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## **Application of Soft Landings in the Design Management process of a non-residential building.**

### **Abstract**

A study into the design processes involved in Soft Landings is an important aspect to realising energy efficiency and environmental sustainability in buildings. Previous Soft Landings papers have focused mainly on post occupancy evaluations and aftercare. No comprehensive study has been attempted with respect to Soft Landings at the design stage. In response to this gap, this paper investigates the application of Soft Landings during the design stage of a central government building in London. It provides an insight into the working processes of a Soft Landings design team and its interaction with other team members and end users. Information from interviews with the design team, minutes of meetings, walk-through in the designed spaces were used to explore how design decisions were reached. It highlights the role the Soft Landings Champion played to ensure that the environmental sustainability objectives of the project were carried from design to construction. The paper also explains the fundamentals of Soft Landings and its potential as a client-driven management tool. The paper concludes by highlighting the implications of the result to designers, contractors and clients.

**KEYWORDS:** Soft Landings, Design Management process, Sustainability, Non-residential buildings, Energy performance gap

## Introduction

The problem of underperforming buildings in terms of energy use has been highlighted in different studies over the past years (Gupta and Gregg, 2016; Fedoruk, Cole, Robinson, Cayuela, 2015; Bordass, Cohen & field, 2004). Building performance reviews have found failings in essential requirements of the buildings such as energy targets and comfort for occupiers. The difference between estimated energy targets and actual energy usage is known as a 'performance gap' (Gupta and Gregg, 2016; Johnston, Farmer, Brooke-Peat, Miles-Shenton, 2016; Galvin, 2014). These performance gaps can impact building owners and tenants negatively because the buildings end up costing more to operate and can lead to missing energy and carbon emission targets (Fedoruk et al, 2015). According to Axon, Bright, Dixon, Janda and Kolokotroni (2012), this issue is most prevalent in non-residential buildings where activities and end users are almost certain to be different daily. The performance gap can be due to deficiency in design, construction and operation or a combination of these factors. (Way and Bordass, 2005); this gap can lead to projects missing their sustainability targets.

Soft Landing processes can be the conduit which would help to link the distinctive stages in construction (design, construction, and handover). Using feedback from past projects to influence changes in design is one of the core principles of Soft Landings (SLF<sup>1</sup>, 2014). This can be achieved with collaboration between stakeholders of the project. The designers will get a 'head start' in the project by learning from similar projects. The emphasis on 'information sharing' between stakeholders will create opportunities for all parties to achieve the sustainability targets of the project even during construction and handover. A review of the literature revealed that current case studies about Soft Landings projects do not sufficiently focus on the interactions of core design teams with sub-contractors and other team members. Rekola, Makelainen, and Hakkinen (2012) and Sebastian (2004) argued that sustainable design should not be seen as a separate task and design should not be seen as solely the responsibility of the design team. Rather, it should be a social process where the individual is stimulated by collaborative work of the collective (Den Otter and Emmitt, 2008). A review of the literature revealed that current case studies about Soft Landings projects do not sufficiently focus on the interactions of core design teams with sub-contractors and other team members. Past studies have focused on feeding back information to the stakeholders and post occupancy evaluations

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<sup>1</sup> SLF: Soft Landings Framework; This literature was originally developed by BSRIA in 2008.

using empirical field work and monitoring buildings (Way and Bordass, 2005; Bordass and Leaman, 2005a).

This paper is exploratory; its aim is to offer insights into the working processes of a Soft Landings design team and its interaction with other members of the project as well as end users. The research will address the current problem that building projects face in trying to achieve sustainability by seamlessly linking the design, construction, and handover stages. The main research question is ‘how was Soft Landings applied during the design stage to achieve the environmental sustainability goals of the project? The study uses selective case study to explain the Soft Landings process and its application at the design stage. The paper also explains the fundamentals of Soft Landings and its potential as a client-driven management tool.

## **Literature Review**

### ***An overview of Soft Landings***

Soft Landings aims to close the gap between estimated energy targets and end user expectations with actual energy performance of the building (Way and Bordass, 2005; Clark, 2012; SLF, 2014; Fedoruk et al, 2015). It emphasises greater participation of the building designers and contractors during and after construction. Soft Landings usually requires a high level of multi layered information exchange (SLCP<sup>2</sup>, 2014) and reality-check(s) at key stages to ensure the success of the project (See Table 1). Soft Landings recognises that until recently, many Architects and Designers rarely took sufficient account of how end users were going to operate the different controls in the buildings. With current buildings becoming increasingly dependent on advanced technological systems, pre-handover and commissioning must include the Facilities Managers and where possible, the end users (Way and Bordass, 2005). Soft Landings can be employed to work alongside most of the standard procurement routes (SLF, 2014, Gupta and Gregg, 2016). Table 1 provides a side by side comparison of the design work stages of Soft Landings with the RIBA plan of work. In design stages 2, 3 and 4 where RIBA calls for concept, developed and technical design, the BSRIA Soft Landings work calls for design reality checks in stage 3 and technical reality checks in stage 4. At every stage of the design, the framework encourages reality-checks to make sure that the sustainability objectives and

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<sup>2</sup> Soft Landings Core Principles; This literature was developed by BSRIA and the Soft Landings User group

energy efficiency targets of the project are on track from the design stage. These are not routine in conventional design or they are adhered to in principle but not in detail.

### **Insert Table 1 here**

Soft Landings emphasises

- Achieving the needs of the end users
- Environmental performance of the building and the efficiency of all operating systems (sustainability of the building)
- Post occupancy evaluations of buildings
- Feeding back information for current and future projects.

Soft Landings often requires the participation of a Soft Landings Champion (SL-CHAM); In some cases, one on the client's side and a second one on the contractor's side (SLF, 2014). The champion is involved from the inception to aftercare stage. They provide support to set realistic energy efficiency and sustainable targets and manage the targets to completion. The targets and performance expectations will be reviewed regularly during design and construction stages to ensure that they can be achieved (See Table 1).

### ***Soft Landings as a Client-driven Management tool for Sustainability***

The core principles of Soft Landings can be seen as tools for increasing energy efficiency and producing better buildings. According to Eppler (1999), a conceptual management tool is a structured, model based way of proceeding to improve the problem solving or decision making process either individually or for a group in an organizational context. By this definition, Soft Landings can be regarded as a Management tool. Many of the decisions for a building project are agreed on from client and contractors' meetings with key professionals. The fact that a Soft Landings process must be specified early during the procurement stage (SLF, 2014) will inform all the key stakeholders of the nature of the project. Bunn, HPSL<sup>3</sup>(2014) outlines the following for stage 1 (see Table 1) project brief and design

1. Define roles and responsibilities
2. Set environmental and other performance targets
3. Incentives related to performance outcomes

Recognizing Soft Landings as a management tool is determined from the 12 core principles (SLCP, 2014). The 12 SLCP are divided into 3 main groups; Management, Information

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<sup>3</sup> How to procure Soft Landings

sharing/flow and Aftercare (Figure 1). The first five principles are decisions that should be taken by client and managers on the project. These tools are in terms of performance measures and quality control.

- a. The agreement that the Soft Landings process should be adopted throughout the project. This will be from the procurement to the post-completion stage as stated in the SLF (2014). Committing to the whole Soft Landings process is a decision that must be made by the client (Bunn, HPSL, 2014).

**Insert Figure 1 here**

- b. The provision of leadership indicates that the client must play a significant role in steering the project into achieving its goals (Way and Bordass, 2005). The SL-CHAM will ensure this is done by reality-checking and reviewing design targets at every stage (Figure. 1).
- c. Setting roles and responsibilities in addition to their traditional roles should be led by both the client and the main contractor (Way and Bordass, 2005). The duration and the level of involvement of professionals after handover also should be decided by the client due to costs involved (SLCP).
- d. Ensuring continuity of the process (SLF, 2104) guarantees if there is a change of partner or sub-contractor, any new parties will have to sign up to the process.
- e. Contract documents will indicate the shared risks and responsibilities between the stakeholders. It is agreed in the SLF (2014) that the risks and responsibilities have to be shared among the project sponsor (client), client advisors, project manager and design professionals.

The above performance and quality control measures highlight the need for the design management team to incorporate targets and checks set out by the Soft Landings process; one could therefore anticipate deviation from the conventional management process (Table 1) especially in point C. This is not to say that Soft Landings is purely a management tool but for a Soft Landings project to be successful, the client and the management have to be aware of the process and the commitments that will be needed. They must decide whether to undertake the project and agree to work within the Soft Landings framework. The overarching theme of the core principles is communication between all stakeholders.

## **Methodology**

### ***Theoretical Framework***

A constructivist epistemology is used to underpin this research. A constructivist point of view assumes that people experience the same situation differently and even though they have a common background of training (Architects, Engineers, Designers), their experiences will give them different ways to solve a common problem; this is due to their different interactions and individual thoughts or constructed realities (Cresswell, 2007). This is all encompassed in the method based on 'Grounded Theory' (Glaser and Strauss, 1967; Strauss and Corbin, 1998). What grounded theory aims to do, is to discover and explain the underlying social processes that shape the interactions and human behaviour (Nayar, 2012). A process such as Soft Landings can only be successful by a closed and a multi-layered interaction of stakeholders. The educational background and working experience of each respondent is taken into account when analysing the interview transcripts. The design team leader who was the most experienced with Soft Landings was more objective in answering the questions. The rest of the team could only base their replies on their current experience with Soft Landings. Grounded theory allowed the researcher to find common ground in the experiences and answers given by all respondents to draw conclusions and develop theories on the working processes at the design stage.

### ***Case Study***

A case study methodology was used for this paper. This was because Soft Landings projects (like all other projects) are restricted to a certain period and location. Soft Landings deals with real-life problems and high level of design details (SLF, 2014). The case study approach is best suited to study this complex relationship (Flyvbjerg, 2006). Leaman, Stevenson & Bordass (2010) believe that a single case can shed light on new issues and processes and create hypotheses that can be tested. Flyvbjerg (2006) also agreed that generalization from a single case was possible depending on the case and how it was selected. The essence of the case study in this paper covered investigating a single building project to understand why and how decisions were taken to achieve the project goals. The study was carried out after completion because of the need for occupants to settle and experience the new development and changes in the building. However, the focus of the case study was at the design stage of the project. The interviews allowed the 'case' to be viewed not only as building but revealing the processes and

how decisions were made. Further study then revealed the consequences of the decisions taken and their end results.

### ***Case Study Selection***

Although some projects are labelled as Soft Landings projects, detailed studies showed that many projects were not procured as Soft Landings projects. Instead, the researchers used post occupancy evaluations to define their projects as Soft Landings projects (Bordass and Leaman (2005a; 2005b; Way and Bordass, 2005). Often these projects miss out on the early advantages of the process during the pre-design and design stages. Such projects were therefore not suitable for this study as the focus is on the design stage.

The building finally selected for the case study was a central Government building which houses offices for a Government department. The project was to redesign and build a new entrance and main reception area to connect a series of buildings owned by the department. The reason for redesigning the reception area was to adopt the enhanced security measures outlined by the Government with the introduction of new security pods. The reception area was to provide a light, modern space with a comfortable ambient temperature with new heating and lighting controls. This is a place for the reception staff to process workers and visitors to the building. It also provides visitors with a waiting area before going into the office area. The area has six security pods through which everybody must pass to get to the office areas. The project started in January 2014 and completed in May 2015.

### ***Data Collection and Analysis***

The lead researcher collected data from key stakeholders of the project within the natural context of the building. Pink et al (2010) claimed that researchers watching the interaction of the end users and the designed space can gain meaningful insights into the case. Therefore, all meetings were conducted in the building with walk-throughs and observations to see how the end users interacted and used the reception space and the security doors. The respondents consisted of four professionals, Design team leader (Architect), Sustainability Manager, Facilities Manager and Quantity Surveyor who acted as the client representative. Two end users were also interviewed. Table 2 contains the background of all the respondents.

**Insert Table 2 here**



Semi-structured interviews were the main method of data collection, Way and Bordass (2005) used similar methods on Soft Landings research focusing on post occupancy evaluations and feedback. The semi structured and open ended questions allow each of the respondents to give their own unique perspective on the project. As the project did not have a designated SL-CHAM (Soft Landings Champion), the professionals who acted as SL-CHAM were interviewed. This was following the Soft Landings framework which allows for project team members to assume the role. It also allowed for shared responsibility of the role amongst team members. A literature review, highlighted certain themes as barriers to achieving sustainability. They include the early introduction of non-design professionals in the design process (Senaratne and Ruwanpura, 2016), integrating results from end user meetings and consultations into the overall design (Hellmund, Wymelenberg & Baker, 2008), the time to introduce the end users into the process, and the length of time used for the design stage. Upon identifying important themes, the researchers designed specific interview questions to allow the theme to be investigated in more detail

The questions were divided into two sections. The first set of questions was asked to establish their knowledge and level of experience in Soft Landings. (Table 2).

The second set of questions (appendix A) was about the design stage. These questions were asked to find how the processes of Soft Landings were interpreted with respect to the design stage.

An Ethics procedure conforming to the University of Kent ethics review board was followed and the study was approved by the ethics committee. As per the requirement, information and consent forms were distributed prior to the interviews. The information was anonymized as stated in the information forms. The interviews were transcribed and copies of the transcripts were sent to the respondents for review and final approval.

Nvivo software was used for the management and analysis of data from the interviews. The analysis of the data was in three stages; In the first stage, interviews were coded for themes derived from the literature review and for new elements that can influence the sustainability of buildings. The focus from the literature was descriptive themes such as ‘the introduction of the end users to the design stage’, ‘the introduction of other professionals at the design stage’ and ‘the effects of Soft Landings on the design stage.’

The second stage involved analysis using the SLCP as a guide to see if the generated themes fitted into the three Soft Landings categories (figure 1). Some of the descriptive codes changed but their core characteristics remained constant.

In the third and final stage the data was recoded to identify where the codes from the first stage intersected with the second stage. In considering the findings, it is essential to note that the analysis solely depends on the interviews and formal documents on the project. For this reason, as stated in the constructivist theoretical framework, it is a reflection of the respondents' experience and perception of the project. The researchers acknowledge that while the data from the six respondents is more robust than a single respondent, it is still a combination of different views offered at the time of interview.

## **Findings**

### ***The role of the Soft Landings Champion (SL-CHAM).***

The role of the SL-CHAM which was central to the project was not allocated to an individual. Instead the role moved from the Project Manager to the Sustainability Manager and later to the Facilities Manager. The SLF argues for a designated SL-CHAM who is a member of the project team. The ideal scenario will be two SL-CHAMs; one from the client side and one on the project team (SLCP, 2014).

The Facilities Manager explained the reason

*'There was no specific Soft Landings champion, the role shifted from the project manager, because during the subsequent weeks he got too busy to attend to both roles properly so he nominated the sustainability manager and later I took over the job.'*

However, as per Facilities Manager, the duties and responsibilities of the SL-CHAM did not change.

*'We passed a lot of information to the sub-contractors and other members of the construction team through the Soft Landings Champion, when the role fell to the Project Manager. This was particularly handy because we did not need to have separate meetings, all our discussion and deliberations were relayed by the Soft Landings Champion.'*

The design team leader however, felt that the role should be allocated to one person. He expressed his opinion

*'... because this was our first Soft Landings project together, we wanted to find out how everyone would deal with the role. For our next project, I will definitely push for one person in the designated role. That will make things easier from my perspective.'*

The tasks involved keeping the sub-contractors informed of any new changes to the design. The sub-contractors were based in Italy and were only able to attend the first few meetings; the rest of the information was passed to them through the SL-CHAM. This made the rate of information exchange quicker than a traditional project where design meetings are generally carried on without the representatives of sub-contractors. The sub-contractor did not receive the information on a 'need to know' basis but on the understanding that shared information about the project makes changes quicker to adopt.

The lack of a dedicated SL-CHAM may have impacted negatively on the project. Team members had to take turns in assuming the role which would have led to their original roles suffering because of the extra workload.

In response to how other professionals fulfilled the role, the design team leader stated that

*'The soft landings champion was particularly handy when the Facilities Manager took over. The project was still in the construction stage. The Facilities Manager was involved with the design and construction and discussed options with the sub-contractors.'*

While a traditional Project Manager mainly focuses on the highly technical aspects of the project, the SL-CHAM focuses on the 'soft' side of project management like bringing awareness to the end users, highlighting policy issues to team members and assessing each project decision from a sustainable point of view.

### ***Soft Landings at Design Stage.***

All the respondents agreed the design stage was relatively longer than in a traditional process. They conceded that Soft Landings made the process longer as more people were involved and there were therefore more opinions to consider. When questioned in this regard, the Sustainability Manager felt:

*'...it takes a lot of time and effort and patience to be able to listen to different ideas and solutions'.*

The Design team leader agreed:

*'I would say the time spent in getting from the concept stage to detailed drawings was relatively longer for a soft landings project than a conventional project.'*

This could make a client nervous about adopting Soft Landings while architects may argue for higher consultancy fees.

On the question of the design management elements that were most useful with a Soft Landings project, the design team leader answered

*'I cannot really pick an element of design management and say this was successful but I can say for my team, we concentrated on the basics with time, cost, quality and the sustainability of the project. Our goal could only be successful with a team with the same objectives as ours. The team work and the information exchange was a big part of the success of this project. With every milestone, we went back to review the design to see if anything could be done better. Of course, we used cost analysis and value management to determine whether we were in line with the budget but there were other elements that were just as important.'*

It is clear that the presence of a SL-CHAM made the design team continually review the design decisions in terms of sustainability objectives. On a traditional architectural consultancy, this may not be possible because they may not carry out more than one or two reviews to their designs. So, the SL-CHAM provided a certain degree of design management input indirectly. This can be seen in Table 4 where the project goals are compared to achieved goals.

#### ***Introduction of other professionals at the Design Stage.***

The sub-contractor who supplied the security doors was based in Italy. It was therefore very important that they were appointed early in the project. The design team leader explained

*'Working within the Soft Landings principles allowed us to solve several project specific problems, the most important one being the time constraint on the project. The sub-contractor who provided the security pods was available at the second design meeting.'*

The design team in collaboration with sub-contractor produced the preliminary design. This gave the sub-contractor time for early fabrication of the security doors while the final overall designs were worked out. This meant that as soon as the supporting structures were completed, the security doors were fixed into position. This deviation from the conventional process helped to cut the waiting time for the security doors significantly. This would not have taken place smoothly in the absence of a SL-CHAM, who passed the necessary information between both parties.

The Sustainability Manager agreed with the Design team leader saying

*‘The security doors were from Italy and they had to be included very early in the design because the whole project revolved around the entrance foyer where the security doors played a very central role.’*

However, the process was also made easier because the client had a list of pre-approved contractors. Since the SL-CHAM advocated bringing in the contractors and sub-contractors early into the project, the client could secure necessary approvals for a closed tendering process.

The Facilities Manager’s opinion on the Facilities management team being included during the design process allowed the team to have input on practical problems such as the location and position of light fittings in the main reception area.

*‘Our collaboration also allowed us to include a LED lighting replacement which will reduce the maintenance backlog and in turn offer a more energy efficient lighting solution for an area which is lit for the majority of the day’.*

In a conventional design process, such inputs are incorporated on some occasions, however when the design is completed, it is not reviewed by the stake holders in terms of its viability and applicability before execution. The presence of a SL-CHAM opened the avenue for such evaluations.

### ***Introduction of the end users***

In response to questions on when and how the end users were introduced into the design stage, the Facilities Manager explained that

*‘There were messaging boards all around the building and the details and dates of the consultation with the design team were made available for any interested parties to attend.’*

A separate consultation targeting reception and building security staff was organized. Such an arrangement was necessary because they were the primary users of the space.

The SL-CHAM facilitated this process by summarizing and providing stakeholders with feedback to the design team. The design team also had consultation with other stakeholders. The internal stakeholders were front of house security, departmental security, Ministry of Justice disability network, Ministry of Justice fire officer, Trade Union representative, Ministry of Justice communication division, London underground, Government Art collection and the Ministry of Defence. All the proposals from the internal stakeholders were discussed in design team meetings along with the SL-CHAM and Sustainability Manager to arrive at the final draft of design. It appears that the design team participated only in the targeted group consultation while the SL-CHAM discussed with the wider stake holder community as well as participating in the targeted group consultation. This helped to save time on multiple consultations.

The design leader described the process of consultation with the reception staff:

*‘The end users were introduced as soon as the concept was decided..... consultations with them (reception and security staff) we asked about their expectations for the new space, and elements that they did not enjoy in the former space.....’*

The design team briefed them on the concept and how the design will affect the flow of the people. This consultation brought the attention of the design team to draughts experienced in the former space. The stakeholders indicated that they experienced a temperature of 4°C during 2012 winter and the space was uncomfortable to work in. They also highlighted the energy inefficiency of the former lighting layout. As a result of this consultation some practical changes were made. The front counter was initially designed to curve around the reception area. However the reception team, drew the attention to the curve around the reception showing that a part of it would disturb an area where the drawer with their documents were stored. Upon the feedback this area was redesigned with a rectangular shape to suit the purpose.

### ***Information Exchange***

All the respondents confirmed the use of a central messaging forum for all professionals included in the project management Paragon software. Information such as time and location of meetings was available as well as variations in any part of the project. The clients’ representative had the following opinion on the lines of communications:

*'I was kept informed about the progress of the project by email and was invited to some meetings which included sub-contractors. I requested for minutes from some meetings and it was emailed to me as well.'*

The design team leader

*'We had different lines of communication when dealing with different stakeholders, there was a central email enquiry address provided so that all concerns could be addressed centrally.....'*

A communication matrix (Table 3) in the software enabled them to pass the information across all project team members. The SL-CHAM played a key role in developing this matrix. This initiative helped project team members engage with other teams throughout the project. There was a 'meet the contractor' forum where the end users could ask questions about the project. A proposed digital screen for the BIM fly through demonstrations was not provided by the client; therefore, this initiative was relatively unsuccessful. There was an information board in the main atrium where end users were informed of new developments. The SL-CHAM continually updated the information on the board and made the end users aware of emails addresses where they could get in touch with any questions or comments.

Even though there was open flow of information between the professionals, there seemed to be a disconnection of information flow between the project team and some end users. The position of communication boards in the corridors was not suitable as many people did not stop to read the information. One of such end users explained....

*'I did not usually have the time to stand and read information pasted on the walls, the information that I received was from colleagues. Some of them went for a meeting arranged for our department but even that meeting seemed hastily arranged.'*

When asked if they felt included in the process, one end user answered

*'I felt we were not as important as some other end users and information was passed to us after many of the decisions were taken. Why wasn't the information emailed to us? I did not feel included at all'.*

The building has 14 floors and houses hundreds of staff; it would therefore be almost impossible to speak to every worker in the building. The project team outlined the major internal stakeholders and focused their interactions with those identified. The end user who felt they were not consulted worked on the 5<sup>th</sup> floor therefore the construction had minimal effect on them.

The security staff who work in the newly redesigned reception space had a different view to information exchange. When asked about the information boards, the reply was:

*‘The communication boards were updated so we were able to tell what to expect during construction especially when there was going to be a change in the routes into the building.’*

## **Discussion**

The study revealed that there are more complex relationships and team work needed for a Soft Landings project to be successful. Table 3 shows the communication matrix for the project. In the matrix, the role of each stakeholder is clearly stated with respect to the objective. The Sustainability Manager led the team in terms of sustainability, energy and environmental performance objectives as shown in Table 4. The role was supported by the SL-CHAM and the Project Manager. The sub-contractors were informed of the objectives which they had to consider when delivering their goods and services. This cleared up any ambiguity within the project with every objective clearly planned. The respondents talked extensively about the need for collaboration from all parties involved in the project. They also emphasised the need for multiple lines of communications to be available so that information can flow quickly to the appropriate party. The Facilities Manager had the leadership role to accomplish the objectives of training management staff, handover and post occupancy evaluation (Table 3). This was clearly stated in the communication matrix while the SL- CHAM had the supporting role. A clear strategy on communication process is an essential for any construction project (Senaratne and Ruwanpura 2016). Emmitt and Gorse (2007) also stressed the common objectives and goals between the parties to make communication streamlined so that discreet parties of the construction process can be efficiently engaged. While Rekola et al (2012) stated that effective communication and cooperation is an essential aspect for sustainable construction.

The project had very strict time constraints and sustainability objectives. By outlining the objectives very early on, the SL-CHAM could keep track of all changes and help the flow of



information to have a positive effect on the outcome of the project. Although Sebastian (2004) concluded that design is a social process, Otter and Emmitt (2008) pointed out that design team communication stimulates individual understanding of the design. This individual understanding had given the SL-CHAM a unique position to be able to keep all team members in the loop. This was particularly challenging as the sub-contractor was based in another country and was not available for many meetings. This project was able to demonstrate that given clear sustainability objectives, a project can achieve its sustainability goals by fully implementing the Soft Landings philosophy and principles.

### **Insert Table 3 here**

The project faced additional pressure in regard to the time because the design stage took longer than conventional projects. The team was able to make up the time by working simultaneously with the sub-contractor producing the security doors. The Design Manager's 5 years of experience with Soft Landings also enabled him to lead the team effectively. The design stage overrun can be countered by streamlining the meetings between the teams and reducing the time used in deliberating on end user suggestions and comment.

Table 4 summarizes the input to the design team as a result of adopting the Soft Landings process i.e. the influence of the Soft Landings process on the design management. It is clear from the table that every decision is carefully vetted to avoid waste. It also highlights the importance of bringing in high level of clarity to roles so that results can be closely monitored against objectives. This helps to flag up any short falls and call for action from the relevant or responsible person. Although the SL-CHAM participated in all critical decisions, the scope and nature of work kept changing from objective to objective. In the absence of a dedicated SL-CHAM, any other member of the project team will be reluctant to take the tasks considering the time and skill required, especially design team members.

### **Insert Table 4 here**

## **Conclusion**

The authors have explored the impact of the Soft Landings processes on the design stage of a project. The research highlights the collaborative process that is necessary to use Soft Landings as a design management tool and the scope of work for a design team in a Soft Landings project. It also highlights the level of information sharing as the main difference between a Soft Landings project and a conventional project. The SL-CHAM added a sense of cohesion to the different stakeholders by making sure all parties were informed about the project goals. Further, the regular review of targets by the SL- CHAM during and after design allowed the team to make adequate changes where necessary to reduce the performance gap. The results clearly showed that the adoption of Soft Landings afforded every team member an opportunity to contribute positively. This in itself is not sufficient for a project to achieve its objectives but it created a platform from which the team could solve critical problems. The implication of this research on the design team is the realization that environmental sustainability can be achieved not only with the adoption of new technology but also with the collaborative influence of a SL-CHAM who will continue to review targets and cross-check the objectives of the project. Despite the communication matrix, some of the information did not reach its intended target. Two factors led to the partial breakdown in communication. The lack of a dedicated SL-CHAM meant that the Facility Manager who was acting as the Champion was occupied with preparation for the handover. The second was the sub-contractor not fully adopting the Soft Landings framework. This can be attributed to lack of knowledge and time constraints.

Kurul, Tah and Chenug (2012) concluded that to deliver sustainable buildings a change must occur in practice and professionals must reorient their 'sight' to a more open and collaborative partnership with other industry partners. The project, from a practical application embraced this philosophy by using Soft Landings; this can be seen as reorienting the relationship between all stake holders of the project. Although the project achieved majority of its environmental sustainability objectives, the end users had complaints about operating some mechanical systems which can affect the sustainability of the building. This is an opportunity for architects, engineers and services providers to collaborate on interface of building controls to be more user friendly. The future research will focus on the relationship between the design stage and the post occupancy evaluations of projects. It should explore how Soft Landings at the design stage can be documented effectively so that post occupancy evaluations can be easier to carry out.

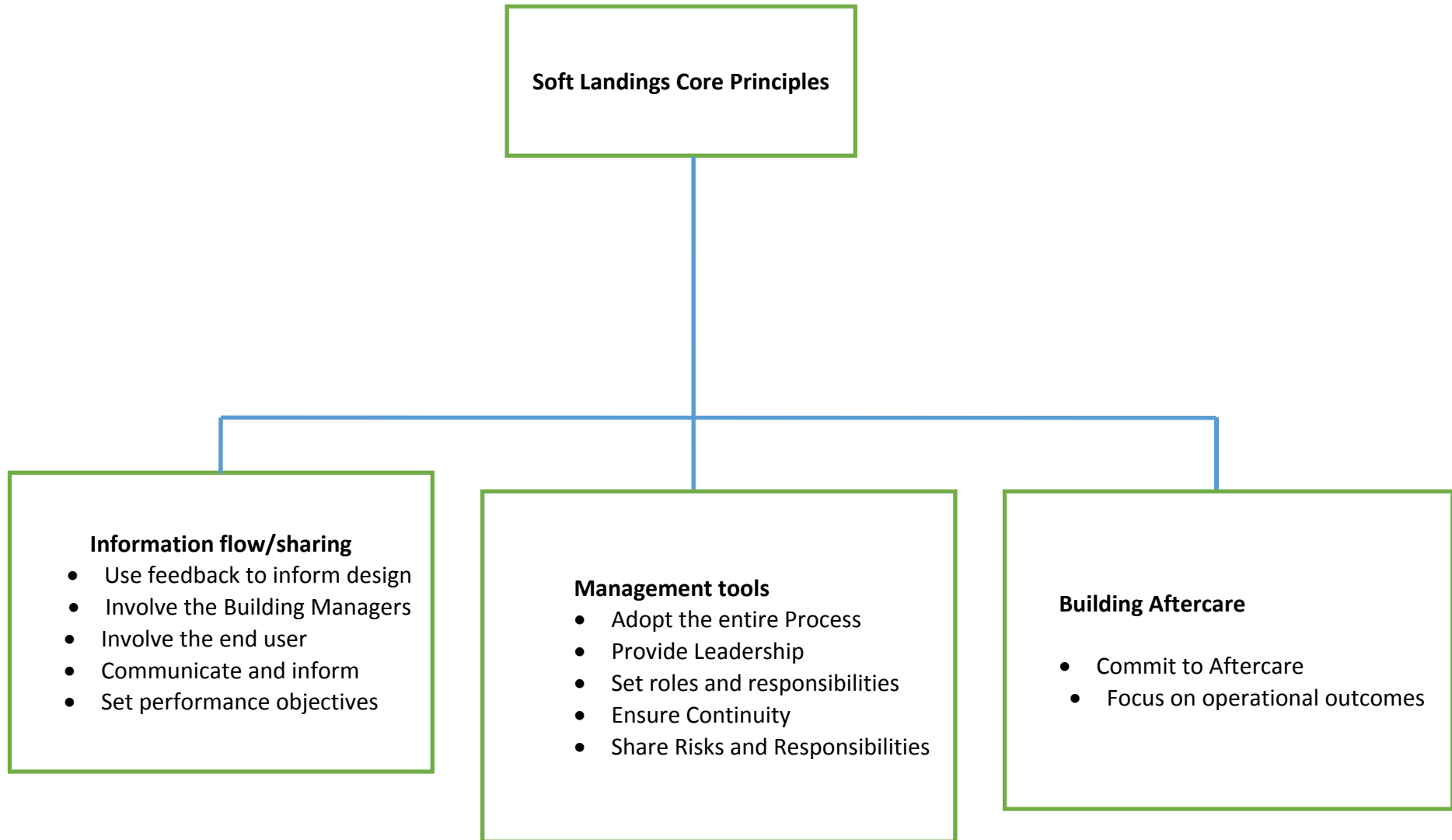
Table 1: Plan of works under different Institutional Frameworks

RIBA 2013 Stages	CIC Stages 2012	BSRIA Soft Landings Work stages		BSRIA BG 6/2014 Design Framework pro-formas
0- Strategic definition	0- Strategic Definition	Soft Landings Core Activities	Soft Landings Supporting Activities	0- Strategic activities
1- Preparation and brief	1- Preparation and brief	Stage 1. Briefing: Identify all actions needed to support the procurement	Define roles and responsibilities	1- Preparation
			Explain Soft Landings to all participants, identify processes and sign off gateways	
2- Concept design	2- Concept Design	Stage 2: Design development: To support the design as it evolves	Review past experience. Agree performance metrics. Agree design targets	2- Concept
3- Developed design	3- Developed Design	Scheme design reality-check	Review design targets. Review usability and manageability.	3a & 3b Developed design
4- Technical design	4- Technical Design	Technical design reality-check(s)	Review against design targets. Involve the future building managers.	4a, 4b & 4c Technical design
		Optional tender stage Reality-check	Include additional requirements related to Soft Landings procedures	

Information exchanges will vary depending on the procurement route and building contract. Designers can create a bespoke plan of work for the client's chosen procurement route in order to set out specific tendering and procurement activities for each stage.		Tender award stage Reality-check	Include evaluation of tender responses to Soft Landings requirements	
5- Construction	5- Fabrication Design		Confirms roles and responsibilities of all parties in relation to Soft Landings requirements	5- Construction
6- Handover and close	6- As constructed	Pre-handover reality-check	Include FM staff and/or contractors in reviews. Demonstrate control interfaces. Liaise with move-in plans	6- Handover
		Stage 3: Pre-handover Prepare building readiness. Provide technical guidance		
		Post-handover sign-off review. Ensure all outstanding reality-checked items are complete and system is signed off and operational		
7- In Use	7- In Use	Stage 4: Aftercare in the initial period: support in the first few weeks of occupation	Incorporate Soft Landings requirement	7- In Use
		Stage 5	Set up home for resident on-site attendance	

		Years 1 to 3 Aftercare: Monitoring review, fine-tuning and feedback	Operate review processes. Organise independent post-occupancy evaluations	
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Figure 1: Core Principles of Soft Landings Divided into 3 groups



*Table 2: Summary of background information of respondents*

<b>Profession</b>	<b>Sustainability Manager (SM)</b>	<b>Facilities Manager (FM)</b>	<b>Design Team Leader (DTL)</b>	<b>Client Representative (CR)</b>	<b>End users (EU)</b>
<b>Years of experience in the construction Industry</b>	8	5	15	11	N/A
<b>Years of experience in Soft Landings</b>	2	2	5	3	
<b>Types of project</b>	Commercial Institutional	Commercial Institutional	Institutional Commercial Healthcare Domestic	Institutional Commercial	N/A
<b>Educational Background</b>	Environmental Management (MSc)	Facilities Management (BSc)	Architectural Design (MSc)		Lawyer

Table 3: Project Communication Matrix

Stakeholders	Project Objectives							
	Sustainability objectives	Energy and environmental performance	Design and functionality of space	Construction Stage	Training of facilities management staff	Engagement with end user	Handover	Post occupancy evaluation
Client Sponsor	△	▲	△	▲	▲	●	▲	▲
Design Manager	△	△	○	◎	▲	◎	△	▲
End users			△	△	▲	△	▲	△
Facilities Manager	△	△	△	△	○	●	◎	●
Project Manager	◎	●	◎	○	◎	○	○	△
Soft landings Champion	●	●	●	●	●	●	●	○
Sub-contractor	▲	△	△	◎	●	△	△	△
Sustainability Manager	○	○	△	●	△	△	△	△

Legend

△	Consulted	▲	Informed	○	Responsible/ Team leader	◎	Accountable	●	Supporting role
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Table 4: Project objectives and how they were achieved using Soft Landings

Project Objectives	Relevant stakeholder	Process used	Soft Landings Principles used	Result
<p><i>Sustainability objectives:</i></p> <ul style="list-style-type: none"> <li>• Air tightness and design to benefit from low and zero carbon technologies. and passive control methods.</li> <li>• Minimise operational energy use and reduce overall CO<sub>2</sub> emissions.</li> <li>• BREEAM 'Excellent' rating.</li> </ul>	<ul style="list-style-type: none"> <li>• SL-CHAM</li> <li>• Sustainability Manager</li> <li>• Design Manager</li> <li>• Project Manager</li> <li>• Specialist sub-contractor</li> <li>• Client sponsor</li> <li>• Construction team.</li> </ul>	<ul style="list-style-type: none"> <li>• Reality checking decisions at key stages of the project.</li> <li>• Utilizing low carbon technology solutions like LED lighting replacement that will offer more energy efficient lighting solutions.</li> </ul>	<ul style="list-style-type: none"> <li>• Adopting the entire process of soft landings</li> <li>• Focusing on operational outcomes</li> </ul>	<ul style="list-style-type: none"> <li>• The targeted air permeability was 5m<sup>3</sup>/hr/m<sup>2</sup> @50 pa. A test revealed that the building achieved a performance of 4.91m<sup>3</sup>/hr/m<sup>2</sup> @50 pa.</li> </ul>
<p><i>Energy and environmental performance:</i></p> <ul style="list-style-type: none"> <li>• Emphasis on the building fabric</li> <li>• The performance of the heating and cooling systems.</li> </ul>	<ul style="list-style-type: none"> <li>• SL-CHAM</li> <li>• Sustainability Manager</li> <li>• Project Manager</li> <li>• Specialist sub-contractor</li> <li>• Technical assessor.</li> </ul>	<ul style="list-style-type: none"> <li>• A technical assessor produced an energy model which reviewed the energy outlay of the reception area.</li> <li>• Overhead door heaters were linked to the BMS system to reduce the indoor energy outlay and to switch them off when they are not needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Setting performance objectives</li> <li>• Setting out roles and responsibilities</li> <li>• Bring key specialists to advice during the design development stage allowed a realistic target to be set for the energy performance of the space.</li> </ul>	<ul style="list-style-type: none"> <li>• Comparison against CIBSE TM46 benchmarks</li> <li>• bridging around the side double glazed windows.</li> <li>• Overall the thermal comfort of the occupants achieved.</li> </ul>

<p><i>Functionality of the space designed:</i></p> <ul style="list-style-type: none"> <li>• Outlay of the reception area</li> <li>• Flow of the traffic of people</li> <li>• Position of security pods</li> </ul>	<ul style="list-style-type: none"> <li>• SL-CHAM</li> <li>• Project Manager</li> <li>• Design Manager</li> <li>• Client sponsor</li> <li>• End users.</li> </ul>	<ul style="list-style-type: none"> <li>• SL-CHAM worked with the design team to ensure that each stakeholder was given adequate attention during the design stage.</li> <li>• All suggestions were discussed and rated to ensure that all important points were noted and incorporated in the design.</li> </ul>	<ul style="list-style-type: none"> <li>• Using feedback to inform design</li> <li>• Involving the end user during the design stage.</li> </ul>	<ul style="list-style-type: none"> <li>• The space designed met the expectations of the end user.</li> <li>• The flow of traffic has been improved</li> </ul>
<p><i>Facilities management and training of staff:</i></p> <ul style="list-style-type: none"> <li>• Interaction of the facilities management team with the project team members and end users</li> </ul>	<ul style="list-style-type: none"> <li>• SL-CHAM</li> <li>• Project Manager</li> <li>• Facilities Manager</li> <li>• Sustainability Manager.</li> </ul>	<ul style="list-style-type: none"> <li>• Engaging with the facilities management team by weekly meetings.</li> <li>• maintenance and operational issues like identifying blind spots where additional CCTV cameras could be placed.</li> </ul>	<ul style="list-style-type: none"> <li>• Involving building managers</li> </ul>	<ul style="list-style-type: none"> <li>• Better understanding of the space</li> <li>• The change in the ceiling finish materials.</li> </ul>
<p><i>Handover:</i></p> <ul style="list-style-type: none"> <li>• Prepare all staff for the use of new security pods</li> <li>• Structured training of facilities team.</li> </ul>	<ul style="list-style-type: none"> <li>• SL-CHAM</li> <li>• Project Manager</li> <li>• Facilities Manager</li> <li>• Sub-contractor</li> </ul>	<ul style="list-style-type: none"> <li>• A training and handover strategy was developed with the help of the SL-CHAM</li> <li>• Complete operating manuals.</li> <li>• Video training for the security staff.</li> </ul>	<ul style="list-style-type: none"> <li>• Communicating and informing the team</li> </ul>	<ul style="list-style-type: none"> <li>• The transition to handover was handled smoothly.</li> <li>• The new heating and cooling system was working correctly.</li> </ul>

<p><i>Post occupancy evaluation:</i></p> <ul style="list-style-type: none"> <li>• Review building sustainability performance</li> <li>• TM22 assessment</li> </ul>	<ul style="list-style-type: none"> <li>• SL-CHAM</li> <li>• Facilities Manager</li> <li>• Sustainability Manager</li> <li>• Specialist sub-contractor.</li> </ul>	<ul style="list-style-type: none"> <li>• The sub-contractors stayed after handover to help the transition.</li> </ul>	<ul style="list-style-type: none"> <li>• Committing to building aftercare</li> </ul>	<ul style="list-style-type: none"> <li>• Complaints about the wait for security doors.</li> </ul>
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