Cost model

Capital investment is pouring into the NHS and the prognosis for improved performance is good. In this month's cost model, Davis Langdon & Everest and Mott Green Wall examine the aims of the hospital programme, probe design issues, and break down the price of adding a trauma unit to an existing hospital

datafile

Introduction

The NHS' largest ever building programme is in full swing, addressing demand for radical improvements in healthcare delivery in the acute and primary healthcare sectors. Recent research, published by the Nuffield Trust, shows that the NHS has the capacity to improve and that foundations are in place for long-term progress. The principal objectives of the NHS Plan, which is driving the current investment and which runs until 2010, are:

- To reduce waiting times
- To provide universal access to high quality healthcare
- To increase the capacity of diagnostic and preventative medicine
- To take advantage of methods of service delivery provided by new technologies, innovative ways of working or alternative sources such as the private sector.

The implications for a capital build programme are significant. Under a spend programme worth more than £11bn, 100 large hospital schemes are should be open by 2010, together with a new generation of Diagnostic and Treatment Centres. The NHS Plan also involves the private sector in the provision of DTCs contracted specifically to provide elective surgery to reduce waiting lists.

With the introduction of a partnering approach to procuring capital works worth £1-25m, Procure 21, the NHS' management of medium-scale capital projects is also being overhauled. As a supplement to previous articles on the PFI, DLE focuses in this cost model on smaller-scale hospital development.

Challenges facing the NHS

In the short and medium terms, the NHS will have to deal with challenges in three main areas:

- **Growth in demand** Demand grows inexorably, driven by demographics and rising expectations. Some PFI schemes have experienced growth in output of more than 20% since opening. Despite substantial investment in online services, primary care and day-care capacity, a further 10,000 beds are planned to be delivered by 2010, although there are concerns as to whether such an increase can be delivered and staffed within the programme.
- **Changing user expectations** A more patient-centred health service has implications for the NHS Estate in terms of the facilities provided, the clarity of their organisation and the environment provided for staff, patients and visitors.
- **The NHS estate** NHS property totals 25 million m^2 with a replacement value of £72bn. Although 30% of the value of the estate is less than 15 years old, 25% of it predates the NHS and much of the rest has been developed in a piecemeal fashion, making it difficult to improve internal environments or to introduce new methods of treatment or flexible working.

Affordability and funding

Under current funding arrangements, NHS hospital trusts and the soon-to-be-operational foundation trusts obtain their revenue from healthcare commissioners such as primary care trusts (PCTs). NHS hospital trusts are paid in accordance with a fixed regional tariff, on the basis of the number of medical procedures undertaken. Healthcare commissioners are very powerful project stakeholders, providing capital and revenue support.

Health commissioning need, which defines the range and number of procedures required in a proposed hospital is defined by PCTs and determines the range of services needed and the revenue they will generate. This drives detailed health planning, capital budgets and the design itself. Affordability is the key benchmark in the business case process.

This planning process works by translating health commissioning need into a functional requirement based on area and cost. It is used to calculate capital cost to demonstrate that affordability criteria have been met. Although significant capital is now available for investment, it remains scarce and the preparation of a business case involves competition between trusts for resources.

In addition to capital cost, the business case process is also concerned with life cycle costs, the quality of the implementation plan and risk management – particularly to manage "optimism bias", the risk that project teams set inadequate briefs, budgets and programmes.

Because hospital design is so detailed, a system of estimating floor areas and costs by function has evolved to enable the financial assessment of clinical needs ahead of the completion of detailed design work.

Some of the principal stages of the assessment, justification, approval and implementation procedures in the NHS, which apply to England and Wales, are detailed below:

- **Strategic outline case (SOC)** Demonstrating the need for a health investment, presenting options and establishing the case in the context of a wider estates strategy. This assessment will be made ahead of any detailed work and involves risks in assessing the overall functional requirements.
- **Outline business case (OBC)** Identifying the preferred option, confirming the affordbility, value and flexibility of the solution together with expected benefits. This assessment is based on early stage design work and will provide a more accurate assessment of the design solution.
- **Full business case (FBC)** The full business case presents the detailed case for project approval and will include details of the scheme, its management and plans to realise expected benefits. FBC approval fixes the capital budget. On a Procure 21 scheme, it is prepared ahead of detailed design, whereas on a PFI project, being prepared just ahead of financial close, the FBC will involve the commitment of a considerable contractor resource.

Key business case criteria

At all business case stages, there are three key questions that determine the feasibility of a proposal:

- Do the proposed functions meet the medical need?
- Do the proposed functions generate sufficient revenue to fund the scheme?
- Can the functions be provided within the capital budget?

Failure to meet these criteria will result in the business case needing to be reworked or at worst, abandoned, all involving abortive costs and the risk of not meeting NHS Plan timescales.

The most critical decisions are made at an early stage in the absence of significant detail. In order to facilitate this process, cost and area information based on standard definitions of functional requirements have been developed by NHS Estates, published as health building notes and departmental cost allowances.

Vital cost planning skills

Application of this information, which was designed for use on 1000-bed general hospitals, is a highly skilled process that requires an understanding of clinical processes and the range of clinical and support accommodation required, an appreciation of how requirements might differ as a result of case load, and awareness of how technical innovation might supersede standard NHS advice.

The key issues to consider in preparing early stage function-based cost advice include:

- The experience to work with health planners to optimise accommodation schedules.
- Understanding the basis of the NHS standards, to be able to adapt the results to meet the specific circumstances of caseload or changing medical practice.
- Ensuring that all necessary ancillary requirements and circulation is provided in support of the required functionality
- Taking into account the implications of the site and its effects on layout, procurement, programme and the allocation of risk, which will affect the on-cost allowances applied to standard departmental cost allowances.
- The ability to identify opportunities for reducing overall floor area
- Optimising space allowances, critical dimensions, circulation and adjacency
- The ability to communicate effectively the cost drivers affecting a scheme.

The provision of a good quality working environments is a necessary to recruiting and retaining scarce staff.

Patients who spend a long time in hospital can be strongly influenced by their surroundings as well as by their care. Increasingly, the impact of elements of building design upon a patient's experience and recovery are recognised and measured.

Trends in healthcare delivery

Healthcare delivery methods have a significant influence on design. With the rate of change in healthcare accelerating – the role of healthcare design in enabling or blocking changes in medical practice will become an increasingly significant issue. Key trends in present and future healthcare delivery include the following:

■ **Specialisation and multidisciplinary working** Delivery of healthcare has become increasingly specialised, within the acute sector, with resources being concentrated in dedicated departments in large centralised hospitals. In parallel with this trend, in some areas of elective care, departmental barriers are being broken down to provide more patient focused healthcare. This approach can be seen most clearly in the Diagnostic and Treatment Centre (DTC) model for diagnostic work and day surgery.

■ **Care in the community** Greater emphasis is also being placed on care in the community, and demand for this element of patient-focused healthcare is being supported by further investment in community hospitals and facilities for Partnership Trusts, designed to deliver integrated health and social care.

■ **Development of new patient pathways** The patient pathway describes the sequence of events involved in a medical procedure. In traditionally managed hospitals the pathways of emergency, elective and chronic patients can cross as a result of the shared use of common facilities and staff, potentially causing constraints on capacity, cancellations, and lengthening waiting lists. Using the DTC model, new pathways are being designed to deliver specific strands of treatment, such as elective medicine, making effective use of emerging medical technologies to provide a more efficient and reliable service.

■ **Consumerism** Consumerism in the NHS involves providing a patient-centred service. This agenda has direct effects on buildings used by clinical and non-clinical staff, while also dealing with issues of ease of access and spatial arrangements for visitors, together with improvements to patient accommodation and facilities. For example,services such as mobile TVs and telephones have been introduced as part of a PPP scheme.

The consumerism agenda has increased capital costs by at least 12-13% overall, driven by quality enhancements and an increase in area allowances. As with all aspects of NHS investment, the priority of the quality of patients' experience has to pass affordability hurdles, and these requirements may adversely affect the extent to which consumerism can be delivered.

■ **Information and medical technology** I&MT's role in the delivery of healthcare will continue to grow significantly as technologies currently in use in America are adopted in the UK. Areas such as imaging and diagnostics are being developed at all levels of care. The NHS National Programme for IT has a planned expenditure of £5bn over the next five years for projects including online bookings and patient notes.

The greater use of medical technologies will over time have an effect on room sizes, layouts, IT infrastructure and building services requirements. For example, the introduction of robotics is anticipated to require a 50% increase in operating theatre floor area.

Design and cost drivers

Healthcare buildings are highly complex, supporting a large and varied workforce, high-tech equipment and a bewildering array of functions, departments and user groups. Well designed and managed, hospital buildings help to support the work of frontline staff, provide an appropriate environment for patients and can contribute to improved clinical outcomes.

CABE's campaign

Because of the size of the investment programme and the impact of the NHS as a construction client, CABE has been running a campaign to improve the quality of UK health building design, most recently through the "Healthy Hospitals" consultation. Key areas identified by CABE include:

- Balancing clinical requirements with the needs of staff and patients
- Making best use of the site in urban design terms
- Providing high quality landscape and external environments
- Creating high quality space, particularly in public areas
- Ensuring the legibility and ease of access.

CABE has been highly critical of some recent hospital designs, and although the primary challenges concern the efficient delivery of required functions within strict affordability criteria, the needs of patients and of those who treat and look after them are paramount. Civic design issues also need careful consideration, as hospital buildings can make a significant impact on their surroundings.

Hospital organisation

The organisation of clinical and non-clinical activities has a considerable effect on the efficiency, affordability and effectiveness of a hospital. An outline design should ideally be prepared in close consultation with user groups to account for the specific implications of clinical workload.

Organisation and layout have significant effects on the operation of a hospital, including:

Departmental organisation Distributing department functions, such as a radiology unit, into departments which generate high demand, such as accident and emergency, can contribute to reducing travel distances and reduce pressure on hospital circulation.

Dedicated resources Alternative healthcare models such as DTCs depend on the availability of dedicated facilities such as operating suites, which can involve some duplication of space, equipment and circulation.

Effective day-to-day operation Elements of building design which contribute to the smooth running of a hospital include:

- Sizing and location of facilities to prevent operational gridlock
- Appropriate departmental adjacencies
- Minimising journey times for staff and patients and the correct sizing of corridors
- Clarity of layout including ease of navigation for patients and visitors
- Segregation of public/clinical circulation routes
- Security and access control without compromising staff's work.

Affordability

As space requirements are the primary cost driver in healthcare design, the spatial implication of proposed treatment pathways and requirements for circulation, non-clinical and administrative support areas can have a significant effect on affordability, including running cost implications, which need to be assessed in the context of a trust's revenue streams.

Costs can be partially controlled by optimising the use of shared resources such as consulting rooms, using multi-function clinical space or applying flow-line principles in operating suites and DTCs. However, these changes will affect the patients and medical teams, and have to be fully understood before being adopted.

The effect of inadequate space allowances is well known and has been illustrated in some of the earliest PFI schemes. Adequate space in wards, waiting areas, corridors and for storage are particularly important in providing a good working environment, a high quality patient experience and contributing to positive patient outcomes, including infection control.

Other areas where affordability issues need to be resolved include equipment requirements, which can often exceed their budgets and which in turn affect room sizes and layouts.

Flexibility

Requirements for flexibility in healthcare space planning are driven by the need to increase useable space and to accommodate clinical change, which subject to affordability, need to be built into a scheme's design. However, because of the specialist requirements of many medical disciplines and budgetary constraints, loose-fit design is a difficult objective to meet. The key approaches to achieving flexibility are:

- Use of a small number of room size modules. Examination and treatment rooms should be designed and equipped to accommodate as many procedures as possible. With multifunction space, storage becomes critical and in particular must be accessible from outside of individual rooms.
- Providing universal clinical space for medical departments and specialisms
- Achieving greater flexibility in the use of clean treatment space to undertake a wider range of procedures, including diagnostic and treatment work.

Management of cross-infection

Management of cross-infection is a growing problem, costing the NHS £1bn a year, exacerbated by a large number of elderly long-stay hospital patients. A range of design approaches affecting space planning, ventilation, finishes and sanitary installations can control cross-infection.

- Bed spacing of 3.6 m or more between bed centres is necessary to control common air-borne infections
- Use of segregated clean and dirty corridors, controlled pressure regimes and high efficiency filters to prevent the air-bourne transmission of infection. Large schemes with a deep plan can generate particular challenges for mechanical systems
- Selection of finishes that are robust and resistant to aggressive cleaning regimes
- Provision of hand-washing or sterilisation facilities next to beds to improve hygiene.

Patient experience

Patients who spend a long time in hospital can be strongly influenced by their surroundings as well as by their care. Increasingly, the impact of elements of building design upon a patient's experience and recovery are recognised and measured. CABE in particular are campaigning for wider consideration of the therapeutic elements of design. The main ways in which hospital buildings can contribute, which are not unique to healthcare buildings are:

- Minimising patient and visitor stress by providing an attractive environment, clear layouts and easy navigation
- Housing beds in single rooms or small bays of four to provide choice and appropriate levels of privacy
- Providing a degree of control over a patient's immediate environment
- Providing visual simulation through external views, artwork etc
- Providing a high quality, relaxing environment through the use of colour, acoustics, artwork, detailing and the "greening" and planting of hospitals
- Investment in a high quality working environment is increasingly recognised as being associated with faster recovery, and also motivates doctors, nurses and non-clinical staff.

Staff needs

Over 1.2 million people work in the NHS and the bulk of expenditure is on revenue costs related to staff and treatment. Staff are scarce, so recruitment and retention of people is a key issue. Research by CABE and the Royal College of Nursing has demonstrated how important working environments are to attract and motivate staff.

One of the most effective staff motivators is efficient working practice. Elements of design that can support this include:

- Smaller wards which group patients by medical condition
- Wards with good sight lines and storage
- Direct front- and back-of-house circulation routes
- Good quality working environments
- Good quality staff areas

Other initiatives to address staff needs include PFIs to provide low-cost key worker housing.

Efficient circulation is key to a cost-effective and well managed hospital.

Procurement

The NHS controls one of the government's largest capital budgets and, as a result, has been the focus on initiatives to improve the performance of NHS trusts as best practice clients. Although the PFI has been the main vehicle for delivering large-scale capital investment into the NHS, Procure 21 has been introduced to provide a prime contracting route for the delivery of medium-scale hospital projects.

The biggest success of the PFI has been to deliver a new-build hospital programme and to increase the certainty of delivery. However, there have been problems, notably with bed capacity and management of support services on early schemes. However, feedback from the managers of completed hospitals presently suggests high levels of satisfaction with buildings and their management regime.

Procure 21 is being rolled out nationally during 2003-2004, based on 12 principal supply chain partner-led (PSCP) teams. Use of Procure 21 is not mandatory, but based on evidence from pilot projects, the anticipated benefits of Procure 21 are expected to be considerable and include:

- Use of standard processes
- Use of established integrated design and construction teams with experience and continuity of hospital-based workload
- Simplified appointment of the PSCP at an early project stage, avoiding the costs and delays of the *OJ* process
- Single point responsibility provided by the PSCP
- Involvement of the project team with clinicians and user groups
- Cost and time certainty provided by a guaranteed maxiumum price based on 80% design and market testing
- Effective management of supply chains, including performance measurement and benchmarking

The initial challenge for Procure 21 is to get NHS trusts to change design teams and appoint a PSCP-led team at the earliest stage. With the roll-out starting as foundation hospital trusts win greater independence, Procure 21 will need to deliver clear benefits to secure wide adoption.

In the procurement of healthcare projects, the following high level issues are vital to ensure the successful delivery of the project:

- **Client management** Strong management by a client representative is needed to manage users, stakeholders and to ensure the project vision is delivered
- **Briefing and consultation** Commitment to a staff consultation to develop an effective solution, reduce the potential for change at a later date and maximise the motivation levels. Consultation is vital if changes in practice or organisation are being proposed.
- Mobilisation of hospital trust resources to contribute to the outline business case
- Integration of design and clinical service strategies, based on involvement of designers and skilled technical advisors
- Active management, by the PSCP, of the design and approvals process to ensure delivery.
- Control of affordability at all stages – particularly in connection with initial assessments of area and cost and with equipment budgets as the project proceeds
- Detailed co-ordination of design information
- Early involvement of the PSCP and specialist contractors in the planning, phasing and co-ordination of building works.

Hospital Cost Model - Cost breakdown

The cost model illustrates the type of capital investment which the Procure21 route will focus upon, with an acute trauma facility comprising out-patient facilities, consulting rooms and treatment rooms and care beds. The scheme does not include operating theatres or other specialist space.

The scheme, with a gross internal floor area of 3253 m², comprises three storeys of accommodation together with roof level plant. It is based on a scheme built on an existing urban health campus.

Rates in the model are at fourth quarter 2003 price levels, based on outturn costs for a project let on a two stage, lump sum contract, located in south-east England. Demolition and site preparation, type 2, 3 and 4 equipment, professional fees and VAT are excluded.

Rates in the model may need to be adjusted to account for specification, site conditions, procurement route and programme. Care should be taken in applying general location factors to health service projects with a high proportion of specialist systems and proprietary equipment.

	element cost	cost/m² gfa £	% of total cost
Substructure	253,300	77.87	4.13%
Reinforced insitu concrete column bases and ground-floor slab with edge beams; vapour barrier; blinding; limited excavation and disposal 1,058 m² @ 185			
Lift pit and walls; including formwork 18 m² @ 3,200			
Frame	278,200	85.52	4.53%
Structural steel frame; standard and cellular beam sections; equivalent to an allowance of 72 kg/m²; erection on site 232 t @ 1,060			
Steel frame fire protection; rigid intumescent fire boarding to beams and columns; to receive decorative finish 718 m @ 45			
Upper Floors	215,200	66.15	3.51%
Composite construction; 350 thick reinforced concrete on metal deck; power floating deck 2,152 m² @ 100			
Roof	239,500	73.62	3.90%
Composite construction; 350 thick reinforced concrete on metal deck; power floating; bitumen primed; felt vapour barrier; insulation 1076 m² @ 115			
Three layers polymeric roof covering; membrane; insulation; boundary work, walkways and rainwater pipes and gutters 925 m² @ 105			
Standing seam aluminium roofing; 0.9 mm coated profiled outer sheet; foam insulation; 0.5 mm profiled white faced aluminium liner sheet 219 m² @ 70			
Mansafe system Item @ 3,300			
Stairs	85,800	26.38	1.40%
Precast concrete stairs and half landings; 4.2m rise 5 @ 6,400			
Balustrades; 1.1m average high ; galvanised steel balustrade and handrail 62 m @ 320			
Handrails; galvanised steel 77 m @ 140			
Safety balustrade to roof; polyester powder coated steel 12 m @ 100			
Miscellaneous metalwork; cat ladders; open mesh flooring in risers etc Item @ 22,000			
External walls	561,400	172.58	9.15%
Aluminium faced insulated composite cladding panels; including secondary steel supports and internal proprietary liner panel 1812 m² @ 290			
Free standing screens to roof plant; louvre panels as required 46 m @ 780			
Windows and external doors	342,000	105.13	5.57%
Entrance door unit; aluminium framed glazed doors; automatic operation 1 @ 17,000			
Curtain walling; aluminium framed stick system with sealed double glazed units; manifestation strip 495 m² @ 550			
External doors; aluminium framed; polyester coated; to match windows 3 @ 4,800			
Brise soleil 137 m @ 280			
Internal Walls and Partitions	346,200	106.42	5.64%
Plasterboard partitions; metal stud with proprietary impact resistant boarding; including acoustic insulation and support for fixed equipment 1211 m @ 230			
Plasterboard partitions; metal stud with proprietary impact resistant boarding; acoustic insulation; support for fixed equipment; including lead lining for use in X-ray areas 41 m @ 680			
Plasterboard dry lining to internal face of external walls; proprietary impact resistant boarding on metal furrings 398 m @ 100			
Internal doors	202,500	62.25	3.30%
Flush doors; solid core; paint grade; vision panels; wrot softwood frame; 30/30 fire resistance; stainless steel door furniture; decorations 150 @ 1,350			
Wall finishes	50,600	15.55	0.82%
Emulsion paint to wall surfaces 1700 m² @ 4			
Eggshell paint to wall surfaces 5100 m² @ 5			
Asceptic sterile proprietary two coat surface finish to clinical and procedure areas 600 m² @ 25			
Wallpaper 300 m² @ 11			
Floor finishes	229,200	70.46	3.74%
Screed; 50mm thick; quick drying; levelling; including surface DPM 2704 m² @ 25			
Vinyl sheet flooring; to general areas; including stairs, stair nosing and edge trims 2161 m² @ 41			
Vinyl sheet flooring; slip resistan 181 m² @ 39			
Vinyl sheet flooring; electrostatic conductive 90 m² @ 50			
Carpet; 32oz broadloom 272 m² @ 70			
Epoxy floor paint to plantroom areas 549 m² @ 13			
Skirtings 2902 m @ 8			
Allowance for entrance barrier matting Item @ 12,000			
Ceiling finishes	143,000	43.96	2.33%
Suspended ceilings; 600 drop; resin bonded glasswool tile; exposed grid 2305 m² @ 42			
Plasterboard suspended ceilings; generally 400 m² @ 47			
Ceiling bulkheads; plasterboard 300 m² @ 75			
Painting to MF ceilings and bulkheads; generally 700 m² @ 7			
Furniture and fittings	419,800	129.05	6.84%
Supply and install Group 1 medical equipment (fixed furniture); fit only Group 2 and 3 medical equipment (loose furniture) 3253 m² @ 90			
Trolley crash rails and corner protection Item @ 23,000			
Reception counter and nurse stations 4 @ 12,500			
Window blinds Item @ 54,000			
Sanitaryware	137,700	42.33	2.24%
Sanitaryware generally 153 @ 900			
Disposal Installations	66,800	20.53	1.09%
Sanitary plumbing, soil and vent pipework 153 @ 400			
Syphonic rainwater installations Item @ 5,600			
Hot and cold water installations	57,900	17.80	0.94%
Cold water storage tank Item @ 5,000			
Direct fired gas water heaters 2 @ 3,500			
Hot and cold water distribution pipework, insulation; total length 2100 m 153 @ 300			
Heat source	33,000	10.14	0.54%
220 kW gas-fired boilers; roof level; flues and accessories 3 @ 11,000			

	element cost	cost/m² gfa £	% of total cost
Air treatment and ventilation	601,000	184.75	9.79%
Air-cooled chiller Item @ 42,000 Four pipe fan coil units; distribution measured separately 2,226 m² @ 11 Chilled water pipework, insulation, trace heating 2,226 m² @ 23 Variable temperature heating circuit; ceiling-level perimeter radiant panel heater system; LST radiators; pipework, valves, pumps, insulation and trace heating 3,253 m² @ 32 Air curtains and door heaters; generally Item @ 6,700 Air-handling units; total combined capacity 9.2 m³/s; including vibration mountings and attenuation to one air-handling unit Item @ 52,000 Duct mounted cooling and heating batteries 2,226 m² @ 2 Supply and installation of ductwork, grilles, diffusers and dampers 2,226 m² @ 98 Thermal insulation to ductwork 2,226 m² @ 36 Dirty extract system 2,226 m² @ 8			
Electrical Installation	346,400	106.49	5.65%
Incoming mains supply, containment, associated earthing etc. 538 m @ 69 Standby generator; 1 no 200 kVA Diesel Generator; switchgear, controls and cabling; diesel oil booster set and break tank Item @ 63,000 Main LV system: essential and non essential distribution; incoming and outgoing MCCB's; incoming on-site generator supply; automatic changeover switch; energy monitoring meters Item @ 29,000 Sub mains low voltage system: essential and non essential distribution; sub mains distribution boards, cabling and trunking 14 @ 1,250 Lighting: including standard luminaires, wiring, containment, accessories 559 @ 185 Emergency lighting: including luminaires, wiring, containment, accessories 178 @ 245 Small power: essential and non-essential small power, including cabling, trunking and socket outlets 3,253 m² @ 11 Electrical supply for mechanical services Item @ 17,000			
Gas Installations	13,000	4.00	0.21%
Incoming gas supply, including steel pipework, valves etc 1 item @ 13,000			
Lift installations	176,000	54.10	2.87%
Electro-hydraulic bed lift; serving 3nr floors Item @ 176,000			
Protective installations	11,500	3.54	0.19%
Lightning protection system Item @ 3,500 Earthing and bonding Item @ 8,000			
Communication installations	229,000	70.40	3.73%
IT pathway and infrastructure Item @ 16,700 Security system; security access points; wiring and equipment 77 @ 450 Intercom system 5 @ 1,800 Nurse call system to bed heads 56 @ 1,500 Public Address system 3 @ 450 Induction loop system Item @ 5,400 TV system to bed heads 52 @ 360 Fire alarm points 245 @ 160 Fire alarm panels Item @ 20,000			
Specialist Installations	178,100	54.75	2.90%
Medical gas system: including oxygen manifold and vacuum plant; distribution pipework and fittings, AVSU and associated equipment 106 @ 420 Pneumatic tube system; stations and receiver cabinets 3 @ 12,000 Building management and automatic control systems 3,253 m² @ 30			
Builder's work in connection	71,600	22.00	1.17%
Forming holes, chases etc 3253 m² @ 22			
Preliminaries and contingencies	848,000	260.68	13.82%
Management costs, site establishment and site supervision Contractor's preliminaries @ 16% Item @ 848,000			
Total construction cost – Building only	**6,136,700**	**1886.45**	**100%**

Location Factors

The cost breakdown is based on a price levels current in the South East and should be adjusted by the following location factors for schemes in other regions. Care should be taken in applying locatiuon factors to projects with a high proportion of specialist systems and proprietary equipment.

Inner London	1.13
Outer London	1.06
South-east	1.00
South-west	0.93
East Midlands	0.91
West Midlands	0.91
East Anglia	0.95
Yorkshire & Humberside	0.88
North-west	0.91
Northern	0.90
Scotland	0.91
Wales	0.91
Northern Ireland	0.72

Acknowledgements

Davis Langdon & Everest would like to thank Nic Allen of Devereux Architects and Richard Harrington of Architects, Nightingale Associates for their assistance in the production of this cost model.