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Designing for material efficiency in building projects —

Part 1: Code of practice for Strategic Definition and Preparation and Brief

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 32, an inside back cover and a back cover.

Foreword

This document is published by BSI Standards Limited, under license from The British Standards Institution, and came into effect on 31 July 2013. It was prepared by Technical Committee B/209, *General Building Codes*. A list of organizations represented on this committee can be obtained on request to its secretary.

Information about this document

This document gives recommendations for designing for material efficiency that are accepted as good practice by industry leaders and practitioners, and brings together the results of practical experience and acquired knowledge for ease of access and use of the information.

This code of practice sets out the process for the integration of designing for material efficiency into the Strategic Definition and Preparation and Brief stages of the RIBA Plan of Work [N1].

It is the first part in a projected suite of codes of practice that address specific and interrelated issues and processes of material efficiency in building projects in line with the RIBA Plan of Work.

BS 8895, *Designing for material efficiency in building projects*, will eventually comprise the following parts.

- Part 1: *Code of practice for Strategic Definition and Preparation and Brief.*
- Part 2: *Code of practice for Concept and Developed Design.*
- Part 3: *Code of practice for Technical Design*.
- Part 4: *Code of practice for operation, refurbishment and end of life*.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

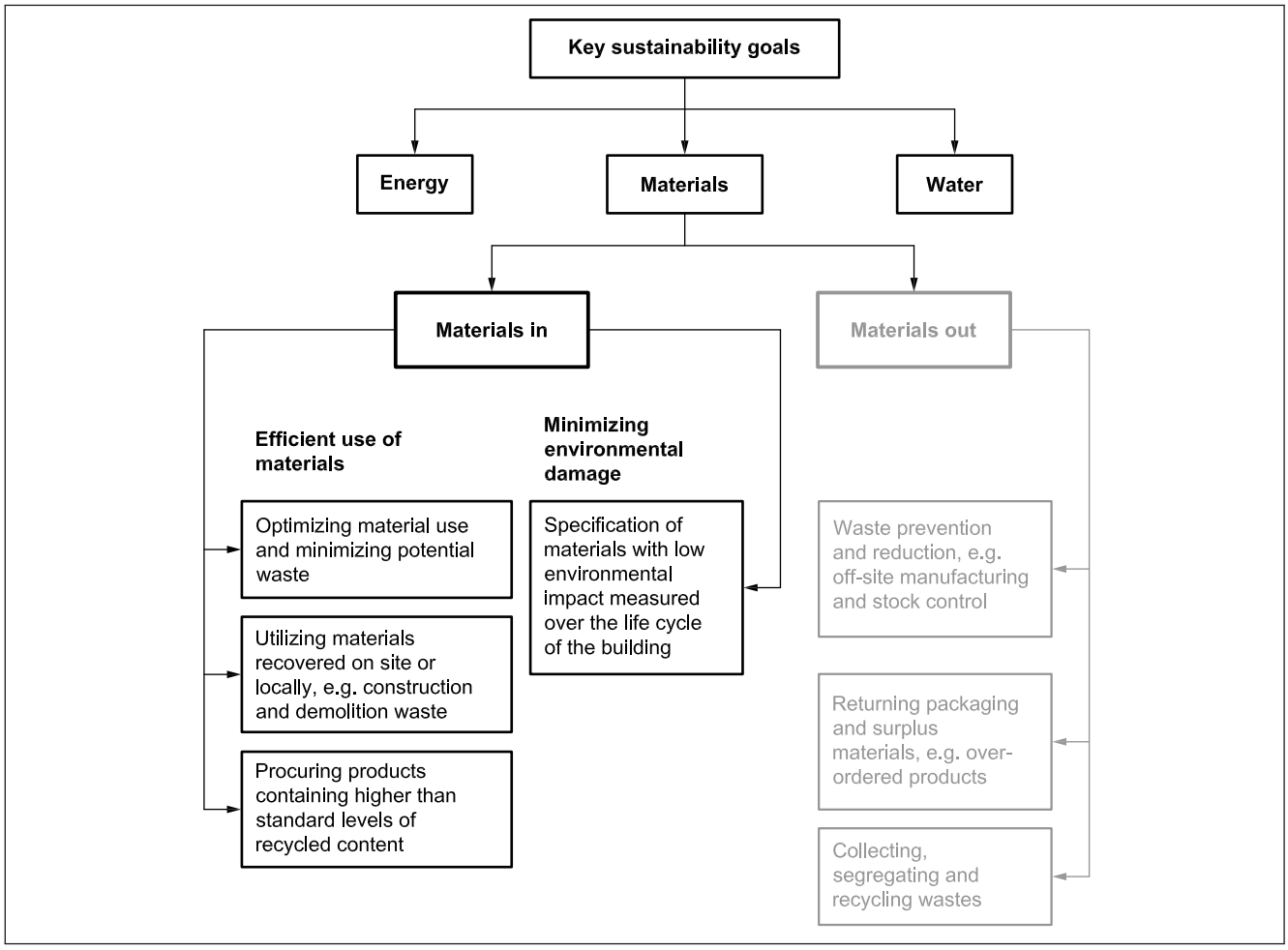
Compliance with a British Standard cannot confer immunity from legal obligations.

0 Introduction and the case for material efficiency

0.1 Material efficiency

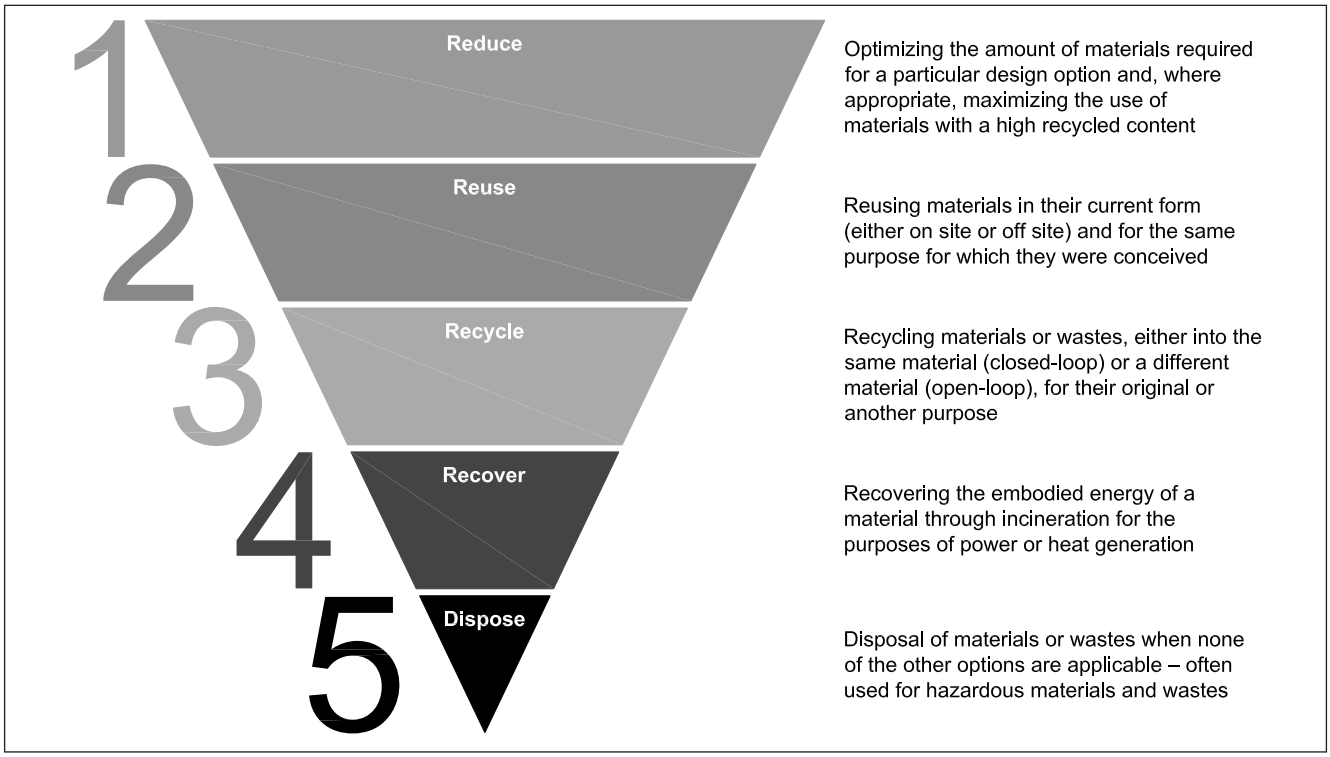
Material efficiency is one of the three key resource efficiency goals of any good practice sustainability strategy, and involves various components intended to ensure the efficient use of materials, waste prevention and reduction, and minimal damage to the environment and depletion of natural resources. Figure 1 sets out the key aspects of material efficiency and, more specifically, how this is broken down in terms of "materials in" during the design process and "materials out" in terms of project delivery. The focus of this code of practice is on the "materials in" aspects, though the design can have a significant influence on the ability to implement "materials out" aspects.

Figure 1 **Material efficiency components relating to material selection during design (materials in) and waste management on site (materials out)**



Material efficiency on a building project involves the implementation of the waste hierarchy (see Figure 2) to reduce the use and waste of materials wherever possible, reuse materials and increase the use of materials with a higher level of recycled content, and recover and recycle any waste that arises, with disposal being the last resort once all other options have been exhausted.

Figure 2 **Material efficiency and the waste hierarchy**



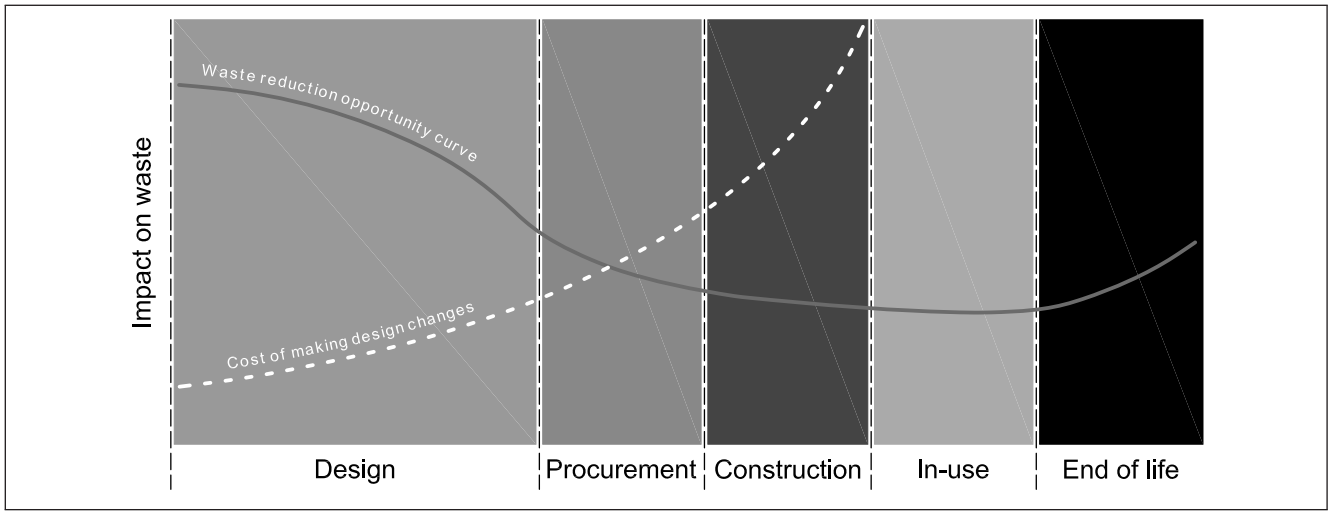
0.2 Implementing material efficiency through design

Opportunities and solutions for material efficiency arise during planning, design, procurement, construction, refurbishment and use, and at end of life. However, the most effective way to implement material efficiency is to comprehensively consider materials and waste during the design and planning stages of a project. This is when maximum impact can be made.

NOTE Figure 3 outlines the opportunity curve for integrating material efficiency and waste reduction against each stage of a project. The majority of opportunities to reduce waste and increase material efficiency exist up-front during the design and planning stages, when the design can be altered to take into account solutions that reduce waste and optimize materials. As the design develops through the preparation and design stages, decisions are taken and the design becomes more fixed, making it more difficult to implement opportunities for waste reduction.

Opportunities also exist when the design is already formulated and construction is under way, particularly under a design and build contract where the contractor has the opportunity to put forward alternative design, procurement and construction methods that can accrue significant reduction in waste during the construction period. However, with other procurement routes the emphasis is more on waste management and recovery rather than reduction.

Figure 3 **Indicative opportunity curve for material efficiency and waste reduction against each stage of a project**



0.3 The case for designing for material efficiency

As illustrated by Figure 3, there is a clear business case for designing for material efficiency at the earliest point possible on a project, but there are further drivers, including:

a) cost savings from greater material efficiency and avoidance of increased waste disposal and landfill costs;

b) reduced resource extraction, processing and consequential carbon dioxide (or equivalent) emissions from transport and manufacture of materials, as well as reduced depletion of landfill capacity (environmental drivers);

c) commitment to sustainable construction and good environmental management (corporate responsibility drivers);

d) meeting requirements for improved performance and achievement of targets, and correlation with parallel environmental rating systems, particularly in relation to the adoption of good waste minimization and management practices (project-specific drivers);

e) increased competitive differentiation that improves project efficiency through a reduction in construction costs and programme, particularly where waste reduction opportunities can help to meet the prospective client's sustainability objectives.

NOTE Planning for waste reduction requires a number of disciplines to contribute and to monitor performance throughout each stage.

0.4 The objectives and intended audience of this standard

BS 8895-1 is an industry code of practice for designing for material efficiency, giving recommendations for the processes and project responsibilities for designers to incorporate into projects. Creating a standardized and qualified approach for designing for material efficiency allows for clients and design teams to integrate the principles of designing out waste (see **4.5**), and communicate these in a formalized and easily referenced manner.

BS 8895-1 is specifically intended for design teams, in assisting the client to integrate the process of designing for material efficiency during the pre-design stages, to set out the strategic direction for material efficiency in a building or refurbishment project. It is also applicable to the broader project team members who can influence material selection and, as a consequence, waste produced throughout a project. As such, the standard emphasizes the need at RIBA Plan of Work [N1] Stage 0, Strategic Definition, and Stage 1, Preparation and Brief, to consider material efficiency throughout all subsequent project stages.

BS 8895-1 is intended to be used when the client, in discussion with any consultants, first appraises and documents their project needs, aims, resources and parameters to produce the initial project brief to be referenced by the client and design team throughout project design development.

It is of particular relevance for the lead designer who, as the driver of the design process, instigates the appraisal of the impact of the building or refurbishment project in terms of construction, demolition and excavation (CD&E) waste, and suggests to the client tailored options to reduce, reuse, recycle and recover energy from waste.

The lead designer requires input from the wider design team, so the standard is intended for all those taking part in the preparation of the initial project brief, for example, clients, consultants, building occupiers, and any others who are authoritative, informed or likely to be affected.

The client, however, as initiator and purchaser of the works, retains the ownership of the project and its general management, including the choice of designer, the preparation of the initial project brief and the evaluation of any response to it.

1 Scope

This part of BS 8895 gives recommendations for the process by which design and project teams seek to maximize material efficiency through design. It outlines what material efficiency in design involves and how the process of designing for material efficiency is implemented through the Strategic Definition and Preparation and Brief stages of a project.

NOTE 1 This includes optimizing material use, increasing materials with a higher level of recycled content, designing out waste, and planning for waste reduction and recycling.

NOTE 2 For an explanation of the need for designing for material efficiency, see the Introduction.

NOTE 3 Annex A demonstrates how other parts of BS 8895 will cover material efficiency at other stages of a project.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 7832, *Performance standards in building – Checklist for briefing – Contents of brief for building design*

[N1]RIBA Plan of Work 2013 (http://www.ribaplanofwork.com/)

[N2]WRAP, *Designing out Waste: A design team guide for buildings*

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1 design team
individuals involved in the decision-making process affecting material efficiency and the reduction of waste

NOTE The design team can include architects; civil and structural engineers; building surveyors; landscape architects; consultants; and manufacturers, who contribute to, or have overall responsibility for, any part of the design, or who specify or alter a design, or who specify the use of a particular method of work or material, such as a design manager or a quantity surveyor who insists on a specific material, or a client who stipulates a particular layout for a particular building project.

3.1.1 client
person who, in the course of business:

- seeks or accepts the services of another in carrying out a project on behalf of that person; or
- carries out a project on their own behalf

3.1.2 client advisor
person who works on behalf of the client to carry out a project

3.1.3 cost consultant
role within the design team that estimates the cost of the materials and labour necessary to complete a project

3.1.4 engineer
role within the design team that researches, analyses and plans various building components to achieve the required design goals

NOTE The term "engineer" encompasses the broad spectrum of engineering disciplines within a design team, e.g. civil engineers, mechanical and electrical engineers and structural engineers.

3.1.5 lead designer
role within the design team responsible for supervising all design elements related to the project and for leading the transformation of the client's specification into a design

3.1.6 principal contractor
main or managing contractor, whose key responsibility is to properly plan, manage and coordinate work during the construction phase of project delivery

3.2 construction, demolition and excavation waste (CD&E)
material produced directly or incidentally by the refurbishment, construction, demolition and excavation works of a building

NOTE This can include a variety of waste, both hazardous and non-hazardous. This also includes strip-out waste.

3.3 designing out waste
proactively targeting options to reduce waste through the design process

3.4 material efficiency
process of undertaking a building project to enable the most efficient use of materials over the lifecycle of the building and its components

NOTE This includes using fewer materials, reusing existing demolition/strip-out materials and, where appropriate, procuring materials with higher levels of recycled content. It also includes following the waste hierarchy to avoid and reduce waste wherever possible.

3.5 Preparation and Brief
development of project objectives and initial project brief and any related feasibility studies

NOTE This involves the identification of sustainability aspirations, procurement strategy, procedures, organizational structure and range of consultants and others to be engaged for the project.

3.6 recycled content
material incorporated within a construction product, or a construction material itself, that meets at least one of the following criteria:

a) is listed in the List of Wastes Regulations [1, 2, 3];

b) is classified, or intended to be classified, as "waste" within the definition of BS EN ISO 14021 (including post-construction waste and returns from the distribution chain);

c) is an offcut or scrap generated within a process where a recovery operation process is required prior to its reuse that changes the physical or chemical nature of the material (e.g. granulation of extruded plastic or crushing of waste blocks);

d) is a production residue (by-product) that is not a waste and meets the following criteria:

   1) the further use of the residue is not a mere possibility, but a certainty;

   2) the residue does not need any further processing prior to reuse; and

   3) the residue is produced for further use as an integral part of a continuing process of production.

NOTE Further information is given in the WRAP publication Calculating and declaring recycled content in construction products: "Rules of Thumb" guide [4].

3.7 site waste management plan (SWMP)
all-encompassing and evolving document for recording, monitoring and managing materials and waste associated with all aspects of the project, from the project Strategic Definition stage to the Handover and Close Out stage

NOTE Even where a site waste management plan is not required by law, it still represents a good practice approach.

3.8 Strategic Definition
identification of initial project objectives, business case, strategic brief and other primary project requirements

NOTE This may involve a review of alternative sites or options to enable the client to define the scope of a project before the briefing process can begin.

4 Design for material efficiency process

4.1 Identify, Investigate and Implement

4.1.1 Designing for material efficiency should be an iterative process that is repeated throughout the project stages, starting as early as possible to ensure that:

a) design opportunities are not missed;

b) design decisions can be informed by quantified information; and

c) the design solutions are embedded in the project.

NOTE Each iteration of the material efficiency process at each design stage is likely to generate additional information.

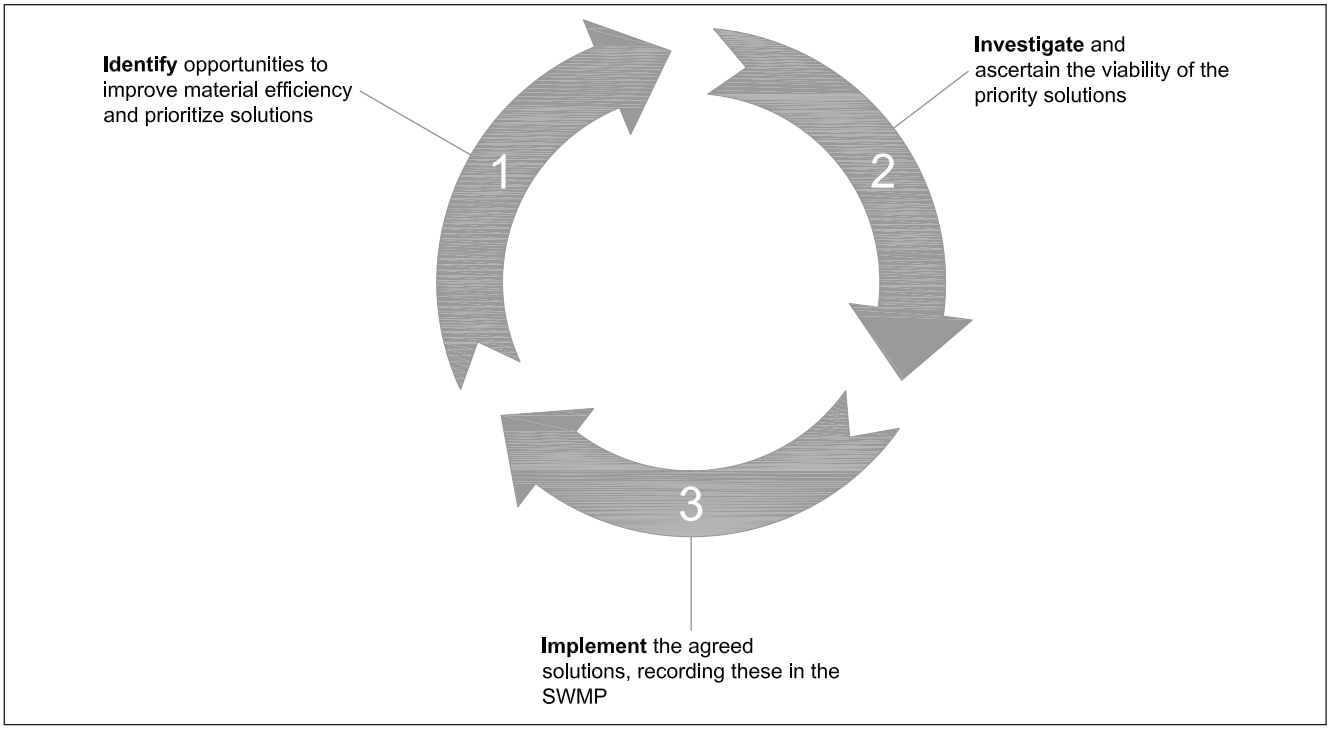
4.1.2 Designing for material efficiency should involve a simple, continuous process to Identify, Investigate and Implement opportunities to reduce waste and, where appropriate, increase the level of recycled content (see Figure 4).
However, the emphasis on Identify, Investigate or Implement should be greater at certain design stages as this aligns to the design activity at that time.

a) During the early stages of Strategic Definition, Preparation and Brief, and Concept and Developed Design, the emphasis should be on **IDENTIFY**.

b) During Developed Design, the emphasis should be on **INVESTIGATE**.

c) During Technical Design, the emphasis should be on **IMPLEMENT**.

Figure 4 **Design for material efficiency process**



4.2 Identify

4.2.1 The design and delivery plan should be reviewed to identify potential waste streams and opportunities to reduce materials use and/or waste creation.

4.2.2 Opportunities should be identified to improve materials efficiency by:

a) reducing the quantity of materials used, where this does not adversely impact on other aspects of resource efficiency, such as improving energy efficiency;

b) reducing the quantity of materials wasted during the construction process by designing out waste (see **4.5**) and planning for effective project waste management wherever possible;

c) designing for effective project waste management, which includes reducing, reusing, recycling and recovering waste material as appropriate; and

d) using more recycled materials and mainstream products containing higher levels of recycled material (recycled content; see WRAP's *Delivering higher recycled content in construction projects* [5] and *Calculating and declaring recycled content in construction products: "Rules of thumb" guide* [4]), including material not necessarily sourced from construction and demolition waste, for example, mineral extraction or post consumer waste.

4.2.3 An effective way of identifying possible design solutions is to hold a design for material efficiency workshop. The design solutions most likely to have the largest impact on material efficiency or that are most feasible for implementation should then be prioritized.
NOTE Workshops are a useful way to identify opportunities. See WRAP's Design Review Workshop – Facilitator's pack [6].

4.2.4 Key actions the client or client advisor should take include:

a) determining and reviewing the key project drivers in the context of organizational commitments and any specific project parameters;

b) assessing what is possible in terms of potential targets or performance indicators for the type of project against industry benchmarks, including BRE SMARTWaste [7] and WRAP Construction Waste Benchmarks [8]; and

c) periodically (e.g. annually or at key project stages) reviewing the design team's performance on achieving materials efficiency against the performance indicators and targets set.

4.3 Investigate

4.3.1 The viability of the priority solutions identified should be investigated and ascertained. The waste, cost and programme impacts should also be quantified where possible. This should involve assessing the potential size and scale of the development and the likely impact of each option on waste streams, quantities and reduction recovery opportunities, to provide an outline of the pre-design project SWMP and indicative material arising/waste streams as a high-level investigation for potential waste reduction or recovery opportunities.

4.3.2 Key actions the client advisor or design team should take include:

a) using, where appropriate, the five designing out waste principles (see **4.5**) as prompts in an initial workshop or meeting with the client;

b) strategically reviewing potential sites, including reuse of existing facilities, building components or materials, and requesting a pre-demolition/strip-out audit if appropriate at the time;

c) assessing any likely impacts of design for reuse and off-site construction;

d) identifying all materials, components or elements that could be reused, recovered or recycled on site, providing solutions for their use on the project and reporting findings.

4.4 Implement

4.4.1 The first step towards material efficiency should be to implement, during the planning and design stages of a project, solutions that reduce and prevent waste, and, where appropriate, increase the use of materials with a high recycled content.

4.4.2 The design solutions should be embedded in drawings, specifications, project reports and the procurement process where possible. The project brief should outline the client's requirements, including suggested approaches or indicators for measurement, appraisals and testing methods for material efficiency, and proposed site options.

4.4.3 The agreed solutions and site waste management decisions and actions should be recorded in the project SWMP, and regularly updated during design development and construction, and at project completion. Once effective waste reduction measures are in place, consideration should be given as to how to reuse, recycle, recover or finally dispose of waste. These management activities should also be recorded in the project SWMP.

4.4.4 Key actions the client advisor or design team should take include:

a) reviewing any proposed waste forecasts based on pre-demolition/strip-out audits, site assessments and any further testing that has been carried out;

b) reviewing material efficiency options based on the five designing out waste principles (see **4.5**);

c) focusing on specific options relating to project fundamentals, i.e. reuse/refurbishment versus newbuild, site options, pre-demolition/strip-out waste construction methods, site layout, etc.;

d) including appraisal information in the project brief and pre-design project SWMP.

4.5 Prompts for material efficiency

The designing for material efficiency process of Identify, Investigate and Implement at each design phase should be implemented through design team meetings or specific material efficiency workshops. To assist the exploration of design for material efficiency opportunities, WRAP's five principles of designing out waste should be applied during design development, and serve as prompts for investigating opportunities for material efficiency in design.

NOTE These principles do not dictate how to design buildings and are not exclusive of what can be considered throughout a project. Design solutions vary from project to project, but the basic principles of designing for material efficiency remain the same.

a) *Design for reuse and recovery*. The reuse of buildings and building elements, specification of reclaimed and recovered materials, both on and off site, and procurement of products with a high level of recycled content reduce waste and reduce demand for primary materials.

b) *Design for off-site construction*. The manufacture of building elements and components off site results in site activity becoming a process of assembly rather than construction. The result is a reduction in damage, rework and associated waste due to a reduction in the amount of trades, activities and material storage on site. Transport movements can also be reduced and a quicker project programme implemented.

c) *Design for materials optimization*. The use of lean design principles that consider the impact of material choice against building layout, form and function to maximize material efficiency. This principle draws on a number of "good practice" design initiatives, such as simplification, standardization and repetition of elements of the design to minimize the number of variables and bespoke elements without compromising design concept.

d) *Design for waste efficient procurement*. The ability of specifications and procurement to influence activity and reduce waste on site. The contractor should be involved early to obtain their expert insight into waste generation and reduction opportunities.

e) *Design for deconstruction and flexibility*. The consideration of material efficiency for the duration and end of life of a building project; flexible, adaptable spaces that enable a resource-efficient, low-waste future change of use; durability of materials and how they can be recovered effectively when maintenance and refurbishment are undertaken and during disassembly/deconstruction.

4.6 Roles and responsibilities in the design for materials efficiency process

4.6.1 General

The design team should drive material efficiency in the design process, e.g. the design team can influence both material selection and the reduction of waste on site through choices made early in a project.

4.6.2 Client

The client should give reasonable direction to the design and project team(s) of the objectives and requirements for material efficiency. The client should perform a leadership and monitoring role throughout the project and provide key inputs during the Strategic Definition and Preparation and Brief stages. The client should be accountable for compliance with legislation and planning requirements, but may delegate the responsibility (not the accountability) for these actions to the project team.

4.6.3 Lead designer

The lead designer should advise and consult the client during project set-up. The lead designer should also lead and structure the approach to designing for material efficiency during design development, including project-specific roles and responsibilities, communication routes and the facilitation of material efficiency workshops, if appropriate. The lead designer should be involved in or informed of any decision-making process that impacts waste. The lead designer should be responsible for the project SWMP until the beginning of construction. If the lead designer cannot fulfil this role then an adequate alternative should be appointed from the project team to perform the role.

4.6.4 Project manager

The project manager should clarify the responsibilities of the lead designer and should formulate a design management plan as a basis for managing and controlling the design process. The project manager should work with the lead designer and design team to ensure that material efficiency is integrated into the project planning and design development procedures. The project programme should include key design milestones relating to material efficiency, such as designing out waste workshops, updates of the project SWMP and design stage reports.

4.6.5 Engineer(s)

The engineer(s), whether structural, civil or mechanical/electrical, should help Identify, Investigate and Implement options for material efficiency in the design.

4.6.6 Cost consultant

The cost consultant should work closely with the design team to investigate the feasibility of design options, using forecasting tools to quantify waste and recycled content on a project. They should help to investigate the feasibility and impact of designing for materials efficiency. The cost consultant should work with the project manager and client during the tendering process.

NOTE Forecasting tools are a useful way to identify likely quantities of waste arising during design. See, for example, WRAP's Net Waste Tool [9].

4.6.7 Demolition/Strip-out contractor

In the case of full or partial demolition, the demolition contractor should provide early input to the design process through a pre-demolition/strip-out audit during the Preparation and Brief stage.

NOTE Designing for material efficiency opportunities relating to material reuse and recovery relies on this input.

4.6.8 Principal contractor

Early input from the principal contractor, when available, is invaluable in identifying robust waste forecasts and informing the design development of what is achievable on site. The project SWMP should be handed over to the contractor during project tendering. The plan should subsequently be updated with waste reduction and management activities related to site activity.

5 Strategic Definition

5.1 Application of the design for material efficiency process

The design for material efficiency process of Identify, Investigate and Implement should be applied during the Strategic Definition stage, in accordance with Figure 5. However, the emphasis at this point should be to Identify client aspirations and objectives with respect to material efficiency. Client objectives and the strategic brief should be developed, based on initial design and site information.

*NOTE The process chart in Figure 5 outlines each of the material efficiency process steps (see Clause **4**) during the Strategic Definition stage. It sets out "actions" for delivering each step, the persons responsible and the guidance and tools that are available. Specific outputs are described and a series of key questions are provided as prompts before proceeding to the next material efficiency process stage.*

5.2 Material efficiency objectives

During the Strategic Definition stage, the client should make early decisions about the project that will influence the parameters of design and delivery. Material efficiency should be integrated into the strategic project decisions taken at this stage to ensure the material efficiency principles and process are embedded in the project and that specific requirements and targets can be developed and implemented by the project team.

The material efficiency objective of this stage should therefore be to appraise, evaluate and confirm (i.e. scope) material efficiency objectives and requirements for the design and construction of the project for inclusion in the strategic brief. A review of alternative sites or options (e.g. extension, refurishment or newbuild) and potential waste streams, quantities and opportunities to reduce and recover waste should be included in the project strategic brief.

5.3 Roles and responsibilities

The roles and responsibilities of the design team members at this stage should be as follows.

a) **Lead responsibility: Client**

1) Determine the material efficiency drivers and ensure these are appraised in terms of relevance to the project design.

2) Communicate roles and responsibilities to the design team, ensuring these are included in design team procurement.

3) Ensure the strategic brief incorporates material efficiency.

b) **Lead input: Client advisors/consultants**

1) Ensure the client understands the principles, process and benefits of designing for material efficiency in the context of the specific project.

2) Appraise the proposed project scenarios in terms of material efficiency.

3) Provide an initial, high-level waste forecast, e.g. by benchmarking with a comparable project, for the proposed scheme options and outline initial waste reduction and recovery options.

4) Gain input from design team, if available.

c) **Contributors: Design team (if appointed or consulted at this stage)**

1) Provide input and experience to material efficiency appraisal of project scenarios.

*COMMENTARY ON **5***

Table 1 outlines the Strategic Definition process and the key tasks relevant to material efficiency against those responsible for delivery, the specific materials efficiency process and the resulting outputs specific to materials efficiency at each stage. Supporting guidance and tools are also referenced.

Figure 5A Material efficiency process steps during the Strategic Definition stage: Identification

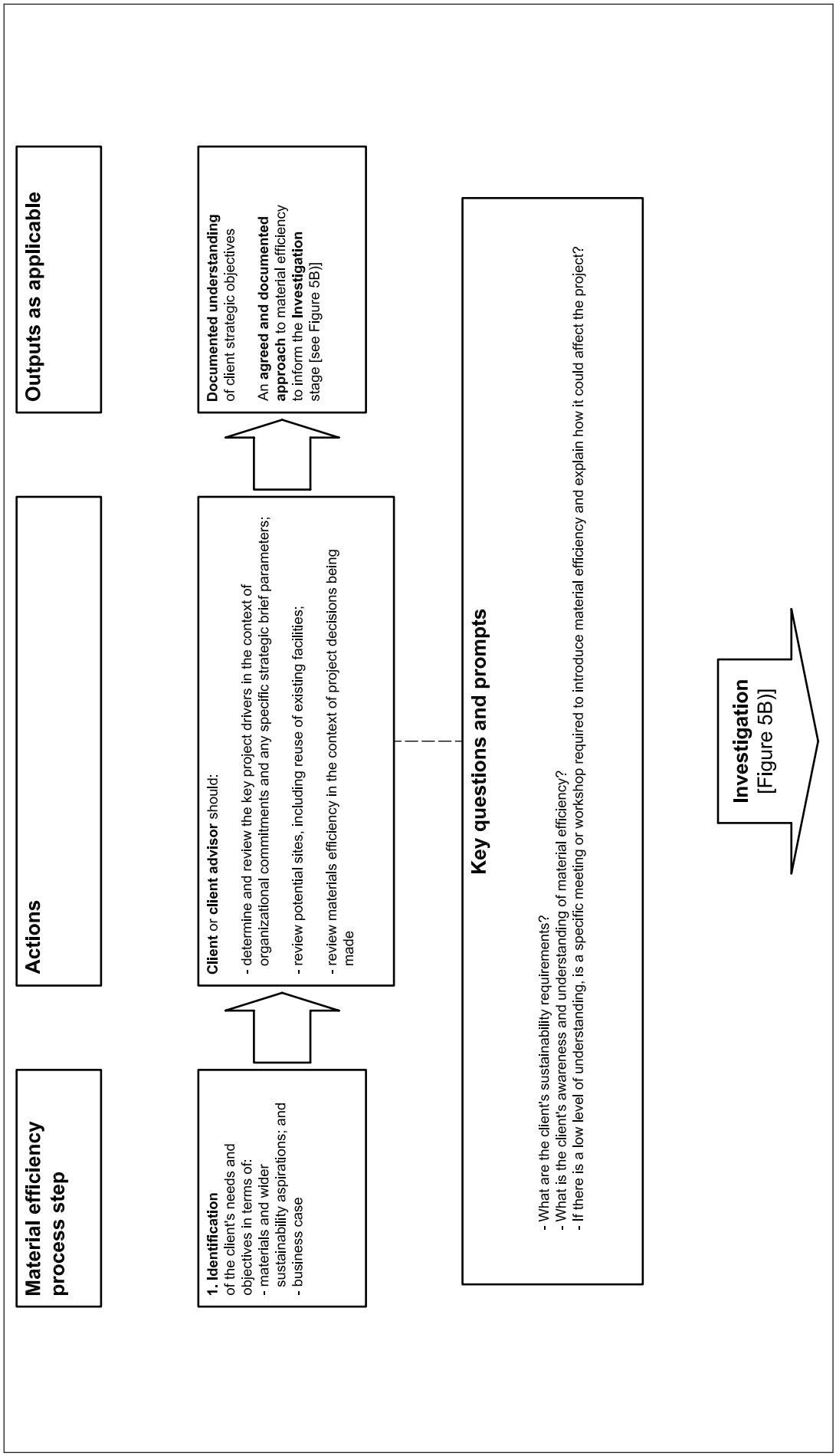


Figure 5B Material efficiency process steps during the Strategic Definition stage: Investigation

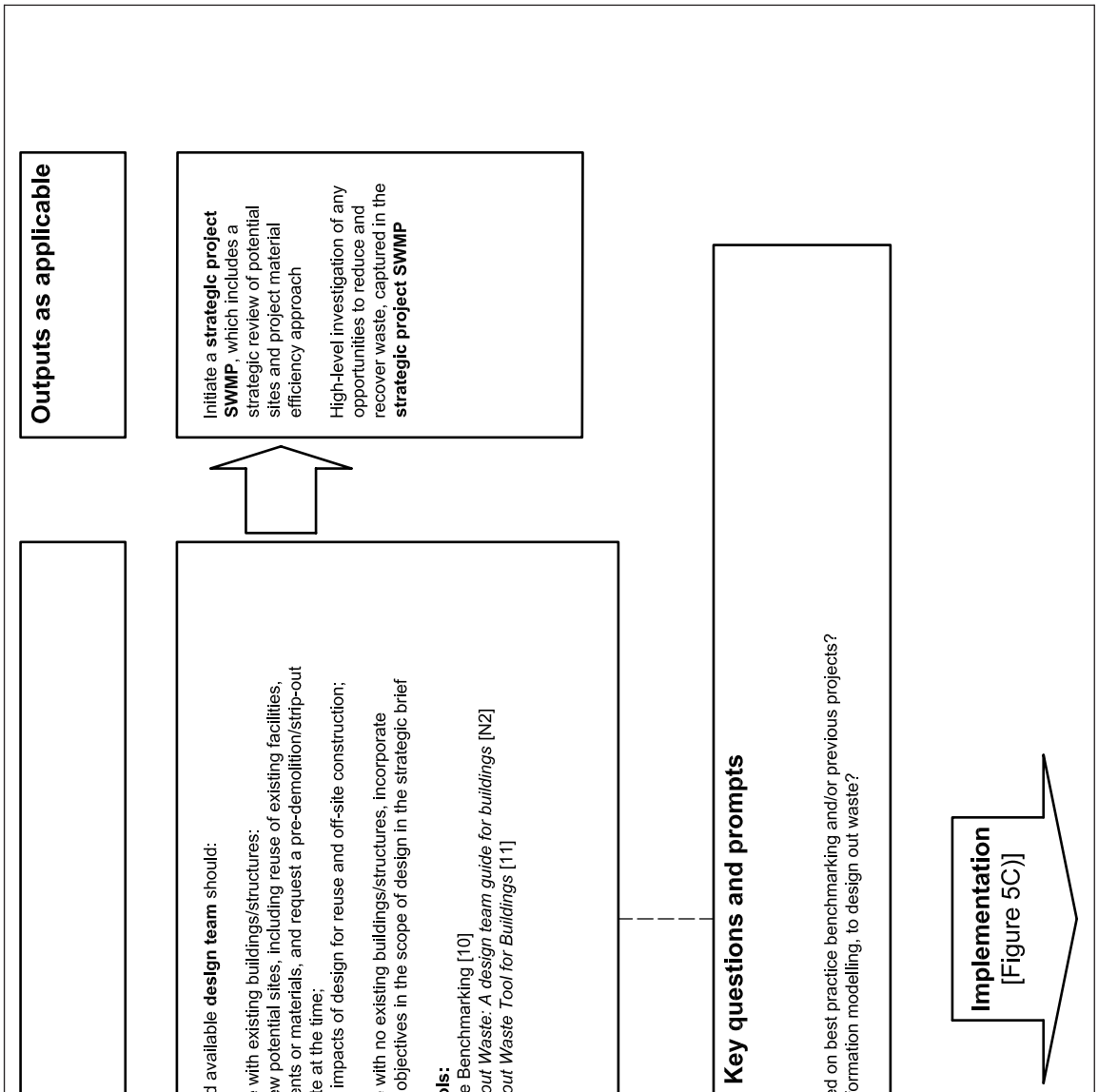


Figure 5C Material efficiency process steps during the Strategic Definition stage: Implementation

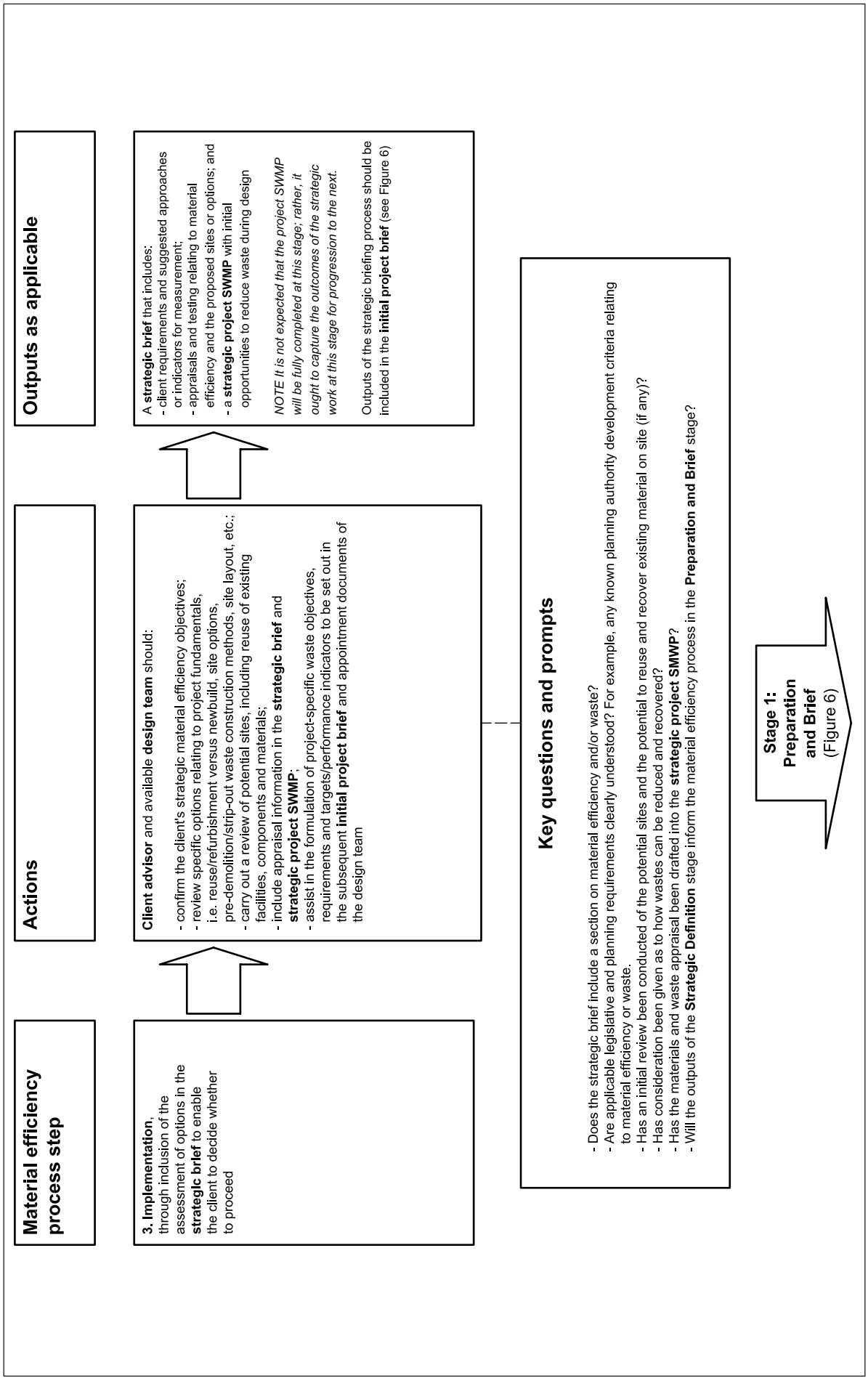


Table 1 **Strategic Definition: Key tasks, responsibilities and resulting outputs relating to material efficiency**

Key task	Team member responsibility	Material efficiency process	Output as applicable	Example tools and guidance
Identification of the client's business case and strategic objectives in terms of waste, materials and wider project sustainability. Strategic assessment of high-level options (such as alternative sites; reuse of existing facilities, building components and materials; size and scale of development), and the likely impact of each option on materials efficiency and waste reduction/recovery opportunities.	**Lead responsibility**: Client **Lead contributor:** Client advisor/consultant **Further input:** Design team (when appointed): - lead designer; - engineers; and - cost consultant	**Identification** of the client's business case and strategic objectives in terms of waste, materials and wider project sustainability. **Investigation** and strategic assessment of high-level options (such as alternative sites; reuse of existing facilities, building components and materials; size and scale of development), and the likely impact of each option on materials efficiency and waste reduction/recovery opportunities. **Implementation** through strategic project-specific waste objectives, requirements and targets to be set out in the strategic brief.	**Strategic brief**, which includes: - common understanding of client requirements and agreed approach to material efficiency; - initial indication of types of materials and waste streams on a project (if applicable); - high-level investigation into opportunities to reduce and recover waste against the five principles of designing out waste; - site analysis (including pre-demolition/strip-out audit, results from any testing or analysis undertaken); and - the introduction of a **project SWMP** with strategic decisions to reduce waste during design.	**WRAP *Designing out Waste Tool for Buildings*** **[11]** provides an initial, approximate waste forecast, and waste reduction opportunities based on proposed building type. **WRAP *Designing out Waste: A design team guide for buildings*** **[N2]:** - explains the five principles of designing out waste and provides a prompt checklist; - outlines the designing out waste workshop format to brainstorm and prioritize ideas, including those relating to site appraisal.

6 Preparation and Brief

6.1 Application of the design for material efficiency process

The design for material efficiency process of Identify, Investigate and Implement should be applied at the Preparation and Brief stage, in accordance with Figure 6. However, the emphasis at this stage should be on Identifying clear performance indicators for material efficiency. The client's requirements and objectives should be incorporated into the initial project brief.

*NOTE The process chart in Figure 6 outlines each of the material efficiency process steps (see Clause **4**) during the Preparation and Brief stage. It sets out "actions" for delivering each step, the persons responsible and the guidance and tools that are available. Specific outputs are described and a series of key questions are provided as prompts before proceeding to the next material efficiency process stage.*

6.2 Material efficiency objectives

During the Preparation and Brief stage, the client and design team should develop the project objectives and sustainability aspirations, the potential procurement method and organizational structure; undertake feasibility studies; and review site information. The final output should be an initial project brief that serves as an essential point of reference for both the client and design team, and permits important design issues to be considered and questioned before the designer starts work.

The material efficiency objective at this stage should therefore be to ensure the initial project brief clearly articulates the client's aspirations, objectives and targets for materials and waste on the project. The initial project brief should outline what is required of the design team to integrate the material efficiency process, roles and responsibilities and specific requirements and targets that have been identified during the Strategic Definition stage.

6.3 Roles and responsibilities

The roles and responsibilities of the design team members at this stage should be as follows.

a) **Lead responsibility: Client**

   1) Ensure an initial project brief is developed that clearly articulates project material efficiency objectives and requirements.

   2) Receive and incorporate as necessary feedback from the design team.

   3) Use the initial project brief as a reference point for material efficiency during design development and procurement.

b) **Lead input: Client advisors/consultants**

   1) Advise and help the client to develop an initial project brief that includes clear project material efficiency objectives and requirements.

   2) Outline the material efficiency process, roles and responsibilities of the design team and how this will be monitored.

   3) Set out clear objectives, targets and key performance indicators (KPIs) specific to the project that are informed by any feasibility or appraisal studies.

   4) Include any design and site investigations considered to reduce waste and increase the level of recycled content, e.g. site investigations and reuse of existing building components.

   5) Help to revise and develop the initial project brief as feedback is received from design team.

c) **Contributors: Design team**

1) Interpret, investigate and scrutinize the initial project brief in the context of their experience and technical role.

2) Use the initial project brief as a reference point for material efficiency during design development.

6.4 Initial project brief related to material efficiency

The initial project brief should incorporate the client's aspirations in terms of material efficiency and specific project level requirements, including design and construction objectives, targets and KPIs.

NOTE Annex B provides an example of the type of wording that can be included within the initial project brief in relation to material efficiency.

*COMMENTARY ON **6***

Table 2 outlines the Preparation and Brief process and the key tasks relevant to material efficiency against those responsible for delivery, the specific materials efficiency process and the resulting outputs specific to materials efficiency at each stage. Supporting guidance and tools are also referenced.

Figure 6A Material efficiency process steps during the Preparation and Brief stage: Identification

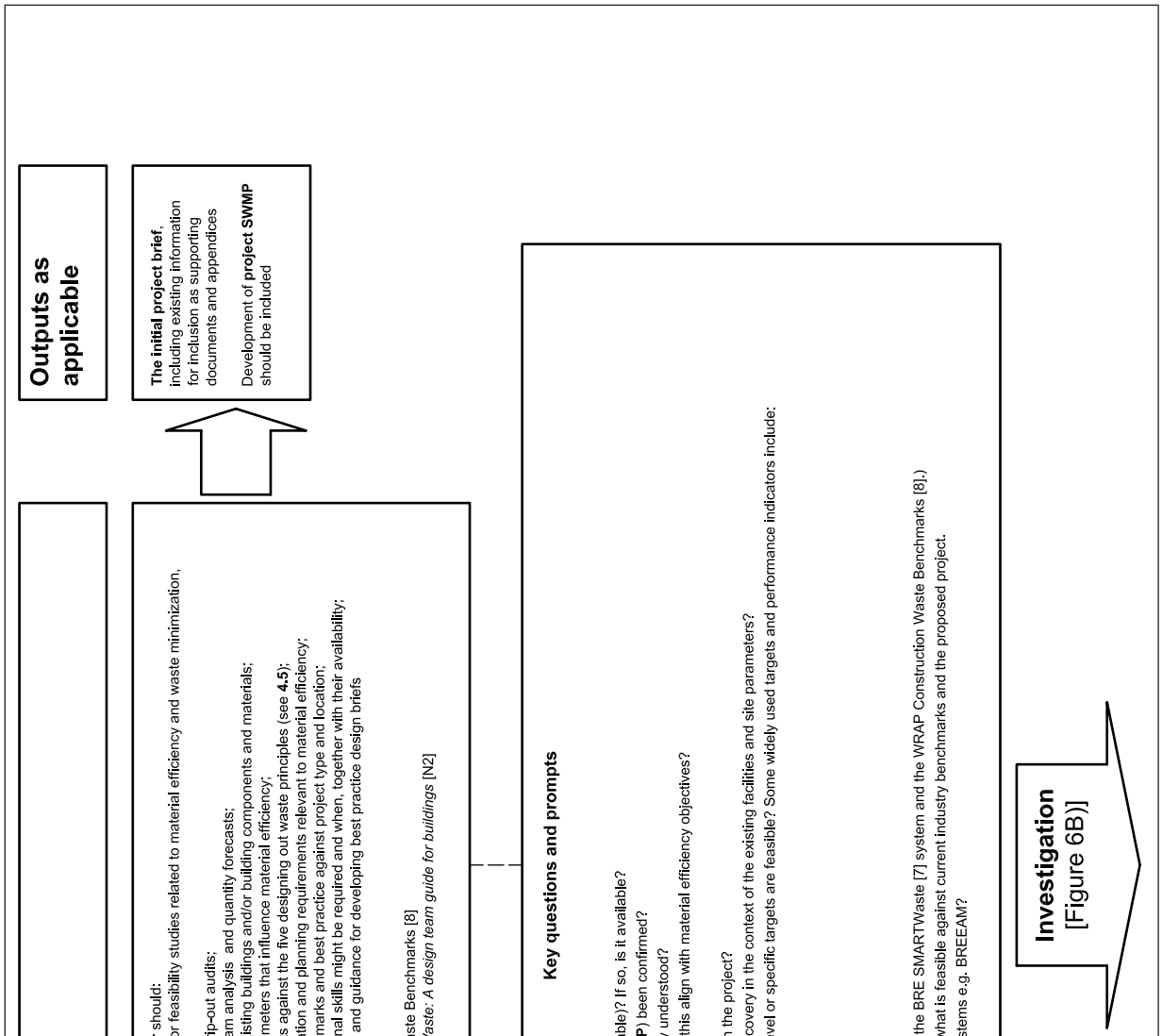


Figure 6B Material efficiency process steps during the Preparation and Brief stage: Investigation

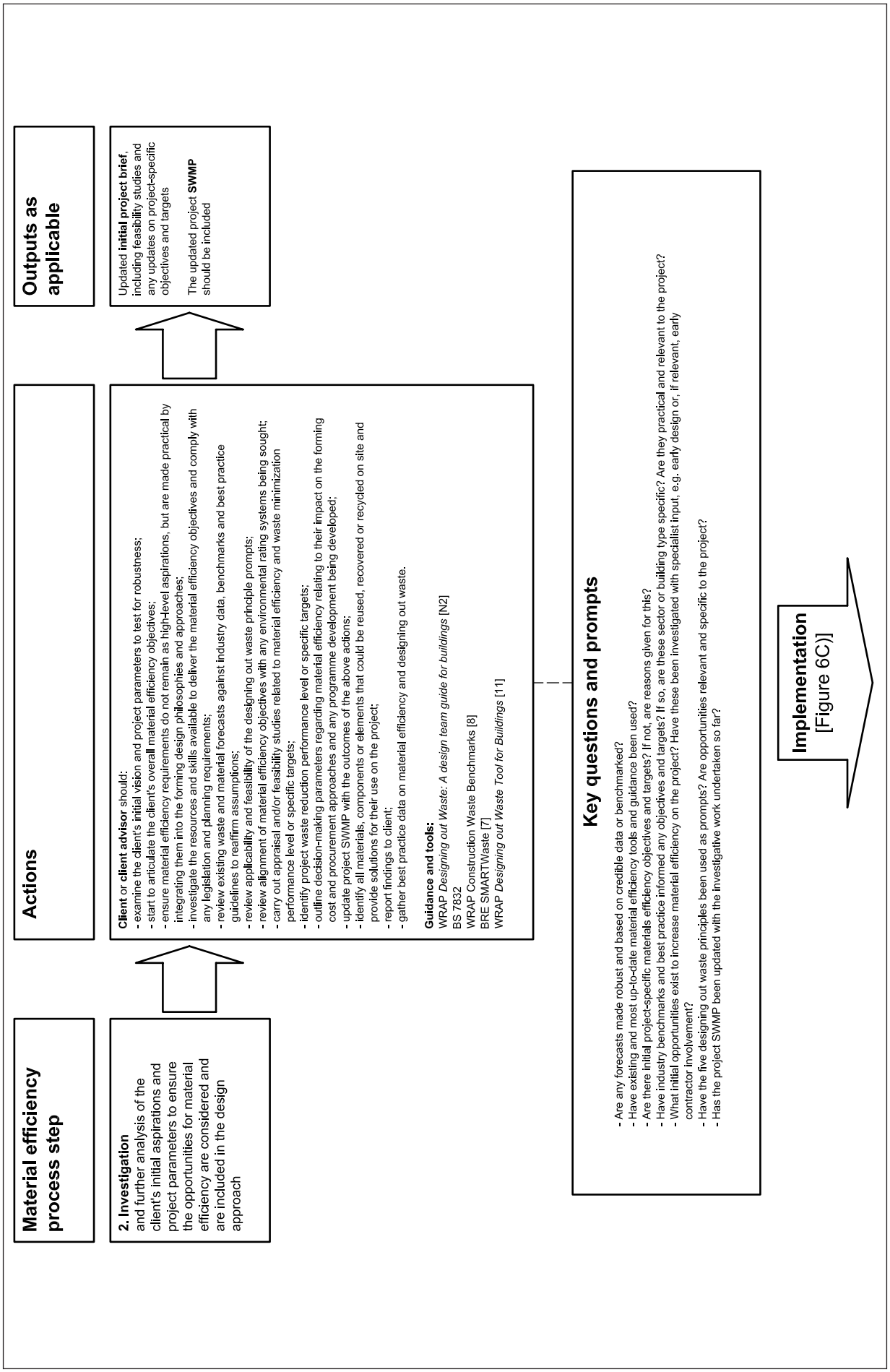


Figure 6C Material efficiency process steps during the Preparation and Brief stage: Implementation

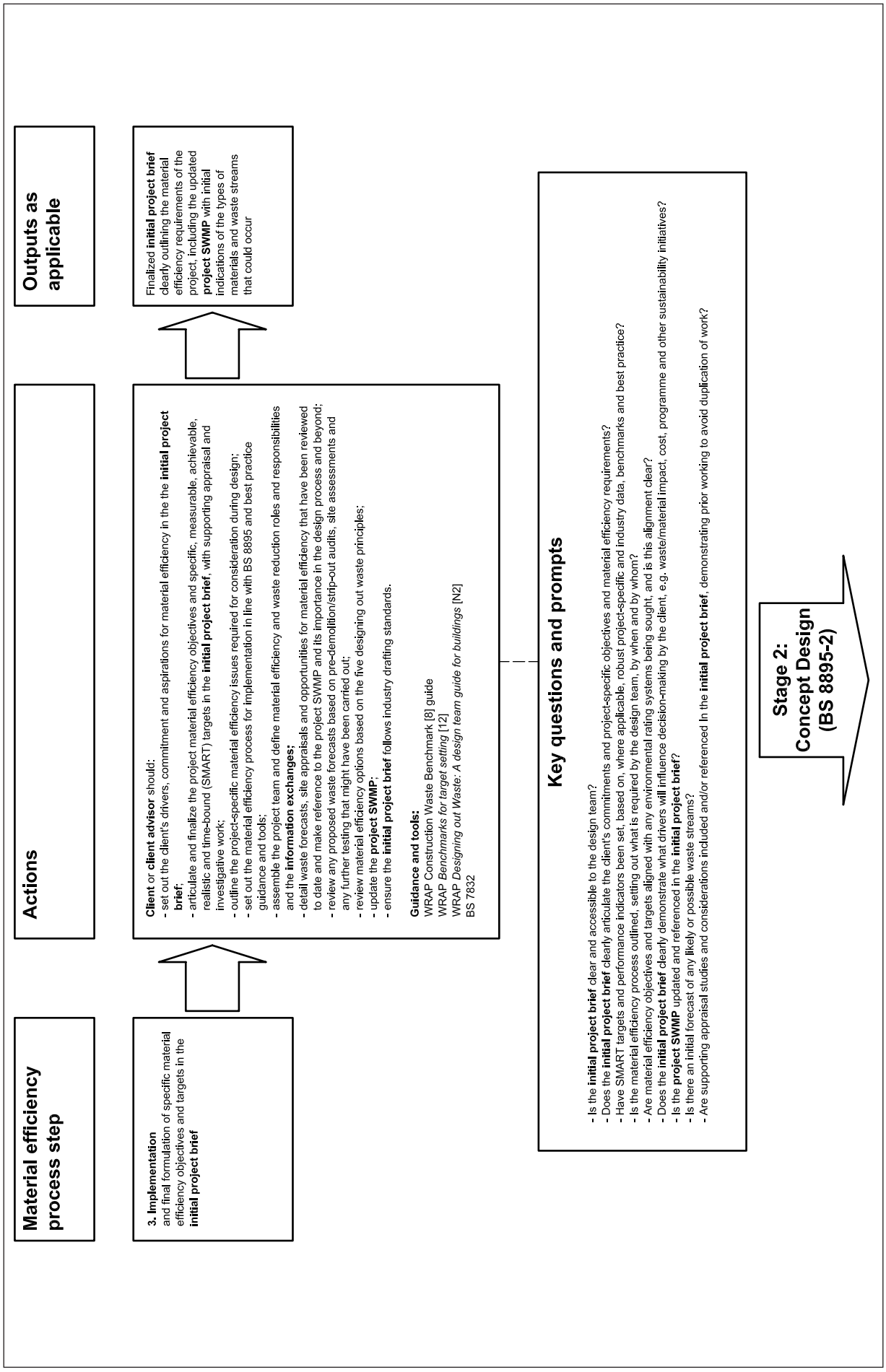


Table 2 **Preparation and Brief: Key tasks, responsibilities and resulting outputs relating to material efficiency**

Key task	Team member responsibility	Material efficiency process	Output as applicable	Example tools and guidance
Development of the initial statement of requirements into the initial project brief by or on behalf of the client, confirming key material efficiency requirements. Preparation of project roles table and contractual tree related to material efficiency.	**Lead responsibility:** Client **Lead contributor:** Client advisor/ consultant **Further input:** Design team (when appointed): - lead designer; - engineers; and - cost consultant	**Identification** and commissioning of suitable feasibility studies to test the project-specific material efficiency requirements of the draft initial project brief and inform its development. Review of relevant legislation and planning requirements for waste. **Investigation** and further analysis of client's initial vision and project parameters to ensure fundamental opportunities for material efficiency are considered and integrated or excluded as appropriate. **Implementation** and formulation of specific waste requirements, targets and considerations in the initial project brief and SWMP. Outline of roles and responsibilities relevant to material efficiency to be carried out throughout the project.	**Initial project brief**, which includes: - a statement of the material efficiency requirements and objectives for the project; - project parameters that integrate material efficiency sufficiently; - waste streams and reduction/recovery options considered to that point; - specific targets/performance metrics; - specific roles and responsibilities relating to material in accordance with 2013 RIBA Plan of Work [N1] **Design Responsibility Matrix**. **Project SWMP**, which includes: - an indication of the types of materials and waste streams that could occur; and - updated opportunities to reduce waste through design.	BS 7832 – see also Annex B.

Annex A (informative)

Concept and Developed Design development to operation, refurbishment and end of life

Table A.1 to Table A.3 outline the RIBA Plan of Work Stages to be covered in other parts of BS 8955, and the key tasks relevant to material efficiency against those responsible for delivery, the specific materials efficiency process and the resulting outputs specific to material efficiency at each stage. Supporting guidance and tools are also referenced. The title of each table indicates which part of BS 8895 will eventually cover each stage.

Table A.1 **Concept and Developed Design: Key tasks, responsibilities and resulting outputs relating to material efficiency (BS 8895-2)**

Key task	Team member responsibility	Material efficiency process	Output as applicable	Example tools and guidance
Concept Design Implementation of the initial project brief and preparation of additional data. Preparation of concept design, including outline proposals for structural and building service systems, outline specifications and preliminary cost plan. Development of the **final project brief**. **Developed Design** Implementation of the **final project brief** and preparation of additional data. Preparation of developed design to include coordinated and updated proposals for structural and buliding service systems, outline specifications, cost information and project strategies.	**Lead responsibility:** Lead designer **Lead contributor:** Design team: - architect; - civil, structural and M&E engineers; - cost consultant; - project manager; - landscape designer **Further input (if available):** - Client; - Principal contractor; - Supply chain members (depending on procurement route)	**Identification** of more robust waste forecasts (types and quantities), the level of recycled content and a wide range of potential opportunities to design out waste against the five principles of designing out waste. Review of pre-demolition/strip-out audit. Involve the contractor if possible to identify methods of waste reduction relating to procurement route and site activity. Prioritization of those opportunities that have maximum impact on waste reduction and are most feasibly implemented on the project. **Investigation** of prioritized opportunities through their likely impact against project requirements and targets in terms of waste reduction, waste recovery and recycled content. Quantification where possible of likely waste, cost and carbon savings. **Implementation** of agreed solutions by incorporation into design drawings, outline specifications and design reports. Ensure all waste information and related decisions/actions are recorded in the project SWMP.	**Reports,** which can be an expansion of the project brief. They ought to outline activity relating to material efficiency (ideas discussed, analysis and decisions taken) and summarize any specific designing out waste workshops and review processes. **Project SWMP**, which includes: - accurate waste forecasts (type and quantity) and assessment of recycled content on the project; - a list of prioritized opportunities to design out waste and increase the level of recycled content; - quantified relative savings; - remaining actions and action owners.	**WRAP *Designing out Waste: A design team guide for buildings* [N2]:** - provides the five principles of designing out waste and prompt checklist; - outlines the designing out waste workshop format to brainstorm and prioritize ideas, including those relating to site appraisal; - provides checklists to monitor activity. **WRAP *Designing out Waste Tool for Buildings* [11]** provides an initial, approximate waste forecast and waste reduction opportunities based on proposed building type. **WRAP *Net Waste Tool* [9]:** - uses cost plan data to provide waste forecast and level of recycled content by value for the project; - provides quick-win opportunities for improvement. BRE SmartWaste and WRAP provide SWMP templates.

Table A.2 **Technical Design: Key tasks, responsibilities and resulting outputs relating to material efficiency (BS 8895-3)**

Key task	Team member responsibility	Material efficiency process	Output as applicable	Example tools and guidance
Preparation of technical design(s) and specifications, sufficient to coordinate components and elements of the project and information for statutory standards.	**Lead responsibility:** Lead designer **Lead contributor:** Design team: - architect; - civil, structural and M&E engineers; - cost consultant; - project manager; - landscape designer **Further input (if available):** - Client; - Principal contractor; - Supply chain members (depending on procurement route)	**Identification** and completion of any long "investigation" processes and opportunities identified in previous stages. Identification of any further opportunities in detailed design – likely to be smaller, more detailed elements of the project. Prioritization of any further opportunities identified. **Investigation** with other consultants, contractors, subcontractors and suppliers to make them aware of the waste reduction aims and gain their engagement to determine further insight into waste forecasts and reduction/recovery opportunities. Ensure and agree options meet material/component performance, cost, technical and performance standards. Consultation with any relevant planning or building regulation authorities Quantification of the savings of any further opportunities identified where possible. **Implementation** of all material efficiency opportunities in technical design drawings, detailed specifications and the report. Finalize the project SWMP.	**Report** that records any identification and investigation activities, and includes: - finalized options from the Concept and Design Development stages; - any further opportunities identified and investigated during technical and specialist design; - reasons for options being embedded or excluded; - reference to the project SWMP where detailed information is recorded. **Project SWMP**, which includes: - revised waste forecasts following revised analysis and/or early input from the contractor and supply chain members where posssible; - a record of design decisions to implement waste reduction opportunities and a record of the quantified waste, cost and programme savings if possible; - performance of design against targets set; - input into opportunities to reduce and manage waste on site.	**WRAP *Desinging out Waste: A Design Team Guide for Buildings* [N2]:** - provides the five principles of designing out waste and prompt checklist; - outlines the designing out waste workshop format to brainstorm and prioritize ideas, including those relating to site appraisal; - provides checklists to monitor activity. **WRAP *Net Waste Tool* [9]:** - uses cost plan data to provide waste forecast and level of recycled content by value for the project; - provides quick-win opportunities for improvement. BRE SmartWaste and WRAP provide SWMP templates.

Table A.3 **Operation, refurbishment and end of life: Key tasks, responsibilities and resulting outputs relating to material efficiency (BS 8895-4)**

Key task	Team member responsibility	Material efficiency process	Output as applicable	Example tools and guidance
Operation Undertake repair, maintenance and improvement (RMI) activities with consideration of the need to ensure material efficiency throughout the building's life.	**Lead responsibility:** Facilities manager **Lead contributors:** - Client/building owner; - Service providers/ contractors **Further input:** Design team and specialists (e.g. architect, M&E engineer)	**Identification** of: - service level targets for materials efficiency based on activity to date, industry benchmarks and guidance; - specific opportunities to improve material efficiency in current and future RMI works. **Investigation** of: - the capability of potential tendering service providers/contractors to implement the opportunities identified and deliver the targets for materials efficiency; - the feasibility of performance mechanisms, such as financial incentives/penalities linked to targets and/or waste generation on site; - the feasibility, design and implementation strategy of the opportunities identified. **Implementation** of: - procurement and contract documents that establish the service provider's/ contractor's capability and responsbilities for undertaking RMI works in a materials efficient way; - a robust measurement and reporting mechanism to monitor materials efficiency performance and support continual improvement; - the opportunities identified; - a resource management plan (RMP).	**Resource management plan (RMP)** established to record the materials efficiency targets, actions taken and required, measured outcomes, and performance against the targets. **Building manual**, updated to reflect any changes made to the as-built design and specification as a result of ongoing RMI works.	**WRAP *Facilities Management Procurement Toolkit*** [13] provides information, guidance and templates to assist with realizing cost and material savings by improving the resource efficiency of facilities management services.

Table A.3 **Operation, refurbishment and end of life: Key tasks, responsibilities and resulting outputs relating to material efficiency (BS 8895-4)**

Key task	Team member responsibility	Material efficiency process	Output as applicable	Example tools and guidance
Refurbishment Undertake the design and construction of refurbishment works as projects following the recommendations of BS 8995-1 to BS 8895-3.	See BS 8995-1 to BS 8895-3.	See BS 8995-1 to BS 8895-3.	See BS 8995-1 to BS 8895-3.	See BS 8995-1 to BS 8895-3.
End of life Vacate and secure the built assets such that materials efficiency can be maximized in subsequent uses of the site.	**Lead responsibility:** - Client/building owner **Lead contributors:** - Architect; - Local authority planners; - Property consultant/estate agent **Further input:** - Demolition contractor	**Identification and Investigation** of: - opportunities to keep the building operational, even on an interim basis, until subsequent permanent use of the site has been established; - opportunities for future uses of the site that retain and use the existing built assets. **Implementation** of: - measures for vacating and securing the built assets that prevent damage and deterioration; - planning and preparation of the client's business case and strategic brief that links the proposed use of the site to the existing site conditions and built assets. If site clearance is unavoidable then investigate and implement opportunities for reuse of materials through deconstruction, and recycling of materials through the demolition. Use the building manual and site surveys to inform the investigation.	Retained value of built assets and materials on site.	**ICE *Demolition Protocol*** [14] provides an overarching framework which enables the waste hierarchy to inform approaches for managing buildings and structures at the end of their lives. **WRAP *The efficient use of materials in regeneration projects*** [15] is a step-by-step guide to implementing the ICE *Demolition Protocol* to encourage greater resource efficiency by optimizing the quantity of: - material recovered from demolition for reuse and recycling; - recovered materials retained on site for use in newbuild construction; and - recycled content used in newbuild construction.

Annex B (informative)

Example initial project brief

This annex provides an illustrative example of the type of wording that can be included in an initial project brief in relation to material efficiency. The structure follows the guidance in BS 7832, but the wording can be changed to reflect specific project requirements.

Initial project brief for XXXXX Project

Context, aims and resources

BS 8895, *Designing for material efficiency in building projects*, will be adhered to by the project team. Legislative requirements [*insert references as required*] must also be fulfilled, and compliance evidenced.

Using the design for material efficiency process, both the design and project team will ensure material resource efficiency is maximized throughout design and construction, by:

1) Identifying design options to optimize materials use and/or waste creation by reviewing the design and delivery plan. Prioritize those options that will have the largest impact on material efficiency and are the most feasible for implementation.

2) Investigating the priority design options to ascertain their viability and quantifying their associated waste, cost and programme benefits and impacts, where possible, to provide an evidence base for decision making.

3) Implementing the agreed design solutions in project documents, such as drawings, specifications, reports and the procurement process. Record the agreed solutions in the project Site Waste Management Plan (SWMP), and use the project SWMP to communicate the options to the principal contractor and ensure their implementation on site.

The project manager and lead designer will be responsible for driving this process through the design development stage up to handover to the principal contractor. The principal contractor will then be responsible from handover at pre-construction through construction to completion. All design and project teams, as well as supply chain members, will be required to provide quality input into the designing for material efficiency process and its delivery. The project manager will monitor and supervise this activity to ensure it takes place.

This project will make use of the full suite of materials efficiency tools currently available [*insert references as required*] to ensure that all opportunities for material efficiency are identified, investigated and ultimately implemented. The design team will provide evidence of this at each stage of design to help the client make informed decisions.

The design team will apply the processes for designing for material efficiency as follows.

- At the commencement of service identify the possible options to maximize material efficiency and reduce waste in design.
- During the course of the service, report [*state to whom and frequency, e.g. monthly or at the end of each design and construction phase*] the financial and practical implications of implementing the recommended options.
- Work with the project team to ensure the implementation of design options to optimize material use and minimize potential waste.

- Develop the project SWMP from the earliest design stage possible, including waste forecasts and data on reduction targets and actions.

The design team will refer to all parts of BS 8895 and other supporting guidance [*insert references*] to help them identify, investigate and implement ways of meeting the project targets for waste.

Design and performance

Design and performance of the project includes the ability of the project to reduce waste through efficiency measures. The project team will develop and use waste forecasts to assist with setting specific targets, in line with industry best practice standards.

The project team will work towards the project objective to reduce waste and use materials efficiently through the following performance processes.

- Forecast waste quantities and reused and recycled content, and set targets for these and waste reduction from an early design stage.
- Develop and implement the project SWMP throughout the design and construction period, and ensure it includes project-specific targets for waste recovery, reused and recycled content and waste reduction.
- Measure and report progress against the corporate KPIs for the quantity of waste produced and the quantity of waste sent to landfill (measured in tonnes per £100k construction value).
- [*if requested by the client*] Report performance for construction, demolition (including strip-out) and excavation waste streams separately, where applicable.
- Recover at least [*state target*] of construction materials, and aim to exceed [*80% – state target*], where applicable.
- Recover at least [*state target*] of demolition, strip-out and excavation materials (where applicable), and aim to exceed [90% – state target].
- Ensure that at least [*state target*] of total material value derives from reused and recycled content in newbuild, select the top opportunities to exceed this figure without increasing the cost of materials, and report actual performance.

The project manager will ensure that material efficiency is incorporated into all aspects of the project management. Before starting on site, the project manager will lead responsibility for submitting a copy of the project SWMP to the client [*insert deadlines and/or frequencies*], identifying the actions to be taken to reduce waste, increase the level of recovery and increase reused and recycled content, and quantifying the resulting changes. On completion of the works, the project manager will submit to the client a copy of the completed project SWMP, reporting the forecast and actual performance for waste quantities, disposal routes, and reused and recycled content used in the finished construction.

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For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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[1] ENGLAND. List of Wastes (England) Regulations 2005. London: TSO.

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Further reading

BS 7000-4, *Design management systems – Part 4: Guide to managing design in construction*

BS EN 15643, *Sustainability of construction works – Sustainability assessment of buildings*

BS EN 15804, *Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products*

BS EN 15978, *Sustainability of construction works – Assessment of environmental performance of buildings – Calculation method*

PAS 402, *Waste resource management – Specification for performance reporting*

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