

SUSTAINABLE CONSTRUCTION PERFORMANCE INTRODUCTION

Please read this introduction and use this advice to help you submit appropriate information as part of your planning application to: planning@stroud.gov.uk

The purpose of this document is to provide information on sustainable construction and design matters referred to in delivery policy ES1 of the Stroud District Local Plan. Other policies of the Local Plan deal with other aspects of sustainability, ensuring that development in Stroud District is as sustainable as possible. This information should assist you in completing the Housing or Non-Domestic Building Checklist which should be submitted with all relevant planning applications.

The Checklist is intended to complement elements of sustainable construction that are incorporated in to the building regulations. It will help you to consider how to incorporate sustainable construction principles into your development proposals for new build and/or refurbishment of existing buildings.

Sustainable construction can encompass a whole range of techniques that could minimise any potential adverse environmental and social impacts of new development. The Council strongly encourages a holistic approach to the development process. The Checklist seeks to ensure that sustainability considerations are taken fully into account from initial project thinking through to development completion. Such an approach should avoid unnecessary project delay and cost to the developer.

The sustainable construction techniques in this document are not intended to be prescriptive for all new developments. The document is intended to promote various sustainable construction techniques and give options for what could be incorporated into new developments. It can encourage developers to adopt practical and cost efficient solutions. In terms of cost efficiency, this includes taking the lifetime costs of new developments into account. With this in mind developments should be designed for longevity and flexibility to accommodate different uses over time.

When considering the implementation of the construction techniques and options promoted in this document it will be important to have regard to the wider planning policy framework for the District. Policies in the Local Plan concerning issues such as design, listed buildings, conservation areas, archaeological sites, biodiversity, landscape, flood risk, the re-use of buildings and crime prevention all need to be considered when proposing to implement sustainable construction techniques. It will be important that the sustainable construction and design techniques proposed do not seek to conflict with these policies.

Reducing Demand – Energy efficiency

The layout of a development has a significant impact on energy demand both in buildings and through transport use. Energy demand in buildings can be reduced, both for new developments and the refurbishment and conversion of existing buildings through the use of passive solar design techniques. Part L of the Building Regulations requires a minimum standard of energy efficiency in new developments.

The Council will, however, strongly encourage developers to strive to achieve standards beyond these minimum standards, so that the significant benefits of reducing energy consumption are maximised. Passive solar design is a concept of designing a building to reduce the need for energy by minimising heat loss in winter and heat gain in summer and using natural light and ventilation as much as possible. Solar gain for heating is one aspect of passive solar design. Solar gain can make a significant contribution to the heating of a building although care has to be taken, particularly for

buildings with large glazed areas, to design buildings that avoid overheating in the summer and hence the need for air conditioning and increased energy use. One principle of solar gain is to locate development sites on southerly slopes rather than those sites that are north facing or level. Southerly slopes can be developed at higher densities and still allow for solar access, thereby avoiding over shading, than north facing or level sites. Glazed areas should be made to a high specification to ensure that annual heat gains exceed heat losses.

In some instances there is a need to address too much solar gain, in particular in office buildings that have large glazed areas and a large amount of electronic equipment that emits heat. In some instances it may be appropriate to site a building to face north.

Other ways of avoiding overheating as a result of solar gain include designing a building with features such as a large thermal capacity, night cooling, over shading and reflective glazing. It is important to remember that in assessing the prospects for solar gain, factors such as proposed use and site location need to be considered to determine what is appropriate in that particular case.

One of the most important ways to reduce energy demand is by minimising heat loss through insulation. In new buildings insulation can be generally integrated into walls and roofs. Generally insulation is cheap and can be incorporated easily into new developments, as well as many existing buildings. To reduce heat loss from windows double glazing or even triple glazing should be considered. However, adequate ventilation without draughts is essential to avoid condensation problems. It is also important to note that when reglazing historic buildings regard should be had to their special characteristics, meaning that in most instances the use of UPVC (plastic) windows will not be appropriate. In these cases original materials such as wood or metal should be utilised, as not only do they preserve the characteristics of the building, but UPVC windows are also considered to be hazardous in terms of their disposal as they can give rise to toxins and have low biodegradability. In addition the use of sustainably produced timber products, as opposed to UPVC, generally requires less embodied energy. Embodied energy is the total energy required to bring an item into its existing state. It therefore includes the energy consumed in winning raw materials, processing them and manufacturing composite items as well as transporting materials between and within these processes. By constructing timber framed buildings the operational energy demands for a building can be significantly less than a conventionally built development (generally steel structural frames). It is widely recognised that timber framed houses are top performers with regards to thermal and acoustic efficiency. In addition timber is recognised as being recyclable, biodegradable, non-toxic and most importantly carbon-neutral.

Practice has shown that well insulated buildings, which also incorporate other aspects of passive solar design, can be used throughout the year with very little additional heating other than heat gained from occupants and electrical appliances such as TV's and computers. An example of this is the Beddington Zero Energy Development (BedZED) in Beddington, Sutton. Initiated by the environmental specialists BioRegional, BedZED was developed by the Peabody Trust in partnership with BioRegional Development Group and designed by Bill Dunster Architects. The development is comprised of 82 housing units, various community and recreational facilities and employment space. This development has incorporated many of the aspects of passive solar design. Other features of the development include the roof top, wind powered ventilation 'cowls' that passively recover heat loss from the existing stale air and use it to preheat incoming air (these ventilation 'cowls' can be seen on the roof tops of the buildings pictured on the top of the following page), solar panels on each house and energy efficiency fittings and appliances that reduce annual energy bills. These sustainable construction methods are all promoted in this document. In addition recycled and recovered materials have been used for the structural steelwork, timber internal doors and in the crushed concrete aggregates. In summary the BedZED development has resulted in a sustainable scheme (it is carbon neutral, meaning that the development does not result in any addition of carbon dioxide to the atmosphere) that also achieves high quality living and working space.

Coupled with solar gain, natural daylighting can reduce the energy demand of new developments. Daylighting is the controlled entry of natural light into a building through windows, skylights, atria and other building envelope components. A well designed daylighting system should admit only as much

light as necessary, distribute it evenly and avoid overheating. Alongside the energy saving benefits, natural daylighting can also have a positive impact on the well being, productivity and satisfaction of the occupants of buildings that employ this passive solar design technique. This is because natural daylight offers building occupants a pleasant and highly valued connection to the outdoors that can evoke positive physiological and psychological responses that promote well being and morale. Studies have shown that this can lead to a boost in performance and productivity of occupants by around 15-20 per cent. With this in mind, natural daylighting is particularly important for office developments. Ways in which to maximise natural daylighting include the use of sunpipes and natural lighting through an atrium for example. Sunpipes are often a very effective way of providing light to a room that does not benefit from any windows. It is also possible to maximise natural daylighting by minimising north facing glazed areas whilst having the majority of the glazed areas facing between south west and south east. With regards to this principle, the issues of security and privacy need to be taken into account, thereby not always making it practical to have the glazed areas of buildings facing certain directions.

Natural ventilation is another important aspect of passive solar design. The key aim of a good ventilation strategy is to ensure adequate ventilation for good internal air quality, but not to the extent where heat is wasted. Natural ventilation uses the passive stack effect and pressure differentials to bring cool fresh air from the outside through the building without the use of mechanical systems. This process cools the occupants and provides comfort.

Although not classed as a passive solar design technique, the use of green roofs on developments is another way of reducing energy demand. Quite simply, a green roof is a roof with vegetation growing on it. A green roof can range from a roof with moss or grass growing on it to a fully fledged roof garden. The benefits of green roofs include increasing the biodiversity value of developments, boosting the environmental credentials of a business, improving the thermal performance of a building and attenuating rainwater flows and can help to reduce landscape impact in some cases.. Green roofs help prevent heat loss in the winter, as well as keeping buildings cool in the summer, as planting on the roof will reduce the amount of solar radiation that can be absorbed by the roof's bare surface. As well as reducing energy demand, green roofs can provide benefits in the reduction of carbon dioxide in the atmosphere.

Outside of the actual structure of the building, energy use can be reduced through careful design of the development site. For instance, shelter from cold northerly and prevailing winds can be provided by vegetation. In this instance the vegetation would need to be appropriate to the site and type of development. In some cases it may be possible to use deciduous trees as a shelter belt, thereby enabling low level winter sun to filter through the bare branches and provide natural lighting. Another example is by having buildings arranged in irregular street patterns to avoid channelling wind.

Water efficiency and Sustainable Drainage Systems (SuDS)

The principle of reducing demand should also be applied to water. Many water efficiency measures that can be applied in new or existing developments are outside of the control of the planning system and are reliant on homeowners installing water efficiency appliances. However, there are ways in which water efficiency measures can be incorporated into new developments as well as renovations and conversions at the application stage. The need for reducing the demand on water supplies has become even more apparent recently in the news. As well as the environmental benefits of reducing water usage there is also economic benefits, in particular for those properties that are metered. All new developments should have a water meter installed as part of the development, and existing unmetered properties should consider installing a meter.

In commercial and domestic buildings the demand for water can be reduced by as much as 50% using a variety of simple and innovative strategies that are integrated into the plumbing and mechanical systems, as well as the design of the building and its surroundings. Rainwater harvesting is one way in which to reduce the demand for mains water. Rainwater harvesting is the collection of water that would otherwise have gone down the drainage system, into the ground or been lost to the

atmosphere through evaporation. Large surfaces such as roofs or driveways are ideal for rainwater harvesting and can be used to flush the toilet, water gardens and even fuel the washing machine. Rainwater harvesting systems can be installed in both new and existing buildings, and the resulting water used for all purposes except drinking. A rainwater harvesting system can be as simple as a water butt used to collect rainwater for the purposes of watering a garden. A typical example of a more sizeable system would be rain collected from the roof travelling via a drainpipe into a storage tank (usually underground) once the leaves and debris have been filtered out. This water can then be used to supply toilets, outside taps, etc through a separate network of pipes.

As previously mentioned, more water efficient appliances are another way of reducing demand. Appliances that should be encouraged include dual flush toilets and low flow showerheads. Where possible, the use of appliances that are inefficient in water use, such as baths and high pressure showers, should not be used. Use of more innovative water efficient appliances is increasing with appliances such as waterless urinals and toilets increasingly getting Building Regulation approval. Such appliances need to be fit for purpose and are therefore more appropriate for certain types of developments. For instance, waterless urinals are becoming common in institutional buildings, such as some schools and visitor centres.

The impact of new and existing development on the water environment is an important aspect of sustainable construction. Traditionally, surface water run off has been routed into pipes and drains to be moved as quickly as possible to the nearest discharge point, generally a watercourse. This has a number of negative implications, namely directing water away from below ground aquifers, which is an important water resource (particularly in the south east), exacerbating flood risk on the receiving watercourses, which in turn causes loss of aquatic habitats, and giving a greater risk to pollution incidents. The aim of SuDS is to prevent these negative impacts by managing water on-site by minimising surface water run off, attenuating surface water discharge rates, recharging aquifers and in some instances creating aquatic habitats, landscape benefits and open space provision.

Swales and basins are a form of drainage that can be incorporated into a development as a feature of a landscaped area. Swales are grassed depressions which lead surface water overland from the drained surface to a storage or discharge system, typically using the green space of a roadside margin. They may be used to replace conventional roadside kerbs, saving construction and maintenance costs. Compared to a conventional ditch, a swale is shallow and relatively wide, providing temporary storage, treatment and the possibility of infiltration under suitable conditions. Swales are a useful form of drainage alongside roads and provide low maintenance costs as when matters go wrong remedial measures are easier to deal with than conventional drainage systems.

A basin (also known as an infiltration trench) is designed to hold back storm runoff for a few hours and to allow the settlement of solids. Because of this they are dry outside of storm periods. They provide temporary storage for storm water, reduce peak flows to receiving waters, facilitate the filtration of pollutants (deposited and incorporated into the substrate) and allow for water infiltration directly into the ground.

Ponds and wetlands are a sustainable drainage method that can also provide amenity and biodiversity benefits to a development. They are a form of drainage that is generally appropriate where the geology is relatively impermeable. Ponds and wetlands are generally appropriate on larger developments and allow for surface water to be stored/attenuated to allow for a controlled discharge to a nearby watercourse, thereby minimising flood risk downstream. The ponds/wetlands can also trap sediment and hold back pollution, thereby enabling the pollutants to be broken down or, in the case of a disaster incident be removed. When considering the implementation of SuDS such as ponds, swales and basins it is important to consider the planting schemes and design in order to produce a drainage system that has biodiversity value.

When considering the use of wetlands as a means of surface water drainage it is important to remember that existing wetlands should not be utilised as the increase influx of surface water, which is likely to contain some pollutants, is likely to have adverse ecological impacts on that existing

wetland feature. Although ponds and wetlands can be 'wet' or 'dry' they are most likely to contribute to visual amenity and biodiversity where they include a permanent water body.

Some of the sustainable drainage methods that have been highlighted require a certain amount of maintenance to ensure that they operate effectively and continue to provide associated benefits of biodiversity and visual amenity, particularly where such features are integral to the overall landscape distinctiveness of a site or development. With this in mind it will be essential that the adoption of SuDS is considered at the earliest stage possible in the development process. The District Council will need to be assured that appropriate arrangements for maintenance are in place for drainage schemes, namely establishing who has or will adopt the scheme. They must operate effectively and continue to provide associated benefits of biodiversity and visual amenity, particularly where such features are integral to the overall landscape distinctiveness of a site. Surface water must not be allowed to drain to the foul sewer, as this is known as a major contributor to sewer flooding in some places within the District..

Re-using and recycling demolition/construction waste

With over 80% of construction materials arising from natural resources there is increasing pressure to find ways to conserve and make best use of these scarce resources. At the same time the Department of Trade and Industry (DTI) estimate that annually over 70 million tonnes of construction and demolition waste is generated, much of which ends up in landfill sites, where spare capacity is becoming increasingly scarce. It is also estimated that over 13 million tonnes of this construction and demolition waste is building material that is delivered to building sites but never used. In reducing construction and demolition waste not only does it reduce the amount of waste that goes to landfill, but it also reduces the environmental impact of producing new materials, and can reduce overall building project expenses through avoided purchase/disposal costs.

Construction and demolition waste comprises of waste arising from the total or partial demolition/construction of buildings and other structures and materials arising from the preparation of construction sites (i.e. soil and rocks). Much of this waste can be either re-used or recycled. The re-using of waste means that the materials can be used again without the need for them to be modified. The recycling of waste means that the waste product needs to be processed in some way before it can be used again.

Concerning the demolition of buildings, the first preference should be to retain and reuse existing buildings that are of a good quality. Where demolition is necessary the contractor should undertake a removal of the valuable and/or potentially contaminated materials before the actual demolition takes place. This means that these materials can either be re-used or disposed of in such a way so as to avoid any adverse environmental or human impact effects.

Deconstruction of buildings and reclamation of materials should always be the preferable option to wholesale demolition. A Demolition Protocol has been produced by the Institute of Civil Engineers (www.ice.org.uk). The Protocol establishes an 'audit trail' for demolition materials, from an initial building audit and the setting of targets for recovery to the use of re-used and recycled materials in new build projects. As well as utilising re-used and recycled materials in new developments, the District Council will encourage developers to utilise locally sourced and produced materials in an effort to reduce transport energy use.

Health and Wellbeing

Health, well-being and the environment are interdependent. Good design can create high quality, sustainable places that meet a wide range of goals. There is a realisation that enabling healthy lifestyles can mean long-term savings in health treatment costs. These can be through incremental improvements or renovation; and not necessarily complete redevelopment. The National Planning Practice Guidance encourages health and wellbeing, health infrastructure matters are considered in local and neighbourhood plans and in planning decision making. The built environment does affect

our wellbeing. Good health is determined by a range of factors — many of them linked to the quality, accessibility and sustainability of our physical environment. Sustainability and design quality are indivisible. For instance, it is essential to consider weather and temperature fluctuations when designing facilities or places meant to encourage healing and good health. Buildings can have a positive effect on health and well-being, minimise energy bills and help protect the environment. Those planning, designing, constructing or using a new building should consider wider health and well-being benefits, rather than deliver on narrow goals.

With an ageing population the home and community can directly support health and well-being, providing a setting where people feel a sense of security, independence and choice. Yet the ability to live at home may be compromised for vulnerable groups, for example older adults living with mobility or functional difficulties or those experiencing housing insecurity and are at-risk of becoming homeless. The built environment, through the design of housing and supportive community spaces, should reflect the desire to age-in-place through providing opportunities for social participation and community engagement.

Generally everyone needs the chance to recover from fatiguing tasks and reflect upon daily and life experiences. Some environments have been shown to be more restorative than others, such as good quality natural environments. Without access to restorative environments, people's stress levels can rise and general wellbeing suffers.

People experience environments through all their senses, thus how it is perceived and how the environment is designed is important in creating a healthy sensory experience. For example, aspects to consider include acoustic and thermal comfort, smooth surfaces for wheelchair users but textured surfaces for people with visual impairments. Sensory experiences can also enhance the enjoyment of a place, through play and encouraging further interaction, such as sensory gardens and art installations, all of which contribute to improved wellbeing.

Sustainable design for health and well-being:

- uses service space efficiently, minimising energy and resources
- uses renewable energy and sustainable materials
- exploits planting and greenery to increase cooling and water run-off
- uses passive design techniques such as thermal massing, natural ventilation and natural lighting to reduce stress energy use, and to improve long-term value for money
- means locating services in accessible places that can be reached on foot, bicycle or public transport . In larger buildings or ones in multiple occupation locating attractive staircases in convenient places will also encourage walking and reduce the use of lifts and escalators; and
- means buildings should be easily adapted to future changes in lifestyles or the delivery of services and carbon reduction technologies. They could need allowances for extensions or reconfiguration.

Transport

The Local Plan provides for a variety of forms of transport as alternatives to the private car which includes public road, rail and bus services. The infrastructure network further includes provision for walkers and cyclists. A significant percentage of people in the District will continue to drive their own private vehicle whether through choice or need. Electric vehicles enable them to do it in a way that does not contribute to the air quality problems. Electric vehicles will not resolve congestion issues on our roads and the Council sees their expansion as only part of the solution to transport and air quality issues. Electric vehicles are suited to traffic conditions where engines spend a lot of time idling but emissions are still being pumped out. The Council acknowledges that currently electric vehicles have a shorter range than comparable petrol and diesel vehicles. Furthermore this matter is compounded by the lack of publicly accessible charging infrastructure. These factors in a rural District are identified as a major barrier to the greater uptake of electric vehicles. However as this technology develops and hybrid electric vehicles are increasingly manufactured, the Council will wish to encourage provision of

alternative fuels and electric vehicle charging points and work to develop electric vehicle charging points. You can charge your Electric Vehicle (EV) at home if you have off-street parking such as a garage, driveway or carport. Cables for electric vehicles are not usually very long, so make sure that the parking space is near a suitable plug socket or a dedicated home charging unit if you have one fitted. It's important to check that the existing cabling, sockets and the main household supply fuse will be able to carry the additional current drawn by the vehicle, and that there are adequate safety cut-outs. You should consider having a separate, dedicated spur fitted to supply the charge point – much like a cooker has its own electric circuit. This way, you can avoid the potential risk of overloading the ring main which supplies the household wall sockets. The charge point should also have its own circuit breaker and a residual current device, which will prevent an electric shock or damage to the circuit in the unlikely event of a fault with the vehicle. A number of home charging solutions have already been launched in the UK, and manufacturers of electric vehicles are recommending that users have an approved home charge point installed when they buy an EV. A home charge point will have its own dedicated electrical spur and incorporates a range of safety devices and features to ensure maximum safety while charging an EV.

Useful Links:

- *Stroud District Local Plan*
http://www.stroud.gov.uk/docs/planning/planning_strategy.asp#s=sectioncontent2&p=lp
- *Gloucestershire Local Nature Partnership Strategic Green Infrastructure Strategy*
<http://gloucestershirebiodiversity.net/>
- *Gloucestershire Waste Core Strategy*
<http://www.gloucestershire.gov.uk/extra/wcs>
- *BREEAM Standard*
<http://www.breeam.org/about.jsp?id=66>
- *BRE Home Quality Mark*
<http://www.homequalitymark.com/standard>
- *BRE Green Guide*
<http://www.thegreenguide.org.uk>
- *Passivhaus Standards*
<http://www.passivhaus.org.uk/standard.jsp?id=122>
- *Building for life*
<http://www.designcouncil.org.uk/resources/guide/building-life-12-third-edition>
- *Lifetime Homes*
<http://www.lifetimehomes.org.uk>