MAYOR OF LONDON

MODULE A - DRAFT FOR CONSULTATION

GOOD QUALITY HOMES FOR ALL LONDONERS

LONDON PLAN GUIDANCE

OCTOBER 2020

GOOD GROWTH BY DESIGN

OPTIMISING SITE CAPACITY

A DESIGN-LED APPROACH

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INTRODUCTION

1.1 Purpose

The purpose of this London Plan Guidance is to help interpret and implement the Intend to Publish London Plan (London Plan) policies on housing design, optimising site capacity on all scales of site and enabling housing supply through smaller housing developments, with the wider purpose of supporting *Good Growth*. The guidance sets out a design-led approach to intensification, using residential types to quickly identify the indicative capacity of a site or area, with careful consideration of housing design standards that protect quality of life for residents.

The document provides guidance on assessing the capacity of land and buildings to accommodate housing by optimising site capacity at all stages of the planning process (plan-making, site allocation, area-based strategies, pre-application discussions and application determination). The National Planning Policy Framework (NPPF, 2019) encourages the use of ways of proactively granting permission for new housing. This document provides guidance to boroughs and neighbourhood forums for bringing forward high-quality homes by way of development orders and Permission in Principle (PiP).

The Government and the Mayor recognise that small housing development should play a greater role in the provision of additional homes. This guidance provides advice on how opportunities to deliver new homes on small housing developments should be identified, shaped and permitted to meet London’s housing needs and deliver contextually appropriate, better quality design (London Plan Policy H2: Small sites).

Housing is the most common land use in London, yet there is not enough. Its inclusion as part of mixed-use developments in town centres, high streets, and some industrial areas, can enliven places and make them more attractive and safer, as well as providing much needed additional homes. This guidance provides advice on how housing can be successfully integrated with a range of uses and building types to provide successful places and high-quality additional homes. The guidance focuses on general needs housing across tenures, including Build to Rent. However, it does not provide advice on specialist forms of housing such as housing for students or older people. Relevant London Plan policies and other guidance are referenced throughout the document.

1.2 Structure

This London Plan Guidance is constructed as a series of modules.

Foreword: Good Quality Homes For All Londoners

The foreword communicates the Mayor's vision for high-quality housing, particularly housing delivering improved quality of life through design-led processes of site optimisation. This narrative situates the purpose and content of the Housing Design guidance within the wider context of the Greater London Authority's mission to ensure Good Growth and provide good quality housing for all Londoners.

Module A: Optimising Site Capacity - A Design-led Approach

Module A advocates a design-led methodology for optimising site capacity at the plan-making stage. It is aimed at borough policy officers when calculating capacity on strategic and non-strategic site allocations. It sets out an approach to assessing sites' suitability for development and offers a tool for assessing site capacity.

The module provides a range of residential types to test site capacity. The most common existing and emerging housing types are categorised based on their typical characteristics, access and circulation arrangements and their ability to meet Module C's housing design quality standards. Each type is described in terms of its inherent qualities, characteristics, flexibility to accommodate different tenure and type mixes and suitability for integration with mixed uses. Module A provides guidance on the residential type suitable for a site, in order to determine potential capacity.

Module B: Small Housing Developments - Assessing Quality and Preparing Design Codes

Providing guidance on both assessing the quality of small sites schemes and preparing design codes, Module B will help boroughs to optimise development opportunities on sites below 0.25 of a hectare and deliver on their small sites housing targets set out in London Plan Policy H2 (Small sites). To do this, the module explores the typical conditions found across London which might be suitable for small site development and offers examples of how a borough could write design codes linked to the Housing Design – Quality and Standards identified in Module C, offering template design codes. Case studies of successful small sites development are included in Module D and can be referenced when writing codes as best practice examples.

Module C: Housing Design - Quality and Standards

Module C updates the *London Housing Design Guide* (2010). It is aimed at borough development management officers and developers and their design teams seeking planning permission. The guidance is categorised under the broad themes of Shaping Good Places, Designing for a Diverse City, From Street to Front Door, Dwelling Space Standards, Home as a Place of Retreat, Living Sustainably and Future Proofing. In addition to providing technical standards where applicable, Module C provides qualitative guidance, with reference to best practice examples (in Module D: Housing Design- Case Studies and Appendices), to demonstrate where good design has been critical to a positive resident experience.

Module D: Housing Design - Case Studies and Appendices
Module D is a library of best practice case studies, additional information on the planning process and a glossary of terms used within the guidance.

1.3 Who is it for?

The document comprises four modules that seek to provide helpful guidance and increased certainty for all Londoners that good growth is possible and will happen. This guidance is aimed at landowners, prospective developers, architects and wider design teams, planners and decision-makers across the public, private and community sectors. The different modules will be of different levels of interest to different parties. The guidance also hopes to provide local communities with confidence that the Mayor is determined to work with development partners to deliver growth that safeguards amenity and helps ensure that all Londoners have a good quality of life.

Module A is principally aimed at borough policy officers tasked with determining site capacity.

1.4 What is site optimisation?

Good growth across London requires residential developments that optimise site capacity rather than simply maximising density. This means responding to the existing qualities of the surrounding context, and balancing the capacity for growth and increased housing supply and affordability alongside an improved quality of life for Londoners. This guidance directly contributes to the wider Good Growth by Design programme by setting standards and articulating best practice for the creation of successful, inclusive and sustainable places.

Boroughs are expected to establish optimum site capacities for site allocations through a consultative, proactive, design-led approach that allows for meaningful collaboration with communities, organisations and businesses. Community engagement by boroughs is an important dimension of ensuring the design- led approach to optimising site capacity. When successful this will deliver housing of the good quality necessary to enhance the quality of life for all Londoners and make a positive contribution to the quality and character of existing neighbourhoods. Boroughs should commit to sincere community engagement - carried out in accordance with up to date Statements of Community Involvement - that connects with the views of their local communities. Feedback gained should then be used to shape the policy framework throughout its various stages of development.

1.5 Introduction to Module A: Identifying optimum site capacity

Optimum site capacity is defined as development with the most appropriate form for its site, following an evaluation of the site's attributes, its surrounding context and its capacity for growth (London Plan Policies D1, D2, and D3). There are three stages to identifying optimum site capacity:

Stage One: Site analysis using capacity factors

A set of capacity factors is presented to help boroughs to evaluate the attributes of sites and their capacity to support growth. Capacity factors are the existing qualities and characteristics of the site and surrounding area that will contribute to site capacity, including existing and proposed infrastructure - an important element in determining optimum site capacity – and any ongoing engagement feedback from stakeholders. This approach is consistent with the identification of areas appropriate for extensive, moderate or limited growth to support borough-wide growth requirements.

Stage Two: Use of residential types

This stage introduces a range of prevalent and successful housing types in London. It details their characteristics and capacity to optimise housing delivery.

Certain residential types may be particularly suitable for unlocking smaller housing developments on constrained, small sites (see Module B). A combination of other residential types, such as terraces, linear blocks, villa blocks and towers, may be best suited to optimise site capacity on larger sites. Each residential type is accompanied by case studies and an evaluation of how they perform against housing design quality and standards (Module C).

Stage Three: Testing site capacity

A site capacity tool has been included to test indicative site capacities during plan-making. This ensures a proposed development delivers optimum site capacity. The tool requires the selection of residential types based on their appropriateness for a site and their ability to deliver quality of life for residents.

1.6 Borough-wide growth and change

Respecting character and accommodating change are not mutually exclusive. Successful plan-making can strike a balance between understanding the existing character of a place and improving Londoners' quality of life through positive change.

Identifying the optimum site capacity for a given site during plan-making occurs within a sequence of proactive planning. This begins with characterisation as part of borough-wide area assessments required by London Plan Policy D1 London's form, character and capacity for growth.

- Area assessments: Identify the areas that are appropriate for extensive, moderate or limited growth to accommodate borough-wide growth requirements as the foundation of Development Plan preparation and area-based strategies. This process should inform decision-making about how places should develop, speeding up the Development Plan process and bringing about better-quality development (D1.B).

Within this guidance, area assessments are mainly concerned with analysis associated with characterisation. Characterisation should evaluate how the socio-economic and cultural, physical and environmental, and experiential and perception factors have shaped the places within and across boroughs. It should also indicate the potential for sites and their immediate context to support appropriate forms of extensive, moderate, or limited growth associated with transformation, enhancement, and conservation of areas (Figure A.1).

For consistency and accessibility, boroughs should produce borough-wide character assessments with clear guidance for planning officers, prospective developers and consultant teams. This should use an open format compatible for use with Geographical Information System (GIS) software.

Areas identified to accommodate extensive, moderate or limited growth during area assessments will be likely to experience physical and social change characterised by transformation, enhancement and conservation respectively. The presence of site-specific opportunities will determine what level of growth is suitable. Plans may seek interventions for more extensive growth in areas that currently have low-quality development of ill-defined character, or where an opportunity exists to establish a newly-coherent character, especially in the case of plan-led land use change for example. Such improvements would both enhance positive elements where they exist, and improve the physical character through developments that offer scope for placemaking to create attractive new neighbourhoods. Moderate growth in areas of mixed quality should promote incremental change that seeks to enhance overall character. Limited growth may be appropriate in areas of consistently high quality and coherent character, where necessary change must be undertaken sensitively to maintain existing quality. Where change is proposed, boroughs should be able to clearly define elements of significant value that contribute to the place's distinctive character and those elements that do not (London Plan Policy D3.B.11).

Boroughs should consider potential change along a continuum of transformation, enhancement and conservation, and recognise that there may be changes in character across relatively small distances with implications for characterisation and optimum site capacity. Larger sites in areas with indistinct character offer opportunities to positively define their own character through strategic place-making and judicious selection of residential types and built forms, helping to achieve site capacity optimisation at higher densities than may be possible elsewhere. Strategic placemaking for large sites offers opportunities to proactively manage the interface and relationship between new development and surrounding areas.

Attention should be given in policy and guidance to managing the interface with surrounding land and properties, particularly for small sites that are generally more acutely affected by characteristics of their surrounds.

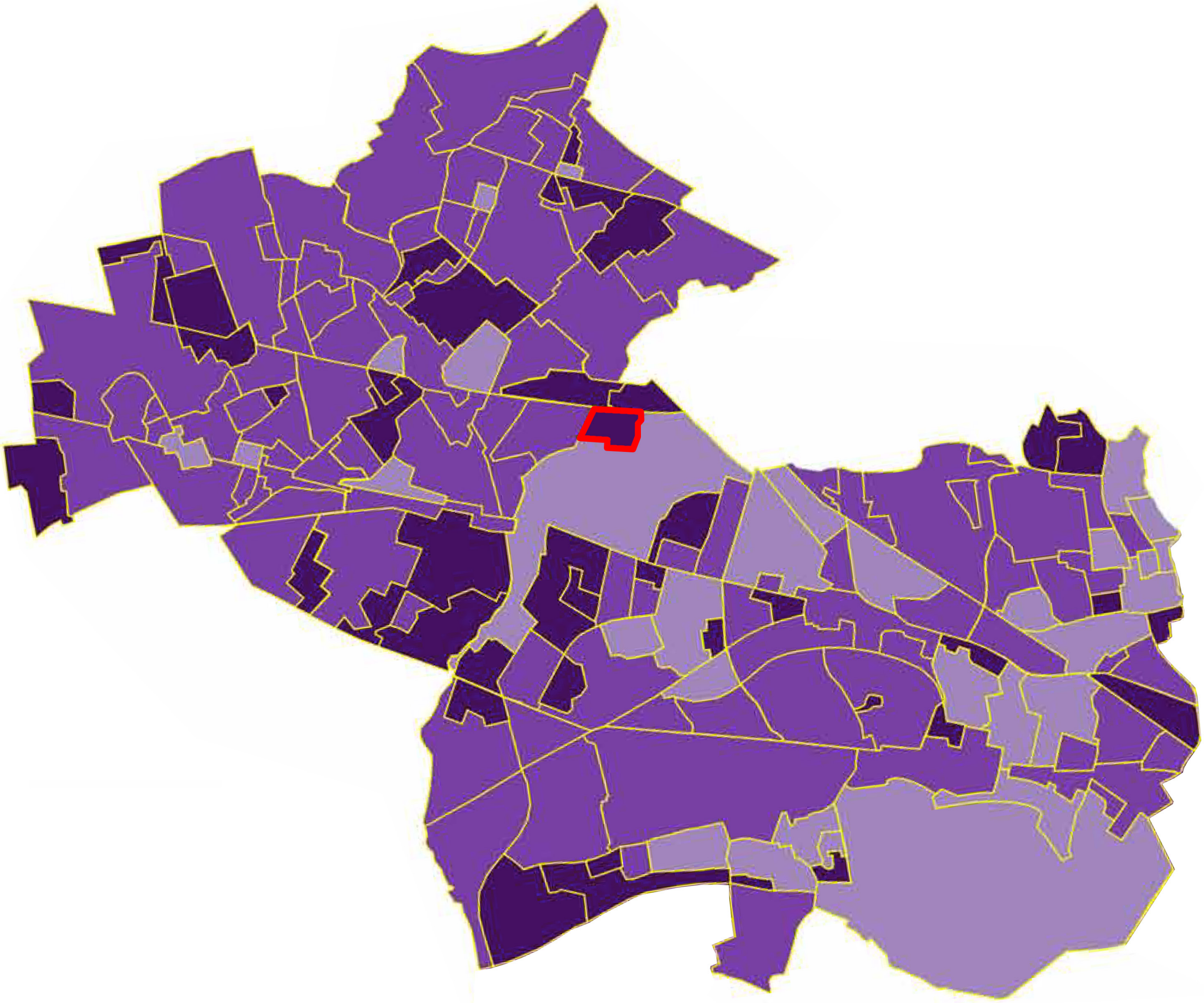


Figure A.1: Borough-wide characterisation from area assessments. This provides a useful, early indicator of the potential for an area to support different forms of good growth.

- **Conserve:** areas that have a high quality, well-established and coherent character that is sensitive to change
- **Enhance:** areas that have a medium quality, mixed character that would benefit from sensitive improvement through intervention
- **Transform:** areas that have a low quality, poorly-defined character and/or where an opportunity exists to establish a new coherent character by enhancing positive elements

2
STAGE ONE:
SITE ANALYSIS USING CAPACITY FACTORS

2.1 Use of capacity factors

Site analysis, including planning history and surrounding context is the crucial first stage of determining the optimum site capacity. This will support the assessment of what constitutes an appropriate form and scale for new development. This section explains how to apply capacity factors during site analysis to support consistent, detailed evaluation of the attributes of potential development sites and their context.

It is anticipated that before attempting individual site and context analysis, boroughs will have undertaken characterisation to define character areas (see Fig B.1) in accordance with London Plan Policy D1. This will inform a borough-wide spatial strategy for distributing good growth. Where borough-wide characterisation is available, the capacity factors outlined in the next section provide a complementary means of character analysis associated with optimising the capacity of individual sites. Where boroughs are yet to undertake characterisation as part of their area assessment, the following factors (Section 2.2) should be considered (Policy D1: Part A).

Judgement should be used to deploy proportionate resources to the scale and sensitivity of the site under evaluation. It may be appropriate for boroughs to emphasise analysis linked to the capacity factors that scrutinise the most relevant, unique qualities of a given site.

2.2 Capacity factors

2.2.1 Physical site characteristics

A detailed analysis of the physical features of the existing development site should include consideration of the following questions:

- What is the size, shape and topography of the site?
- How are the boundaries and edge conditions of the site defined?
- Are there existing buildings worthy of retention?
- What are the uses of existing buildings and external spaces?
- Are uses on the site or its immediate context vulnerable to flooding?
- How much of the site is built out?
- What is the current scale of development (height, width and length)?
- How are buildings and public and private spaces arranged on the site, and

what is the relationship of this layout to the buildings and spaces in the immediate site context?

- Do existing open spaces, play and recreation areas, trees and landscaping contribute to the character of the place?
- How do the buildings and spaces on the site appear (e.g. building materials, architectural details)?
- How are existing vehicular, cycle and pedestrian accesses configured and how do these connect to the area beyond the site?
- Is there provision for cycle parking and public transport, and is it successfully integrated to support access?
- If there is car parking, how is it managed and does it create a sense of vehicle dominance?
- Is there scope to extend the scheme to include adjacent sites?

These questions mirror those commonly addressed within design and access statements, and encourage boroughs to consider the basic design qualities of existing development at the level of the site. Relevant evidence could include recorded observations from site visits and virtual site visits using current views from web mapping and GIS.

2.2.2 Planning policy, guidance and history

Understanding existing and emerging development plan designations is critical when considering the potential for a site to support good growth, and when preparing development plans and area-based strategies. A thorough assessment of existing policy should begin by addressing questions, including:

- Are there any relevant allocations, planning or environmental designations for the site or adjoining sites in adopted and emerging development plans?
- What policies do the designations relate to, and what are the implications for promoting or constraining good growth on the site or its immediate context?
- Is the site subject to any relevant site-specific or topic-related planning guidance documents or strategies with implications for site capacity?
- Is the site subject to any broader regeneration, economic and/or environmental strategies, and do these provisions have implications for site capacity?
- Are there any existing uses that will need to be retained as a result of existing policies?
- Are there any studies produced by the Mayor or the borough that provide an evidence-base relevant to considering site capacity (e.g. existing characterisation study or tall building study)?

Ongoing pre-application discussions, existing planning applications, and planning consents and approvals, may provide useful insight during plan-making. Note that pre-application discussions will normally be confidential, so any pre-application advice will only be available to the parties concerned. A thorough assessment of planning history should begin by addressing questions, including:

- Is the site or adjoining sites subject to current pre-application discussions with the borough and/or Mayor?
- Do these pre-application discussions indicate the site is suitable for development and/or its optimum site capacity?
- Is the site or adjoining sites subject to extant planning permissions or recently expired permissions that indicate the site is suitable for development and/or its optimum site capacity?

Development proposals should also be informed by analysis of the historic and existing street patterns and urban grain. Historical street maps (Figure A.2) can give an insight into former street patterns that could be re-connected or building types that may be reimagined. Existing street patterns (Figure A.3) should be analysed in terms of their hierarchy and strategic connections. This can help inform where points of height or taller buildings can be located. Figure ground plans (Figure A.4) offer clues about the range of building types in a neighbourhood and illustrate how homogenous or varied the urban character is. Building heights (Figure A.5) should be assessed beyond the immediate vicinity of the site as this could help support the case for taller buildings on a site.

Optimum site capacity will be achieved where the opportunities and challenges arising from physical characteristics have been accommodated within a design-led approach to development. Boroughs will have used current planning policy and recent planning history in order to best optimise site capacity by considering how relevant policy-makers and applicants evaluated context and character against development objectives.

Figure A.2: Historic street maps. What constitutes optimum site capacity in the present, is likely to have been shaped by past development. Historic maps provide insight into how street patterns and urban centres have developed over time when reviewed as a chronological sequence. This insight can help identify relevant heritage assets able to enhance future developments. Overlaying historical information with other forms of evidence, e.g. topographical maps, may help reveal how development on your site adapted to the underlying landscape. It can also show insensitive interventions that new development may offer an opportunity to repair.

Figure A.3: Existing street patterns. Understanding how your site relates to existing street patterns and hierarchies, both in relation to how important streets are for movement and how important they are as places, is critical to assessing the potential of linking new development with existing streets and infrastructure in order to enhance access to local destinations and connectivity to places further afield. Existing street patterns may be well-established and offer a clear steer for the shape of future development by demonstrating a clear hierarchy, good local permeability and a rational relationship with different forms of infrastructure. Alternatively, assessment of existing street patterns may reveal poor connectivity, car dominance and characteristics that discourage walking and cycling. These offer major opportunities for improvement through a design that generates a more legible street hierarchy. Development site boundaries may be produced by streets of differing character, relating to different orders within the neighbourhood street hierarchy. In these circumstances, optimising site capacity may be best served by prioritising which existing patterns to connect to or replicate, and which offer limited opportunity for enhancement.

Figure A.4: Figure ground plan. Figure ground plans support an understanding of the existing urban grain, the proportion of buildings to open space, and the predominant house types that form the street and neighbourhood. When combined with building height, this form of diagram provides insight into the overall intensity and pattern of development within an area. This supports judgement about the appropriateness of future development and site optimisation in relation to the existing urban grain and open spaces.

In this example, the development site is bounded south, west and north by terraces. These elements define a clear urban grain and reinforce existing street patterns. The eastern boundary is less well defined along with the site development on the site itself, which is situated in open space at distance from street patterns. The site offers potential to optimise site capacity by replicating the existing urban grain of terraced perimeter blocks.

Figure A.5: Building heights. Assessing building heights inside and outside the development site provides insight into the potential to contribute to the optimisation of site capacity through appropriate selection of building height. When combined with figure ground plans, this form of diagram provides an understanding of the overall intensity and pattern of development within an area. This includes the potential for overshadowing produced by existing or proposed development. In this example, the development site and adjacent buildings to the south and west are between two and three storeys, reflecting the typical terrace height for the area. Building heights to the north and east of the development site are largely four to five storeys, with a distinct building of between 10 and 15 storeys to the southeast corner of the site.

This height profile presents several options for the optimisation of site capacity through a consideration of height, depending on other aspects of character. For example, it may be appropriate to reflect the typical terrace height to the southern and eastern perimeter due to relatively narrow road widths. There is potential to propose four to five storey heights to the northern boundary due to taller adjacent building heights, and also the potential to set back new development from the road. To the eastern and southern boundary, existing taller building heights offer opportunities to propose corresponding storey heights in part of the development, taking into consideration overshadowing and other environmental issues.

This approach seeks to transition height across the site to reflect existing development heights and is more appropriate in areas for conservation and enhancement. In areas identified for transformation, a bolder approach proposing taller building across the site may be more appropriate.

Plan-making & guidance (master planning) stage	Development management (building design) stage
Draw on borough characterisation studies and site assessments to ensure that character and context fully informs site allocations, area-based strategies, development briefs and design codes. Undertake increasing levels of assessment and provide increasing levels of policy/ guidance, proportionate to the document being prepared, to inform the likely capacity of a site/area.	Take full account of relevant policy and guidance and demonstrate a full understanding of context and character and how the proposed development scheme responds positively to this.
Policy D1 (London's form, character and capacity for growth) Policy D2 (Infrastructure requirements for sustainable densities Policy D3 (Optimising site capacity through the design-led approach) Policy D4 (Delivering good design) Policy D8 (Tall buildings) Policy HC1 (Heritage conservation and growth)	Character and Context SPG (June 2014)

2.2.3 Heritage assets and views

Heritage assets and protected views can make significant contributions to local character, adding to the distinctiveness of place. A thorough consideration of how heritage assets and views may benefit local character and offer opportunities to enhance new development should begin by addressing the following questions:

- Does the site or wider area possess designated and/or non-designated heritage assets or protected views?
- What importance does the site demonstrate in relation to the social and cultural history of the local area?
- What research or collaborative work is required to fully appreciate the significance of heritage assets (e.g. reviewing relevant policy and guidance and consultation with Historic England, heritage and community groups, councillors and local people)?
- Does the site or wider area contain strategic views as designated in local plans?
- What measures are required to ensure inclusive public access to viewing locations (as required by the London View Management Framework (LVMF)?

- Does the site or wider area contain locally important views that require consideration?
- How should the layout, scale and massing of new developments be promoted or constrained to respectfully integrate heritage assets and views into proposals?

Optimum site capacity will be achieved where heritage assets and culturally significant views contribute to an appropriate scale and form of development that enhances Londoners’ experiences of existing neighbourhoods and their potential to sustain good growth.

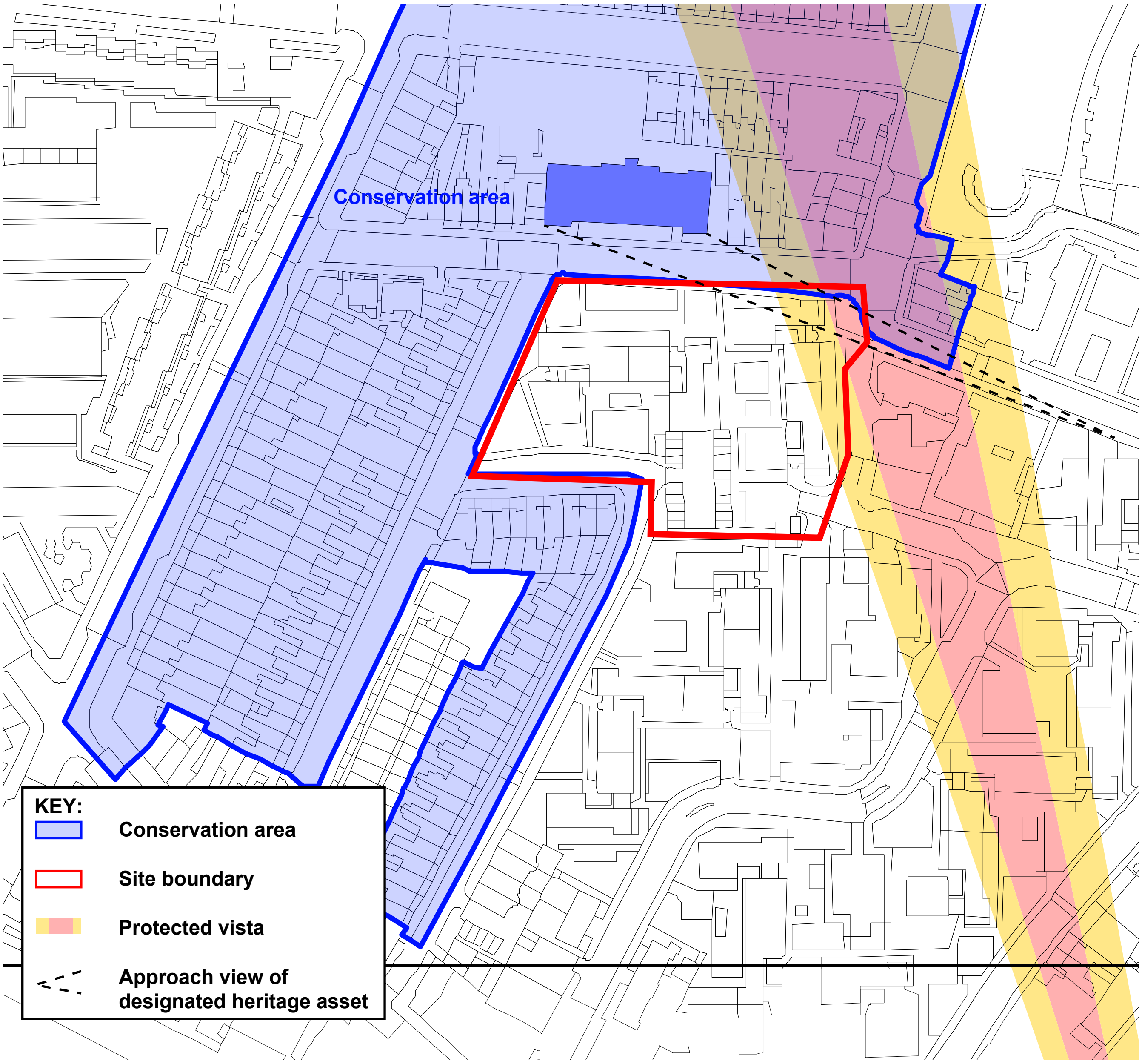


Figure A.6: Mapping heritage assets and protected views. Mapping heritage assets and protected views. Mapping heritage assets and protected views within, surrounding and intersecting a development site provides insight into the potential to harness and protect heritage to enhance site optimisation. Heritage assets are the remaining traces of the development history and contribute much to the continuity of an area's identity. They often provide landmarks that aid navigation through the city. While conservation areas and listed buildings can be seen as constraints on development, their upkeep relies on their relevance and usefulness. Sensitive interventions and adaptations both to the wider area and to buildings themselves helps to preserve them for future generations.

In this example, a conservation area forms the southern, western and northern boundary to the site, reflecting the terraced street pattern noted in other diagrams. A relatively tall listed building (school) is adjacent to the site's northern boundary, with a protected view intersecting the eastern boundary. Much of the site boundary to the south and east, and the site itself, is not a designated conversation area and does not contain any heritage assets. An appropriate strategy for site optimisation may be to reflect the character of the built form adjacent to the conservation area, e.g. limiting heights and replicating street patterns, to create a backdrop to existing assets. Adopting a more tranformational approach to the south-east portion of the site is likely to be much more appropriate.

Plan-making & guidance (master planning) stage	Development management (building design) stage
Clearly identify and include guidance for any relevant strategic and local views.	Assess the likely impact on relevant strategic and/or local views, in accordance with the LVMF SPG and borough guidance.
Links with key relevant London Plan policy and guidance	
Policy HC1 (Heritage conservation and growth) Policy HC2 (World Heritage Sites) Policy HC3 (Strategic and Local Views) Policy HC4 (London View Management Framework)	London View Management Framework SPG (March 2012) London World Heritage Sites (March 2012) Borough conservation area appraisals and management plans Historic England Advice Note 4 – Tall Buildings (Historic England, 2015)

2.2.4 Environmental considerations

Optimum site capacity will be achieved where the form of development is shaped by an understanding of environmental factors (e.g. flood risk, air quality and noise pollution) to enhance opportunities for positive environmental change for all Londoners and prevent or reduce the negative impact of potential detrimental environmental change.

A thorough consideration of environmental factors should begin by addressing questions, including:

- Is the site or wider area subject to relevant environmental designations contained within policy or guidance (e.g. Flood risk zones, Critical Drainage Areas, Heat Network Priority Areas, Air Quality Management Areas, Air Quality Focus Areas, Areas of Deficiency in Access to Open Spaces/Nature)?
- Does the site or surrounding area contain important landscape or ecological features, and does new development offer an opportunity to enhance biodiversity and/or green corridors themselves or access to them?
- How does the site relate to existing local sources of air pollution and features that promote or inhibit the dispersion of pollutants? Does new development offer opportunities reduce pollution or exposure to pollution?

- Is the site or surrounding area exposed to noise pollution, and does new development offer a means of reducing noise or resident exposure?
- Does the site or surrounding area suffer from land contamination from past or current uses, and does new development offer a means of land remediation?
- Is the site or surrounding area likely to suffer from overheating? If so, does new development offer opportunities to proactively manage heat risk by minimising heat gain through design, layout, orientation and materials?
- Does the site or surrounding area offer access to existing water infrastructure and water treatment infrastructure, or does it require improvements to ensure security of water supply, treatment and conservation?
- What opportunities does the site or surrounding area offer in terms of energy supply options, e.g. is the site in a Heat Network Priority Area, are connections to district heating networks available, and are there sources of environmental or waste heat that could be utilised?
- Is there an opportunity to minimise the adverse impacts on local amenity during construction and demolition?

Consideration of environmental factors should inform type selection and urban arrangements. These should be capable of enhancing the benefits of existing positive features; creating new positive features; reducing the impact of detrimental features; and promoting developments able to contribute positively to the quality of life of Londoners. Protecting Londoners from potentially detrimental environmental impacts requires developments to prioritise building on the parts of the site least likely to flood, to recognise the need to accommodate infrastructure, and to reduce overheating and direct exposure to sources of noise, air pollution and overheating.

When considering site capacity optimisation for larger sites where extensive growth is expected, boroughs should consider in detail the potential to upgrade existing energy infrastructure and water infrastructure using principles outlined within the London Plan.

Flood risk

The Environment Agency's flood map for planning provides useful information to inform an initial assessment of the probability of flooding, based on search by postcode or national grid reference (https://flood-map-for-planning.service.gov.uk/) (Figure A.7). Complementary evidence is provided through the Government's long-term flood risk assessment for locations in England (Figure A.8), which establishes the likelihood, depth and velocity of surface water flooding from rivers, reservoirs, the sea and some sources of groundwater.

The flood risk assessment provides an indication of potential damage to transport, power, and communication networks and the management of flood risk (https://flood-warning-information.service.gov.uk/long-term-flood-risk). In combination with a broader assessment of infrastructure capacity and investment (Section 2.2.6, Module A) these tools provide a useful indication of whether a full flood risk assessment is required and whether additional infrastructure provision will be required to optimise site capacity where flood risk is high. In addition to the Environment Agency flood mapping, the Lead Local Flood Authority's (LLFA) Surface Water Management Plans (SWMPs) also contain more detailed information related to localised surface water flood risk, in particular the delineation of Critical Drainage Areas (CDAs). Development located within a CDA will often, depending on local policy, be required to carry out a full flood risk assessment with a focus on surface water management.

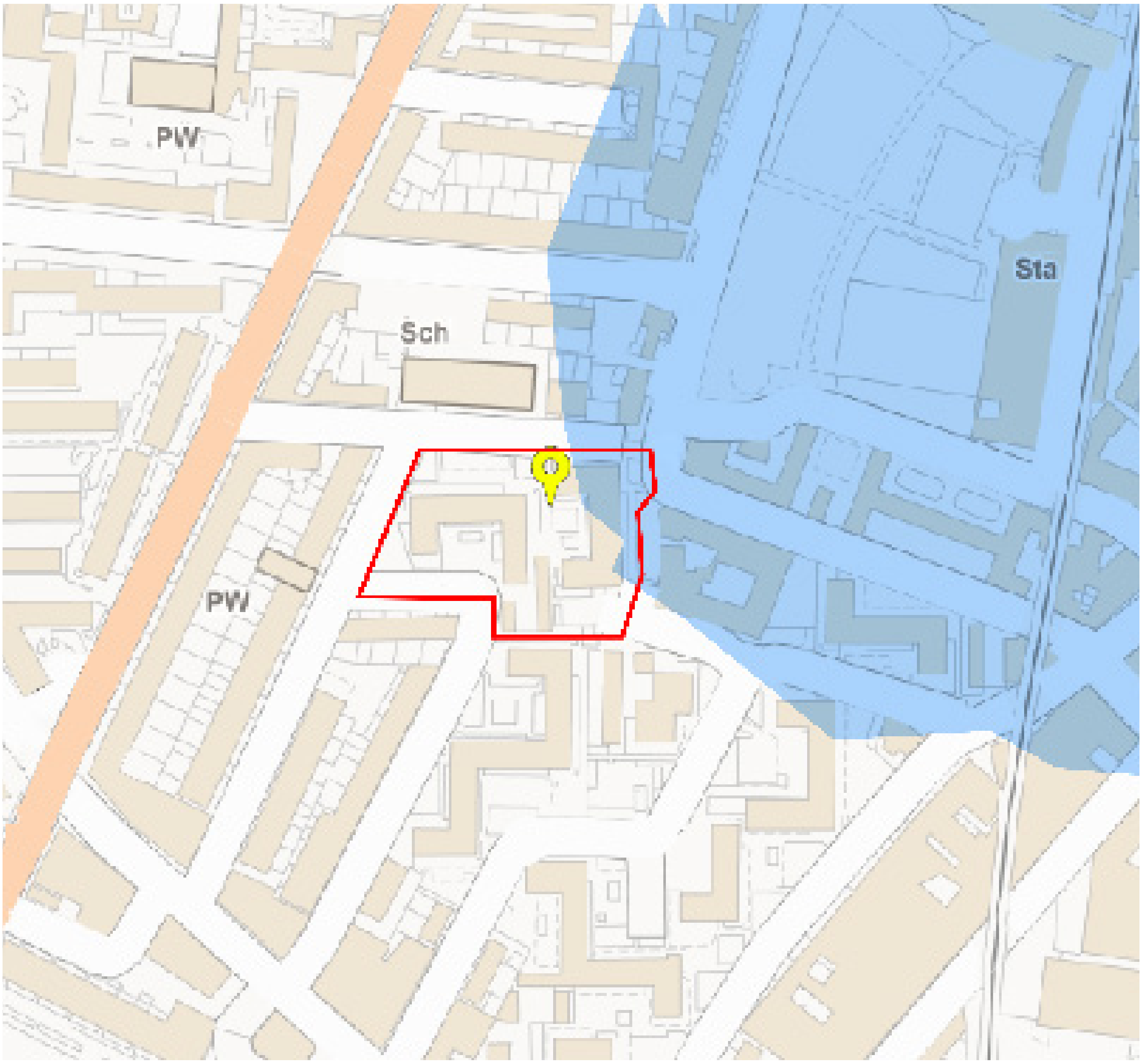


Figure A.7: Flood risk probability

Flood Defence

Flood Zone 1

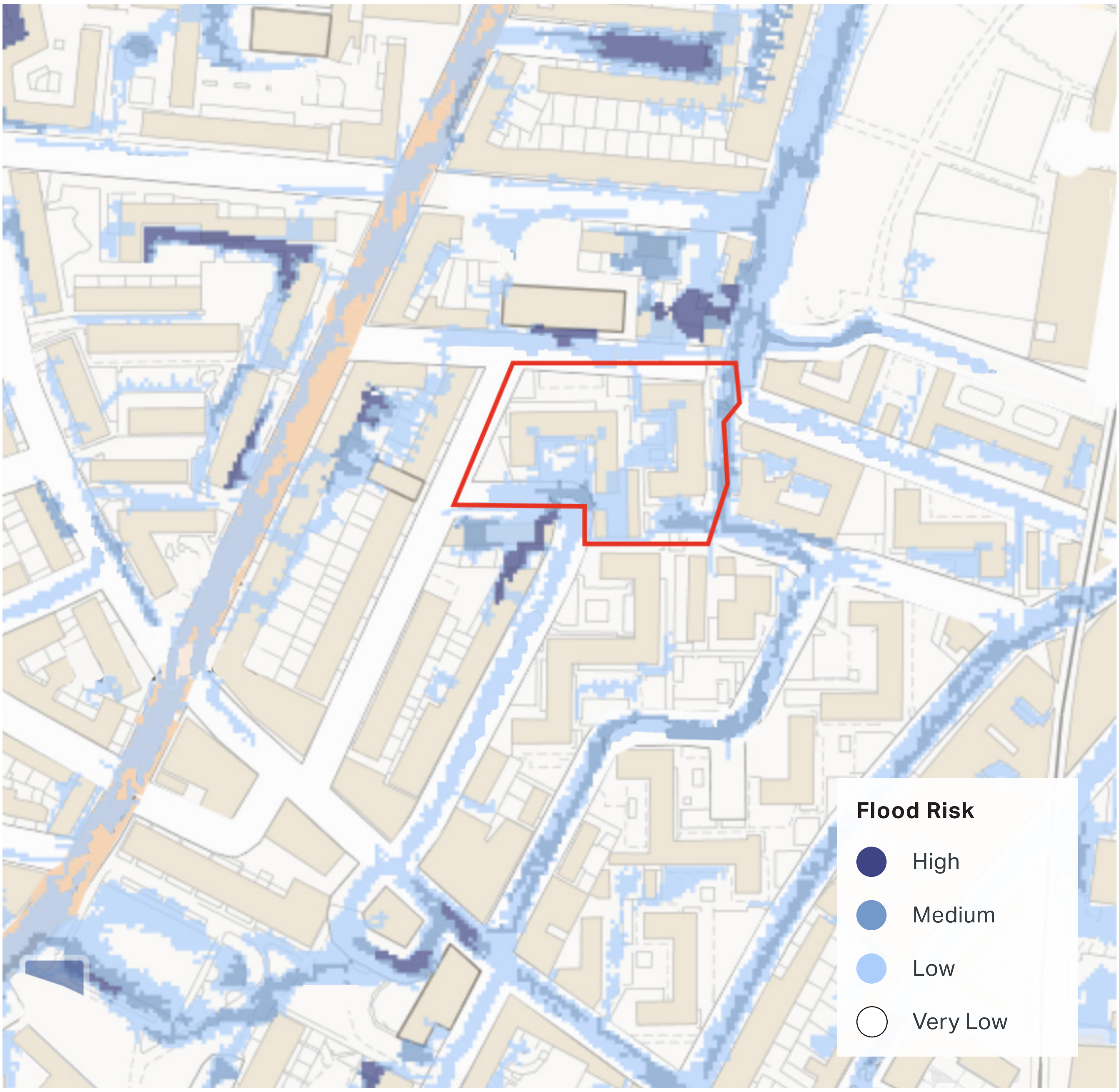


Figure A.8: Flood risk from rivers, surface water and reservoirs (Environment Agency). Flood risk mapping can determine the relative probability of flooding (Zones 1 to 3), the location of water courses, existing flood defences and areas benefiting from flood defences and flood storage areas. Where a development site is within or close to a flood zone, mapping risk may provide insight into how best to optimise site capacity while considering mitigation measures to decrease the impact of flooding. This could mean avoiding building on low-lying land within a site, using sustainable urban drainage systems (SuDS), selecting appropriate house types, avoiding basement accommodation and locating vulnerable uses or people on upper floors.

In the example, the northeast corner of the scheme is most vulnerable to flooding, with a low risk of flooding from rivers being identified within the site. This may suggest more intense forms of development should be avoided to the northeast of the site, and potential benefit from the adoption of flood mitigation infrastructure to manage potential flooding over the site.Z

Air quality

Site capacity will be optimised and good growth served where new developments contribute to reducing public exposure to pollution. This can be achieved by minimising or avoiding new sources of pollution and considering how the overall design and urban form can contribute to aiding the effective dispersion of pollution.

The principal pollutants that characterise poor air quality are NO2, NOx, PM10 and PM2.5, However other pollutants may need to be considered in mixed use sites or sites abutting industrial areas. Data should be used to identify existing sources and concentrations of air pollution (including consented developments that have yet to be built). This should inform the selection of appropriate residential types, site layout and the accommodation of green infrastructure and other measures to reduce the harmful effects of air pollution and promote cleaner air quality. Relevant policy includes Air Quality Management Areas and Air Quality Focus Areas where special measures are required for sensitive development proposals close to pollution sources (e.g. main roads or industrial areas).

More generally, the changes in air pollution across a site and the relationship between the buildings, open spaces and sources of pollution should be considered when selecting appropriate residential types and optimising density. For instance, linear blocks may not be appropriate where these would form a street canyon and courtyard developments could trap pollution if pollution is released into the enclosed area. Conversely careful use of mixed typologies and arrangements of buildings within a site can prevent accumulation or aid dispersion of pollutants. Approaches to minimising exposure to poor air quality should consider both the internal and outdoor environment of the development (Module C) (London Plan Policy SII: Improving air quality). For larger sites where significant improvements in local air quality are expected over time and the development is phased, consideration could be given as to how later development of some areas of the site may affect optimising density.

The GLA is developing guidance on Air Quality Assessments which will explore some of these issues in more detail but in general terms the best outcomes will be achieved by planners and developers engaging as early as possible with air quality experts. For major developments a preliminary assessment of the prevailing air quality conditions should be undertaken at an early stage (i.e. at the site analysis stage, before any detailed design work commences) to identify risks, opportunities and any constraints imposed by local air quality conditions. Potential impacts on local air quality (positive or negative) should also be reviewed at the key points during the iterative design phase.

Policy makers should consider whether air quality issues mean that certain forms or development types should be promoted or resisted in different locations, and how these impact on density and optimisation. They should also consider how multiple developments will work together to improve or worsen air quality. Designers should consider the individual sites in detail to identify forms

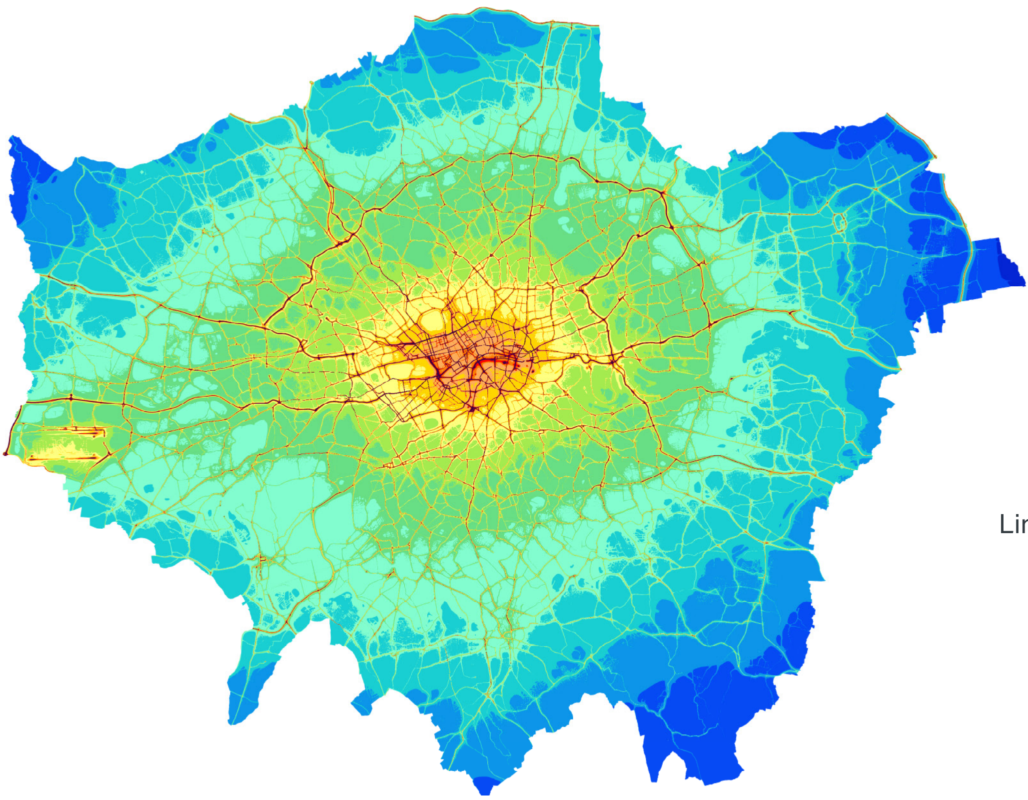


Figure A.9: Output from London Atmospheric Emissions (LAEI). Evaluating the likelihood of poor air quality due to emissions provides insight into the selection of housing types and site layout to mitigate the worst impacts of air pollution, for example, considering increased distances between buildings and known sources of pollution such as busy roads.

and layouts that will promote dispersion and prevent accumulation of pollutants and exposure, including internal layouts and outside spaces.

The GLA's London Data Store website contains air pollution data and maps (https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory--laei--2016) (Figure A.9). It is recommended that the planning officer consults with the borough's air quality officer in relation to potential mitigation and how the site relates to other local and regional programmes to improve air quality. The aim should be to avoid the need to use 'hard' mitigation measures, such as mechanical ventilation.

The Mayor's School Air Quality Audits pioneered a detailed approach to understanding how existing site conditions, surrounding infrastructure and other determinants of exposure to air pollution interact to provide a detailed characterisation of local air quality. These also identify priority measures for intervention or change. The methodology is published as a toolkit report on the GLA website , and while not completely transferable to new development, the principles and techniques described can provide a basis for detailed assessment. The report describes the assessment process in chapter 2 with an audit template in appendix B. The relationship between audit outputs and measures is described in chapter 6 of the report: not all of the measures will be appropriate or effective for new developments and there will also be opportunities on some new developments to include other measures that were not possible for already built schools. Expert advice should be sought to identify the best design solutions to resolve issues identified through the audit process.

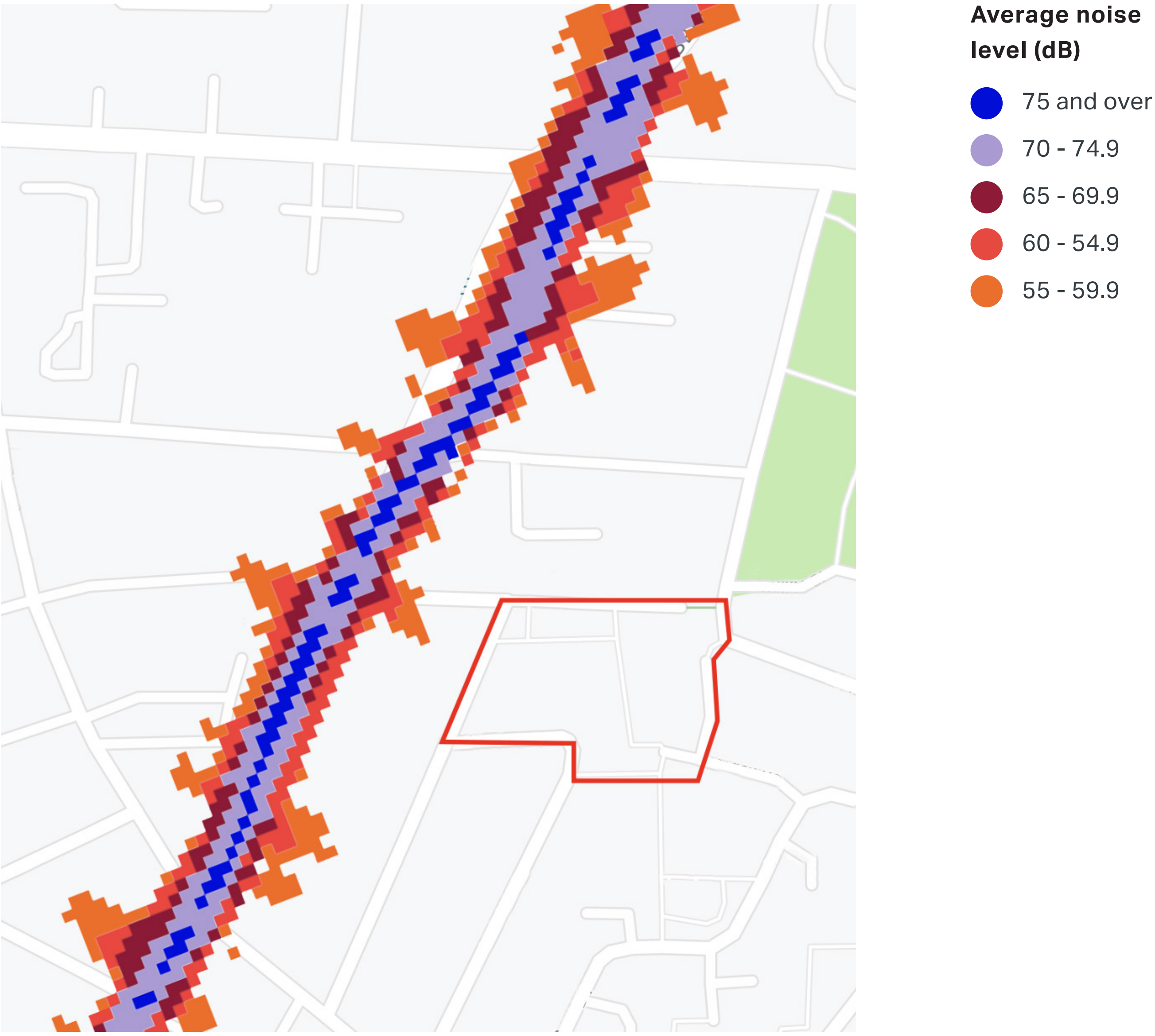


Figure A.10: Average noise levels. Evaluating the proximity to sources of noise pollution provides an opportunity to consider noise pollution as a potential development constraint. Site optimisation can be supported by increasing distances between buildings and sources of pollution, selecting building forms and orientation that shield or limit noise transmission, etc.

In this example, high average noise levels associated with high vehicular traffic on a busy road are at a distance from the site.

Noise pollution

Boroughs should identify sources of noise pollution that have the potential to impact negatively on future residents and existing communities. These sources include noise generating uses (e.g. pubs, concert halls and sports pitches); noise from infrastructure (e.g. road, rail and air); and plant noise (London Plan Policy D14: Noise). Noise levels within internal environments should ensure internal noise levels minimise the risk of adverse noise impacts on health. Site layout, building orientation, separation distances, acoustic screening, and other measures should be considered carefully to mitigate noise pollution. Noise pollution officers are an invaluable source of early guidance, which should be supplemented by advice from an acoustician within the applicant's consultant team if required.

The Department for Environment, Food and Rural Affairs (DEFRA) maps noise pollution in the capital with its Noise Pollution in London dataset (https://data.london.gov.uk/dataset/noise-pollution-in-london), (http://extrium.co.uk/noiseviewer.html#). This provides a useful insight into the noise levels likely to be produced from road and rail during day and night (Figure A.10). Boroughs should explore whether more detailed information is available to them to support analysis at site level covering noise from industry, aircraft and other sources.

Optimum site capacity can be achieved where the choice of residential types and the distribution of buildings and open space across the site responds to existing sources of pollution. This should be achieved by considering air quality and noise both at an early stage and throughout the development.

Green infrastructure

Site capacity can be optimised and good growth served where the benefits of green infrastructure are integrated into site design. Well-designed green infrastructure can make an important contribution to addressing flood risk, urban heat and exposure to poor air quality for people more vulnerable to exposure such as children and young people[1], in addition to enhancing biodiversity and ecological resilience and providing more attractive places for residents. Boroughs should use available data to inform decisions about what existing landscape or ecological features should be retained and what additional green infrastructure could be included to address particular local needs. The GLA's Green Infrastructure Focus Map (https://www.london.gov.uk/what-we-do/environment/parks-green-spaces-and-biodiversity/green-infrastructure-maps-and-tools) provides a useful overview as to the range of environmental and social issues that could be addressed by green infrastructure interventions. *Optimum site capacity will be achieved where the form of development is shaped by an understanding of green infrastructure and open space*

1. While well-designed green infrastructure can contribute to reducing exposure to poor air quality, it should not be relied upon as the sole or principle mitigation measure. Poorly-designed green infrastructure can contribute to the accumulation of pollutants, or result in sensitive uses such aschildren's play areas being situated in areas of high pollutant concentrations, and this should be avoided.

requirements, and where early steps are taken to reduce the negative impact on residents of potentially detrimental environmental change. This will enhance opportunities for producing a positive environmental for all.

Plan-making & guidance (master planning) stage	**Development management (building design) stage**
Identify potential issues in allocations, area-based strategies and development briefs.	Demonstrate how scheme design responds positively to existing environmental considerations and, where necessary, mitigates any likely adverse effects. Demonstrate how sustainable design has been factored into the form of the development, such as the impact of massing, orientation and glazing on energy efficiency and thermal comfort, and the incorporation of water reuse, etc. Demonstrate how urban greening has been integrated into the form of the development to address any constraints, enhance environmental resilience and contribute to amenity.
Links with key relevant London Plan policy and guidance	
Policy D1 (London's form, character and capacity for growth) Policy D2 (Infrastructure requirements for sustainable densities) Policy D3 (Optimising site capacity through the design-led approach) Policy D9 (Basement development) Policy D12 (Agent of Change) Policy D13 (Noise) Policy G1 (Green infrastructure) Policy SI1 (Improving air quality) Policy S12 (Minimising greenhouse gas emissions) Policy S13 (Energy Infrastructure) Policy S15 (Water Infrastructure) Policy SI12 (Flood risk management) Policy SI13 (Sustainable drainage)	The Mayor's Regional Flood Risk Appraisal The CIRIA SuDS Manual London Green Infrastructure Focus Map SuDS Opportunity Mapping Tool

2.2.5 Connectivity and access to local services

When optimising site capacity, boroughs are encouraged to consider levels of future provision of infrastructure, in addition to existing infrastructure (London Plan Policy D2). An optimum capacity and density will be one where development takes full advantage of a site's current and future planned connectivity by public transport, walking and cycling to enhance access to employment and services, both in the immediate area and through the public transport network. This also requires ensuring that the connectivity between the site and its local surroundings, including transport nodes, is maximised through the design and layout, as well as through changes to the walking network where appropriate. Boroughs should make certain that the density of a development is proportionate to the connectivity available to future residents. This will ensure that as many of London's new homes are in well-connected locations as possible.

WebCAT (Web-based Connectivity Assessment Toolkit, www.tfl.gov.uk/WebCAT) provides access to Transport for London's connectivity measures, namely Public Transport Access Levels (PTAL) and Time Mapping (TIM). Both these resources should be used to consider a site's current and future connectivity, and can be configured to reflect either the current or planned public transport network.

PTAL provides a consistent measure across London of the public transport network, reflecting aspects such as walking access time, service frequency and the range of destinations served (Figure A.11). TIM provides a measure of access to employment and services through the public transport network (Figure A.12). Users can plot travel time catchments on a map interface for any location in London based on a selection of travel time characteristics: year, mode (all public transport modes, bus, step-free, or cycling), time period and direction. Users can then view the extent to which employment, population and other service locations (town centres, GPs, schools) can be accessed within a given travel time catchment. This allows boroughs to evaluate connectivity to a range of opportunities and services, providing a useful insight into the potential for residents to access social infrastructure to support a good quality of life.

WebCAT enables a broader assessment of connectivity that complements what is measured by PTAL. This enables boroughs to assess PTAL and access to employment/services for potential development sites across London alongside existing contextual information, e.g. the local street network, rail stations and bus stops. Outputs from WebCAT provide useful forms of complementary evidence for boroughs to develop a design-led approach to site capacity optimisation and justify it graphically within related policy and guidance. This includes the ability to consider how a site should be designed and built out to optimise capacity alongside changing infrastructure provision. Large-scale development contingent upon transport infrastructure improvements will need to either be phased in line with known planned PTAL changes or contribute to improvements where there are none planned. Finally, information from WebCAT should be complemented by an assessment of connectivity on foot to local town centres and other amenities as well as the quality and extent of local walking and cycling conditions and infrastructure.

- PTAL (Public Transport Access Level): a measure of access to the public transport network. For any given point in London, PTAL combines walk times from a chosen point to the network (stations and bus stops, for example) together with service frequency and destination data at these locations. This provides an overall access index that can be allocated to nine access levels between 0 and 6b. In WebCAT, PTAL values have been pre-calculated for a grid of points covering the whole of London (approximately 150,000 points).

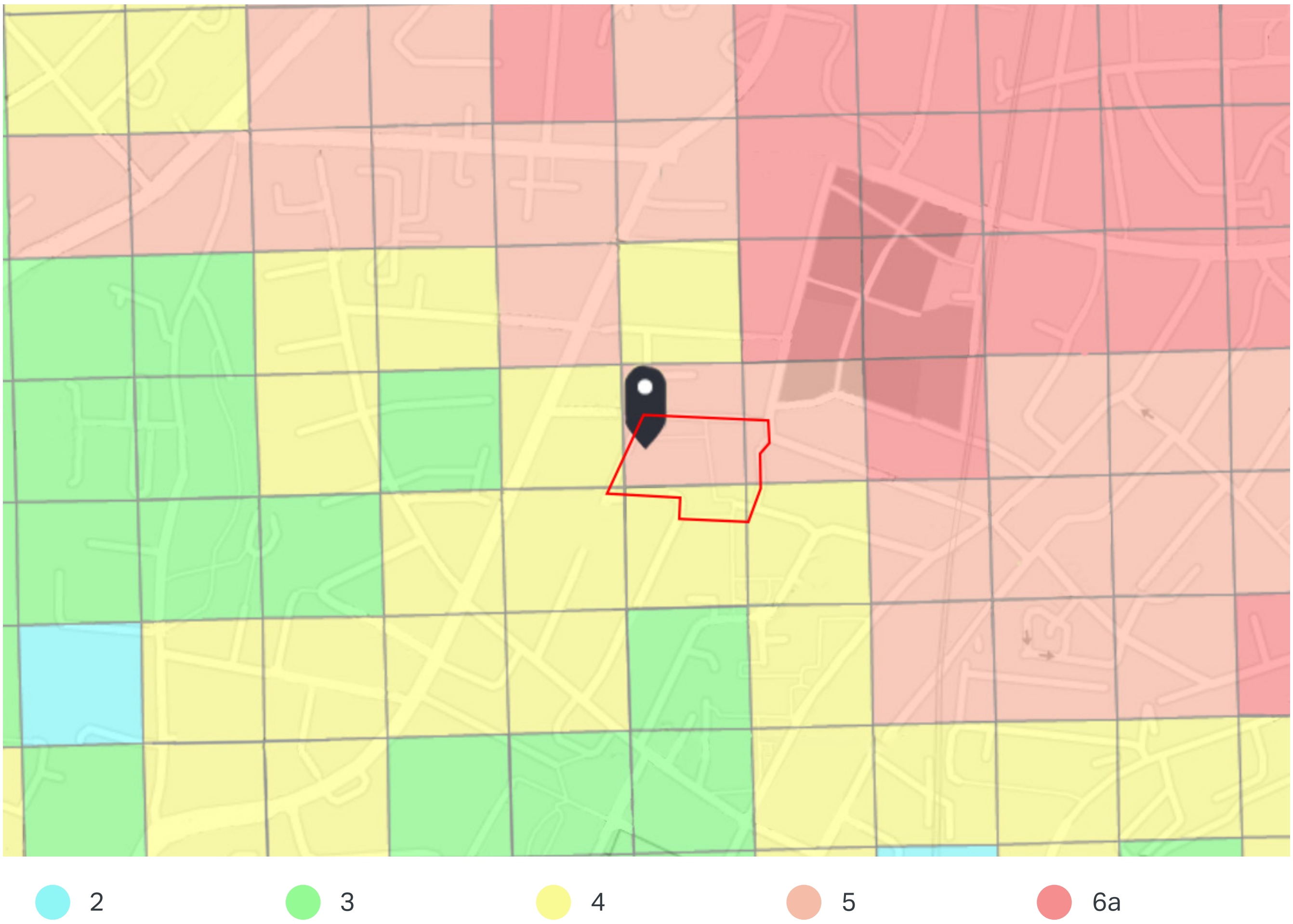
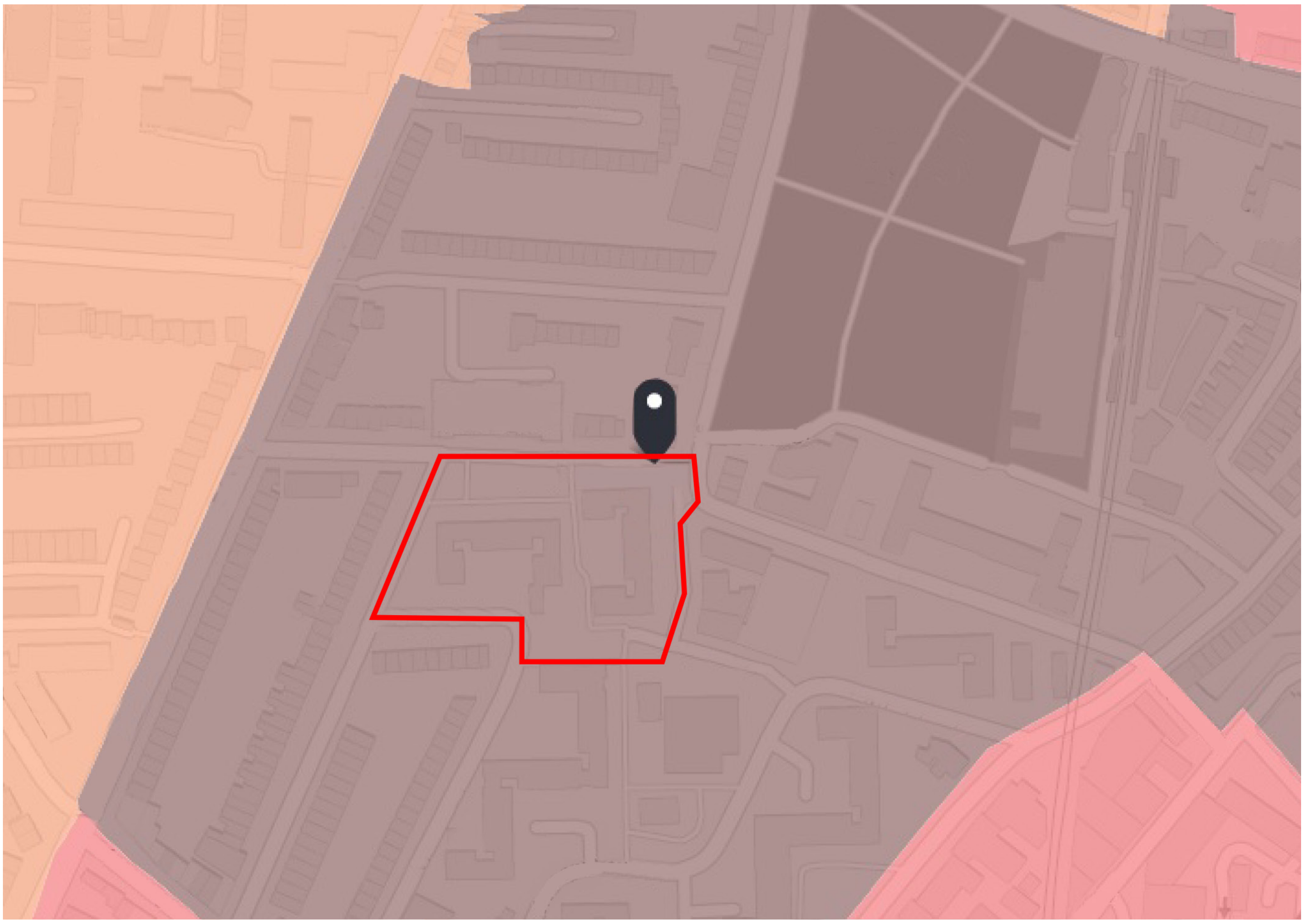


Figure A.11: Public Transport Access Level (PTAL) forecast. The general principle of providing increased levels of housing in areas with good access to public transport is well established. Assessing the PTAL within and surrounding a development site provides a useful insight into the opportunities or potential barriers to achieving site optimisation. Where transport provision is currently considered insufficient to support development, anticipated provision should be considered and where possible provision should be increased. Small housing developments are encouraged in areas with a PTAL of 3-6 or within 800m of a rail station.

In this example, most of the development site has a PTAL of 5, with the southern portion of the site having a PTAL of 4 and neighbouring contexts a PTAL of 6a. The surrounding streets have a PTAL of 4 or above and would be suitable for small housing developments. Under these circumstances there are unlikely to be barriers to site optimisation arising from access to public transport.

- TIM (Time Mapping): a complementary measure of connectivity to PTAL in WebCAT. Travel times in TIM use travel time data derived from TfL's transport models. The models divide London into over 3200 statistical areas or zones, providing times for all possible origin and destination zone combinations - equivalent to over 9 million records for each scenario. This means the user can select any location within London and WebCAT can quickly display travel times based on the zone where the selected point is located.



< 5 mins   5 - 10 mins   10 - 15 mins

Figure A.12: TIM travel time mapping to social infrastructure (in WebCAT). PTAL should be considered alongside TIM to provide an enhanced understanding of access to employment and services through the public transport network within a given travel time catchment.

In this example, the development site is shown within the context of its local catchment areas. Downloading the catchment analysis of the site through TIM demonstrates that it is less than 5 minutes from a town centre, with access to education and health services. Under these circumstances, there are unlikely to be barriers to site optimisation arising from access to public transport and available services.

Public transport connectivity through existing and planned services may vary across larger sites. This variation should be recognised within character assessments, and related policies, guidance and scheme design should respond positively to these differences. Larger sites generally provide greater opportunities to improve connectivity by incorporating new, publicly accessible walking and cycling routes as well as provision for new or improved access to existing bus routes, and rail infrastructure. Some large sites also have the potential to increase access and inclusion, for example through the provision of step-free access to public transport facilities and/or other access improvements. Boroughs are encouraged to promote developments on smaller sites within areas of good public transport access – as indicated by PTAL ratings of between 3 to 6 - or within 960m[2] walking distance of a station or town centre. They should also make use of complementary assessments of connectivity. Boroughs should consider the Healthy Streets Indicators when assessing sites and their immediate context and utilise them when preparing indicative layouts for generating and testing options to produce indicative site capacities[3]. These indicators provide a useful basis for considering how connectivity to employment and local services may be harnessed or enhanced through new development. This should include an evaluation of issues that intersect with those outlined in other capacity factors, for example, providing healthier pedestrian and cycle routes that have less air and noise pollution or are enhanced by contact with heritage, views or green infrastructure.

An optimum capacity will be achieved where development takes full advantage of a site's current connectivity by public transport, walking and cycling, and of opportunities to enhance access to employment and services both in the immediate area and through the public transport network. Boroughs should ensure that the density of a development is proportionate to the connectivity available to future residents.

Plan-making & guidance (master planning) stage	**Development management (building design) stage**
Map out existing and planned local services and connections with the site or area. Identify deficiencies and potential to improve connectivity.	Respond to existing and planned local services and connections with the site or area. Identify and address deficiencies and potential to improve connectivity.

2. Policy H1 and H2 refer to a crow-flies distance of 800m, but for the purposes of the document, the equivalent walking network measurement of 960m is preferred as it takes into account potential barriers to walking including rivers and railways, and can be lengthened by addressing severance issues.

3. Details of the Healthy Street Indicators can be found in Guide to the Healthy Street Indicators (Mayor of London/ TfL, 2017), A City for All Londoners (Mayor of London, 2016) and Healthy Streets for London (Mayor of London, 2017).

2.2.6 Infrastructure capacity

Establishing an appropriate optimum site capacity requires detailed consideration of the adequacy and potential of existing and planned infrastructure provision to support good growth (London Plan Policy D2). An evaluation of infrastructure capacity should extend beyond transport connectivity to consider other forms of infrastructure and its impact on quality of life, such as energy, water, waste, digital and smart technologies, social and green infrastructure. Optimising capacity requires the development of a form and scale that corresponds to the potential of existing and future infrastructure, and that is able to sustain existing infrastructure or enable infrastructure enhancement.

Assessing adequacy of infrastructure capacity

There are a number of ways to determine infrastructure sufficiency within an area and early engagement with infrastructure providers is recommended. Evaluating the implications of borough Infrastructure Delivery Plans (IDPs) should provide a good starting point for assessing the adequacy of infrastructure capacity for optimising site capacity during plan-making and site allocation. Similarly, annual Infrastructure Funding Statements (IFS) may provide further detail to IDPs by detailing the projects where finance received through developer contributions and Community Infrastructure Levy will be spent. Where infrastructure capacity is deemed inadequate to support planned, good growth, borough Planning Obligations Supplementary Planning Documents and Community Infrastructure Levy Regulation 123 Lists[4] will help clarify priorities and locations for infrastructure capacity improvements, and how funding may be secured.

The GLA's Infrastructure Mapping Application (IMA) can support site design by providing contextual information that can help boroughs plan for the optimisation of site capacity. This is in relation to neighbouring existing land uses and current and future development and infrastructure projects through a GIS platform capable of generating site-specific data (Figure A.13). This tool provides:

- Spatial data relating to area population projections
- Information on future investment in energy, water and transport infrastructure
- Information on future construction projects (e.g. residential, commercial, retail, civic, education and health sectors)
- Borough-wide contextual information (e.g. Strategic Housing Land Availability Assessments (SHLAAs), Sewer and Drainage Catchments, and Opportunity Areas, Strategic Industrial Locations and Town Centres) (Figure A.14).

The IMA provides boroughs with insight into how development and infrastructure provision will be phased over time. This enables greater accuracy and proactivity in optimising site capacity for housing. Boroughs

4. The Community Infrastructure Levy Regulations 2019 replace Regulation 123 Lists with Infrastructure Funding Statements. The first tranche of these is expected to be published by 31 December 2020.

should also consult the London Heat Map, to establish the potential for connecting to existing or planned district heating networks. Pre-application discussions, feasibility studies and draft agreements for planning obligations (e.g. Section106 agreements), may provide useful insight into potential future provision of infrastructure that is yet to be recorded within the IMA and other forms of GLA monitoring.

- Infrastructure Delivery Plan (IDP): a policy identifying the infrastructure required to support development within an area, including its capacity, location and available funding.

- Infrastructure Funding Statement: an annual report published by a local planning authority setting out sums received in the previous financial year through Community Infrastructure Levy and S106 planning obligations, and detailing how these will be spent.

- Infrastructure Mapping Application (IMA): an interactive tool to identify current and future development and infrastructure projects sorted by location, project value and funded status. The tool provides phasing status in relation to sectors including: transport, housing, energy, water, commercial and retail, and civic and public projects (https://maps.london.gov.uk/ima/).

Figure A.13: Land uses. The Infrastructure Mapping Application (IMA) provides convenient, up-to-date information on a variety of land uses including housing, retail, education, health and transport. This enables an indicative assessment of provision of services adjacent to the proposed development site, and identifies potential opportunities and barriers to site optimisation.

In this example, the development site is located within a rich mix of land uses, and there are no indicators that there would be barriers to achieving site optimisation at higher optimum densities.

Opportunities should be taken to incorporate replacement or necessary additional infrastructure on the site wherever possible. Large sites generally provide greater opportunities to incorporate additional social infrastructure and open space including facilities for education, leisure and health. This may be necessary to support the number of new homes proposed for the site or meet an existing need in the area (or both). Infrastructure assessments should identify need and feed that into polices and guidance. This should inform scheme design by flagging up requirements/opportunities for infrastructure and facilities.

In some cases, potential development will depend on the planned, future provision of public transport, walking and cycling infrastructure. Where there is currently insufficient infrastructure capacity to support proposed higher densities, boroughs should work with applicants and infrastructure providers, including TfL, to ensure that sufficient capacity will exist at the appropriate time. Where development depends upon new planned infrastructure, boroughs should consider how phased development could help optimise capacity over time.

Minor developments will typically have incremental impacts on local infrastructure capacity. The cumulative demands on infrastructure of minor development should be addressed in boroughs' Local Plans, IDPs and Programmes (and funded for example by planning obligations). Therefore, it will not normally be necessary for minor developments to be supported by infrastructure assessments. Boroughs should also not need to refuse permission to these schemes on the grounds of infrastructure capacity if necessary and proportionate contributions towards the cost of supporting infrastructure are planned and secured.

- Green infrastructure: a network of green spaces, including features such as street trees and green roofs, that is planned, designed and managed to deliver a range of benefits. As well as providing more attractive places for people, these benefits include mitigating flooding, cooling the urban environment and enhancing biodiversity and ecological resilience.

- Green Infrastructure Focus Map: online tool and evidence base to support targeted infrastructure improvement and investment in green infrastructure. This identifies where there is need for green infrastructure related to specific environmental or social issues within a given area. (https://data.london.gov.uk/dataset/green-infrastructure-focus-map).

- London Heat Map: online tool to identity and develop decentralised energy (DE) projects in London. This includes data relating to majorenergy consumers, fuel consumption, carbon dioxide emissions, energy supply plants, community heating networks and heat density. (https://www.london.gov.uk/what-we-do/environment/energy/london-heat-map/what-london-heat-map).

Anticipating increasing demand for services
Boroughs should proactively plan for estimated population growth within areas of new residential development, and ensure that a site capacity currently capable of supporting a good quality of life for residents remains so in the future. Planning for the needs of children and young people growing up within new housing developments is a key consideration. Optimum play space may have to be provided on site to optimise capacity. This will depend on a range of factors including the number and age of children and young people likely to live in a new development and the accessibility/ inclusivity, quantity and quality of play space near the site.

Population and child yield vary across type of home and housing tenure. The GLA Population Yield Calculator should be used, which gives an indication of the possible number and age of children that could be expected to live in a new housing development of any given bedroom or tenure mix to determine the likely number and age of people, including children and young people expected to live in a new development of a given bedroom or tenure mix (house/flat and number of bedrooms). The expected population yield can assist in determining the potential need for open space and social infrastructure generated by a new development to inform the infrastructure planning process when calculating the indicative site capacity (Section 4.1).

- Population Yield Calculator: a tool for estimating population yield from new housing development. The calculator provides users with an indication of the possible number and age of people who could be expected to live in a new housing development of a given bedroom or tenure mix (https://data.london.gov.uk/dataset/population-yield-calculator).

An optimum capacity will be achieved where the scale and form of development sustains or enhances existing infrastructure and harnesses the planned future infrastructure investment needed to enrich the lives of Londoners living in the area and those who will attracted to it.

Plan-making & guidance (master planning) stage	**Development management (building design) stage**
Identify any necessary on-site infrastructure in site allocations, area-based strategies and development briefs. Identify existing and planned district heat networks in the surrounding area and potential connections to them.	Identify and secure necessary infrastructure provision as part of the scheme. Secure Section106/CIL contributions towards necessary site-specific and borough- wide infrastructure capacity improvements.

Links with key relevant London Plan policy and guidance	
Policy D2 (Infrastructure requirements for sustainable densities) Policy G1 (Green infrastructure) Policy S1 (Developing London's social infrastructure) Policy S2 (Health and social care facilities) Policy S3 (Education and childcare facilities) Policy S4 (Play and informal recreation) Policy SI3 Energy infrastructure) Policy SI13 (Sustainable drainage) Policy SI5 (Water infrastructure) Policy SI6 (Digital connectivity infrastructure) Policy SI7 (Reducing waste and supporting the circular economy) Policy T9 (Funding transport infrastructure through planning) Policy DF1 (Delivery of the Plan and Planning Obligations	London Infrastructure Plan 2050 Social Infrastructure SPG (May 2015) Crossrail Funding SPG (Use of planning obligations and the Mayoral CIL) (April 2013) Borough Planning Obligations SPD Borough CIL Regulation 123 List Borough Infrastructure Delivery Plan

2.2.7 Deliverability

Optimising site capacity is only possible where sites identified for housing supply are deliverable and viable at the scale, form and use intended during site allocation.

A thorough consideration of deliverability for a range of residential uses should begin with addressing the following questions:

- Is the site developable: in a suitable location for housing development with a reasonable prospect that the site is, or will be, available and could be viably developed at the point envisaged?
- Is the site subject to complex land ownership or phasing likely to affect its timely deliverability?
- Where complex patterns of land ownership affect optimisation, is there an opportunity to consider the reasonable use of compulsory purchase powers to facilitate land assembly?

- Is the site likely to be subject to exceptionally high costs that may affect viability, e.g. need for land remediation following contamination from previous industrial use?
- Does the site optimise affordable housing delivery?
- Is there an undersupply or oversupply of a specific residential type or tenure in the area that may promote or inhibit housing delivery, e.g. across planned phases of large sites?
- Does the development phasing present an opportunity to deliver beneficial temporary uses en route to more permanent optimum site capacity, e.g. meanwhile housing?

Boroughs and applicants should proactively consider these issues. For large sites where delivery will be phased, applicants should outline a delivery schedule with their planning applications detailing the provision of affordable housing, publicly accessible open spaces, enhancement of accessibility measures and provision of social infrastructure.

Optimum site capacity will be achieved where an understanding of deliverability is used by boroughs to promote strategies that ensure that housing and any required supporting infrastructure can be delivered at the appropriate time, scale, form and use intended during site allocation.

Plan-making & guidance (master planning) stage

Take account of relevant evidence base on land supply including the borough's brownfield land register and potential windfall sites.

Take account of relevant evidence base on development plan viability and land owner/prospective developer comments.

Identify any particular ownership and/or phasing issues and proposed solutions.

3
STAGE TWO:
USE OF RESIDENTIAL BUILDING TYPES

3.1 Residential building types

Boroughs are encouraged to determine optimum site capacity by harnessing the benefits of residential building types, and combinations of types, that can meet required housing standards and support quality of life for future residents.

A residential building type is a category of housing based on typical characteristics, including form, scale and site configuration (Figure A.14). A type-base method for evaluating optimum site capacity is predicated on the idea that London's urban landscape consists of familiar, repeatable types, brought together to work in coherent, urban arrangements. Types evolved historically because they delivered new housing and improvements in the quality of life within the existing context of London. Residential building types recommended here are those most commonly recognised in London, and are best placed to address the concerns of the Housing Design quality and standards module (Module C). This does not preclude the development of hybrid types in response to site-specific characteristics or the emerging needs and aspirations of Londoners.

To improve opportunities for optimisation across a range of sites, this guide distinguishes between residential types promoted to unlock constrained, small sites, and those most able to optimise site capacity on larger sites (Section 3.3). Types particularly suitable for smaller housing developments include residential conversions and extensions (Type A), individual houses (Type B), and clusters of houses or stacked maisonettes that are capable of forming a coherent design response on a single site (Type C). These types are introduced within Module A, but they are best understood in relation to their role in the preparation of place-specific design codes (Module B). Residential types intended to optimise larger sites include terraces (Type D); linear blocks (Type E); villa blocks (Type F); and towers (Type G). These are discussed in detail within Module B, and are accompanied by an outline of their anticipated performance against the Housing Design - Quality and Standards as a means of promoting quality of life (Module C).

This module assesses the characteristics, qualities and limitations of each type and considers how types may be combined in different urban arrangements for different purposes (Section 3.2) and in mixed-use developments and neighbourhoods (Section 3.5). Exemplars of each residential type are presented through best practice case studies of new developments in London. These demonstrate the potential of specific types to contribute a form and layout that enhances local character and improves the quality of life of Londoners (Module D).

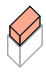
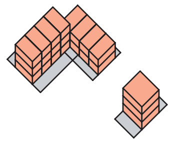
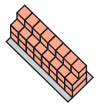
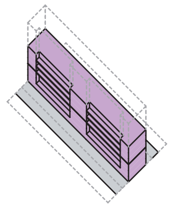
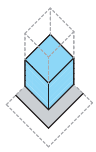
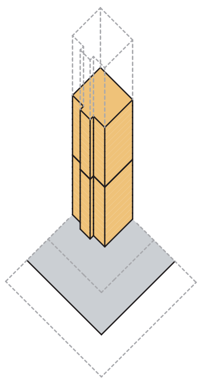
A: Residential conversions and extensions		Residential types promoted to optimise site capacity of smaller, constrained sites (Module C). Clusters could be appropriately used to infill vacant or underused street-facing and backland plots, and could optimise site capacity following demolition and residential redevelopment.
B: House		
C: Cluster, including detached, semi-detached or stacked maisonettes		
D: Terrace		Residential types promoted to optimise the site capacity of larger sites in various combinations.
E: Linear block		
F: Villa block		
G: Tower		

Figure A.14: Residential types summary..

Boroughs should independently assess how well residential schemes perform against the housing design standards when they comprise types that vary from recommended forms. This includes a scheme's ability to provide for a diverse city, and deliver new, affordable housing and family-sized housing. Boroughs should remain open to professional design judgement during pre-application discussion and decision-making, and encourage interrogation of site and context, type refinement, and the creation of alternative types and innovative configurations during development management. They should bear in mind that established types were once themselves prototypes. Site and context analysis using capacity factors (Stage One) and other characterisation undertaken by boroughs should confirm the predominant residential types and densities within an area. This can be used to inform an evaluation of the need for consistency or variation in residential type to support borough-wide good growth.

Selection of residential types should respond to the character of their urban context; ensure the efficient use of land; maximise connectivity; and support other measures to enhance the quality of life for residents. The type-based method provides boroughs with an opportunity to test the ability of several urban arrangements to address capacity factors within a modelled context. Boroughs should form a judgement about whether site capacity has been optimised through reflection on the appropriateness of design options modelled within their context and the resulting quantitative measures from the Indicative Site Capacity Calculator (Section 4.1)

3.2 Types

The following guidance summarises the characteristics, qualities and limitations of small site types (A-C), and terraces (D), linear blocks (E), Villa blocks (F) and towers (G), to enable an appropriate choice for a given site context. The use of small site types within larger sites is not encouraged, as they are intended to unlock highly constrained sites that may only deliver a small number of dwellings. Module C provides guidance for small housing developments and the design code preparation to realise good growth through neighbourhood intensification.

3.2.1 Type A: Residential conversions and extensions

Residential conversions and extensions can increase housing provision. This can range from providing new homes through the extension and conversion of existing buildings, to subdividing a large dwelling into smaller dwellings (Figure A.15).

Residential conversions and extensions enable the optimisation of site capacity in contextually sensitive locations. The principal limitation of conversions and extensions is that they are restricted by existing built form and allow only incremental change to building heights. This constrains dwelling type mix and the potential for increased independent mobility. However, the type has the potential to achieve growth, while maintaining consistency of urban character, and it can provide opportunities for growth in relatively sensitive contexts that meet the needs of established communities and harness existing infrastructure. As with other small site types, the potential for conversions and extension is enhanced through design coding (Module C).

Relevant case studies:
D1.1 Piper Rooftop
D1.2 Garden House

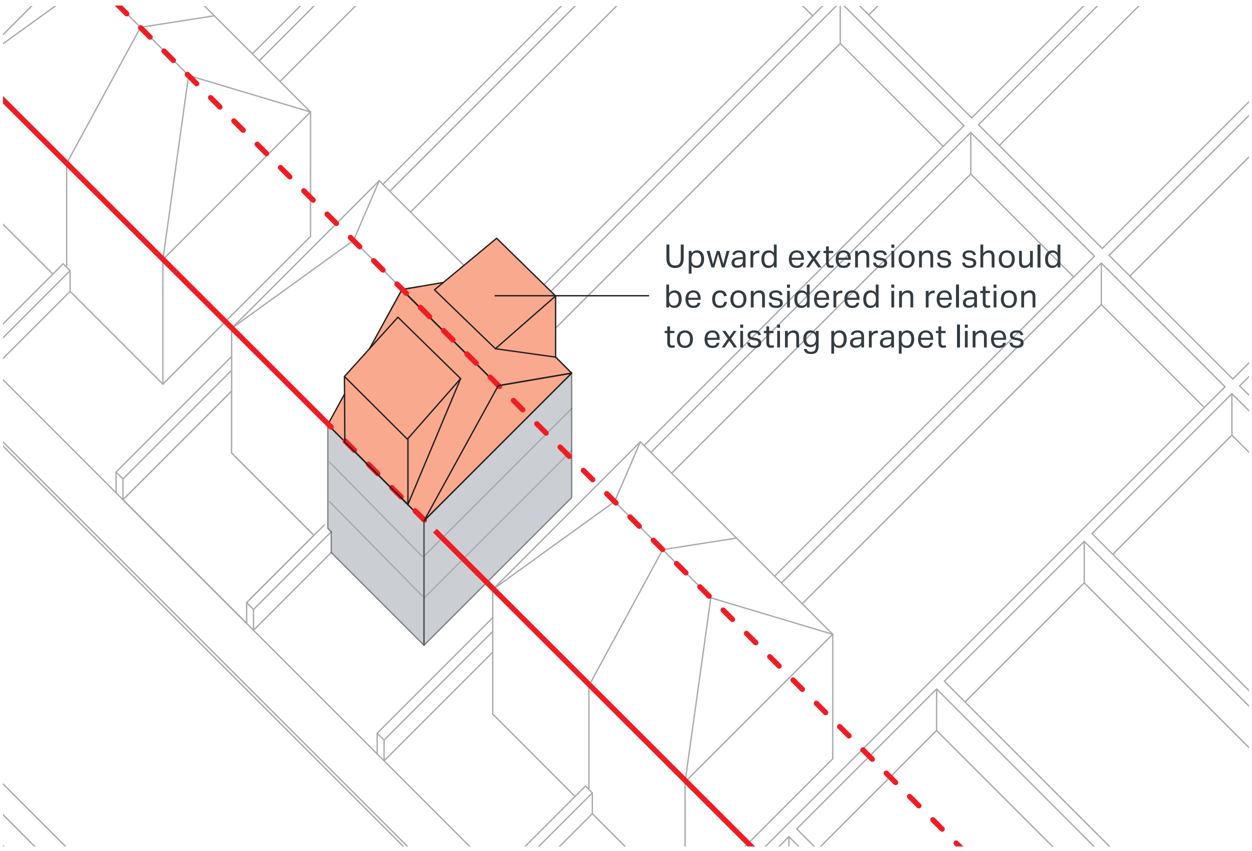


Figure A.15: Upward extension

3.2.2 Type B: House

Typical height range: 2 – 3 storeys

A house is an individual dwelling that stands within its own plot, functioning independently of adjacent dwellings with no dwelling above or below it. Suitable opportunities for the use of a single house may be infill within a street setting, the curtilage of an existing house, or on a vacant or underused backland site (Figure A.16). If a site is large enough to incorporate more than one house, then a cluster of houses or other types enabling optimum site capacity should be explored.

A direct relationship between the home and outdoor space makes the type appropriate foraccommodating families with children. Depending on the plot size and other site constraints, the individual dwelling may provide ideal accommodation for larger families within existing neighbourhoods.

Houses enable the optimisation of site capacity individually, or in groups, where forms of development associated with limited to moderate growth are contextually appropriate. As houses provide semi-public frontages and private rear gardens, the form is particularly suitable for families, where independent mobility or access to private amenity space is beneficial. As with other small site types, houses provide opportunities for incremental growth to meet the needs of established communities and to harness existing infrastructure. The potential of houses is enhanced through design coding (Module B).

Relevant case studies:

D2.1 Strange House
D2.2 Hidden House
D2.3 Adolphus Road

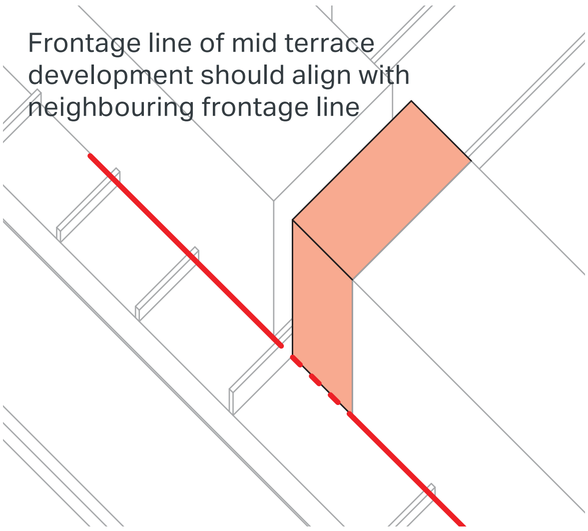


Figure A.16: House in street-facing conditions and backland conditions. Well-designed small house developments are promoted in street-facing conditions, where the site has direct access to the street, and in backland conditions where the site is behind development.

3.2.3 Type C: Cluster

Typical height range: 2 – 4 storeys

A cluster is a small collection of houses that cohesively form a single site. This could range in form from a homogeneous block to a series of individual, related buildings, e.g. detached, semi-detached or stacked maisonettes (Figure A.17). Clusters optimise site capacity by responding to site constraints and the character of the immediate context. Clusters efficiently share cores and communal features, e.g. utilities, parking, refuse storage and gardens, fostering a strong sense of community. Clusters can be used to infill vacant or underused street-facing and backland plots, and optimise site capacity following demolition and residential redevelopment.

The typical height range offers opportunities for a mix of dwelling types in response to local context and resident need. It also provides the opportunity to provide sheltered, communal outdoor space.

Clusters enable the optimisation of site capacity where forms of development are associated with limited to moderate growth and where lower increases in density are contextually appropriate. Clusters provide an opportunity to vary height and form, introduce alternative dwelling mix, and produce innovative forms of communal outdoor space within relatively confined site conditions. A cluster provides a means of balancing limitations of individual small site types in the way site arrangements might do at a larger scale. This may support divergence from the existing character of an area, e.g. where clusters occur within backland sites to introduce new forms of family homes or where infill extends existing street frontages. As with other small site types, clusters provide opportunities for incremental growth to meet the needs of established communities and to harness existing infrastructure. The potential of clusters to optimise site capacity is enhanced through design coding. Design coding may be used to manage potential variation in the types that form clusters, as well as between clusters and the character of the existing neighbourhood (Module B).

Relevant case studies:

D3.1 Otts Yard
D3.2 Sheendale
D3.3 Caudale
D3.4 Two Family Houses
D3.5 Barretts Grove

Figure A.17: Cluster. Clusters can be formed by the addition of new houses and extensions to existing streets and new development sites, in backland and street facing locations.

3.2.4 Type D: Terraces

Typical height range: 2 – 3 storeys

Typical characteristics

A terrace is a row of individual homes, producing a collective, urban order due to their repetition, continuous street frontage and uniform appearance (Figure A.18). Sub-types include those linked by a carport, townhouses or rows of mews houses. In emerging site arrangements, terraces are typically positioned on narrower secondary, and tertiary streets, with larger residential types lining the primary roads[5]. Terraced houses commonly have private gardens or courtyards, increasing their suitability for family housing. Terraced houses are separated by party walls and have their own private access from the street. As each terraced house sits on its own plot, the type falls into the lower density range.

Heights

A terrace is usually characterised by uniform height for much of its length. However, additional height added at the ends of a terrace can help define street corners and differentiate the end of the terrace.

Dwelling size mix

Terraced housing usually provides larger homes, typically three and four bedrooms. The mix can be varied through the provision of additional storeys, or by locating habitable rooms in roof space. If outward consistency is key, the size mix can be varied through the provision of double height interior spaces that can be easily adapted into an additional bedroom.

Independent mobility

The way housing and residential developments are designed impacts on the ability of children and young people to move between domestic, playable and social spaces independently. The direct relationship between the home and outdoor space makes the terrace suitable for accommodating families with children.

As accommodation is stacked over a number of storeys, it can be less suitable for many disabled and older people. The close connection of the terraced home to the street can sometimes afford a well-managed connection between parking (where needed) and the front door which can be beneficial for people who require nearby disabled persons parking. However the internal arrangement will dictate the need for through floor lifts for wheelchair user dwellings and compliance with Approved Document Part M4(3) of the building regulations (Housing Design - Quality and Standards: Module C.

5. *Street Types for London*, (Transport for London, 2014).

Mixed uses

Since a terrace house has no other ownership above or below, it does not lend itself readily to the multiple occupation of mixed-use buildings. However, different uses can be located at the end or within the length of a terrace as part of an urban arrangement, e.g. in larger developments where there is evidence that other uses (e.g. retail) may be required to improve site capacity.

Limitations of type

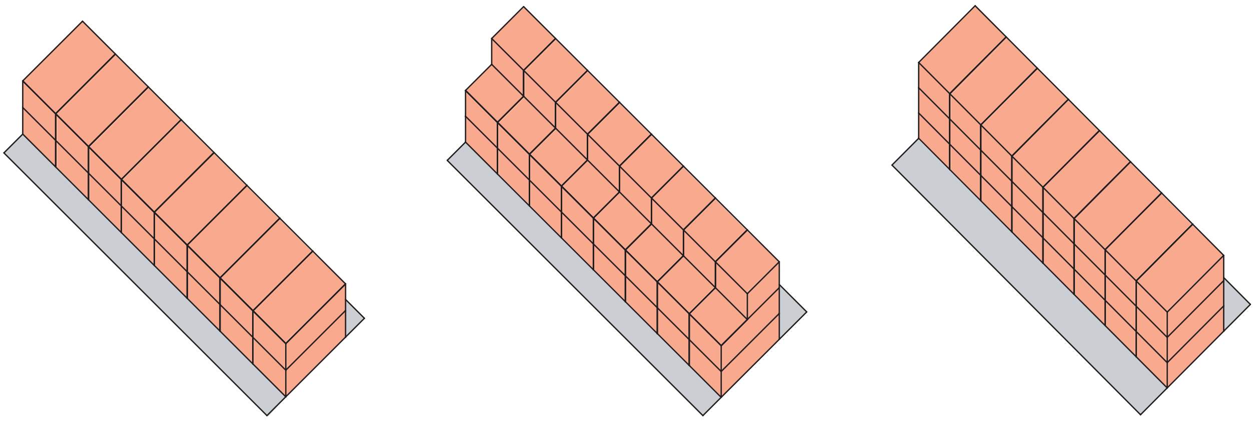
In comparison to the linear block, the terrace provides lower densities on construction, and therefore less opportunity to generate new housing of all types, including affordable housing. However, terraced housing is highly flexible and may be converted into multiple dwellings, and extended to create additional homes or increase accommodation within existing footprints (Type A: Residential conversions and extensions). Systematic upward extension of existing terraces (facilitated and managed by area design codes) may achieve similar results to linear blocks, allowing greater density within the same footprint. Boroughs are encouraged to promote the future proofing of terraces to enable adaption and intensification in the future. As continuous forms and narrow streets may concentrate air pollution, care should be taken to consider the building orientation in relation to prevailing wind direction and also the location of discharge points and stacks.

Terraces enable the optimisation of site capacity where forms of development associated with moderate growth are contextually appropriate. As with houses, terraces provide some access to semi-public street frontages and private rear gardens, offering benefits for families with children. On larger sites, terraces may provide a useful intermediate scale that can connect existing streets to more intensive forms of development. In terms of future-proofing, the repetitive character of terraces offers some opportunities to increase densities in response to planned enhancements to infrastructure or where incremental growth of established communities is anticipated in the medium-term.

Relevant case studies

D4.1 Foundry Mews
D4.2 Dujardin Mews
D4.3 Signal Townhouses
D4.4 Beveridge Mews
D4.5 Moray Mews

Performance against Housing Design Standards	
Shaping Good Places	Relates in scale and rhythm to much of historical residential London Flexibility to deal with changes in topography
Designing for a Diverse City	Larger homes with gardens suitable for families Can generate new affordable housing, but less so than linear block and tower types
From Street to Front Door	Security of public realm through front doors and windows onto streets facilitating surveillance Ease of access and servicing due to direct relationship with street Cycle parking can be within the domain of individual homes, so long as it is provided over and above the minimum space/storage/circulation standards. Cycle storage identified in habitable rooms or on balconies is not acceptable
Dwelling Space Standards	All dwellings have private gardens Opportunity for interesting spatial relationships across multi-levels
Home as a Place of Retreat	Dual aspect is good for privacy, aspect, daylight, ventilation and passive cooling
Mixed Places	Less suited to integration with mixed uses Potential to incorporate small scale live-work units
Living Sustainably	Opportunity to increase biodiversity and green cover and integrate SuDS into gardens and through green roofs Opportunity to incorporate rainwater harvesting systems for outdoor water use Opportunity to incorporate property flood resilience measures More difficulty in meeting fabric energy efficiency, but more opportunity for renewable energy.
Future Proofing	Adaptability and flexibility due to singular ownership.



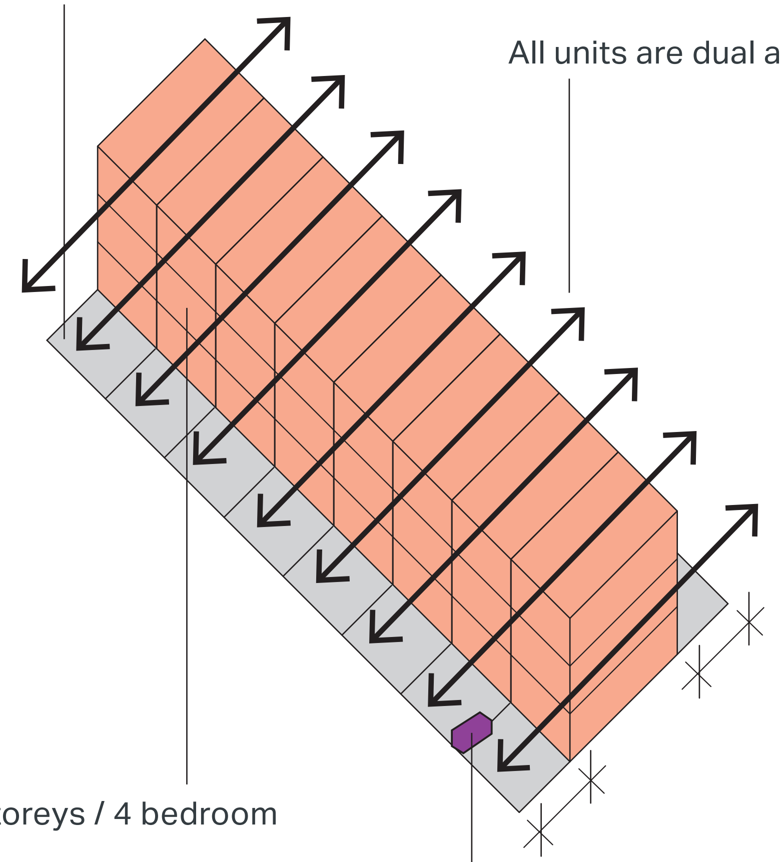


Figure A.18: Performance of terrace type against key Housing Design Standards. The above diagram identifies some of the key design standards a terrace performs well against

3.2.5 Type E: Linear blocks

Typical height range: 3- 10 storeys

Typical characteristics

Linear blocks allow a similar relationship to the street as terraces, but offer higher densities by accommodating multiple dwellings in a vertical stack (Figure A.19). Commonly, linear blocks comprise maisonettes at ground and first floors, with additional maisonettes or lateral apartments at upper floors. This enables homes on lower floors to have individual entrances on the street, while homes on upper levels are reached by communal stairs and lifts. Upper level homes may be paired around a lift or stair core, or accessed from a short corridor or external gallery. Mansion blocks are a common form of linear block in London.

Heights

Above 10 storeys achieving adequate daylight and sunlight into neighbouring homes, open spaces and streets can be problematic and will require increased spaces between buildings to protect amenity. At early capacity testing, a useful principle is to assume that half the building height will cast a shadow on the neighbouring ground taking account of building orientation, neighbouring building heights and topography. As proposals are developed and tested, it may be possible to refine building height, building profile and building orientation to minimise overshadowing and realise the benefits of achieving the requirements of the housing design standards (e.g. supporting passive cooling, daylighting, ventilation and aspect).

Dwelling type and tenure mix

Linear blocks enable a variety of configurations of dual aspect maisonette and flat types to be achieved. Consideration should be given to the relationship between dwellings and the means of access. For example, flats with kitchens fronting a gallery access can facilitate a good level of neighbourly interaction and passive surveillance. However, orientating bedrooms to gallery access will result in a lack of privacy. Use of voids or setbacks as buffers between habitable rooms and gallery access can enhance privacy.

Independent mobility

Gallery access of limited distances enables a clear visual connection from the front door of homes to the street or outside amenity space. Where homes are accessed by corridors or internal cores, windows should be provided to these communal internal areas to afford access to natural light and views.

Mixed uses

Linear blocks are highly versatile since different scales of mixed uses can be easily integrated by replacing homes at ground floor. Consideration should be given to appropriate floor to ceiling heights for mixed uses at ground floor.

Limitations of type

The height of linear blocks needs to be managed to reduce the impact of overshadowing. Where higher densities are required, linear blocks may have to be used in combination with other types to maintain good levels of daylight and sunlight. In addition, upper floors could be set back to reduce visual impact and improve daylight to the ground.

If site constraints or development plans require a deeper block, designers should be careful to avoid deep, narrow dwellings that result in poor daylight levels due to internal spaces being some distance from windows. Long, double-loaded corridor arrangements should be avoided due to the high proportion of single aspect dwellings.

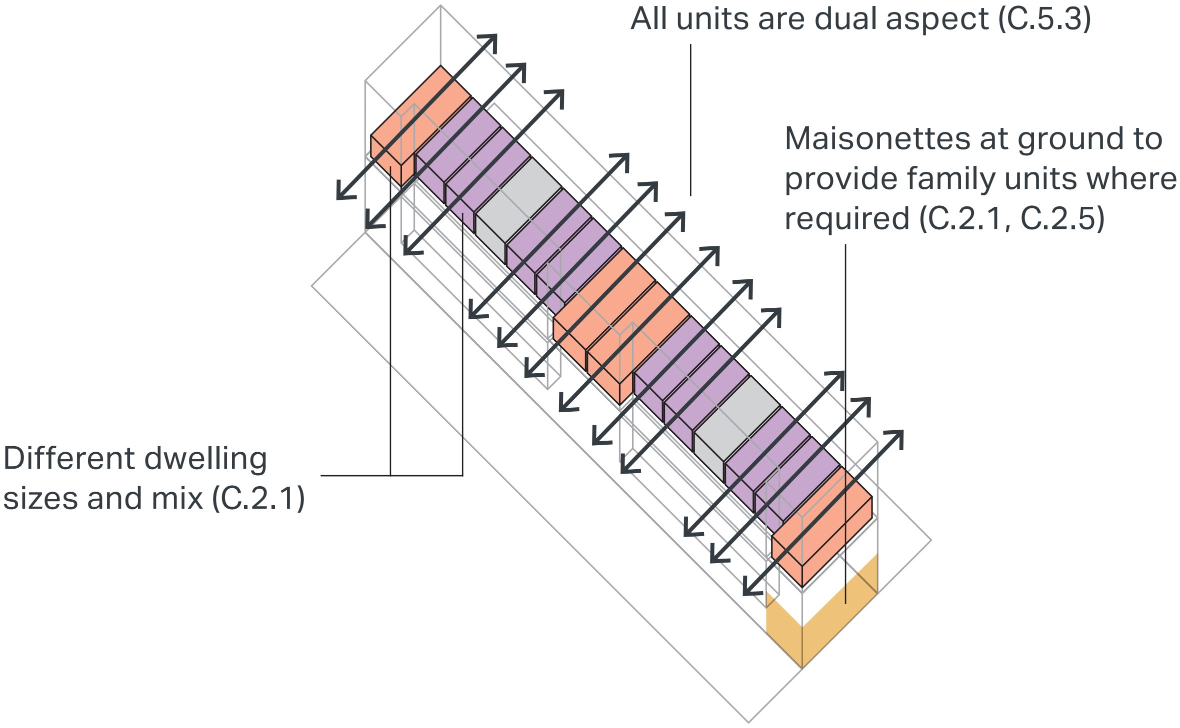
Continuous, tall linear buildings on narrow streets can concentrate air pollution. Consideration should be given to building location and orientation within the site, to adjacent road usage, and to the potential of using setbacks and stepped building forms to avoid the concentration of air pollutants.

Linear blocks enable the optimisation of site capacity where forms of development associated with moderate to extensive growth and higher density are contextually appropriate. As with terraces, linear blocks provide some access to semi-public street frontages and open public spaces but offer relatively limited private rear gardens. Lower floors offer benefits for families with children and those with impaired mobility. Linear blocks enable higher densities of varied dwelling mix and tenure, including affordable housing. They are particularly appropriate for newer communities on larger sites promoting enhanced infrastructure in the near future.

Relevant case studies

D5.1 Bourne Estate
D5.2 Ely Court
D5.3 Kirkfell
D5.4 Darbishire Place
D5.5 Redwood Park
D5.6 Silchester Estate
D5.7 Trafalgar Place
D5.8 Chobham Manor

Performance against Housing Design Standards	
Shaping Good Places	Versatile and responsive to context Building heights can be adjusted based on location along primary or secondary streets
Designing for a Diverse City	Larger homes with gardens suitable for families can be accommodated at ground floor Multiple dwelling types can be accommodated within the same block Opportunity to generate larger amounts of new affordable housing Suitable for wheelchair accessible houses when planned with lift access
From Street to Front Door	Security of public realm through front doors and windows onto streets providing activity and surveillance Consideration needs to be given to the location of plant rooms, refuse and cycle stores Cycle parking can be within the domain of ground floor homes, providing it is provided over and above the minimum space/storage/circulation standards. Cycle storage identified in habitable rooms or on balconies is not acceptable. Communal cycle stores will need to be provided for upper level homes Car parking, if provided, must be designed to best support place-making and optimised site capacity
Dwelling Space Standards	Dwellings at ground floor can have private gardens while balconies or terraces need to be integrated for upper level homes
Home as a Place of Retreat	Dual aspect is good for privacy, aspect, daylight, ventilation and passive cooling
Mixed Places	Suited to incorporation of non-residential uses at ground floor
Living Sustainably	Opportunity to increase biodiversity and green cover and to integrate SuDS into gardens and through green roofs Opportunity to incorporate rainwater harvesting systems for outdoor water use Opportunity to incorporate property floor resilience measures
Future Proofing	Shallow block depths and structural systems allow dwellings to be easily adaptable.



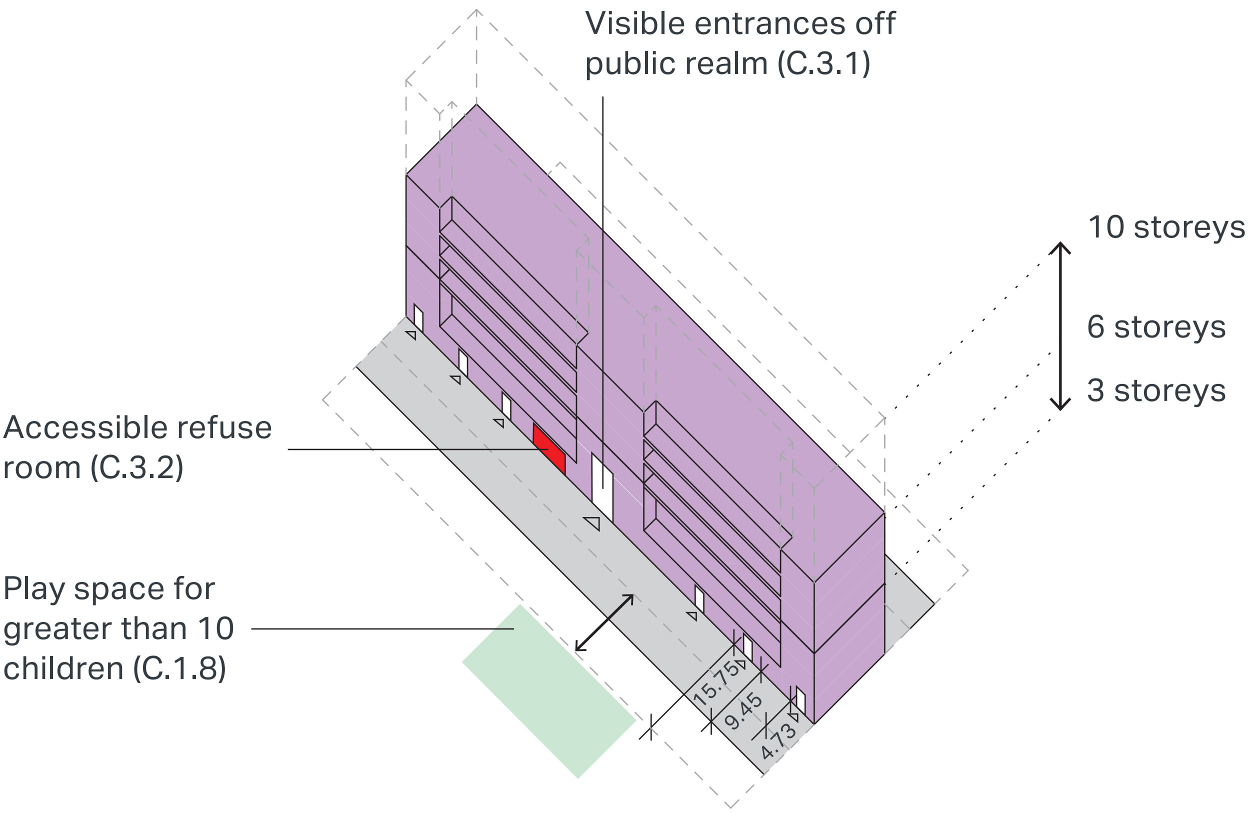


Figure A.19: Performance of linear block against Housing Design Standards. The above diagram identifies some of the key design standards a linear block performs well against

3.2.6 Type F: Villa block

Typical height range: 5 – 10 storeys

Typical characteristics

The villa block is characterised by a central core and efficient circulation arrangement. This enables habitable rooms to be orientated towards the façade to provide frontage and aspect in all directions (Figure A.20). This affords a different relationship to the street, providing an alternative to the terrace or linear block where the fronts and backs of dwellings conform to anticipated social and functional conventions about public access and private retreat. This makes the villa block ideal for both use as a stand-alone building, and importantly, as part of site arrangements (Section 2.2).

Heights

Proportionally, the villa block is at least as tall as it is wide or deep, with a recommended height range between five and ten storeys. With increasing height, consideration should be given to the potential for overshadowing of neighbouring homes, open spaces and streets, and the need to increase spaces between buildings to protect amenity and maintain adequate natural light. At early capacity testing, a useful principle is to assume that half the building height will cast a shadow on the neighbouring ground taking account of building orientation, neighbouring building heights and topography. As proposals are developed and tested, it may be possible to refine building height, building profile and building orientation to minimise overshadowing and achieve the requirements of the housing design standards (e.g. supporting passive cooling, daylighting, ventilation, effective dispersion of air pollution and aspect).

Dwelling type and tenure mix

Four dwellings per floor provides good efficiency, while allowing all dwellings to be dual-aspect. The number of dwellings per floor will depend on dwelling type and size, but the central core allows for a variety of different flat types around it. Care should be taken to accommodate different tenures sensitively to avoid segregation of residents e.g. where different management structures and service charges operate within a single block.

Independent mobility

As villa blocks are accessed by central cores, there is less potential to create a visual connection between front doors and play space at upper levels. Visual connection can be improved where stair cores have external windows that allow overlooking onto doorstep play, encouraging passive surveillance. A clear visual connection should be established between ground floor entrances and outside spaces that children and young people may wish to access for play and recreation to encourage their independent movement.

Mixed uses

The villa block has multiple street frontages at ground level, which means that residential and mixed-use entrances can be easily separated. Consideration should be given to the space required at ground floor for access and servicing of dwellings, as this will impact on the space available for other uses. As building height and dwelling numbers increase, the space required at ground level for bin stores, cycle stores and plant rooms will increase, requiring efficient design to enhance segregation of uses for convenience and amenity.

As villa blocks are often used at prominent corners within site arrangements, they are particularly suited to the integration of retail, community and leisure uses within residential areas. In taller villa blocks, commercial office space could be provided at upper levels as the central core and free façade make it ideal for open plan uses.

Limitations of type

The provision of single-aspect dwellings should be avoided. Where flats per floor exceed four, single-aspect flats are inevitable. In the exceptional circumstances where single-aspect dwellings are provided, alternative prospect should be offered to reduce the detrimental effects e.g. by articulating the building line or creating bays to allow for windows on a perpendicular façade. North-facing and south-facing single-aspect dwellings are likely to suffer from inadequate natural light and the potential for overheating respectively. Residents living in single-aspect dwellings orientated towards sources of noise, air and light pollution are likely to be consistently exposed to harm reducing their quality of life.

Villa blocks enable the optimisation of site capacity where forms of development associated with extensive growth and higher density are contextually appropriate. The use of villa blocks in combination with other types is particularly appropriate. This supports site optimisation through the efficient use of land, provision of shared facilities and mediation of scale to achieve a contextually appropriate response. Villa blocks enable higher densities of housing of all types including affordable housing. They are particularly appropriate for newer communities on larger sites promoting substantial or enhanced infrastructure in the near future. Limited individual access to street frontages and open public spaces from dwellings means site optimisation requires a consideration of how residents access all forms of infrastructure as part of the wider development.

Relevant case studies

D6.1 Finsbury Park
D6.2 Brentford Lock West Phase 2
D6.3 Camden Road

Performance against Housing Design Standards	
Shaping Good Places	Versatile in its use either to define and densify corners/ edges of urban arrangements or used independently Compact footprint can be useful when dealing with difficult topography Flexible in its external appearance as it can be used to create distinction or blend in to surrounding context Building heights can be adjusted based on strategic location within urban arrangement or neighbourhood
Designing for a Diverse City	Multiple dwelling types can be accommodated within the same block Opportunity to generate larger amounts of new affordable housing Suitable for wheelchair accessible houses when planned with lift access
From Street to Front Door	When designed as a stand-alone building, careful planning is required to integrate refuse, plant or storage at ground level to avoid blank frontages
Dwelling Space Standards	Can help deliver high levels of dual-aspect dwellings
Home as a Place of Retreat	Ground floor needs careful planning to manage privacy and achieve active frontages Can achieve high levels of daylight into dwellings owing to floor to façade ratio Need to consider impacts of glazing proportions on overheating risk
Mixed Places	Limited scope to integrate alternative uses at ground level unless as part of a larger site arrangement

Living Sustainably	Small building footprint allows for more space for green infrastructure and urban greening to support biodiversity, SuDS and cooling in addition to green roofs Efficient form and appropriate building fabric can enable energy efficiency Opportunity for communal heating and renewable energy, facilitated by efficient central core.
Future Proofing	Limits scope to build in close proximity owing to continuous active frontage.

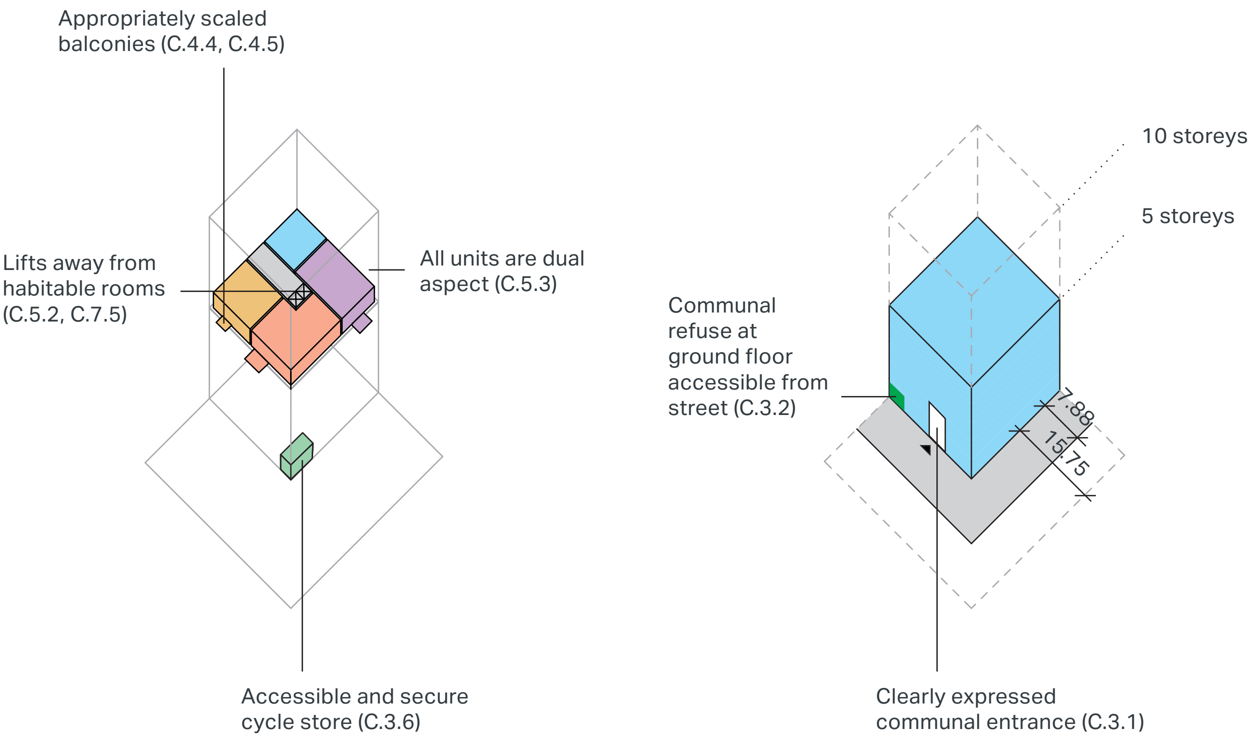


Figure A.20: Performance of villa block against key Housing Design Standards. The above diagram identifies some of the key design standards a villa block performs well against

3.2.7 Type G: Tower

Typical characteristics
Within this guidance a tower is defined as being ten storeys or over. As with the villa block, the tower is characterised by a central core and efficient circulation arrangement, allowing habitable rooms to be orientated towards the façade and providing aspect in all directions (Figure A.21).

Height
With increasing height, consideration should be given to the potential for overshadowing of neighbouring homes, open spaces and streets, and the need to increase spaces between buildings to protect amenity and maintain adequate natural light. At early capacity testing, a useful principle is to assume that half the building height will cast a shadow on the neighbouring ground taking account of building orientation, neighbouring building heights and topography. As proposals are developed and tested, it may be possible to refine building height, building profile and building orientation to minimise overshadowing and realise the benefits of achieving the requirements of the housing design standards (e.g. supporting passive cooling, daylighting, ventilation and aspect).

Dwelling type and tenure mix
Towers are typically composed of around two to five lateral apartments, accessed per floor from a central core. Linear blocks are the preferred type where more than five dwellings are to be provided per floor. Taller buildings do not always result in more affordable homes, as additional height can increase development costs which may not be covered by increased revenue. This can be more evident in lower value locations and can result in reduced affordable housing as a proportion of total delivery. On such sites, alterative lower rise build types may be more appropriate.

Independent mobility
There is a lot of potential in the planning and design of new developments that can unlock opportunities to create child-friendly housing typologies. Research into children's independent mobility in different housing typologies has found that maximising the quality of shared spaces, both interior and exterior, is fundamental to facilitating children and young people to move between spaces freely and safely[6] Private outdoor amenity space requires careful planning to function positively, and rooftop amenity space may be unsuitable for play by children without careful supervision.

Mixed uses
As with villa blocks, towers can have multiple street frontages at ground floor. This means that residential and mixed-use entrances can be more easily separated. Towers are often used at prominent corners and are suited to

6. Bornat, D. Housing Design for Community Life. 2018.'

the integration of retail, community and leisure uses that may require open plans, particularly if designed with a podium or integrated with a lower rise neighbouring building. Consideration needs to be given to the space required at ground floor to access and service a high number of dwellings. As tower height and dwelling numbers increase, servicing the building becomes more complex. Requirements for larger plant rooms, and storage and refuse capacity will increase. When towers are used in conjunction with other types and not solely reliant on their own footprint, there may be an opportunity to share communal amenities with adjacent types and encourage neighbourly interaction. As with villa blocks, increasing building height is likely to increase the potential for overshadowing neighbouring buildings, streets and open space, and building distances should be considered accordingly to preserve quality of life.

Limitations of type

Towers have similar limitations to villa blocks. As dwellings are configured around a central core, there is potential for single-aspect dwellings where more than four flats are attempted per floor. Single-aspect dwellings should be avoided. Articulating the building and creating bays to allow windows to present perpendicular to the façade may limit the detrimental impact of single-aspect dwellings on residents. The visual impact of towers on their surroundings and the townscape can be considerable and therefore their location within urban arrangements should be carefully assessed and views modelled from sensitive locations (London Plan Policy D9: Tall Buildings). Tall buildings interact with air pollution in complex ways, including the potential creation of accumulation modes in locations away from pollution sources. These are not typically captured by standard dispersion models. Where possible, more advanced modelling, including information from wind microclimate or wind tunnel studies, should be used to better understand and design out exposure to air pollution.

Towers can enable the optimisation of site capacity where forms of development associated with extensive growth and higher density are contextually appropriate. Towers are best used in combination with other types, and support site optimisation through the efficient use of land, provision of shared facilities and opportunities for increased scale. Towers can significantly enable higher densities that are particularly appropriate for newer communities on larger sites promoting substantial or enhanced infrastructure in the near future. Towers will contribute to site optimisation and can benefit the wider area where they provide well-planned communal outdoor facilities and access to shared infrastructure for residents and others, to support the development of inclusive, sustainable places.

Relevant case studies

D7.1 Keybridge House
D7.2 Lock Keepers
D7.3 Porters Edge
D7.4 Tiger Way

Performance against Housing Design Standards	
Shaping Good Places	Can successfully work as part of a mix in high-density areas or neighbourhood centres Need considerable care to manage visual impact Should be planned as part of a broader tall buildings strategy in an area
Designing for a Diverse City	Multiple dwelling types can be accommodated within the same block Suitable for wheelchair accessible houses with lift access Can generate new affordable housing, but over-extension can reduce affordable housing as a proportion of total delivery
From Street to Front Door	When designed as a standalone building, careful planning is required to integrate refuse, plant or storage at ground to avoid blank frontages Can help manage reasonable numbers of dwellings per floor, per core
Dwelling Space Standards	Can help deliver high levels of dual-aspect dwellings
Home as a Place of Retreat	Needs consideration of the impact of building orientation and the potential for single-aspect dwellings Needs consideration of the glazing proportions, ventilation and building structure on overheating risk, and the benefit of incorporating passive cooling measures
Mixed Places	Can work well in achieving mixed use when part of a larger site arrangement or designed with a podium

Living Sustainably	Small building footprint allows for more space for green infrastructure and urban greening to support biodiversity, SuDS and cooling in addition to green roofs and green walls Efficient form and appropriate building fabric can enable energy efficiency Opportunity for communal heating and renewable energy, facilitated by efficient central core.
Future Proofing	Offers limited scope for future conversion.

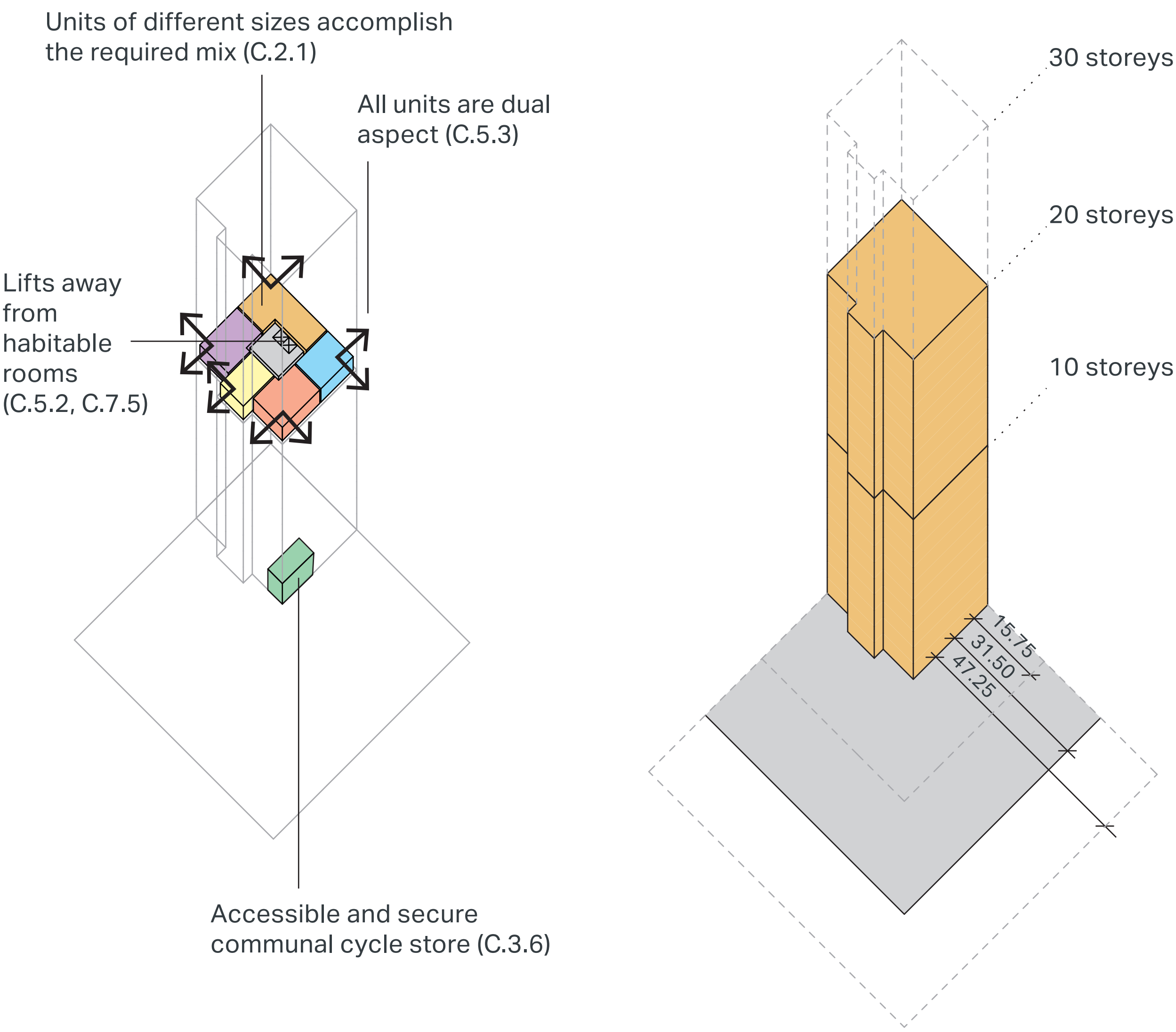


Figure A.21: Performance of tower against Housing Design Standards. The above diagram identifies some of the key design standards a tower performs well against

3.3 Choosing residential types

The Indicative Site Capacity Calculator requires the selection of types based on the analysis undertaken during site and context analysis. These types should enable an understanding of the character of the place and what constitutes an appropriate site-specific form and scale of development (Stage One). Types should principally be selected for their form, scale and their configuration on the site to perform well against the housing design standards. When choosing combinations of types, boroughs should consider:

- Potential to positively conserve, enhance or transform the local character
- Existing or proposed layout of streets and open space
- Successful integration of non-residential uses
- Successful integration of different tenures
- The need to provide appropriate family housing and facilitate the independent mobility of children and young people[7]
- Limitations of each type at different building heights and densities.

During site and context analysis, consideration of certain capacity factors may reveal priorities relating to site-specific opportunities or constraints that will direct the selection of residential types. For example, development in proximity to a particularly valuable heritage asset may require a selection and configuration of residential types that either preserve a protected view of the asset or create a new view that enhances the site's character. Alternatively, the absence of a distinct character on a larger site may enable transformational change through the introduction of different typologies across the site and the inclusion of non-residential uses. As previously discussed, on larger sites several character conditions may occur across the site. This requires consideration of what combination of types will support an effective urban arrangement best able to optimise site capacity.

7. The freedom to occupy and move around the public realm - either alone or with other children - without adult supervision

3.4 Site arrangements

Optimisation of site capacity will be achieved where boroughs select and combine types in arrangements to produce forms and layouts that are contextually appropriate, enable the efficient use of land, support connectivity and help realise improved quality of life for residents and all Londoners.

Residential types can be combined in a range of ways to respond to the specific character of a place or contextual features. Site arrangements allow for variety of expression, massing, tenure and dwelling type. Each residential type has specific strengths and limitations, and combining types may provide a means of meeting a wider range of needs and aspirations to create successful, characterful places. As residential building types A to C are those more likely to be used to optimise capacity on smaller or constrained sites, the discussion below focuses on building types D to G, which are more likely to be used in combination to optimise capacity on larger sites.

Terrace (Type D)

Terraces can be an important part of urban arrangements because they provide larger, family homes with gardens and an immediate connection to the street and play spaces. Their low-rise character allows for intimate streets, which can be more pedestrian, cycle and child-friendly. Although relatively low density, they can be a vital part of a site arrangement in the right location, by allowing more daylight and sunlight to reach other homes and amenity spaces.

Linear block (Type E)

Linear blocks are a common type in urban arrangements, providing continuity of street frontage and flexibility in terms of height and dwelling mix. They create a similar urban grain to that of terraced London streets, while allowing for increased density. Mansion blocks are a form of linear block. Four linear blocks can form a courtyard block of consistent scale and provide an opportunity for private or semi-private amenity space.

Villa block (Type F)

Within site arrangements, villa blocks can provide continuous frontage at corners, acting as landmarks in strategic locations such as crossroads, transport hubs and places of civic importance. They can also create gateways or edges between character areas. This is due in part to their height, which is typically at least one to two storeys above the shoulder height of the adjacent types. It is also due to their dense building form, which is typically both deeper and wider than traditional, linear blocks.

Tower (Type G)

Towers can be a useful way of optimising capacity by using points of heights in combination with a lower overall ridge height to the development, rather than a higher consistent ridge height. As towers provide high numbers of dwellings relative to their ground floor footprint, they can help relieve the pressure for height on other parts of a development. Combinations of lower and higher buildings in arrangements can help improve access to daylight and sunlight, define important points within townscapes and articulate massing. This combination can create a varied streetscape. Stepping the building line and heights can be used to form a perimeter around a courtyard or internal garden.

Below, we look at typical urban arrangements that combine several types and have the potential to achieve contextually appropriate responses at varying densities.

Courtyard-forming arrangements

Courtyard-forming blocks or perimeter blocks characterise much of historic London, forming strong street frontages and clear backs. Although higher density types are increasingly used to meet housing need, the courtyard-forming block is still commonplace as an arrangement of singular or multiple types. This is because it allows a continuation of the grain of London's streets, legibility and safety through active frontages and overlooking, and the ability to provide high-quality amenity space for residents away from vehicles. The impact of their height within shared external areas may be mitigated by using a podium to which level/ step-free access is provided, which raises the external space one level and frees up the ground floor for services. Courtyards may concentrate air pollution emitted from on-site combustion sources, and care should be taken with the location of discharge points or stacks.

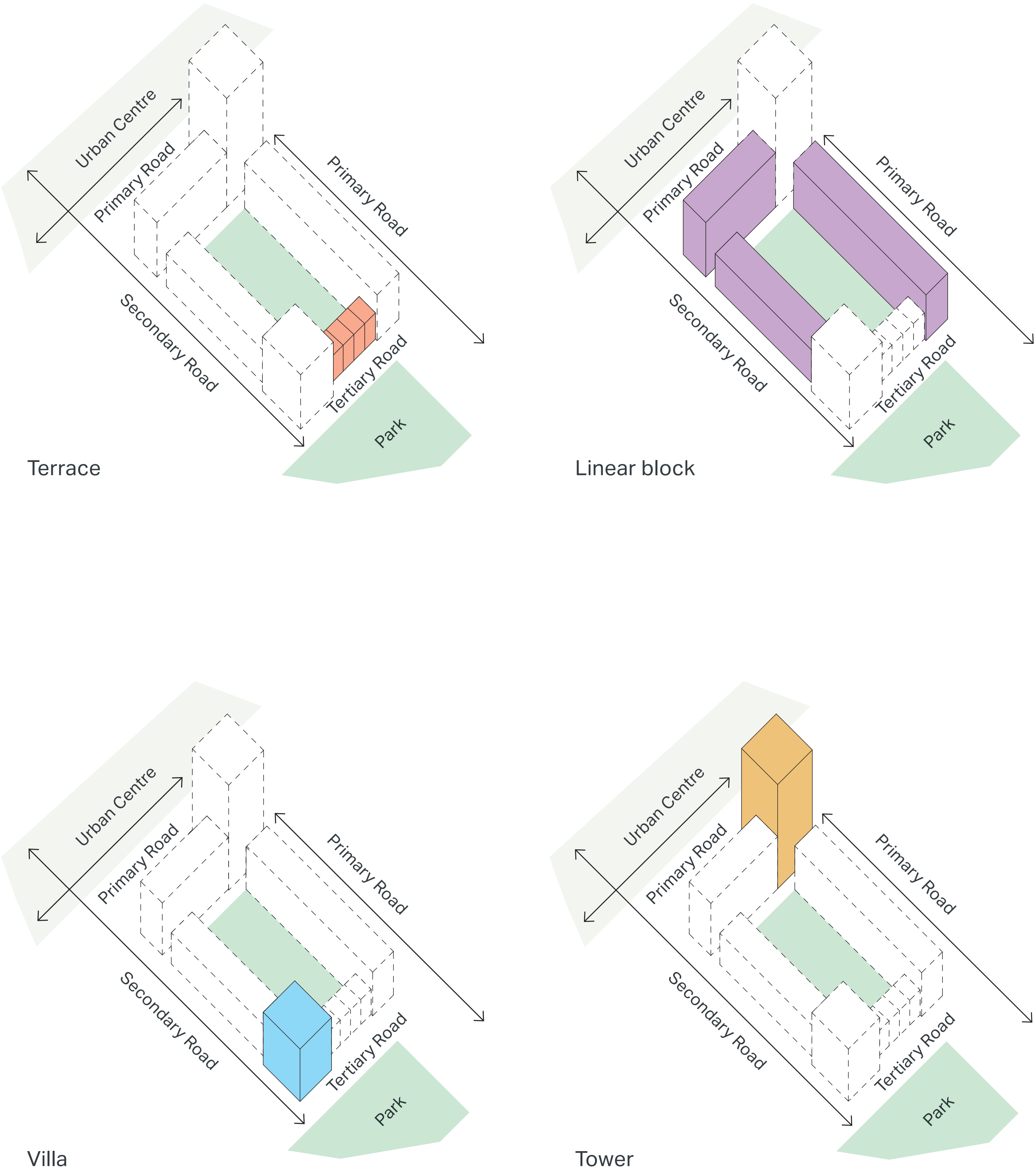


Figure A.22: Optimising site capacity using combinations of different types within perimeter blocks. Using different combinations of types on the same site can achieve different optimum densities and realise different capacities, as appropriate, in relation to the character of the site and surrounding area. Where higher optimum densities are desirable, linear blocks can substitute terraces within perimeter blocks. Where higher optimum densities can be supported, towers may be considered on corners rather than linear blocks.

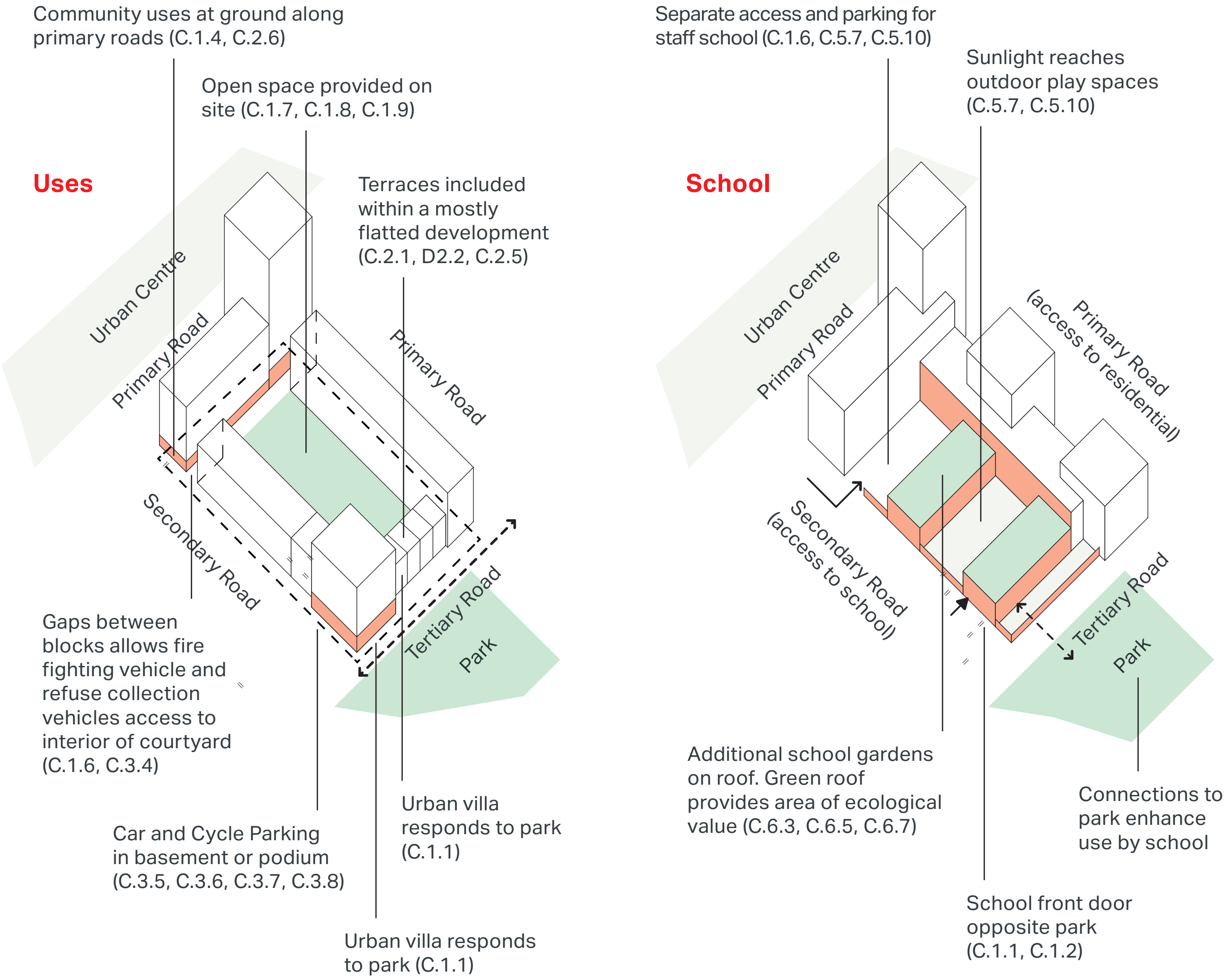
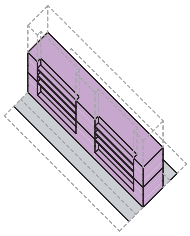


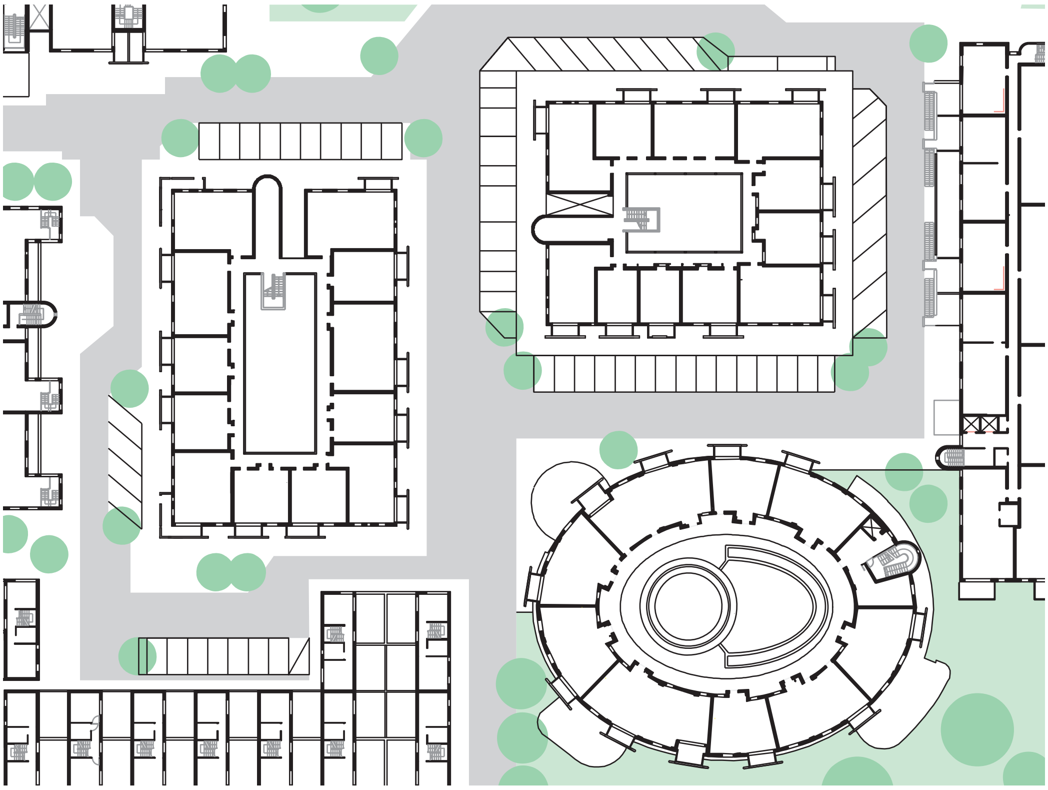
Figure A.23: Integrating a mix of uses within an urban block. The diagrams illustrate some of the typical situations that arise when mixing uses. The left-hand example shows residential above commercial uses. The right-hand diagram illustrates a school as part of a residential block. The relevant design standards are noted against some of the block features.

Other arrangements

Courtyard-forming blocks are not appropriate in every situation and sites may require alternative arrangements to successfully respond to the site's context and optimise its use. Streets and public spaces should be fronted by buildings wherever possible to avoid under-use and limited natural surveillance of the public realm (eyes on the street), which may lead to issues of safety and security. For sites where single buildings are surrounded by public realm on three or four sides, the building type should be capable of addressing this condition. Where traditional fronts and backs are not possible for ground floor homes, special attention needs to be paid to the provision of usable private amenity space. Figure A.24 and A.25 show how a couple of the case studies deliver courtyard-forming blocks by combining a number of block types. Types can also be combined to successfully deliver alternative non-courtyard forming urban configurations as illustrated in Figure A.26 and Figure A.27.

4 Linear blocks





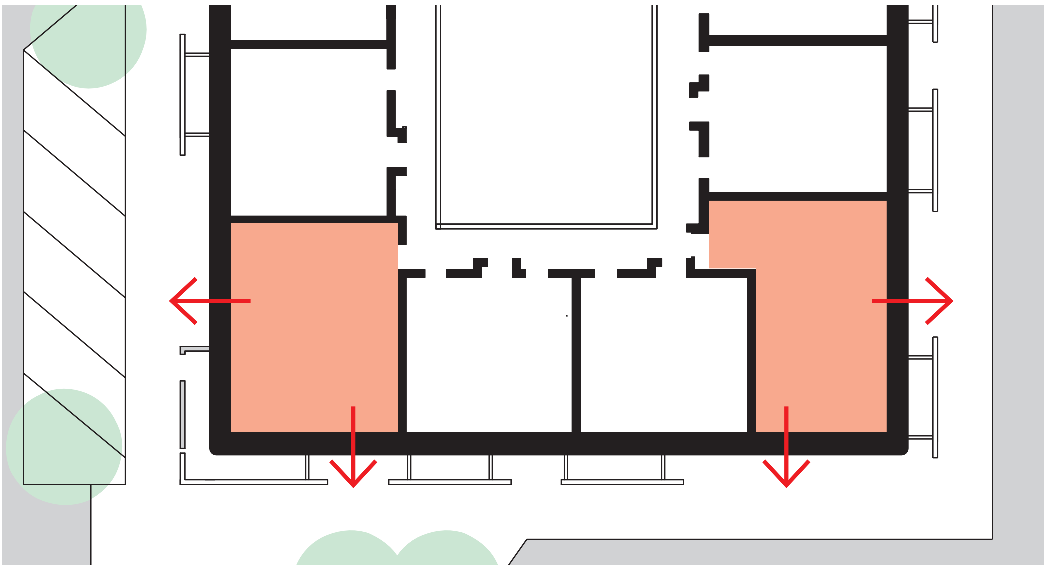
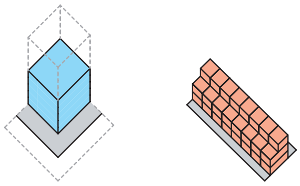


Figure A.24: Case study D5.1 Redwood Park is made up of four interlinked gallery access linear blocks with the access core sitting in one of the linear blocks. The four blocks form a courtyard block with a dual aspect apartment filling the corner.

6 Villa blocks,
2 Terraces



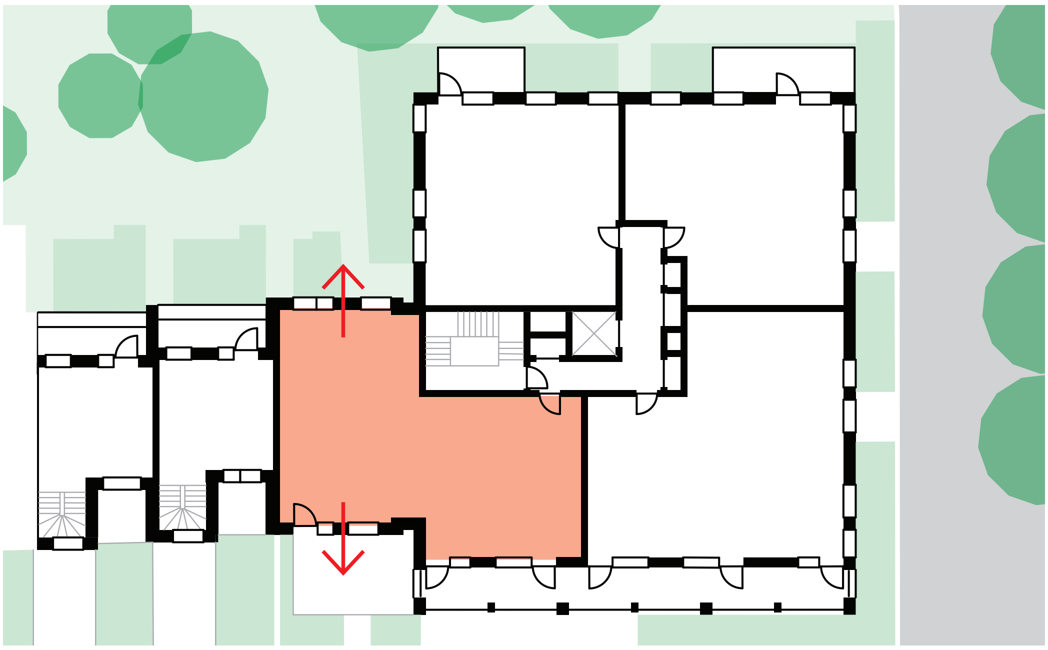
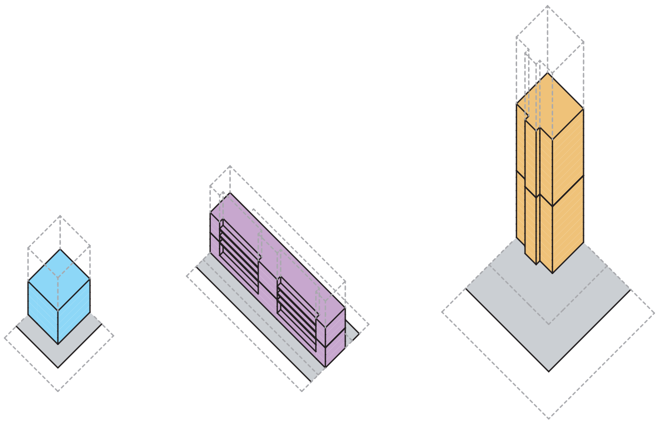


Figure A.25: Case study D6.2 Brentford Lock West Phase 2 is made up of four villa blocks that mark the corners of the plot. The villa blocks are linked on two sides by terrace housing and on the third by a bridge of apartments. The fourth side is left open to allow views out and sunlight into the courtyard.

1 Villa block,
1 Linear block,
1 Tower



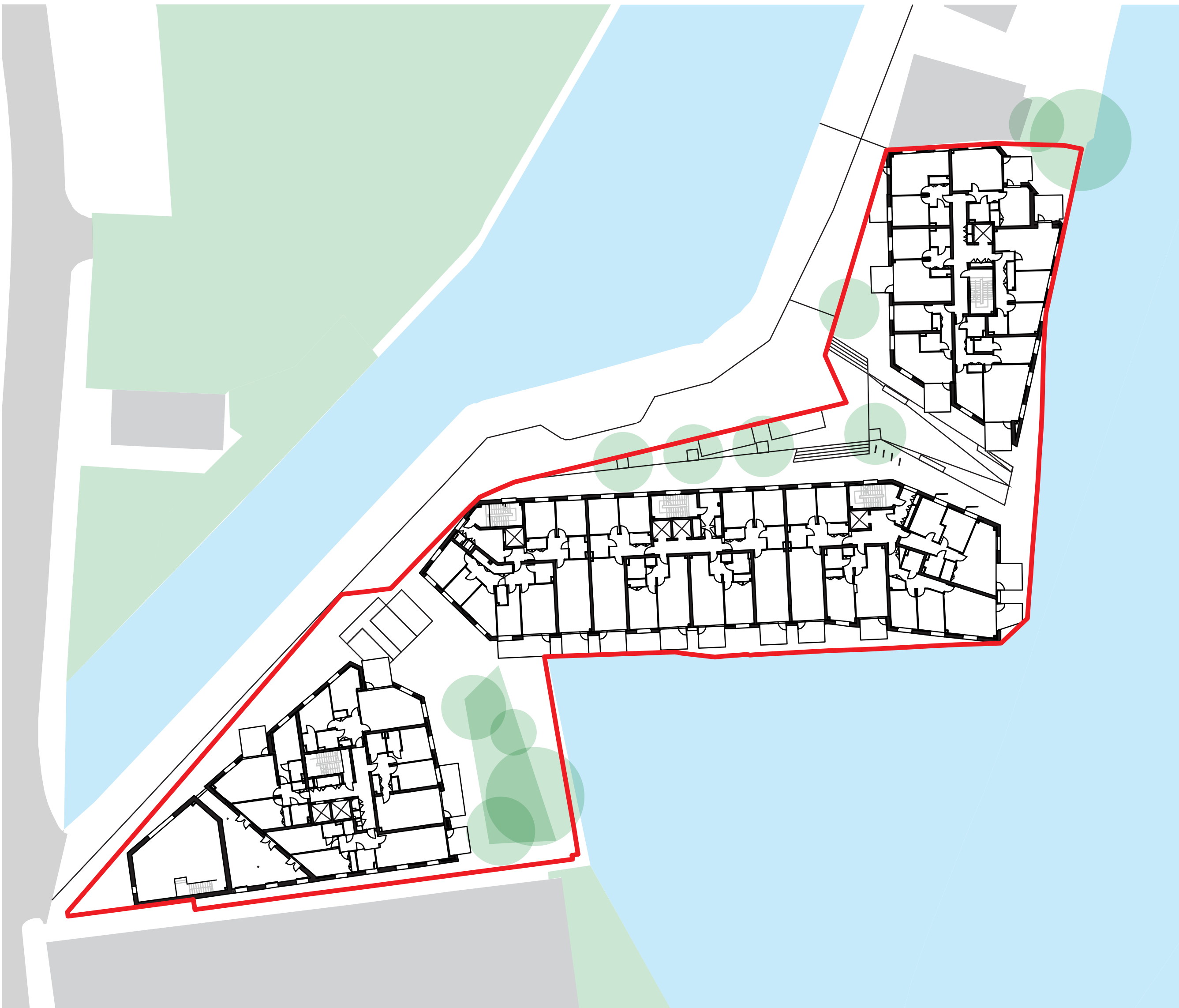
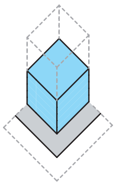


Figure A.26: Case study D7.2 Lock Keepers This comprises a loose fit arrangement of villa block, linear block and tower forming an urban ensemble with routes through between the blocks improving the provision of dual aspect dwellings.

6 Villa blocks,
2 Terraces



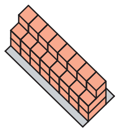


Figure A.27: Case study D3.3 Caudale This is made up of a villa block, which gives height and marks the street corner, and a connected terrace of three houses. The latter helps form an active urban edge to the street.

The following issues need careful consideration when combining residential types:

Corners

When types meet on a corner, adjustments will be needed to make the layout work or specifically designed corner blocks could be introduced to link the neighbouring buildings. This could be dealt with in numerous ways, but it is common to use corner flats or flats that are integrated into adjoining types. Careful consideration should be given to the orientation of corner dwellings and urban realm design to avoid overshadowing and overheating, and provide adequate privacy, daylighting and natural ventilation.

Parking

Reduced parking provision can facilitate higher-density development and support the creation of mixed and vibrant places that are designed for people rather than vehicles. Improvements to public transport, walking and cycling networks are helping to reduce dependency on the car. The London Plan supports car-free or car-light developments in places that are (or are planned to be) well connected by public transport (with the exception of disabled persons parking). In locations where developments are not car-free, consideration should be given to how best to integrate parking to ensure streets are designed to promote active travel, safe play, an inclusive environment and enjoyment of the space rather than it being dominated by vehicles. Details of parking provision should be set out in a Parking Design and Management Plan, as part of any application, with reference to Transport for London guidance. The solution selected should prioritise high-quality public realm and will be influenced by location, ground conditions and management arrangements.

Noise

When urban arrangements enclose an external courtyard, consideration should be given to the potential for noise reverberation. The design of the surrounding buildings, breaks in massing and increased soft landscaping within courtyards can all help to reduce the effect of reverberating sound.

Daylight and sunlight

It is important to consider the daylight and sunlight received by the courtyard and by the homes that surround it. A fully enclosed courtyard block over a certain height may struggle to achieve good daylight and sunlight levels for homes at lower levels. Consideration should be given to how daylight and sunlight can be maximised in higher density courtyard-forming urban arrangements. This could be through variation in massing around the courtyard, using lower buildings to admit more light in strategic places and balancing this with taller blocks in locations that have less impact.

There are many ways in which different housing types might be combined to form urban arrangements. The following case studies illustrate successful urban arrangements of multiple types.

Relevant case studies
D5.1 Bourne Estate
D6.3 Brentford Lock West Phase 2
D7.3 Porters Edge

3.5 Mixed use

Successful communities require a full range of conveniently located local services and facilities, including commercial, educational, health, religious and civic uses. But communities can also benefit from the integration of cultural, entertainment, retail, office and industrial uses. This helps deliver more sustainable neighbourhoods, reduce demands on transport, can bring together a dynamic and diverse mix of people and economic opportunity, and provide opportunities for improved social integration.

This guide considers some of the likely impacts on housing design when other uses are integrated with residential. It is beyond the scope of this guide to offer best practice guidance on the design of non-residential uses such as offices, schools or industrial buildings, but many such uses can be successfully integrated with residential. The guide, therefore, includes case studies where non-residential use forms part of the development and identifies some of the key considerations for integrating housing and other uses. This guide should be read alongside other GLA publications such as the Mayor of London's Industrial Intensification Primer, which explores the co-location of residential with industrial uses, and also the Industrial Intensification and Co-location Study: Design and Delivery Testing, commissioned by the GLA.

Divergent land uses may bring some conflict, but conflicts can be designed out or managed. Mixed-use development requires that housing and the other uses are co-dependent, particularly with regards to servicing and public space. Compatible uses can be stacked vertically and increasingly housing is being built above retail, above community uses, and even above schools. In large urban developments, an urban block may allow different uses to coexist side by side. More active uses such as retail or light industry should be prioritised at ground level and consideration of the ground plane and the intersecting requirements of all uses is vital to successful site arrangements (Figure A.28).

This section covers the key considerations for integrating housing with mixed uses. In Section 3.2 we identified how the residential block types described in this module could be most successfully combined with different mixed uses. This guidance does not cover how mixed uses should be determined for any given site or area. Instead, it is up to local authorities to strategically plan the provision of mixed uses based on identified need, and for the designers to determine how best to combine uses while fulfilling the requirements of the housing standards.

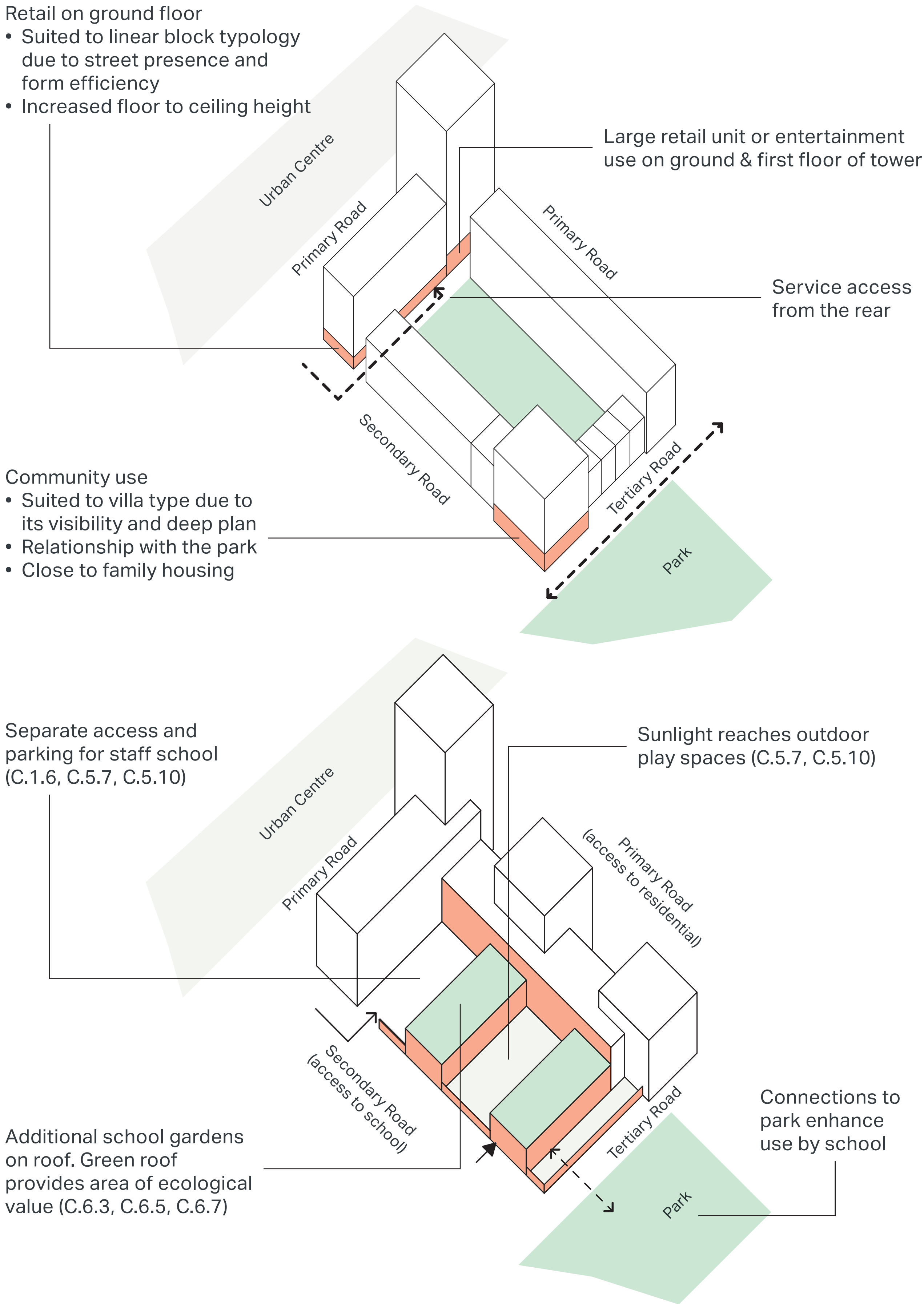


Figure A.28: Addressing performance within mixed use schemes against Housing Design Standards. Key considerations for integrating housing and mixed uses

Active frontages

Consider the need for mixed-use developments to have active frontages and how this can be balanced with residential entrances. For example, retail, entertainment, community and leisure uses will all require street frontages and their success will depend on their visibility and ease of access. Offices and industrial uses, however, could occupy other parts of urban arrangements and would rely only on an entrance rather than a frontage.

Social infrastructure and public services can encourage a sense of community and identity, which should be emphasised through their prominent locations and civic presence. Public services like nurseries, libraries, community centres, police stations etc. are best placed at central points in highly visible locations, with public squares used to emphasise their civic status.

Traffic generation, vehicle access & servicing

Mixed uses should not necessarily generate more traffic. For instance, mixed office/retail and residential developments in areas of high PTAL could be car free (with the exception of disabled persons parking). Space for vehicle access and servicing and deliveries should be carefully designed and managed and should consider how they can be designed to support zero-emission, last-mile deliveries. Consideration must be given to the type of traffic associated with the nature of the mixed uses, for example heavy goods vehicles alongside industrial uses, ambulances or patient transport with healthcare, or delivery vehicles associated with retail uses, where air pollution, noise or resident safety issues may arise.

Servicing

Servicing for mixed uses should be clearly separated from residential entrances and vehicle access, and movement networks should seek to keep the flow of servicing traffic away from pedestrian areas. This is for safety as well as amenity reasons. In order to create a positive street frontage, avoid large areas of mechanical plant or servicing against the perimeter of the building. Aim to create a more attractive street front by wrapping servicing with active uses.

Separation of entrances and efficiency

Careful consideration should be given to the planning of means of access. Dwellings' entrances should not be compromised by the planning of other ground floor uses and should remain clearly legible and easily accessible. Planning can help manage potential conflicts, for example avoiding having heavily trafficked retail entrances immediately next to a residential entrance, or avoiding locating non-residential service areas (mechanical plant, refuse stores etc) immediately next to dwellings. With large urban blocks, it will be easier to balance residential frontage with other uses to ensure an active ground floor or avoid large areas of blank frontage.

Scale of mixed use

Smaller scale mixed uses such as a shop, café or office can often be integrated into the ground floor footprint of a single block type. However, the incorporation of large-scale uses such as schools, superstores or retail warehouses will require larger volumes within urban arrangements. They could be accommodated in podium arrangements where the mixed-use element takes up a larger area at ground floor, with amenity space for the residential blocks raised above it at first floor or above (whilst achieving level/ step-free access).

Some 'big box' uses may be able to be wrapped with smaller mixed-use units to establish active street frontages. Where the larger use requires little daylight such as a warehouse or storage depot, this could be placed adjacent to railway embankments or other areas where no frontage is required. Through doing this, the residential spaces are lifted higher, reducing issues of overshadowing and improving access to daylight and sunlight. This wrapping approach also allows streets to be active and overlooked, rather than fronted by blank elevations. Where dwellings are used to wrap inactive frontages, care should be given to minimise the number of single-aspect homes.

Noise

Potential sources of noise increase with more diverse environments. Any decision to mix uses will therefore need to consider how noise pollution can be mitigated for the wellbeing of residents. Traffic studies and noise analysis should form part of any design proposal that promotes mixed uses. Where noise pollution may be an issue, these studies should demonstrate how the layout or form of construction is intended to mitigate any likely problems.

Air pollution

The location of delivery and servicing can lead to localised hotspots of air pollution. Increased heating or power generation from combustion sources (including standby and emergency generators) associated with commercial or industrial uses can also have local impacts on some of the new dwellings. Care needs to be taken when planning servicing and delivery locations, plant rooms and stacks or other emission points to prevent these issues from arising.

Some light industrial and commercial uses, such as dry cleaners or workshops that use high solvent spray paints can lead to emissions of less common pollutants that are injurious to health. Care should be taken to ensure that where such uses are expected, they are designed to minimise and effectively disperse emissions and to future proof developments as uses change in the future.

Servicing impact

It is important that consideration is given to the building services, especially mechanical ventilation, which can have significant implications for amenity. Exhausts should be designed to avoid increasing the street temperatures and exacerbating the heat island effect. A larger ceiling zone than is typically required in a residential floor is likely to be required to accommodate the mechanical plant (ventilation, heating and cooling) for the mixed-use space, as well as allowing space for any services distribution or drainage offsets that are required to serve the rest of the building. Consideration should be given to the space requirement of heat pumps if connecting to a heat and cooling network is not possible. Often, this will be located in a podium space or on an external wall or roof. Ventilation will commonly be through a louvre in the façade or naturally through opening windows. If catering or industrial ventilation is required, it is sensible to allow for a riser duct to the roof, where the extract fan and/or discharge point will ideally be located in order to avoid impacting on adjacent residential spaces.

Where the mixed-use element is more significant, such as a leisure centre, school or health centre, it is likely that it will be built for and operated by a completely different party to the homes. This creates a different relationship to that of the landlord and tenant relationship in smaller commercial units. It may be preferable to retain full separation as far as possible between the residential and mixed-use parts of the development. For example, it might not be appropriate for the building services distribution and drainage offsets for the residential development to run in the domain of the mixed-use part of the building. Separate central plant may be preferred and early stage consideration should be given to these issues and appropriate measures taken.

Relevant case studies
D5.3 Kirkfell
D7.1 Keybridge House
D7.3 Porters Edge
D7.4 Tiger Way

4
STAGE THREE: TESTING SITE CAPACITY

This section provides a step-by-step guide to using the Indicative Site Capacity Calculator. This calculator enables boroughs to identify the indicative site capacity and net number of additional new homes for a given site at plan-making stage.

Three worked examples are provided below to illustrate the sort of design decisions that need to be made. The examples show how the Stage One site and context analysis factors have influenced the decision and produced three potential optimum site capacities. Although the shape, size and orientation of the site is the same in each scenario, these different outcomes assume differences –described with the examples in the character of the site and wider area. Worked Example 1 assumes the site has been identified in local character assessments as an area to conserve. Worked Example 2 assumes the site has been identified as an area to enhance . Worked Example 3 assumes the site has been identified as an area to transform.

4.1 How to use the indicative site capacity calculator

This design-led method draws on the understanding developed during site and context analysis (Stage One) and consideration of residential types, urban arrangements and mixed-use developments (Stage Two).

Residential types are selected from the types shown in Section 3.2, specifically types D to G. These are promoted to optimise site capacity for larger sites. Design solutions will be limited owing to the use of the toolkit of types. If capacity studies are undertaken by design professionals, they may want to develop their own approach to layout and type. They should however be mindful that designs will need to meet the London Housing Design – Quality and Standards (Module C). The toolkit of types includes residential building types recognised as ones that can readily meet the standards and can deliver a good quality of life at high density. While individual houses and clusters of houses will be appropriate for many of the small sites, they are excluded from the Indicative Site Capacity Calculator. The calculator is intended for use on larger sites, where individual houses would be likely to result in an inefficient use of the land. Module B provides guidance for small housing developments and the design code preparation to realise good growth through neighbourhood intensification.

Capacity testing is intended to be undertaken digitally using simple CAD software such as SketchUp or other CAD software. However, assessments can be made by drawing to scale the types on a site plan and adding up floor areas to arrive at a Gross External Area (GEA) to be entered on the calculator.

The types are available through the GLA website as a downloadable digital resource. We describe the process as if using SketchUp[8]:

- Open SketchUp
- Select metres from the choice of model units
- Load the site in question into the model space. This could be a flat OS map extract in 'dwg' or a 3D site model (such as a zMap) as shown in the worked example
- Once this is imported into the SketchUp file, load the housing type components library found under the components tab under window. These range from 2 storey terraced houses up to 30 storey towers and are shown in the component window with a small icon of their appearance and a descriptive name.

Step 1. Having imported the site plan into SketchUp, site movement infrastructure should be placed onto the site. This should be informed by an understanding of how best to improve connectivity for people walking and cycling and how vehicle access (where applicable) can be carried out safely with minimal conflict.

Step 2. Next, existing and proposed open space should be indicated on the site considering issues such as the role of green infrastructure, suitable locations for play, need to protect the site from noise or air pollution, etc.

Step 3. Where applicable, locate non-residential uses on the site. Note that this method is not suitable for sites that have identified largely non-residential uses, i.e. those that cannot be accommodated solely within the footprint of the types selected.

Step 4. Next, select a residential type or combination of types based on their potential for an appropriate response to site context. Residential types are available as a range of downloadable templates, and all dwellings meet London Plan Space Standards.

Step 5. Modelling the site allows boroughs to test the appropriateness of several layouts, the use and combination of several residential types. In this way they can select the option that best optimises capacity and responses to local context and character considering the capacity factors.

Step 6. Once satisfied with the design options produced, the residential GEA (m2) can be taken from the modelled scheme(s), and can then be used to identify indicative capacity based on tenure and type mixes through the calculator. The GEA is based on building heights minus any loss due to the allocation of non-residential uses at ground level and above in mixed-use building(s). This gives total residential GEA (m2).

8. SketchUp Pro (2019 version)

Step 7. Next, use the Indicative Site Capacity Calculator to enter the total residential GEA (m2) into the Residential GEA field and input a policy compliant tenure mix. This produces an indicative site capacity. Subtract any existing homes on the site to provide an indicative net number of additional new homes. Finally, produce an indicative scheme population using the Population Yield Calculator (Section 2.2.6) to estimate the likely population and child yield to feed into infrastructure planning process.

The steps necessary to produce an indicative site capacity and indicative net number of additional new homes will be demonstrated in the following section using worked examples. These use the same shape, size and orientation of site but result in differing optimum site capacities to suit different forms of good growth supporting either conservation, enhancement or transformation of a given neighbourhood. They demonstrate how this can be achieved by interpreting a range of differing factors associated with the character of the site's context, and by selection of the appropriate housing types.

4.2 Worked example

Below, we provide a worked example to take you through the capacity calculation process step-by-step.

The diagram below shows the CAD model of the surrounding area and the site in question outlined in red:

Step 1

Set out site movement infrastructure

Successful places rely on good connections and clear legible movement patterns. Start by setting out a hierarchy of streets that considers 'place' as well as 'movement' across the site. These may be pedestrian or cycle routes rather than vehicular, however access for emergency and utility vehicles across the wider site should be considered. Often, clues in the surrounding streets will assist and offer the potential to easily connect beyond the red line of the site. The historical maps sourced in Stage One may help to identify old movement corridors that could be re-connected. Or, the knowledge of the infrastructure capacity and the understanding of local land uses can offer clues of local uses around the site that would benefit from new connections.

For the worked example, we have introduced a new pedestrian and cycle route through the site that connects two roads at either side of the site. This helps connectivity in the area and also provides more frontage to position buildings. It is proposed to help link a network of green spaces, which was identified in the area at Stage One.

Step 2
Locate open green space

Green and open spaces should be considered early in the design process rather than simply occupying the 'left over' spaces. To do this, account should be taken of the needs that will arise from developing the site, as well as the wider context (for example, whether the broader area is subject to green or open space deficiencies). In our worked example, the infrastructure capacity analysis indicated that there was a network of green spaces that had been severed by this site. Providing new green space along a movement corridor would improve that wider network of green spaces. Local analysis indicates a need for play space of approximately 400m2 to serve the local area. We have located a green park to the south of the site to take advantage of the sun path and to be accessible both to surrounding residents and occupants of the new development. This serves as public open space and is distinct from the green space that sits within the site, for example, courtyard blocks. These may only be accessible to the residents of that block due to the enclosed nature of the space. The park is also distinct from other elements of green infrastructure that might be planned and designed to address other needs such as sustainable drainage, enhancing urban ecology or improving air quality. A calculation of child yield in the new development (Step 7, below) will determine the amount of any additional open green spaces in the development. Green spaces intended for play or recreation should be placed to avoid or minimise exposure to air pollution. In the three worked examples, we have calculated that the different quantum of open space for each scenario can be accommodated within the remaining site either using spaces between buildings or a combination of spaces between buildings or on rooftops or podiums.

Step 3

Locate non-residential uses (non-residential and mixed-use buildings)

An assessment of local need during Stage One will help determine what area should be allocated to non-residential uses. Specific consideration should be given to community infrastructure and whether the site is suitable for a local school, health centre or community facilities. If the site is being repurposed from industrial land or other uses it may be desirable to retain a proportion of employment space. For the capacity testing exercise, it is not necessary to determine whether non-residential use sits within its own building or across the residential buildings, for example across the ground floor. For capacity testing, the floor area for non-residential uses can simple be deducted from the GEA (Gross External Area) once building blocks have been laid out to an acceptable height. The balance of floor area figure entered into the calculator gives a correct capacity of residential based on standard net-to-gross ratios.

For our worked example, we have assumed different requirements based on the assumed differences in site character (Step 5).

Step 4

Select appropriate type(s)

Refer to specific guidance about each type available in Section 3.2

A choice of residential block type can be made by observing the scale and character of the area (see Stage One). If the site is large enough, a variety of types can help meet the diversity of need or respond to different conditions. The simplest choice would be to reflect the predominate type familiar in the area, but this may lead to homogeneity of the housing offer and not optimise the site. Terraces can help optimise backland sites, add family housing to a large mixed development, or form a mews within a deeper urban block. Linear blocks can be a good alternative to a terrace as these deliver more dwelling while following a similar form factor and being of similar height. Villas or towers can help add variety to a neighbourhood, and aid legibility and wayfinding.

In our worked example, we have used all the types in the toolkit in different scenarios depending on whether the site is identified as an area to conserve, or enhance or transform and in response to different levels of accessibility and local services. Using the digital toolkit library, each block type has a footprint and a shaded area to at least two sides. This represents the area you need to offset buildings by to ensure sufficient daylight reaches the lower levels.

Choice of block types' height should be driven by the character of the context and by an assessment of whether the site is in an area suitable to conserve, enhance or transform. This will have the biggest bearing on optimising capacity. Height will also have to factor in the over-shadowing of surrounding buildings or any particular sensitivities such as viewing corridors. It is important, however, to recognise that there are trade-offs when trying to optimise a site. Adding height may help improve the percentage of dual-aspect apartments, privacy or daylight since buildings can be located further away from each other.

Step 5

Use downloadable components to lay out preferred building types across the site/area, taking account of Steps 1 to 3

Our worked example demonstrates three outcomes assuming the character assessment is different in each:

Conserve: This scenario assumes that the site is in a conservation area with a listed school building to the north of the site. It assumes there are sensitive views through the site that limit height in certain areas. It also assumes that the prevailing character of the area is consistent and has changed little over time and that public transport connectivity is low to medium, as are local services. A terrace of five dwellings at three storeys is proposed opposite existing three storey houses. This was selected to match the height of buildings opposite owing to the fact that a view from the east looking west was considered sensitive. A single linear block at four storeys is planned to fit in with the listed school opposite. Proposed buildings then step up to the south east side of the site where there are existing taller buildings - one linear block of seven storeys, two villa blocks of seven storeys, and one of nine storeys nearer an existing 15 storey tower.

Conservation area   Listed building   Local protected view

Enhance: This scenario assumes that the site is not a conservation area and development can be reasonably taller than the surrounding buildings. The context has changed over time and there is no consistent character to the architecture. Transport connectivity is medium to high as are local services, but there is no expected improvement on WebCAT in the 2021 or the 2031 forecast.

Three linear blocks of seven storeys and two villa blocks of seven and nine storeys are arranged on the site. The taller building responds to the increased scale around the existing 15 storey tower to the south-east.

Transform: This scenario recognises that the area is undergoing considerable change. It has high public transport connectivity and good local services and can therefore support higher density. It is forecast in WebCAT that a significant improvement for public transport will happen by 2031, and the nearby local services are already undergoing positive change.

Having been identified as a site in the town centre, ground floor uses will be non-residential. Three linear blocks step up from six to eight storeys. Together with a villa block, these run along three sides of the site. This scale is above the surrounding buildings whilst not compromising the daylight of surrounding buildings to the north. A 15-storey tower is positioned to the south west where impact of daylight on surrounding properties can be best managed, and where it can visually relate to an existing tall building on the same street.

These solutions are certainly not the only ones and they would need to be thoroughly tested if taken forward as proposals. But they can help give an early steer on the likely optimised capacity of the site or, if a certain number of homes are required, can give an early indication of the likely form and height needed to achieve that number.

High Street improvement zone

Planned new bus route

Pedestrian route to new Underground station

Step 6

Determine total residential GEA (m2) based on chosen building heights and modelled scheme, taking account of any loss due to the allocation of non-residential uses at ground level and above in mixed-use building(s)

Take note of the number of types and their storey heights included in each corresponding proposal and enter this information into the Excel Toolkit Calculator. The types are selected using the drop down menu with storey heights being entered manually. If several different heights of a single type are used, they will need to be entered as separate rows. For example, two four-storey linear blocks will accompany one row and two seven-storey linear blocks will occupy another. These cannot be merged.

Conserve: 12,696m2
Enhance: 16,360m2
Transform: 20,309m2 (This figure is the balance following deduction of non-residential floor area requirement)

Step 7

Use the GLA's calculator to identify indicative site capacity as follows:

Input the total residential GEA (m2) established in Step 6 directly into the Residential GEA field in the calculator, ignoring the first half of the calculator

Input the policy compliant tenure mix. For indicative site capacity purposes, assume 50% affordable (60:40 rented: intermediate), unless a more robust tenure split is known

Input the policy compliant affordable (rented) dwelling mix and site appropriate mix assumptions for private and affordable (Intermediate)

Output: indicative site capacity (Subtract any existing homes on the site/area to provide an indicative net number of additional new homes)

After filling in the relevant tenure mix and required typical unit sizes, this will be used to calculate an indicative site capacity for the GEA achieved by the type quantities and mix included in the first half of the toolkit spreadsheet.

Worked example: Conserve

GLA Indicative Site Capacity Calculator

Digital Toolkit Record

Type (select from pulldown menu)	GEA per storey (m2)	Number of storeys	Total GEA per block (m2)	Quantity	Total GEA per type (m2)
Terrace	55.0	16	880	5	4400
-Select Type-	0	0	0	0	0
Linear block	453.7	7	3175.9	1	3175.9
Villa block	430	7	3010	1	3010
Villa block	430	9	3870	1	3870
-Select Type-	0	0	0	0	0
-Select Type-	0	0	0	0	0

Capacity Calculator

Residential GEA*	**14,456**	m2
Residential GIA	13,010	m2
Residential NIA	9,107	m2

*If fields are added to Digital Toolkit Record above, ensure formula for Residential GEA is extended to capture all types listed

Tenure	Tenure mix	NIA (m2)	Type	Type mix	NDSS Area (m2)		Indicative unit count
Market	50%	4,554	1 bed	30%	50	27.3	27
			2 bed	40%	70	26	26
			3 bed	50%	86	15.9	15
					Total		68
Affordable (Intermediate)	15%	1,366	1 bed	30%	50	8.2	8
			2 bed	40%	70	7.8	7
			3 bed	50%	86	4.8	4
					Total		19
Affordable (Low cost rent)	35%	3,188	1 bed	30%	50	19.1	19
			2 bed	40%	70	18.2	18
			3 bed	30%	86	11.1	11
	100%				Total		48
					Indicative Site Capacity		135

Notes:

- To be used in conjunction with the GLA Housing Design SPG - Methodologies for Identifying Potential Capacity
- Editable fields for data input are denoted in white. Figures shown are illustrative.
- GIA calculated as 90% of GEA
- NIA calculated as 70% of GIA (reduced ratio to allow for site and scheme variables that may impact capacity)

Worked example: Enhance

GLA Indicative Site Capacity Calculator

Digital Toolkit Record

Type (select from pulldown menu)	GEA per storey (m2)	Number of storeys	Total GEA per block (m2)	Quantity	Total GEA per type (m2)
Villa block	430	7	3010	1	3010
Linear block	453.7	5	2268.5	1	2268.5
Linear block	453.7	7	3175.9	2	6351.8
Villa block	430	9	3870	1	3870
-Select Type-	0	0	0	0	0
-Select Type-	0	0	0	0	0
-Select Type-	0	0	0	0	0

Capacity Calculator

Residential GEA*	**15,500**	m2
Residential GIA	13,950	m2
Residential NIA	9,765	m2

*If fields are added to Digital Toolkit Record above, ensure formula for Residential GEA is extended to capture all types listed

Tenure	Tenure mix	NIA (m2)	Type	Type mix	NDSS Area (m2)		Indicative unit count
Market	50%	4,883	1 bed	30%	50	29.3	29
			2 bed	40%	70	27.9	27
			3 bed	30%	86	17	17
					Total		76
Affordable (Intermediate)	15%	1,465	1 bed	30%	50	8.8	8
			2 bed	40%	70	8.4	8
			3 bed	30%	86	5.1	5
					Total		22
Affordable (Low cost rent)	35%	3,418	1 bed	30%	50	20.5	20
			2 bed	40%	70	19.5	19
			3 bed	30%	86	11.9	11
	100%				Total		50
					Indicative Site Capacity		144

Notes:

- To be used in conjunction with the GLA Housing Design SPG - Methodologies for Identifying Potential Capacity
- Editable fields for data input are denoted in white. Figures shown are illustrative.
- GIA calculated as 90% of GEA
- NIA calculated as 70% of GIA (reduced ratio to allow for site and scheme variables that may impact capacity)

Worked example: Transform

GLA Indicative Site Capacity Calculator

Digital Toolkit Record

Type (select from pulldown menu)	GEA per storey (m2)	Number of storeys	Total GEA per block (m2)	Quantity	Total GEA per type (m2)
-Select Type-	0	0	0	0	0
Linear block	453.7	8	3629.6	3	10888.8
Villa block	430	6	2580	1	2580
Tower	516.5	15	7747.5	1	7747.5
-Select Type-	0	0	0	0	0
-Select Type-	0	0	0	0	0
-Select Type-	0	0	0	0	0

Capacity Calculator

Residential GEA*	**21,216**	m2
Residential GIA	19,095	m2
Residential NIA	13,366	m2

*If fields are added to Digital Toolkit Record above, ensure formula for Residential GEA is extended to capture all types listed

Tenure	Tenure mix	NIA (m2)	Type	Type mix	NDSS Area (m2)		Indicative unit count
Market	50%	6,683	1 bed	30%	50	40.1	40
			2 bed	40%	70	38.2	38
			3 bed	30%	86	23.3	23
					Total		101
Affordable (Intermediate)	15%	2,005	1 bed	30%	50	12	12
			2 bed	40%	70	11.5	11
			3 bed	30%	86	7	6
					Total		27
Affordable (Low cost rent)	35%	4,678	1 bed	30%	50	28.1	28
			2 bed	40%	70	26.7	26
			3 bed	30%	86	16.3	16
	100%				Total		70
					Indicative Site Capacity		200

Notes:

- To be used in conjunction with the GLA Housing Design SPG - Methodologies for Identifying Potential Capacity
- Editable fields for data input are denoted in white. Figures shown are illustrative.
- GIA calculated as 90% of GEA
- NIA calculated as 70% of GIA (reduced ratio to allow for site and scheme variables that may impact capacity)

Step 8:
Estimate indicative scheme population

Use the GLA's Population Yield Calculator (referred to in Section 1.2.6) to estimate the likely population and child yield expected to live in the development to feed into infrastructure planning process.

In doing so, assume borough policy compliant dwelling mix and, where appropriate, 50% affordable housing (60:40 rented: intermediate).

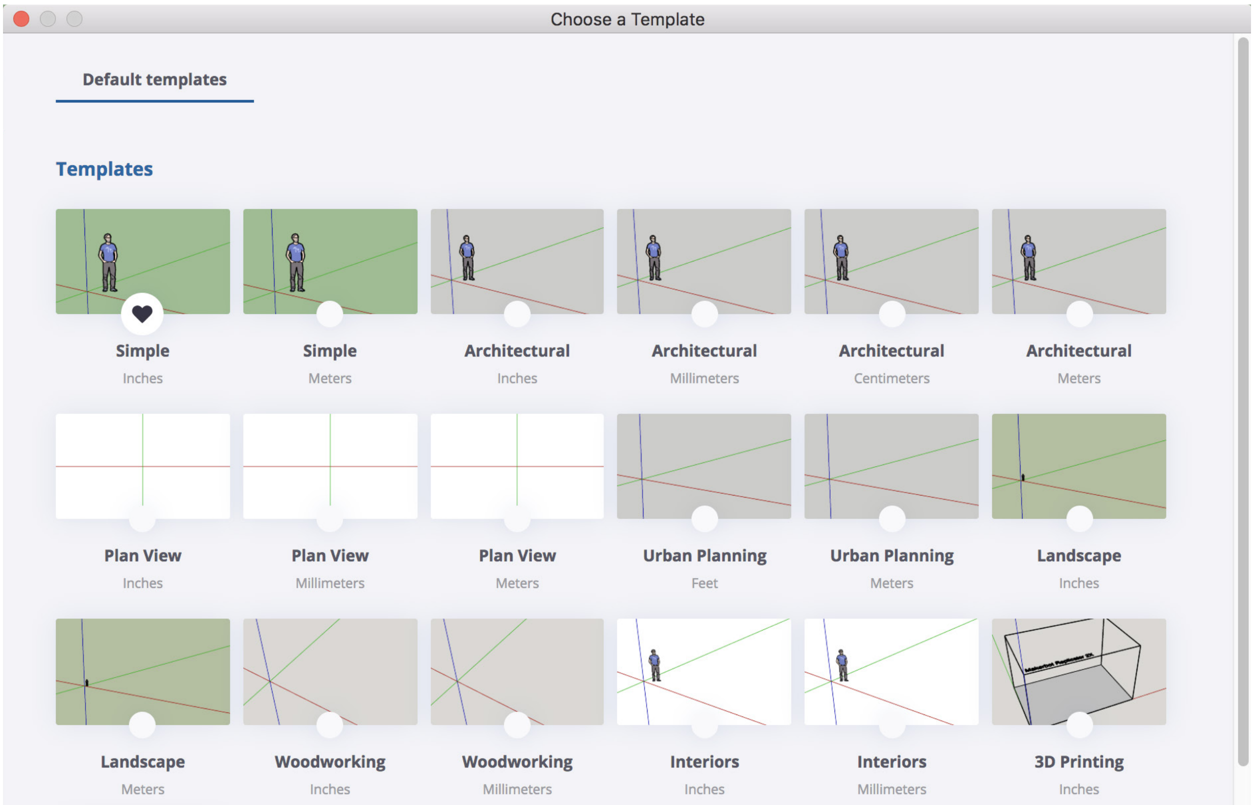
The indicative count of the unit types can then be inserted into the GLA's Population Yield Calculator alongside the PTAL values of the site. This estimates the number and age of people expected to live in the new housing development. The number and ages of children and young people expected can be used to estimate the total amount of additional play space likely to be required. The area requirement can then feed back into the SketchUp model to make sure that the development is feasible solely at ground level on site or whether alternate solutions will be required.

4.3 Optimising Site Capacity Digital Toolkit instructions

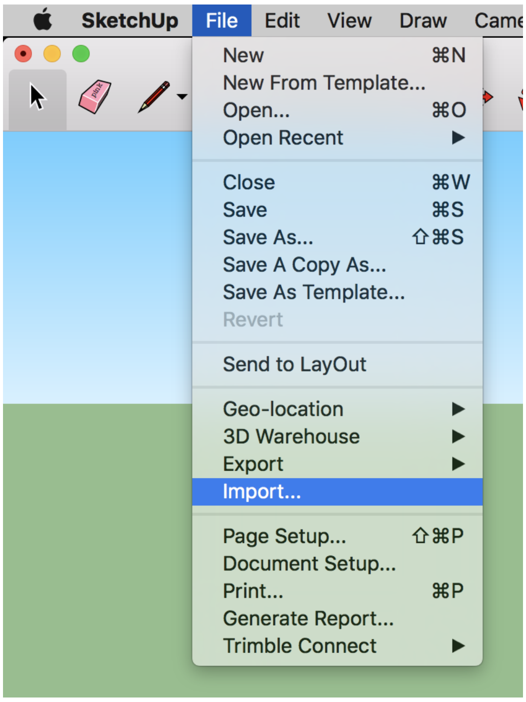
The Optimising Site Capacity Digital Toolkit is provided as a downloadable digital resource from the GLA's website. SketchUp components are available for each of the types described in Section 3 (terrace, linear block, villa block and tower) and can be selected by height. Each component is tagged with its number of storeys and Gross External Area (GEA).

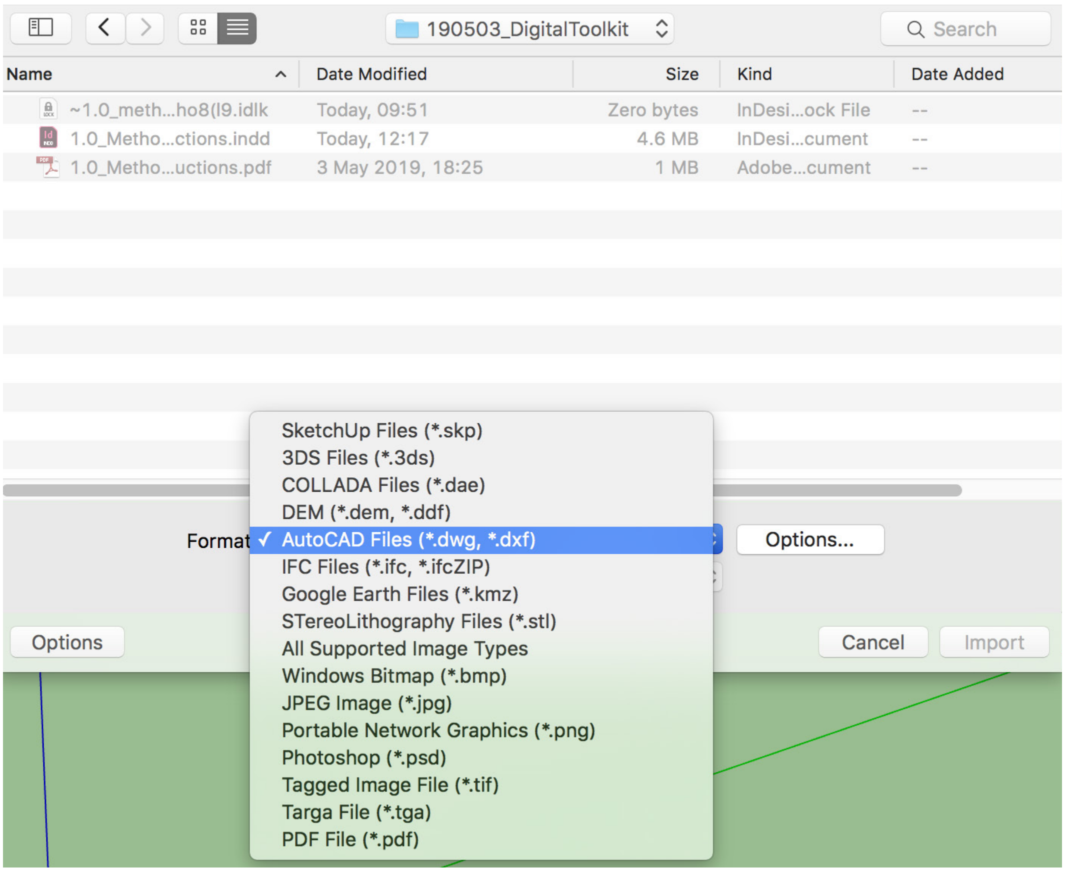
Note: The following instructions demonstrate the use of the Digital Toolkit and Optimising Site Capacity Calculator only. In order to test the capacity for a site or area, design choices need to be made by the user in order to select suitable types and create urban arrangements. Further guidance on this can be found in Section 3.

1. Download the component library of types from the GLA's website
2. Open a new SketchUp file using a template set to measure in metres

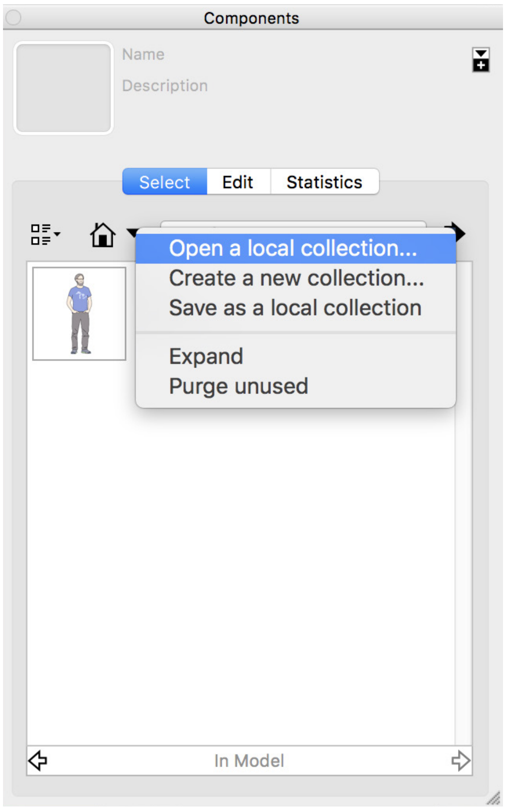


3. Import a 2d OS map or 3d site model to use as a base for testing proposals. External 2d or 3d files can be imported by selecting ‘File’ > ‘Import’ and then navigating to the source of the file, using the ‘Format’ drop down list to select the file type. Ensure the base site information is imported at 1:1 scale and in metres.

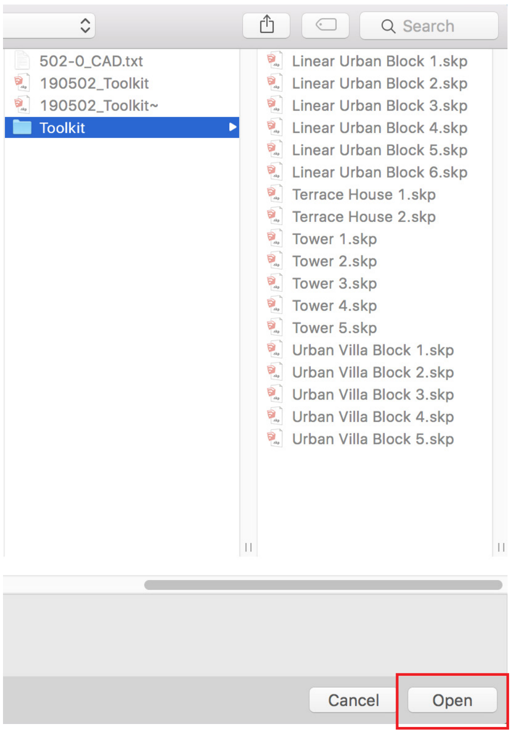




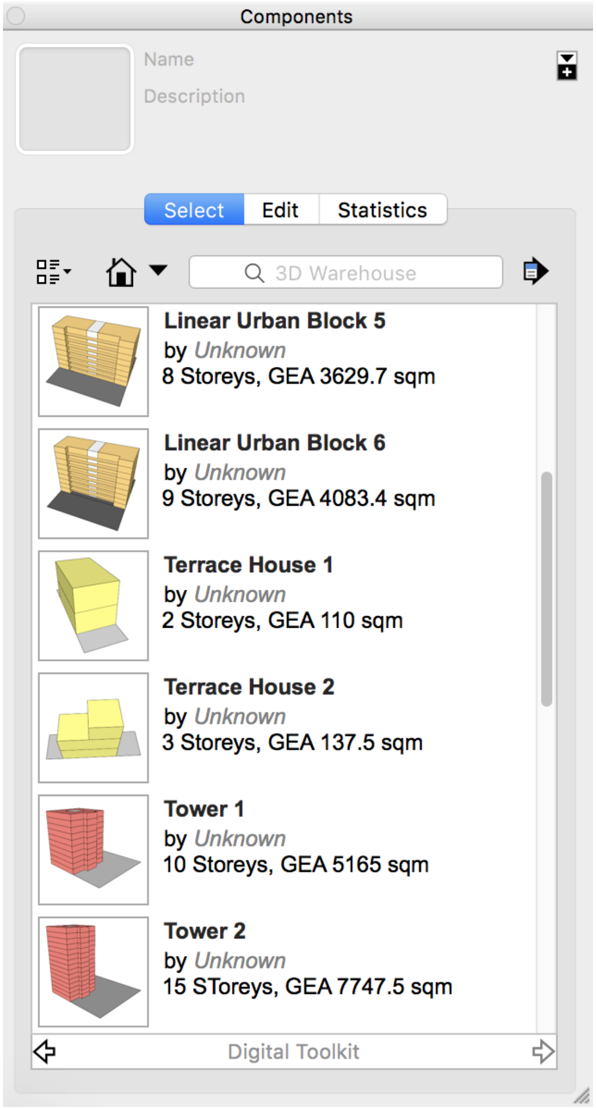
4. In the component palette click on the 'details' arrow and select 'Open a local collection...'



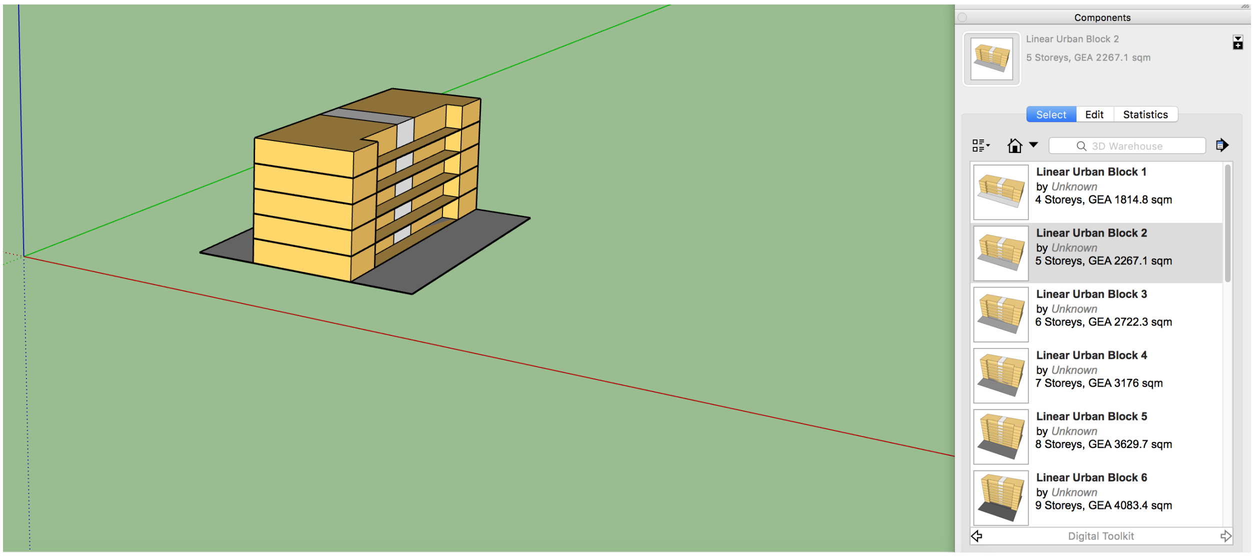
5. Navigate to the downloaded toolkit of types and click 'Open'. Note: select the folder rather than individual SketchUp files to import the whole library of types.



6. The list of types will appear in the components palette within SketchUp. Each component is named by type and has the number of storeys and total GEA of the block indicated.



7. Select types and place in the model space to test proposals. Refer to guidance found in Section 3 of this document on type selection and urban arrangements.



8. Record the quantities of each type used in the GLA's Optimising Site Capacity Calculator. Record types with different storey numbers as separate lines in the record. Use the pulldown menu to select the type (a), fill in the number of storeys (b) and add the quantity used in the SketchUp model (c). The calculator will generate a Total GEA per type (m2) based on the inputted data (d).
9. The calculator will generate a Residential GEA for the modelled scheme (e). Input tenure mix (f) and type mix for each tenure (g). The calculator will generate an Indicative Site Capacity (h).

GLA Indicative Site Capacity Calculator

Digital Toolkit Record

Type (select from pulldown menu) A	GEA per storey (m2)	Number of storeys B	Total GEA per block (m2)	Quantity C	Total GEA per type (m2) D
Linear block	453.7	4	1814.8	2	3629.6
Linear block	453.7	6	2722.2	4	10888.8
Terrace	55	2.5	137.5	10	1375
Villa block	430	5	2150	1	2150
Tower	516.5	10	5165	1	5165
-Select Type-	0	0	0	0	0
-Select Type-	0	0	0	0	0

Capacity Calculator E

Residential GEA*	**23,208**	m2
Residential GIA	20,888	m2
Residential NIA	14,621	m2

*If fields are added to Digital Toolkit Record above, ensure formula for Residential GEA is extended to capture all types listed

Tenure	Tenure mix	NIA (m2)	Type	Type mix	NDSS Area (m2)		Indicative unit count
	F		1 bed	25% G	50	36.6	36
Private	50%	7,311	2 bed	30%	70	31.3	31
			3 bed	45%	86	38.3	38
					Total		105
			1 bed	25%	50	14.6	14
Affordable (Intermediate)	20%	2,924	2 bed	30%	70	12.5	12
			3 bed	45%	86	15.3	15
					Total		41
			1 bed	25%	50	21.9	21
Affordable (Rented)	30%	4,386	2 bed	30%	70	18.8	18
			3 bed	45%	86	23	22
	100%				Total		61 H
					Indicative Site Capacity		207

Notes:
- To be used in conjunction with the GLA Housing Design SPG - Methodologies for Identifying Potential Capacity
- Editable fields for data input are denoted in white. Figures shown are illustrative.
- GIA calculated as 90% of GEA
- NIA calculated as 70% of GIA (reduced ratio to allow for site and scheme variables that may impact capacity)

CONTRIBUTORS AND THANKS

This suite of guidance documents has been led by GLA's Planning team with the input and support of the GLA's Housing and Land, Environment and Regeneration teams. It draws on the findings of the Good Growth by Design Housing Design and Quality of life Inquiry and input from a range of contributors including the Stephen Lawrence Trust and Urban Design London members. The guidance documents have been prepared by a consultant team led by Mae Architects Ltd in close liaison with the GLA.

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Good Quality Housing For All Londoners
London Plan Guidance (Modules A to D)
Draft for consultation

Greater London Authority
October 2020

Published by:
Greater London Authority
City Hall
The Queen's Walk
More London
London SE1 2AA

www.london.gov.uk
Enquiries 020 7983 4000
Minicom 020 7983 4458

ISBN 978-1-84781-733-4