

Basements for Housing

Key Benefits of Basements

Basements are a popular way of creating additional residential space, either as part of a new build home, a conversion of an existing cellar or a retrofit basement beneath an existing home. Basements can provide comfortable day-lit rooms, with natural ventilation and external access, as an extension to the living spaces above. They also provide the opportunity for more unique uses, such as gyms, music rooms and swimming pools. Alternatively, basements can simply provide practical space for home offices, parking or storage. There are many benefits to providing basement space in a house including: added value; improved energy efficiency; good sound insulation; increased flexibility and the creation of high-quality living space.

Added value and space

A bigger home is a key requirement for many house buyers¹ and basements allow more useable space to be created within the same building footprint. The provision of additional floor space in a home clearly increases the value of a property and the addition of a basement adds space with little or no effect on the garden area. Additionally, basements allow additional space to be created in locations where an extra storey above ground level is not possible or desirable due to planning and site constraints.

Desirable and adaptable spaces

One of the major benefits of basements is allowing the creation of a single large space. This is because a single span is often economical due to the forms of external wall construction used.

The resultant space is typically the single largest area in the house and, due to its location on a different level from the rest of the house, provides the opportunity for uses not always possible to accommodate in more basic dwellings. The space also offers flexibility as non-loadbearing internal walls can be installed to suit a range of layouts and future alterations can be carried out more simply.



Space for working from home

Working from home has become increasingly popular over recent years², enabled by improvements in technology and accelerated by the COVID-19 pandemic. Basements offer the possibility of quiet, private spaces for working from home, with the potential for direct access from the outside, and therefore designated work-based visits or deliveries.

Additionally, the solid nature of basement construction provides excellent conditions for workshop spaces and activities that create noise, require support for heavy equipment or require robust, cleanable surfaces.

Changing uses for basement spaces during the life of a family home

- Home office/studio
- Wine cellar
- Home cinema
- Guest suite
- Separate self-contained flat
- Living room
- Extra storage
- DIY workshop
- Utility room
- Hobby room
- Home gym/sauna
- Wet room for outdoor gear
- All-weather playroom
- Band practice/music room

Sustainability benefits

There are many sustainability benefits associated with basements. They are energy efficient spaces where the thermal mass of the structure may be used as part of the strategy to control temperatures within the building and this is discussed further below.

For new developments, particularly where large areas of excavation and significant foundations are required, creating a basement allows this space to be utilised, rather than backfilled. The foundations may be integrated with the basement slab, thus optimising the design. Similarly, on sloping sites, designers either have the option to build at the higher level, using a podium or infill beneath the building, or to build into the slope. Since building up will likely require excavation below the building for foundations, this excavated space may instead be used as a partial basement, within the slope.

For existing buildings, converting an existing cellar or retrofitting a new basement may enable the building to be adapted and repurposed, rather than demolished to allow for a new development. Reuse of an existing structure is a fundamental principle of construction in a circular economy. Additionally, basements are typically constructed of concrete or masonry, which have many inherent sustainability benefits (see box right). There is a useful synergy between many forms of low carbon concrete and the performance requirements for basement construction.

Energy efficiency

Energy efficiency is a key requirement for homeowners and tenants, with 93% of respondents listing it as a priority in a 2018 study³. Basements benefit from the surrounding ground improving their energy efficiency. As a consequence, the amount of insulation needed to reduce heat loss through a basement wall can be less than that required on upper floor levels. The saving is around 35-40% when the same type of insulation is used above and below ground. Alternatively, if the same thickness of insulation is continued below ground, the U-value for the basement walls will be enhanced by around 25%. For information on insulation, see the *Basements for Dwellings* guidance document published by The Basement Information Centre www.basements.org.uk/TBIC/Publications-Guidance.aspx. The simple construction methods and minimum wall penetrations associated with basement construction also lead to minimal heat loss through cold bridging.

Good sound insulation

Good acoustic attenuation is provided by concrete and masonry walls surrounding basement rooms, by the earth itself, and the ground floor if it is built from concrete. Basement spaces are therefore inherently well insulated for sound and ideal for locating noisy activities such as music practice, home cinemas or other loud equipment that could disturb neighbours or the rest of the house.

Conversely, the quiet nature of the space provides a peaceful place for reading, relaxing or working; away from ground-level noise, in and outside of the home.

Sustainable benefits of concrete and masonry construction

- **Low carbon options** – through specification, designers can reduce the embodied carbon of the structure. For further information, refer to The Concrete Centre publication *Specifying Sustainable Concrete*.
- **Precast solutions** – offsite manufacture using factory processes can reduce material wastage.
- **Fire resistance** – concrete and masonry do not burn and noxious gases are not given off if a fire does occur. Performance is achieved through minimum dimensions for concrete elements, avoiding the need for additional protective coatings or boarding.
- **Durability** – concrete and masonry are durable materials which require little or no maintenance.
- **Acoustic performance** – excellent inherent sound insulation properties which avoid the need for additional partition materials to minimise disruption from neighbours or other parts of the home.
- **Thermal mass** – this can be used to reduce heating and cooling requirements.

Thermal mass

The heavyweight nature of basement construction can be utilised to naturally regulate the internal temperature of a home and can be part of an energy efficient strategy for controlling the temperature of the whole house. The Met Office has projected average daily temperature rises throughout the UK, indicating the increasing need for passive methods to cool homes, which heavyweight construction – including basements - is well placed to provide. For further information refer to The Concrete Centre publications *Thermal Mass Explained* and *Thermal Mass for Housing*. www.concretecentre.com/publications. The risk of overheating is recognised as a growing problem and the creation of naturally cool spaces in homes is becoming increasingly essential.

Typically the walls of a basement will be externally insulated, this means the thermal mass may be fully optimised as the concrete structure can absorb and release heat within the space. This requires a suitable surface finish that will conduct heat freely, such as wet plaster, paint, or visual concrete. Waterproofing strategies involving internal membranes or cavity drain systems may reduce the effectiveness of thermal mass in the concrete structure. However, in projects where the inner leaf is made of masonry or concrete, the thermal mass of this may be used, providing it has a suitable surface finish. The use of visual concrete offers potential cost, carbon, and programming benefits, by omitting the need for subsequent use of finishing materials and trades, along with the associated waste produced on site.

Air tightness

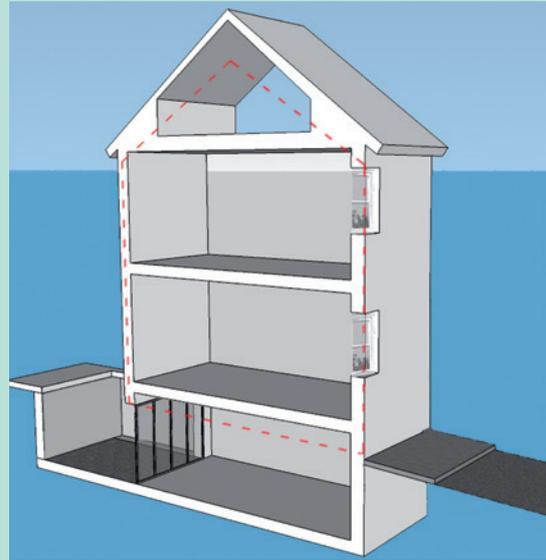
Controlling the air permeability is identified as a key feature of improving the energy efficiency of the building fabric. This is easy to achieve with basements since the structure is below ground and also typically has an impermeable waterproofing layer.

Optimising development potential

Higher density development - minimal extra height

The use of a basement provides increased floor area in a house without significantly increasing the apparent size of the building; thereby improving the viability of a development, particularly in areas where building height or size of footprint is restricted.

The potential to increase the number of proposed dwellings in one property is boosted if both a basement and habitable roof space are proposed; thereby potentially creating two additional storeys in a similar building envelope.



Utilise existing slope

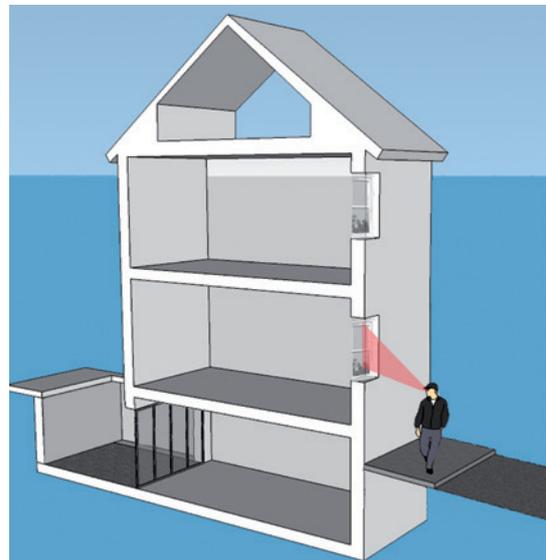
Partial basements on sloping sites are a good alternative to create space where alternative substructure construction would be required to make up ground levels.



Maximise site layout - build up to street boundary

By lifting the ground floor level above street level to create upper and lower ground floors, properties can be constructed close to site boundaries while maintaining privacy for occupants.

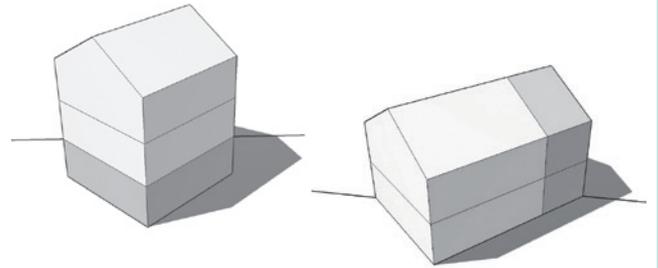
With this approach, consideration of Building Regulation Part M requirements for access is required.



Protect amenity space

The use of a fully below-ground basement or partially below-ground basement gives increased usable space within the building footprint. Larger dwellings can therefore be built on small sites without losing amenity space around the buildings.

Shading in the diagram opposite indicates equivalent accommodation areas located beside or below a dwelling, impacting on available garden space.



Better use of poor sites with poor soil

Where poor ground conditions necessitate deep foundations, the additional cost can be mitigated by including a basement to add space and therefore value to new properties.

Where large areas of contaminated soil are removed from site, the viability of including a basement level is increased. If constructed before original ground levels are reinstated, the amount of replacement ground material is reduced and further excavation is unlikely. Back fill will need to be compacted around the walls, but in general the programme of construction is likely to benefit from improved access conditions.

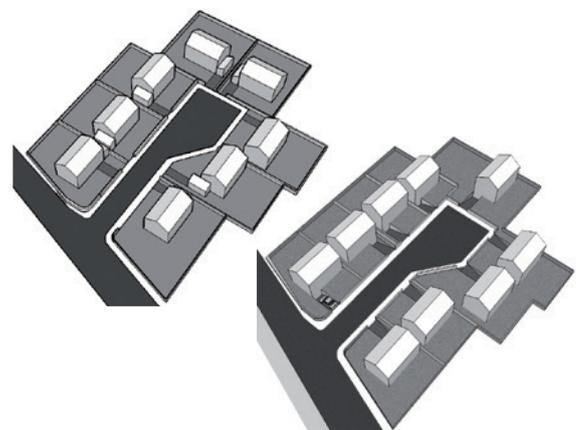
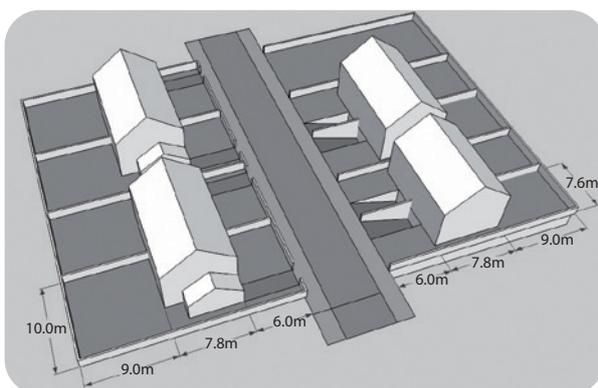
Stable building stock

Basements create a good stable structural base, capable of supporting heavy loads above. By combining foundation design with the provision of habitable space, the extra depth of structure provides the building with greater ability to cope with climate change effects in the soil, such as shrinkage or tree roots. This means buildings with basements are less prone to movement and cracking as a result of potential future changes in soil conditions.

Increased number of plots per hectare for large developments

Housing using a basement garage requires less street frontage, compared to houses with garages located alongside at ground level.

By incorporating facilities such as garages, utility rooms or habitable space at basement level, it is possible to reduce the footprint of a proposed property; thereby increasing the number of houses on a given site or along a fixed street frontage.



Nine plots possible with basement garages, compared to eight plots on the same site.

References

1. What are home buyers looking for in 2020?, Home Owners Alliance website, 2020. www.hoa.org.uk
2. Working from home: What's driving the rise in remote working? London: Chartered Institute of Personnel and Development, CIPD, 2020.
3. A Dream Home: An exploration of aspirations, Modern Masonry, 2018.