Construction

In this section

This section will detail:

1 / How to address waste in construction

2 / On-site testing required to deliver high performance

3 / Post Occupancy Evaluation and certification

Executive summary

> Circular principles are key to reducing construction waste, which is accounts for more than half the waste generated in the UK annually.

> Introducing a hierarchy of decisions that first prevents waste, then minimises excavation and demolition waste by reuse and recycle will drastically improve the environmental impact of a development and will ensure alignment with the emerging Herefordshire Minerals and Waste Local Plan (MWLP). Considering longer lifecycle building products will also minimise the lifecycle waste associated with a project.

> Reducing travel, and particularly car travel, will have a significant impact on the greenhouse gas emissions associated with developments.

> The average performance gap on UK buildings is 40%. Air testing during construction and post-completion - and including robust performance testing as part of plans from the outset - will help drive the kind of performance standards referenced in this document.

Introduction

This final chapter discusses the considerations at construction phase that must be implemented to address embodied carbon and operational energy use in the built environment. Whilst much of this does require forward planning at earlier design stages, it is during the construction stage that action happens.

The importance of embodied carbon assessments has been discussed in earlier sections. The management of waste generation on site is an important aspect for discussion, as careful consideration can lead to improved reuse and recycling opportunities. However earlier design decisions can have implications on the amount of waste generated both on site immediately and also during the lifetime of the building. Considering waste at all stages can help reduce the embodied carbon within a building and create efficient use of resources.

Ensuring buildings perform as anticipated at design stage and addressing the **performance gap** is vitally important during the construction phase. Whilst there is a responsibility for designers to ensure buildings are modelled realistically and assumptions reflect in-use performance of buildings, a large responsibility also rests with those constructing the building to eliminate the performance gap. Methods to facilitate this, including testing, monitoring and certification are discussed in this chapter.

The effect development has on physical resources and reduction, reuse and recycling of waste, particularly on development sites featured within Herefordshire Council's Core Strategy policies SS6, SS7, and SD1 along with the the Herefordshire Minerals and Waste Local Plan. Currently reliance is placed on certification and achieving building standards to ensure building performance targets are met. However, as certain Government targets are met and it becomes necessary to prove that buildings achieve these required targets it is intended that the **performance gap** will disappear.

Policies

- Policy SS6 Environmental quality & local distinctiveness
- Policy SS7 Addressing climate change
- Policy SD1 Sustainable design and energy efficiency
- Herefordshire Minerals and Waste Local Plan

Definitions

- **Performance Gap:** the difference in how a building was anticipated to perform at design stage and the in-use energy consumption.

Waste

As part of a 25-year Environmental Plan and a focus on resource efficiency, the Government have set out to eliminate all kinds of avoidable waste by 2050. To help deliver this goal, the National Resources and Waste Strategy was published in 2018, focusing on the concept of the **Circular Economy**.

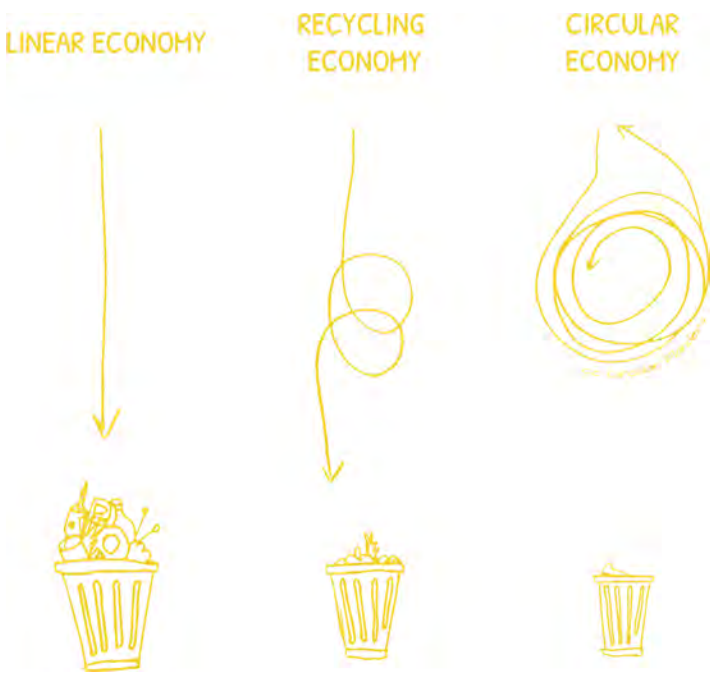

Image 70: Circular Economy (Image courtesy of Circular Flanders)

The construction sector accounted for 62% of the total waste generated in the UK in 2016 and while small improvements are being made, the construction industry needs to make some big strides in the near future. Efforts must be made to eliminate waste from the outset and to minimise use of resources.

In order to achieve this, it is important to understand the impact various elements of the construction process (including demolition, excavation and construction) have on waste generation. The following should be prioritised:

Managing demolition waste: A demolition strategy should be developed, setting out how materials will be segregated on site and how waste flows can be managed to maximise re-use and reclamation. Larger projects should also consider independent pre-demolition audits to aid in this process and demonstrate a commitment to minimise waste.

Managing excavation waste: An excavation strategy should be developed to highlight the nature of this waste, the reasons behind its removal and if it can be reused or recycled, ideally on site or in the locality (for example to raise levels to address flood risk). This can then inform key design decisions from the outset.

Definitions

- **Circular Economy:** refers to a regenerative economic system aimed at continual use of resources to eliminate waste. This contrasts the traditional linear economic system: 'take, make, dispose.'

Further Information

- UK Statistics on Waste
- Our Waste, Our Resources: A Strategy for England
- Circular Economy Statement Guidance, Draft for Consultation

Managing construction waste: Waste generated during construction can arise due to a number of reasons such as, inefficient design that leads to wastage, over ordering of materials, poor storage that results in damage and poor workmanship that results in duplication of work.

Segregating materials to allow them to be recycled and repurposed is important. It may also be possible to reuse materials on site and for this reason materials with this potential should be separated from those that will need to be recycled off-site. Developing a strategy to address construction waste will again assist with decision making from early in the process.

Managing lifecycle waste: Re-useable coffee cups are more robust, last longer and reduce the single use impact of disposable cups. In the same way, choosing building products with longer lifespans, a nd ones that are easily recycled or made of naturally occurring materials, will mean that when materials are replaced less waste will go to landfill and more can be recycled. The same considerationshould also be applied to the materials specified for the infrastructure and landscaping around buildings.

Whole life carbon assessments are a good start in assessing the carbon impact over the expected lifespan of a building and can often provide a direct reflection of the impact of waste too.

Waste hierarchy: As illustrated below, the priority is to prevent the creation of waste from the outset, followed by preparation of waste for reuse; to recycling, and then recovery. Disposal, in landfill for example, is regarded as the worst option.

71 **Image 71**: Waste hierarchy

Definitions

- **Whole Life Carbon:** (WL-CO2e) refers to the carbon dioxide equivalent (the measure by which greenhouse gases' impact on the climate is measured) emissions from EN:15978 building stages A, B and C, with D reported separately.

Best Practice Recommendations

- All developments shall calculate life-cycle carbon emissions (including embodied carbon emissions) with a nationally recognised methodology and demonstrate actions taken to minimise life-cycle carbon emissions
- A Site Waste Management Plan to be implemented

One Planet Living is a simple framework designed to help people live well with the resources of the planet we have. It comprises ten intuitive One Planet Living. Principles that can be used by anyone – personally and professionally – to imagine, plan, do, and communicate about deep sustainability. It is based on what science is currently telling us about what is needed to live within the Earth's means.

The One Planet Living Framework is not a prescribed standard, certification or accreditation system and consequently there is no pass or fail, but instead, its application required thought about a wide range of design considerations. It is a commitment to a journey rather than a tick-box certification.

This framework ensures a complete approach to development and for this reason is a recommended tool. A One Planet Action Plan would be developed for each site and will be dynamic, allowing modification and improvement. This will include a set of goals for each topic, outlining the strategies and actions for implementation. This is where this framework can work alongside other standards; with these standards set as goals within the One Planet topics.

ONE PLANET LIVING

72 **Image 72**:
Bioregional One Planet Living Logo

- Health and happiness
- Equity and local economy
- Culture and community
- Land and nature
- Sustainable water
- Local and sustainable food
- Travel and transport
- Materials and products
- Zero waste
- Zero carbon energy

73 **Image 73**:
Bioregional One Planet Living
10 principles

Further Information

- One Planet Living

Testing during construction

- **Air testing:** It is a set requirement for all buildings to have an **airtest** upon completion as well as diagnostic testing during the construction process to suggest improvements, if required. An airtest at the end leaves minimal options for improvement without significant cost.

A draughty building doesn't only cost more money to heat, it is also uncomfortable to be in.

The required value for this airtest will depend on the standard the building is set to achieve. The airtest and measured airtightness will be essential in being able to use **MVHR** at this stage or in the future.

Image 74: 74 Air test during construction

- **Performance testing:** Post completion performance testing is an effective way of ensuring quality in construction, and that targets have been achieved.

It is also possible to undertake performance tests (simulations) for a building in the early stages of design, which can be used to define how the building will perform against how it will work spatially/visually. This is a positive step to ensuring that required/set standards can be achieved.

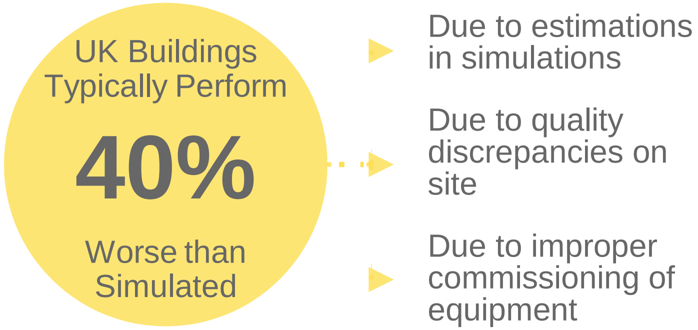

Image 75: 75 Performance Gap

Further Information

- Veritherm
- UKGBC targets
- BSRIA Soft Landings Framework

Definitions

- **Airtest:** tests the air leakage through uncontrolled ventilation, for example gaps in walls, between walls, windows, doors or the roof. This provides an indication of how draughty a building is.
- **MVHR:** Mechanical Ventilation with Heat Recovery. This is a key element of energy efficient / Passivhaus buildings with high levels of airtightness.

Best Practice Recommendations

- Carry out an air test on all new buildings and a minimum airtightness reading of 0.6 air changes/hr @ n50 should be achieved.

Handing the building over & monitoring performance

To ensure the handover of a building is smooth, and how the building is used and maintained is understood, a **soft landings** approach is recommended.

Post Occupancy Evaluation (**POE**) of this nature allows for clients/building users to engage with designers/contractors and ensure their building is performing as designed. It highlights any issues in the performance so that these can be addressed and resolved.

Post Occupancy Evaluation: It is important to understand if a building performs as it was designed to do. This often includes:

- Monitoring actual energy use (and consideration to sub metering of different uses such as energy used for heating, hot water, **small power**, lighting and energy generation from renewables.
- Monitoring internal air quality (temperature, **relative humidity**, carbon dioxide), this gives an important indication of user comfort and potential health concerns – for example high levels of carbon dioxide in a school will impact significantly on concentration of pupils.
- User comfort surveys – maybe more use for major projects where the developer could undertake user comfort surveys to assess how occupants find the buildings in terms of their environment but also useability. This can be used to feedback into future projects.

76 **Image 76**: Thermal imaging for POE

Best Practice Recommendations

- All developments shall put in place a recognised monitoring regime to allow the assessment of energy use, indoor air quality and overheating risk and ensure that the information recovered is provided to the owners and the planning authority. Monitoring running and user satisfaction should also be implemented on larger developments.
- All major developments shall implement a soft landings scheme from the outset.

Definitions

- **Soft Landings:** a set of procedures with the aim of passing a building smoothly from the build phase to the occupation phase, ensuring operational needs are fully considered as early as possible in a project
- **POE:** Post Occupancy Evaluation is the process of analysing how a building functions while in use.
- **Small Power:** refers to unregulated energy demand, e.g. socket and appliances energy demand.
- **Relative Humidity:** (RH) The relative amount of water vapour in the air. A healthy indoor space should be between 40% and 60% RH.

Certification

It is important that this is considered and actioned from the outset. There are various methods, services and products available to enable **POE.**

The certification of a development is linked to the chosen standards set out at start that the development intends to achieve. Whilst many standards have levels of accreditation it is important when utilising these to improve the environmental performance that there is an aspiration to achieve the highest rating.

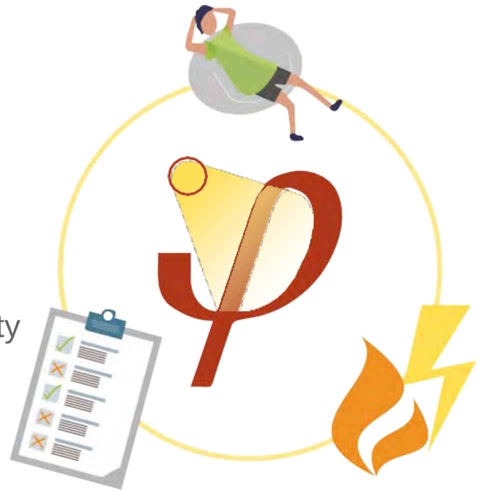

Image 77: Passivhaus Principles

Certifiying a building to the passivhaus standard assures design quality but is also provides quality assurance on site, it is especially good to hold builders to account and ensure a minimum quality is met.

The Passivhaus standard uses a third party to certify the design, construction and commissioning stages. This helps to ensure that buildings are delivered to perform as designed, and achieve the low energy targets.

- **Design quality:** Passivhaus buildings are validated using passivhaus software (PHPP), which creates a detailed energy model. Additionally, Passivhaus designers and certifiers are constantly on the look out for troublesome details - those that result in poor insulation, or make achieving airtightness difficult - in order to design them out of the project.
- **Construction quality:** Passivhaus certifiers act as a second set of eyes on site, ensuring what is designed is what is constructed, and that the quality of workmanship is up to standard.
- **Commissioning quality:** Passivhaus certifiers act as overseers to validate commissioning information for buildings, to ensure it operates as intended.

Best Practice Recommendations

CS1 All developments shall calculate life-cycle carbon emissions (including embodied carbon emissions) with a nationally recognised methodology and demonstrate actions taken to minimise life-cycle carbon emissions.

CS2 A Site Waste Management Plan to be implemented.

CS3 Carry out an air test on all new buildings and a minimum airtightness reading of 0.6 air changes/hr @ n50 should be achieved.

CS4 All developments shall put in place a recognised monitoring regime to allow the assessment of energy use, indoor air quality and overheating risk and ensure that the information recovered is provided to the owners and the planning authority. Monitoring running and user satisfaction should also be implemented on larger developments.

CS7 All major developments shall implement a soft landings scheme from the outset.