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## After Design, During Construction

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# Preface

The purpose of building services engineering systems is to provide a safe environment that is comfortable for building occupants and/or suitable for any processes happening within buildings: their remit may also extend to areas outside buildings in places where a controlled environment is required. I have come across very many situations where a finished building does not perform as building services engineers had intended: there is a performance gap; for example, the end users are not comfortable in their environment, the building operator is not happy with the maintainability, flexibility or energy consumption of the finished building, or the building does not satisfactorily support the processes happening within. In a worst case scenario, a completed building may fail to comply with the requirements of an enforcing authority such that the building cannot be occupied and used.

Despite improvements in design procurement methods that encourage more, and earlier, involvement of construction personnel and the advancement of Building Information Management (BIM) as a tool for collaborative working, suboptimal design solutions and a lack of constructability may only become apparent once the construction works start. The consequences of rectifying these go beyond the reworking of the design, extending in some cases to a knock-on effect on interfacing, programme delays and cost overruns, an increase in claims and disputes and, at the end of the process, higher maintenance costs, which are ultimately borne by clients commissioning the building. This situation can reflect badly on building services engineers capability and competency. At best, on a personal level, such 'criticisms' can be mildly disheartening; at worst, they can involve building services engineers in litigation processes, with all the associated disruption, costs and potential effects on reputation. In the middle, they may have to endure requests for call-backs, investigations, revisiting of the basis of design documentation – this may be during construction, at handover or initial occupancy, or may be years later. Whatever the circumstances, such distractions are irritating and are all at a cost and time to individuals and business organisations.

Furthermore, some of the original design information is included in the documentation handed over at completion of a building. This needs to be reliable, accurate and in a suitable format for the lifetime,

and ultimate decommissioning and disposal, of a building. Operators and occupiers of a building need to understand the expected 'design' performance so as to help with operation and maintenance. Likewise, any decision-making processes of organisations with respect to capital planning (new construction and renovation) programmes may depend on original design; for example, allowances for extending systems for additional electrical power, humidity control, more building management system (BMS) functionality, drainage capacity and so on.

Construction is a multifarious process, with the focus changing as the project progresses. After the design team has completed the bulk of its work, the construction cohort takes the lead; however, building services engineers have strong incentives to support the continuity, quality, and intent of the design. By being properly involved they can better manage and limit the potential risks, such as defects and client complaints, and achieve recognition for the quality of their design work.

This book aims to give practical and relevant information to those involved with the design of building services engineering systems. In particular, it recognises the idiosyncrasies and distinct features of building services engineering that are not specifically covered in general texts on construction management issues. This book follows on from *Building Services Design Management* (Portman, 2014), which recognises the particular planning and management techniques to progress the design of the building services engineering system to ensure that the design deliverables are suitable for onward use in the construction phase. The intended audience includes:

- Building services engineering students and their tutors: to forewarn them what to expect during the construction phases of projects.
- Other students in construction-related disciplines and their tutors: to educate them on the particular issues associated with building services engineering during construction.
- Practicing building services engineers frustrated that all their efforts to deliver the best design are subsequently scuppered.
- Construction project managers who want a better understanding of the particular characteristics of building services engineering during construction.
- Clients who want to understand what measures they should take to ensure that their aspirations for a safe, comfortable and appropriate environment are translated into reality.
- Other built environment practitioners who are not qualified or expert in building services engineering but who wish to develop a greater understanding of the implications of the increasingly important building services sector.

Part One of the book sets the scene by describing the stakeholders involved in the construction phase who are involved with translating the building services engineering design into the finished installation.

Part Two focuses specifically on the potential processes and duties building services engineers may be involved with during construction and the initial post-construction period.

Throughout, two types of boxed text are included to provide some light relief from the main text: one is used give further explanations or useful background information while the other comprises worked examples. Feedback questions are included at the end of most chapters to help with the learning process. The responses for these are discussed in the book's companion web site (www.wiley.com/go/portman/buildingservicesengineering). On this website you will also find Scenario Questions with detailed explanatory answers for many of the chapters; these will help to test your understanding of the issues covered in the book.


Whilst the book is biased towards the UK market in terms of references to terminology, legislation and working practices, the approaches and methodologies are applicable to other regions.

## Reference

Portman, J. (2014) *Building Services Design Management*. John Wiley & Sons Ltd, Chichester, UK.

# About the Author

Dr Jackie Portman DBEnv, MSc, BEng(Hons), ACGI, CEng, FCIBSE, FIET, MCIOB, is a highly accomplished building services engineering project manager with an enviable track record of delivering complex multi-million pound infrastructure and construction projects within budget and operational standards. She graduated in electrical engineering from Imperial College, University of London, and took her first steps into the construction industry. She was attracted by the exciting, challenging, ever-changing and all-encompassing nature of the construction industry, where there are always new challenges and areas of interest, and has never looked back. She has worked in consultancy, main contracting, building services subcontracting, project management and client organisations in Europe, Africa, Asia and the Middle East.

She has led the project management process of a range of projects in terms of complexity, size and uses: university complexes (libraries, archive buildings, state-of-the-art education and research facilities), healthcare projects (wards, laboratories, clinical areas), single and mixed use commercial office complexes, residential developments and schools.

She has always been keen to enthuse and motivate students and trainees and has used her 'hands-on' perspective to support full-time academics and teachers. She has been a visiting lecturer at the University of the West of England and the City of Bristol College, also contributing to the development of the syllabuses, in particular, ensuring the relevance to current industry trends and requirements.

She obtained her doctorate from the University of the West of England, researching into ways and means of improving the contribution of building services engineers to the building design process: looking at how they are perceived by the rest of the construction industry and what tools and processes would help improve their performances.

# Introduction

Building services engineers are responsible for developing and delivering information that describes the design intent for the building services engineering services for specific building projects. It is part of the design continuum (Figure 0.1).

The design information needs to be sufficient for the purpose of informing those responsible for the construction about what is required for the physical works and provides a starting point for determining how long it may take and how much it may cost.

However, the building services engineers' contribution to successful building projects should not stop when these design deliverables are 'complete'.

Building services engineers may be colloquially referred to as building engineers, architectural engineers, environmental engineers or mechanical and electrical (M&E) or mechanical, electrical and public health (MEP) engineers. The individuals and organisations involved as engineers are sometimes referred to as consultants or designers. For consistency this book uses the term 'building services engineers' throughout.

Building services engineering design is delivered by an entity that may be 'stand alone' or integrated with other entities. This integration may be on a vertical or horizontal basis (Figure 0.2). In a vertical integration arrangement, building services engineering entities may be part of a subcontractor or main contractor organisation, or a client organisation. In a horizontal integration arrangement, building services engineering entities may be part of a multidisciplinary organisation with other design-related disciplines: civil and structural engineering, architectural or quantity surveying services.

The material values of the building services installation is typically in the order of 30–60% (Hawkins, 2011) of the total value of the construction of a building project. This can be even higher for buildings heavily reliant on close control of the internal environment, such as data centres, laboratories and specialist healthcare areas including operating theatres. Furthermore, the importance of the building services engineering

*Building Services Engineering: After Design, During Construction*, First Edition. Jackie Portman.

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