2009	106,195	51809700	2.05	640300	1312	1061	0.81

3.31 It is notable that the figures for primary aggregate consumption per capita have fallen by some 37% over the period, whereas Oxfordshire's sales have fallen by 64%, hence the notable change in the ratio of sales to consumption, suggesting that the balance of 'trade' has changed significantly over the period 2001 – 2009. In 2001, the calculations suggest that Oxfordshire's total primary aggregate sales were 1.4 times its primary aggregate consumption; the ratio was at about parity in 2004 and 2005 and in 2009 aggregate sales was only 80% of primary aggregate consumption.

3.32 It is not possible to obtain a breakdown of the relative positions of sand and gravel and crushed rock from this analysis, and therefore the data could mask different import and export patterns for sand and gravel and crushed rock over the period. Nevertheless it seems reasonable to assume that this change in the net 'balance of trade' is explained by the marked decline in aggregate sales in Oxfordshire over recent years, particularly of sand and gravel, and that declining sales are being made up by supplies being brought in from elsewhere.

3.33 Local knowledge of operators suggests that imported sand and gravel is most likely being obtained from sources in Gloucestershire close to the boundary with Oxfordshire. More information may be available from the aggregated results of AM2009 when available.

3.34 Much of the net crushed rock imports are via rail depots, and these imports are of aggregate types not available in Oxfordshire (i.e. hard crushed rock). Oxfordshire has 3 rail depots that handle general construction aggregates: (a fourth just supplies rail ballast). Recent survey results of the 3 general aggregate rail depots show that the following amounts were imported: - 320,000 tonnes in 2007; 362,300 tonnes in 2008 and 231,500 tonnes in 2009.

3.35 A report of Aggregate Wharfs and Rail Depots in SE England commissioned by SEERA records adequate remaining capacity in existing rail depots in Oxfordshire for the foreseeable future. The limiting factor on ongoing imports will be rail freight path capacity.

Alternative Aggregates

Available information

3.36 'Alternative aggregates' is a collective term to include recycled and secondary aggregates. Information on alternative aggregates is relatively poor by comparison with information on primary aggregates.

3.37 The national surveys of Arisings and Use of Construction, Demolition and Excavation Waste (CDEW) and other materials in 2005 suggested that the national production of recycled aggregates appeared to have increased slightly since the previous 2003 survey, and the recycling industry maintains this view. The figures are 39.60 mt ± 13% in 2003 and 42.07 mt ± 15% in 2005.

3.38 An update survey for 2008 reports that the fall in construction activity that started in mid 2008 led to a fall in the national production of all types of CDEW. Overall, most of the difference can be accounted for in a reduction in the arisings of excavation waste. Arisings of 'hard inert' CDEW generating recycled aggregate rose between 2005 and 2008 by 3% from 42.07 mt to 43.5 mt.

3.39 The statistics at a regional level are regarded as less robust, and should be relied upon as no more than a 'reasonable indication' of what is taking place. The SEERAWP Aggregate Monitoring Reports for 2007 and 2008 record that alternative aggregates production was 3.6 mt in 2007 and 3.1 mt in 2008. Most of the tonnage was recycled aggregates. These figures are collected via surveys carried out by the MPAS in the South East. The response rate for these surveys is low.

3.40 Arisings of alternative aggregates in Oxfordshire are a combination of recycled aggregates and secondary aggregates (ash) from Didcot A Power station.

3.41 Existing recycled aggregates production capacity in licensed and permitted sites has been recorded by Oxfordshire County Council as 800,000 tpa. Of this total capacity, about 500,000 tpa is permanent, and 300,000 tpa is temporary. Most of this temporary capacity is at quarries or landfills. It is reasonable to assume either that these temporary permissions will be further

extended or that they will be replaced by permissions at other sites, as quarries and landfills close and are replaced.

3.42 The secondary aggregates production capacity at Didcot A Power Station needs to be added to this. All PFA and FBA produced is used as aggregate or at a nearby landfill site. Over the period 2001 – 2005 Didcot A Power Station produced between 0.260 and 0.515 mtpa of ash, of which between 0.145 and 0.230 mtpa was sold for aggregate use. The ash reprocessing plant at Didcot A can produce 0.125 mtpa; other ash is sold in unprocessed form for bulk construction fill but demand for this is limited and variable. This position will not change unless there is significant investment in further ash reprocessing plant at the power station, which seems unlikely given the limited remaining life of the power station.

3.43 The Didcot A coal powered plant is due to close by 31st Dec 2015, although the Business Plan anticipates that it will close in the first quarter of 2013. It has 13,000 hours of operations left. The site will be retained as power generation will still be required; no information on the type of replacement plant is available as yet.

3.44 This gives potential total secondary & recycled aggregates capacity of 925,000 tpa to 2015, made up from 800,000 tpa recycling capacity at licensed sites and the remainder at Didcot A Power Station.

3.45 There will be further capacity available at mobile processing plant operating at construction sites throughout the county, for which information is not currently available.

3.46 The other side of the equation is the question of actual production. Figures from recent surveys of Oxfordshire's arisings from both recycled and secondary aggregates are in the table below. However these are derived from partial returns.

Table 3.7 – Recorded Production of Alternative Aggregates in Oxfordshire

Year	Production in tonnes
2003	261,000
2004	452,000
2007	338,000
2008	503,000
2009	286,000

3.47 The local campaign group AGGROW (Anti Gravel Group of Residents in Oxfordshire West) reported that a survey by direct contact with the four largest recyclers in Oxfordshire showed an estimated 420,000 recycled tonnage in 2010.

Forecast Arisings

3.48 The national forecasting model used to calculate the National and Regional Aggregate Provision Guidelines takes account of the anticipated contribution of alternative aggregates in its assessment of need for total aggregates. The 2005-2020 Guidelines assumed a contribution to national forecast demand from secondary and recycled sources of 58 mt out of a total aggregate tonnage of 217 mt in 2005 and a contribution of 65 mt out of a total of 259 mt in 2016, with both overall aggregate demand and alternative aggregate demand remaining constant thereafter. (see Table 7 of the Draft Guidelines).

3.49 If Oxfordshire's recorded production figures are factored up by the same growth rate, the total recycled aggregates demand in 2016 can be estimated depending on the assumed figure for 2010, as indicated in the following table.

Table 3.8 – Estimated demand for recycled aggregate in Oxfordshire 2010 and 2016

Year	OCC Record-ed aris-ings	National Growth factor from Table 7 mt	Estimated demand from OCC 2003	Estimated demand from OCC 2004 result	Estimated demand from OCC 2007 result	Estimated demand from OCC 2008 result	Estimated demand from OCC 2009 result
2003	261,000	56	261,000				
2004	452,000	57	265,661	452,000			
2007	338,000	58	270,321	459,930	338,000		
2008	503,000	59	274,982	467,860	343,828	503,000	
2009	286,000	60	279,643	475,789	349,655	511,525	286,000
2010		61	284,304	483,719	355,483	520,051	290,767
2016		65	302,946	515,439	378,793	554,153	309,833

3.50 If the national forecasting model assumption is correct, this would indicate a maximum of contribution of say 400,000 to 550,000 tonnes of recycled aggregate would be available each year after 2016. The 2005 CDEW survey estimated that an additional 25% or marginally under that amount should be added to account for production at mobile plant to obtain an overall estimate of aggregate recycling in England. So it might be reasonable to add the same percentage to the above survey figures to allow for the partial nature of the information.

3.51 Generally rates of utilisation are regarded as good by the industry, and the 2008 CDEW report reports that there is little evidence of hard C&D waste which could be recycled into aggregates being landfilled as waste. The 25% national market share in total aggregate supply is three times higher than the European average, highlighting the fact that the use of recycled and secondary materials in Britain is close to full potential. It is suggested by the industry however that this includes some recycled aggregate being used for purposes that primary aggregate would not be used for, such as landscaping of general fill.

3.52 Furthermore, the industry reports that a high proportion of aggregates generated at construction sites is now re-used on site, so there is little potential to increase availability of this source of aggregates. This conclusion is also made in the 2008 CDEW report.

3.53 As to the possible contribution that alternative aggregates can make to total consumption, estimates of utilisation of recycled and secondary aggregate have to be treated with caution. Secondary and recycled aggregates do not currently substitute for primary aggregates in structural uses, only in lower specification construction uses like car parks. Secondary and recycled aggregate can replace crushed rock produced in Oxfordshire, but not sand and gravel.

3.54 The MPA reports that the use of recycled and secondary materials in the GB aggregates market has increased rapidly, rising from 30 million tonnes pa in 1990 to over 70 mt in 2007. Over that period the share of the aggregates market supplied from recycled and secondary sources has risen from 10% to 25%. The Mineral Products Association Sustainable Development Report for 2010 estimates that over Great Britain as a whole 28% of the supply of aggregate materials comes from the recycled and secondary materials, the highest proportion in Europe.

3.55 The proportion of total aggregate demand assumed for alternative aggregates in national forecast demand in Table 7 of the Draft Guidelines for the period 2005-2020 is 25.3%.

3.56 A comparison of the 2005 figure for South East demand for total aggregates in the Draft Revised National Guidelines Provision in England 2005-2020 (Table 11) and reported Consumption of Primary Aggregates in the AM2005 Survey report (Table 11) indicates that alternative aggregates comprised 27% of total consumption in the South East in 2005, as indicated in the following table.

Table 3.9 – Comparison of Total aggregate demand with Consumption of Primary Aggregates

Total aggregate demand in SE 2005	Consumption of primary aggregates in SE 2005	Percentage
29 mt	21.17 mt	27.2%

3.57 It will be interesting to see the equivalent figures from the AM2009 survey when available. The equivalent information is not readily available for 2001.

Findings

3.58 The above analysis shows that there has been a significant fall in sales of sharp sand and gravel in Oxfordshire. The fall between 1999 and 2009 is 68%. The fall in sales of sand and gravel has been noted elsewhere as well. Nationally there has been a fall in sales of sand and gravel by 40% between 1999 and 2009. The comparable figure for the South East is 57%.

3.59 There are local factors which are considered to contribute to this notable fall in sales, in particular the depletion of reserves at 3 of Oxfordshire's formerly most productive quarries. It is understood that planning permissions have been granted for further areas of working at 2 of these quarries which may assist in halting or possibly reversing this trend in future. The higher fall in sales in the South East is considered to be partly due to the increased utilisation of marine sand and gravel, increasing from 33% in 1999 to 55% in 2009.

3.60 Oxfordshire does not derive any significant supply from marine sand and gravel. However the net balance of imports and exports of land-won aggregates is an important factor in Oxfordshire's aggregate supply. This 'trade' of aggregates is in order to ensure that the range and amounts of aggregates available in Oxfordshire matches the range and amounts of aggregates required by the construction industry. This trade is carried out by all counties in order to balance off their geology and construction requirements.

3.61 Information on aggregate movements is collected every 4 years. A comparison of the data in AM2005 and that collected by Oxfordshire for the AM2009 survey suggests that Oxfordshire now consumes a greater proportion of its sand and gravel sales than was the case in 2005. This position is also suggested by an estimate of the overall net balance of trade over the period 2001 to 2009 using per capita consumption of aggregate derived from national information, which indicates that over that period Oxfordshire has moved from being a net exporter of aggregate to being a net importer.

3.62 Analysis of Oxfordshire's consumption figures from AM2005 suggests that Oxfordshire was a net exporter in 2005. The position should be checked when the AM2009 information is available.

3.63 Information on alternative aggregates is patchy, but national data suggests that the contribution of alternative aggregates to total aggregate supply has risen significantly in recent years, although the rate of increase is now falling off.

3.64 The latest survey by Oxfordshire County Council indicates that there is sufficient processing capacity to cater for recorded production of alternative aggregates at present, although some of this capacity will be lost by 2016 because of the closure of Didcot A Power Station.

3.65 Production of alternative aggregates is anticipated to grow by a small amount in the period to 2015, but level off thereafter. The anticipated level of production in Oxfordshire varies from 400,000 to 550,000 tonnes, with a level of uncertainty yet to be verified. Further capacity and production are anticipated from mobile plant.

3.66 Rates of utilisation are considered high, and the contribution to total aggregate consumption is slightly higher in the South East than in England as a whole. It is estimated to be about 27%.

4. Approaches to Estimating Future Aggregate Requirement

4.1 A range of different approaches to the estimation of Oxfordshire's future aggregate requirement were explored.

4.2 It is logical that future demand will at least in part be a function of one or more variables in construction or economic activity, and the following forecasts were considered as possible indicators which may be useful in determining aggregate demand.

- Forecast contained in Draft Revised National Guidelines for Aggregate Provision in England: 2005-2020.
- Construction Industry Forecasts.
- HM Treasury forecasts, as an indication of predicted general economic activity.
- PricewaterhouseCoopers (PwC) forecasts of GDP and inflation, as indicators of general economic activity.
- Predicted housing completions.
- Predicted Gross Value Added (GVA).

4.3 Further details regarding those forecasts are provided in Appendix C.

4.4 Research was also undertaken into the tonnage of aggregate used in the construction of a typical house (suggested as some 60 tonnes of aggregate – see Planning4minerals - A Guide on Aggregates), and into the tonnage of aggregate used in the construction of a typical hectare of commercial or industrial development (suggested as some 10,000 tonnes – source: Faithful & Gould), or in road building. It was envisaged those quantities might be used in conjunction with information on future investment projects in Oxfordshire's Local Investment Plan. However most of the information therein was qualitative, so there was no definitive basis on which to estimate how many tonnes of aggregate each project, such as a school or town centre development scheme, might consume.

4.5 The figures produced by the model used to inform the National Guidelines for Aggregate Provision indicate anticipated aggregate demand. The other forecasts indicate anticipated levels of potential economic activity, typically in terms of monetary units over the respective forecast periods. In general the forecasts are considered useful as providing a general contextual picture of future aggregate demand, and in summary the findings are as follows:

- The forecasting model used to calculate the national and regional aggregate provision figures to 2020 indicates a small but steady rise in aggregate consumption over the period 2005 to 2015, levelling off thereafter at the 2015 level. However as these are national or regional forecasts they do not provide a locally derived approach.
- The construction industry forecast indicates a variable forecast in the value of construction work over the period to 2014, the measure of more aggregate intensive work is less variable than that of less aggregate intensive work.
- The independent economic forecasts published by the Treasury and the short and long-term forecasts of GDP produced by PricewaterhouseCoopers indicate a return to growth in the coming years, albeit gradual and possibly delayed until 2013. Annual housing completions are predicted to be greater over the period 2011 to 2016 compared to recent years, and though forecasts of GVA for construction in Oxfordshire indicate little change during the next few years, growth is expected in Oxfordshire's total GVA, though for construction not until after around 2014.

- Other than in the short term, none of the forecasts indicate that either general economic activity or construction activity in Oxfordshire will remain depressed, and thereby continue the apparent rate of decline in aggregate sales, particularly as displayed by the recent sales of sharp sand and gravel. In general the forecasts indicate increased economic activity, suggesting that future aggregate consumption in Oxfordshire is likely to be similar or slightly higher than recently.

4.6 In order to forecast future aggregate demand, the study firstly made a comparison of Oxfordshire's primary aggregate sales with past performance of the construction industry or the economy (via GVA), and regression analysis was used as a tool to seek to quantify any link. The details of that appraisal are provided in Appendix D, however the conclusion is that due to the overriding downward trend in recent past aggregate sales in Oxfordshire which may not be wholly reflective of aggregate consumption in Oxfordshire, the results of the regression analysis do not provide a sufficiently reliable link between past sales and the independent variables in construction or economic activity with which to make a confident forecast of Oxfordshire's future aggregate demand.

4.7 Therefore the study turned to other methods of forecasting future aggregate demand in Oxfordshire, as discussed in the following chapter.

4.8 The information on imports and exports is useful in assessing the overall 'balance of trade' for Oxfordshire, but there is insufficient information from which to be able to derive an assessment of the levels of movement of aggregates by type into and out of Oxfordshire over future years.

5. Assessments of Future Aggregate Demand

5.1 This chapter considers the following methods of assessing future aggregate demand in Oxfordshire:

- An application of the sub-regional apportionment methodology used on the 2003 National and Regional aggregate provision guidelines to the regional figure in the Secretary of State's Proposed Changes to South East Plan Policy M3, March 2010.
- Moving averages analysis of past sales figures.
- A comparison of Oxfordshire's planned housing provision against national housing statistics and national primary aggregate consumption, in other words using housing as a proxy for overall development and hence total primary aggregate consumption.
- A comparison of Oxfordshire's projected population figures against a comparison of national population statistics and national primary aggregate consumption, in other words using past primary aggregate consumption per head to forecast future primary aggregate consumption.

5.2 These methodologies principally address primary aggregates, but figures for the contribution from alternative aggregates can be derived in parallel, by reference to the anticipated percentage of total aggregate supply made up by alternative aggregates. The figures given in the following assume that alternative aggregates contribute 27% of total aggregate supply. This figure was chosen as a maximum practicable contribution, based on the regional rate for the South East and the available processing capacity in Oxfordshire as assessed earlier.

Application of 2003 Sub Regional Apportionment Methodology

5.3 The method used to sub apportion the 2003 National and Regional sand and gravel aggregate provision guideline was based on average sales of sand and gravel in the South East during the 7 year period 1995 to 2001 minus highest and lowest sales years. Information from all MPAs in the South East was used and the results sub divided over the 2003 Regional apportionment was sub-apportioned in proportion to each MPA's or group of MPAs' sales as a proportion of the total South East sales.

5.4 The same methodology has been applied to the total regional apportionment figure in the Secretary of State's proposed change to Policy M3 using the recent past sales of sand and gravel for the MPAs or groups of MPAs in the South East to derive an equivalent figure for Oxfordshire. The result is shown in Table 5.1.

Table 5.1 – Application of 2003 sub-regional apportionment method to Regional sand and gravel apportionment in SoS's changes to Policy M3.

	2002	2003	2004	2005	2006	2007	2008	av – max & min	% of total	Applied to SoS M3 SE app'ment
Berks Unitaries	1048	1000	993	1055	645	615	775	892.2	9.30	*1.03*
Bucks	1499	1221	1313	1155	1236	1076	785	1200.2	12.50	*1.39*
E. Sussex	*	*	*	*	*	*	*	*	*	
Hants	2193	1808	1668	1543	1244	1492	1269	1556	16.21	*1.80*
Isle of Wight	*	*	*	*	117	88	88	17.6	0.18	*0.02*

	2002	2003	2004	2005	2006	2007	2008	av – max & min	% of total	Applied to SoS M3 SE app'ment
Kent	1737	1931	1719	1712	1692	1823	1595	1736.6	18.09	*2.01*
Medway	*	*	*	*	*	*	*	*	*	
Milton Keynes	*	*	*	*	*	*	*	*	*	
Oxford-shire	**1787**	**1606**	**1480**	**1289**	**1166**	**1059**	**780**	**1320**	**13.75**	***1.53***
Surrey	2369	2242	2155	1979	2063	1631	1358	2014	20.98	*2.33*
West Sussex	825	804	872	660	573	466	426	665.6	6.93	*0.77*
Total	***11.48***	***10.63***	***10.40***	***9.57***	***8.80***	***8.50***	***7.29***			***11.12***

* indicates amounts not available due to confidentiality constraints.

Figures in italics are in million tonnes, all other figures in 1,000 tonnes.

5.5 Some slight adjustment will need to be made to the apportionment amounts in Table 5.1 to take account of counties for which information is not available and those to which it is impractical to apply an apportionment rate of greater than 0.1mtpa, but the quantities involved are small.

5.6 A current figure for sand and gravel in Oxfordshire calculated according to the method used to sub apportion the 2003 guidelines might be in the region of 1.53 mtpa. It is interesting to note that Oxfordshire's share of the Secretary of State's proposed change to Policy M3 guideline figure is the same percentage as Oxfordshire's share of the 2003 regional guideline amount (13.7%), showing that Oxfordshire's share of regional sand and gravel sales has remained generally the same since 1995.

5.7 There is no equivalent methodology by which to derive a crushed rock figure, or an alternative aggregates figure. Moreover this is not locally derived. Its main value is as a comparison to demonstrate the distortion caused by the new method used to sub apportion the 2009 Regional sand and gravel provision guideline amount.

'Smoothing' of past sales as a forecast for future demand

5.8 Then for comparison other approaches to deriving a 'smoothed' evaluation of the past sales data were applied for the sand and gravel sales data from 1990 to 2009 and for crushed rock data from 2001 to 2009, because prior to 2001 the crushed rock sales values do not include ironstone. To smooth a data set statistically is to create an approximating function that attempts to capture important patterns in the data, while leaving out 'noise' or other fine-scale variations or rapid changes. Hence the premise was that a 'smoothed' evaluation of the past sales data could provide an indication of possible future demand, and thereby provide a basis for determining the local aggregate requirement.

5.9 Many different algorithms can be used for smoothing, though one of the most common is the 'moving average'. That technique is often used to try to capture important trends in repeated statistical surveys. Therefore several smoothing approaches, including the methodology used in the 2003 sub regional apportionment for sand and gravel, were applied to the past sand and gravel and crushed rock sales data for Oxfordshire on its own. Full details of the appraisal are provided in Appendix E.

5.10 In general terms a moving average or other smoothing function, such as a moving median, will tend to lag behind the actual trend, hence the values calculated by applying the smoothing techniques were generally higher than the actual past sales values due to the notable decline in Oxfordshire's aggregate sales over the last decade. The appraisal indicates that a cumulative

average of all sales is a steady measure of historical consumption which would be relatively resistant to any possible increase in future sales. But the cumulative average does not follow the trend as well as the other smoothing approaches, and is considered too cautious an approach on which to base possible aggregate requirement, particularly given the magnitude of recent year on year changes in sales.

5.11 The other smoothing approaches generally showed similar trends though differed by the amount by which they varied from past sales data. For sand and gravel the closest smoothed values are 325-350,000 tpa greater than the past sales data for the last five years. For crushed rock, the closest smoothed values are 20-65,000 tpa on average greater than past sales data. It is acknowledged that for certain smoothing approaches, e.g. the exponential moving average, it could be possible to refine the smoothing to reduce the differences in both cases.

5.12 However given the generally similar trends of the smoothing approaches, it is suggested that if Oxfordshire's future aggregate requirement was to be assessed based on past sales data, application of one of the simpler smoothing methods would suffice e.g. a seven or five year moving average or moving median (the median being the middle value from during the period). That should ensure an initial buffer above recent past sales sufficient to absorb an increase in sales in the short term i.e. one to three years.

5.13 But should strongly rising aggregate consumption occur in future, determination of aggregate requirement based on a smoothing function could forecast less demand than actual sales. This could result in the land bank for the required aggregate being diminished at too rapid a rate.

5.14 Hence a more precautionary approach would be to apply an additional contingency buffer, for example 10% to 20%. Thus Oxfordshire's future aggregate requirements could be simply based on for example a seven year moving median (as that approach entails no calculations) plus a buffer amount, which based on past sales data to 2009 would be as follows:

- For sand and gravel, as a seven year moving median: 1.17mtpa. Including a nominal 10% buffer of 0.12mtpa buffer would give 1.29mtpa.
- For crushed rock, as a seven year moving median: 0.56mtpa. Including a nominal 10% 0.06mtpa buffer would give 0.62mtpa.

5.15 If alternative aggregates contribute 27% of total aggregate supply, and total primary aggregate demand was 1.73mtpa, the amount of alternative aggregates requirement would be 0.64mtpa.

5.16 This approach would be relatively uncomplicated and also easy to subject to regular review.

Comparison of national and local housing provision

5.17 A comparison was made of Oxfordshire's current planned housing provision against national housing statistics and national aggregate consumption, in other words using housing completions as a proxy for total aggregate consumption. The reason for using housing as a proxy is because the relevant information is available; housing development is accompanied by other types of development in tandem, such as roads, drainage, schools, health facilities, employment and retail developments. Therefore each house can be taken to represent a 'development unit' which implicitly includes this related development as well. In addition, housing and related developments involve the use of alternative aggregates as well as primary aggregates. This means that, provided there is no significant difference in the national and local rates of utilisation, the methodology implicitly also addresses the contribution from alternative aggregates to the overall supply of aggregates. As stated above forecasts have been made on the basis of a 27% contribution from alternative aggregates.

5.18 The detailed description of the methodology used is in Appendix E.2. Briefly, a comparison was made of the number of tonnes of total primary aggregate sales per new build housing completion in England to obtain a number of tonnes per 'development unit' for each of the years 2001-2009.

5.19 An average of the last 5 years' tonnes per 'development unit' was then applied to the average number of dwellings planned per year in Oxfordshire for the period to 2026 to provide a notional annual figure of future total primary aggregate demand in Oxfordshire.

5.20 This total primary aggregate demand was then divided into fractions according to the relative proportions of sand and gravel sales and crushed rock sales in Oxfordshire to give a notional breakdown between the two. The average proportion over the period 2001-2009 was used.

5.21 A factor was then applied to the resulting figures to allow for a continuation of the 'trade' of Oxfordshire's primary aggregates for other types of primary aggregates needed in order to achieve the range of total aggregate types required by the construction industry.

5.22 Using a factor of 1, suggesting that Oxfordshire has a parity net balance between imports and exports of primary aggregates, indicates the following figures for sand and gravel and crushed rock:

- Sand and gravel – 1.58 mtpa
- Crushed rock – 0.81 mtpa.

5.23 If alternative aggregates contribute 27% of total aggregate supply, and total aggregate demand was 2.39 mtpa, the amount of alternative aggregates requirement would be 0.88mtpa.

5.24 These figures, as with all calculations, are sensitive to the assumptions implicit in the methodology.

5.25 In this case the following needs particularly to be noted:

- The national housing figures are completions of new build housing; this is converted into a notional tonnes of primary aggregate per 'development unit' using total primary aggregate sales in the same year, including marine sand and gravel. The inclusion of marine sand and gravel is considered appropriate because the methodology looks at total primary aggregate used per dwelling 'as a proxy for 'development units' nationally and then takes account of Oxfordshire's aggregate supply source by applying this to the types of aggregates found in Oxfordshire.
- The result will be influenced by the choice of the appropriate values for both primary aggregate consumption per 'development unit', and the relative proportions of sales of sand and gravel to crushed rock, both of which vary over the period of available data.
- The number of tonnes of primary aggregate per 'development unit' declines in the period 2001-2009. The assessments of future consumption assume a constant value derived from an average over the last 5 years. This is because the trend downwards breaks down in the last 5 years, making an assumption of ongoing decline questionable. This could be reviewed annually as national figures become available.
- At 922 tonnes per 'development unit' the figure used in the assessment is some 15 times greater than the average tonnes per typical dwelling (60 tonnes), suggesting that new housing represents only an appropriate proxy for forecasting ongoing demand.
- Finally, the figures will also be influenced by the allowance for the net balance of 'trade' between imports and exports. The method allows any value to be used, but the calculations assume a parity ratio between imports and exports. The analysis in Chapter 3 suggests that Oxfordshire's position has changed in recent years from being a net exporter to a net importer as the overall consumption of primary aggregate per head of population has fallen. It is strongly recommended that this position is checked when the results of the AM2009 survey are available.

A comparison of national and local per capita consumption of primary aggregates

5.26 An alternative approach to deriving a local aggregate supply requirement for Oxfordshire was to multiply Oxfordshire's projected population figures against a comparison of national population statistics with national primary aggregate consumption to give per capita consumption of primary aggregates. In other words, the approach uses population as a proxy for total primary aggregate consumption.

5.27 The justification for using population as a proxy for total primary aggregate consumption is that the relevant information is readily available; per capita consumption of primary aggregates implicitly includes all types of new development and also aggregate usage associated with maintenance and repair construction projects, so is possibly a more robust proxy than the previous approach based on new dwellings. As with the previous approach, alternative aggregates are implicitly accounted for in the methodology, so provided there is no significant difference in the national and local rates of utilisation, or reason to believe that a significant difference may occur in Oxfordshire, the methodology implicitly also addresses the contribution from alternative aggregates to the overall supply of aggregates.

5.28 A comparison was made of the number of tonnes of total primary aggregate sales per head of population in England for each of the years in the period 2001-2009 to give a figure for tonnes of primary aggregate consumed per head.

5.29 An average was made of the last 5 years consumption per capita and applied to Oxfordshire's forecast population figures for each year in the period to 2030 to provide an estimated figure for total consumption of primary aggregates for the period to 2030. An average was then calculated to give a notional annual consumption of primary aggregates in the plan period.

5.30 This annual primary aggregate consumption was then divided into fractions according to the relative proportions of sand and gravel sales and crushed rock sales in Oxfordshire to give a notional breakdown between the two. The average proportion over the period 2001-2009 was used.

5.31 A factor was then applied to the resulting figures to allow for a continuation of the 'trade' of Oxfordshire's primary aggregates for other types of primary aggregates needed in order to achieve the range of total aggregate types required by the construction industry.

5.32 Using a factor of 1, suggesting that Oxfordshire has a net balance between imports and exports of primary aggregates, indicates the following figures for sand and gravel and crushed rock:

- Sand and gravel – 1.23 mtpa
- Crushed Rock – 0.64 mtpa

5.33 If alternative aggregates contribute 27% of total aggregate supply, and total primary aggregate demand was 1.87 mtpa, the amount of alternative aggregates requirement would be 0.69 mtpa.

5.34 Again, the results of these calculations are sensitive to the assumptions implicit in the methodology.

5.35 In this case the following needs particularly to be noted:

- The population figures for England were compared against total primary aggregate sales in England, including marine sand and gravel. The inclusion of marine sand and gravel is considered appropriate because the methodology looks at total primary aggregates used per capita and then takes account of Oxfordshire's aggregate supply source by applying this to the types of aggregates found in Oxfordshire.
- The result will be influenced by the choice of the appropriate values for both primary aggregate consumption per capita, and the relative proportions of sales of sand and gravel to crushed rock, both of which vary over the study period. In both cases an average has been used.
- The number of tonnes of primary aggregate per capita declines in the period 2001-2009. The assessments for future consumption assume a constant value derived from an average over the last 5 years. This is because it is suspected that the last 2 year's figures are influenced by the recent recession making an assumption of ongoing decline questionable. This could be reviewed annually as national figures become available.
- Finally, the figures will also be influenced by the allowance for the net balance of 'trade' between imports and exports. The method assumes a parity ratio between imports and exports, but the analysis in Chapter 3 suggests that Oxfordshire's position has changed in

recent years from being a net exporter to a net importer as the overall consumption of primary aggregate per head of population has fallen. It is strongly recommended that this position is checked when the results of the AM2009 survey are available.

5.36 This methodology using estimated aggregated consumption per head may be viewed as a more robust methodology for forecasting future aggregate supply requirement in Oxfordshire than using new build housing as a proxy for overall development. That is because the actual usage of aggregate per house (perhaps 60 tonnes) represents only a small proportion of the estimated aggregate usage per 'development unit' (922 tonnes on average). Hence it could be argued that housing cannot represent a good proxy.

6. Summary and Conclusions

6.1 An analysis of recent aggregate supply and demand in Oxfordshire has revealed a mixed picture for relative sales of sharp sand and gravel against sales of soft sand and crushed rock. Generally sales of sharp sand and gravel and of crushed rock have both fallen since 2001, whereas sales of soft sand have remained relatively steady over the same period. Sales of sharp sand and gravel have fallen by a greater amount than sales of crushed rock. It is suggested that this is a product of a combination of regionally observed trends exacerbated by local factors. These local factors have considerably complicated the process of assessing future aggregate supply requirements in Oxfordshire.

6.2 There is circumstantial evidence over the period from 2001 to 2009 of a possible switch from Oxfordshire being a net exporter of primary aggregates to being a net importer from neighbouring counties. It is understood that planning permissions have been granted for further areas of working at 2 of these quarries which may assist in halting or possibly reversing this trend in future.

6.3 There is no 'right' or 'wrong' position with regards to the balance between imports and exports (or of sales v consumption). Certainly it would not be realistic for each MPA to seek to achieve parity in this. For example it would be impossible for any metropolitan MPA to produce the same amount of primary aggregate as it consumes. Therefore by implication, the less urbanised MPAs that have primary aggregate resources are net contributors to the overall primary aggregate supply.

6.4 Map 9 of the AM2005 shows the position on a regional basis, and the level of consumption in the South East region as a whole is higher than its sales (including marine sand and gravel).

6.5 Certainly Oxfordshire needs to have some level of exchange of primary aggregates with other counties to ensure that the range of primary aggregates available matches the range required by the construction industry, rather than the range that can be derived from local geology.

6.6 The latest survey by Oxfordshire County Council indicates that recycled and secondary aggregates processing capacity is adequate to cater for anticipated arisings, although some of this capacity will be lost because of the closure of Didcot A Power Station. Further capacity may be available in mobile plant, from which information is not currently available.

6.7 The overall proportion of utilisation of alternative aggregates in Oxfordshire is considered likely to reflect that elsewhere in the South East and represent about 27% of total aggregate use.

6.8 There is little evidence to suggest that either Contractor's Output or GVA is a useful indicator as a comparator for past sales in order to use either of these measures as a basis for assessing future aggregate requirements. A forecast of Contractor's Output is available, but only goes as far as 2014. These and other forecasts have been examined to provide a general picture of future economic activity, rather than a basis for an assessment of primary aggregate requirements. The overall picture suggests a gradual return of economic growth, and there is no suggestion that the downward trend of sand and gravel sales will continue indefinitely.

6.9 Four possible calculations have been undertaken to produce assessments of Oxfordshire's future aggregate demand. These are:-

- An application of the method used to sub apportion the 2003 National and Regional Aggregate Provision Guideline to the regional figure in the Secretary of State's Proposed Changes to South East Plan Policy M3, March 2010. The result is some 1.53 mtpa for sand and gravel. It is not possible to derive a result for crushed rock in this way.
- An application of a series of 'moving averages' to recent sales of sand and gravel in Oxfordshire. Under this approach, Oxfordshire's future aggregate requirements could be simply based on, for example, a seven year moving median (as that approach entails no calculations) plus a buffer amount, which would indicate a requirement of 1.29 mtpa for sand and gravel, and 0.62 mtpa for crushed rock. If alternative aggregates contribute 27% of total aggregate supply, the amount of alternative aggregates requirement would be 0.64mtpa.

- A method based on a comparison of national and local housing provision, using new housing as a proxy for 'development units' to represent total aggregate consumption. The methodology enables an allowance for the ongoing balance of 'trade' to be included. A reasoned judgement is provided as a basis for choosing an average figure for tonnes per 'development unit' and the long term average proportion of sales of sand and gravel to sales of crushed rock. Assuming a parity balance of trade, the resulting assessment is some 1.58 mtpa for sand and gravel and 0.81 mtpa for crushed rock. If alternative aggregates contribute 27% of total aggregate supply, the amount of alternative aggregates requirement would be 0.88mtpa. Recommendations are made for checking the assumptions made in future years.

- The final approach to deriving a local aggregate supply requirement for Oxfordshire was to compare Oxfordshire's projected population figures against national population statistics and national primary aggregate consumption, in other words using population as a proxy for total primary aggregate consumption. Again, the methodology enables an allowance for the ongoing balance of 'trade' to be included. A reasoned judgement is provided as a basis for choosing an average figure for per capita consumption of primary aggregates and the long term average proportion of sales of sand and gravel to sales of crushed rock. Assuming a parity balance of trade, the resulting assessment is some 1.23 mtpa for sand and gravel and 0.64 mtpa for crushed rock. If alternative aggregates contribute 27% of total aggregate supply, the amount of alternative aggregates requirement would be 0.69 mtpa. Recommendations are made for checking the assumptions in future years.

6.10 All results are subject to uncertainty and those based on information from fewer observations are more uncertain than those based on a greater number of observations, in particular conclusions from AM2005 alone are not considered to give a sufficient picture on the position for net imports and exports. The position will need to be checked again when the results of AM2009 are available. In addition there are clear indications that recent sales figures, particularly those for sharp sand and gravel have been distorted by local factors, representing a trend that seems unlikely to continue in future.

6.11 Whilst the results of the above approaches differ, they all suggest that the apportionment for sand and gravel in the Secretary of State's proposed changes to policy M3 are too high. Due to the uncertainty about the balance between imports and exports, it is not possible at this stage to make any firm conclusion about the amount by which the apportionment is too high.

6.12 The results for crushed rock are closer to the equivalent figure in the Secretary of State's proposed changes to policy M3.

6.13 A contingency is recommended for any local assessment that may be used to inform the Minerals Development Framework. In all cases, the results of local assessments should be carefully monitored and all calculations updated when new information becomes available.

6.14 The terms of the brief have been addressed as far as is possible given the available information as listed below:-

- An analysis of current aggregates supply and demand in Oxfordshire, covering all types of aggregates: local land-won minerals; secondary and recycled materials; and materials sourced outside the county. ***This is provided in Chapter 3.***

- An appropriate, transparent and robust methodology that can produce a forecast demand for aggregates in Oxfordshire over the period to 2030 that is related to anticipated economic activity. ***Four possible methodologies with comments on their potential utilisation are given in Chapter 5.***

- An assessment of the maximum practicable contribution that could be made from secondary and recycled aggregate sources. ***This is provided in Chapter 3.***

- An assessment of the appropriate levels of movement of aggregates by type into and out of Oxfordshire that will be required over the period to 2030; and the implications, if any, for aggregates supply infrastructure requirements within Oxfordshire such as rail aggregate

depots. ***The information on imports and exports is useful in assessing the overall 'balance of trade' for Oxfordshire, but there is insufficient information from which to be able to derive an assessment of the levels of movement of aggregates by type into and out of Oxfordshire over future years. A comment on rail depot capacity is provided in Chapter 3.***

- A breakdown of the quantities of aggregates supply (in tonnes per annum) that will be required from the following sources in Oxfordshire over the period to 2030 (taking into account movements into and out of the county):
  - sand and gravel from quarries in Oxfordshire;
  - crushed rock from quarries in Oxfordshire;
  - secondary and recycled aggregates sites in Oxfordshire.

  This is provided in chapter 5. The figures are generally expressed as an annual amount for the period, and subject to a contingency, and ongoing monitoring and review. The methodology based on population projections includes an annual breakdown and total aggregate supply requirement for the period to 2030.

- A record of the process that the consultant has gone through to come up with their conclusions and recommendations, including a record of dialogue with third parties. ***This is recorded through the contents of this report and its appendices.***

Appendix A – Notes of Meetings

ATKINS

Local Assessment of Aggregates Supply Requirements for Oxfordshire

Note of Meeting between Atkins and Representatives of Environmental Groups, Friday 26th November 2010 at OCC offices, Speedwell House.

Present: Anthea Hoey, Atkins
Tim Morgan, Atkins
Arnold Grayson, CPRE
Rod Stewart, AGGROW
David Slack, AGGROW
Steve Thompson, PAGE
Peter Day, OCC
Lois Partridge, OCC

Atkins had prepared a diagram showing the methodology they would use to carry out a locally based assessment of aggregate supply and demand in Oxfordshire. The meeting used the proposed methodology as the basis for discussion. Atkins noted that their methodology would make use of quantitative data and contextual information to build up a forecast of future demand. The assessment will incorporate elements of supply and demand as the two cannot be treated entirely separately.

It was noted that the previous methods used by central and regional Government to determine apportionments had not been transparent and that the methodology used in this study should be simple and transparent to ensure that it is accessible to all.

Stage 1 – Context

Stage 1 of the methodology would establish the historic context of aggregate supply and demand by seeking to correlate past sales, known exports and apportionment rates with housing completions, infrastructure development and maintenance of existing building stock, in Oxfordshire and in neighbouring counties.

It was noted that consideration of imports and exports is important. Quantifying levels of imports and exports would be difficult to do as the only information available are sales from rail depots which import crushed rock and the data from 4 yearly National Aggregates Monitoring surveys, which publishes data for groups of counties. However, Atkins noted the importance of establishing the significance of established movements across the county boundaries as part of the overall picture and taking these movements into account when assessing future supply and demand.

The meeting noted the importance of considering secondary and recycled aggregates as part of the total supply of aggregates in the county. There are increasingly sophisticated methods of recycling aggregate which enables production of higher quality products with a wider range of uses although the take up of these products by the construction industry as a substitute for higher grade primary aggregates is low.

Possible sources of data on secondary and recycled aggregate which were discussed included WRAP, BRE and Waste Management Site Plans. It would also be useful to obtain data on the proportions of secondary and recycled aggregates used in the housing, infrastructure and repair and maintenance industries. The MPA may have information on this. It was noted that there is a high level of on site C&D recycling, in many cases up to 96%; much is used as hard core to avoid the expense of sending it to landfill.

Atkins will use ONS figures to review past trends in construction performance and will project these trends forward to estimate future spend and aggregate use.

Stage 2 – Future projections

Stage 2 of the methodology identifies future projections of both supply and demand. On the demand side, strategic trends and influences on future demand will be considered, as well as specific forecasts of future construction activity and future planned development. There was some discussion that recognised the importance of a trend in declining intensity of aggregate use, per £'000 of construction investment,

and that this ratio was different for different types of construction or maintenance activity. Atkins agreed that this should be reflected in their forecast demand model.

Demand for aggregates over the plan period was discussed. It was noted that demand for aggregates for new infrastructure projects may be reduced as many strategic projects have been delayed. Individual projects such as the High Speed Rail Link and the proposed Upper Thames Reservoir were also discussed, but it was agreed that a strategic overview of future demand will be necessary which is more trend based.

It was noted that the availability of secondary and recycled aggregates is a potential constraint to future use of these materials. Didcot power station, the main producer of secondary aggregates in the county must cease to operate by the end of 2015. The demolition of the power station will provide a significant, although short term source of recycled aggregates. The proposed Ardley Energy from Waste plant will (if permitted) provide a potential source of secondary aggregate (bottom ash).

For the remainder of the life of non-inert landfill sites, secondary and recycled aggregates may be required as engineering and cover material. Partial data on supply of secondary and recycled aggregates can be supplied by OCC, as well as the capacity of secondary and recycled aggregate sites, although it is important to note that the capacity can only be realised if there is adequate supply of and demand for these aggregates.

Supply of primary aggregates will also be reviewed and high-level environmental constraints will be identified as far as they potentially constrain capacity; specific local constraints will not be identified.

Stage 3 – Synthesis of the report

The report will be based largely on trends such as economic activity, declining use of aggregates and increased use of secondary and recycled aggregates, as well as established imports and exports of aggregates, rather than on econometric analysis. The findings will be subject to a sensitivity analysis and will explicitly identify uncertainties. Atkins agreed to comment on levels of uncertainty in their calculations and conclusions which might be due to lack of information, but did not commit to making any recommendations as to obtaining better data in future.

The consultant's report will identify the forecast total need for aggregates over the plan period and the proportions of this that can be obtained from primary aggregates, imports and secondary and recycled aggregates. The sensitivity analysis will identify a range of figures under different scenarios; figures from the middle of those ranges will be used.

The meeting noted the difficulty of obtaining reliable data on secondary and recycled aggregate production, although the returns from larger companies generally account for the majority of the market share and the data from their returns can be extrapolated to build up a complete picture of the market. Atkins noted that more reliable data may be available from Environment Agency waste returns, exemptions certificates and site waste management plans.

OCC planning officers will forward to the representatives of the environmental groups any requests for further information that Atkins may have. On behalf of the groups, Rod Stewart thanked Atkins for meeting them and discussing the proposed methodology.

LGP
16th December 2010

ATKINS

Local Assessment of Aggregates Supply Requirements for Oxfordshire

Note of Meeting between Atkins and Minerals Industry Representatives, Friday 26th November 2010 at OCC offices, Speedwell House.

Present: Anthea Hoey, Atkins
Tim Morgan, Atkins
Martin Layer, Smiths' Bletchington & BAA
Paul Williams, Hanson
Richard Small, Cemex
Alan Mackenzie, Hills' Quarry products
Stewart Mitchell, Grundon
Douglas Symes, planning consultant
John Brooks, Peter Bennie Ltd
Ken Hobden, Mineral Products Association
Mike Pendock, Lafarge
Steve Bowley, planning consultant
Peter Day, OCC
Lois Partridge, OCC

Atkins opened the meeting by explaining that they have been asked by OCC to undertake a locally based assessment of need for primary aggregates over the plan period, taking into account the contribution made by secondary and recycled aggregates and imports and exports of aggregates. The LUC methodology was briefly discussed; this balanced demand, resource and environmental considerations in the Modified Option E which had resulted in a figure of 2.1mtpa sand and gravel for Oxfordshire. One of the reasons that Oxfordshire has a high apportionment is that the county has a relatively high proportion of the South East's sand and gravel resources.

Atkins had prepared a diagram showing the methodology they would use to carry out a locally based assessment of aggregate supply and demand in Oxfordshire. The meeting used the proposed methodology as the basis for discussion. Atkins noted that their methodology would make use of quantitative data and contextual information to build up a forecast of future demand. The minerals industry asked how local demand data would be obtained; one way of doing this would be based on a pro rata assessment of national forecasts assuming that the county is a high growth area.

It was suggested by the minerals industry that this study should await the AM2009 survey results, which should be published early in 2011. However, it is unlikely that data collation will improve significantly in the short term. This work has been commissioned by OCC to be carried out using the best data available at the time. The minerals industry requested that the study results be reviewed against the AM2009 figures to check that it is sound.

The minerals industry were also concerned that the work would raise Member expectations and suggested that officers should make it clear that there are limitations and sensitivities which the report will identify. They also noted that it is unlikely to be any more robust or dependable than the methodology which underpins the current system. The meeting discussed the current methodology for calculating the apportionment figures which is calculated nationally as part of the Managed Aggregates Supply System.

Stage 1 – Context

Stage 1 of the methodology would establish the historic context of aggregate supply and demand in the county by seeking to correlate past sales, known exports and apportionment rates with housing completions, infrastructure development and maintenance of existing building stock, in Oxfordshire and in neighbouring counties. It was acknowledged that a lack of data on movements of aggregates did raise difficulties in assessing supply and demand for Oxfordshire.

The minerals industry was sceptical that any credible local assessment could be carried out in isolation of the broader regional/sub regional picture.
They questioned the basis of using Oxfordshire as the centre of an artificial 'sub-region' and noted the difficulties in obtaining data on movements of aggregates across the Oxfordshire border. It was suggested that Oxfordshire is actually part of the Thames valley sub region; aggregates are travelling

further than ever in this sub-region. Atkins acknowledged the difficulties in obtaining data, but noted that the assessment would use trends rather than quantitative data. It was also recognised that the situation was exacerbated because Oxfordshire was bordered by four separate planning regions; the South East, the South West, the West Midlands and the East Midlands.

The minerals industry asked whether the methodology would take account of current sales figures. Atkins confirmed that sales figures would be correlated with trends in construction activity and that rather than absolute figures, trends would be important.

The minerals industry asked whether the figure recommended by Atkins would be simply accepted or would be critically reviewed by the Council. Officers will make a recommendation to Cabinet based on the figure proposed by Atkins. The figure will need to be set at a realistic, practical level for the period to be covered by the plan. It will need to be robust as it will be tested by a Planning Inspector as part of the Core Strategy examination.

There should also be a contingency built in to address the areas where there has been a lack of information or to accommodate changes in circumstances and to cover uncertainties in the methodology. In Oxfordshire, sand and gravel is currently being imported from Gloucestershire as there has been a problem in releasing new reserves of sand and gravel in Oxfordshire, but this is a temporary movement created by local circumstances. Additional crushed rock is also temporarily being imported for use in place of local sand and gravel in concrete manufacture. It would be useful to have better evidence on the level of substitution by imports due to reduced production capacity in Oxfordshire.

The minerals industry noted the importance of a sensitivity analysis and the use of different scenarios to reach a figure which could be shown to be robust and transparent.

Stage 2 – Future projections

Stage 2 of the methodology identifies future projections of both supply and demand. On the demand side, strategic trends and influences on future demand will be considered, as well as specific forecasts of future construction activity and future planned development. Trends in the likely use of different construction materials, including secondary and recycled aggregates, over the plan period will be identified and economic cycles will also be factored in. The minerals industry noted that house completion rates did not always correlate with sand and gravel sales in the county. National data on future economic activity could be used to obtain forecasts for Oxfordshire. There was a discussion on the split between high and low intensity uses and how these would affect a demand forecast.

The minerals industry noted that the introduction of the community infrastructure levy (CIL) could increase the amount of aggregates required for high intensity use infrastructure projects which are developed in conjunction with new housing. Equally the introduction of CIL could deter developers.

The minerals industry thought that past sales are still the most pragmatic methodology on which to base future predictions of need.

Another strategic trend to take into account is the intensity of use of aggregates in construction projects, and the extent to which secondary and recycled aggregates can be substituted for primary aggregates. Secondary and recycled aggregates do not substitute for primary aggregates in structural uses, only in lower specification construction uses. Secondary and recycled aggregate can replace crushed rock produced in Oxfordshire, but not sand and gravel. 95% of aggregates generated at construction and demolition sites can be captured for recycling. Most construction and demolition waste arisings generated at construction sites are now re-used on site. The minerals industry considers there is little room for further growth in quantity of recycled aggregates. But records on the quantities of construction and demolition waste recycled and used as aggregates are poor. Concerns were raised over the achievability of the South East Plan target for secondary and recycled aggregates.

The national forecasting model had taken this into account in its assessment of need for primary aggregates. It recently assumed a contribution of 65 million tonnes from secondary and recycled sources and acknowledged that this is unlikely to significantly increase. Thus the Oxfordshire apportionment of 2.1 million tonnes is a net figure for land won sand and gravel that has already taken account of the contribution made by recycled aggregates.

Other planned development, such as that in the Oxfordshire Local Investment Plan, and maintenance of the existing built environment will also be taken into account in the review of future demand.

The review of future supply will briefly assess the availability of primary aggregates and any potential constraints to that supply in Oxfordshire and in neighbouring counties.

Stage 3 – Synthesis

The timetable for preparing the report is:

- Draft report by 10 December
- Final report by Christmas
- Report to OCC Members Jan 2011
- Finalise interim strategy options February 2011

OCC will endeavour to make the report publicly available in January. Concerns were raised over such a tight time frame and local data gaps that could not be addressed given the desire to proceed quickly.

The minerals industry noted that the new figure for need for aggregates provision would form the basis of the plan and asked how often it would be reviewed, especially in light of the fact that it is to be based on economic development. The annual monitoring report will indicate whether the apportionment is still appropriate; if this shows that it is consistently higher or lower than the level of demand, it will need to be reviewed. It was also asked how many years of monitoring would be necessary to trigger a review and establish a need for change in apportionment. It was suggested this could create a lag in planning applications contrary to the principle of maintaining a steady and adequate supply.

The minerals industry noted that the localism agenda will place a responsibility on local authorities to carry out monitoring more regularly to ensure that local changes can be taken into account. The meeting discussed the Government's stated intention to continue to ensure a steady and adequate supply of minerals through some sort of national planning framework. It was reported that funding for the RAWPs beyond March 2011 has been agreed by DCLG.

The meeting discussed other SE counties' approach to the apportionment. Hampshire is considering reviewing its apportionment with the aim of reducing it. Milton Keynes and West Sussex also do not accept their apportionments. It would be useful to know the extent to which other counties would be prepared to accept increased apportionments to compensate. The minerals industry raised the question of how the shortfall would be met if other counties would not accept an increase.

LGP
16th December 2010

Appendix B – Oxfordshire's Geology

Geology of Oxfordshire

Oxfordshire is rich in mineral resources. There are extensive alluvial sand and gravel resources along the River Thames and its tributaries, smaller deposits of fluvio-glacial sand and gravels in the north east of the county, deposits of soft sand mainly in the south west and extensive areas of limestone and of ironstone in the north west and north. There are also chalk, clay and Fuller's Earth resources which have historically been worked but are no longer economically viable.

Sand and Gravels

Sand and gravel resources can be sub-divided into river terrace and glaciofluvial resources. Map 1 shows the location of sand and gravel resources in Oxfordshire.

River terraces of sand and gravel occur at several levels in the Thames, Evenlode, Windrush and Thame valleys and minor tributaries. This mineral comprises unconsolidated materials laid down by rivers and streams since the end of the last ice age about 10,000 years ago. River terrace deposits are an important resource in the county since they generally have a low clay content. The older terraces are higher above the present course of the river and are generally dry in their upper parts. Younger terraces can be saturated at their bases. The deposits comprise sequences of sands and gravels with sheet-like morphology, sub-horizontal upper surfaces and thicknesses of up to a few metres.

Deposits of glaciofluvial sand and gravel are located in the north east of the county and in an area east of Wallingford, along the foothills of the Chiltern Hills. These were deposited by glacial melt-waters during the ice ages the last of which ended around 10,000 years ago.

Glaciofluvial sand and gravels are normally of poorer quality and much more variable than their alluvial equivalent. This is because they are less well sorted and the level of silt and other impurities tends to be higher, although they contain flint & quartzite gravels which can be of higher quality than found elsewhere in the county.

The County's sand and gravel resources are extensive and are located along most of the Thames valley and its major tributaries. To date, working has been concentrated west and south of Oxford and this has had a profound and lasting impact on the landscape in some areas such as the Lower Windrush Valley. There are still significant, economically viable resources in the Thames, Lower Windrush, Lower Evenlode and Lower Thame valleys.

In the far west of the county along the Thames there are significant resources but vehicular access to this rural area is poor, distances from markets are great and no working has taken place here.

In the south of the county there are large areas of alluvial sand and gravel associated with the River Thame and the Thames. There has been much previous working in this part of the county but there are still extensive sand and gravel resources.

The Faringdon Sponge Gravel Formation outcrops in a small area near Faringdon and comprises red and yellow sponge gravels overlain by clayey sands and capped by ferruginous sands and sandstones. It is quarried to the south of Faringdon.

Sand and gravel resources associated with minor tributaries of the Thames such as the River Cherwell in the north of the county and the River Ock in the south west are incidental in nature and of no strategic importance. They are either limited in spatial extent, are thin and/or have a high silt content.

Soft sands

There are several formations of poorly consolidated sandstone in Oxfordshire which are worked for building sand. Map 2 shows the soft sands in the county. The Horsehay sand formation outcrops in a limited area in the north of the county. It consists of a medium to fine grained quartzose sand up to 7m thick.

The Kingston formation outcrops in the southern part of Oxfordshire and runs west-south-west to east-north-east from Faringdon to the north east of Oxford. The whole formation is up to 30m thick, although

the principal resource, the Highworth Grit is only part of the formation and probably has a maximum thickness of 10-20m. The Highworth Grit consists mainly of medium-grained quartzose sand and is currently quarried in the Hatford/Shellingford & Tubney areas.

Crushed rock

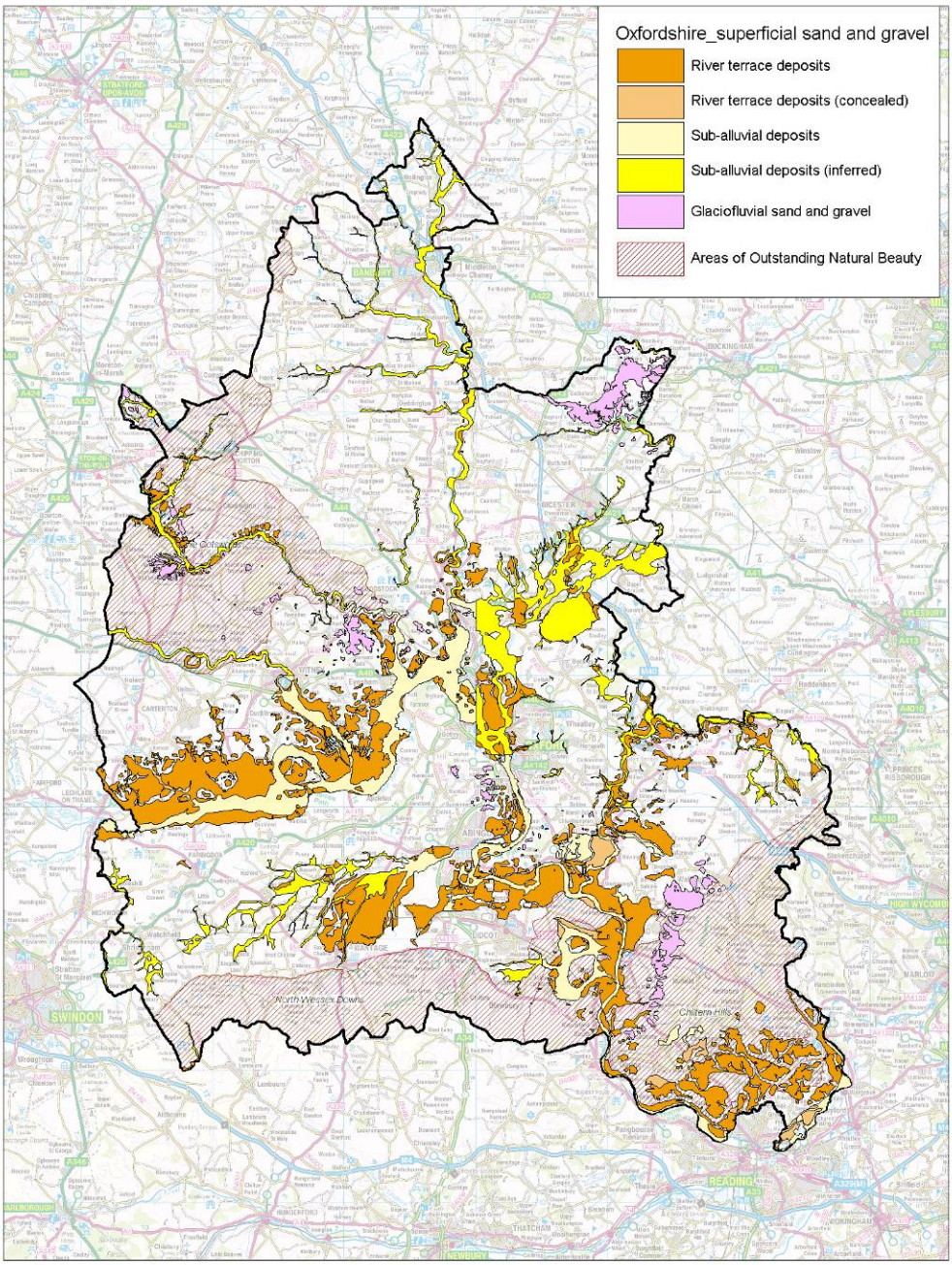
Map 3 shows the limestone and ironstone resources in Oxfordshire. The Great Oolite group runs north east to south west across northern Oxfordshire. It includes the Chipping Norton limestone which is a medium- to coarse grained oolitic limestone forming an extensive plateau, which is up to 10.7m thick near Chipping Norton. It thins towards the north east and east.
White limestone, which is cream coloured and fine grained, outcrops extensively across Oxfordshire and is currently worked in quarries in the north east of the county at Ardley and far west of the county near Burford, primarily for aggregate use.

The Corallian group is a mix of limestones, sands and mudstones. Within it, the Stanford formation limestones lie above the sand at Bowling Green and Shellingford. These limestones have historically been considered as over burden to win the soft sand beneath; they are not comparable with the white limestone. At Hatford, a harder limestone, the Highworth limestone, which meets Type 1 specification is quarried at depth.

Ironstone occurs in the Marlstone Rock Formation, which is worked in the far north of the county, west of Banbury.

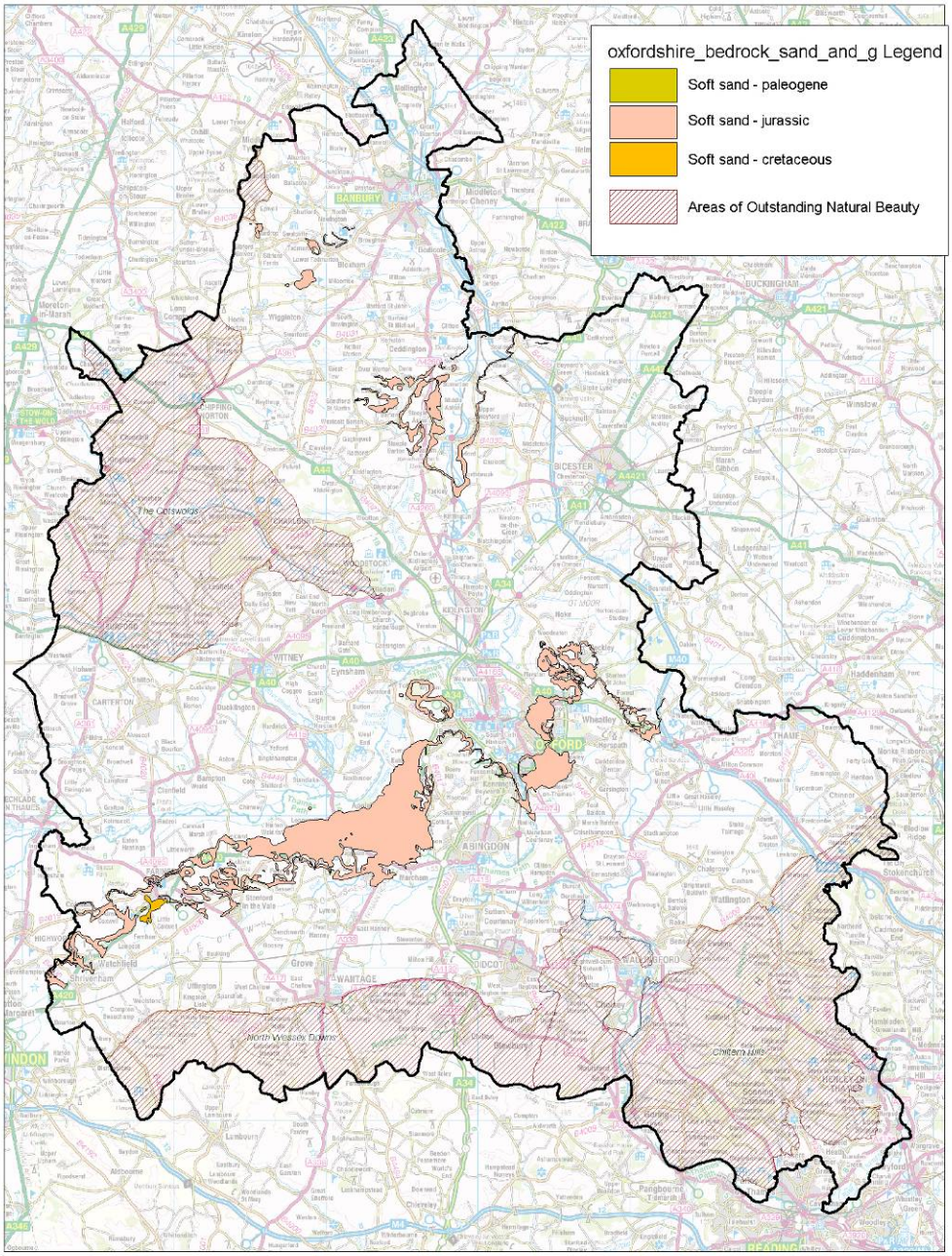
Map 1: sand and gravels in Oxfordshire

Oxfordshire sand and gravel deposits



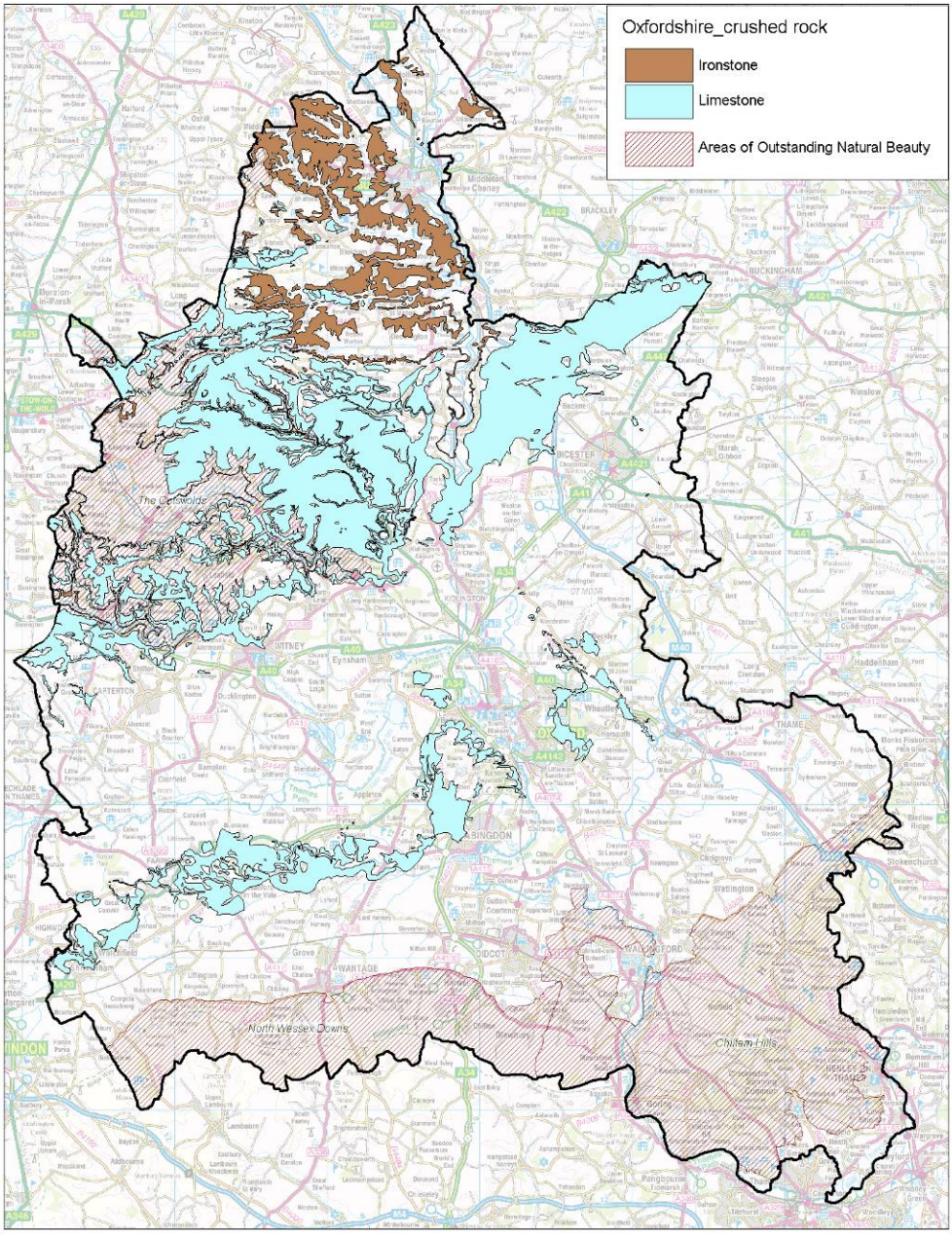
Map 2: bedrock (soft) sands in Oxfordshire

Oxfordshire bedrock sand deposits



Map 3 Crushed rock (limestone and ironstone) in Oxfordshire

Oxfordshire crushed rock resources



Appendix C – Possible Indicators for Determining Future Aggregate Demand

C.1 Possible Indicators for Determining Future Aggregate Demand

C.1.1 The following considers forecasts from which it may be possible to derive a general picture of future aggregate demand. Possible forecasts which have been found to be readily available and hence could be used as general indicators of potential future aggregate demand are:

- Draft Revised National Guidelines for Aggregate Provision in England: 2005-2020 shows a forecasted level of increase in demand.
- Construction Industry Forecasts.
- HM Treasury forecasts, as an indication of predicted general economic activity.
- PricewaterhouseCoopers (PwC) forecasts of GDP and inflation, as indicators of general economic activity.
- Predicted housing completions.
- Predicted Gross Value Added.

C.1.2 The figures produced by the model used to inform the National Guidelines for Aggregate Provision indicate anticipated aggregate demand. The other forecasts indicate anticipated levels of potential economic activity, typically in monetary terms, over the respective forecast periods.

Draft Revised National Guidelines for Aggregate Provision in England: 2005-2020

C.1.3 The Draft Revised National and Regional Guidelines for Aggregates Provision in England: 2005–2020 Consultation, April 2008, published forecasts for aggregate demand for the regions as summarised in the following table for England, the South East and other regions around Oxfordshire. Thus those forecasts can also be used as a general indicator of possible future demand for aggregate in Oxfordshire.

Table C.1 – Forecast of Aggregate Demand from Draft Revised National Guidelines for Aggregate Provision in England: 2005-2020

Year	South East	South West	East Midlands	West Midlands	England
2005	29	31	29	24	217
2006	32	32	29	24	224
2007	33	33	29	24	228
2008	33	33	29	25	231
2009	34	34	30	25	235
2010	35	35	30	26	239
2011	35	35	31	26	243
2012	36	36	31	27	247
2013	36	36	32	27	251
2014	37	37	32	28	255

Year	South East	South West	East Midlands	West Midlands	England
2015	38	38	33	28	259
2016	38	38	33	28	259
2017	38	38	33	28	259
2018	38	38	33	28	259
2019	38	38	33	28	259
2020	38	38	33	28	259
Total 2005-20	566	569	498	453	3925
Average 2005-09	32.2	32.6	29.2	24.4	227
Average 2005-20	35	36	31	28	245
Change from average of 2005-2009 to 2020	18.0%	16.6%	13.0%	14.8%	14.1%
Change from 2010 to 2020	8.6%	8.6%	10.0%	7.7%	8.4%
Effective Annual Change from 2010-2020	0.83%	0.83%	0.96%	0.74%	0.83%

Notes:

1 Source: Draft Revised National and Regional Guidelines for Aggregates Provision In England: 2005–2020 Consultation, April 2008, Table 11: Demand arising within regions for total aggregates (September 2007)

2 Values in millions of tonnes.

C.1.4 The indication from the regional forecasts which take account of an assumed proportion of alternative aggregates to total consumption, is that growth in aggregate demand will occur but will be under 1% per year on average.

Construction Industry Forecasts

C.1.5 Information on past Contractors' Output is available nationally, regionally and sub-regionally, from the Office of National Statistics (ONS), with the most local information available in Table 2.9 of Chapter 2 of the Construction Statistics Annual 2010, which provides figures for the sub-region of Berkshire, Buckinghamshire, Hampshire and Oxfordshire for the period 1996 to 2009.

C.1.6 The ONS contractors' output information is split between different categories; new work and repair and maintenance; public and private, housing and different categories of other types of development as shown in the following table.

Table C.2 – Contractors' Output Categories

New Housing		Other new non housing work				Repair & maintenance			
		Infra-structure	Other new work			Housing			All repair & maintenance
New housing			Public	Private	Private		Other work		
Public	Private			Indus-trial	Comm-ercial		Public	Private	

C.1.7 Construction Industry Forecasts provide an analysis of the changing pressures and influences facing the construction industry and their implications for construction activity over the next five years. And the forecasts contain detailed output projections for the sectors and categories of construction activity used by the ONS in its reporting of Contractor's Output. However the freely available version of the forecasts is only as a national forecast for the whole of Great Britain which covers the period to 2014. Other forecasts are available by subscription.

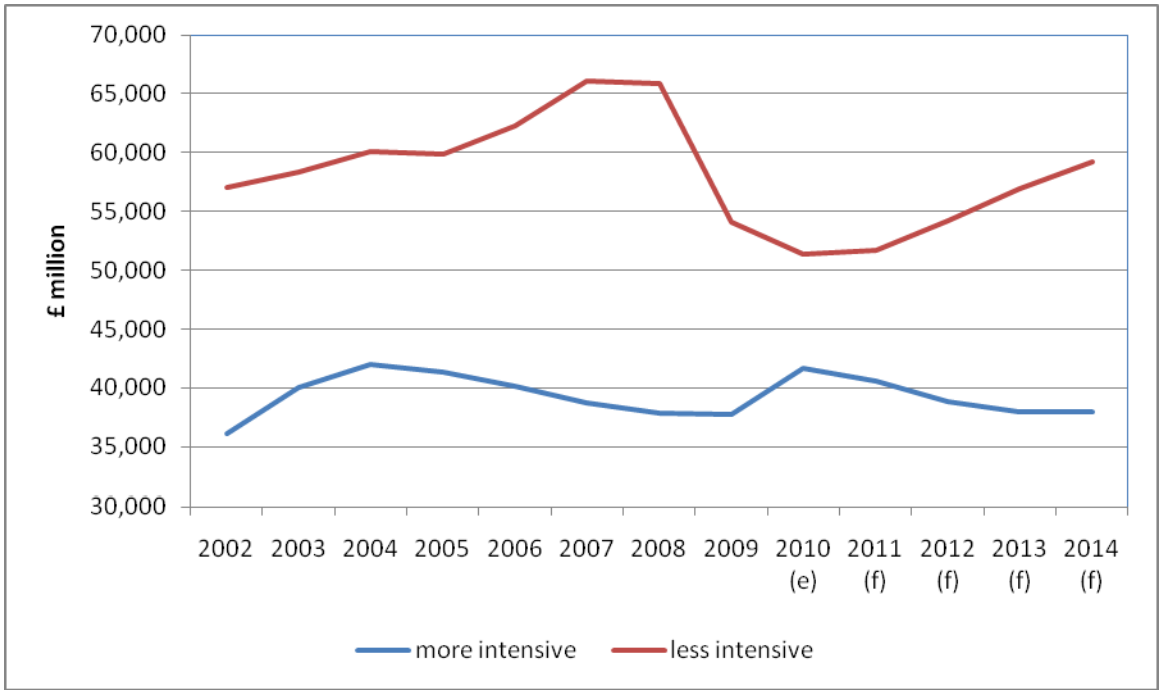
C.1.8 The categories in the latest national forecast dated Autumn 2010 have been divided between 'more' aggregate and 'less' aggregates intensive categories as per the following table, that division being used in the CLG approach to forecasting demand for aggregate nationally (published as Forecasting Aggregate Demand – A Technical Summary).

Table C.3 – Aggregate Intensity

'More' aggregate intensive	'Less' aggregate intensive
New Housing	Industrial
Infrastructure	Commercial
Other new work (public)	Housing repair
Other public repair	Other private repair

C.1.9 An analysis undertaken on the relative performance of the forecast monetary value of the more and less aggregate intensive sectors for the period to 2014 provided the following profile (note the figures are in current prices £ million for the whole of Great Britain).

Figure C.1 – Forecast performance of more and less aggregate intensive construction sectors



C.1.10 There was a notable dip in the value of less aggregate intensive work after 2008, which is anticipated to recover gradually in future years. The value of more aggregate intensive work fell very marginally between 2004 and 2008, but stabilised in 2009 and rose again in 2010. Thereafter the former marginal decline is forecast to continue for a couple more years before stabilising in 2014. Overall, whilst there is no growth forecast for more aggregate intensive work in the period to 2014, the above figure suggests that the more aggregate intensive sectors of the industry are less volatile than the less aggregate intensive sectors.

Independent forecasts published by HM Treasury

C.1.11 The HM Treasury publishes monthly 'Forecasts for the UK economy: a comparison of independent forecasts', compiled by its Macroeconomic Prospects Team, the latest publication being No. 283 November 2010. This is a summary of published material reflecting the views of the forecasting organisations themselves and does not provide new information on the Treasury's own views. It contains selection of 'city' and 'non city' based organisations with a comparison of medium-term projections for the calendar years 2010 to 2014, and the fiscal years 2010-11 to 2013-14. The following table summarises the independent average of forecasts for GDP growth and the GDP deflator. The GDP deflator measures the ratio of nominal (or current-price) GDP to the real (or chain volume) measure of GDP i.e. GDP deflator equals nominal GDP divided by real GDP times 100.

Table C.4 – HM Treasury Published Average of Independent Forecasts for the UK Economy

Parameter	2010	2011	2012	2013	2014
GDP Growth, %	1.6	1.9	2.1	2.3	2.4
GDP deflator, % change		2010-11 3.2	2011-2012 2.8	2012-2013 2.5	2013-2014 2.6
Domestic demand, % change	2.4	0.4	0.6	1.4	1.7
Notes: Values from Tables M1, M2, and M3 of 'Forecasts for the UK economy' No. 283.					

C.1.12 The 'GDP Growth' and 'Domestic demand' projections rise from 2011 to 2014, predicting increases of 9% and 4% over that period.

Forecasts by PricewaterhouseCoopers

C.1.13 PricewaterhouseCoopers provides short and long-term forecasts of GDP growth and inflation, available via http://www.pwc.co.uk/eng/issues/economy_forecasts.html and summarised in the following table.

Table C.5 – PwC Forecasts (October 2010) for the UK Economy

Parameter	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016 -19
GDP % change	2.9	2.6	0.5	-5.0	1.8	2.0	2.3	2.4	2.5	2.6	2.5
Inflation %	2.3	2.3	3.6	2.1	3.2	2.8	2.5	2.4	2.3	2.2	2.0
GDP less inflation %	0.6	0.3	-3.1	-7.1	-1.4	-0.8	-0.2	0	0.2	0.4	0.5

C.1.14 This provides a forecast for GDP over a longer period though still not to the end of the plan period. However the forecast suggests that whilst there has been a notable dip in the economy which is expected to continue over the period 2008 – 2012, GDP is anticipated to begin rising again after 2013.

Forecasts of Gross Value Added (GVA)

C.1.15 Gross Value Added (GVA) measures the contribution to the economy of each individual producer, industry or sector in the United Kingdom, and is used in the estimation of Gross Domestic Product (GDP). GVA is a top down measure of economic performance at "basic" prices and at county level includes wages and profits. The intention is that GVA is a measure

of production, and hence it was considered plausible that GVA may provide an indication of the possible demand for aggregate.

C.1.16 Past GVA values are available from the ONS via its NUTS data. NUTS stands for 'Nomenclature of Units for Territorial Statistics' which is a geocode standard developed and regulated by the European Union for referencing the subdivisions of countries for statistical purposes. There are three levels of NUTS defined, with for England NUTS1 being for Government Office Regions, NUTS2 being for counties (some grouped) and inner and outer London, and NUTS3 being for upper tier authorities or groups of lower tier authorities e.g. unitary authorities or districts.

C.1.17 The GVA Values are available from 1999 to 2007 for the economic activity as a whole or different sectors in the economy, including the construction industry, subdivided per region e.g. Oxfordshire, the South East and other counties. The GVA reflecting general economic activity is available via the NUTS3.1 table, which is titled 'Headline Gross Value Added (GVA) by NUTS3 area at current basic prices by region', whereas the GVA for the construction industry is available via the NUTS3.4 table which is titled 'Headline Gross Value Added (GVA) by NUTS3 area and 6 industries at current basic prices by region'.

C.1.18 Looking forward, forecasts of GVA accompanying the Oxfordshire Economic Assessment, Draft 18 14th July 2010, are provided in the following table.

Table C.6 – Forecast of GVA for Oxfordshire from the Oxfordshire Economic Assessment, Draft 18, July 2010

Year	Forecast of GVA for construction, £m 2005 prices	Forecast of total GVA £m 2005 prices	Relative Price Index[1]	GVA for construction, £m 2008 prices	Total GVA £m 2008 prices
2005			212		
2008			239		
2009	572.18	13730		645	15311
2010	556.54	14098		627	15479
2011	553.65	14458		624	15893
2012	555.54	14820		626	16299
2013	557.11	15181		628	16708
2014	558.7	15557		630	17114
2015	563.07	15970		635	17538
2016	567.17	16400		639	18004
2017	572.2	16846		645	18488
2018	577.84	17305		651	18992
2019	582.88	17770		657	19509
2020	587.99	18222		663	20033
2021	593.01	18697		669	20542
2022	597.7	19194		674	21078
2023	602.39	19709		679	21638
2024	607.16	20235		684	22219

Year	Forecast of GVA for construction, £m 2005 prices	Forecast of total GVA £m 2005 prices	Relative Price Index[1]	GVA for construction, £m 2008 prices	Total GVA £m 2008 prices
2025	611.96	20782		690	22813
2026	616.68	13581		695	23429
Notes: 1. Source BCIS Tender Price Studies for the South East.					

C.1.19 The forecast of Oxfordshire's GVA for construction is relatively stable with little variation from 2011 to 2014, but rises slightly thereafter with approximately 11% increase in GVA for construction from 2011 to 2026, whereas the forecast of total GVA for Oxfordshire increases by approximately 47%. That suggests growth in construction over the period is expected to be much less on average than for other industry sectors (Agriculture; Distribution, Hotels and Catering; Engineering; Financial and Business Services; Public Services; Metals, Minerals and Chemicals; Transport and Communications).

Findings

C.1.20 The forecasting model used to calculate the national and regional aggregate provision figures indicates a small but steady rise in aggregate consumption over the period 2005 to 2015, levelling off thereafter at that level.

C.1.21 The construction industry forecast indicates a variable forecast in the value of construction work over the period to 2014, the measure of more aggregate intensive work is less variable than that of less aggregate intensive work.

C.1.22 The independent economic forecasts published by the Treasury and the short and long-term forecasts of GDP produced by PricewaterhouseCoopers indicate a return to growth in the coming years, albeit gradual and possibly delayed until 2013. Annual housing completions are predicted to be greater over the period 2011 to 2016 compared to recent years, and though forecasts of GVA for construction in Oxfordshire indicate little change during the next few years, growth is expected in Oxfordshire's total GVA, though for construction not until after around 2014.

C.1.23 Other than in the short term, none of the forecasts indicate that either general economic activity or construction activity in Oxfordshire will remain depressed, and thereby continue the apparent rate of decline in aggregate sales, particularly as displayed by the recent sales of sharp sand and gravel. In general the forecasts indicate increased economic activity, suggesting that future aggregate consumption in Oxfordshire is likely to be similar or slightly higher than recently.

Appendix D – Comparison of Primary Aggregate Sales with Past Performance of the Construction Industry

D.1 Comparison of Primary Aggregate Sales with Past Performance of the Construction Industry

D.1.1 The levels of past sales have been compared to two readily available measures of past performance of the construction industry, namely Information on Contractors' output and Gross Value Added (GVA), as both are readily available from the Office for National Statistics and should reflect activity in the construction industry or the economy as a whole, as a possible basis for comparison with available long term forecasts.

Comparison of Sales with Data on Contractors' Output

D.1.2 Information on Contractors' Output is available nationally, regionally and sub-regionally. The most local information available is Table 2.9 from Chapter 2 of the Construction Statistics Annual 2010 which provides figures for the sub-region of Berkshire, Buckinghamshire, Hampshire and Oxfordshire for the period 1996 to 2009. Consideration was given to the possibility of disaggregating this information according to the population of each county in the sub region, but the relative proportions of population for those counties do not vary more than by 0.5% over the period, so that exercise would not have altered the overall picture available by using the total figures for the sub-region.

D.1.3 The Contractors Output figures are in current prices in £ million, so they were normalised for inflation using the value index derived by the Building Cost Information System (BCIS) from BCIS Tender Price Studies for the South East. The relative values used are indicated in the following table.

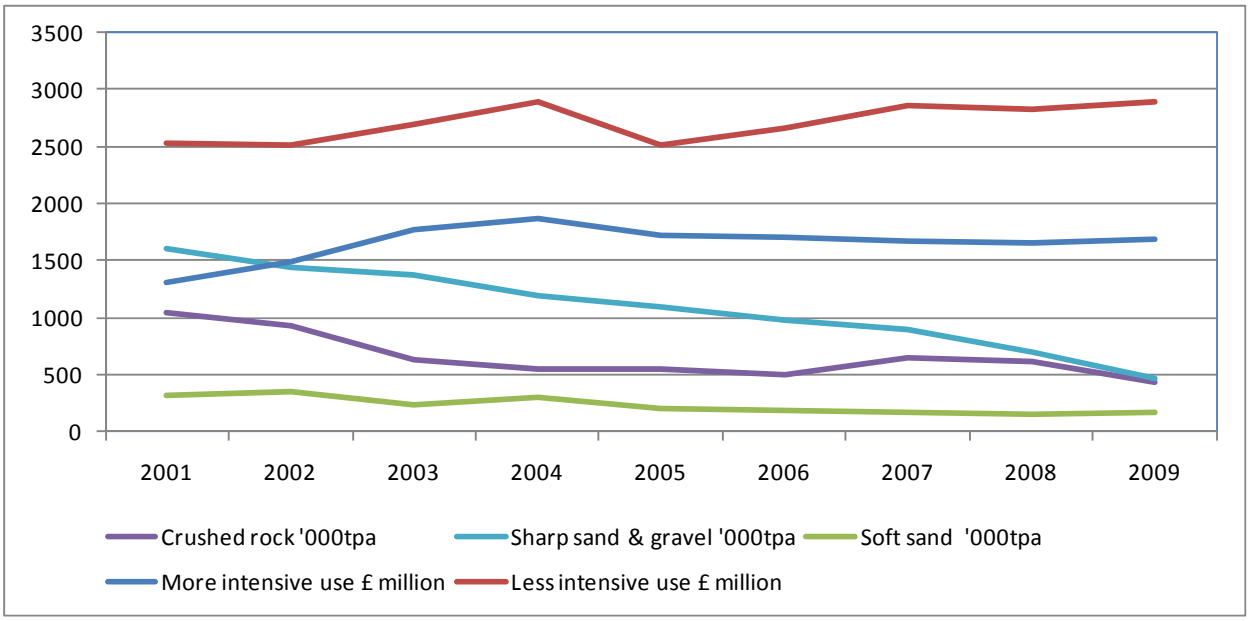
Table D.1 – Relative Value Index based on BCIS Tender Price Studies for the South East

Year	Relative Value Index
1996	121
1998	135
2000	154
2002	176
2004	194
2006	217
2008	239

D.1.4 Those normalised output values were then combined according to whether the category represented the 'more' or 'less' intensive user of aggregates, using the same division as is used in the CLG approach to forecasting the demand for aggregate (published as Forecasting Aggregate Demand – A Technical Summary).

D.1.5 The following figures show the resulting values for each year between 1996 and 2008 plotted against the level of sales of the different types of sand and gravel (sharp s&g and soft sand) and against sales of crushed rock.

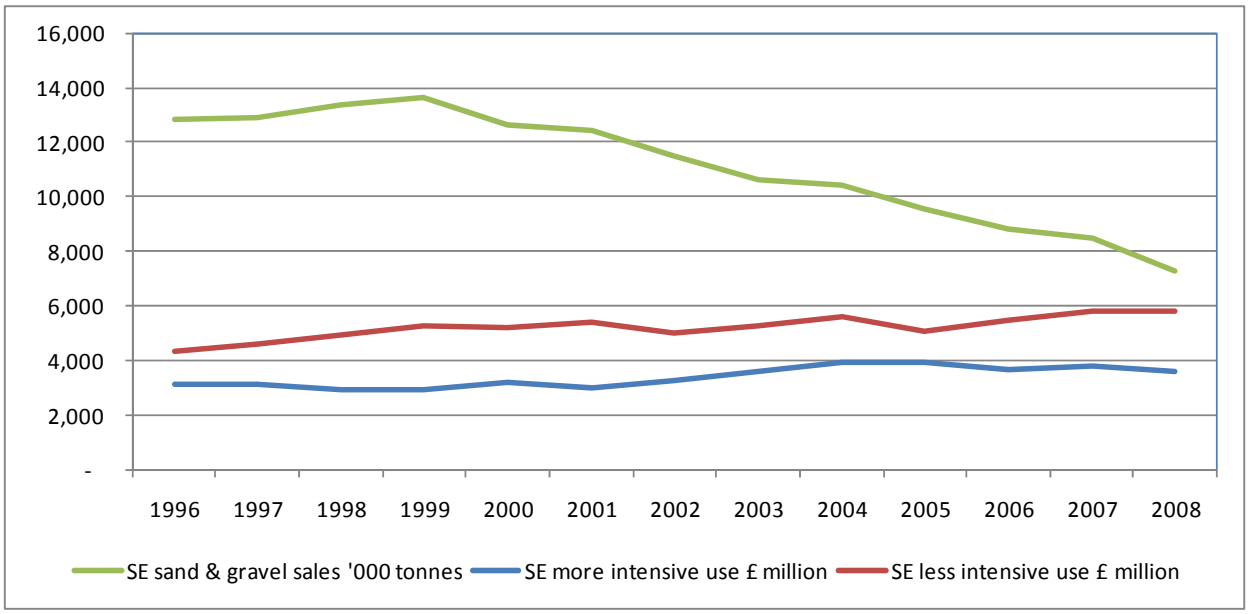
Figure D.1 – Oxfordshire aggregate sales versus aggregate intensive categories for the sub-region of Berkshire, Buckinghamshire, Hampshire and Oxfordshire



D.1.6 The figure broadly indicates that Oxfordshire sales of soft sand and crushed rock correlate somewhat better with the more aggregate intensive categories of Contractors Output than sales of sharp sand and gravel, as sales of sharp sand and gravel are shown as falling relative to both of the 'more' or 'less' intensive Contractors output measures.

D.1.7 Sand and gravel sales in the south east region have also been compared against the Regional Contractors Output figures, as shown in the following figure, which again confirm the sales of sharp sand and gravel are shown as falling relative to both the 'more' and 'less' intensive Contractors output measures. (SE sales for 2009 are not yet available).

Figure D.2 – SE sand and gravel sales compared with aggregate intensive categories for the SE



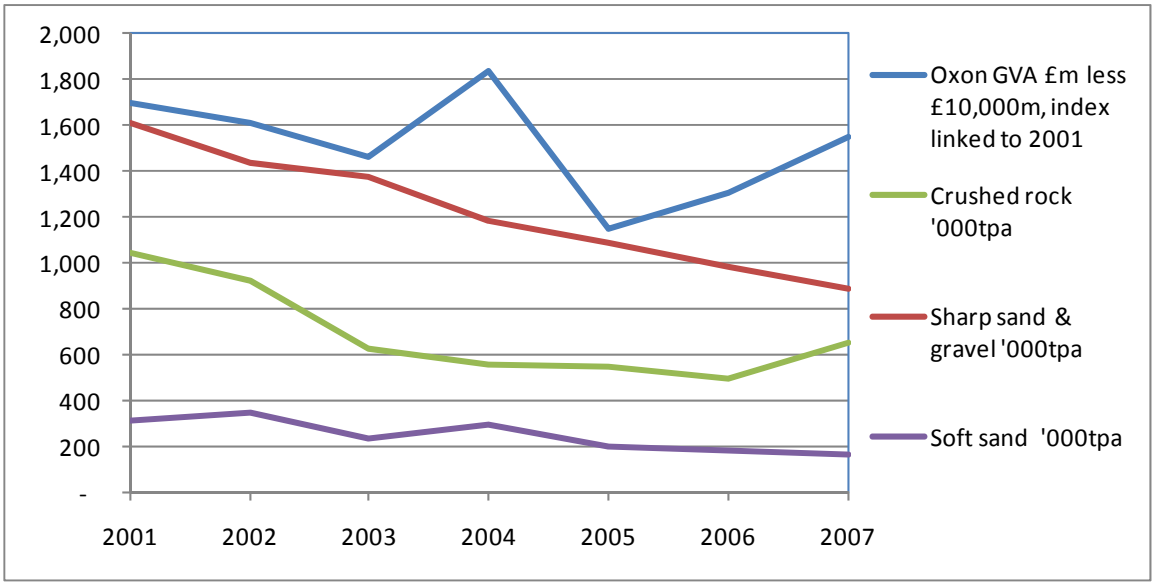
D.1.8 Similarly derived figures could not be included for other counties adjacent to Oxfordshire because lack of a full data set of recent sales.

Comparison of Sales with Past GVA values

D.1.9 The same approach was undertaken to compare sand and gravel and crushed rock sales in Oxfordshire against GVA values. GVA values data for years up to 2007 are available from the ONS via its NUTS. The GVA values have been normalised for inflation using the relative value index derived from Building Cost Information System (BCIS) Tender Price Studies for the South East.

D.1.10 The normalised GVA values for Oxfordshire are shown in the following figure plotted against the aggregate sales values from 2001, though with GVA adjusted as indicated to correspond more closely with the tonnage sales values.

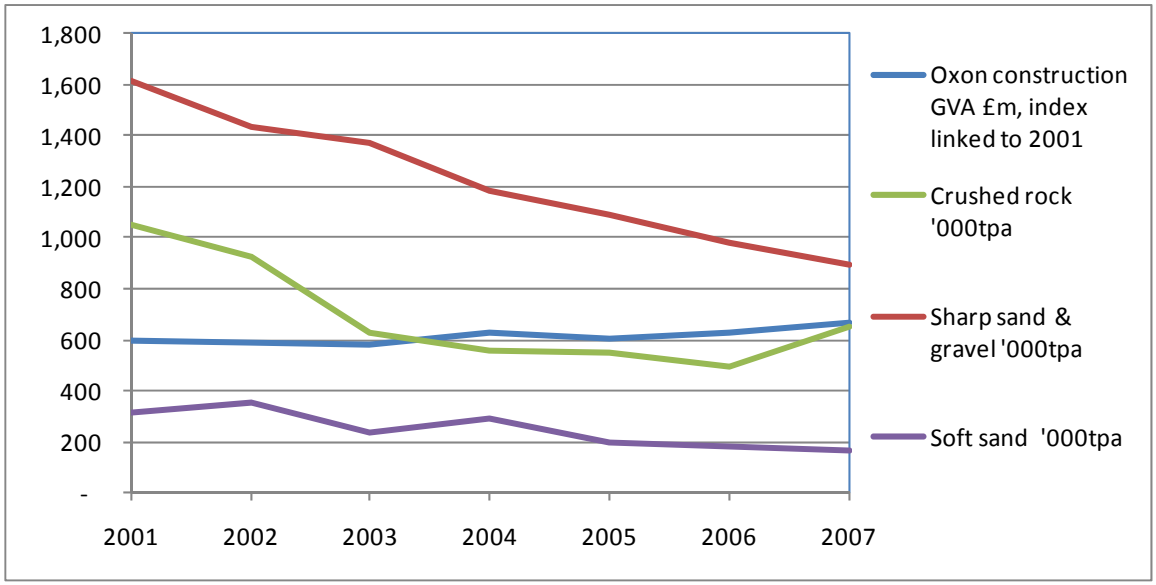
Figure D.3 – Sales of S&G and crushed rock compared to normalised GVA for Oxfordshire



D.1.11 This graph suggests that there might have been some relationship between sand and gravel sales with Oxfordshire's GVA as both variables are seen to decline over the early part of the period, however the apparent relationship breaks down after 2003. There is a less apparent correlation of GVA with crushed rock sales. The outcome of testing for any relationship by regression is reported below.

D.1.12 The following figure compares the total sales of sand and gravel and crushed rock from 2001 with construction GVA for Oxford.

Figure D.4 – Sales of S&G and crushed rock compared to normalised Construction GVA for Oxfordshire



D.1.13 There is no obvious relationship between sand and gravel or crushed rock sales for Oxfordshire and the GVA for Oxfordshire construction, though given the likelihood of export and import of aggregates, GVA for construction in Oxfordshire alone maybe too narrow an indicator of possible aggregate demand.

D.2 Regression Analysis

D.2.1 Regression analysis has been carried out to more rigorously appraise whether there is useful link between aggregate sales and other measures or indicators of construction output, such as data on Contractors' output, house completions and GVA. Regression analysis is a technique for modelling and analyzing several variables, when the focus is on the relationship between a dependent variable e.g. aggregate sales, and one or more independent variables, and is one of the fundamental statistical methods used by econometricians. For this study regression has been carried out by utilising the regression function in the MS Excel data analysis Add-In.

D.2.2 Simple regression was utilised in the Communities and Local Government (CLG) publication Draft Revised National and Regional Guidelines for Aggregates Provision In England: 2005–2020, where its Annex A: The Method and Assumptions used in Preparing the Draft Revised Guidelines 2005–2020, records that the forecast of demand for all aggregates in England, regardless of origin, was estimated using a method based on a simple regression equation (or model) which describes the recorded relationship between construction and aggregates consumed in Great Britain over the years 1980 to 2005.

D.2.3 Annex A states the following:

"The model used is a simple one that relates aggregates consumption to construction activity by means of a regression equation. Construction activity is broken down into two broad categories based on intensity of use of aggregates. Account is also taken of changes in intensity of use in the construction industry over time. Previously the model was based on aggregate use being grown from a single year's data on the basis of predicted GVA growth before being constrained to the results of the regression. In order to improve the reliability of the model it has now been decided, on advice from the Technical Sub-Group to the National Co-ordination Group (NCG) of the Regional Aggregate Working Parties (RAWPs), to grow aggregates from the average of three year's data. A small alteration was made in the model to allow for the likely effects of the aggregates levy."

D.2.4 The regression equation is not given, though in the Annex A it is also stated that "forecasts of changes in construction activity were applied to current construction output data from the Department for Business, Enterprise and Regulatory Reform. The resulting construction forecasts were used to determine the impact on aggregates consumption using regression analysis." However the approach to forecasting the demand for aggregate is published within Forecasting Aggregate Demand – A Technical Summary, which reports the model as:

AGGCON = f (IC, LIC, trend).

D.2.5 Whereby the CLG approach says that consumption of aggregates (AGGCON) is a function of two categories of construction that are more (IC) and less (LIC) aggregates intensive, and of a general trend in the reduction of aggregates intensity. The model derived is given as:

AGGCON = -144.758 + (0.0139 x IC) + (0.0055 x LIC) + (-4.265 x trend), for which $R^{2=}0.89$

D.2.6 While it was noted within the CLG Annex A that the negative constant term is counter intuitive, the remaining terms were viewed as representing increasing aggregate demand with construction activity offset by a general reduction in use (in an example calculation for 1997 the Annex A publication uses a value of '18' for the trend variable). However with this formulation it seems there is a potential for the 'trend' variable to be dominant and not necessarily reflect for example increased substitution of primary aggregates by secondary or recycled aggregates.

D.2.7 As the CLG model was derived on an overall national basis, it did not need to consider and would not be affected by regional or local variances such as may occur due to imports and exports. Nevertheless the possible application of regression analysis to indicate Oxfordshire's aggregate supply requirements has been explored. Initially regression analysis was carried out for Oxfordshire's sales of primary aggregate i.e. sand and gravel plus crushed rock, with Oxfordshire's primary aggregate sales as the dependent variable (Y) and utilising the CLG formulation independent variables as a starting point. Other independent variables such Gross Values Added or housing completions, to which it was thought aggregate sales (demand) might be a function of, were also utilised, and the results are summarised in the following table.

Table D.2 – Results of Regression Analysis

Model No.	Independent Variables	Regression Results (Y = total primary aggregate sales)	Adjusted Regression Coefficient R^2 and Standard Error in ()
1	Construction output as single variable of more aggregate intensive (IC) plus less aggregate intensive (LIC)	Y = 7790 – 1.32 x (IC + LIC)	0.45 (403)
2	Construction output as more aggregate intensive (IC) and less aggregate intensive (LIC) categories separately	Y = 7501 – 1.52 x IC – 1.09 x LIC	0.34 (439)
3	Construction output as more aggregate intensive and less aggregate intensive categories combined (IC + LIC), and dummy variable (DV) reducing at nominal 2% per year.	Y = -5816 – 0.34 x (IC + LIC) + 11075 x DV	0.94 (129)
4	Construction output as more aggregate intensive and less aggregate intensive categories combined (IC + LIC), and construction price index for south east (PI).	Y = 7574 – 0.405 x (IC + LIC) - 18.56 x PI	0.98 (83)

Model No.	Independent Variables	Regression Results (Y = total primary aggregate sales)	Adjusted Regression Coefficient R^2 and Standard Error in ()
5	Construction output as more aggregate intensive and less aggregate intensive categories combined (IC + LIC), and Oxon housing completions (HC).	Y = 7076 -0.97 x (IC + LIC) – 0.32 x HC	0.52 (365)
6	Oxon GVA for construction (GVAc)	Y = 5624 – 4.78 x GVAc	0.89 (179)
7	Oxon total GVA (GVAt)	Y = 7574 – 0.40 x GVAt	0.96 (104)
8	SE GVA for construction (SEGVAc)	Y = 5173 – 0.31 x SEGVAc	0.90 (170)
9	SE total GVA (SEGVAt)	Y = 6563 – 0.029 x SEGVAt	0.92 (158)
10	Construction GVA for Oxon (GVAc) and adjacent counties: Buckinghamshire, Berkshire, Wiltshire, Gloucestershire, Warwickshire, Northamptonshire, (AdjGVAc)	Y = 6206 – 11.64 x GVAc + 1.12 x AdjGVAc	0.90 (175)
11	Total GVA for Oxon (GVAt) and adjacent counties: Buckinghamshire, Berkshire, Wiltshire, Gloucestershire, Warwickshire, Northamptonshire (AdjGVAt)	Y = 8144 – 0.628 x GVAt + 0.037 x AdjGVAt	0.97 (99)
12	Oxon housing completions (HC) and Oxon GVA for construction (GVAc)	Y = 5585 – 0.1 x HC – 4.39 x GVAc	0.88 (185)
13	Oxon housing completions (HC) and Oxon total GVA (GVAt)	Y = 7496 – 0.038 x HC – 0.386 GVA	0.96 (111)

Notes:

1. Analysis carried out on sales data for 2001 to 2008 inclusive, as the crushed rock sales data prior to 2001 did not include ironstone.

2. The regression coefficient provides an indication of 'goodness of fit' though to compare models of different size (i.e. different numbers of independent variables and/or different sample sizes) the Adjusted R-Squared must be used because the usual R-Squared tends to grow with the number of independent variables. For a regression prediction there would be approximately 68% likelihood of the actual value being ± one standard error, and 95% likelihood of being within two standard errors.

D.2.8 Due to the overriding downward trend in past sand and gravel sales over recent years it was found possible to 'fit' a relationship to that trend, as shown by the regression analysis results with the higher regression coefficients, but due to that dominant recent trend of reducing sales, the relationships derived are not deemed wholly reliable. For example past sales decreased as GVA increased, hence from the regression results, a rapid increase in GVA would predict a decrease in demand whereas more logically demand might be expected to increase. This was tested for the regression result formulations by simply assuming a 5% increase per year for each independent variable, and each formulation predicted continued decreasing demand. Regression analysis was also carried out setting the constant to zero, but that generally led to lower regression coefficients and much larger standard error values.

D.2.9 Nevertheless as forecasts are available of new houses in Oxfordshire and GVA to 2026, those forecast values have been utilised in the regression formulations for Models 6, 7, 12 and 13, and provide the following results:

- Model 6, independent variable forecast of Oxfordshire GVA for construction, the estimated average primary aggregate demand is 2.51mtpa for 2011-2026. Using the average forecast of Oxfordshire GVA for construction of £656mpa (at 2008 prices) for 2011-2026 the estimated primary aggregate demand is 2.49mtpa.
- Model 7, independent variable forecast Oxfordshire total GVA, the estimated average primary aggregate demand is 0.042mtpa for 2011-2026. Using the forecast average Oxfordshire annual total GVA of £19394mpa (at 2008 prices) for 2011-2026 the estimated primary aggregate demand is -0.183mtpa. Those results are not deemed plausible.
- Model 12, independent variables forecast of Oxfordshire housing completions average of 2578pa, and forecast of GVA for construction, the estimated average primary aggregate demand is 2.47mtpa for 2011-2026. Using the forecast of Oxfordshire housing completions average of 2578pa and forecast average GVA for construction of £656mpa (at 2008 prices) for 2011-2026, the estimated primary aggregate demand is 2.45mtpa
- Model 13, independent variables forecast of Oxfordshire housing completions average of 2578pa, and forecast of total GVA, the estimated average primary aggregate demand is 0.104mtpa for 2011-2026. Using the forecast of Oxfordshire housing completions average of 2578pa and forecast average annual total GVA of £19394mpa (at 2008 prices) for 2011-2026, the estimated primary aggregate demand is -0.087mtpa. Those results are not deemed plausible.

D.2.10 Although the Model 6 and Model 12 formulations may estimate primary aggregate demand at levels that might appear plausible, the fact that the Model 7 and 13 formulations (which have higher regression coefficients) forecast primary aggregate demand values that are not plausible, suggests the regression analysis methodology is not a sufficiently reliable approach for assessing Oxfordshire's future aggregate demand.

D.2.11 It is logical that demand will at least in part be a function of one or more of the independent variables appraised by the regression analysis, or indeed other possible variables that have not been utilised by this analysis. However due to there being an overriding downward trend in recent past aggregate sales in Oxfordshire which may not be wholly reflective of aggregate consumption in Oxfordshire, it is recommended the regression results are not construed as indicating a sufficiently reliable link between past sales and the independent variables, and so should not be relied on for forecasting future aggregate demand.

D.2.12 Regression analysis is one statistical technique that can be utilised to find the best fit of a times series to past values of the time series in order to make forecasts. There are also other similar statistical techniques or combinations of techniques which could be used to find the best model. However the merit of applying regression analysis or further similar statistical analysis or approaches is doubtful in the context of forecasting Oxfordshire's planning for aggregate provision, given a relatively limited data set, and the possible constraints on the availability of data or resources required to obtain and process data. Furthermore the mineral planning process through its monitoring can respond to changes in aggregate sales or the economy, but little additional benefit would be derived from having to revisit a complex statistical analysis or approach.

D.2.13 Therefore having carried out and appraised the results of regression analysis for variables potentially relevant to Oxfordshire's aggregate sales, it is concluded that Oxfordshire's planning for aggregate requirements should be based on a more straightforward approach than a methodology which utilises regression analysis or other similar or more complex statistical techniques.

Appendix E – Details of Other Analysis Methods to Forecast Oxfordshire's Aggregate Requirement

E.1 'Smoothing' of past sales as a forecast for future demand

E.1.1 Approaches to deriving a 'smoothed' evaluation of the past sales data were applied to the available past sales data. To smooth a data set statistically is to create an approximating function that attempts to capture important patterns in the data, while leaving out 'noise' or other fine-scale variations or rapid changes. Hence the premise was that a 'smoothed' evaluation of the past sales data could be used as a basis for determining the local aggregate requirement.

E.1.2 Many different algorithms can be used for smoothing, though one of the most common is the 'moving average', and that technique is often used to try to capture important trends in repeated statistical surveys. Therefore the following smoothing approaches, including the methodology used in the 2003 sub regional apportionment, have been applied to the past aggregate sales data for Oxfordshire on its own:

1. A moving 7 year average excluding data for the maximum and minimum sales years i.e. as per the 2003 sub regional apportionment method.
2. A cumulative average of all past sales, each year taking the average over a longer period.
3. A moving 5 year average, simply adding the previous 5 years sales for each year for which this information was available.
4. A moving average of the past 5 years sales, plus the standard deviation of that 5 years sales from the average, the aim of that addition being to provide a contingency.
5. A moving 5 year average excluding the last 2 years sales.
6. A simple maximum of the past 5 year's sales i.e. a conservative approach.
7. A linearly weighted moving average for past 5 year sales i.e. to weight past years greater than more recent years.
8. A linearly weighted moving average for past 7 year sales i.e. to weight past years greater than more recent years.
9. An exponential moving average (EMA1) for the past sales, where the EMA1 = (α x Sales for Year) + [(1 – α) x EMA1previous] with the starting EMA1previous as the average of the first two years. The EMA applies weighting factors which decrease exponentially and higher α discounts older observations faster and for this assessment an $\alpha = 0.3$ has been used.
10. An exponential moving average (EMA2) for the past sales where the EMA2 = EMA2previous + α x (Sales for Year – EMA2previous) and the starting EMA2previous has been taken as the average of the first two years, and for this assessment $\alpha = 0.3$ has been used.
11. A moving median for past 5 years of sales, as a moving median should be less susceptible to rare events or rapid changes than a simple moving average.
12. A moving median for past 7 years of sales, as a moving median should be less susceptible to rare events or rapid changes than a simple moving average.

E.1.3 Simple sensitivity measures were also calculated as the difference in the maximum and minimum for each smoothing approach using the whole data set and over the last five years, and also the average of the difference between the smoothed value (i.e. when there is a smoothed value from each methodology) and the actual sales value. The premise for calculating the difference in the maximum and minimum was that a smoothing approach which

produced the lowest difference would be less susceptible to sudden changes and hence might be better for long term planning. A larger difference could imply a need for increased frequency of review of the locally derived value for aggregate requirement. The reason for evaluating the difference between the smoothed value and the actual sales value average was to provide an indicator as to which of the smoothed values was closest on average to the actual sales values.

E.1.4 The variations to the basic moving averages were applied, in part to see their sensitivity to the years of data used, and in part with a view to not weighting very recent sales data too heavily. Also from a statistical point of view, the moving average, when used to estimate the underlying trend in a time series, is susceptible to rare events such as rapid shocks or other anomalies. Statistically, the moving average is optimal for recovering the underlying trend of the time series when the fluctuations about the trend are normally distributed. But a more robust estimate of the trend is the simple moving median over n time points, as statistically the moving median tolerates shocks better than the moving mean.

E.1.5 The estimated values for both sand and gravel and crushed rock were derived, using sales for the years 1990 to 2009 for sand and gravel, and for crushed rock sales for the years 2001 to 2009 because prior to 2001 the crushed rock sales values do not include ironstone.

E.1.6 The figures for sand and gravel are provided in Table E.1 and Figures E.1 and E.2, along with the change in sales from year to year, with the figures for crushed rock provided in Table E.2 and Figures E.3 and E.4.

E.1.7 In general terms a moving average or other smoothing function such as a moving median, will tend to lag behind the actual trend, hence the values derived by applying the smoothing techniques were generally higher than the actual past sales values due to the notable decline in Oxfordshire's aggregate sales over the last decade. The appraisal indicates that a cumulative average of all sales is a steady measure of historical consumption which would be relatively resistant to possible increase in future sales. But the cumulative average does not follow the trend as well as the other smoothing approaches, and maybe too cautious an approach on which to base possible aggregate requirement, particularly given the magnitude of recent year on year changes in sales.

E.1.8 The other smoothing approaches generally showed similar trends though differed in the amount by which they varied from past sales data. For sand and gravel the closest smoothed values are 325-350,000tpa greater than the past sales data for the last five years. For crushed rock, the closest smoothed values are 20-65,000tpa on average greater than past sales data. It is acknowledged that for certain smoothing approaches, e.g. the exponential moving average, it could be possible to refine the smoothing to reduce the differences in both cases.

E.1.9 However given the generally similar trends of the smoothing approaches, it is suggested that if Oxfordshire's future aggregate requirement was to be derived based on past sales data, application of one of the simpler smoothing methods would suffice e.g. a seven or five year moving average or moving median (the median being the middle value from during the period). That should ensure an initial buffer above recent past sales sufficient to absorb an increase in sales in the short term i.e. one to three years.

E.1.10 But in times of strongly rising aggregate consumption, determination of aggregate requirement based on a smoothing function could forecast less demand than actual sales. That could result in the land bank for the required aggregate being diminished at too rapid a rate.

E.1.11 Hence a more precautionary approach would be to apply an additional contingency buffer, for example 10% to 20%. Thus Oxfordshire's future aggregate requirements could be simply based on for example a seven year moving median (as that approach entails no calculations) plus a buffer amount, which based on past sales data to 2009 would be as follows:

- For sand and gravel, as a seven year moving median: 1.17mtpa. Including a nominal 10% buffer of 0.12mtpa buffer would give 1.29mtpa.

- For crushed rock, as a seven year moving median: 0.56mtpa. Including a nominal 10% 0.06mtpa buffer would give 0.62mtpa.

E.1.12 If alternative aggregates contribute 27% of total aggregate supply, and total primary aggregate demand was 1.73mtpa, the amount of alternative aggregates requirement would be 0.64mtpa.

E.1.13 This approach would be relatively uncomplicated and also easy to subject to regular review, with the example buffer amounts as fixed values for simplicity, rather than a percentage.

Table E.1 – Results of smoothing applied to Oxfordshire's past sand and gravel sales data ('000 tonnes)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Sensitivity Assessment		
Oxon sand & gravel sales	2445	1631	1715	1632	1856	1881	1875	1908	2068	1970	1866	1925	1787	1606	1480	1289	1166	1059	780	628	**All**	**5yrs**	**Avg**
Year to year change in sales		814	-84	83	-224	-25	6	-33	-160	98	104	-59	138	181	126	191	123	107	279	132			
1.Moving 7 yr average excluding max & min.							1792	1792	1847	1898	1900	1912	1909	1891	1831	1733	1606	1466	1320	1155	757	578	189
2.Cumulative average of past data		2038	1930	1856	1856	1860	1862	1868	1890	1898	1895	1898	1889	1869	1843	1808	1771	1731	1681	1585	313	225	250
3. Moving 5yr average					1856	1743	1792	1830	1918	1940	1937	1947	1923	1831	1733	1617	1466	1320	1155	984	963	633	116
4. Moving 5yr average plus 5yr standard deviation					2198	1863	1904	1943	2004	2021	2021	2024	2029	1974	1918	1868	1713	1544	1416	1258	771	609	285
5. Moving 5yr average excluding last 2yrs							1856	1743	1792	1830	1918	1940	1937	1947	1923	1831	1733	1617	1466	1320	627	511	246
6. Maximum of past 5 yrs					2445	1881	1881	1908	2068	2068	2068	2068	2068	1970	1925	1925	1787	1606	1480	1289	779	636	331
7. Linearly weighted moving average for past 5yrs					1934	1700	1754	1792	1888	1916	1934	1959	1964	1885	1806	1723	1570	1414	1263	1098	865	624	153
Weighting for above	5	4	3	2	1																		
8. Linearly weighted moving average for past 7yrs							1900	1735	1790	1832	1903	1921	1930	1930	1906	1815	1720	1622	1468	1307	623	508	241
Weighting for above	7	6	5	4	3	2	1																
9. Exponential moving average 1		2038	1753	1726	1660	1797	1856	1869	1896	2017	1984	1901	1918	1826	1672	1538	1364	1225	1109	879	1138	659	83
10.Exponential moving average 2		2038	1941	1848	1851	1860	1864	1877	1935	1945	1921	1923	1882	1799	1703	1579	1455	1336	1169	1007	938	389	134
11. Moving 5yr median					1715	1715	1856	1875	1881	1908	1908	1925	1925	1866	1787	1606	1480	1289	1166	1059	866	386	114
12. Moving 7yr median							1856	1856	1875	1881	1881	1908	1908	1908	1866	1787	1606	1480	1289	1166	742	509	204

Figure E.1 – Results of Smoothing of Applied to Oxfordshire's Sand and Gravel Past Sales Data – First Six Methodologies

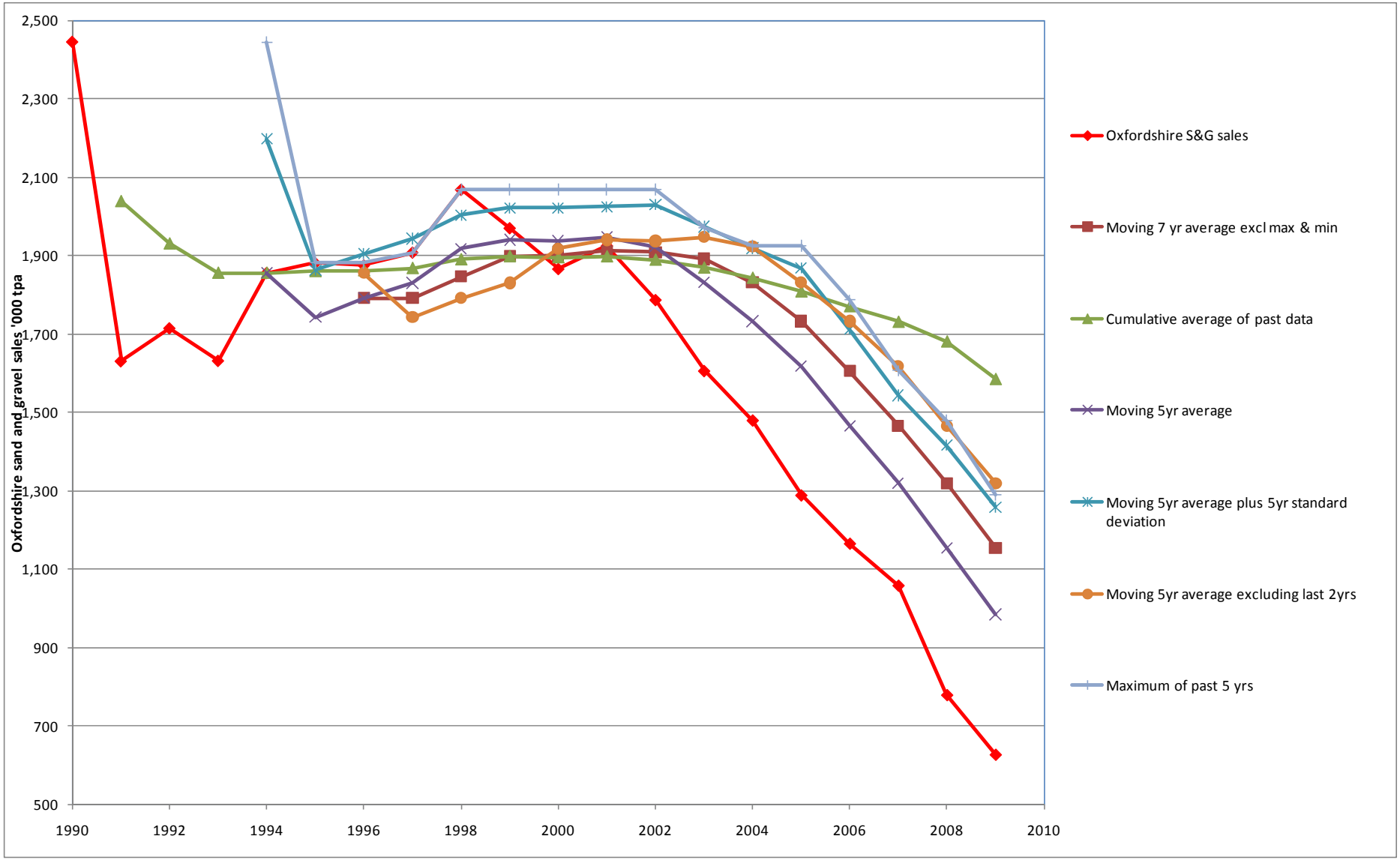


Figure E.2 – Results of Smoothing of Applied to Oxfordshire's Sand and Gravel Past Sales Data – Second Six Methodologies

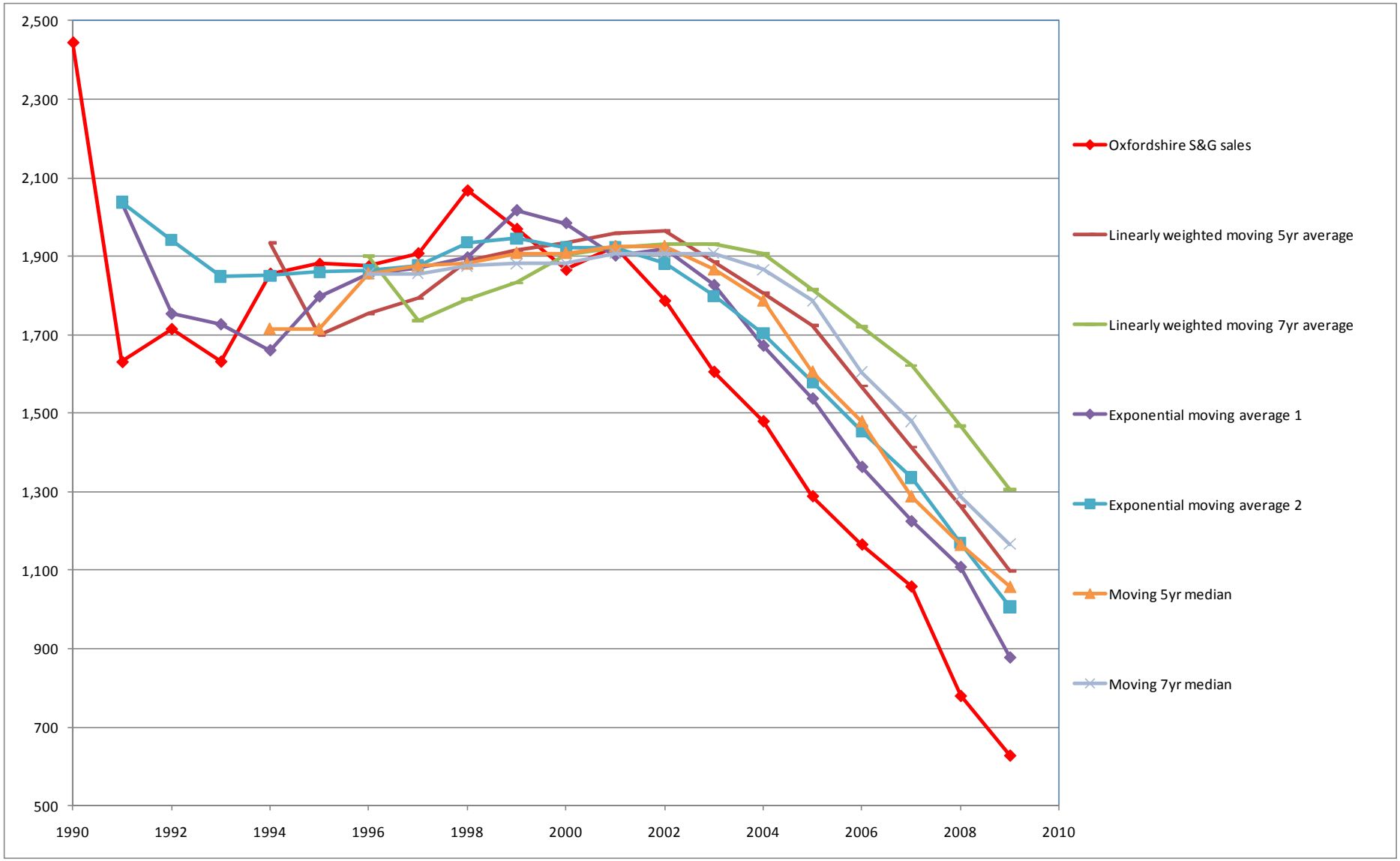


Table E.2 – Results of smoothing applied to Oxfordshire's past crushed rock sales data ('000 tonnes)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Sensitivity Assessment		
Oxon crushed rock sales, pre 2001 excludes ironstone so only 2001 onwards has been used for the appraisal	1842	905	590	559	706	644	719	441	494	562	732	1050	923	620	557	546	495	655	618	433	**All**	**5yrs**	**Avg**
Year to year change in sales		-937	-315	-31	147	-62	75	-278	53	68	170	318	-127	-294	-72	-11	-51	160	-37	-185			
1.Moving 7 yr average excluding max & min.																		662	601	569	93	93	42
2.Cumulative average of past data													987	867	790	741	700	694	684	656	330	85	158
3. Moving 5yr average																741	630	576	574	549	192	192	65
4. Moving 5yr average plus 5yr standard deviation																972	801	641	637	639	335	335	189
5. Moving 5yr average excluding last 2yrs																		741	630	576	165	165	80
6. Maximum of past 5 yrs																1050	923	655	655	655	395	395	238
7. Linearly weighted moving average for past 5yrs																833	693	577	559	556	276	276	94
Weighting for above	5	4	3	2	1																		
8. Linearly weighted moving average for past 7yrs																		769	695	575	195	199	101
Weighting for above	7	6	5	4	3	2	1																
9. Exponential moving average 1													987	942	723	607	564	516	613	617	471	101	93
10.Exponential moving average 2													987	879	783	712	647	649	640	578	409	134	136
11. Moving 5yr median																629	557	557	557	546	83	83	20
12. Moving 7yr median																		629	618	557	72	72	33

Figure E.3 – Results of Smoothing of Applied to Oxfordshire's Crushed Rock Past Sales Data – First Six Methodologies

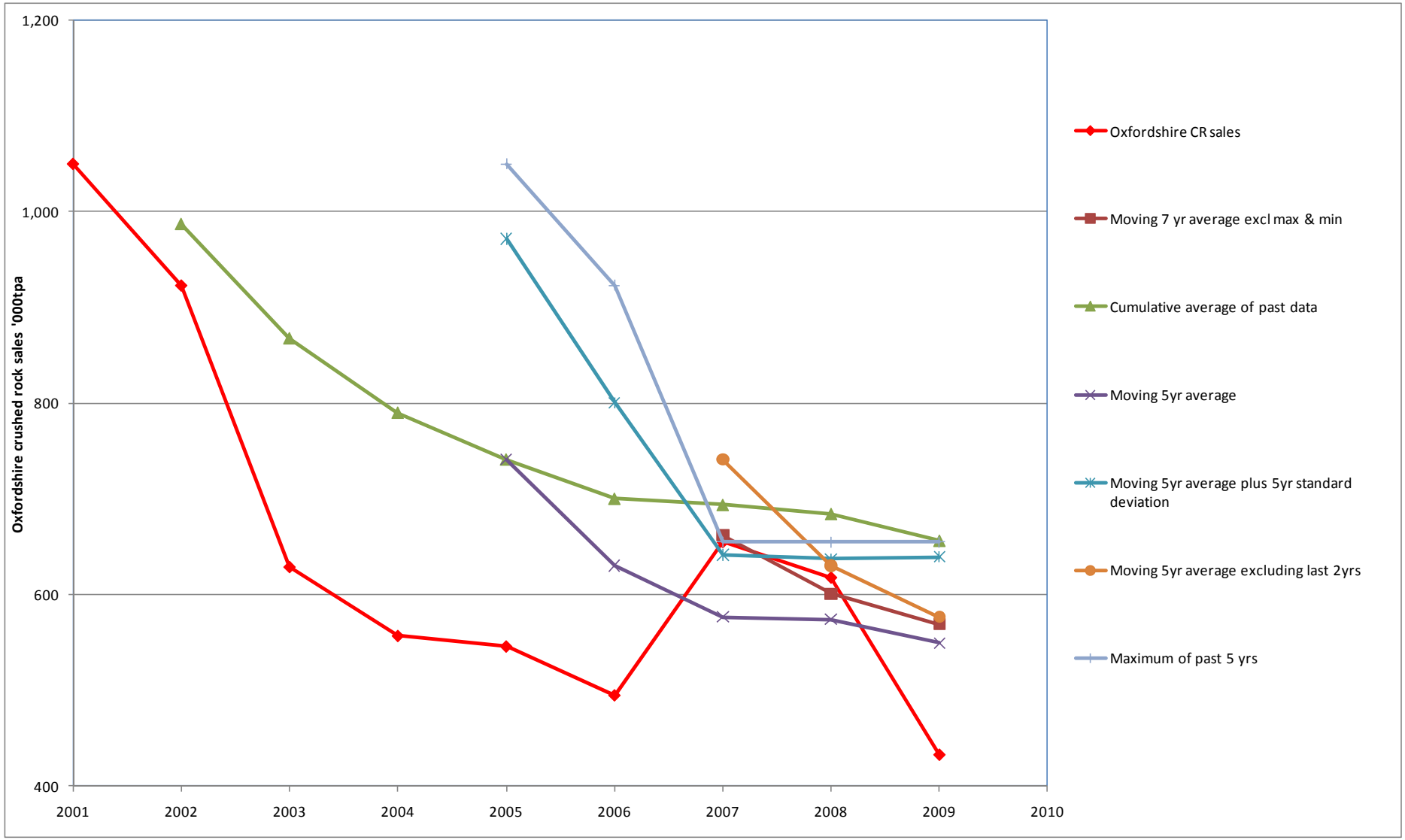
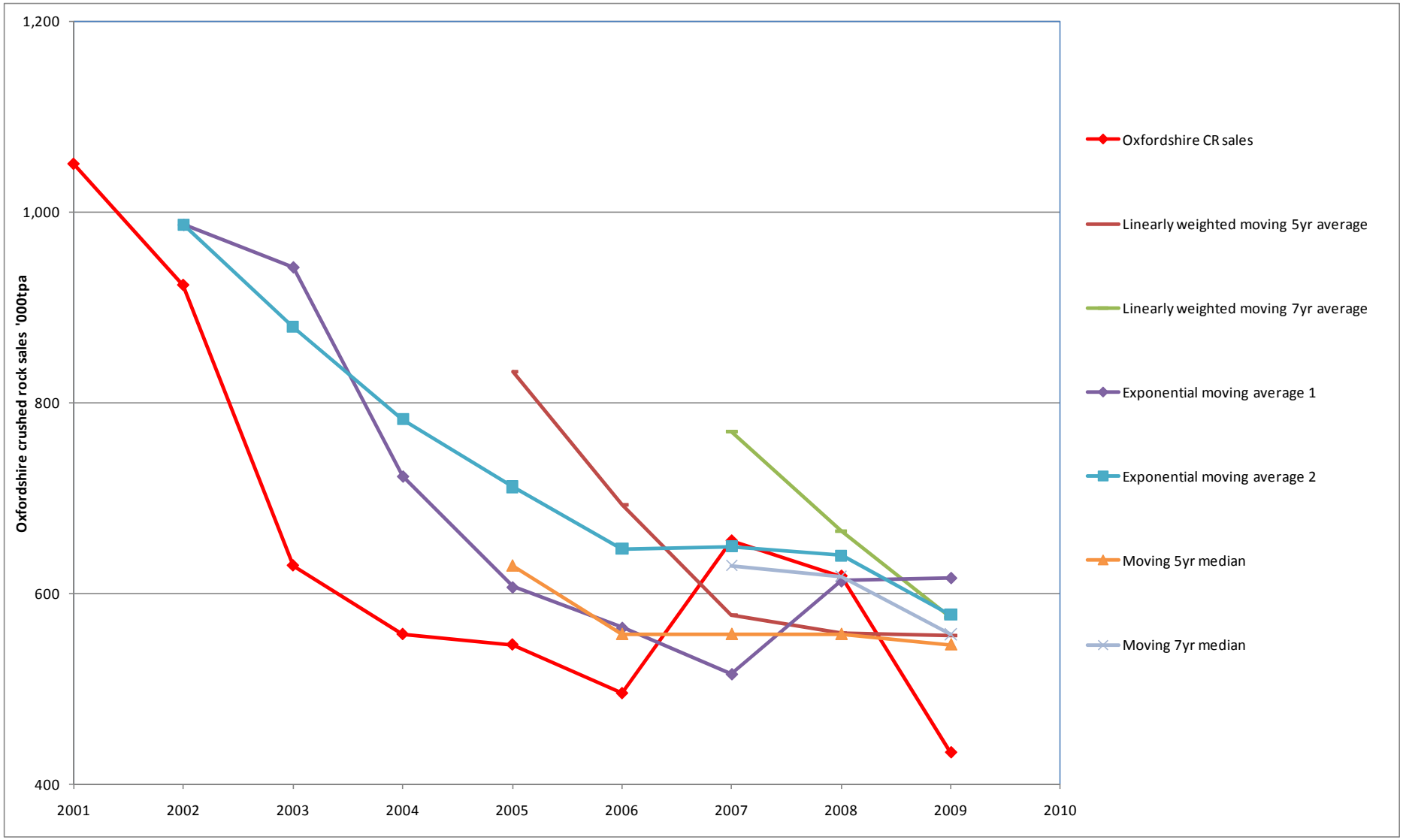


Figure E.4 – Results of Smoothing of Applied to Oxfordshire's Crushed Rock Past Sales Data – Second Six Methodologies



E.2 Description of comparison of national and local housing provision

E.2.1 A comparison was made of Oxfordshire's current planned housing provision against national housing statistics and national aggregate consumption, in other words using housing completions as a proxy for development and hence for total aggregate consumption. The reason for using housing as a proxy is because the relevant information is available; housing development is accompanied by other types of development in tandem, such as roads, drainage, schools, health facilities, employment and retail developments. Therefore each house represents a 'development unit' which implicitly includes this related development as well. In addition, housing and related developments involve the use of alternative aggregates as well as primary aggregates. This means that, provided there is no significant difference in the national and local rates of utilisation, or reason to believe that a significant difference may occur in Oxfordshire, the methodology implicitly also addresses the contribution from alternative aggregates to the overall supply of aggregates.

E.2.2 In this methodology, figures from 2001 to 2009 were used because this is the period over which both sand & gravel and crushed rock sales have been recorded on a consistent basis.

E.2.3 Total statistics for permanent dwellings completed in England for the years 2001 to 2010 were obtained from the CLG website. Permanent dwellings completed are collated from the annual P2 returns from local authorities.

E.2.4 Total primary aggregate sales in England for the same period were obtained from the annual Aggregates Raised survey reports on the ONS and CLG websites. The figures include marine sand and gravel. Marine sand and gravel made up some 18% of total national primary aggregate throughout this period, whereas Oxfordshire's consumption of marine sand and gravel is minimal. However, the inclusion of marine sand and gravel is considered appropriate because the methodology looks at total primary aggregate used per 'development unit' nationally and then takes account of Oxfordshire's aggregate supply source by applying this to the types of aggregates found in Oxfordshire.

E.2.5 A comparison was made of the number of tonnes of total primary aggregate sales per 'development unit' as shown in the following table.

Table E.3 – Comparison of England total aggregate sales with net dwellings completed

Year	Permanent dwellings completed ENGLAND	Total primary aggregate sales 1000t ENGLAND	Tonnes per 'development unit'
2001	129,510	169,202	1,306
2002	136,800	158,967	1,162
2003	144,060	153,342	1,064
2004	154,070	160,135	1,039
2005	159,450	151,431	950
2006	160,850	152,757	950
2007	175,560	150,059	855
2008	142,680	136,848	959
2009	118,160	106,195	899

E.2.6 A similar comparison between Oxfordshire's own housing completions and aggregate sales was considered, but the values varied over a wide range with significant swings from one year to another, and because the sales values ignore imports and exports the results do not represent net consumption. However, logically the conclusion was that there is no reason to assume that the profile of development in Oxfordshire on average uses a significantly different amount of primary aggregate than development elsewhere, so the national figure was considered most appropriate.

E.2.7 It is also notable that the figure of tonnes per 'development unit' declines notably over the study period. Accordingly it was necessary to adopt a view of the most appropriate value to apply. Possible values suggested from Table E.3 are:

- The minimum of the last 5 years = 855 tonnes per 'development unit'.
- The maximum of the last 5 years = 959 tonnes per 'development unit'.
- The average of the last 5 years = 922 tonnes per 'development unit'.

E.2.8 In view of the fact that the figure has generally fallen over the whole period, the earlier years were ignored in favour of more recent figures. In the last 5 years the figure has both fallen and risen, so the average is considered the most appropriate value to use.

E.2.9 Oxfordshire's future housing figures are based on The South East Plan housing targets for the period 2006-2026, minus completions to date (2010) obtained by Oxfordshire County Council from the district councils in Oxfordshire. The figures are shown in Table E.4 – Ox

Table E.4 – Oxfordshire Planned and windfall housing completions

District	SE Plan target 2006-2026*	Completions 2006-2010	Residual 2011-2026
Oxford City	8,000	2,272	5,728
Cherwell District Council	13,400	2,172	11,228
South Oxfordshire District Council	10,940	1,124	9,816
Vale of White Horse District Council	11,560	1,738	9,822
West Oxfordshire District Council	7,300	2,639	4,661
County	51,200	9,945	41,255

E.2.10 The residual figure for 2011-2026 of 41,255 was divided by 16 to calculate an average number of houses per annum = 2,578. This is an increase on the average number of dwellings completed per year over the period 1996-2010 which was 2,396; over the period from 2001-2010 which was 2,365; and over the period 2006-2010 which was 2,486.

E.2.11 Applying the 5 year average tonnes per 'development unit' from Table E.3 to this average annual rate of house building would give a notional figure of total primary aggregate consumption in Oxfordshire for each year in the plan period, whether this was to 2026, or beyond. This total primary aggregate consumption can then be divided into fractions according to the relative proportions of sand and gravel sales and crushed rock sales in Oxfordshire, on the assumption that the ratio of sand and gravel consumption to crushed rock consumption is the same as that for sales.

E.2.12 Possible values for the appropriate relative proportions of sand and gravel sales to crushed rock sales were derived for the period 2001 – 2009, as shown in Table E.5 – Co.

Table E.5 – Comparison of Oxfordshire's Sand & Gravel and Crushed Rock sales

Year	Oxfordshire S&G sales '000 tonnes	Oxfordshire CR sales '000 tonnes	Total aggregate Sales '000 tonnes	S&G proportion	CR proportion
2001	1,925	1,050	2,975	0.65	0.35
2002	1,787	923	2,710	0.66	0.34
2003	1,606	629	2,235	0.72	0.28
2004	1,480	557	2,037	0.73	0.27
2005	1,289	546	1,835	0.70	0.30
2006	1,166	495	1,661	0.70	0.30
2007	1,059	655	1,714	0.62	0.38
2008	780	618	1,398	0.56	0.44
2009	628	433	1,061	0.59	0.41

E.2.13 The range of possible values is:

- The maximum proportion of sand and gravel sales to crushed rock sales = 73:27
- The average proportion of sand and gravel sales to crushed rock sales = 66:34
- The minimum proportion of sand and gravel sales to crushed rock sales = 56:44

E.2.14 In view of the fact that the proportions have swung both ways over the period, the average is considered the most appropriate value to use, because it reflects the recent situation and is not specific to any one year.

E.2.15 A factor should then be applied to allow for a continuation of export of Oxfordshire's primary aggregates to balance off the ongoing import of other types of primary aggregates needed in order to achieve the required range of total aggregate types required by the construction industry.

E.2.16 The allowance for the continuation of 'trade' can be estimated in 2 ways. The first way would be to base it on a comparison of the total aggregate sales for Oxfordshire against a figure for total aggregate consumption in Oxfordshire derived from Table 11 of the AM2005 report which shows consumption for BOB counties. The second way would be to use the indicator comparison of Oxfordshire's net consumption per year derived from the consumption per head of population figures. Both methodologies are considered in Chapter 3.

E.2.17 The results from these two methodologies differ markedly.

E.2.18 A calculation of the balance of 'trade' based on the figures in Table 11 from the AM2005 Report suggests that Oxfordshire's total primary aggregate sales were 1.09 times its primary aggregate consumption.

E.2.19 Looking at the population figures for consumption of primary aggregates per head in Chapter 3, would suggest instead that the balance of 'trade' has changed significantly over the period 2001 – 2009. In 2001, the calculations suggest that Oxfordshire's total primary aggregate sales were 1.42 times its primary aggregate consumption, the ratio was at about parity in 2004 and 2005 and in 2009 aggregate sales was only 81% of primary aggregate consumption. The information from Chapter 3 is reproduced here in Table E.6.

Table E.6 – Comparison of consumption per head with total aggregate sales in Oxfordshire 2001-2009 to give ratio of sales to consumption

Year	England primary agg sales	England Popu-lation	Tonnes of Primary agg per head	Oxford-shire Popu-lation	Estimated Oxfordshire primary aggregate consumption	O'shire total primary agg sales	Ratio of sales/ consum ption
2001	169,202	49138831	3.44	607300	2091	2975	1.42
2002	158,967	49652000	3.20	610600	1955	2710	1.39
2003	153,342	49866000	3.08	616700	1896	2235	1.18
2004	160,135	50111000	3.20	621100	1985	2037	1.03
2005	151,431	50466000	3.00	627500	1883	1835	0.97
2006	152,757	50762900	3.01	629600	1895	1661	0.88
2007	150,059	51092000	2.94	632300	1857	1714	0.92
2008	136,848	51456500	2.66	635500	1690	1398	0.83
2009	106,195	51809700	2.05	640300	1312	1061	0.81

E.2.20 This produces two scenarios for consideration: either an allowance for net exports as per the AM2005 figures, or a view taken on an appropriate balance of trade from the figures in Table E.6.

E.2.21 The following assessments assume that there is a net parity balance of 'trade' of 1.0; i.e. that Oxfordshire consumes the same amount of primary aggregates as it produces. According to the figures in Table E.6 was the approximate position between 2004 and 2005, before the recent fall in sharp sand and gravel and crushed rock sales. It is very important that this assumption is cross checked when the AM2009 survey report is published, and a comparison made against the figure of 1.09 derived from the AM2005 Report.

E.2.22 Combining the figures of average dwellings completed per year (2,578), with the average value of tonnes per 'development unit' (922) and disaggregating the results between sand & gravel and crushed rock sales according to the average proportion of 66:34 and then applying the parity trade allowance (no change to results) suggests the following figures for sand and gravel and crushed rock:

- Sand and gravel – 1.58 mta
- Crushed rock – 0.81mta.

E.2.23 If alternative aggregates contribute 27% of total aggregate supply, and total aggregate demand was 2.39 mta, the amount of alternative aggregates requirement would be 0.88mtpa.

E.2.24 These figures, as with all calculations, are sensitive to the assumptions implicit in the methodology. In this case the following needs particularly to be noted:

- The national housing figures are completions of new build housing; this is converted into a notional tonnes of primary aggregate per 'development unit' using total primary aggregate sales in the same year, including marine sand and gravel. The inclusion of marine sand and gravel is considered appropriate because the methodology looks at total primary aggregate used per dwelling 'as a proxy for 'development units' nationally and then takes account of Oxfordshire's aggregate supply source by applying this to the types of aggregates found in Oxfordshire.

- The result will be influenced by the choice of the appropriate values for both primary aggregate consumption per 'development unit', and the relative proportions of sales of sand and gravel to crushed rock, both of which vary over the period of available data.
- The number of tonnes of primary aggregate per 'development unit' declines in the period 2001-2009. The assessments for future consumption assume a constant value derived from an average over the last 5 years. This is because the trend downwards breaks down in the last 5 years, making an assumption of ongoing decline questionable. This could be reviewed annually as national figures become available.
- The average tonnes used per typical dwelling (60 tonnes) represents only 6.5% of the estimated 922 tonnes per 'development unit' used in the calculations. Consequently there may be less confidence in using new building housing as a proxy for overall development than if the proportion was higher.
- Finally, the figures will also be influenced by the allowance for the net balance of 'trade' between imports and exports. The method assumes a parity ratio between imports and exports, but the figures in Table E.6 suggest that Oxfordshire's position has changed in recent years from being a net exporter to a net importer as the overall consumption of primary aggregate per head of population has fallen. It is recommended that this position is checked when the results of the AM2009 survey are available.

E.3 Description of comparison of national and local per capita consumption of primary aggregates

E.3.1 An alternative approach to deriving a local aggregate supply requirement for Oxfordshire was to multiply Oxfordshire's projected population figures against a comparison of national population statistics with national primary aggregate consumption to give per capita consumption of primary aggregates. In other words, the approach uses population as a proxy for total primary aggregate consumption.

E.3.2 The justification for using population as a proxy for total primary aggregate consumption is that the relevant information is readily available; per capita consumption of primary aggregates implicitly includes all types of new development and also aggregate usage associated with maintenance and repair construction projects, so is possibly a more robust proxy than the previous approach based on new dwellings. As with the previous approach, alternative aggregates are implicitly accounted for in the methodology, so provided there is no significant difference in the national and local rates of utilisation, or reason to believe that a significant difference may occur in Oxfordshire, the methodology implicitly also addresses the contribution from alternative aggregates to the overall supply of aggregates.

E.3.3 Figures from 2001 to 2009 were used because this is the period over which both sand and gravel and crushed rock sales have been recorded on a consistent basis.

E.3.4 Statistics for England's population were obtained from the ONS Website. Total primary aggregate sales in England for the same period were obtained from the annual Aggregates Raised survey reports on the ONS and CLG websites.

E.3.5 A comparison was made of the number of tonnes of total primary aggregate sales per head of population for each of the years in the period to give a figure for tonnes consumed per head. This was then multiplied by the population of Oxfordshire to provide an estimated total consumption of primary aggregates for each year in the study period. The information is the same as in column 4 of Table E.6.

E.3.6 The rate per head falls during the period from 3.44 tonnes per head to 2.05 tonnes per head, there was a period of relative stability in the years 2003 to 2007, but the figure had fallen off sharply since then and the amount for 2009 was a significant fall on the figure for 2008. It is suspected that these last 2 year's figures are influenced by the recent recession and it is considered not reasonable to assume an indefinite continuation of the downward trend, therefore an average of the last 5 years has been taken as an appropriate value to use to estimate future per capita consumption of primary aggregates. This could be reviewed annually as national figures become available.

E.3.7 The five year average of 2.73 tonnes per capita was then applied to population forecast figures for Oxfordshire obtained from the ONS. The projection figures were only provided for years 2013, 2018, 2023, 2028 and 2033, so the figures for the years in between were calculated assuming a steady increase per annum. The resulting population for each year of the plan period was then multiplied by the average per capita consumption to provide an estimated figure for total consumption of primary aggregates for each year in the plan period. The resulting figure was totalled and then subdivided by a figure to represent the appropriate relative proportions of sand and gravel sales to crushed rock sales in Oxfordshire. The figures chosen are the same as those derived in the previous methodology from Table E.5, with the value of the average proportion of sand and gravel sales to crushed rock (66:34) considered the most robust as it reflects the recent situation band is not specific to any one year.

E.3.8 The resulting figures are shown in the following table.

Table E.7 – Projected future consumption of primary aggregates in Oxfordshire

Year	Oxfordshire's population	Total primary aggregate consumption '000 tonnes	Sand and gravel as 66% '000 tonnes	Crushed rock as 34% '000 tonnes
2010	644,175	1,759	1,161	598
2011	648,050	1,770	1,168	602
2012	651,925	1,781	1,175	605
2013	655,800	1,791	1,182	609
2014	659,640	1,802	1,189	613
2015	663,480	1,812	1,196	616
2016	667,320	1,823	1,203	620
2017	671,160	1,833	1,210	623
2018	675,000	1,844	1,217	627
2019	679,220	1,855	1,224	631
2020	683,440	1,867	1,232	635
2021	687,660	1,878	1,240	639
2022	691,880	1,890	1,247	642
2023	696,100	1,901	1,255	646
2024	700,400	1,913	1,263	650
2025	704,700	1,925	1,270	654
2026	709,000	1,936	1,278	658
2027	713,300	1,948	1,286	662
2028	717,600	1,960	1,294	666
2029	721,380	1,970	1,300	670
2030	725,160	1,981	1,307	673
Total consumption 2010-2030		39,238	25,897	13,341
Average consumption 2010-2030		1,868	1,233	635

E.3.9 A factor was then applied to the resulting figures to allow for a continuation of the export of Oxfordshire's aggregates to balance off the ongoing import of other types of primary aggregates needed in order to achieve the required range of total aggregate types required by the construction industry.

E.3.10 As with the housing proxy methodology above, there are two possible scenarios for this factor: either an allowance of 1.09 for net exports as per the AM2005 figures, or a view taken on an appropriate balance of trade from the figures in Table E.6. The following assessments assume that there is a net parity balance of 'trade' of 1.0; i.e. that Oxfordshire consumes the same amount of primary aggregates as it produces. According to the figures in Table E.6 this was the approximate position between 2004 and 2005, before the recent fall in sharp sand and gravel and

crushed rock sales. It is important that this assumption is cross checked when the AM2009 survey report is published, and a comparison made against the figure of 1.09 derived from the AM2005 Report.

E.3.11 Using a factor of 1, suggesting that Oxfordshire has a net balance between imports and exports of primary aggregates, indicates the following figures for sand and gravel and crushed rock:-

- Sand and gravel – 1.23mtpa
- Crushed Rock – 0.64mtpa

E.3.12 If alternative aggregates contribute 27% of total aggregate supply, and total primary aggregate demand was 1.87mtpa, the amount of alternative aggregates requirement would be 0.69 mta.

E.3.13 Again, the results of these calculations are sensitive to the assumptions implicit in the methodology.

E.3.14 In this case the following needs particularly to be noted:-

- The population figures for England were compared against total primary aggregate sales in England, including marine sand and gravel. The inclusion of marine sand and gravel is considered appropriate because the methodology looks at total primary aggregates used per capita and then takes account of Oxfordshire's aggregate supply source by applying this to the types of aggregates found in Oxfordshire.
- The result will be influenced by the choice of the appropriate values for both primary aggregate consumption per capita, and the relative proportions of sales of sand and gravel to crushed rock, both of which vary over the study period. In both cases an average has been used.
- The number of tonnes of primary aggregate per capita declines in the period 2001-2009. The assessments for future consumption assume a constant value derived from an average over the last 5 years. This is because it is suspected that the last 2 year's figures are influenced by the recent recession making an assumption of ongoing decline questionable. This could be reviewed annually as national figures become available.
- Finally, the figures will also be influenced by the allowance for the net balance of 'trade' between imports and exports. The method assumes a parity ratio between imports and exports, but the analysis in Chapter 3 suggests that Oxfordshire's position has changed in recent years from being a net exporter to a net importer as the overall consumption of primary aggregate per head of population has fallen. It is recommended that this position is checked when the results of the AM2009 survey are available.

E.3.15 This methodology using estimated aggregated consumption per head may be viewed as a more robust methodology for assessing future aggregate supply requirement in Oxfordshire than using new build housing as a proxy for overall development. That is because the actual usage of aggregate per house (perhaps 60 tonnes) represents only a small proportion of the estimated aggregate usage per 'development unit' (922 tonnes on average). Hence it could be argued that housing cannot represent a good proxy.

info@atkinsglobal.com
www.atkinsglobal.com