NATIONAL AUDIT OFFICE

CASE STUDIES

Improving Public Services through better construction

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL | HC 364-II Session 2004-2005 | 15 March 2005

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Photographs courtesy of case study organisations and other departments featured in the report, Alamy.com, Imagestate and Jon Barlow.

INTRODUCTION

1 This volume of the report contains case studies of good construction practice drawn from both public and private sector organisations. The good practices that are identified in the case studies cover a number of approaches but they have all had an impact on enabling the organisations involved to improve their business efficiency and the quality of services they deliver to end users.

2 While the examples we give are specific, they draw on principles and practices that can be applied across the public sector. By successfully implementing these principles and practices of good construction, organisations in the public sector will be in a stronger position to improve the efficiency with which they operate their businesses and the quality of the services they deliver.

Case studies

3 The case studies of construction work across the public and private sectors were selected to represent different aspects of good practice which if departments implement will help them to deliver successful construction projects.

4 The case studies provide lessons for departments in the six key areas they need to address if they are to improve further their construction delivery performance:

- Establishing effective construction programmes;
- Developing and supporting capable clients;
- Basing design and decision making on "whole life value";
- Using the appropriate procurement and contracting strategies;
- Working collaboratively through fully integrated teams;
- Evaluating performance and embedding project learning.

CASE STUDY ONE

BAA Terminal 5

BAA has adopted a partnering approach to its Terminal 5 construction project taking ownership of all the risks to the success of the project and securing a commitment to continuous improvement from its partners

1 BAA owns and operates seven airports in the UK, and is the largest global airport operator. It delivers total airport management contracts, providing investment, expertise, and resources to develop and manage the airports – including both commercial facilities and operational functions.

2 One of BAA's UK airports is Heathrow – the busiest international airport in the world. Passenger numbers have grown steadily over the years (up by 3.7% in 2003) leading BAA to plan and start constructing a new terminal at Heathrow: Terminal 5.

3 The Terminal 5 project:

- Includes nine tunnel projects, two river diversions and a new M25 spur road;
- Has more telecoms and technology per square metre than the City of London;
- Is a major multi-disciplinary exercise drawing on civil, mechanical and electrical, systems, communications and technology contactors;
- Has highly constrained site access and working arrangements, between live runways, the M25 and existing terminal buildings;
- Has some 700 conditions imposed on it by the UK's longest planning inquiry.

Key Statistics

Total forecast cost of constructing Terminal 5	£4.2 billion
Current daily rate of spend	£3 million
Number of workers on site at peak of activity	6,500
Target date for first operations	30 March 2008

The Challenges facing BAA

4 The scale of the project means that cost over-runs could have a material affect on BAA's reputation, cash flow, balance sheet, and future viability. Similarly, delays are highly undesirable, given the rising trend in passenger numbers. This project is one of the most significant BAA has ever undertaken.

5 Site access is confined to one main route. Stringent traffic restrictions from the Planning Inquiry constrain traffic volumes and routes outside the site. BAA's view at the start of the project was that the then current best practice construction and project management techniques would not produce a successful outcome. Early planning work concluded that without a radically different approach the project would cost over £1 billion more than was affordable and would be delivered two years late.

6 BAA expects a high degree of design evolution during the project:

- First, the general pace of technology change means that new ideas and solutions will emerge from time to time during the project;
- Second, the operator requirements are likely to change, possibly in terms of security, space requirements, or facilities functionality;
- Third, in common with most major projects involving complex multi-disciplinary design solutions carried out in phases, it will naturally be some time before BAA is in a position to freeze the design of the final construction solution.

BAA's response to the challenges

Main principles

7 BAA's approach builds on the principles of the Latham and Egan initiatives, but goes further than any solution so far adopted in the UK. Two principles stand out:

- **The client always bears the risk**. Based on its experience of major recent projects, for example the Heathrow Expressway, BAA's view is that, no matter how the risk is apparently placed under different forms of contractual regime, the end result is the same: the client still bears and pays for risk. For example, in Design and Build contracts the client pays for the risk premium that the contractor naturally includes at the start and pays (often over-pays) for changes made to the scope during design and construction. In Construction Management contracts, the work is awarded in smaller "packages" once the scope has been developed and, whilst each is usually on a fixed price basis, the client bears the cost and timetable risk for the project in its entirety. In PFI contracts the client pays for the risk foreseen at the start and pays (again often heavily) for subsequent changes. BAA's insight, that the client always bears the risk and that it is not possible to displace this, underpins many of the innovations described below. BAA's aim is to identify the sources of risk, and then marshal and bring to bear the best resources possible into managing them.
- **Partners are worth more than suppliers**. The T5 project has a total emphasis on motivating, organising and generally getting the best out of the talented people working on the project - whichever organisation they belong to. BAA has developed an "Integrated Project Team Approach", also described below.

8 The challenges, and the two main principles described above, are producing interesting innovations and examples of best practice in the following areas:

- the form of contract;
- risk management;
- sponsorship and leadership;
- logistics management;
- insurance;
- approval process;
- teamwork.

The form of contract

9 "The T5 Agreement" is a cost-reimbursable[1] form of contract which ringfences suppliers' profits and where the client retains the risk. The contract focuses on the causes of risk and on risk management through integrated team approaches. The contract is drafted in a non-adversarial style.

10 BAA uses cost information from other projects, validated independently, to set target cost levels. If the out-turn cost is lower than the target, the savings are shared with the relevant partners. This incentivises the teams to work together and innovate. It is also the only way to improve profitability: all other costs, including the profit margin, are on a transparent open-book basis. BAA is aware of the financial risk that this approach creates, particularly with innovative or complex solutions where there is little or no relevant cost benchmark data. The risk is that the target cost is too high. BAA takes precautions against that risk by a combination of the following:

- Detailed "bottom up" cost analysis by independent consultants;
- Keeping options open for approval to proceed for longer, and working with more than one supplier in order to maintain competition.

1 Under cost reimbursable contracts the contractor is repaid all costs incurred plus a profit margin. The repayment mechanism varies, but is usually either based on evidence of costs incurred (receipts, wage slips) or on pre-agreed rates for specified activities.

11 The reimbursable form of contact means that there have been no claims for additional payments, and no payment disputes so far on the project. BAA's view is that the effort previously wasted on such activities is now being channelled into productive work rather than unnecessary legal activity.

Risk management

12 BAA's view of risk management is that "project management is a tool of the risk management approach, not vice-versa". Risk control ratings are set in the overall programme. These cascade through the project's management and translate into personal plans and objectives of all team members. As such, the data in the system tends to be meaningful and purposeful. The risk process identifies the "root cause" of each risk, enabling the risk to be managed in the most effective way **(case example A)**.

13 BAA recognises four levels of control risk. The aim is to keep all risks between level 2 and 3 in the following scale:

4 the solution does not manage the risk acceptably;

3 the risk is acceptably managed, but could be improved;

2 the risk management solution is optimal;

1 the solution exceeds the level of risk, and should be adjusted.

14 Critical risks are identified early on, and where appropriate the solutions are tested in advance to determine effectiveness **(case example B)**.

Sponsorship and leadership

15 BAA's approach to sponsorship and leadership is to have the T5 project managing director as an executive main board member of BAA. The project is regularly reported at that level, and receives frequent involvement and overt support from other board members. BAA regards active high-level project sponsorship and leadership as essential.

CASE EXAMPLE A

Thames Water runs a large strategically important Sewage Treatment works near the T5 site. Two T5 projects affected that facility – (a) some direct works at ground level, and (b) a tunnel passing immediately under the works. The risk management approach highlighted two root causes of risk in the direct works at ground level and in the tunnel. The answer was not obvious: the costs were significant and implementation of the solution at the live plant difficult.

The risk process generated options for mitigating the risk. These had different implications for the management of the two construction contracts, ranging from more stringent tunnelling requirements to carrying out additional civil engineering work at ground level. Ownership of the risk was complex, as it involved two separate projects. BAA generated risk response plans and identified the relevant skills and competencies. The risk review process highlighted the issue early on, and promoted constructive challenge and problem-solving. It allowed sufficient time for a third option to emerge involving a temporarily increased level of operational support by Thames Water during the period of risk, at a cost which was several orders of magnitude lower than any of the conventional engineering options.

CASE EXAMPLE B

An example of pre-emptive risk management

The T5 roof team, including the designers, suppliers and fabricators pre-erected the roof abutment structure off-site in Yorkshire to understand better the challenge in erecting the huge roof (which spans more than 150 metres). The pilot identified 140 significant lessons. Each had a risk mitigation plan enabling faster construction on site.

Overall, the project team estimates that at least three months have been saved by this pre-emptive risk management approach.

In this particular case, the time saved enabled delays that had previously arisen during the wet winter of 2001-02 to be recovered, and the project remains on track.

Logistics management

16 The access constraints into and around the site, and the confined working areas on the site itself, have led BAA to:

- Pre-assemble elements of the project in factories located, sometimes at some distance away from the T5 site. Some 70% of the Mechanical and Electrical engineering solution is manufactured off-site, compared with a more typical level of 20%. Entire steel reinforcement cages are pre-assembled off-site in dry factory-controlled environments and brought assembled onto the site.

- Build a railhead, and using that as the main means of bringing bulk material onto and off the site. The scale of the project, and the severe access problems and Planning Inquiry restrictions, warranted this investment which handles the equivalent of a lorry delivery every 30 seconds for 4 years.
- Use "demand fulfilment" software (usually found in manufacturing industries or car production lines), to make sure that the needs of the site are met on a "just in time basis", thus avoiding stop-start cycles, minimising site storage and waste, and creating safer working conditions.

Insurance

17 BAA took out project-wide insurance covering loss or damage to property, for injury, for death and also covering Professional Indemnity. Bulk-buying ensured the cover was in place and was tailored to meet the needs of the project. It reduced the costs of insurance, and avoided wasted effort and duplication on behalf of all the partners. Crucially, it placed the responsibility with BAA – who is best placed to manage the risk in the first place **(case example C)**.

Approvals process

18 BAA runs a five-stage approvals process, which is based on the changing level of risk during the development of each project. An important feature of this process is that BAA is prepared to move forwards into the next stage without having completed production design. This exercise of judgement by BAA's "intelligent client" team enables rapid progress based on a combination of fact and experience:

a Project registration – recognition that there is a problem to solve;

b Business case, responding to Stage A. Costs and timings are +/- 30%;

c Design brief, or concept completion. Costs and timing are +/- 15%;

d Approval to proceed, at which point the production design must be 80% complete;

h Handover to operations.

CASE EXAMPLE C

The Control Tower

During construction of the 87m high control tower it became evident that it was being built outside its tolerance. The causes were unclear. A combination of design, manufacturing and assembly challenges were possible reasons.

Rather than arguing defensively about blame and cost allocation, the clear confirmation from the project director that "this is BAA's problem, not the suppliers" enabled the entire integrated project team to concentrate solely on problem-solving.

The solution cost substantially less than would have been the case via the traditional adversarial routes, and delays were reduced to a minimum.

19 This is a relatively streamlined decision process, and reflects the more dynamic and interactive approach between design, procurement, logistics management and construction adopted by BAA compared with more traditional forms of procurement, as illustrated in **Figure 1**. Only clients who have a strong expert in-house capacity as an "intelligent client" should use this form of procurement and management.

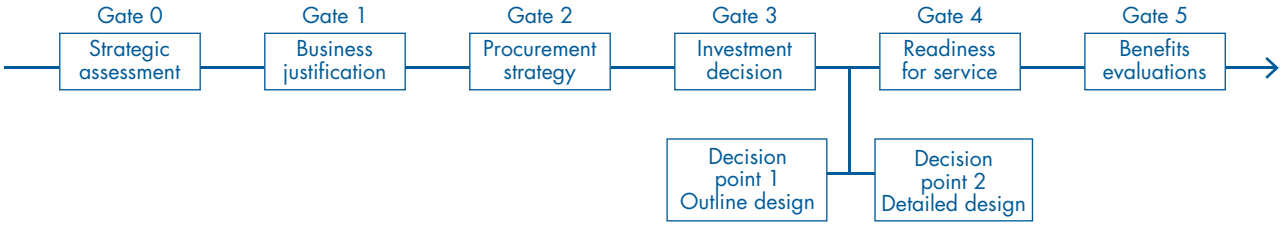
Teamwork

20 BAA's aim is to establish one common team, comprising people from BAA and different partner businesses, working to a common set of objectives. To do this:

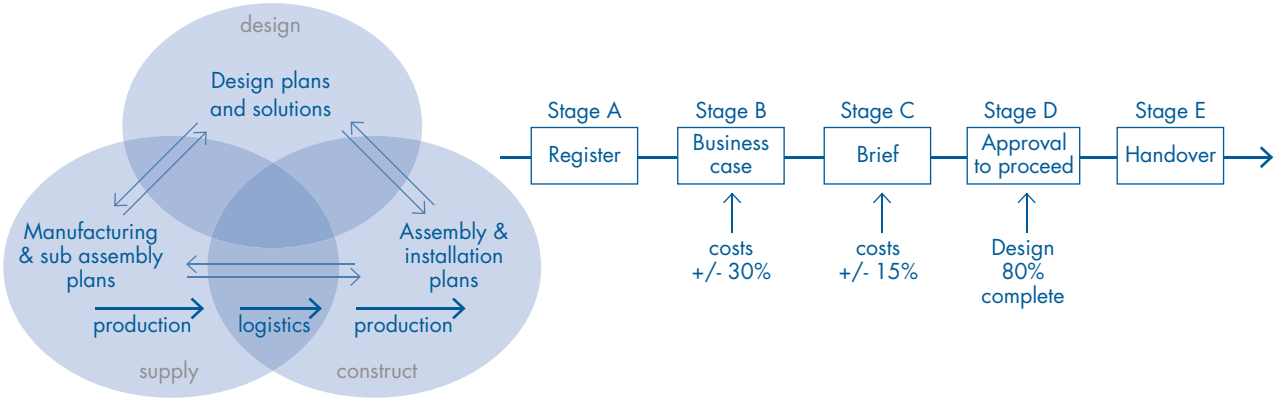
- **The T5 agreement** provides a mechanism for BAA to bring talented people into the project. The agreements with suppliers do not specify the work required, nor offer a commitment to a given level of work. They are a commitment from the partner and a statement of capability, capacity and scope to be provided from the partner organisations. This enables BAA to assemble project teams from expertise within the partner firms. The agreements with suppliers are procured in a way that is consistent with EU legislation.
- **The organisation structure** is based on delivery of products, not on the constituent partner companies. The products themselves are seen as operational facilities, not construction outcomes: "we are creating an operating terminal, not a set of buildings".

1 The Gateway and BAA processes compared

The Gateway process offers a more 'linear' series of control points in a project's life



The T5 approach enables supply and production to proceed concurrently with design



- **Team selection** BAA aims to pick the best people to suit the particular project needs, irrespective of their parent organisation. This is a highly sophisticated approach, requiring both judgement and experience of the "intelligent client". In terms of selecting people to be in the core BAA project team, which comprises 160 people, highly experienced and capable people are sought on the basis of merit from significant UK and international projects both from the construction industry and from other disciplines.
- **Collaborative project software** makes available important information such as the timetable, the risk reports, and the work scope to the integrated project team. The aim is to communicate openly in a timely way, and so reduce misunderstanding and delays.
- **Culture change** is seen as a vital, ongoing element of the entire project. Recognising that in the UK clients and contractors are not necessarily used to working in an open collaborative way, the project employs an Organisational Effectiveness Director who leads around 30 Change Managers in providing training and support in collaboration techniques and team-work, and support when teams face particular challenges.

Key Lessons

- **The client always bears the risk.**
- **Project management is a tool for risk and opportunity management and not vice versa.**
- **Put risk management activity in the hands of those best able to manage the risk, and adopt forms of contract that support a risk management approach.**
- **A collaborative, integrated working arrangement with suppliers has substantial benefits for all parties.**
- **Leadership and sponsorship at Board level is vital.**
- **Off-site prefabrication and assembly of elements of work leads to faster and safer construction and fewer defects.**
- **Seek excellent highly experienced people to work on major projects and minimise confrontation through establishing trust and openness in working relationships.**

CASE STUDY TWO

Blyth Community College

Blyth Community College was delivered to time and cost and provides educational and wider social benefits. Key factors in the success of the project include effective leadership from the outset and the collaborative team approach of the client, main construction and specialist supplier and specialist contractors.

1 Blyth Community College is Northumberland's first new high school for 20 years. The £15 million landmark design was created by combining the existing Tynedale and Ridley High Schools on one large site. The building includes state of the art IT facilities reflecting the increased use of technology within the curriculum. There is also provision for a learning centre that is open to the general public, a 400 seat multipurpose auditorium, sports hall, child care facility and food court. The College offers a programme which focuses on the performing arts.

2 The client on the project was Northumberland County Council, the contractor was MJ Gleeson, architectural partners were Waring and Netts, the mechanical and the electrical partner was White, Young and Green. The college is designed around "The Street" – a three storey high glass roofed centrepiece to the whole of the building which gives access to all subject areas.

3 The College opened on 1 September 2000 and in addition to its function as a "13-19" High School it also provides the bulk of adult education in Blyth and has the aims of raising aspirations and achievement and providing learning opportunities for the whole community.

Key Statistics

Total cost of construction:	£15 million (to budget)
Cost per sq m:	£1,003
Start of construction	April 2001
Completion of construction	August 2002
Opening of school	September 2002 (to time)
Maximum number of pupils	1,450

What Northumberland County Council wanted to achieve

4 Blyth is a socially deprived area with high levels of social exclusion where local schools were underperforming such that the two pre-existing schools were heavily under-subscribed and their academic results were worsening. This was epitomised by a low proportion of pupils progressing into the sixth form (around 30 per cent) and a high proportion of pupils leaving school with no qualifications. (15-20 per cent). To address these problems Northumberland County Council decided to:

- replace the two existing schools with a new flagship college;
- create a new building that would have a positive impact on its users and the wider community;
- incorporate a business-like feel to the building;
- integrate facilities within the college that the wider community would want to use.

How Northumberland County Council achieved its objectives

5 The client – Northumberland County Council – established a clear vision of what it wanted the new college to achieve and had clear ownership of the project from the start. The head of the college was able to use his long standing experience of the education sector to articulate to delivery partners how the school, if properly designed, could have a positive influence on its pupils and their education and the community more widely by acting as a tool of regeneration in the area.

6 The decision-making structure was led by a steering group which made the key decisions on the project. Below the steering group a core team was formed of all the delivery partners and the client who met at the earliest possible stage and then fortnightly onwards in workshops to ensure that everyone could be involved collectively in making decisions. The workshops had an external facilitator who defined clear rules of engagement between the different parties and ensured that all views were heard. The core team was empowered to make most of the day to day decisions on the construction project and with completely open discussions the team was able to discuss the cost implications and potential trade-offs in design decisions.

7 The project team worked closely throughout the design and construction phases of the project and developed positive relationships based on trust and a shared desire to overcome obstacles to the delivery of the building. The team was also flexible in that its members were prepared to change their views and priorities if others could identify better solutions. The team also worked closely with its key suppliers at an early stage to ensure that only the most capable individuals with the ability to work collaboratively would be involved in the project.

8 The college was procured through a guaranteed maximum price design and build partnering contract with the contractor putting together the team. The contract was operated on an open book principle, with a fixed six per cent profit margin which made it easy and quick to settle the final account. The partnering agreement included a system for sharing the risks and rewards with half of the savings being allocated to the client, 25 per cent to the contractor and the rest shared among the project consultants. Six key trade contractors were allowed to take any savings they made on their packages of work.

9 Where appropriate, additional experts were brought in to advise on key parts of the project's delivery. For example, an independent consultant was employed to assess all aspects of the furniture and fittings to determine whether they could be delivered to a better quality and for less money and information and communication technology experts advised on the most effective installation of a wireless computer network.

10 The early stages of the design process involved the local community. The design team led several public meetings and visited community groups throughout the area and a website was set up at the start of the project to invite comments and suggestions. The result of this approach was a planning application with no material objections.

What the construction project has achieved

11 Blyth Community College was delivered to time and cost and meets the expectation of students, staff and the community. The college is a Constructing Excellence demonstration project demonstrating good practice in sustainability, partnering and supply chain management.

12 The design and building of Blyth Community College has delivered a flexible teaching space in which conditions have been created to optimise the performance of pupils and staff. Teaching has become more straightforward, for example ICT can now be used in all classrooms because, in addition to conventional cabling in classrooms, the building is provided with wireless communication enabling laptops to be used anywhere. Every department has its own staff base to enable teachers to be dispersed throughout the building which has impacted positively on student behaviour. The building has been designed to have flexibility in its future use, for example there are no internal structural walls, few wall mounted radiators and "the Street" structure can be easily extended so that more classrooms can be created to cope with any increases in future demand for college places.

13 Educational standards are steadily improving. Fifty-two per cent of pupils are now staying on in to the sixth form compared to the previous level of 30 per cent. The downward trend in the number of pupils achieving 5 A* to C grades has now levelled off. Pupil attendance has improved and is now approaching the national average. Parental confidence in the college is increasing and fewer parents are sending their children elsewhere.

Key Lessons

- By having effective leadership right from the start of the project and throughout the course of its life Blyth Community College provides a high quality teaching and learning environment that reflects the needs and aspirations of its users. The head of Blyth Community College provided a clear vision of how he considered the school should be designed and constructed to optimise its contribution to improving educational attainment and also to deliver benefits to the wider community of Blyth. Given his educational experience the head was a highly knowledgeable and credible voice when articulating his views to those who were involved in the construction project, its teachers, pupils and the wider community.
- By forming at the earliest stage of the project a co-operative team comprising the client, the main construction supplier and a number of specialist contractors that was focused on achieving a shared objective all parties were better able to contribute to achieving the best possible outcome for the teachers, pupils and the wider community.
- By using a mechanism to share any savings on the project all partners had an incentive to work collaboratively to reduce costs.

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CASE STUDY THREE

Cambridge University's Approach to Construction

The support provided by the University's Estates Management and Building Services, as the "intelligent client", ensures that all projects, even those delivered by infrequent sponsors, receive professional project management support to reduce the risk of cost and time overruns.

1 The University of Cambridge is currently involved in the largest expansion of the University in its 800 year history. It delivers projects within a complex environment with multiple public and high profile private funding sources, an eminent and influential academic user community, and buildings ranging from the oldest and finest in the country to ultra-modern, sophisticated and cutting-edge, all set within an historic city location.

2 The University of Cambridge approach provides a useful model for infrequent sponsor departments in helping their successful construction procurement. The central estates function provides expertise to infrequent sponsor departments, establishes and supports a clear decision-making framework and process, and takes on responsibility for delivery after a project has been approved.

Key statistics on the University's construction programme

Value of current estate	£1,300 million
Value of construction programme	£570 million
Daily expenditure on construction	£500,000
Total number of staff and students	Over 26,000

3 Delivery to time, cost and quality depends on :

i **Following clearly defined roles for the University governance bodies, academic end users, and client representatives**

- Planning and Resources Committee: A committee of Council (the principal executive and decision-making body of the University), responsible for advice about major strategic matters and for the conduct of higher-level planning and resource management of the University, serviced by the Planning and Resource Allocation Office.
- Buildings Committee: A committee of Council which advises the Planning and Resources Committee on all matters relating to the operational estate and the buildings programme. Membership includes five lay members who are experts in the construction sector.
- Sponsor Department and Representative User: The Sponsoring Department appoints the Representative User, a senior member of the department, is the link between academic needs, the procurement team and the main contractors.
- Estates Management and Building Services: Acts as an intelligent and expert client, providing support for the sponsor and manages the contractors.

ii Committing to a clearly defined and well understood 'Capital Projects Process' for major projects (over £2 million) (**Figure 2**):

2

Stage	Planning and Resources Committee	Buildings Committee	Sponsor Department	Estates Management and Building Services
Step 1: Identify investment opportunity	**Project registration:** Monitor impact on current decisions, funding opportunities and wider strategy	Made aware of the project	Development of project and nomination of project sponsor	Advice on indicative building and running costs
Step 2: Produce concept paper	**Gateway 1:** Approval of concept and development costs	Awareness raised	Strategic concept, academic case, affordability, option and risk analysis	Estate implications, strategic options, outline programme, indicative capital and whole life costs, key building risks
Step 3: Produce full case	**Gateway 2:** Approval no/go	Review plans to ensure fitness for purpose and value for money	Full evaluation of costs, sensitivity analysis, project plan and sign off from the Head of Department	Procurement, design and construction strategy, discounted cash flow analysis
Step 4: Implementation	**Gateway 3:** Readiness for service	Oversight and sign-off of key project stages	Representative user involvement in key meetings and formal sign off of key project stages	Project management: in-house supplemented by bought-in expertise
Step 5: Benefits evaluation	**Gateway 4:** Post completion review	Review report; if appropriate, modify policies	Representative user participates in post occupancy evaluation	Post completion report 6-12 months after completion and post occupancy evaluation and user satisfaction survey 24-36 months after completion.

Key Lessons from the University's Approach to Construction

- The support provided by the Estates Management and Building Services, as the "intelligent expert client" ensures that all projects, even if they are produced on an infrequent basis by an academic department, receive professional project management support. This helps to reduce the risk of cost and time overruns on the project.
- The Buildings Committee and its membership provide internal and external construction expertise to the University. Their presence provides further assurance from a more strategic position to ensure that construction projects are appropriate, which reduces the risk of inappropriate projects being progressed.
- The process for taking decisions works because it is sponsored at the highest level and there is a rigorous budget and change control culture.
- The continued involvement of a senior user from the start of a project to its delivery, via the Representative User as the key representative of the sponsoring academic department, has provided a single liaison point between the end users, the Estates Management and Building Services and the contractors' teams. By adopting this approach the potential for confusing, incoherent and conflicting end user demands being placed on the contractors and designers has been significantly reduced.
- By using post occupancy reviews and user satisfaction surveys the Estates Management and Building Services can compare the actual performance of the building against that which was planned. Lessons can then be applied to future projects.

4 Two examples of where the University of Cambridge has delivered successful construction projects are its Centre for Mathematical Sciences, which was completed in December 2002 and the William Gates Building (completed August 2001) which provides flexible accommodation for the Computer Laboratory, the University's fastest growing department. Further details on these two construction projects are shown below.

The Centre for Mathematical Sciences

5 The Centre for Mathematical Sciences was a four and a half year project which was delivered within budget, to time and with high user satisfaction. It has enabled new academic initiatives not possible at the old site, and the retention and attraction of recognised world leaders in mathematical sciences.

6 As it was assumed it would take 10 years to raise the funds, the project was delivered in three phases **(Figure 3)**. The first involved a traditional single tender contract competitively awarded on lowest cost. The next two phases of the project involved a shift to two stage tendering and selection based on value for money leading to improved construction performance.

Key statistics on the Centre for Mathematical Sciences

Total cost of construction	£64 million
Cost per sq m	£3,175
Start of construction	May 1998
Completion of construction	December 2002
Staff and students	1,012
Awards	British Construction Industry (BCI) Best Major Project 2003
	RIBA Award 2003
	Royal Fine Art Commission Trust Specialist Award 2003
	David Urwin Design Award 2003

Key Lessons from the Centre for Mathematical Sciences Construction Project

- **By using integrated team working approaches, supported by New Engineering Contracts/Engineering Construction Contracts, which are non-adversarial and which promote good project management, issues could be resolved promptly and successfully.**
- **By using a structured approach enforced by the Estates Team, users were involved at appropriate points, leading to a high degree of satisfaction with the completed project.**

3

Contract 1 (1998)

Traditional single stage tender awarded on lowest price.

No contractor involvement in design.

Cost and time overruns with buildings containing many defects and relationships with the contractor strained.

Cost: + 2%

Time: 8 weeks late

Client satisfaction: 6/10 (post-project completion review six months after practical completion).

Contract 2 (2000)

Two stage tendering process (JCT98 contract).

Contractor involved in design.

Effective teamwork.

New contractor so limited lessons learnt from repeat work.

Cost: + 0%

Time: On time

Client satisfaction: 7/10

Contract 3 (2002)

Two stage contract (New Engineering Contract), with a professional services contract used for the first stage and the contractor and principal sub-contractor involved in the design.

Selection on transparent criteria (30% quality: 70% price balance), with the original contractor re-engaged and so lessons brought to bear along with effective teamwork.

Changed user move dates successfully met.

Cost: - 3%

Time: On time

Client satisfaction: 9/10

The William Gates Building

7 The William Gates Building is the first standard-setting development at the University's new West Cambridge campus, providing flexible accommodation for the Computer Laboratory, the University's fastest growing department. Key to the project was achieving a good value building to a tight budget and timescale, with sustainability and low energy usage being important requirements.

8 Delivering Sustainability. The University sought a building that would be sustainable, based upon an energy efficient design given its planned use, low whole life costs, highly adaptable work space, and the consideration of the wider impact of the building in its environment.

9 Energy Efficiency and Whole Life Costs. A key aim for the Gates project was to deliver a building where whole life costs were minimised **(Figure 4)**. The design incorporates the following features, each of which aim to increase energy efficiency and therefore reduce whole life running costs:

- Extensive use of natural rather than mechanical ventilation and the recycling of surplus heat generated by the computers as heating during cooler periods;
- Insulation in excess of current building regulations;
- The building's energy consumption was used as a low energy benchmark for computer buildings. The chart and table below shows how the building compares with other computer laboratory space in more conventional buildings, and how its usage costs compare with the rest of the University.

10 Space Adaptability. Internally, the building is designed to allow the layout to be changed easily. Ceilings are high, permitting easy installation of further services. The floors are designed to allow up to a 200 per cent expansion of data cabling. Such provisions will allow the building to be adapted quickly and cheaply should the Department's requirements change in the future.

11 The Wider Impact of the Building. As the first building on the West Cambridge site, the University has given careful consideration of the interaction of the building with its environment and users. In particular, a sustainable transport strategy has been implemented, focusing on limiting car movements. This is achieved through the limited presence of car parking at the building, the provision of cycle and pedestrian routes, the UK's first "park and cycle" scheme, a new bus service linking the site to the city centre, and the provision of affordable housing close to the site allowing people to commute without a car.

Key statistics on the William Gates Building

Total cost of construction	£21.8 million (to budget)
Cost per sq m	£1,810
Start of construction	February 2000
Completion of construction	August 2001 (to time)
Staff and students	450
Awards	Royal Institute of British Architects (RIBA) Sustainability Award 2002
	Highly Commended in the British Construction Industry (BCI) Awards 2002

Benefits Delivered

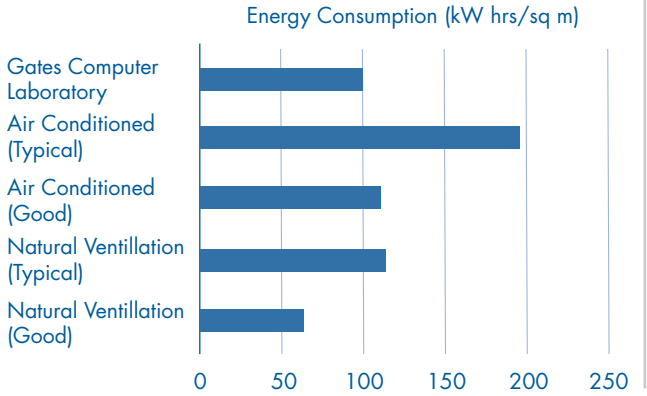
- A building which is considerably more energy efficient than others with a similar function, which will result in a relatively low whole life cost;
- A highly flexible space which can be altered easily and cheaply as needs change;
- A building which is sympathetic to its environment and one which supports more environmentally sensitive transport policies;
- A building whose design encourages social interaction between students and teaching/research staff.

Key Lessons from the William Gates Building Construction Project

- By focusing on issues of sustainability and flexibility at the design stages of the construction project the University was able to reduce the whole life costs of the building by incorporating features that would allow for the layout to be changed easily and cheaply and for energy efficiency to be increased.
- Having a clear understanding at the design stage of how the building should have a positive impact on its end users allowed the University to deliver a building that encourages social interaction between students and teaching and research staff.
- By investing time and resources at the design stage the University was also able to deliver a building that was sympathetic to its environment and which could support environmentally sensitive transport policies.

4

1 - Comparison of the Energy Consumption of the Gates Building to other typical buildings



2 - Comparison of the annual running costs of the Gates Building to the wider University (based on the first three years of operation)

Cost per sq m (net useable area)

	Gates Laboratory average £/sq m	**University average £/sq m**
Utilities	10.5	15.2
Maintenance	2.4	23.6
Total	**12.9**	**38.8**

NOTE

The Gates Building shows relatively low energy consumption per sq m compared to other computer laboratories and offices ([Fig i]. Its running costs per sq m compare favourably with the wider University of Cambridge estate [Fig ii].

CASE STUDY FOUR

Defence Logistics Organisation Offices

Defence Estates worked collaboratively with the Defence Logistics Organisation through fully integrated teams to reduce the costs and improve the quality of the project, and by using a single project bank account secured the timely payment of all parties in the supply chain despite the main contractor going into administration for a brief period. In 2003, the project won the British Institute of Facility Management Best PFI/PPP Award.

1 The Defence Logistics Organisation Offices at Andover North was the first major capital prime contract to be let by the Ministry of Defence (the Ministry). The £40 million development accommodates new offices for the Defence Logistics Organisation (DLO). The construction project has resulted in the DLO having a Headquarters building that contains 17,300 square metres of office space; 4,200 square metres of technical accommodation which provides test and evaluation facilities; 3,800 square metres of mess facility and ancillary buildings such as a gatehouse, nursery, sports facilities and over 640 car parking spaces.

2 Key to the success of the project and achieving the required financial performance was the development of effective collaborative working between those responsible for delivering the project. This involved a more equitable sharing of risks and rewards and the adoption of a less adversarial approach to working relationships. The scope of the project involved the prime contractor maintaining the building fabric and engineering services for six and a half years after its completion.

Key Statistics

Total cost of construction	£40 million (to budget)
Start of construction	July 2001
Completion of construction	October 2002 (to time)
Number of staff	850
Awards	Building Research Establishment Environmental Assessment Measure Rating of "Excellent"

Developing a single team

3 From the outset, those involved in delivering the construction project, made up of the prime contractor (CITEX), specialist contractors and the client formed a single team. The project was consultant-led by CITEX who assembled and managed a virtual organisation made up of:

- CITEX – prime contractor;
- Pearce Construction and Thomas Vale – lead organisations for construction;
- SEC – lead organisation for mechanical and electrical work;
- Percy Thomas – architect and lead organisation for design;
- URS Thorburn Colquhoun – structural engineering;
- Hoare Lee and Halcrow – services engineers;
- Hyder – infrastructure design.

4 The main parties involved in delivering the construction project developed and agreed a project charter which detailed the key objectives of the project. The document was backed up by an Integrated Project Agreement which all parties signed. The Agreement set out how the parties would work in partnership together. It defined the responsibilities of each organisation, how risks and rewards would be shared and authorised and defined the authority of a joint steering committee to oversee the progress of the project. All parties were considered to be equal players who were to operate in a non-hierarchical structure. This approach helped to minimise the risk of adversarial relationships developing in the way that had blighted previous construction projects.

5 The management of both the client and the prime contractor formed an integrated team which was co-located on site. Decisions about the project were made jointly and where disagreements occurred both sides worked pro-actively together to resolve them without recourse to more formal contractual remedies.

Integrating the supply chain

6 One of the main drivers with prime contracting is developing and working with an integrated supply chain, and the approach developed for the DLO Headquarters provided for integration at all levels. The core team for construction (Pearce Construction and Thomas Vale) and mechanical and electricals (SEC) already had their own well developed supply chains but all supply chain members chosen for the project were pre-qualified, irrespective of whether they existed or were new. This process involved the completion of a questionnaire, briefing meetings and workshops plus a final interview. The members of the supply chain were actively involved in the design development and value engineering workshops to ensure that their buildability knowledge and technical expertise was used in the decision-making process in order to optimise the through life value for money of the project.

7 The approach to integrating the supply chain relied not only on identifying and working with those organisations who had the aspiration and means to work collaboratively but also those individuals within the organisation who were best able to do so. The project had its own Project Board, made up of director representatives from each core team organisation which met on a monthly basis to review and resolve key project issues. All decisions were made democratically and no single organisation held a casting vote.

Sharing risks and rewards

8 At the outset all parties took the decision to share the risks and rewards that would be involved in delivering the whole of the project, not just its individual parts. In effect there was shared responsibility across the core team regardless of where a problem originated. This agreement was underpinned by all parties having a clear understanding and agreement on the target cost for the project and, as margins were ring fenced, the proportion of the final profit they would receive. The Ministry would receive 70 per cent of any underspend with the remaining 30 per cent being divided between the prime contractor and other parties involved in the construction projects in agreed proportions. If the cost of the project exceeded its target cost the Ministry was protected against having to make any additional payments.

9 To support the approach of sharing the risks and rewards of the project all parties agreed there would be a working culture that was free from blame and that no claims would be made against each other. Conversely this increased the possibility that the rewards due to organisations delivering a high standard of performance could be adversely affected by others performing less well within the supply chain.

A single project bank account:

10 Defence Estates was concerned to ensure the timely payment of all parties working in the supply chain to manage the risk that the prime contractor might unfairly withhold payments from subcontractors. A project bank account was set up in trust for the whole supply chain and payments from it needed the authorisation of the client and the prime contractor. Defence Estates also had the ability to audit the account. Interim applications for payment were put together by the supply chain and interim payment was certified by Defence Estates and the allocation of payment was agreed on the basis of principles which had been agreed by all those involved in the supply chain. The payment schedule was then certified by the client and prime contractor. Once Defence Estates had advised its finance department of the amount to be paid into the project bank account a signed payment breakdown analysis was forwarded to the bank and the bank would then distribute monies to the supply chain without delay.

11 Not only did the use of a single project bank account help to ensure the timely payment of all parties in the supply chain it also protected the Ministry against unforeseen circumstances. CITEX, the main contractor on the project, went into administration and the funds within the bank account were claimed by the administrators as a CITEX asset. Had the funds from the project bank account been taken by the administrators there would have been no funds to pay the supply chain and the success of the project would have been placed in jeopardy. The legal position was, however, a clear one. The project bank account had been set up in trust for the supply chain of which CITEX was only one member. The account could not therefore be claimed as a CITEX asset and it continued to be operated for the benefit of those working on the project by Bucknall Austin, the successor organisation to CITEX.

Approach to sustainability

12 Defence Estates used the Ministry of Defence's policy on environmental impact and sustainability as a benchmark and then strove to achieve a more. A specialist sustainability consultant was employed to advise and audit the designs and works, not only in terms of functionality and efficiency but also the whole life costs of the materials selected. The target was to achieve a "very good" Building Research Establishment Environmental Assessment Measure rating but the project secured "excellent". Particular strong examples of the measures adopted are:

- recycling the demolition material and incorporating them in the works;
- using natural materials, from proven sustainable sources in construction;
- low energy, intelligent light fittings;
- on-site cycle and pedestrian routes linked to the local transport infrastructure.

What the Ministry's approach delivered

13 The approach taken to the construction of the DLO Offices resulted in the project being delivered to time and to cost and resulted in a Building Research Establishment Environmental Assessment Measure Rating of "Excellent".

14 By having the prime contractor responsible for maintaining the building fabric and engineering services for six and a half years after the completion of the building there was a smooth transfer from the construction phase to its occupancy and use. There was an opportunity for the client and prime contractor to assess together how effectively the design of the building was working and, where there were technical problems, there was a single point of responsibility to identify potential solutions.

Key Lessons

- **By working collaboratively through fully integrated teams to reduce costs and improve quality the Ministry and its partners were successful in understanding and agreeing at the outset of the project what they expected from each other; how their working relationships would operate and how risks and rewards would be shared. By agreeing to share the risks and rewards from the whole of the project, rather than its individual parts, all parties were incentivised to identify the most effective approach to working together.**
- **By using a single project bank account Defence Estates was able to ensure the timely payment of all parties working in the supply chain. This mitigated the risk that the prime contractor might unfairly withhold payments from subcontractors. In addition the single project bank account helped to protect the Ministry and the project from financial failure when the main contractor went into administration.**

CASE STUDY FIVE

Department for International Development

The Department completed a successful refurbishment of its headquarters as a result of having effective leadership throughout the life of the project and an appropriate procurement strategy. After the project was completed the Department evaluated its success.

1 The Department for International Development (the Department) relocated its London offices from 94 Victoria Street to a newly refurbished building located at 1, Palace Street, previously occupied by the Foreign and Commonwealth Office. The project was successfully completed on time, within the agreed budget and without significant defects in November 2001.

Key Statistics

Total cost of refurbishment	£27 million
Start of refurbishment	July 2000
Completion of refurbishment	November 2001
Planned occupancy	850

The problems facing the Department

2 The lease on the existing building was coming to an end and the leaseholder wanted to redevelop the site. The Department had a fixed date of November 2001 by which time it had to relocate its offices and staff prior to the lease running out on its Victoria Street offices.

3 Palace Street was not the original favoured option for the relocation of the Department. It comprised four buildings of varying age and style, including a Grade II listed hotel, which had to be amalgamated into a single building. In addition, the initial brief envisaged that the building would require minimal work but detailed investigation works and surveys showed that a greater scope of work would be required.

4 The Department required the design of Palace Street to facilitate this change in its working culture; for example by introducing flexible open plan office spaces. The focus of the Department's work was shifting from providing aid for specific projects to influencing the policies of governments and other major players around the world. One consequence of this change was that the Department would need to bring together staff with the relevant expertise and experience from different sections of its organisation to work more collaboratively with multi-disciplinary teams on both short and longer term projects.

How the Department tackled the problems it faced

5 Given that the build programme had to be completed by November 2001 it was essential for the contractor to undertake extensive surveys prior to the commencement of the works. A two stage design and build route was selected and helped to create an integrated approach; allowed for the early procurement of plant and labour as well as allowing the issues relating to the project to be fully considered through the early involvement of sub-contractors.

6 The early involvement of Turner and Townsend (project managers) and Wates (main contractors) allowed the design brief to be developed to take into account the scope of the changes required. As the structure of Palace Street placed limitations on the construction programme and the project had to be completed by November 2001, the design brief focused the scope of the work on key aspects of the construction project to ensure that these were completed as an absolute minimum.

7 An integrated approach was adopted by those working on the project and team structures were very clear with well defined roles and responsibilities. This approach helped those involved to identify how the whole life costs of the building could be reduced. For example by bringing forward the date for an upgrade in IT equipment to reduce the amount of heat that was generated by computers a smaller and less expensive cooling system could be installed.

8 Members of the Department's senior management had an understanding of how the new building could facilitate the change in working culture they required and recognised that the refurbishment would provide them with an opportunity to get more from staff resources. Senior management provided support for the building project during its lifetime and communicated to staff how the building would contribute to making their daily working practices more effective.

9 The Department consulted widely within the organisation to secure support from its staff for the adoption of a building incorporating open plan workspace. Through its consultation it was able to identify the impact that open plan would have on the Department's work and how the design of the building could be used to overcome any problems. Staff were keen for example, that the new accommodation should have sufficient rooms in which they would be able to hold private meetings and space for quiet thinking.

What the Department's approach has achieved

10 The approach to designing and constructing 1, Palace Street resulted in its completion to time, cost and quality. The design of the building allows the Department to carry out its work more effectively. The open plan workspace for example, now allows the Department to operate more flexibly when it has to form teams made up of individuals with different skills and experiences from around the organisation. The new building also provides better communication links such as video-conferencing and for the first time provides a worldwide communications system to its offices based overseas.

11 The new building has provided an opportunity for the Department to reduce the environmental impact of its operations. It has been fitted with a number of features designed to minimise resource use and pollution, such as automatic sensors instead of light switches, energy efficient boilers, and carpets and ceiling tiles made from recyclable materials. The new building received a favourable rating under the Building Research Establishment Environmental Assessment Measure.

Key Lessons

- The project's success was helped by having effective leadership throughout the course of the project. Senior management had a clear understanding of how the building would be able to improve the business effectiveness of the Department.
- By selecting a two stage design and build approach the Department was able to involve sub-contractors at an early stage to identify the most effective way of progressing the project.
- The Department evaluated the performance of the construction project. Shortly after the Department moved into Palace Street it held a Post Project Review Workshop to review the completed project through the various stages from inception to completion and to identify both the successful and less successful aspects of the process. Those involved included representatives from the Department, Turner and Townsend, Wates Construction and the Office of Government Commerce. The following key learning points were identified:
  - One of the key reasons for the success of the project was that where access was possible surveys were undertaken prior to the commencement of the project;
  - The functions of design elements should be identified prior to looking at detailed solutions;
  - The daily involvement of the client facilitates the effective management of risk;
  - A formal cost reporting process during the development of the scope of the works enables the impact of change to be identified and assessed;
- The successful partnering approach taken by all parties on Palace Street should be adopted by all parties on future projects.

The challenge for the department is to embed these lessons in its future construction projects.

CASE STUDY SIX

Kingsmead Primary School

By focusing on whole life value and working closely together at an early stage the project team was able to deliver a building that provides a high quality teaching environment with comparatively low running costs.

1 Kingsmead Primary School is located in Northwich, Cheshire. The construction project to design and build the school was delivered through a partnership of Cheshire County Council; Willmott Dixon; White Design; Mander Structural Design; Arups and Mitie Engineering. The school is part of the Department for Education and Skills' "Schools for the Future Agenda" and the Rethinking Construction Programme.

What Cheshire County Council wanted to achieve

2 The client, Cheshire County Council, had four key objectives for the construction project to deliver Kingsmead Primary School:

- to provide a 210 place primary school on a new housing development in Cheshire;
- to produce an exemplar project of sustainable construction and collaborative working;
- to enhance the teaching and learning environment for pupils and staff alike to support to Government's "Sustainable Development Action Plan for Education and Skills";
- to stimulate design options for future construction developments in Cheshire.

Key Statistics

Total cost of construction	£2.4 million (to budget)
Cost per sq m	£1,500 (similar to the average cost per sq m for other exemplar schools)
Start of construction	October 2003
Completion of construction	July 2004
Opening of school	September 2004 (to time)
Maximum number of pupils	210

What Cheshire County Council did to achieve its objectives

3 Cheshire County Council and its delivery partners made their key decisions based on the whole life value that Kingsmead Primary School would deliver. The Council had a clear objective of what they wanted the school to deliver in terms of its ability to operate to the highest environmental standards and ensured that its design and construction was based around the principles of reducing the whole life costs of the building rather than achieving least cost at the construction stage. The Council also recognised that by investing time and money up front in getting the design right they would be better able to deliver a school that provided an effective teaching and learning environment.

4 The delivery partners worked closely together through fully integrated teams and showed a continuous commitment to improve the quality of the completed construction project. By establishing close working relationships between the client, the main construction supplier, and a number of specialist contractors at the crucial, early stages of the project the following benefits were delivered:

- At the outset Cheshire County Council was able to communicate clearly to its main contractor and others working in the supply chain the key objectives it wanted the school to achieve;
- All parties were able to identify the opportunities to take a more creative and innovative approach to designing and constructing the school so that the quality of the final building was maximised;
- Through regular meetings of all key members of the project team at the design stage, all parties including the County Council, the contractor, and the architect could quickly identify and resolve problems and assess proposals that might add value to the design of the school and where appropriate, incorporate them into the design;
- Strong working relationships based on trust and openness were established between all key parties which helped to reduce potential confrontation and led to greater predictability of the cost, time and quality of the project.

What the construction project has achieved

5 The design and building of Kingsmead Primary School has delivered a flexible teaching space in which conditions have been created to optimise the performance of pupils and staff. For example:

- The building is fitted with internal and external sensors to detect temperature, humidity, sunshine, rain and air movement. These are connected to a building management system which automatically opens and closes windows, sky lights and blinds, allowing fresh air to flow through the building and providing shade for pupils where necessary.
- All classrooms are square in plan and have loose desks and chairs, which can be arranged for any class size or mode of teaching. In IT classes all the laptops and personal computers supplied to pupils can connect wirelessly to the internet through the school's IT network.
- Four of the classrooms are paired on either side of a folding acoustic wall, which offers high sound insulation when locked into position but can be folded away on an overhead track to encourage classes of different ages to mix.

6 Kingsmead Primary School is a good example of how a school has been designed and constructed to respond to the Department for Education and Skills' desire that all publicly funded educational establishments should operate to the highest environmental standards. Although the costs of constructing the school exceed those of other similar sized primary schools (though not other exemplar design schools) its sustainable features were designed and constructed in such a way that they are planned to reduce utility and maintenance costs by some 50 per cent of those of conventional new school buildings. Strong examples of how this has been achieved include:

- The north facing orientation of the building avoids the need to manage unwanted heat gain in the summer. Windows have been sized and located to ensure that the use of artificial light is minimised.
- The school is designed to minimise energy consumption. There are high levels of insulation within the building fabric and a gas condensing boiler, which is significantly more efficient than a conventional boiler, provides heat during periods of low demand. A wood burning boiler satisfies higher demand by providing up to 60 per cent of the overall heating requirements of the school. The school currently uses wood pellets in the boiler but is proposing to move to locally produced wood chip and may eventually grow its own fuel on site. By minimising energy consumption the running costs of the school have been reduced which in turn allows more money to be spent on books, computer equipment and other teaching materials.
- Where possible the building uses sustainable materials and construction techniques to ensure it minimises the amount of energy used both in its construction and at the end of its life when it is dismantled and recycled. The roof has been designed in a "V" shape so that all of the rainwater that falls on the roof can be collected and used to flush toilets and urinals, reducing the demand for mains water. As a result of its design the roof also requires no gutters and fewer down pipes than a traditional roof.

7 Kingsmead Primary School has been used as a Constructing Excellence demonstration project and has been adopted as an exemplar school by the Department for Education and Skills.

Key Lessons

- **By focusing during its design and construction on the whole life value that Kingsmead Primary School could deliver, Cheshire County Council has delivered a building that provides a high quality teaching and learning environment with comparatively low running costs. By working closely at an early stage the client and its delivery partners were able to establish a clear shared objective of delivering a school that would operate to high environmental standards and provide an environment in which teachers and pupils could thrive.**
- **By forming a co-operative team at the outset of the project comprising Cheshire County Council, the main construction supplier and a number of specialist contractors, all parties were better able to identify the opportunities to take a more creative and innovative approach to the design and construction of the school so that the quality of the final building could be maximised. The strong working relationships that were based on regular communication between all the parties involved in the design and construction of the school led to a greater predictability of the cost, time and quality of the project.**

CASE STUDY SEVEN

NHS ProCure21 and Milton Keynes Treatment Centre

The ProCure21 approach provides highly effective central facilitative expert support for infrequent and inexperienced clients in NHS construction

1 The NHS has a range of building types and sizes, including hospital developments, primary care centres, and diagnostic and treatment centres. The NHS is a large procurer in absolute terms, but individual NHS Trusts typically procure on an infrequent basis. As such, for larger capital schemes, many NHS Trusts are inexperienced clients, and in the past have experienced unwanted cost and time overruns on projects leading to a range of adversarial behavior and situations.

CASE EXAMPLE D

In 2002 the entire Accident and Emergency department of Sandwell General Hospital was destroyed in a fire. Eight days after the disaster, Interserve Health was selected as the ProCure21 Principal Supply Chain Partner to rebuild the department. Without ProCure21 the Trust may have had to wait months before being able to appoint a design team because of the need to comply with the OJEC tendering process. An emergency procedure could have been used, but it would not have involved any element of competition.

2 In response, NHS Estates developed ProCure21, an initiative to help NHS Trusts deliver better buildings, on time, at lower costs, more rapidly and more safely than before. The initiative seeks to improve the construction process through the creation and support of long-term supplier relationships and integrated teamwork; and provides the client, who may be inexperienced at construction, the support to deliver a successful project. The main features of the ProCure21 approach are:

- **Creation of 12 principal supply chain partners:** the supply chain partners have been chosen following a thorough selection process, fully compliant with EU rules and based on an economic test. This test will be used throughout the life of the framework to determine one aspect of value for money. The client chooses from this pre-selected list of supply chains, which precludes the need for competitive tendering at the local level and accelerates the pre-construction phase **(case example D)**. NHS Estates subject each supply chain partner to an annual assessment to see whether they are adhering with the fundamental principles of the ProCure21 approach. Ultimately if a supply chain partner fails to deliver, or to operate in accordance with the ProCure21 principles (or to improve their performance), it may be removed from the framework.

- **Encouragement of partnering approach:** to support integrated and collaborative working ProCure21 uses the Engineering and Construction Contract. The client and supply chain agree a guaranteed maximum price, working to agreed margins with full open book accounting procedures in place, which builds trust, helps to overcome the adversarial approach to construction and leads to rapid conflict resolution. The guaranteed maximum price can only be adjusted for a compensation event such as extra work required by the client, similar to a variation in other standard contracts. Should the supply chain, however, incur additional costs in excess of the guaranteed maximum price the contractor has to meet these. Should the guaranteed maximum price be bettered, the savings are shared equally between the client and the contractor.
- **Regional policy advisers:** who meet with the client at the earliest stages in procurement to influence and develop their thinking, assess their expertise and to provide training and support throughout the process. ProCure21 is a radically different procurement approach compared with traditional methods and demands a culture change within Trusts. Implementation managers support both the Trust and the principal supply chain partners in this transition.
- **Accredited project directors:** all ProCure21 projects have a project director who provides clear leadership to the scheme and possesses the strategic and project management skills to create the "expert client". NHS Estates has developed a training programme to ensure project directors are suitably equipped to manage a ProCure21 project and to help build capacity throughout the NHS. A register of accredited Project Directors has been established.
- **Design champions:** at the NHS Trust and Primary Care Trust level to ensure design issues are considered throughout the procurement process. Each supply chain has a nominated design champion whose responsibility is to ensure good, appropriate design is delivered to the client.
- **Equipping the team:** provision of the Building on Partnering Toolkit. This comprises the Achieving Excellence in Design Toolkit (AEDET), NHS Environmental Assessment Toolkit (NEAT) and a Diagnostic and Risk Tool (DART). They help the client determine and specify their design objectives to develop a full business case; to identify and mitigate construction risks, and to ensure that high quality design and whole life costs are considered.
- **Comprehensive and ongoing benchmarking:** to assist in delivery of projects to time, cost and quality, including use of the Construction Industry Key Performance Indicators and national construction indices, with lessons learned on one project shared across all the supply chains.

3 The use of appropriate techniques, such as the Achieving Excellence in Design Toolkit and the Diagnostic and Risk Tool, during the pre-construction phases of the project enables all parties to be confident in agreeing the Guaranteed Maximum Price and timescale before the contract is signed. The Guaranteed Maximum Price places the client in control, and should further work be required it can be obtained at a known cost and time scale and in a controlled manner. The ability to deliver to time and cost helps reduce the risk of adversarial behaviour and the associated delays and waste.

4 The NHS launched ProCure21 nationally in October 2003. Eight of the 171 schemes registered so far have reached completion. The ProCure21 team estimates that cost savings of around 10 per cent are achieved compared with conventionally constructed schemes, and that schemes constructed via ProCure21 are taking up to 12 months less than conventionally procured projects to start building on site.

Milton Keynes Treatment Centre

5 Milton Keynes General is an NHS Trust hospital. It occupies a 16 hectare site to the south of the centre of the city. Opened in 1984, the hospital serves the population of Milton Keynes and surrounding areas and it provides the full range of services normally associated with a district general hospital.

Key Statistics

Total budget for construction	£12 million
Forecast cost per sq m	£1,987
Start of construction	August 2003
Estimated completion of construction	May 2005

6 It gained NHS Trust status in 1992 and the site has grown over the years. A two-storey building housing a 26-bed ward and Breast Screening Unit opened in the summer of 2002. An extension to the Children's Ward to house a GP referral unit and assessment centre, and a new 28-bed ward and patient Transit Lounge both opened in June 2003.

The challenge facing the Trust

7 The Government's stated policy of reducing waiting lists, combined with population expansion of approximately 3,000 people per year within the hospital's catchment area necessitated further rapid expansion. The Trust Board decided to build a 60 bed Treatment Centre at the hospital, as a matter of priority. The Board faced two main challenges:

- Meeting the deadline of the completed facility by December 2004 from a "cold start" in December 2002;
- Ensuring that good value was obtained, and not paying over the odds for a project that was, by necessity, time-driven.

8 An initial appraisal concluded that a PFI approach would not provide a solution in the time available. Further, alternative procurement routes such as Design and Build, Prime Contracting and Construction Management were felt to be too risky from a cost and time perspective.

Approach

9 The Trust adopted the ProCure21 approach in order to mobilise the design and construction teams very quickly, while at the same time enabling the Trust to contain its cost risk. The inclusion of the constructor and installers at an early stage was intended to simplify construction and maintenance.

10 The Trust was able to interview quickly the principal supply chain partners who comprised complete procurement chains: a lead contractor, a design team, and key specialist suppliers. The teams were already formed, which was an important factor already checked and reviewed by the central ProCure21 team, and were fully compliant with OJEC requirements. The Trust found that it was able to engage in purposeful dialogue almost immediately with five principal supply chain partners. The Trust was able to appoint a principal supply chain partner led by Norwest Holst less than two months after the decision to proceed.

11 With the supply chain appointed, the Trust worked with Norwest Holst and the rest of its principal supply chain partners to develop a solution that would not exceed the budget of £12 million. For three months, the principal supply chain partner worked on a fee basis, developing options for the hospital to consider. At that point, the design solution was sufficiently stable, and acceptable to the Trust, to enable the principal supply chain partner to enter into a guaranteed maximum price contract. The contract was signed in May 2004, but the guaranteed maximum price had been agreed several months before. The combined team effort brought the forecast cost down from its initial level of £15 million to within the set budget without compromising the users' requirements.

12 The guaranteed maximum price contract includes an incentive arrangement that encourages the principal supply chain partner to offer savings back to the Trust. Both parties share any savings equally, which provides a strong incentive to review costs regularly and to innovate.

13 The Trust was concerned about obtaining value for money from the procurement process. The perceived risk was that, in common with any non-competitive negotiation, the Trust would not obtain fair value. The ProCure21 team assisted the Trust by:

- Comparing the specific costs in this case with generic rates supplied by the principal supply chain partner in bidding to become part of the ProCure21 initiative;
- Using an independent cost consultant to review the construction costs;
- Comparing the costs with general construction cost information stored centrally in the Department of Health's cost allowance database.

14 During that important decision-making time leading up to the award of the contract, two factors were critically important:

- Client Leadership – The Trust appointed an Executive Board Member as the Project Sponsor. This greatly assisted the decision-making process, by giving it an authoritative single point of responsibility.
- Stakeholder Management – The Sponsor, the Project Manager, and the principal supply chain partner's leaders developed a consultative approach with the Stakeholders (clinical, non-clinical, patients), stating clearly when decisions would be required. They provided sufficient information and allowed enough time for each of the decision points. The result was that the design met the Stakeholders' needs and met the Principal Supply Chain Partner's timetable.

15 The form of contract recommended by the ProCure21 approach, the Engineering Construction Contract (Option "C" target cost and activity schedule), forms the basis of the contractual relationship between the principal supply chain partners and the Trust. This promotes good project management principles, encouraging early issue resolution and role clarity.

16 The ProCure21 approach brings benefits to the quality of the built product, as well as having cost and time advantages. Suppliers warrant the quality of their work for the stated life of their products, which is often 10 years. This is supported in each case by an insurance backed guarantee. Doing this improves the quality from the outset, thus reducing the on-going risk of disruption during the life of the product. It also reduces the level of financial risk and administrative effort should a problem arise later.

17 The central ProCure21 team supported the Trust during the contract in other ways:

- By offering facilitation services, to help the team establish itself;
- Providing expert techniques, such as the Diagnostic and Risk Toolkit (DART) to make sure that the main risks were identified. Identified risks were either included within the Guaranteed Maximum Price contract, or were excluded and held by the Trust;
- As knowledge sharing forms an important element of the ProCure21 solution each Trust has a design champion, who shares learning opportunities with counterparts in other Trusts;
- Providing best practice advice and standard designs for the Trust to consider. This saves time and enables manufacturers to offer bulk-buying discounts for common solutions across different Trusts.

Successes to date

18 The project is forecast to finish six months before the target date. The team's assessment is that the ProCure21 solution saved nine to twelve months at the start of the project, and a further three months during the construction phase. The Guaranteed Maximum Price arrangement enabled the Trust to arrive at a fixed price three months after engaging the principal supply chain partner, and has successfully kept the project cost within its budget. The main stakeholders, including the medical staff, have expressed a high degree of satisfaction with the whole process.

Key Lessons

- Where other departments have similar characteristics to the NHS, in that they devolve responsibility for construction project to local units, they need to acknowledge the risk that their dispersed community could potentially suffer from reduced buying power and low level of knowledge transfer. The ProCure21 approach has created a highly effective supporting central solution to counteract those risks by bringing significant value to the otherwise dispersed community.
- Other departments facing a similar set of circumstances should consider how they could most effectively support their own community of infrequent construction clients by:
  - (i) providing assembled supply chains which will result in the saving of time and resources;
  - (ii) promoting learning and knowledge transfer from the centre and between infrequent clients;
  - (iii) harnessing buying power by bundling together packages of work;
  - (iv) using standard designs.
- The Engineering Construction Contract encourages each party to be proactive in resolving problems by the application of early warning notices used by the project manager for the Trust and primary supply chain partner. This process alone has developed a good working relationship between both parties and ensured programme and costs were kept on target.

CASE STUDY EIGHT

Royal Mail Property Group

By bringing together the management of its estate and the provision of facilities management into one organisation the Royal Mail Group is now able to plan its whole property portfolio in an integrated, balanced and transparent way in the best interests of the entire business.

1 Royal Mail Group Property, known as Property Holdings operates in the United Kingdom delivering construction and property management and facilities services to the constituent businesses of Royal Mail Group, namely Royal Mail Letters, Post Office Ltd, Parcelforce Worldwide and GLS.

The problems facing the Royal Mail Group

2 Historically, Property Holdings had managed the capital investment and estate of the Royal Mail Group while the individual businesses provided their own facilities management. As a result of this approach:

- planning construction projects and managing property across the whole of its estate was impossible;
- there were inconsistencies in the management of the estate and its facilities in terms of policies, procedures and standards;
- demand management was weak and fragmented on the "client side" of the organisation, with weak challenge and review mechanisms;
- a culture of spending budgets up to their limits had developed, hinged around an annual budget approval process;
- buying power in the market had been diluted, as buying decisions were made on a dispersed, sub-regional basis.

Key statistics of Royal Mail's Estate

Managed portfolio	4.4 million sq m made up of 4,800 separate interests covering retail, industrial and office use
Value of estate	£1.4 billion
Average annual capital investment	£100 million
Average annual maintenance cost	£70 million
Occupancy level of premises	195,000 staff

What the Royal Mail Group did to tackle the problems it faced

3 Royal Mail Group brought together the management of the estate and the provision of facilities management from nine regions each with three or four sub-regions into one central organisation, Property Holdings. It gave the new organisation the clear objective of providing fit for purpose property and facilities at agreed service levels which would meet the agreed operational needs of its businesses at least cost.

4 New business processes and supporting organisational arrangements separated demand management from supply management. Skilled people within the client side of the business became the "informed client" leading the demand challenge process and setting the required policies and standards. Property Holdings changed its organisation structure to match the new business processes, and became the intelligent solutions provider with clear accountability for delivery.

5 The planning of the property portfolio was carried out in a balanced and transparent way in the interests of the Group as a whole. Clear standards, policies and procedures ensured transparency, consistency, and realised better buying aggregation potential. The capital and maintenance programmes were designed to deliver and support the plans for the entire portfolio. An outsourcing programme was also carried out to transfer the delivery of property and facilities management to other service providers **(Figure 5)**.

CASE EXAMPLE E

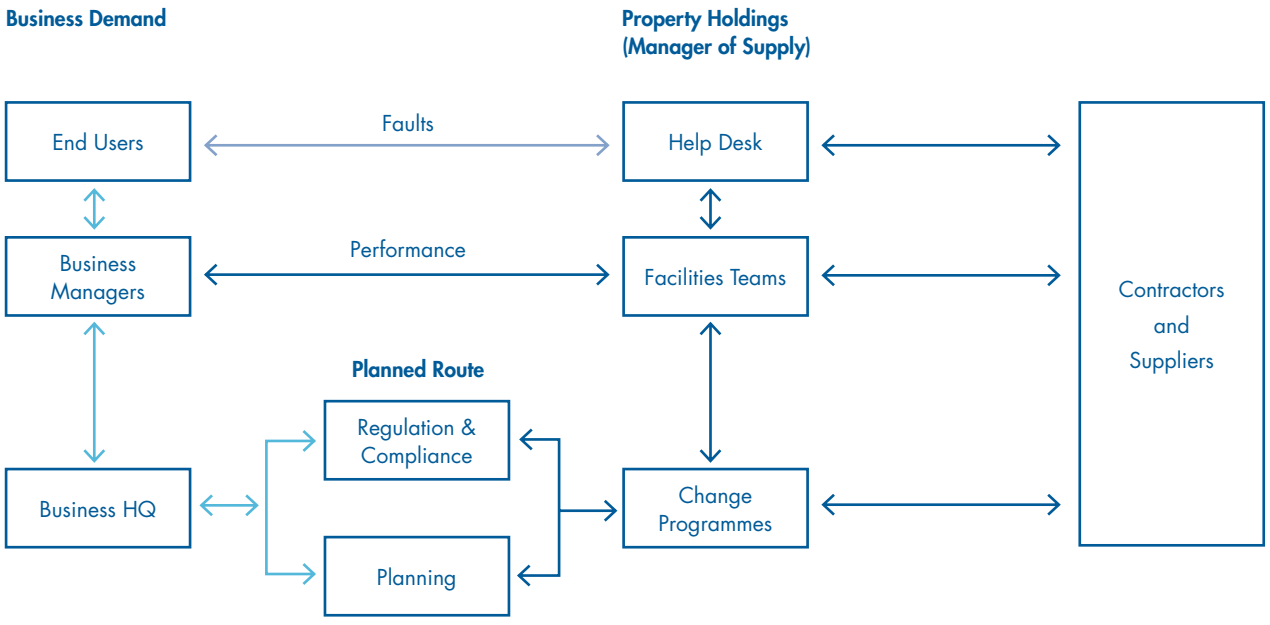
National Distribution Centre, Daventry

The Post Office is delivering a major business change recovery programme. That process led to the need to construct a strategically important National Distribution Centre as quickly as possible. The planning of these tasks was greatly simplified by the fact that there was a centralised property function with executive authority for projects and estate management. Under the previous regional management arrangement planning would have involved a much more complex and parochial approach.

Key features

- Fast track procurement including all legal work in eight weeks, enabled by the central property function, a clear brief and high level sponsorship.
- Construction commenced before design completion, in a fast track process; supported by teamwork approach.
- 37 weeks to build 24,100 square metres on a 12.1 hectare site.
- Operations training overlapped with practical completion, made possible by collaborative working.
- £20 million construction cost.

5 Property Holdings organisation chart



What the new approach has achieved

Business efficiency has increased

6 Bringing the estates and facilities management under the control of a single organisation increased efficiency. The number of staff working in internal property and facilities management reduced from over 1,200 to 260, and the number of people on the client-side of the process similarly reduced.

7 The supplier base transformed from one which was fragmented and had poor cost and performance visibility to one delivering high standards of health and safety; it is strictly cost controlled and performance managed with appropriate key performance indicators and financial reward.

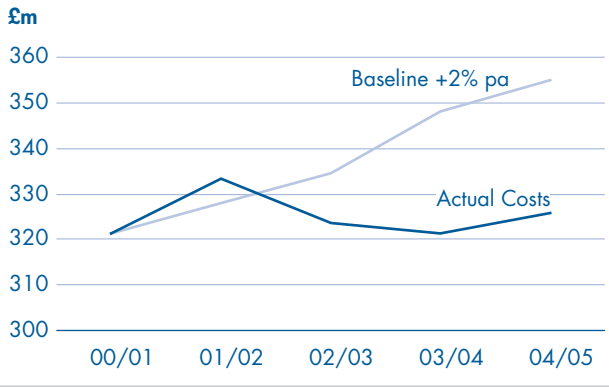
- Prior to the implementation of the strategy there were some 500 suppliers of building fabric maintenance works, 25 per cent of which had annual contracts of less than £2,500 per annum and 25 per cent of which had annual contracts of less than £500 per annum. Currently five contractors cover the whole of the UK.
- Similarly Property Holdings has made significant reductions to the number of facilities management suppliers. For example in 1999 there were 350 waste management suppliers, whereas by 2004 there was one.

8 By reducing supplier numbers the administration time has reduced significantly and the quality of the supplier management driven up.

Financial impacts have been generated

9 The Royal Mail Group has achieved savings of some £81.5 million per annum against a 1996-97 cost baseline of £650 million per annum which were made up of a combination of bottom line savings and avoided costs **(Figure 6)**.

6 Property and Facilities Management Expenditure in Royal Mail



10 Following completion of the project to centralise the property and facilities functions Property Holdings has gone on to achieve additional savings. Improved portfolio planning has led to the disposal of 155 of its 182 administration units, releasing 189,000 square metres of surplus space and saving a further £50 million per annum.

Business performance has improved

11 The new approach has contributed to meeting estate management customer satisfaction levels against all primary key performance indicators (although some second level ones were not met). The overall customer satisfaction trend shows a slow upward trend from 82 per cent to 85.5 per cent between 2002 and 2004.

Future planned developments

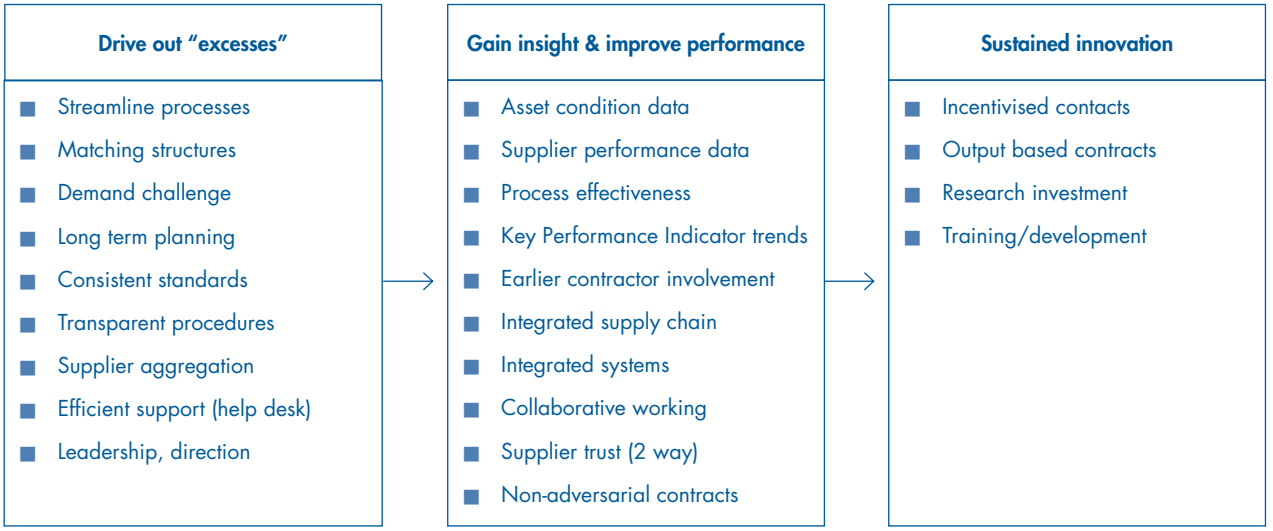
12 Property Holdings is setting out a new and pro-active approach to the use of property within the Group to support the development of sustainable businesses. To achieve this it is placing a greater emphasis on:

- Delivering a Group "corporate property strategy", integrating property considerations into business units' strategies;
- Maintaining an organisational culture which focuses on the needs of customers, and using third party suppliers to a greater extent to enable continuous market testing;
- Having an organisational structure which can communicate and deliver effectively;
- Focusing on the provision of efficient and affordable services. 70 per cent of suppliers operate on contractual terms incorporating financial reward or abatement for exceeding or failing key performance indicators;
- Maintaining an appropriate internal control and risk environment, using one integrated enterprise system using common data;
- Having a clear action plan that allows the maximum value to be extracted from under-utilised property assets.

13 The Royal Mail Group was able to bring together successfully the management of its estate and facilities management by:

- Setting up a project steering group covering both the demand and supply sides of the business and actively managing and sponsoring the project at a high level throughout the project both to secure consensus for the change across the Group and to resolve cross-business issues;
- Setting up a combined team which provided a blend of experience from within the Group and external expertise which worked in a collaborative fashion with frequent and responsive communication which helped to eliminate organisational "silos";
- Involving those directors who would be responsible for running the future organisation in the development of the new processes; they joined the project team before the new organisation went live;
- Using a business case which clearly identified the benefits that change would deliver; how change would be delivered; and putting in place a robust monitoring system with performance being managed at the highest level;
- Recognising at the outset that the change programme would evolve over time, and would move through different phases **(Figure 7)**.

7 Evolution of the change programme over time



Key Lessons

- By bringing together the management of its estate and the provision of facilities management into the one organisation, Property Holdings, The Royal Mail Group can now plan its property portfolio in a balanced and transparent way in the interests of the Group as a whole and the capital and maintenance programmes now match the plans for the entire portfolio. The Royal Mail Group is now in a stronger position to plan for the longer term and provide greater certainty and better information to the market about its likely construction and maintenance requirements. Royal Mail Group has achieved integration between its strategic business decisions and its property decisions.
- Royal Mail Property Group can now use the greater certainty of its long term planning as a means to establish longer term relationships with suppliers and specialist contractors and can take advantage of economies of scale by bundling together its construction and maintenance work.
- The centralised property function gave a better, consistent understanding of the client requirements. It enabled more robust supplier management and it enabled data from centrally managed systems to inform decisions.
- There was value in separating the longer term portfolio planning process from the day to day operational planning and management.

CASE STUDY NINE

Stanhope

Stanhope has minimised whole life costs and delivered sustainable developments by investing in project specific and generic research to identify how performance can be improved and by working collaboratively with its supply chain on a repeat basis

1 Stanhope is a private developer, specialising in complex mixed-use developments, major urban regeneration schemes and commercial offices. It is engaged by public and private clients, some with limited experience in designing and delivering major construction projects, to act on their behalf and interface with the construction industry. In the last 20 years, Stanhope has won over 70 major awards for development, design and construction excellence with a wide range of industry stakeholders acknowledging its reputation for high quality design and efficient, low risk construction delivery. An independent benchmarking service compared recent performance on around twenty comparable London office projects (including five Stanhope projects) and found that Stanhope projects were five of the eight lowest unit cost projects, and five of the six fastest delivered projects (build rate in square metres per week).

2 Stanhope's experiences have proved that, whether for public or commercial buildings or regeneration projects, there is a common underlying process through a project's life cycle with three key stages which help to minimise whole life costs and deliver sustainable developments:

- **Assessing the value:** exploring and implementing continual improvement against previous project performance underpinned by generic and targeted research, with each completed project adding to the overall knowledge base.
- **Creating the value:** through a well managed iterative design process that involves challenge and peer reviews and focuses on how the project will deliver improvements in the customer's business performance.
- **Delivering the value:** through effective supply chain management that encourages innovation and the use of appropriate performance benchmarks and targets to assess whether improved value is being delivered.

3 The emphasis is on ensuring the value created at the design stages is ultimately delivered. This is partly achieved by introducing 'hold points' which are similar in concept to the Office of Government Commerce's Gateway Review process, but focused more on getting the design correct. The 'hold point' will involve peer challenge of the project design by the directors from within Stanhope, often in parallel with senior representatives of the customer. Key issues and risks must be resolved, before proceeding to the next stage.

4 Further details, with illustrative examples, on how Stanhope implements its approach are set out in **Figure 8**.

Key Lessons

- Stanhope is successful in minimising whole life costs and delivering sustainable developments by using project specific or generic research, and allocating project funding for this, to find new ways to improve performance. Stanhope ensures there is leadership on the project by encouraging the client to field a senior representative, to work with its own staff and with the appropriate understanding of what the project is required to deliver in terms of business change and performance, and with executive decision-making authority.
- Stanhope invests time in getting the design right and understands when to reach agreement with the client so as to not affect overall project performance. Its experience has allowed it to recognise that once design is complete there is limited scope for significant variations during the construction and operation phases.
- By installing confident leadership and encouraging appreciation of the skills of its partner supply chain, Stanhope has created an assembly of integrated specialist expert delivery partners rather than traditional sub-contractors and keeps the teams together wherever possible for the next project.
- By negotiating contract prices with specialist contractors based on an in-depth understanding of the value and cost of the planned work set against cost benchmarks, Stanhope can set prices to allow contractors to invest in capacity and skills, to the ultimate benefit of the client, as well as making a profit themsleves.
- By recognising the value to their partner supply chain of a steady repeat workload, Stanhope can encourage contractors to be confident in making longer-term investment in capacity and innovation, for example in new off site pre-fabrication factory facilities.
- Stanhope recognises that a project's handover and commissioning stages are traditionally rushed and ill planned which causes major problems for both occupiers and the industry. To avoid these problems Stanhope plans the stages of a project's handover and its commissioning from the outset of a project to control commercial risks as well as ensuring high levels of safety and quality.
- Stanhope evaluates the outcome of a project in terms of the construction process and the delivery of the wider benefits required by the client and actively uses this information to "feed" the brief to improve performance on the next project.

8 Stanhope approach - considerations at each stage of a project

KEY

★ Stanhope design hold points (similar to the OGC Gateway process).

Assessing the Value

Research

Invest in research (typically an allowance of 0.25% of the construction cost on each project) on:

- The client's requirements and how their business is likely to change and evolve over time
- The marketplace and opportunities (in relation to property trends and potential sites)
- Current and future developments in both the occupier's needs and technology advances within the construction industry
- Benchmarking data to assess broadly whether, for example, the envisaged build rates and unit costs are achievable
- Learning lessons from past projects to improve on performance (both from Stanhope's and its partners' experiences in the UK and abroad)

Identify Opportunity

Establish a business case and determine whether there is benefit to the customer to progress in terms of whole-life commercial value.

Feasibility

Develop an in-depth understanding of the customer's requirements and the business environment in which they operate.

Establish the existence of any key risks and constraints, both physical (e.g. ground conditions and site access) and commercial (for example, does the client have approved funding in place) and whether effective solutions exist. Translate these into the Brief including definition of clear success criteria.

Creating the Value

Concept Design ★★

Encourage the customer to nominate a senior representative who has the appropriate understanding of what the project is required to deliver in terms of business change and performance, together with executive decision making. This person should be encouraged to participate in the entire process and be highly visible to the project team.

Establish key members of the project team; select the best available skills.

Conduct sustainability and environmental assessments. (Stanhope is committed to developing buildings that improve local community facilities and reduce the use of non-renewable natural resources and they have established performance measures and benchmarks to achieve this).

Develop a detailed Base Building Specification for the project, describing the product, scope, nature and quality levels.

Scheme Design ★

Consider the whole life cost of scheme options using a model based on the running costs of similar completed projects.

Encourage the production of a co-ordinated design with associated costs, programme and specification.

Establish a series of peer reviews of key elements through the design phase; an important element at this stage.

Use IT-enabled project management tools allowing information to be placed on an intranet for access by the whole project team to facilitate integration and collaboration.

Detail Design ★★★

Include specialist trade contractors in planning workshops to maximise the benefits of value engineering and innovation, and to identify and address risks to successful construction delivery. (Stanhope has been able to work with the supply chain to identify and apply best practice from across the industry in the use of pre-fabrication and standardisation to increase quality and reduce time on site.)

Delivering the Value

Procurement ★

Stanhope packages of work are not tendered; instead prices are negotiated based on benchmarked data. The benefits include:

- suppliers can be brought in early to add value, utilising their expertise and experience from past projects;
- consistency in pricing despite the peaks and troughs associated with the industry.

Ensure that when passing risks onto a partner he fully understands the risk and has the capability to address the risk.

Work with the supply chain to minimise specific risks and optimise the solution.

Keep successful teams together for the next project. If change is required, limit it to only one new member in the design team per project if possible.

Work on a regular repeat basis with a number of selected specialist suppliers using contracts specifically evolved for this purpose. Benefits include:

- Stanhope develops a better understanding of the suppliers' expertise and capacity to help formulate project deliverability
- Suppliers are aware of Stanhope's expectations and approach so there is no lost time through learning curves at the start of each new project.

Construction ★

Use a dedicated on-site logistics team for deliveries and waste management to improve productivity and safety. For example, deliveries are held outside city sites and brought to the site 'just in time' minimising transport movements and cost and waste.

Focus on providing a high standard of welfare facilities and achieving health and safety standards that promote pride in the workforce and enhance their output.

Ensure that there is focus on the detailed and continuous planning from the outset to assist a controlled end to the project. Involve the entire team to enable an efficient close-out process within the completion date and to required standards.

Aftercare:

Benchmark the project data and review performance against the targets created at the start.

Undertake occupier feedback and performance studies.

Capture and share lessons learnt and identify further areas of research in order to improve on future projects.

8 Stanhope approach - considerations at each stage of a project *(continued)*

Examples of successful projects delivered to time, cost and stakeholder requirements

HM Treasury

Challenge: to transform a depreciating asset into a predominantly open plan space fit for modern government whilst also delivering environmental gains. The building is 40% underground and included the removal of over 7 miles of corridor.

Key Facts:

- 39,220 sq m, Grade II* listed.
- £112m construction costs under PFI.
- Winner British Council for Offices Refurbished Building Award 2004.
- Best Design PFI 2003.

How was this achieved:

- The process of design development included HM Treasury at all stages to ensure the design met their needs as well as contractual obligations. The HMT project champion was the Permanent Secretary. The design delivered a 25% increase in useable space.
- Collaborative working started at an early stage. Workshops with groups of specialist contractors identified risks in the project which could then be managed. Effective integrated teamwork meant that construction sequencing difficulties inherent in complex refurbishment projects were resolved quickly.
- Involvement of the facilities management team throughout the project meant that the building they will operate for 35 years incorporates their needs and the process benefited from their knowledge.
- A first year occupancy evaluation shows that 75% of respondents said that they are now 80% more productive, absences due to sickness have fallen and staff churn has reduced. Electricity consumption is half the industry benchmark set for a naturally ventilated corporate building and water consumption is in the upper quartile of performance according to industry benchmarks.

Mid City place

Challenge: to deliver a 43,700 sq m office building to exacting timescales and budget constraints

Key Facts:

- 780,000 site hours worked without a reportable accident.
- Build rate of 743 sq m per week achieved.
- Build cost of £990 per sq m to shell & core (i.e. without finishes, ceilings or raised floors).
- Significant waste reduction through use of logistics planning.

How was this achieved:

- The appointment of a specialist logistics contractor to take delivery and distribute materials to the workforce. Made a big difference to the overall productivity.
- The use of a three dimensional design model allowed the design team to identify physical issues before they occurred on site, at different stages of construction.
- The design was fully completed and reviewed prior to starting on site so as not to delay on site activities.
- Virtually 100% performance in terms of materials distribution accuracy (right time, right place).
- On site nursing provision saved over 1,000 hours of potential site absence. The nursing input to site inductions assisted in achieving the safety standards.

8 Stanhope approach - considerations at each stage of a project *(continued)*

Examples of successful projects delivered to time, cost and stackholder requirements

Chiswick Park

Challenge: to address the desire of the client consortium to attract and retain key employees by providing the highest standards of internal and external working environment

Key Facts:

- Average build periods of 38 weeks for 9,300 sq m buildings including finishes, ceilings and raised floors with an average cost of £1,020/sq m
- Winner British Council for Offices "Best of the Best" Award 2003 and the British Construction Industry Best Practice Award 2002.

How was this achieved:

- The design incorporated simple details and standardisation throughout, which enabled significant pre-fabrication.
- High level of off-site prefabrication including concrete columns, concrete floor slabs and pre installed light fittings in ceiling tiles.
- Simple well thought through design involving not only the developer and the professional team but also the input (and ownership) of the construction manager and the trade contractors.
- Fit-out period reduced using a simple air displacement system thereby reducing need for additional mechanical works.
- Top class on-site welfare for the construction team including free breakfast for early starters to ensure workforce commenced work on time.
- Maximising use of crane lifting - 2 per building as opposed to 1. Higher crane costs but big saving in programme.
- The lessons learned on the first buildings were quickly evaluated and applied to the successive construction phases. An example being ensuring that supply of 3 x 4 sq m glass cladding panel manufactured in Germany matched the 7 minute erection/fitting programme.

CASE STUDY TEN

Thames Water

By working collaboratively with suppliers and maintaining competitive tension Thames Water has obtained better value for money from its framework arrangements.

1 Thames Water serves major cities and towns such as London, Reading, Oxford and Windsor by providing drinking water, carrying away and treating sewage, and offering a range of environmental services. Thames Water maintains over 60,000 miles of pipes and sewers.

2 The Office of Water Services regulates its work by monitoring the achievement of several Key Performance Indicators, such as achieving targets for reducing leakage, and failure to meet these targets can lead to financial penalties.

Challenges faced by Thames Water

3 In the mid 1990's Thames Water reviewed its organisation and the way it delivered capital projects. Particular concerns were:

- the adversarial nature of the relationships;
- the large amount of effort spent procuring construction work, for work that was often very similar;
- the amount of effort wasted on claims and disputes about additional payments;
- the unpredictability of cost outcomes, due in part to claims for additional payments;
- the lack of innovation introduced by the suppliers;
- the risk of being unable to deliver its capital programme, and thus satisfy the regulator, due to the factors above.

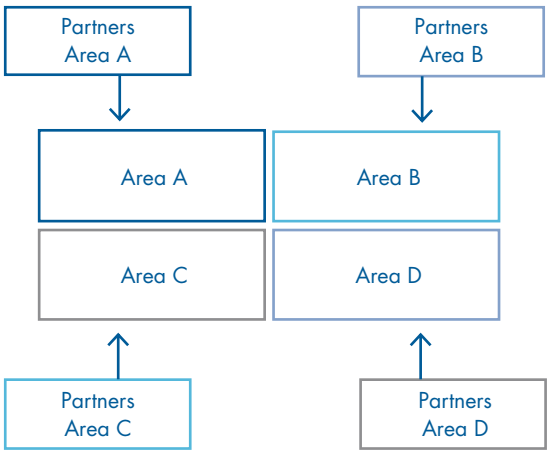
How Thames Water tackled the challenges it faced

4 Thames Water made a major change to its approach to its capital delivery programmes in the mid 1990s, and further refined it in 2000 and again more recently in 2004. It introduced a different culture and philosophy, called "Alliancing". It divided its total area into four regions and appointed different sets of construction contractors to work in them **(Figure 9).** The main selection criteria were the supplier's delivery capability, company culture and the unit prices of typical construction work. Being on a framework list did not, however, guarantee a set volume of work.

Key Statistics

Number of employees	5,000
Number of customers	13 million
Annual capital investment	£450 million
Annual number of capital projects	200
Number of people working in whole supply chain	3,500
Number of staff in capital delivery teams	350

9 Thames Water's organisation of its strategic partners into geographical areas



5 Thames Water negotiates with the contractor with the best experience and skills, to agree a price for carrying out each project. As with any form of non-competitive negotiation, setting the price that is good value is an on-going challenge. Thames Water does this by referring to:

- the prices submitted by the contractor when applying to become an Alliance member;
- comparable relevant information stored in an in-house database;
- independent cost advisers;
- external market testing through routine competitively tendered projects for alliance benchmarking;
- large projects competitively tendered as single site alliance contracts.

6 Thames Water houses in one location the integrated project team, comprising its own people, the designers, the contractors and specialist suppliers. This improves communication, cuts delays and creates a sense of common purpose on each project. Modern contract documents such as the Engineering Construction Contract and the Institution of Chemical Engineers' "Green Book" have replaced more adversarial forms of contract. These embed good project management practices into the contract itself, and contribute to the culture of resolving issues at the earliest opportunity.

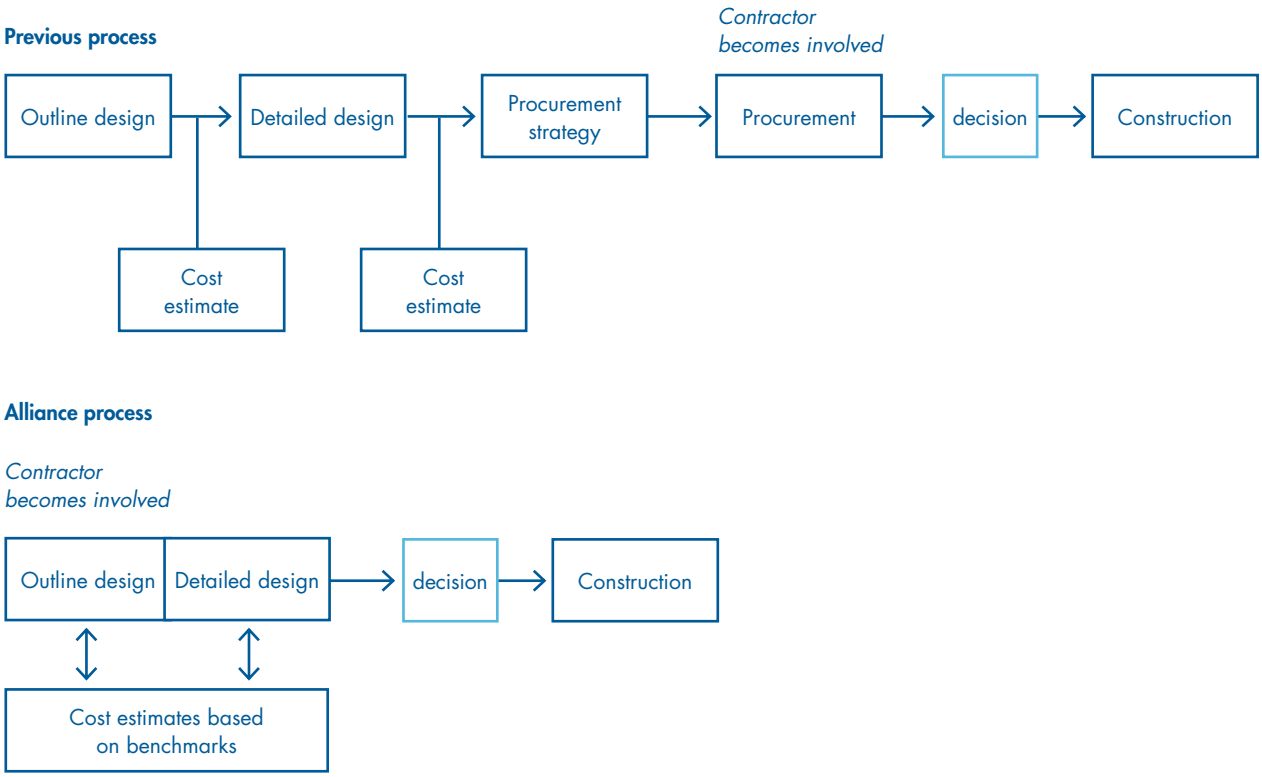
7 The main benefit of the Alliance is that contractors now contribute to the design and the contractor is an early, active and integral participant in the design process **(Figure 10)**. Consequently, projects are easier to implement, costs are lower and ideas are exchanged openly during the initial design phase when they have the best opportunity to make the greatest impact.

8 After several years of experience with the system above, Thames Water has introduced some refinements **(Figure 11)**. The main changes bring a further element of competition into the relationship with the Alliance contractors. Now Thames Water:

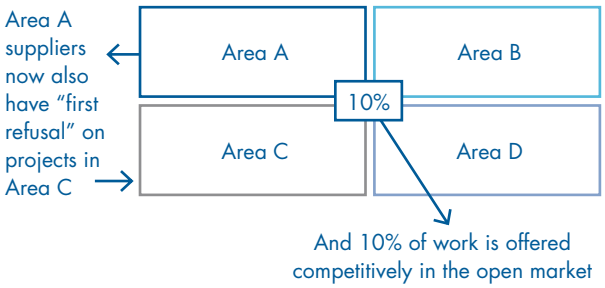
- permits less negotiation about the price. If it cannot agree a price with the contractor, they offer the work to one from another area;
- offers ten per cent of the work to the external market on a competitive basis;
- rewards higher performing partners with more work and lower performing partners with less, and ultimately exit from the Alliance.

9 This approach instils a greater feeling of competition, and encourages contactors to innovate in order to achieve more stretching cost targets. Placing ten per cent of the work out to tender requires more effort, but brings new price information, fresh ideas, and an opportunity to evaluate potential changes to the existing Alliance pool.

10 Earlier contractor involvement through "Alliance" approach



11 Modified Alliance approach



Success to date

10 Thames Water believes that the Alliance approach brings many benefits **(case example F)**:

- procurement effort reduces substantially, for both the client and supplier and avoids an estimated 20-30% of the total effort;
- there are now a minimal amount of claims or disputes, which occurred previously on most projects;
- cost predictability is good and across the portfolio, costs are typically 5 per cent below target;
- responsiveness has improved, and the overall time for projects reduced;
- the pressure to reduce costs encourages contractors to innovate. For example, some contactors use off-site pre-fabrication to reduce costs and minimise defective work;
- the greater trust in the supply chain promotes learning and idea sharing. The combined Management Panels encourage learning and deal with important matters that affect the whole delivery chain, such as health and safety. The Principal Panels review the performance at senior management level;
- the stability provided by the Alliance promotes better people management. Alliance members find it easier to recruit, train and retain staff;
- the stability also generates a shared insight into the condition of assets. This improves understanding, planning, design solutions and performance.

CASE EXAMPLE F

Abbey Mills Pumping Station fine screening project

One of the most challenging requirements of Thames Water's recent Capital Programme was to provide a fine screening and waste handling plant for the river discharges from Abbey Mills pumping station in Stratford, East London - the largest combined sewage pumping station in the United Kingdom.

The scheme forms part of the Thames Tideway Strategy suite of projects that gives substantial environmental benefits to the River Thames. This project will alleviate the impact of storm discharges by screening out any waste material greater than 6mm in diameter.

After extensive investigations, it was decided that drum screens would be best placed to provide the high flow screening capability with the reliability and efficiency required.

Delivery strategy

The project is being delivered by one of Thames Water's Network Alliances, where the client is co-located with the contractors and design consultants under a partnering arrangement to deliver a five year capital programme. The contractor is responsible for the delivery of the project for an agreed target cost which includes all costs, such as design resources and compensation, which have traditionally sat outside the contractor's element. Under this arrangement the contractor has the opportunity to share a proportion of any target out-performance but will also incur a penalty for any under-performance.

This initial phase of the £20 million project was successfully delivered under budget and on time. A year long trial then followed where the plant was tested and further developed for the optimum solution to be completed in the final phase. Operational staff learned a great deal about the maintenance issues during the trial and advised the team on improvements that could be made for the next stage.

The contractor shared Thames Water's aspirations to provide the optimum solution using innovation wherever possible. A smaller and more responsive contractor was chosen, compared with the traditional larger process contractors that normally undertake such specialist projects.

The Alliance arrangement benefited the project by allowing the whole project team to collaborate, much earlier than is normal, on processes like value engineering, risk management, buildability and engagement with the supply chain. This was essential to ensure the tight timescales were met.

With a project team drawn from a number of different organisations, it was important that roles and responsibilities and ownership of key deliverables were clearly communicated, with some form of performance measurement and accountability process against them. This issue was overcome by establishing Service Level Agreements (SLAs) that defined the relevant responsibilities and outputs for all of the major disciplines, such as design. These form a useful tool for driving the programme and measuring performance.

The Alliance procurement route and choice of contractor consequently enabled the fast track approach required to complete the first phase. With Phase 1 completing on time a significant trial period of over 12 months was subsequently possible to optimise the final solution for delivery by April 2005.

Conclusions

Thames Water considers that, although undertaking this project in two phases has extended the overall programme, it has allowed innovation and optimisation of the design which is likely to yield a 15 per cent cost saving.

This has been achieved by a dedicated motivated team that has brought together a vast range of expertise across the water industry. Together with the alliancing approach to project delivery, this has allowed the challenging targets to be met for a wholly unique project.

Key Lessons

- **By working collaboratively with suppliers Thames Water has obtained better value than it would have secured through traditional adversarial methods. The approach has encouraged earlier contractor input, improved designs, reduced costs and increased performance.**
- **Thames Water has also been able to retain a competitive edge to the process and at the same time foster a long-term trusting relationship with suppliers.**
- **The length of the programme is very important. Thames Water's view is that five years is probably too short, and is considering moving to a ten-year arrangement.**