Greater Cambridge HELAA (2021)

Appendix 5: Greater Cambridge Site Typologies and Capacity Study

Greater Cambridge Shared Planning Service

2021

Contents

1. Introduction

1.1. Greater Cambridge Local Plan

1.1.1. South Cambridgeshire District Council and Cambridge City Council are jointly preparing a Local Plan for their two administrative areas – referred to as Greater Cambridge. It will provide a positive, co-ordinated and consistent vision for the future, addressing housing needs and other economic, social and environmental priorities over the period to 2041 and possibly beyond. As part of this planmaking process, the Local Authority is carrying out a Housing and Economic Land Availability Assessment (HELAA).

1.2. Housing and Economic Land Availability Assessment (HELAA)

1.2.1. The purpose of the HELAA is to identify a future supply of land which is available, suitable, and achievable for housing and economic development uses over the plan period. The assessment is an important source of evidence to inform plan-making, decision-taking, and the identification of a five-year supply of housing land. The assessment does not in itself determine whether a site should be allocated for development, rather it is the role of the assessment to provide information on the range of sites which are available to meet the local authority's identified needs. The development plan itself determine which of those sites are the most suitable to meet those requirements.

1.2.2. The guidance states that an assessment should:

- Identify sites and broad locations with potential for development;
- Assess their development potential; and
- Assess their suitability for development and the likelihood of development comingforward (the availability and achievability).

1.3.   Scope of document

1.3.1. The Site Typology and Capacity Study assists the Councils in assessing the development potential of sites. As part of the HELAA process the Councils received representations for sites Call for Sites which was conducted in February and March 2019 and the Local Plan -Issues and Options Consultation which closed on the 24th Feb 2020. These sites have been further supplemented by an identification and audit of other available sites. This study provides a high level methodology for assessing the an indicative capacity of HELAA sites.

1.3.2. To do so, this document:

- Considers a formulaic approach for calculating a site's housing capacity, due to the large number of sites put forward and identified, all of which are required to be assessed.
- Considers an approach for categorising groups of sites that can be delivered to an appropriate density covering a range of contexts in Greater Cambridge. The density should be informed by recent, relevant and successful developments within the Greater Cambridge context, UK and/or International best practice.
- Reviews factors that affect site capacity calculation such as 'gross/net' and 'site-shape modifier'

2.   Key assumptions

2.1.   Strategic scale limitations

2.1.1. The methodology to calculate site capacity is conducted at a strategic scale. A detailed site capacity assessment based on individual site constraints and opportunities is not practical given the large number of sites included in the HELAA process. Therefore, all calculations based on the approach presented in this document should be understood as indicative values to inform early planmaking stages, they should not be used to determine definitive individual site capacities and do not contribute to the planning status of any particular site. The study does not make recommendations on green belt release.

2.1.2. For the preferred options stage of the local plan, further assumptions on using this study are outlined in section 5.6. below.

2.2.   Site typologies

2.2.1. This methodology uses a 'site typologies' approach. Site typologies group sites with similar characteristics and/or geographic locations that have been determined to share a common response to density. Seven different categories of 'site typologies' have been identified, each of which has been assigned a density band as low, medium, high and very high. This is based on criteria that considers sensitivity of a site's context and its accessibility to key facilities, services and infrastructure. These density bands have a value of dwellings per hectare assigned to them - termed 'Applied Density'- that are based on local and best practice case studies.

2.3. Net modifier and site shape modifier

2.3.1. To account for site area inconsistencies and changes of development approach for different scales a capacity modifier based on best practice is considered. The Gross to Net Modifier. The Site shape Modifier makes assumptions about the shapes of sites themselves reducing the overall development potential. It is derived from reviewing local and best practice case studies.

2.3.2. Recommendations on future policies on densities are made based on how the applied density relates to each site typology, the sensitivity of its context and its accessibility to facilities, services and infrastructure.

2.4. Residential density

2.4.1 Residential Density is measured as dwellings per hectare and calculate the number of homes within a given area. It is the established, most common measure of density, identified in the National Planning Policy Framework (NPPF), National Planning Policy Guidance (NPPG) and used as a recognised measure of density within the Councils' local plan policies. Measuring density as dwellings per hectare is particularly useful for HELAA to estimate the number of dwellings a site can accommodate.

2.4.2. For mixed use sites where compatible non-residential uses are delivered on the ground floor with homes above, residential densities remain unchanged and assumes that the site can accommodate the number of dwellings in addition to the other uses and can sensitively accommodate the additional height of non-residential uses.

2.4.3. On larger sites, areas set aside for mixed uses that are typically delivered in stand-alone buildings, such as schools and leisure facilities, are taken into account by the Gross-Net modifier.

2.4.4. A detailed study would be required to assess the housing numbers for large city infill sites that deliver a large proportion of stand alone commercial/retail uses at a later stage.

2.5. House types and development form

2.5.1. While density measured as dwellings per hectare is used to estimate development capacity, it is important to acknowledge its limitations, as it is based on assumptions of certain house types and/or development form. Higher capacities may be achieved on the same site using different housing typologies; for example, apartments would deliver higher dwelling numbers compared to houses, which require a larger private amenity provision. The various local and best practice case studies used to inform density give an indication of the house type most likely to come forward in the various site typologies identified. These house types are then used to make an assumption on the development form for each site typology and estimate capacity.

2.6.   Net density vs. Gross density

2.5.2. Residential density in dwellings per hectare can be measured as Gross Density or Net Density depending on whether the number of dwellings are measured within a 'gross site area' or 'net site area'. Gross site area is defined as the total land area of the development, whereas the net site area is defined as part of the land that is available for developing homes. The net site area is derived by subtracting the land area that is not needed for dwellings and associated areas directly related to them from the Gross Site Area. Net site area not only includes land for dwellings and private spaces, but also other areas of infrastructure and services that contribute to the use and enjoyment directly related to the dwellings.

2.5.3. For the purposes of this study, density is measured as Net Density and is expressed as dwellings per hectare (dph).

- It is the measure of density that most national and local policy documents refer to.
- It is easier to relate to a particular built form.
- It is easier to compare development capacity between a range of sites, large or small in different context. For example, on large sites, gross and net densities vary vastly, whereas on small sites they will generally be the same.
- It is flexible to allow for certain parts of the site to be excluded due to planning constraints identified as part of the HELAA assessment process that would render part of the site undeliverable.
- It does not incorrectly estimate capacities of large sites where developable areas (net) are far smaller than the total development area (gross).
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Figure 1 – Gross to Net Density overview
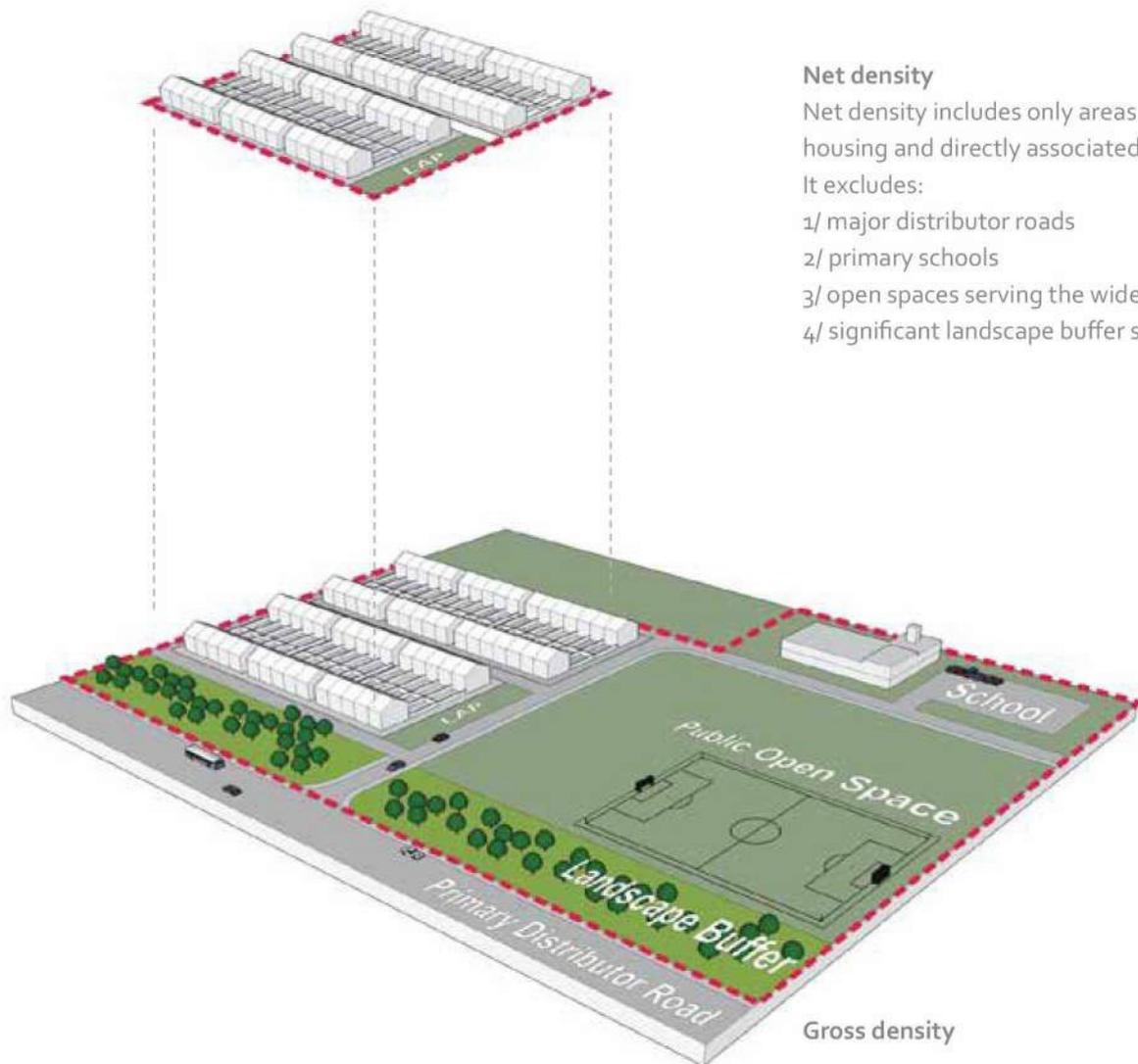
Net density

Net density includes only areas developed for housing and directly associated uses.
It excludes:
1/ major distributor roads
2/ primary schools
3/ open spaces serving the wider area
4/ significant landscape buffer strips.

Gross density
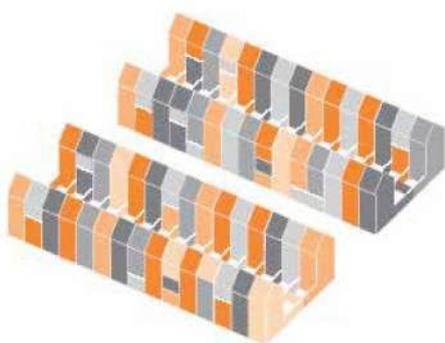
dph / dwellings per hectare

hrh / habitable rooms per hectare

pph / people per hectare

2.7. How is Net Site Area measured?

   2.6.1. The net site area is measured based on national accepted best practice, previously set out in Planning Practice Guidance 3. It includes:

- Buildings and gardens (i.e. private and semi-private spaces).

- Streets that primarily serve to providing access to the homes within the development parcel.

- Parking directly associated with the new homes (i.e. residents and visitors parking).

- Public open spaces and children play areas intended to primarily serve the residents of the development

   2.7.1 Net Site Area does not include:

- The main road corridor and associated verges / buffers that (also) serve other developments.

- Public open space (also) serving residents in the wider areas such as parks, playing fields, strategic open space, visual / ecological buffer zones and green corridors.

- Large Sustainable Drainage System (SuDS) features, such as drainage ponds.

- Community infrastructure such as school, shopping areas, community centre, churches, leisure centre etc, where this is delivered as a stand-alone facility.

2.7.2.   In determining if an open space is included or excluded from the Net Site Area, the following factors have been considered:

2.8.3.1. Size

If a space is large in relation to site area (i.e. significant more than would be expected to be delivered as a policy requirement), it is excluded from the Net Site Area.

2.8.3.1. Use

If the space is likely to see significant use from people outside the development (due to its size, character and location), it should be excluded.

2.8.3.1. Accessibility:

If the space is located on or clearly visible from a through-route (i.e. a primary road and pedestrian/cycle way), it becomes part of the wider community and should be excluded from Net.

2.8.   Climate emergency and COVID-19

2.8.1.   The study is based on established principles of sustainable placemaking which promotes the link between land use and transport planning. This leads to higher densities being proposed in areas with higher levels of active travel and public transport and provision. It takes account of the climate emergency declared by both councils, which requires the reduction of Greater Cambridge's carbon footprint and a change in behaviours including, reducing the need to travel long distances to work, particularly by non-sustainable modes of travel.

2.8.2   The study is conducted during the COVID-19 pandemic, while the medium- and long-term implications on people's work and travel patterns remain unclear. In the short term, the pandemic has accelerated the uptake of digital platforms and increased the practice of remote working and online shopping.

Emerging from the pandemic, there could be long term implications on where individuals chose to live and work, and when and how we commute.

2.8.3. Hence, the principles for densities proposed in the study are still valid i.e. to promote higher densities in areas of high accessibility to sustainable forms of transport and close to places people work.

2..4. In the next few years post COVID-19, a reassessment of this study may be needed, once the medium and long-term impacts become more clear

2.9. Further studies and testing required

2.9.1. Following the identification of a preferred spatial strategy for the Greater Cambridge Local Plan, more detailed site capacity assessments and testing of sites would be required to inform the actual number of homes allocated for each site. The densities proposed consider the implication of their height on sensitive landscape and historic environment contexts. However, further testing of higher densities in sensitive townscape contexts would be required.

3. Site typology and applied density

3.1. Defining the 'Site typology' approach

3.1.1. 'Site Typologies' group sites with similar characteristics and/or geographic location that share a common response to density. This takes account of each site's location, setting and connectivity via sustainable modes (walking, cycling and public transport). It acknowledges the sites status in the settlement hierarchy within the Council's existing Local Plan; i.e. the City Centre, District, Local or Neighbourhood Centre in Cambridge, Rural Centres, Minor Rural Centres, Group Villages and Infill villages in South Cambridgeshire, which are based on access to facilities, services and infrastructure. It also makes assumptions on the most likely housing types within each site typology.

3.1.2. There are some locations that are better connected than others by sustainable modes of transport - walking, cycling and public transport - to key destinations such as major employment sites and centres. Development in well-connected places is more sustainable and suitable for higher densities, as not only do these locations reduce the impact of vehicular trips on the highway network, but they can help strengthen the viability of the existing shops and facilities by increasing their use. The exceptions to this approach are large sites, either in or outside the urban area which have a different but consistent approach to density

3.2. Applied density

3.2.1.   Each Site Typology provides a range of appropriate densities that are proposed based on local differences in connectivity and sites' sensitivities, making assumptions on predominant housing typologies most likely to come forward in these contexts. For example, sites next to a village centre will be better connected to the local shops, and facilities and could be developed at higher densities than sites beyond walking distance from the centre on the edge of a village. However, the setting of the site also needs to be considered; both in terms of prevailing densities in the area and the impact densities would have on the local townscape/landscape character, heritage assets (and their settings). For example, on sites on the edge of settlements or within the historic core within the city centre, a lower density is applied due to the impact the development may have on the landscape, townscape and historic assets.

3.2.2.   Four density bands of Low, Low-Medium, Medium-High and High are developed for the various site typology due to significant variations that exists in different contexts within the Greater Cambridge area. However not all density bands are relevant for all typologies as there may not be that many variations in some typologies and context. For example, a High density band only applies to the Central, Suburban, Rural Connected and Large City Edge/Infill typologies.

3.2.3.   Criteria for assigning low, low-medium, medium-high and high density to various sites have been developed for each typology. These are based on the sites connectivity: access to and distance from higher order public transport (Mass transit) stops, facilities/services and sensitivity of its landscape/townscape. Where there are no facilities/services, the proximity to the core (the geographic centre) of the village is used. The criteria for applying these density bands are stated in each category below.

3.2.5.   A location criteria based approach cannot be used to apply density bands for central and suburban sites within Greater Cambridge because the sensitivity of the site's setting, existing densities and housing typologies varies considerably across the area.

3.2.6.   Density values in dwellings per hectare (dph) are given to each density band after analysing case studies within the Greater Cambridge area and best

practice in similar contexts which are referred to as Applied Density. We have included in the report one most relevant local case study, complemented by one best practice case study in order to represent the applied density value for low, low-medium, medium-high and high density bands for each site typology. The case studies, in each typology takes account of the most likely housing type that could come forward.

3.3.7.   No site-specific density definitions should use these guides as they are indicative for large scale analysis, so an appropriate approach to each context should be applied. For the HELAA, it is proposed that the medium density band is applied, given the large number of sites.

3.3. Site typology categories

Seven categories of sites have been identified for Greater Cambridge – central, suburban, rural connected, rural minor/group, rural infill, large city edge / infill, and new settlement. The last two categories are large sites that create their own identity, establish their own facilities or deliver new sustainable infrastructure to improve connectivity to key destinations. Each site typology is represented in **Error! Reference source not found.** below to provide an understanding of the spatial differences between categories. Walking distances rather than cycling distances have been used to inform the active travel component of these, as the level of cycle provision is variable and shorter distances are more inclusive of a greater number of demographics.

Figure 2 – Spatial overview of site typologies

3.3.1.   Central sites

3.3.1.1.   Central sites are located within the centre of Cambridge based on 5 min (400m) walking distance offset from the city centre boundary (as defined in the adopted Cambridge Local Plan, 2018) as well as the area within 10 min walk (800m) from the railway station as 'the crow flies'.

3.3.1.2.   Low density in this category – 75 dph – Site in established low-density areas that would be highly sensitive to change.

3.3.1.3.   Medium density in this category – 125 dph – Sites in established medium-density areas that would be highly sensitive to change, or in low density areas that can accommodate some change without adverse impact on townscape/heritage assets.

3.3.1.4.   High density in this category – 175 dph – Sites in established high density areas, and in low to medium density areas that can accommodate change without adverse impact on townscape/ heritage assets.

3.3.1.5.   Very high density in this category – 225 dph – Sites in established very high density areas and in lower density areas that can accommodate change without adverse impact on townscape/ heritage assets.

3.3.2. Suburban sites

3.3.2.1.   Suburban sites are within Cambridge and its immediate surroundings, outside of Central (as defined above) or Large City Infill/Edge (as defined in below). These sites are within a 10min walk - 800m - from an existing District, Local or Neighbourhood Centre (as identified in the adopted Cambridge Local Plan, 2018, or which has been proposed as part of an extant planning consent.

3.3.2.2.   Low density in this category – 40 dph – Sites in established low-density areas that would be highly sensitive to change.

3.3.2.3.   Medium density in this category – 60 dph – Sites in established medium-density areas that would be highly sensitive to change, or in low density areas that can accommodate some change without adverse impact on townscape/heritage assets.

3.3.2.4.   High density in this category – 90 dph – Sites in established high density areas, and in low to medium density areas that can accommodate change without adverse impact on townscape/ heritage assets.

3.3.2.5.   Very high density in this category – 120 dph – Sites in established very high density areas and in lower density areas that can accommodate change without adverse impact on townscape/ heritage assets.

3.3.3. Rural connected

3.3.3.1.   Rural connected sites are those within or bordering onto Rural Centres - as identified in the South Cambridgeshire Local Plan 2018 - and/or villages with a mass transit stop/railway station. Sites within or bordering onto any settlement (Rural Centres, Minor Rural Centres, Group Villages or Infill Villages as defined in the South Cambridgeshire Local Plan 2018) and within a 10 minute walk (800m) to a major employment site. Sites within a 10min walk (800m) from a Rural centre or Proposed centre within New Towns of Waterbeach and Northstowe.

3.3.3.2.   Low density in this category - 30 dph – Sites that establish a new edge visible from surrounding landscape or within the village and sensitive to change.

3.3.3.3.   Medium density in this category - 40 dph – Sites further than 400m (5min walk) from the core of the settlement (where the core is not next to the mass transit stop) or further than 800m from a mass transit stop, that can accommodate some change without adverse impact or on a sensitive landscape edge which has the potential to be set back (or screened) due to its large size.

3.3.3.4.   High density in this category – 60 dph –Sites within 400m (5min walk) from the core of the settlement (where the core is not next to the mass transit stop), and between 400- 800m from mass transit stop that can accommodate change without adverse impact.

3.3.3.5.   Very high density in this category – 80 dph – Sites within 400m (5 min walk) from mass transit stop that can accommodate change without adverse impact

3.3.4.   Rural Minor / Group:

3.3.4.1.   Sites not part of Rural Connected category within or bordering onto Minor or Group Villages (as identified in the South Cambridgeshire Local Plan 2018) and not part of Rural Infill: Sites (defined below) .

3.3.4.2.   Low density in this category – not applicable.

3.3.4.3.   Medium density in this category – 30 dph – Sites further than 400m (5min walk) from the core of the settlement, sites that establish a new settlement edge visible from surrounding landscape or within the village and sensitive to change.

3.3.4.4.   High density in this category – 40 dph – Sites within 400m (5min walk) from the core of the settlement or on a sensitive landscape edge which has the potential to be set back (or screened) due to its large size that can accommodate change without adverse impact.

3.3.4.5.   Very high density in this category – not applicable.

3.3.5.   Rural Infill Sites

3.3.5.1.   These are sites within or bordering onto Infill Villages - as identified in the South Cambridgeshire Local Plan 2018 - and not part of Rural Connected category.

3.3.5.2.   Low density in this category – 15 dph – Due to poor sustainable travel connectivity to everyday facilities for these settlements, all sites in this typology have a low density.

3.3.5.3.   Medium density in this category – not applicable.

3.3.5.4.   High density in this category – not applicable.

3.3.5.5.   Very high density in this category – not applicable.

3.3.6.   Large City Infill / Edge Sites

3.3.6.1.   These are groups of sites over 20ha within the suburban and central categories or over 100 ha bordering onto Cambridge and within the Cambridge Green Belt.

3.3.6.2.　　　Low density in this category – 50 dph – Sites without existing or proposed mass transit stop, and potential high impact on the City's landscape and townscape setting.

3.3.6.3.　　　Medium density in this category – 70 dph – Sites without existing or proposed mass transit stop and low to medium impact on the City's landscape and townscape setting.

3.3.6.4.　　　High density in this category – 100 dph – Locations without existing or proposed mass transit stops and relatively low impact of the City's landscape and townscape setting.

3.3.6.5.　　　Very high density in this category – 150 dph – Locations with existing or proposed mass transit stops and relatively low impact of the City's landscape and townscape setting.

3.3.7.　　　New Settlements

3.3.7.1.　　　New Settlements are a large site, or groups of sites, of more than 200 ha, set away from the Cambridge and outside the Cambridge Green Belt. Groups of sites categorised as potential new settlements will retain their primary site typology as well.

3.3.7.2.　　　Low density in this category – 40 dph – Sites without existing or proposed mass transit where a more rural / suburban character is appropriate.

3.3.7.3.　　　Medium density in this category – 50 dph – Sites serviced by mass-transit where it is appropriate to establish an urban character.

3.3.7.4.　　　High density in this category – 60 dph – Sites serviced by mass-transit where it is appropriate to establish a high density urban character.

3.3.7.5.　　　Very high density in this category – not appropriate.

3.3.7.　　　Assumptions

3.3.7.1.　　　Blanket densities are applied to larger sites and represent an average density across the whole site. Given the size of these sites, a gradation of densities within the overall average density should be conducted for any site-specific work to reflect its response to setting and connectivity.

3.3.7.2.   The assumption is that sustainable travel - public transport and active modes - provide an incentive to live closer to reduce travel and encourage more facilities to emerge in these villages. These would include but are not limited to the proposed pipeline of works to be delivered by Cambridgeshire County Council, Greater Cambridge Partnership, the Combined Authority and East-West Rail.

3.3.7.3.   The areas of 20 ha, 100ha and 200ha for large sites are derived from case studies that show these area thresholds will deliver enough no of dwellings to generate a need for their own facilities/infrastructure such as a Primary school.

3.4. Site typology applied density overview

3.4.1. A summary of each typology and their density value measured in dwellings per hectare is provided in Table *1* below.

Table 1:Overview of site typology applied densities for Greater Cambridge

SITE TYPOLOGY	LOW (DPH)	MEDIUM (DPH)	HIGH (DPH)	V HIGH (DPH)
CENTRAL CAMBRIDGE	75	125	175	225
SUBURBAN CAMBRIDGE	40	60	90	120
RURAL CONNECTED	30	40	60	80
RURAL MINOR CENTRE / GROUP	n/a	30	40	N/A
RURAL INFILL	15	n/a	n/a	N/A
CITY EDGE	50	70	100	150
NEW SETTLEMENT	40	50	60	N/A

3.4.2. For the early stages of planmaking, when there is a requirement to identify an applied density for a vast quantity of sites to provide indicative figures of development, it is advisable to use the medium density figure. Medium density is appropriate, as across all scenarios, it considers that an area is sensitive while being able to absorb development growth. For rural infill sites, medium density will be replaced by the low dph as this is the only acceptable density.

3.4.3. As the average difference between low and medium applied densities across all site typologies is 30%, and between high and medium it is 33%, when benchmarking against a developer's figure within this deviation it is possible to use the developer's number as this can be considered medium density.

4. Site Capacity Modifiers

4.1. Gross to Net Site Area Modifier

4.1.1. The sites put forward and identified as part of the HELAA process are gross site areas, while applied densities are measured as net site density which relates to net site area. Hence there is a need to include a Gross to Net modifier in order to calculate the overall capacity of dwelling that can be accommodated on site, using the same metrics and thus not over estimate the site's capacity. Net density is used to consistently measure/compare development potential across all sites submitted.

4.1.2. The part of a development site that is used for the construction of homes (i.e. the Net site area) becomes proportionally smaller as the size of the development increases. This is because on very small sites, the development would typically make use of existing streetsand facilities, whereas on a larger sites, roads, open spaces, SUDS, community facilities and other elements would be delivered on site.

4.1.3. The Site Capacity Calculation will take account of different site sizes by grouping the sitesin broad size bands and assigning a gross to net ratio to each.

4.1.4.   Research undertaken by URBED as part of the "Tapping the Potential" report suggests thatfor small sites the net site area is typically equal to the gross site area. Conversely on largesites the Net Site area may only be 50% of gross site area. The report suggests the use of Gross to net ratios according to site area as set out in Table 2 below.

Table 2 Gross Net Site Area Modifier. Source: Tapping the Potential, URBED, 1999

Site Description	Percentage of site
Up to 0.4 hectares	**100%**
0.4 hectares up to and including 2 hectares	**75-90%**
Over 2 hectares	**50-75%**

4.1.5.   It should be noted that the gross-to-net ratios corresponding to each site area band in Table 2 is broad. Hence the possibility of over- or under-estimating site capacity by applying an average figure is considerable. The report also suggests that ratios selected in capacity work should be drawn up in light of the local context.

4.1.6.   Using Table 2 as a base and the finding of over 75 local and national best practice developments, the Gross to Net Ratios have been refined to be applied to sites in the Greater Cambridge Area. From this wecan conclude the following:

- In the vast majority of the 28 case studies of very small sites (less than 1 hectare), the net and gross development area is the same. These are generally infill sites that utilise existing infrastructure for primary access and

are too small to provide spaces that would be used by the wider community. Thus, for sites under 1 hectare a gross-to-net modifier of 1 should be applied.

- Nine of the case studies reviewed were between 1 and 2 hectares in size. These sites generally include some strategic or buffer landscaping or may include a public route through the site that is deducted from the net site measurement. However, like the verysmall sites, these sites are too small for significant contribution to wider community usage. For sites between 1 and 2 hectare a gross-to-net modifier of 0.9 should be applied.

- At the other end of the spectrum, the case study review included 20 large to very largesites of 10 to 580 hectares. The gross-to-net ratio for these large sites was found to be relatively consistent between 0.4 and 0.5, with a slight increase for brownfield developments. We therefore propose to separate these large sites in a greenfield anda brownfield category with a gross-to-net modifier of 0.5 and 0.6 respectively.

- The finding for the sites in between the small and large sites (2-10 hectares) was lessconclusive. Of the 16 sites reviewed, the gross-to-net figure ranged from 0.4 to 0.95. As expected, the gross-to-net ratio was generally found to decrease as the size of the site increased, but there were several discrepancies in the pattern. We also found no clear relation between gross-to-net and the context of the site (i.e. rural greenfield or urban infill). Therefore, we have taken an average, gross-net ratio of the case studies evaluated, with a split for sites measuring 2-5 ha and 5-10 ha of 0.8 and 0.7, respectively.

4.1.7. Table *3* below outlines how different size sites should be treated to modify the gross area to a net area. Very small sites under one hectare should be unmodified, small sites between one and two hectares should assume a modification to 90% of their gross area, medium sites between two and five hectares should assume a modification of around 80% of their gross site area, large sites between five and ten hectares should assume 70% of their gross site area, and very large sites over ten hectares should assume 60% and 50% in urban and rural settings respectively.

Table 3 Gross to Net Site Area Modifier

Site Description	Site Area	Modifier (% of site)	Note
Very small sites	<1 ha	100	**All infrastructure delivered off-site.**
Small sites	1-2 ha	90	**Likely to include some (public) through-routes / green corridors, but majority of infrastructure serves development only.**
Medium sites	2-5 ha	80	**Include a limited amount of infrastructure – circulation space, through routes, buffer zones**
Large sites	5-10 ha	70	**Include a limited amount of infrastructure – circulation space, through routes, buffer zones**
Very large sites urban	>10 ha	**60**	**Typically deliver larger amount of Strategic Open Space, SuDS and road infrastructure, and also typically include primary schools.**

4.2. Site shape modifier

4.2.1. Site shape modifiers are used in Site Capacity Calculations to take account of awkward shaped sites that are more difficult to develop efficiently. Awkward shape sites include sitesthat are Triangular shaped, Irregular shaped, Narrow shaped and Narrow shaped with restricted frontage.

4.2.2. The size of typical houses and plots are based on standard dimensions which results in blocks being of a similar size and generally rectangular in shape. When fitting this onto anawkwardly sized or shaped site, this results in "left-over" space. Although this can to someextent be addressed by the use of innovative architectural forms, these bespoke building types do not tend to be generally used. For the purposes of this study there is a need to estimate a potential deduction based on a typical, standard approach to site layout and design.

4.2.3. Shape constraints affect the capacity of smaller sites more than larger sites. This is because:

- On larger sites areas of "left-over" space are proportionally smaller.
- On larger sites, the area required for public open space increases. There is more flexibility in sizing and shaping of open space than that of development blocks.

4.2.4. A simple exercise was carried out to determine the shape modifier that should be applied to the capacity calculator, illustrated in Figure *3*. Three standard development scenarios were explored comparing awkward (triangular) sites and regular (rectangular) sites of 1, 2 and 5 ha, with the objective of maximising the development frontage and comparing the total frontage between the rectangular and triangular sites. The ratio between the two frontage length will inform the

value of the shape modifier.

4.2.5. The exercise used the gross-to-net modifier ratio set out in table 2. For example a 1 hectaresite is assumed to have a 100% net coverage whereas a 2 hectare site has 80% coverage. For the purpose of this calculation, the gross area includes a public open space.

4.2.6. Figure 4 demonstrates that the triangular shaped of the site are 10% less efficient thanrectangular sites. This is only true for sites under 2 ha. This has informed site shape modifier stated in Table 4.

Table 4 Site Shape modifier overview

Site shape	Site size	Modifier
Rectangular, square	Any	1
Triangular / irregular / narrow with restricted roadfrontage	<2 ha	0.9
Triangular / irregular / narrow with restricted roadfrontage	>2 ha	1

Note for Figure 4 overleaf: The plotting exercise used two types of plots: a standard plot of 22m depth (10m deep house, 10m back garden, 2m front garden), and a shallow plot of 17m depth (8m deep house, 8m deep garden 1m front garden), and two types of roads: a standard 9.5m wide corridor and a narrow "shared surface" street of 7m. For the purpose of this calculation, the total length of shallow plots have been reduced by 80% as these would require a wider house type.

Site Area: 100 m x 100 m = 1 ha

Type A frontage: 305.5 m
(Standard Plot @ 22 m depth)

Type B frontage: 55 m
(Shallow Plot @ 17.5 m depth)

Total: Type A + Type B = 360.5 m
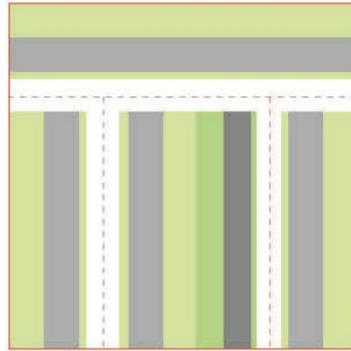
1 ha rectangular block: scale 1:2000 @ A4 as printed

Site Area: 160 m x 120 m= 2 ha

Total type A frontage: 534 m

40 x 75m =
3000 sq.m

22 X 45.5m =
1000 sq.m
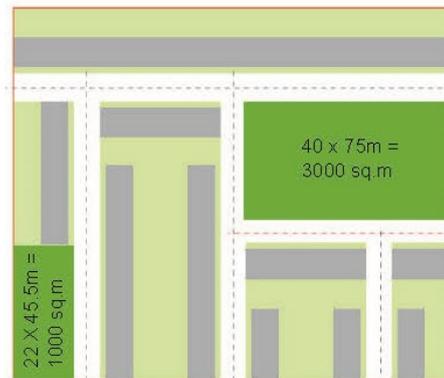
2 ha rectangular block: scale 1:2500 @ A4 as printed

Site Area: 200m x 250m = 5 ha

Type A frontage: 1222.5 m
(Standard Plot @ 22 m depth)

Type B frontage: 144 m
(Shallow Plot @ 17.5m depth)

Total: Type A + Type B = 1366.5 m

132 X 175.75m /2 =
10000 sq.m (20 %)
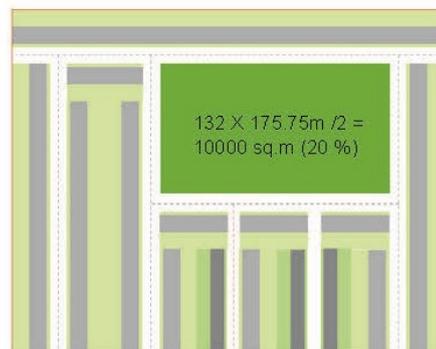
5 ha rectangular block: scale 1:4000 @ A4 as printed

Figure 3 – Site Shape Modifier - rectangular sites three scenarios

Site Area: 141m x 141m/2 = 1 ha

Total type A frontage: 326 m
(Standard Plot @ 22 m depth)

Site modifier: triangular block frontage /
rectangular block frontage = 326 / 360.5 = 0.90
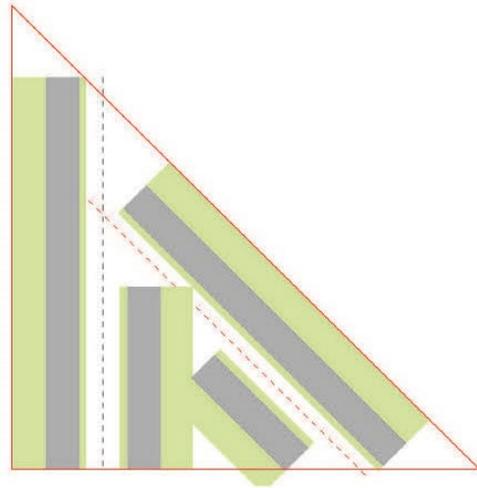
1 ha triangular block: scale 1:2000 @ A4 as printed

Site Area: 200m*200m/2= 2 ha

Type A frontage: 512 m
(Standard Plot @   depth)

Type B frontage: 10 m
(Shallow Plot @ 17.5 m depth)

Total: Type A + Type B = 522 m

Site modifier: Triangular block frontage /
rectangular block frontage = 522/534 = 0.98

60 X 66m /2 =
2178 sq.m

61 X 61m /2 =
1860 sq.m

2 ha triangular block: scale 1:2500 @ A4 as printed

Site Area: 316m x 316m/2= 5 ha

Type A frontage:1338 m
(Standard Plot @ 22 m depth)

Type B frontage: 12 m
(Shallow Plot @ 17.5 m depth)

Total: Type A + Type B = 1350 m

Site modifier: Triangular block frontage /
rectangular block frontage = 1350/1366.5 = 0.99

75 X 75m/2
= 2812 sq.m

120 X 120m /2
= 7200 sq.m
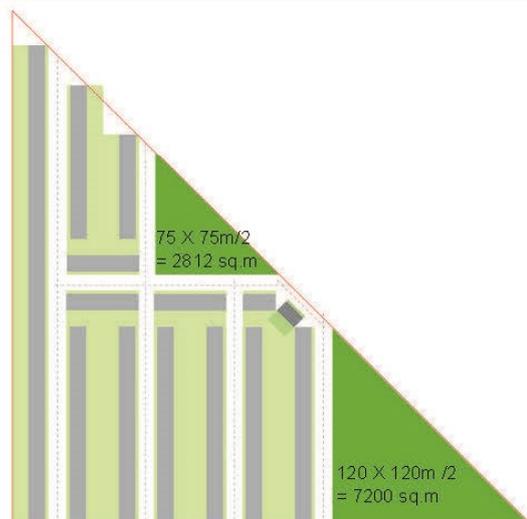
5 ha triangular block: scale 1:4000 @ A4 as printed

Figure 4 – Site Shape Modifier - triangular, 3 scenarios

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# 5. Site capacity calculation

5.1. Site Capacity Calculator (Formula)

5.1.1. The site capacity calculator estimates the potential number of dwellings that could be achieved on a site, by applying an appropriate density multiplier taking account of local context, size, and shape of the site. Site capacity is derived by multiplying Site Area, Applied Density, Gross to Net Modifier, and Site Constraints Modifier. This is summarised below:

Site Capacity =　(　Site Area (Ha)

x　Applied Density (dph)

x　Gross to Net Modifier

x　Site Shape Modifier　)

5.2. Site Area

5.2.1. Site area is the Gross Site Area in hectares (ha).

5.3. Applied density

5.3.1. As described in section 3, Site typology and applied density, applied density the proposed net density value associated to a low, low-medium, medium-high and high density band assigned to site typologies which groups sites with similar characteristics and/or geographic location that share a common response to density. The net density value is derived after analysing local and best practice case studies in similar context. .

5.4. Gross-net modifier

5.4.1. Gross-net modifier is a factor equal to or smaller than 1 that serves to modify the Gross Site Area to a Net Site Area so that the Applied Density (calculated as Net density) can be used. This figure will vary based on the site typology and the size of asite (Please see Table 02).

5.5. Site shape modifier

5.5.1. Site shape modifier is a factor equal to or smaller than 1 that serves to modify the Applied Density (calculated as Net Density) on sites that cannot be developed as efficiently due to their awkward shape (Please see Table 03).

5.6. Applying the site capacity calculation at the preferred options stage

5.6.1. Given the large number of sites that are being assessed at the preferred option stage of the local plan through the HELAA, some further assumptions inform the initial indicative analysis of capacity.

5.6.2. The first is to use the medium density figure outlined in Table *1* for all site typologies (using the low band for the 'rural infill' typology as this does not have a medium value). This enables all sites to be considered in a context that is sensitive to change but can accommodate development. The second, is to assume that all sites are irregular in shape and therefore would be subject to a 10% reduction in gross site area, unless as stipulated in Table *4*, the site is under 2 hectares. It is not practicable to identify deviations from rectangular shapes for over 900 at this stage. All other assumptions in the document remain the same.

5.6.3. Given that the difference between low and medium density, and medium and high density for all site typologies is on average c.30%, when calculating the HELAA site capacity all submitted sites that fall within this deviation from the developer figure will have their number used.

6.　Case Study Information

6.1.1.　This selection of case studies can be read as a density handbook, and is a collection of the most relevant local and best practice case studies that have been used to inform the applied density values for the various density bands (low, low-medium, medium-high and high) for each site typology identified. However,it is important to note that HELAA sites could have densities higher or lower than the applied density values stated in this study and depend on site constraints, design innovation and development opportunities. The actual density delivered on the site would need to be reassessed as part of a formal planning application process.

6.1.2.　For the purposes of this study, one local case study (where available) and one best practicecase study have been represented per density band per site typology. Case studies in each typology take account of the most likely housing type that could come forward. The local case studies are selected from the Greater Cambridge Area while the best practice case studies are selected from UK or International developments which have similar characteristic or/and contexts.

6.1.3.　This section organises the case studies in the order of the site typologies identified. It has a note and summary table at the beginning of each site typology, which provides an analysis of the applied density values for the various density bands. This is followed by local

and best practice case studies. Each local and best practice case study is associatedto a site typology, density band and value. It has a project overview, development specification and a selection of images/plans that provides a good understanding of its context, development form, character and density.

6.1.4. The Development Specification provides the following information:

- Gross Site Area

- Net Site Area

- Number of dwellings

- Gross Density

- Net Density

- Gross-Net Ratio

- Dwelling Mix/typology

- Other uses

- Building heights

- Parking Spaces, Ratio or Strategy

6.1 Central

6.1.1. Case studies show a range of densities from 69 dph to 249 dph that exists within the Central Cambridge Area in differing contexts. The applied density is distinguished into four density bands Low, Medium, High and Very High having 75 dph, 125dph, 175dph and 225 dph respectively. Each band has 50 more dwellings per hectare than the other and provides sufficientdifferentiation in terms of their character and context they could be applied to. It is interesting to note that there have been no local case studies, that could be identified within the high 175 (+/- 10) dph range within the Central Cambridge Area. Hence we have used two best practice examples to inform this range, as it may be applicable for some sites identified as part ofthe HELAA process.

Table 5 Overview of Central case studies

Site Typology Case Study	Site Net Area (ha)	Site Gross Area (ha)	No. of Ho-mes	Densi tyNet	Densi ty Gross	Net-Gross Ratio	Applied Density (dph)
Ceres, CB1, Cambridge	0.55	0.55	137	**249**	249	1.00	**Very High 225**
Parkside Place, Cambridge	0.48	0.48	99	**206**	206	1.00	**Very High 225**
Nightingale Estate, Hackney	2.21	2.21	400	**181**	181	1.00	**High 175**
Harvard Gardens, London	0.88	0.88	147	**167**	167	1.00	**High 175**
Mill Road, Cambridge	1.54	2.14	182	**118**	85	0.72	**Medium 125**
Sutherland Road, London	0.43	0.43	59	**137**	137	1.00	**Medium 125**
Eden Street, Cambridge	0.10	0.10	8	**82**	82	1.00	**Low 75**
Timekeepers Square, Salford	0.52	0.52	36	**69**	69	1.00	**Low 75**

6.1.1. Central – Very high Density: Ceres, Cambridge

Architect: Pollard Thomas Edwards Architects

Application ref. 11/0633/REM

Project overview

The project comprises 150 homes in the form of 6 storey blocks of apartments and duplexes. It is part of the CB1 development in Cambridge City Centre, a new quarter comprising offices and homes arranged around a new park, close to the railway station. The scheme provides 40% affordable housing and includes the restoration of the historic Foster's Mill building.

Development specification

Gross Site Area	0.7 Ha
Net Site Area	0.5 Ha
Number of Units	150
Gross Density	214 dph
Net Density	300 dph
Gross-Net Ratio	1.0
Dwellings mix-typology	1-3 bedroom apartments
Other Uses	A1/A3 Retail & D1Community Uses
Building Height	6-7 Storeys
Parking Spaces	150
Parking ratio	1 space per dwelling

Figure 5 – CERES Cambridge - source: pollardthomasedwards.co.uk

Image credit: to be replaced by Team photos/permission

6.1.2. Central – Very high Density: Parkside Place, Cambridge

Architect:	Glenn Howells Architects
Developer:	Grosvenor
Application ref.	10/0523/FUL

Project overview

A redevelopment of a City Centre site with an existing BLI, the fire station. The scheme sits within the Kite Conservation area, fronting onto Parkers Piece and forms a corner landmark. The project successfully integrates the fire station, commercial uses at ground level, and delivers a **high-density mixed-use** scheme with residential flats and a raised central courtyard.

Development specification

Gross Site Area	0.48 Ha
Net Site Area	0.48 Ha
Number of Units	99
Gross Density	206 dph
Net Density	206 dph
Gross-Net Ratio	1.0
Dwellings mix-typology	1-3 bedroom apartments
Other Uses	Firestation & commercial unit (Class A3) ground floor
Building Height	4-8 Storeys
Parking Spaces	119
Parking ratio	1.2 space per dwelling

Figure 6 – Parkside Place source: Glenn Howells Architects

6.1.3. Central –High Density: Havard Gardens, London

Architect:	Pollard Thomas Edwards Architects
Developer	L&Q

Project overview

Located in South London, the scheme forms part of the redevelopment of the largest housing estate in Europe consisting of 52% affordable homes. Higher densities have been achieved whilst retaining a high proportion of family housing by stacking apartments on top of ground level houses and maisonettes.

Development specification

Gross Site Area	0.88 Ha
Net Site Area	0.79 Ha
Number of Units	147
Gross Density	167 dph
Net Density	186 dph
Gross-Net Ratio	0.9
Dwellings mix-typology	1 - 4 bed large family houses, maisonettes, and apartments
Other Uses	-
Building Height	3-10 Storeys
Parking Spaces	-
Parking ratio	-

Figure 7 – View of Havard Gardens – source: Pollard Thomas Edwards Architects

6.1.3. Central –Medium Density: Mill Road, Cambridge

Architect: Allies and Morrison

Developer: Cambridge Investment Partnership

Application ref: 17/2245/FUL

Project overview

The project consists of 182 dwellings in the form of terraces, mews houses and apartments, that range in height from 2-6 storeys. The development is located in the southeast of Cambridge City, on the site of the former Mill Road Depot, bounded by the railway line to the east. It has community and retail uses with high quality open space accounting for 28% of the site.

Development specification

Gross Site Area	2.14 Ha
Net Site Area	1.54 Ha
Number of Units	182
Gross Density	85 dph
Net Density	118 dph
Gross-Net Ratio	0.72
Dwellings mix-typology	56 houses and 128 apartments
Other Uses	Business and Institution uses, (51sqm)
Building Height	2-6 Storeys
Parking Spaces	101
Parking ratio	0.55

Figure 8 – Computer generated render of Mill Road scheme - source: Allies and Morrison

6.1.3. Central –Medium Density: Sutherland Road, London

Architect: Levitt Bernstein

Developer: East Thames Group

Project overview

Sutherland Road is a new community, located in East London within a mixed character area on previously occupied, semi-derelict industrial land. The scheme delivers high density terraced housing, with a space for doctors to set up practices and an attractive landscape to tie the development together.

Development specification

Gross Site Area	0.43 Ha
Net Site Area	0.43 Ha
Number of Units	59
Gross Density	137 dph
Net Density	137 dph
Gross-Net Ratio	1
Dwellings mix-typology	12 x 1 bed' 40 x 2 bed apartments. 7 x 3 bed houses
Other Uses	Health Centre (650 sq m)
Building Height	5-6 storey apartments and 2 storey houses
Parking Spaces	22
Parking ratio	0.37

Figure 9 – Street elevation of Sutherland avenue scheme – source: Levitt Bernstein

6.1.3. Central –Low Density: Eden Street Backway, Cambridge

Architect: Dpa Architects

Developer: Bidwells Application

Application ref: 12/1443/FUL

Project overview

The project is a redevelopment of a former garage site in the city centre which sits within the Kite Conservation area. Surrounded by 2 storey terraces on Eden Street and Portland Place, the scheme delivers eight houses on a constrained, backland site.

Development specification

Gross Site Area	0.1 Ha
Net Site Area	0.1 Ha
Number of Units	8
Gross Density	82 dph
Net Density	82 dph
Gross-Net Ratio	1
Dwellings mix-typology	5 x 2 bed dwellings and 3 x 1 bed dwellings
Other Uses	-
Building Height	2 storey
Parking Spaces	5
Parking ratio	0.63 space per dwelling

Figure 10:House on Eden Street source – Michael Cameron photography

6.1.3. Central –Low Density: Timekeepers Square, Salford

Architect: Butress

Developer: Butress

Application ref: 14/65810/REM

Project overview

A residential development in Salford at the centre of a Conservation Area, and surrounded by Grade II Listed buildings. The scheme delivers a mix of townhouse typologies, that sensitively respond to the site constrains through layout, scale, massing and retaining key views through the site.

Development specification

Gross Site Area	0.52 Ha
Net Site Area	0.52 Ha
Number of Units	36
Gross Density	69 dph
Net Density	69 dph
Gross-Net Ratio	1
Dwellings mix-typology	2-4 bedroom houses andtownhouses
Other Uses	-
Building Height	3-4 storey
Parking Spaces	27
Parking ratio	0.75 space per dwelling

Figure 11 – Street elevation, Timekeepers Square – source: Buttress Architects & Photographer Daniel Hopkinson

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6.2.   Suburban

Case studies show a range of densities from 42 dph to 130 dph that exists within the SuburbanCambridge Area in differing contexts. The applied density is distinguished into four density bands Low, Low-Medium, Medium-High and High having 40 dph, 60dph, 90dph and 120 dph respectively. Each band has 20 or 30 more dwellings per hectare than the other and provides sufficient differentiation in terms of their character and context they could be applied to.

Table 6 Summary Density Table and Applied Density (Suburban)

Site Typology Case study	Site Net Area	Site Gross Area	No. of Homes	Density Net	Density Gross	Net-Gross Ratio	AppliedDensity (dph
Meadows, Arbury Rd, Cambridge	0.6	0.6	78	**130**	130	1.00	***Very High 120***
Donnybrook Quarter, Hackney	0.36	0.36	40	**111**	111	1.00	***Very High 120***
Colville Road 2, Cambridge	0.7	0.75	69	**99**	92	0.93	***High 90***
Goldsmith Street, Norwich	1.26	1.4	105	**83**	75	0.90	***High 90***
Mitcham's Park, Cambridge	1.6	1.9	106	**66**	56	0.84	***Medium 60***
Accordia, Cambridge	6.65	9.5	378	**57**	40	0.70	***Medium 60***
Marmalade Lane, Cambridge	1	1	42	**42**	42	1.00	***Low 40***
Oakfield, Swindon	*5.27*	*6.43*	*239*	***42***	*37*	*0.82*	***Low 40***

6.2.1. Suburban, Very high density: Meadows, Arbury Rd, Cambridge

Architect: PTE

Developer   Cambridge Investment Partnership

Application ref.   19/1034/FUL and S/4532/19/FL

Project overview

Redevelopment of a leisure centre and car park in walking distance of Arbury Court District Centre. The area lacked cohesion, and the street and park edges of the site were poorly defined. The reprovision and expansion of the leisure centre in a more compact development form allowed for the development of 78 new homes as well as improving the look of the area.

Development specification

Gross Site Area	3.47 Ha
Net Site Area	0.6 Ha
Number of Units	78
Gross Density	22 dph
Net Density	130 dph
Gross-Net Ratio	0.17
Dwellings mix-typology	40 x 1 bed and 38 x 2bed apartments
Other Uses	Community Hub (1845sq m + 40 parking spaces
Building Height	3 - 6 Storeys Apartments
	2 storey Community Hub
Parking Spaces	39
Parking ratio	0.5 space per dwelling

Figure 12 Pollard Thomas Edwards - credit

6.2.2. Suburban, Very high density: Donnybrook Quarter, Hackney

Architect: Peter Barber Architects

Developer: Circle Anglia Housing Trust, (previously Circle 33) and Old Ford Housing

Project overview

Donnybrook Quarter is a low rise, high density street-based city quarter located on a prominent corner site in Hackney, London. The scheme is laid out around two new tree lined streets which cross the site to create strong spatial connections with adjacent neighbourhoods. The streets have an intimate scale of 7.5m wide and they are bordered on each side by two and three storey buildings. Throughout the project, public space is well overlooked by terraces and feature windows.

Development specification

Gross Site Area	0.36 Ha
Net Site Area	0.36 Ha
Number of Units	40
Gross Density	111 dph
Net Density	111 dph
Gross-Net Ratio	1
Dwellings mix-typology	2 x 1 bed, 2 x 2 bed, 1 X 4 bed houses. 14 x 2 bed duplex, 1 x 3 bed, 3 x 1 bed, 14 x 2 bed apartments. 3 live/work units on Old Ford Road providing 2 x 2 bed, 1 x 1 bed.
Other Uses	119 m2 workspace
Building Height	1-3 storeys
Parking Spaces	-
Parking ratio	1 space per dwelling

Figure 13 Donnybrook Quarter - Image Credit: Greater Cambridge Shared Planning

6.2.3. Suburban- High Density: Colville Road 2, Cambridge

Architect: bptw
Developer: Cambridge Investment Partnership
Application ref.   19/1034/FUL

Project overview

Redevelopment of low-quality affordable homes located within minutes of Cherry Hinton High Street. The existing development included 24 apartments in two three-storey blocks. The new development will consist of 63 apartments and 6 family homes, nearly trebling the density whilst retaining a predominant three-storey building height.

Development specification

Gross Site Area	0.75 Ha
Net Site Area	0.70 Ha
Number of Units	69
Gross Density	92 dph
Net Density	99 dph
Gross-Net Ratio	0.93
Dwellings mix-typology	43 x 1 bed apartment, 20 x 2 bed apartment; and 6 x 2 bed houses
Other Uses	500 sq m and 24no spaces public car park (excluded from Net).
Building Height	3 - 4 Storey Apartments 2 Storey terraced houses.
Parking Spaces	45
Parking ratio	0.65 / dwelling

Figure 14 computer render of scheme - credit bptw

6.2.4. Suburban High Density: Goldsmith Street, Norwich

Architect: Mikhail Riches

Developer: Norwich City Council

Project overview

The project comprises over 100 dwellings within seven terrace blocks, arranged in 4 rows with only14m between rows. Windows have been carefully designed and located to minimise overlooking and a asymmetric roof ensures good sunlight. Parking spaces have been pushed to the perimeter of the site to prioritise pedestrian movement within the development. A landscaped pathway and gardens at the centre of the scheme encourages neighbourly interactions.

Development specification

Gross Site Area	1.4 Ha
Net Site Area	1.26Ha
Number of Units	105
Gross Density	75 dph
Net Density	83 dph
Gross-Net Ratio	0.9
Dwellings mix-typology	56 x 1 bed apartment ; 32 x 2 bed house; 12 x 3 bed house; 5 x 4 bed houses.
Building Height	2-storey terraced houses and 3 storey apartments on corners
Parking Spaces	78
Parking ratio	0.74 per dwelling

Figure 15 Image of Goldsmith Street, credit Michail Riches

6.2.5. Suburban Medium Density: Mitcham's Park, Cambridge

Architect: Formation Architect

Developer: Crest Nicholson

Application ref.   C/14/0790/FUL

Project overview

Redevelopment of the former Cambridge City Football Club located within walking distance of Mitcham's Corner District Centre. The large-footprint buildings of Westbrook Centre and Chesterton Sports Centre border the site to the east and west, whilst small-scale family housing is located to the north and south. Introducing a mix of apartment and family housing successfully addresses these different scales.

Development specification

Gross Site Area	1.9 Ha
Net Site Area	1.6 Ha
Number of Units	106
Gross Density	56 dph
Net Density	66 dph
Gross-Net Ratio	0.84
Dwellings mix-typology	25 x 1 bed and 30 x 2 bed apartments and 13 x 2 bed, 24 x 3 bed, 12 x 4 bed and 2 x 5 bed houses.
Other Uses	-
Building Height	3 storey terraced housing and 5 storey apartments
Parking Spaces	112
Parking ratio	1.06 spaecs per dwelling

Figure 16 View of Mitcham's corner - credit: Greater Cambridge Shared Planning Service

6.2.6. **Suburban Medium Density: Accordia, Cambridge**

Architect: Feilden Clegg Bradley, Alison Brookes Architects and Maccreanor Lavington

Developer: Countryside Plc

Application ref.   C/00/1175

Project overview

The redevelopment of the grounds of a former country house located within walking distance of central Cambridge and the railway station. Set within a relative low-density part of the City that is characterised by villas with large gardens, the scheme successfully fits into its context despite being developed at significantly higher densities.

Development specification

Gross Site Area	9.45 Ha
Net Site Area	7.0 Ha
Number of Units	378
Gross Density	40 dph
Net Density	54 dph
Gross-Net Ratio	0.74
Dwellings mix-typology	70x1 bed; 123x2 bed; 82x3 bed;73x4 bed; 30x5 bed houses and apartments
Other Uses	-
Building Height	2 storey villas, 3 to 4 storey town-houses and up to 5 storey apartments
Parking Spaces	472
Parking ratio	1.25 spaces per dwelling

Figure 17 View of development within Accordia, image credit - Greater Cambridge Shared Planning Service

6.2.7. Suburban Low Density: Marmalade Lane, Cambridge

Architect: Mole Architects

Developer: Town and Trivselhus (K1 Housing Group)

Application ref.   S/3223/15/FL

Project overview

The project is Cambridge's first cohousing community located within Orchard Park, a typical perimeter block housing development. It is made up of 42 custom build houses and apartments sharing a common house, a creche, workshop and flats for visitors. Allotments, a garden and a street are located at the heart of the scheme, with parking to its periphery.

Development specification

Gross Site Area	1.0 Ha
Net Site Area	1.0 Ha
Number of Units	42
Gross Density	42 dph
Net Density	42 dph
Gross-Net Ratio	1.0
Dwellings mix-typology	2 to 5 bed terraced houses and 1 and 2 bed apartments
Other Uses	-
Building Height	2-3 Storeys
Parking Spaces	53 car parking spaces including 11 for visitors
Parking ratio	0.79

Figure 18 Image of the Maramlade lane scheme - image credit - Town

6.2.8. **Suburban Low Density: Oakfield, Swindon**

Architect: PRP Architects

Project overview

Oakfield is a pioneering housing scheme which will create a new intergenerational community. It consists of 239 homes, suitable for all ages, to meet the diverse needs of all households. As well as maintaining substantial green spaces, the development will also provide new facilities to benefit the wider local community, including improved links to local amenities, a park with children's play area, and community meeting space.

Development specification

Gross Site Area	6.43 Ha
Net Site Area	5.27 Ha
Number of Units	239
Gross Density	37 dph
Net Density	42 dph
Gross-Net Ratio	0.82
Dwellings mix-typology	2-4 bed houses and 1 - 2 bed apartments.
Other Uses	-
Building Height	1.5-4 Storey
Parking Spaces	403
Parking ratio	1.68 spaces per dwelling

Figure 19 Render of the Oakfield Scheme - image credit: PRP architects

6.3. Rural Connected

Case studies show a range of densities from 22 dph to 162 dph that exists within the Rural Connected typologies in differing contexts. The applied density is distinguished into four density bands Low, Low-Medium, Medium-High and High having 30 dph, 40dph, 60dph and 80 dph respectively. Each band has 10 or 20 more dwellings per hectare than the other and provides sufficient differentiation in terms of their character and context.

Local examples next to mass transit in rural centres show very high-density range of between 100-162 dph. However, local examples next to mass transit in lower order villages show much lower density, e.g. Foxton, Meldreth. Hence, an applied density of 80 dph is proposed for high density band.

There are no local case studies in the medium-high density band due to existing policy constraints within the SCDC local plan which restricts densities up to 40 dph. There is a case to be made for increasing the density in locations that are most accessible to Cambridge or to major employment areas via sustainable travel mode. Hence best practice examples are used to suggest how contextual response above 40 dph are delivered in similar contexts elsewhere. An applied density of 60 dph is used.

While Merrington Place, Impington is within 400 m of a mass transit stop it displays characteristic that are more suitable to sites in medium density areas and also was built within the existing local plan policy constraints on density

Table 7 Summary Density Table and Applied Density (Rural _ Connected)

Site Typology/Case Study	Site Net Area	Site Gross Area	No. of Homes	Density Net	Density Gross	Net-Gross Ratio	Applied Density (dph)
Railway Tavern, Great Shelford	0.12	0.12	12	**100**	100	1.00	**Very high 80**
Tibby's Triangle, Southwold	0.12	0.39	34	**87**	87	1.00	**Very high 80**
Temple Cloud, Bath Somerset	0.34	0.34	19	**57**	57	1.00	**High 60**
Clay Field, Elmswell	0.6	1.15	26	**55**	23	0.41	**High 60**
Merrington Place, Impington	0.96	1.1	35	**41**	32	0.00	**Medium 40**
Lime Tree Square, Somerset	10.9	10.9	408	**37**	37	1.00	**Medium 40**
Land at Oakington Road, Cottenham	7.06	14.76	154	**22**	10	0.48	**Low 30**
Derwenthorpe Phase 1,York	*1.85*	*1.85*	*64*	*35*	*35*	*1.00*	**Low 30**

6.3.1. Rural Connected Very High Density: The Railway Tavern, Great Shelford

Architect: Haysom Ward Miller Architects

Developer: Enterprise Property Group Ltd

Application ref.   S/0291/15/FL

Project overview

The site is located next to the railway station in the village of Great Shelford, outside the Conservation area. It is surrounded by a mix of commercial and residential development approximately 500 metres east of the village centre. The site is bordered on its eastern edge by the railway line which runs between Cambridge and London Liverpool Street.

Development specification

Gross Site Area	0.12 Ha
Net Site Area	0.12 Ha
Number of Units	12
Gross Density	100 dph
Net Density	100 dph
Gross-Net Ratio	1.0
Dwellings mix-typology	2 x. 2 bed, 4 x 3 bed, 2 x 4 bed houses and 1 x 1 bed and 3 x 2 bed apartments.
Other Uses	-
Building Height	3 Storeys
Parking Spaces	12 car parking spaces
Parking ratio	1 per dwelling

Figure 20 Street elevation from Railway tavern scheme - image credit Enterprise Property Group Ltd

6.3.2. Rural Connected Very High Density: Tibby's Triangle, Southwold

Architect: Ash Sakula Architects

Developer: Adnams Brewery / Hopkins Homes

Application ref.   DC/06/0179/FUL

Project overview

A mixed tenure housing with a shop and café was developed on a triangular site on a former bewery distribution depot away from the centre of Southwold. It has a close grain form with small scale passages, little green spaces, streets and attractive new homes.

Development specification

Gross Site Area	0.39 Ha
Net Site Area	0.39 Ha
Number of Units	12
Gross Density	87 dph
Net Density	87 dph
Gross-Net Ratio	1.0
Dwellings mix-typology	Houses and Apartments
Other Uses	Shops and Cafe
Building Height	2-4 Storeys
Parking Spaces	32 car parking spaces including 11 for visitors
Parking ratio	1 space per dwelling

Figure 21 View of development at Tibby's Triangle Image credit - Ash Sakula

6.3.3. Rural Connected High Density: Temple Cloud, Somerset

Architect: Haysom Ward Miller Architects

Developer: Great Shelford (Cambridge) LLP and the Manhattan Corporation Limited

Application ref. S/0291/15/FL

Project overview

The development consists of a mix of new build, converted town houses and semi- detached properties. The proposed design blends Bath and Somerset tradition with a contemporary finishes, using well-considered design and materials that compliment the local area. Particular attention has also been given to sculptured, communal gardens to emphasise the family and community feel of the village surroundings.

Development specification

Gross Site Area	0.3 Ha
Net Site Area	0.3 Ha
Number of Units	19
Gross Density	63 dph
Net Density	63 dph
Gross-Net Ratio	1.0
Dwellings mix-typology	3 & 4 bed houses and 10 letting rooms
Other Uses	-
Building Height	2-3 Storeys
Parking Spaces	34 car parking spaces
Parking ratio	1.78 spaces per dwelling

Figure 22 Elevation from Temple Cloud scheme - credit: Archio

6.3.4. **Rural Connected High Density: Clay Field, Elmswell**

Architect: Mikhail Riches

Developer: Orwell Housing Association, The Suffolk Preservation Society, Mid-Suffolk District Council & the Parish of Elmswell

Application ref.   1144/06/FUL

Project overview

This is a scheme of 26 homes in rural Suffolk. All houses face south and are grouped so that short terraces of 3 storey properties front the backs of 2 storey terraces always facing the south. Car parking of 42 spaces for 26 homes are provided in remote parking courts, located next to a range of amenity spaces and allotments. A local area of play and a sizable football pitch are part of a green space strategy to manage rainwater.

Development specification

Gross Site Area	1.15 Ha
Net Site Area	0.6 Ha
Number of Units	26
Gross Density	23 dph
Net Density	55 dph
Gross-Net Ratio	0.41
Dwellings mix-typology	13 x 2 bed houses; 9 x 3 bed houses and 4 x 1 bed apartments.
Other Uses	-
Building Height	3 Storeys
Parking Spaces	42 car parking spaces
Parking ratio	1.62 spaces per dwelling

Figure 23 view of clay field development image credit Mikhail Riches

Rural _ Connected Medium Density: Merrington Place, Impington

Architect:	RH Partnership Architects
Developer:	ORO Properties Limited
Application ref.	S/1356/08/F

Project overview

The development is situated in an area that is predominantly 2 storey and has a mix of architectural styles and age. It consists of 2-3 storey houses and apartments and green space in between.

Development specification

Gross Site Area	1.1 Ha
Net Site Area	0.85 Ha
Number of Units	35
Gross Density	32 dph
Net Density	41 dph
Gross-Net Ratio	0.77
Dwellings mix-typology	1-2 bed apartments and 2-3 bed houses.
Other Uses	-
Building Height	2 Storey houses and 3 storey apartments
Parking Spaces	51 car parking spaces
Parking ratio	1.46 spaces per dwelling

Figure 24 R H Partnership Architects, photographer, Chris Chudleigh

6.3.6. Rural Connected Medium Density: Lime Tree Square, Somerset

Architect: FCB Studios

Developer: C&J Clark Properties

Application ref. 036277/018 & 2011/0680

Project overview

Lime Tree Square is the first phase of a new urban quarter of 398 homes in the West Country market town of Lime Tree. This new neighbourhood offers a fresh model for high quality housing where the balance between cars and people is redressed, offering homeowners a range of private, semi-private and public open spaces that provide an attractive landscaped setting for family life in the 21st century.

Development specification

Gross Site Area	10.7 Ha
Net Site Area	9.3 Ha
Number of Units	398
Gross Density	37 dph
Net Density	43 dph
Gross-Net Ratio	0.87
Dwellings mix-typology	Houses and apartments.
Other Uses	-
Building Height	2-3 Storeys
Parking Spaces	
Parking ratio	1.2 spaces per dwelling

Figure 25 View of Lime Square Credit FCB Studio

6.3.7. Rural _ Connected Low Density: Land at Oakington Road, Cottenham

Architect: ARMSTRONG BURTON ARCHITECTS

Developer: This Land LTD

Application ref.   S/4207/19/RM

Project overview

The development is situated in an area that is predominantly 2 storey and has a mix of architectural styles and age. It consists of 2-3 storey houses and apartments and green space in between.

Development specification

Gross Site Area	14.76 Ha
Net Site Area	7.06 Ha
Number of Units	154
Gross Density	10 dph
Net Density	22 dph
Gross-Net Ratio	0.48
Dwellings mix-typology	22 x 1 bed apartment, 56 x 2 bed apartment and houses, 37 x 3 bed, 36 x 4 bed and 3 x 5 bed houses.
Other Uses	-
Building Height	2 Storey
Parking Spaces	308 car parking spaces
Parking ratio	2 spaces per dwelling

Figure 26 Land at Oakington Road – image credit Armstrong Burton Architects

6.3.8. Rural _ Connected Low Density: Derwenthorpe Phase 1, York

Architect: Studio Partington

Developer: Joseph Rowntree Foundation Trust

Application ref.   07/02789/REMM

Project overview

This development forms the first phase (64 dwellings) of Derwenthorpe, which is a newly created village of 540 homes built on over a 21.7 ha site situated approximately 2 miles (3.2 km) to the east of York city centre. It benefits from 18 acres of public spaces, parks, green infrastructure, an energy centre, and a community centre, provided as part of the overall infrastructure.

Development specification

Gross Site Area	4.8 Ha
Net Site Area	1.85 Ha
Number of Units	64
Gross Density	13 dph
Net Density	35 dph
Gross-Net Ratio	2.6
Dwellings mix-typology	2-5 bed terraced, semi- detached, detached, mews houses and apartments.
Other Uses	-
Building Height	1.5 - 3 Storey
Parking Spaces	70 car parking spaces
Parking ratio	1.1 spaces per dwelling

Figure 27 View of Derwenthorpe scheme image credit - Studio Partington

6.4.   Rural _ Minor/Group

Case studies show a smaller variation of densities from 28 dph to 40 dph that exists within the Rural Minor/Group typology in differing contexts. The applied density is distinguished into two density bands Low-Medium and Medium-High having 30 dph and 40dph respectively.

Table 8: Summary Density Table and Applied Density (Rural Minor/Group)

Site Typology Case Study	Site Net Area	Site Gross Area	No. of Homes	Density Net (dph)	Density Gross (dph)	Net-Gross Ratio	Applied Density (dph)
Balsham Building Site, Balsham	0.83	0.83	33	**40**	40	1.00	*High 40*
Norton St. Philip, Bath	1.6	1.9	51	**38**	32	0.83	*High 40*
East of Highfields, Caldecotte	1.9	3	66	**35**	22	0.63	*Medium 30*
Pettits Close, Dry Drayton		0.3	10	**33**	33	0.00	*Medium 30*
The Avenue, Saffron Waldon	2.6	2.9	76	**29**	26	0.90	*Medium 30*

6.4.1. **Rural _ Minor/Group High Density: Balsham Buildings Site**

Architect: Hill Residential Ltd

Developer: JHill Residential Ltd

Application ref.   S/1959/16/FL

Project overview

The site is surrounded on three sides by residential housing, with Meadow Primary School to the north and a tree-lined public footpath to the south.

Development specification

Gross Site Area	0.83 Ha
Net Site Area	0.83 Ha
Number of Units	33
Gross Density	40 dph
Net Density	40 dph
Gross-Net Ratio	1.0
Dwellings mix-typology	10 x 2 bed, 6 x 3 bed, 8 x 4 bed and 1 x 5 bed houses and 8 x 1 bed and 2 x 2 bed apartments.
Other Uses	-
Building Height	2-2.5 Storeys.
Parking Spaces	50
Parking Ratio:	1.5 spaces per dwelling.

Figure 28 View of Balsham Buildings, Hill Reseidential Ltd

6.4.2. Rural _ Minor/Group High Density:Fortescue Fields, Norton St. Philip

Architect: ADAM Architecture

Developer: Bloor Homes

Application ref.   2010/0493

Project overview

Fortescue Fields is an extension to Norton St. Philip, located near Bath, and built on the site of a derelict chicken processing factory. The new area reflects the traditional character of the village, using natural stone and locally sourced materials wherever possible, and has a varied dwelling design. The development consists of residential units (family homes, apartments and retirement units), a new shop for the village, a commercial building, as well as a striking new public building.

Development specification

Gross Site Area	1.8 Ha
Net Site Area	1.5 Ha
Number of Units	57
Gross Density	32 dph
Net Density	38 dph
Gross-Net Ratio	0.83
Dwellings mix-typology	Homes, apartments and retirement units.
Other Uses	A shop, commercial building, and a public building.
Building Height	2 - 3 Storeys
Parking Spaces	118
Parking Ratio:	2 spaces per dwelling.

Figure 29 View of Fortiscue Fields Credit ADAM Architecture

6.4.3. Rural _ Minor/Group High Density: Land East Of Highfields Road Highfields Caldecote

Architect: OSP Architecture

Application ref.   0S/4619/18/RM

Project overview

The site is located along Highfields Road which is the man spine road running through village of Highfield Caldecote. It also has an edge facing the countryside. The buildings reflect a mix of existing 20th - 21st century architectural styles in the village. Dwellings are commonly between two and three storey in height.

Development specification

Gross Site Area	3.0 Ha
Net Site Area	1.9 Ha
Number of Units	66
Gross Density	22 dph
Net Density	35 dph
Gross-Net Ratio	0.83
Dwellings mix-typology	Homes, apartments and retirement units.
Other Uses	A shop, commercial building, and a public building.
Building Height	2 - 3 Storeys
Parking Spaces	118
Parking Ratio:	2 spaces per dwelling.

Figure 30 sketch of Highfields Road development by OSP architecture

6.4.4. Rural _ Minor/Group Medium Density: Pettits Close, Dry Drayton

Architect: PIP Architecture

Developer: Dyason Developments Ltd

Application ref.   S/3447/18/RM

Project overview

To development is located in Dry Drayton next to the Cambridge Green Belt. The site is surrounded by a substantial tree belt along the north-eastern, north-western and south-western boundaries. The north-east boundary features some large trees. A two storey development is sensitively integrated into this landscape.

Development specification

Gross Site Area	0.3 Ha
Net Site Area	0.3 Ha
Number of Units	10
Gross Density	33 dph
Net Density	33 dph
Gross-Net Ratio	1.0
Dwellings mix-typology	2-4 bedroom houses.
Other Uses	-
Building Height	2 Storey
Parking Spaces	20
Parking Ratio:	2 spaces per dwelling.

Figure 31 Computer generated view of Pettits Close image credit PIP architecture

6.4.5. **Rural _ Minor/Group Medium Density: The Avenue, Saffron Walden**

Architect: Hill Residential Ltd

Application ref.   UTT/0188/10/FUL

Project overview

The avenue is a development of 76 new homes in a conservation area in a historic market town. It preserves a lime-tree avenue and a listed water tower to create a beautiful setting for homes in the form of flats and houses laid out around narrow driveways and intimate courtyards. In addition to large detached houses, it includes affordable family houses and smaller homes for the over-55 market.

Development specification

Gross Site Area	2.9 Ha
Net Site Area	2.6 Ha
Number of Units	76
Gross Density	26 dph
Net Density	29 dph
Gross-Net Ratio	0.9
Dwellings mix-typology	54 houses and 19 apartments
Other Uses	Junior School (999sqm) and Car park (40 Spaces) and play area (600sqm).
Building Height	2-3 Storey
Parking Spaces	162
Parking Ratio:	2.13 spaces per dwelling.

Figure 32 Image of the Avenue development by PIP architects

6.5.   Rural _ Infill

Case studies show low densities of up yo 20 dph that exists in this context. Due to low levels of connectivity to access everyday facilities within these settlements, this typology includes only a low density allocation of 15 dph which can be sensitively accommodated in all contexts.

Table 9 Summary Density Table and Applied Density (Rural _ Infill)

Site Typology Case Study	Site Net Area	Site Gross Area	No. of Homes	Density Net	Density Gross	Net-Gross Ratio	Applied Density (dph)
The Orchard, Great Abington	2.63	2.44	45	**17**	18	0.93	**Low - 15**
Carrowbreck Meadow, Hellesdon	0.8	0.8	14	**18**	18	1.00	

6.5.1. Rural _ Infill Low Density: The Orchards, Great Abington

Architect: Hill Residential Ltd

Developer: Hill Residential Ltd

Application ref. S/3543/16/FL

Project overview

The site is located to the south east of the village of Great Abington, 225m from the High Street facing the countryside. The northern boundary of the site adjoins Linton Road, which consist of a number of mature trees. The western boundary adjoins an existing allotment while the eastern boundary is defined by an existing hedgerow. The development reflects the existing character of the village which consists of predominantly 2 storey dwellings within large plots.

Development specification

Gross Site Area	2.63 Ha
Net Site Area	2.44 Ha
Number of Units	45
Gross Density	17 dph
Net Density	18 dph
Gross-Net Ratio	0.93
Dwellings mix-typology	54 houses and 19 apartments
Other Uses	-
Building Height	1-2 Storey
Parking Spaces	112
Parking Ratio:	2.50 spaces per dwelling.

Figure 33 Voew of The Orchard Image Credit: Hill Residential Ltd

6.5.2. Rural _ Infill Low Density: Carrowbreck Meadow, Hellesdon

Architect: HBS

Developer: Broadland Growth Limited

Application ref.   20141634 (Broadland District Council)

Project overview

The houses are carefully grouped and positioned on site to sit comfortably in its woodland setting. The development is in keeping with Carrowbreck Meadow, which is a contemporary rendition of a well-established, local typology of a 'Norfolk style' house. A material pallet of white render, black stained timber cladding and either slate or plain red roof tiles reflects the materials used in the adjacent context.

Development specification

Gross Site Area	0.8 Ha
Net Site Area	0.8 Ha
Number of Units	14
Gross Density	18 dph
Net Density	18 dph
Gross-Net Ratio	1.00
Dwellings mix-typology	2-4 bed houses
Other Uses	-
Building Height	2 Storeys
Parking Spaces	38
Parking Ratio:	2.4 spaces per dwelling.

Figure 34 View of Carrowbreck, image credit HBS

Image

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6.6.   Large City Infill/Edge (Blanket density)

Case studies show a range of densities from 40 dph to 180 dph, that exists in Large City infill Edge sites, categorised from low to high. The applied density is distinguished into four density bands Low, Low-Medium, Medium-High and High having 50 dph, 70dph, 100dph and 150 dph respectively. Each band has 20, 30 and 50 dwellings per hectare more than the previous and provides sufficient differentiation in terms of their character and context.

Whilst the proposed NEC AAP (undergoing public consultation) suggests a net core site density equivalent to appx 184 dph, this is an exception as it would have a height implication of up to 15 storeys in some locations. Hence, an applied density of 150 dph is proposed for the high density band for large city infill sites where a new character is envisioned.

Local case studies show a variation of densities in newly developed, large city edge locations such as Eddington and Great Kneighton, depending on the sensitivity of the landscape An applied density of 70 and 50 dph for low-medium and low is used respectively.

It is interesting to note that there have been no local case studies, that could be identified within the medium - high 100 dph density band. Hence we have used best practice examples to inform this density band, as it may be applicable for some sites identified as part of the helaa process.

Table 10 Table F: Summary Density Table and Applied Density (Large City Infill/Edge)

Site Typology Case Study	Site Net Area	Site Gross Area	No. of Homes	Density Net	Density Gross	Net-Gross Ratio	Applied Density (dph)
NEC, Cambridge (Core Site only)	30	48	5525	**184**	115	0.63	*Very High, 150*
New England,Quarter	1.55	8.7	235	**152**	27	0.18	*Very High, 150*
Hammerby Sjostad, Stockholm	130	160	10800	**83**	68	0.81	*High, 100*
Eddington, Cambridge	74	150	5000	**68**	33	0.49	*Medium, 70*
Bo01, Malmo	9.3	18	600	**65**	33	0.52	*Medium, 70*
Great Kneighton, Cambridge	42	109	2250	**54**	21	0.39	*Low, 50*
Newhall, Harlow	*58*	*108*	*2300*	***40***	*21*	*0.54*	*Low, 50*

6.6.1. **Large City Infill/Edge Very High Density: North East Cambridge Area Action Plan (Core Site)**

Project overview

The NEC is a planned mixed-use quarter to the east of Cambridge North station. The Core Site includes the sewage treatment works and will deliver much of the new housing proposed for the area. It will take the form of high density, mixed use blocks, with housing located above commercial uses. Car parking allocation will be low and located off- plot in multi-storey structures.

Development specification

Gross Site Area	182 Ha
Net Site Area	30 Ha
Number of Units	8000
Gross Density	44 dph
Net Density	184 dph
Gross-Net Ratio	0.00
Dwellings mix-typology	Predominantly apartments.
Other Uses	The Core Site is housing-led but will include commercial spaces integrated into blocks at ground floor level, two primary schools, a secondary schools if required as well as a range of community facilities.
Building Height	Varied. Mostly 6-8 storeys with 4-5 storeys along the edges and up to 13 storeys in the centre.
Parking ratio	Maximum 0.5 spaces / unit, located off-plot

6.6.2. Large City Infill/Edge High Density: Hammerby Sjostad, Stockholm

Architect: Masterplan City of Stockholm

Application ref.   Jan Inghe-Hagström designed the masterplan

Project overview

Hammarby Sjostad is a former brownfield, industrial transformed into a model mixed- use eco-district, located 3km south east of Stockholm's city centre. A new tram link formed a key structuring component of the new compact neighbourhood. High density midrise apartments provide critical mass to support a range of uses and systems. It is considered one of the world's most successful and sustainable urban renewal projects

Development specification

Gross Site Area	160 Ha
Net Site Area	130 Ha
Number of Units	10800
Gross Density	68 dph
Net Density	83 dph
Gross-Net Ratio	0.81
Dwellings mix-typology	Largely apartments either arranged in long, thin blocks of 12m width or larger 40mx40m courtyard forms.
Other Uses	Mixed use including office, commercial, education, cultural and light industry. School, Library, athletes centre, ski slope and bathing beach, chapel.
Building Height	Predominantly mid rise 4-6 storeys, taller and denser forms of 7-8 storey along transit corridor.
Parking Strategy	Parking mostly underground. 210 cars/1,000 residents: 0.65 ratio. Large car- pooling system.

Figure 36 View of Sjostad Hammarby development image credit - Greater Cambridge Shared Planning Service

6.6.3. Large City Infill/Edge Medium Density: Eddington, Cambridge

Architect: Aecom

Developer: Cambridge University

Application ref.   13/1402/S73 & 11/1114/OUT

Project overview

Located to the north west of Cambridge, Eddington when complete will provide a mixed-use, urban extension fully integrated with the City. The first phase is complete, establishing the new district centre, award winning community facilities and early strategic cycle connections. Sustainable, high density, midrise forms 'wrap' large format uses; the innovative site wide infrastructure of communal underground waste bins and grey water recycling.

Development specification

Gross Site Area	150 Ha
Net Site Area	73.56 Ha
Number of Units	5000
Gross Density	33 dph
Net Density	68 dph
Gross-Net Ratio	0.49
Dwellings mix-typology	Phase 1 around centre mainly apartments (inc. gallery and duplex), with higher density townhouses and terrace forms beyond.
Other Uses	Up to 100,000 sqm employment space. Local centre uses, 130 bed hotel, primary school, community centre including police office primary health care centre and nursery, 6,500sqm Senior living, sports provision and open space.
Building Height	2-7 Storeys
Parking Strategy	4000 spaces and provision of 12 car club spaces,

Figure 37 Cambridge University Scheme - image credit Greater Cambridge Shared Planning Service

6.6.4. Large City Infill/Edge Medium Density: Bo01, Malmo

Architect: Klas tham

Application ref.   City of Malmo

Project overview

Located within the Western Harbour district of Malmo, Bo01 was created as part of the 2011 European Housing Expo. Famed for the 40 storey 'Twisting Torso', it's real character comes from the network of intimate streets and variety of plot based forms, that creates a familiarity akin to medieval towns/cities. Most streets are closed to cars, creating attractive cycling/ walking routes. This is an example of how dense living can still provide diverse green spaces and biodiversity.

Development specification

Gross Site Area	18 Ha
Net Site Area	9.3 Ha
Number of Units	64
Gross Density	33 dph
Net Density	65 dph
Gross-Net Ratio	0.52
Dwellings mix-typology	Mix of apartments and houses: taller forms line western waterfront to shelter inner more intimate scaled forms from the wind.
Other Uses	-
Building Height	2-6 storeys. Taller 6 storey buildings forms the waterfront edge.
Parking Strategy	Parking mostly underground or in multi- storey 'parking house'. 440 cars/1,000 residents: 0.70 ratio. Car-pool system.

Figure 38 Bo01 Scheme - Image credit - Greater Cambridge Shared Planning Service

6.6.5. Large City Infill/Edge Low Density: Great Kneighton, Cambridge

Architect: Hill Residential Ltd

Developer: Hill Residential Ltd

Application ref. S/4551/17/RM

Project overview

Served by the Guided Busway, Great Kneighton is a new neighbourhood located to the south of Cambridge and forms part of the 'southern fringe' urban extension of the City. Containing award-winning schemes of Abode and Aura, it is a good example of how innovative typologies can create higher density suburban homes, a strong identity and a respectful response that knits into the adjoining countryside and established residential neighbourhoods.

Development specification

Gross Site Area	109 Ha
Net Site Area	41.82 Ha
Number of Units	2250
Gross Density	21 dph
Net Density	54 dph
Gross-Net Ratio	0.38
Dwellings mix-typology	60/40 split of houses and apartments, which frame key routes and spaces. Terrace, townhouses, and mews forms beyond. Looser forms of individual homes at edge.
Other Uses	New country park, up to 3,050 sqm retail/ commercial, 1.5ha allotments, Primary and secondary schools.
Building Height	2-5 Storey
Parking Strategy	On plot approach with TRO. 2010 outline set upper limit of 3,427 off- street spaces; individual homes capped to no more than 2 spaces per dwelling. Ratio 1.52 approx.

Figure 39 View of Great Kneighton Scheme, image credit Greater Cambridge Shared Planning Service

6.6.6. Large City Infill/Edge Low Density: Newhall, Harlow

Architect: studio REAL (masterplan); various

Developer: Newhall Projects Ltd

Application ref.   HW/PL/04/00302

Project overview

Newhall is an emerging new neighbourhood on the eastern edge of Harlow known for its pioneering landscape strategy, innovative approach to streetscape design and award- winning architecture such as North Chase (Richard Murphy Architects) and Newhall Be (Alison Brooks Architects).

Development specification

Gross Site Area   108 Ha

Net Site Area   58 Ha

Number of Units	2300
Gross Density	21 dph
Net Density	40 dph
Gross-Net Ratio	0.54
Dwellings mix-typology	A mix of apartments and 2, 3 and 4 bed houses.
Other Uses	Two primary schools, community facilities, local and district centres with small supermarket and three to four commercial units.
Building Height	Predominantly two to three storeys with some 4-6 storey blocks emphasising key spaces. A relative high proportion of terraced housing.
Parking Strategy	One space for 1 bed units, two spaces for 2 bed units and over.

Figure 40 View of Newhall Scheme , image credit Greater Cambridge Shared Planning Service

6.7. New Settlement (Blanket density)

Case studies show a range of densities from 39 dph to 72 dph, that exists in Large City infill edge sites, categorised from low to high. The applied density is distinguished into three density bands Low, Low-Medium, Medium-High having 40 dph, 50dph and 60dph respectively. Each band has 10 dwellings per hectare more than the other and provides sufficient differentiation in terms of their character and context.

The low and low-medium reflect the existing densities proposed within new settlements in the Greater Cambridge Area. However, there may be a desire to propose higher urban densities than the current Local Plan in the context of significant infrastructure improvements such as East/West Rail . An applied density of 60 dph for Medium-high density band is proposed. A Dutch best practice example shows how such densities could deliver high quality places.

Table 11 Summary Density Table and Applied Density (New Settlements)

Site Typology Case Study	Site Net Area	Site Gross Area	No. of Homes	Density Net	Density Gross	Net-Gross Ratio	AppliedDensity (dph)	
IJburg, nr Amsterdam, Netherlands	250	368	18000	**72**	49	0.68	High, **60**	
Waterbeach West,SCDC	129	292	6500	**50**	22	0.44	Medium **50**	
Northstowe Phase,SCDC	220	483	10000	**45**	21	0.46	Medium **50**	
Bourn Airfield, SCDC	89	210	3500	**39**	17	0.42	**Low**	**40**
Derwenthorpe,York	**14**	**34**	**540**	**39**	**16**	**0.41**	**Low**	**40**

6.7.2. New Settlement High Density: IJburg, nr Amsterdam, Nether-

Architect: Stedebouwkundige Dienst Gemeente Amsterdam,

Palmboom & Van Den Bout, various

Developer: Gemeente Amsterdam

Project overview

IJburg is an emerging new town of 18,000 homes and 12,000 jobs on a series of reclaimed islands in the IJsselmeer east of Amsterdam. Densities vary throughout, but a relatively high blanket density is achieved without the use of high-rise buildings by introducing a high proportion of tall and narrow terraced houses and (vertically) mixed-use urban blocks. This reflects the character of Amsterdam city centre.

Development specification

Gross Site Area	386 Ha
Net Site Area	300 Ha
Number of Units	18000
Gross Density	47 dph
Net Density	60 dph
Gross-Net Ratio	0.78
Dwellings mix-typology	Mixed, but high proportion of family housing in urban setting.
Other Uses	A new town with wide range of facilities and fine-grained employment uses integrated into the development that are planned to provide some 12,000 jobs.
Building Height	Varies across the islands, but a mostly "urban" development form of predominantly 3-6 storeys with continuous frontages. High proportion of self- build units.
Parking Ratio	Mostly 1.25 space / unit.

Figure 41 view of IJburg development- image credit, Stedebouwkundige Dienst Gemeente

6.7.3. New Settlement Medium Density: Waterbeach West, SCDC

Architect: West - Fletcher Priest Architects; East - LDA

Developer: West - Urban and Civic; East – RLW

Application ref.   West - S/0559/17/OL; East - S/2075/18/OL

Project overview

Waterbeach Town is a planned new settlement of about 11,000 homes with a fast rail link to Cambridge. The town will be built out in two parts. Waterbeach West draws upon its history as former airfield to help structure the development and create a sense of place, whereas Waterbeach East will refer to the retained fen landscape. Densities vary throughout in response to local context.

Development specification

Gross Site Area	580 Ha
Net Site Area	217 Ha
Number of Units	11000
Gross Density	19 dph
Net Density	51 dph
Gross-Net Ratio	0.37
Dwellings mix-typology	Subject to Housing Need Policy H/8.
Other Uses	Some supporting retail and employment uses integrated in the local and town centres, and extensive parks and open spaces. It also provides five primary, two secondary and Special Needs schools and a 6th form college.
Building Height	varied, 2-2.5 storey along the edges and up to 6-8 storeys in the town centre and adjoining the railway station.
Parking Strategy	1 space for 1 bed and 2 bed properties and 2 spaces for 3 bed and more. Visitor parking at 0.25.

Figure 42 Aerial view of Waterbeach scheme

6.7.4. New Settlement Medium Density: Northstowe Phase, SCDC

Architect: Phase 1 & Development Framework - Terrence O'Rourke;

Phase 2 & 3 – ARUP

Developer: Phase 1 - Gallagher; Phase 2 and 3 - HCA

Application ref.   Phase 1: S/0388/12/OL; Phase 2: S/2011/14/OL; Phase

3a: 20/02171/OUT; Phase 3b: 20/02142/OUT

Project overview

Emerging new town on the site of a former airbase in a rural location adjacent Longstanton and Oakington, both classified as Group Villages. The Guided Busway provides a fast connection with the City. Density varies throughout the development, with higher densities in the town centre and lower densities on the edges.

Development specification

Gross Site Area	483 Ha
Net Site Area	220 Ha
Number of Units	10000
Gross Density	21 dph
Net Density	45 dph
Gross-Net Ratio	0.46
Dwellings mix-typology	A wide variety of typologies, from detached villas to one- bed flats.
Other Uses	Mixed uses in town and local centres, employment, schools.
Building Height	Typical density of 40dph with higher densities towards the town centre and reduced density along the edges.
Parking Strategy	1 space for 1 bed and 2 bed properties and 2 spaces for 3 bed and more. Visitor parking at 0.25.

Figure 43 Computer render of Northstowe development

6.7.5. New Settlement Low Density: Bourn Airfield, SCDC

Architect: Barton Wilmore

Developer: Countryside Plc

Application ref.   S/3440/18/OL

Project overview

Planned new settlement on former airfield site near the new settlement of Cambourne and the villages of Bourn and Highfields Caldecote. A relative low blanket density of 40dph is planned in response to the character of surrounding settlements and the (current) lack of a fast transport connection with Cambridge.

Development specification

|	
Gross Site Area	210 Ha
Net Site Area	88.74 Ha
Number of Units	3500
Gross Density	17 dph
Net Density	39 dph
Gross-Net Ratio	0.42
Dwellings mix-typology	Mixed housing types but mostly family housing.
Other Uses	Proposals include 13ha of employment land, two primary schools, a secondary school and some supporting retail in the village centre and neighbourhood hub, as well as parks and open spaces.
Building Height	Predominantly 2-3 storey with some higher buildings in the village centre.
Parking Strategy	Subject to Housing Need Policy H/8 . 1 space for 1 bed and 2 bed properties; 2 spaces for 3 bed and more. Visitor parking at 0.25.
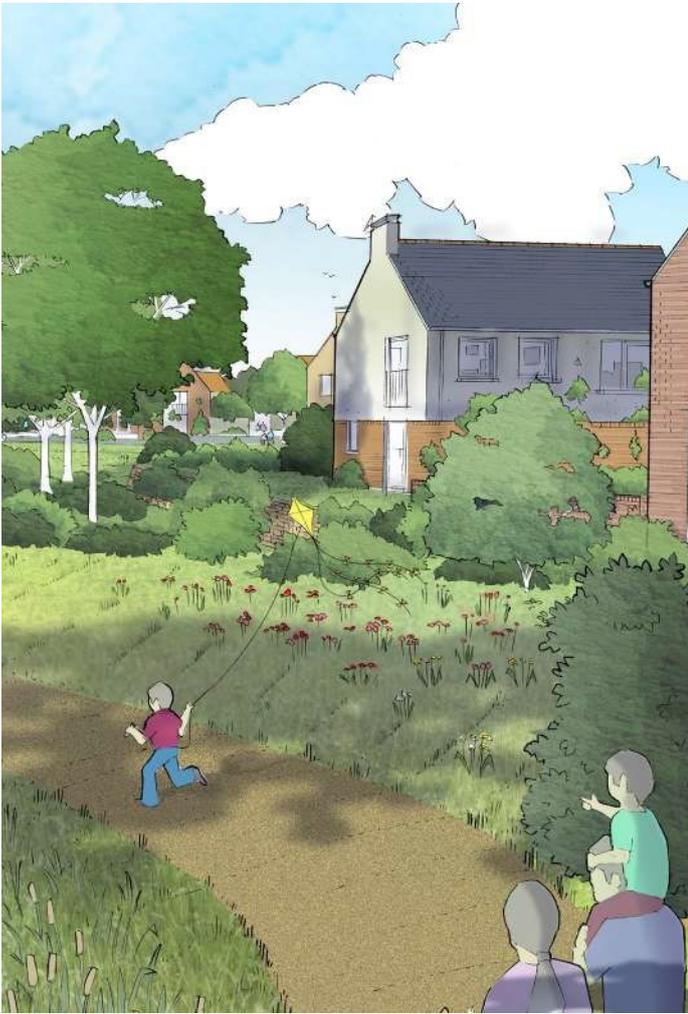
Figure 44 Sketch of Bourn Airfield development image credit Barton Wilmore

6.7.6. New Settlement Low Density: Derwenthorpe, York - All Phases

Architect: Studio Partington

Developer: Joseph Rowntree Foundation Trust

Application ref.   03/02709/OUT, 12/01286/REMM, 12/1878/REMM,

                    12/00242/REMM

Project overview

Derwenthorpe is a newly created village of 540 homes over 21.7 ha situated approximately 2 miles (3.2 km) to the east of York city centre. It consists of 18 acres of public spaces, parks, green infrastructure, an energy centre, and a community centre, which forms the heart of the community.

Development specification

Gross Site Area	34 Ha
Net Site Area	14 Ha
Number of Units	540
Gross Density	16 dph
Net Density	39 dph
Gross-Net Ratio	0.41
Dwellings mix-typology	2-5 bed houses and apartments consisting of terraces, semi-detached and detached houses, mews dwellings.
Other Uses	-
Building Height	1.5-3 Storey
Parking Spaces	594
Parking Ratio	1.1 space per dwelling

Figure 45 View of Derwenthorpe scheme, image credit - Studio partington

6.8. Other case studies

This section provides a summary of the other case studies researched.

Table 12 Summary density table for other case studies researched – Central typology

Site Typology Case Study	Site Net Area	Site Gross Area	No. of Homes	Density Net	Density Gross	Net-Gross Ratio	Applied Density (dph)
Church Works, Hackney	0.025	0.025	4	160	160	1.00	**High**, 175
King Street, Cambridge	0.82	0.82	115	140	140	1.00	**Medium**, 125
Rosebanks Works, Acton	0.25	0.25	35	140	140	1.00	**Medium**, 125
Moray Mews, Finsbury Park	0.07	0.07	8	114	114	1.00	**Medium**, 125
Vaudeville Court, Islington	0.13	0.21	13	100	62	0.62	**Low** 75
Iroko, Coin Street	0.75	0.75	59	79	79	1.00	**Low** 75

Table 13 Summary density table for other case studies researched – Suburban typology

Site Typology Case Study	Site Net Area	Site GrossArea	No. of Homes	Density Net	Density Gross	Net-Gross Ratio	Applied Density (dph)
Malt House, Hillingdon	0.25	0.25	27	108	108	1.00	Very **High**, **120**
Pinnacle N10, Muswell Hill	0.42	0.42	34	81	81	1.00	High, **90**
Colville Road 1, Cambridge	0.52	0.55	33	63	60	0.95	Medium, **60**
Hertsmere School, Borehamwood	5.4	5.7	306	57	54	0.95	Medium, **60**
Nine Wells	5	7.2	270	54	38	0.69	Medium, **60**
St Chads, Tilbury	2.55	3.25	128	50	39	0.78	Medium, **60**
GB2, Cambridge	6	8.7	230	38	26	0.69	Low, 40

Table 14 Summary density table for other case studies researched – Rural connected typology

Site Typology Case Study	Site Net Area	Site GrosssArea	No. of Homes	Density Net	Density Gross	Net-Gross Ratio	Applied Density (dph)
Clock House, Hertfordshire	0.7	0.7	50	71	71	1.00	High, 80

Table 15 Summary density table for other case studies researched – Rural minor typology

Site Typology Case Study	Site Net Area	Site Gross Area	No. of Homes	DensityNet	Density Gross	Net-Gross Ratio	Applied Density (dph)
Station Road, Gamlingay	3.03	3.43	85	28	25	0.88	Medium, 30
Kempsey	3.6	7	120	33	17	0.51	Medium, 30
The Square, Didsbury	0.35	0.35	11	31	31	1.00	Medium, 30
The Channels	24	57	750	31	13	0.42	Medium, 30
Haslingfield Rd, Barrington	10.2	24.3	220	22	9	0.42	Medium, 30
Graven Hill	55	183	1800	33	10	0.30	Medium, 30
Fullers Grove, EastChallow	2.5	6.3	88	35	14	0.40	Medium, 30

Table 16 Gross-net-modifier local and best practice case studies review – very small sites

Site Typology Case Study	Site Net Area	Site Gross Area	No. of Homes	Density Net	Density Gross	Net-Gross Ratio
Church Works, Hackney	0.025	0.025	4	160	1.00	1.00
Moray Mews, Finsbury Park	0.07	0.07	8	114	1.00	1.00
Eden Street, Cambridge	0.10	0.10	8	82	1.00	1.00
Railway Tavern, Gt Shelford	0.12	0.12	12	100	1.00	1.00
Vaudeville Court, Islington	0.13	0.21	13	100	0.62	0.62
Rosebanks Works, Acton	0.25	0.25	35	140	1.00	1.00
Malt House, Hillingdon	0.25	0.25	27	108	108	1.00
Pettits Close, Dry Drayton	0.3	0.3	10	33	33	1.00
Temple Cloud, Bath,	0.34	0.34	19	56	56	1.00
The Square,Didsbury	0.35	0.35	11	31	31	1.00
Donnybrook Quarter, Hackney	0.36	0.36	40	111	111	1.00
Tibby's Triangle,	0.12	0.12	34	283	283	1.00
Pinnacle N10, Muswell Hill	0.42	0.42	34	81	81	1.00
Sutherland Road	0.43	0.43	59	137	137	1.00
Park Place, Cambridge (Fire St)	0.48	0.48	99	206	206	1.00
Timekeepers Square	0.52	0.52	36	69	69	1.00
CB1, Cambridge	0.55	0.55	137	249	249	1.00
Colville Road 1, Cambridge	0.52	0.55	33	63	60	0.95
Meadows, Arbury Rd	0.6	0.6	78	130	130	1.00
Gibson Close, Waterbeach	0.69	0.69	18	26	26	1.00
Clock House, Hertfordshire	0.7	0.7	50	71	71	1.00
Colville Road 2, Cambridge	0.7	0.75	69	99	92	0.93
Iroko, Coin Street	0.75	0.75	5	79	79	1.00

Site	Site Net Area	Site Gross Area	No. of Homes	Density Net	Density Gross	Net-Gross Ratio
			9			
Dujardin Mews, Enfield	0.79	0.79	38	48	48	**1.00**
Carrowbreck Meadow,	0.8	0.8	14	18	18	**1.00**
King Street, Cambridge	0.82	0.82	115	140	140	**1.00**
Farriers Yard, Balsham	0.83	0.83	19	23	23	**1.00**
Station Road, Foxton	0.86	0.86	22	26	26	**1.00**
Average Gross-net modifier (<1 ha)						**0.98**

Table 17 Gross-net-modifier local and best practice case studies review – small sites

Site Typology Case Study	Site Net Area	Site Gross Area	No. of Homes	Density Net	Density Gross	Net-Gross Ratio
Marmalade Lane	1	1	42	42	42	**1.00**
Merrington Place,Impington	0.96	1.1	35	36	32	**0.87**
Clay Field, Elmswell, Suffolk	0.6	1.15	26	43	23	**0.52**
Goldsmith Street, Norwich	1.26	1.4	105	83	75	**0.90**
Church Lane, Papworth Everard	1.76	1.76	50	28	28	**1.00**
Derwenthorpe (Phase1), York	1.85	1.85	64	35	35	**1.00**
Mitcham's Park, Cambridge	1.6	1.9	106	66	56	**0.84**
Norton St. Philip,Bath	1.6	1.9	51	32	27	**0.84**
Oakington Road Cottenham	1.76	1.92	50	28	26	**0.92**
Average						**0.88**
Gross-net modifier (1-2 ha)						**0.90**

Table 18 Gross-net-modifier local and best practice case studies review – medium sites

Site TypologyCase Study	Site Net Area	Site Gross Area	No. of Homes	Density Net	Density Gross	Net-Gross Ratio
Mill Road, Cambridge	1.54	2.14	182	118	85	**0.72**
The Orchards,Gt. Abington	2.44	2.63	45	18	17	**0.93**
Springfield Meadows, Southmoor	2.77	2.77	25	9	9	**1.00**
The Avenue, Saffron Waldon	2.6	2.9	76	29	26	**0.90**
East of Highfields, Caldecotte	1.9	3	66	35	22	**0.63**
St Chads, Tilbury	2.55	3.25	128	50	39	**0.78**
Station Road,Gamlingay	3.03	3.43	85	28	25	**0.88**
Babraham Road, Sawston	3.3	3.5	158	48	45	**0.94**
Meridian Fields, Hardwick	4.1	4.5	98	24	22	**0.91**
Average						**0.86**
Gross-net modifier (2-5 ha)						**0.80**
Hertsmere School, Borehamwood	5.4	5.7	306	57	54	**0.95**
Fullers Grove, East Challow	2.5	6.3	88	35	14	**0.40**
Kempsey, Worcestershire	3.6	7	120	33	17	**0.51**
Nine Wells, Cambridge	5	7.2	270	54	38	**0.69**
GB2, Cambridge	6	8.7	230	38	26	**0.69**
Accordia, Cambridge	6.65	9.5	378	57	40	**0.70**
Lime Tree Square, Somerset	10.1	10.9	408	40	37	**0.93**
Average						**0.66**
Gross-net modifier (5-10 ha)						**0.70**

Table 19 Gross-net-modifier local and best practice case studies review – large sites

Site Typology Case Study	Site Net Area	Site Gross Area	No. of Homes	Density Net	Density Gross	Net-Gross Ratio	
Land at Oakington Road, Cottenham	7.06	14.76	154	22	10	0.48	
Haslingfield Rd, Barrington	10.2	24.3	220	22	9	0.42	
Derwenthorpe, York	14	34	540	39	16	0.41	
The Channels, nr Chelmsford	24	57	750	31	13	0.42	
Northstowe Phase 1	43	97	1500	35	15	0.44	
Clay Farm (Gt Kneighton)	42	109	2250	54	21	0.39	
Eddington, Cambridge	74	150	5000	68	33	0.49	
Poundbury, Dorset	80	162	2200	28	14	0.49	
Northstowe Phase 2, Cambridgeshire	63	165	3500	56	21	0.38	
Barking Riverside, London	75	180	10800	144	60	0.42	
Graven Hill, nr Bicester	55	183	1800	33	10	0.30	
Bourn Airfield, Cambridgeshire	89	210	3500	39	17	0.42	
Waterbeach U+C, Cambridgeshire	129	292	6500	50	22	0.44	
IJburg, nr Amsterdam	250	368	18000	72	49	0.68	
Northstowe Phase 1, 2 and 3, Cambridgeshire	220	483	10000	45	21	0.46	
Waterbeach East and West, Cambridgeshire	217	580	11000	51	19	0.37	
Average						0.51	
Gross-net-modifier (>10-ha greenfield)						0.49	
Large Sites >10ha brownfield							
Bo01, Malmo	9.3	18	600	65	33	0.52	
NEC Core Site only	30	48	5525	184	115	0.63	
Hammarby Sjostad, Stockholm	130	160	10800	83	68	0.81	
Kodak Site East, Harlow	9.44	16.65	1800	191	108	0.57	
Average						0.63	
Gross-net-modifier (>10-ha brownfield)						0.60	

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