# The impact of procurement processes on the sustainability of school buildings

## Conference or Workshop Item

# The impact of procurement processes on the sustainability of school buildings

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## Introduction

Sustainable development is a term which has grown out of the need to integrate two potentially conflicting priorities, that of development, particularly for economic and social good, and the protection of the natural environment. The UK Labour Government from 1997–2010 showed its commitment to improving sustainability through a raft of policy statements and publications, and with the introduction of increasingly stringent building regulations.

The Labour Government also had a strongly stated commitment to education. This led to the introduction of major new state school building programmes, including the Academies programme from 2000, and Building Schools for the Future (BSF) from 2003. The original aim for the new schools was to improve social and economic equality in areas of deprivation, but in 2004 the focus shifted. In a speech to industry, Prime Minister Tony Blair called for the new school buildings to be '*models of sustainable development*', and a visible demonstration of the Government's aspirations.

Over the same period there was a drive to increase productivity and reduce inefficiencies in the UK construction industry, which had led to the development of new procurement processes claiming to promote collaborative working through partnerships, framework agreements and early contractor involvement, and to encourage stakeholder participation in decisions. The need for an effective and rapid method of procurement for the new school buildings was clear, and two new procurement models were introduced which co-existed with the existing routes.

This paper describes some of the impacts of these overlapping policies and aims, through four case studies of secondary state school building projects, each procured through a different route. The paper hypothesised that the new schools, procured through the BSF and Academies programmes with their stronger focus on stakeholder involvement and on developing integrated design and construction teams, would result in more sustainable schools.

## Results

Sustainability is a contested and value-laden term, so the first step was an analysis of Government initiatives and publications for sustainable schools to identify their interpretations. This identified particular Government aspirations for the new schools as: achieving high BREEAM rating as an indication of environmental impact; installing low carbon energy technologies leading to a reduction in operational carbon emissions; the inclusion of stakeholders in design decisions; and ensuring accessibility throughout school buildings for disabled pupils. Consideration of embodied carbon was specifically *excluded* by the Government, but identified as a concern of the construction sector, and so was also included in the study.

The case studies demonstrate that the procurement processes had a clear impact on these aspects, but not necessarily that which was intended. For the BSF and Academies projects the

main design phase takes place during the bidding stage, imposing a confidentiality clause which resulted in considerable restriction of stakeholder engagement during this crucial stage of design decisions. Furthermore a tool specifically introduced to facilitate stakeholder dialogue had the opposite effect of limiting discussion and frustrating the users. The limitations of the consultation process, as well as the calculation of funding at feasibility stage before some major design decisions had been taken, had the result that disabled access remained unresolved at one school where it had been a key aspiration.

The new procurement processes had been intended to produce integrated design and construction teams, and more effective relationships between these delivery teams and the clients. Within the academy project this did work well, but mainly because the client and contractor had a pre-existing healthy working relationship from a previous project, independent of the current framework agreement. However the local framework agreement used at another school appeared to have resulted in an unhealthy imbalance of power, with the result that the services engineer was persuaded to rewrite her design advice to match the client's choice of low carbon technology. BREEAM Very Good was achieved by the BSF procured school, and Excellent by the Academy. However Very Good was also achieved, even though not a requirement, at the school which was procured through a traditional route with separate design and construction teams, late contractor involvement and no continuing relationship with the (inexperienced) client.

The Government's focus on the use of low carbon technologies as a panacea to reducing carbon emissions also appears to have back-fired, with three of the four schools likely to have higher operational emissions than if they had installed standard gas boilers. In two of these cases the choice was made by the client based on cost. In another case the team was pushed towards the choice of biomass by a spreadsheet tool possibly responding to hidden bias in the tool's design.

## Conclusions

This paper concludes that while the Labour Government's aspirations for sustainable schools were worthy, they were not supported by the new methods of procurement. In particular:

- The long period of confidentiality during design development runs contradictory to the need for stakeholder involvement.
- Effective relationships between the client, contractor and design team can have positive benefits for the project; however these were not shown to result from either the new procurement processes, nor the existing framework agreements.
- The BSF process resulted in fragmentation between the design stages, and had harmful effects on the time, cost and satisfactory outcome of the project

The effects of procurement on sustainability are therefore complex and poorly understood.

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## 1. Introduction

'Sustainable development' is a term which has grown out of the need to integrate two potentially conflicting priorities, that of development, particularly for economic and social good, and of the protection of the natural environment. The UK Labour Governments from 1997–2010 showed a commitment to encouraging sustainability in the construction industry with increasingly stringent buildings regulations and a raft of policy statements and publications.

Meanwhile there had been a drive to restructure the UK construction industry in order to increase productivity and reduce inefficiency. Successive Government-commissioned reports [1] [2, 3] had resulted in the introduction of new procurement processes, which promoted collaborative working, early contractor involvement, and encouraged stakeholder participation in decisions.

The Labour Government also had a strongly stated commitment to education, which had led to the introduction of major new state school building programmes. The original aim was to improve social and economic equality, but in 2004 the focus shifted with Prime Minister Tony Blair calling for the new schools to be '*models of sustainable development*' [4]. The schools became a showcase for both the drive towards sustainability and the introduction of the new procurement methods.

This paper considers the impact of the various procurement processes which co-existed for UK schools between 2005 and 2010. Specific aspects of the Government vision for sustainability in schools are derived from an analysis of reports published between 2002 and 2010. Four case studies of secondary state school building projects are then described, each following a different procurement route which imposed different management structures, funding models, processes for stakeholder involvement, and design tools. The outcomes of each project are discussed in terms of the identified sustainability aspects, with a critical analysis of the impact of the procurement route.

## 2. Procurement and sustainability: the political vision for schools

The need for an effective and rapid method of procurement to manage the extensive new building programmes led to the new programmes incorporating ideas from the major reviews of the construction industry. Both Academies and the BSF schools were built through Design and Build contracts, led by the building contractor rather than the design team. The new procurement routes were designed to encourage closer working relationships between the delivery teams and the clients, and less fragmentation of the now integrated design and build team. Academies were usually procured as single projects, with local authority clients inviting bids from teams who had been pre-selected by the National Academies Framework. The BSF programme was designed for Local Authorities to rebuild or refurbish a group of schools at once, saving time and costs on multiple procurement processes. A separate delivery vehicle was designed for this called the Local Education Partnership (LEP) [5]. A number of existing capital funding routes for schools remained active in parallel with the two new programmes.

Successive publications were commissioned by the Government to describe and promote the design intentions for the new schools. The main messages from each are shown in Table 1, in chronological order, and the main issues which are examined in this paper are highlighted.

*Table 1: Government publications on school design 2002-2010*

| | |
|---|---|
| 2002 [6]<br>*Classrooms of the future: innovative designs for schools* | 'major drivers of change' for school design described as changing pedagogy, ICT, **inclusion of pupils with special educational needs**, more community use, flexibility, 'developments in building technology' and 'sustainability of building development and construction'. |
| 2004 [7]<br>*Exemplar designs: concepts and ideas* | Recurrent concerns included energy conservation, the prevention of summer overheating, and natural ventilation. One particular conclusion was that **underfloor heating was to be avoided in school buildings**, as 'it responds too slowly to react to the fast changes of utilisation in a school and therefore requires a supplementary form of heating.'(p.21). All designs were required to achieve **BREEAM Very Good. Renewable energy options** were encouraged, with the report stating that 'By the inclusion of renewable energy sources … the zero carbon school is achievable.' (p.21) This was one of the first uses of the term 'zero carbon' in the UK. 'Sustainable materials' were mentioned, including timber frame construction. |
| 2004 [8]<br>*Schools for the Future: transforming schools: an inspirational guide to remodelling secondary schools* | The report includes the statement that: '..**the involvement of all stakeholders in the briefing process** is vital to creating the best design solutions.' (p.18). It also claimed that 'Reusing existing buildings uses smaller quantities of new materials, and expends less energy in manufacture and transport' (p.19). (These are the elements which make up the **embodied energy** of the building, although the term is not used.) |
| 2006<br>*Sustainable Schools consultation and response* | These defined a National Framework for Sustainable Schools, which set out eight 'doorways to sustainability' to be achieved by 2020 as: 'Food and drink'; 'Energy and water' – which encouraged schools to be 'models of energy efficiency, **renewable energy use** and water management'; 'Travel and traffic'; 'Purchasing and waste'; 'Buildings and grounds' which required schools to have visible 'sustainable design features'; 'Inclusion and participation' which would enable '**all pupils to participate fully in school life'**; 'Local well-being', 'Global dimension'. |
| 2006 [9]<br>*Sustainable Schools: Case studies* | Again this report encouraged a commitment to **the inclusion of stakeholders** in the design of their schools stating that: 'a school that does not meet the needs of its community will not be sustainable. The best examples we have found started by finding out what people really wanted and needed.' (p.6).<br>'Themes' of sustainable schools given as: '**Stakeholder engagement**, Getting the basics right, The building as learning tool, Low energy design, **Renewable energy systems**, Managing energy and ICT' (pp.7-11)<br>'Tools promoting sustainable design' included **BREEAM** Schools and the **DQI**. |
| 2007 [10]<br>*The use of renewable energy in school buildings* | The report describes 'the multiple benefits of **renewable energy technologies'** stating that: 'All technologies will provide carbon savings compared to fossil fuel powered equipment and therefore contribute to local and national carbon reduction targets.' (p.2) However the report suggests that **biomass boilers are unsuitable for town centres** because of the space needed for fuel delivery and storage. The report suggests that biomass is expensive. Also notes that **ground source heating systems 'can't provide instant heat'**, and implies that these will only be an effective alternative if the school has no access to the gas network, or currently uses electric heating. (p9). |
| 2010 [11]<br>*Zero Carbon Task Force Final Report* | The final report of the ZCTF concluded that zero carbon was unachievable in such a short time, but identified a hierarchy of 'five steps to zero carbon' as:<br>'**Engage with LAs, schools, young people and others - The essential first step'**; 'Reduce energy demand - **Low and zero carbon energy supplies are expensive and/or difficult to achieve**, so it is essential to reduce energy demand as much as is practical'; 'Drive out waste through better design'; 'Decarbonise school energy supplies'. |

Many of the issues which emerged from the reports were reinforced by other initiatives. A specific schools version of the BRE Environmental Assessment Method was made a requirement on all projects from 2005. This assessed nine different aspects of design and construction which were considered to have an environmental, and in some cases social, impact, including: Management, Health and well being, Energy, Transport, Water, Land use, Ecology, Materials, and Pollution. The BSF and Academies programmes also required the use of the DQI tool, developed by the Construction Industry Council (CIC) to facilitate the inclusion of stakeholders in the design process.

In 2006 a new set of Building Regulations came into force, which required the reduction of operational energy use and carbon emissions by around 25% compared with the 2002 regulations, and also encouraged the provision of low carbon energy systems ('renewables') for 10% of the regulated energy demand as calculated at design stage. This was also particularly encouraged by a local planning requirement started in the London Borough of Merton, the 'Merton Rule'.

There was therefore a strong concern for environmental sustainability in the new school buildings, seen to be met through achieving BREEAM, and for social sustainability as exemplified by the importance of accessibility for disabled pupils. Ensuring the participation of stakeholders in design decisions was seen as an essential route to achieving both social and environmental aims.

The Government also appears to have become increasingly focused on the reduction of carbon emissions, partly to be achieved through energy efficiency measures required by the Building Regulations, but also partly through low carbon energy technologies. In fact the 2007 DCSF report discouraged ground source heating systems as too slow to respond to instant demands, and concluded that biomass was an unsuitable fuel for town centres [10]. In the same year the 'schools carbon calculator' was launched, as part of a new funding mechanism to encourage 60% carbon reductions again mainly through low carbon technologies. In 2008 the DCSF stated that all schools would be 'zero carbon by 2016' [12], once again encouraging low carbon energy technologies as the route to achieve this. However by 2010 the ZCTF had concluded that the zero carbon target was not viable, and suggested that renewables were not the best route to reducing carbon [11].

One publication [8] had mentioned the impacts from the construction, rather than the operation, of the buildings, in other words the **embodied** impacts. However the Government definition of zero carbon, as developed by both the DCSF and the Department responsible for the Building Regulations deliberately excluded 'embodied carbon'[11, 13]. The concept was not new [14-16]. There was also considerable evidence [17] that the issue was seen as important by many in the construction sector, for example in the responses to a Government consultation [18].

# 3. Procurement and sustainability: the reality of school building

## 3.1 The case studies

Four case study school building projects were chosen to examine the impact of the different procurement routes. Data collected from each case study included semi-structured interviews with multiple project actors, project documents, and direct observation through site visits at different stages of construction. All data was collected during the construction stage. Detailed references and descriptions of the case study schools are given in the PhD thesis of the author [17].

Initial social, geographic and economic conditions were kept constant as far as possible as shown in Table 2. The teams of designers, clients and other stakeholders involved in the projects necessarily had different profiles of interest and knowledge in sustainability, and these are summarised in Table 3. The four projects were built by two large reputable UK contractors, both of whom had specific and stated knowledge and ambition to build sustainable schools.

Requirements for the existing school procurement routes included lower BREEAM ratings, and omitted the use of the DQI tool for stakeholder involvement. The extra funding offered through the use of the carbon calculator was not available for these projects. The new procurement routes had also been designed in the light of the Latham and Egan reports to encourage partnership and

stakeholder involvement. Therefore the initial hypothesis was that the schools procured through the new routes would score more highly in the non-mandatory sustainability aims, both social and environmental, than those procured through the existing routes.

*Table 2: Case studies – project details*

| Case study: | **Backhouse School** | **Eastwick Field School** | **St Augustine School** | **Lane Academy** |
|---|---|---|---|---|
| Procurement: | Local framework agreement | BSF (LEP) | Direct capital grant | National Academies framework |
| Location: | City in East of England | Inner London | City in East of England | City in East of England |
| No. of pupils/ Age range | 1350<br>11-19 | 1500<br>11-19 | 850<br>11-19 | 950<br>11-19 |
| Cost (incl fees): | £12m | £21m | £13m | £20m |
| Approx % of new build: | 70% | 50% | 50% | 100% |
| Feasibility stage: | 2005 | 2005 | 2005 | 2007 |
| Design team appointed: | Spring 2005<br>Autumn 2007 | Autumn 2007 | Summer 2006 | Summer 2008 |
| Contractor appointed: | January 2008 | Autumn 2007 | Autumn 2007 | Autumn 2008 |
| Construction started: | Summer 2008 | Spring 2008 | Autumn 2007 | Spring 2009 |
| Construction ended: | Summer 2010 | Summer 2010 | Winter 2009 | Summer 2010 |

*Table 3: Case studies – initial comparison*

| **Case study:** | **Backhouse School** | **Eastwick Field School** | **St Augustine School** | **Lane Academy** |
|---|---|---|---|---|
| Procurement route: | Local framework agreement | BSF (LEP) | Direct capital grant | National Academies framework |
| Single/ Multiple: | Single project procurement | Multiple project procurement | Single project procurement | Multiple project procurement |
| Traditional/ D&B | Traditional to detailed design (RIBA stage E) then D&B | Traditional to outline design (RIBA stage C) then D&B | Traditional to detailed design (RIBA stage E) then D&B | Traditional to outline design (RIBA stage C) then D&B |
| Contractor: | Contractor 1 | Contractor 1 | Contractor 2 | Contractor 2 |
| Design team Knowledge of sustainability : | Little evidence of interest or knowledge | Evidence of high interest and knowledge (e) | Some, in particular from structural engineer (e) | Evidence of high interest and knowledge (e & s) |
| Stakeholder interest in social (s) and environmental (e) sustainability: | Some knowledge (e) from governors, notable lack of interest from council | Strong interest and motivation (e and s) from council, governors, school, and community | Some interest (e) and knowledge from client, a little from school (s) | Some interest from council (e and s) and school (s) |
| Client Experience: | Medium | Medium | Low | High |

### 3.2 Backhouse School

Backhouse School was initially procured as a traditional contract, with detailed design being

completed by the design team appointed through a local framework agreement with the council. The framework provided 90% of the business for the local office of this designer, and the designer was co-located in the council offices. Due to planning delays, the local authority procurement changed part way through, and at stage E the contract was re-let as design and build (D&B). There were no evident intentions towards sustainability in the Backhouse School, and no stated expertise by the designers, or the client, either at interview or in the early project documents. The council's lack of interest in sustainability issues was noted by several respondents.

The initial design was only required to achieve a desktop study for BREEAM, and this was carried out by the architect rather than by an independent assessor. Consultation during the design phase was imposed as part of the planning requirements. However the impact was negligible, partly because of the inaccessibility to the lay stakeholders of the technical drawings and room data sheets used, and partly due to the lack of motivation by the design team, the project manager suggesting that *'letting the school dictate what they want needed to be managed'*.

The planning authority also asked for 10% renewables, and the services engineer's report proposed energy-generating technologies such as solar photovoltaics. However the final choice was made by the client as ground source heat pumps (GSHP) on the grounds of cost. The services engineers then adjusted their original advice from the planning stage report to align with the client's choice. The school and governors were left baffled as to why they hadn't got solar panels, and concerned about rising electricity prices. Heat pumps had been discouraged by the 2007 DCSF report [10] in areas connected to the gas network, and further analysis showed that the likely effect was an increase rather than decrease in carbon emissions [17].

The original plans for a new school building at Backhouse School had been prompted by the arrival of a disabled pupil who could not access most of the building, but the final design met only the minimum requirements for accessibility.

### 3.3 Eastwick Field School

The Eastwick Field School was procured through BSF as one of the three 'reference' schemes for a group of six projects being carried out by the same council. In contrast with Backhouse School, there was considerable expertise and interest in sustainability by the council, school and architects, and a number of external sustainability advisors.

As a BSF project the DQI tool was a requirement. However, rather than encouraging open discussion, the school felt that the tool had limited the options discussed during feasibility stage and inadequately reflected their concerns. The school and council both made efforts to consult and engage with all stakeholders. However the confidentiality agreement during the design development stage, another aspect of the procurement process, resulted in restricting consultation to a narrow group of respondents. Consultation was only widened once the preferred bidder had been appointed, after all major design decisions had been taken. One commented that *'this is 'consultation' as window dressing; it seems to me too late to have any significant input'*.

The existing school had been built in the 1960s and now had a number of disabled pupils, and a key aspiration of the school was to make sure that 100% of the building was accessible. Attempting to resolve this issue in particular delayed Financial Close of the contract for eleven months, but without success. The early resolution of the BSF funding model appears to have caused the problem, with areas defined at feasibility stage as 'untouched' resulting in no funding for widening doors.

For the requirement to install 10% low carbon energy generation, the contractor encouraged the council to install a combined heat and power plant (CHP) linked to the nearby swimming pool. However although the evidence suggested this would have effectively reduced carbon emissions at feasibility stage a biomass boiler had been costed, and this was therefore what was installed installed, in spite of the discouragement of biomass for built up areas [10]. Again the early determination of funding combined with inadequate consultation seems to have limited choice.

One further effect of the BSF process had been to fragment the design process. The initial feasibility stage designers were not permitted to bid for the LEP contract, due to a perceived unfair advantage. A second design and build consortium carried out the next stage of design during the bid process. However when the contract, which was for three school projects, was won, the contractor did not have the capacity to deliver, and so passed the contract for this school to another contractor. The architect from the bid team stayed on the project, but the contractor brought in a new services engineer. The procurement process therefore led to three separate teams being responsible at different stages, the opposite of what was intended.

### 3.4 St Augustine School

The procurement route for St Augustine was relatively straightforward, a direct capital grant from the DfES to the client. While the clients for the other three projects were the local authorities, experienced in running large schools estates, this client was the relatively inexperienced Roman Catholic diocese. This led to a very different balance of power compared with for example the Backhouse School project, with the design team clearly having far stronger influence.

One result however was similar to the Backhouse School project, in the late appointment of the design and build contractor at RIBA design stage E. In this case this was the choice of the experienced project manager, his reasoning being to retain the detailed knowledge gathered by the design team of the existing building. The client accepted his advice in this and all matters.

The structural engineer also introduced at a late stage a major design change, from the existing steel frame construction to cross-laminated timber, with the expressed purpose of reducing the embodied carbon of the building. The use of cross-laminated timber (CLT) at St Augustine was highly innovative for the UK at this point in time, with only one other CLT school building under construction at the time. Its successful introduction, in such a traditionally conservative and risk-averse industry [19], was highly unusual, and appears to have been a lucky combination of circumstances including a strong design team, an inexperienced and accepting client, little in the way of requirements from the procurement route, and no risk-averse contractor involved.

Though only a good rating of BREEAM was required for this project, it achieved Very Good. 10% renewables were also not a specific requirement, but were installed even so. A ground source heat pump was again installed and as with the Backhouse School analysis suggests that this will have increased rather than decreased carbon emissions. In this case, though, the choice was made by the services engineer, with the approval of the client, the school bursar and of the architect. The school won a prize for sustainability from the Institution of Civil Engineers with particular mention of its embodied carbon. Perhaps even more tellingly, all those interviewed without exception expressed pride in the completed project.

### 3.5 Lane Academy

Lane Academy was procured through the National Academies Framework, through invited bids from integrated design and construction teams led by the contractors. Several weeks into the bidding process the bid manager decided to repeat the experience at St Augustine and redesign the school in CLT, selling it as a low embodied carbon material to the new client. The system had now been successfully demonstrated at one school, and the (far more experienced) local authority client was therefore prepared to accept it. Although the structural engineer from St Augustine was not part of the Lane Academy bid team the contractor appointed him, removing the previous structural engineer on the team. Again the balance of power was clearly determined by the procurement process being followed, in this case towards the contractor.

As for the BSF project, a requirement of the procurement process was the use of the DQI tool, but again it does not seem to have achieved much, with the client commenting that '*it was just a paper exercise'.* While two early consultations were also held, one with the staff and children, and one with the local community, a key omission was the head teacher of the existing school, who was excluded from input to the design and education briefs because the she had not yet been appointed Principal of the new Academy. Although there were then limited consultations during the

bid and design development stage, as for Eastwick Field a confidentiality agreement restricted participation.

In contrast to the St Augustine client, the local authority had put an extremely experienced project manager in charge of the contract, with a strong commitment to sustainability. She adjusted the standard Academies Invitation to Tender document to encourage a BREEAM rating of 'Excellent' rather than just 'Very Good'; the project achieved this, narrowly missing the higher 'Outstanding'. She also added a requirement to use the 'schools carbon calculator' to demonstrate 60% reduction of operational carbon emissions. The calculator appears to have led directly to the choice of a biomass boiler, with the fact of this impact commonly known. The view of the Sustainability Director of Contractor 1 was that the carbon calculator was *'…seriously flawed in that it is very difficult to get it to work if you don't use biomass*', and a CABE senior advisor admitted that '*to get their 60% reduction in carbon …normally they end up getting a biomass boiler because that seems to be the only option*.' The Sustainability Manager of Contractor 2 claimed that he knew of a number of schools which had therefore installed biomass boilers in order to get the '*sustainability points'* and had never switched them on, instead using the 'backup' conventional system which was a design requirement for all biomass boilers. However unlike the Eastwick Field School the Lane Academy does have the space for fuel delivery and storage, and although in a city is far closer to rural and wooded areas, so the choice was assessed as being more likely to reduce carbon emissions in this case. However a review of actual energy use and carbon emissions by the new academies demonstrated them to be 20% higher than the schools they have replaced [20].

### 3.6 Summary of the outcomes from the case studies

*Table 4: Case studies – summary of outcomes (see Moncaster 2012 for further details)*

| **Case study:** | **Backhouse School CS1** | **Eastwick Field School CS2** | **St Augustine School CS3** | **Lane Academy CS4** |
|---|---|---|---|---|
| Procurement route: | Local framework agreement | BSF (LEP) | Direct capital grant | National Academies framework |
| BREEAM rating: | Initial desktop study only | 'Very Good' | 'Very Good' | 'Excellent' |
| Low carbon technologies: | GSHP | Biomass boiler | GSHP | Biomass boiler |
| Likely impact cf with gas | Higher carbon emissions | Higher carbon emissions | Higher carbon emissions | Lower carbon emissions |
| Embodied carbon: | No consideration | No consideration | Reduced through use of CLT. | Reduced through use of CLT. |
| Likely impact cf with standard | - | - | Lower carbon emissions | Lower carbon emissions |
| Stakeholder engagement: | Poor | DQI used Medium | Medium | DQI used Medium |
| Disabled accessibility | An initial driver, but design limited to standard requirements | A key aim, but the project failed to deliver | Design limited to standard requirements | Full disabled access throughout the building |

## 4. Discussion, conclusions and acknowledgements

The paper hypothesised that the new procurement routes for schools, BSF and the Academies programme, with their stronger focus on stakeholder involvement and on developing integrated design and construction teams, would result in more sustainable schools. As sustainability is a diverse term, Government initiatives and publications were first reviewed in section 2 in order to identify their priorities over and above regulated requirements. These priorities were determined to be: high BREEAM rating as an indication of environmental impact, low carbon energy technologies leading to a reduction in operational carbon emissions, stakeholder involvement in design decisions, and disabled access. Consideration of embodied carbon was specifically excluded by

Government but identified as a concern of the construction sector, and so was also included.

From Table 4 and the descriptions of the case studies in the previous section it is clear that the answer to the hypothesis is not straightforward. Certain elements of the new procurement processes, as followed by Eastwick Field and Lane Academy, are shown to have had a negative effect on the stated aims. For example the main design development takes place during the bidding stage, which imposes a confidentiality clause and severely restricts stakeholder engagement. The DQI tool required by the new programmes appears to have been either poorly designed or poorly implemented, and to have had the effect of frustrating users rather than facilitating discussion. Disabled access, repeatedly a concern in the Government publications, remained a problem at Eastwick Field School where it was a key aspiration and need, due to both the limitations of the consultation process and to the calculation of funding at feasibility stage. BREEAM Very Good was achieved by Eastwick Field, and Excellent by Lane Academy. However Very Good was also achieved even though not a requirement at St Augustine. Procured through a direct capital grant, with an inexperienced client and a traditional split between design and construction teams, of all the projects this one produced the greatest sense of achievement for those involved.

The project at Lane Academy worked well partly because the client and contractor had a pre-existing healthy working relationship from a previous project – this was coincidental and independent of the National Academies Framework. However the framework agreement used at Backhouse School appears to have resulted in, rather than a positive working relationship, an imbalance of power in which the engineer was persuaded to rewrite their design advice to match the client's choice of low carbon technology. In the other two schools there had been no previous relationship between the client, designers and contractors.

The Government's focus on the use of low carbon technologies as a panacea to reducing carbon emissions appears to have back-fired, with three of the four schools likely to have higher operational emissions than if they had installed standard gas boilers. Although published Government advice suggested that the choices were wrong, in two cases the choice was made by the client based on cost rather than likely carbon reductions. The situation at Lane Academy was different, with in this case the team pushed towards the choice of biomass by the schools carbon calculator, possibly responding to hidden bias in the designers of the calculator.

The results of this paper suggest that while the Labour Government's aspirations for sustainable schools were worthy, they were not supported by the new methods of procurement. In particular:

- The long period of confidentiality during design development runs contradictory to the need for stakeholder involvement.
- Effective relationships between the client, contractor and design team do have positive benefits for the project; however these are not necessarily brought about by the new procurement processes, nor by the old framework agreements.
- The fragmentation between the design stages at Eastwick Field was a direct result of the procurement, and was harmful to the process and the outcome of the project

The paper concludes that procurement has a noticeable effect on the achievement of sustainability outcomes for building projects, and not always the effects which are intended.

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