Sarah Cremin

From: Ray Mitchell <Ray.Mitchell@hse.ie>
Sent: 27 March 2019 18:09
To: Kieran Lenihan; Public Accounts Committee
Cc: Derek_Finnegan@health.gov.ie; 'Pamela_Carter@health.gov.ie' (Pamela_Carter@health.gov.ie)
Subject: NCHDB
Attachments: 220319 Response to JCH request.pdf; Process to GMP Report 28.11.19 (ID 48273) - to be sent to JCH.PDF

Categories: Green Category

Dear Kieran,

Please find attached two documents relating to the NCHDB which the Joint Health Committee requested. We are providing these to the PAC also as they may be interested in having a copy of them.

With kind regards,

Ray Mitchell
01 6352531

Rannóg na nGnóthaí Parlaiminteacha | Oifig an Ard-Stiúrthóra | Feidhmeannacht na Seirbhíse Sláinte | Bloc D, Ionad Gnó Gheata na Páirce | Sráid Gheata na Páirce | Baile Átha Cliath 8 | D08 YFF1| Teil: (01) 635 2531 | Rphost: ray.mitchell@hse.ie | Gréasán: ww.hse.ie
Cuimhnigh ar an timpeallacht sula gclóbhualann tú an Rphost seo

Parliamentary Affairs Division | Office of the Director General | Health Service Executive | Block D, Parkgate Business Centre | Parkgate Street | Dublin 8 | D08 YFF1| Tel: (01) 635 2531| Email: ray.mitchell@hse.ie | Web: www.hse.ie
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JCH Cover Note: Consideration of Delivery Options for Phase B of the New Children's Hospital

The procurement process for the new children's hospital involved a two-stage tender process. The substructure for the building (i.e. Phase A) was tendered on the basis of a full design with a full bill of quantities, while the associated tender for the main hospital building (Phase B) was on the basis of a preliminary design with an approximate and re-measurable bill of quantities.

Consistent with this approach, and following a competitive tendering exercise, the work on Phase A was commenced in October 2017 and in parallel the second stage detailed design work was initiated to determine the cost for Phase B – the 'Guaranteed Maximum Price (GMP)'. The outcome of Phase B was a cost (GMP) which was considerably in excess of that envisaged following the initial tender process.

In this very challenging context the National Paediatric Hospital Development Board undertook during September and October 2018 a detailed assessment of options to progress to the next stage of the capital development of the new children's hospital. The three options considered by the Development Board were as follows:

Option 1 – Instruct BAM Ireland as main contractor to complete Phase B

Option 2 – Retender project, appointing a new main contractor to complete Phase B

Option 3 – Tender the Phase B works as a management contract.

The option recommended by the Development Board to the HSE and to the Department of Health was Option 1, Instruct BAM Ireland as main contractor to complete Phase B. This recommendation and the associated rationale were set out in the Development Board's GMP Report, 12 November 2018.

In November 2018, the HSE was asked by the Department of Health to consider the three options for completing the project identified by the Development Board in the GMP report. As part of the HSE's examination of these options, input was sought from specialists in health construction and procurement. Based on the balance of delivery, benefits and potential risks, the HSE's advice was that Option 1 (Instruct BAM Ireland as main contractor to complete Phase B) was the most viable option to ensure the most timely and cost-effective completion of the project.

In relation to the Committee's request, enclosed with this note is the Development Board's GMP Report, including recommendations, and the subsequent HSE advice. Information of a commercially sensitive nature has been redacted from the GMP report, where appropriate.

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The New Children's Hospital Programme
Options Going Forward

Objectives

In order to support the decision making process for the next stage of the new children's hospital capital development, the HSE has sought to answer the following questions:

- Are there any options to complete the work that should be considered, other than the three that are outlined in the GMP report:
  - Option 1 - Instruct BAM Ireland as main contractor to complete Phase B
  - Option 2 - Instruct a new main contractor to complete Phase B
  - Option 3 - Instruct a management contractor to complete Phase B
- What are the risks, benefits and considerations of each option?
- What are the particular issues in relation to timeline, deliverability, cost, risk of legal challenge?
- What are the next steps?

The HSE, at the request of the Department of Health, has sought input from a range of advisors including PwC and Alan Moore (Director of Strategic Capital Development in Northern Ireland), who have met with members of the National Paediatric Hospital Development Board and the project delivery team, to inform their views on these questions.

Phase B Delivery Options

Option 1 - Instruct BAM Ireland to complete Phase B

Deliverability and Benefits

- Discussions indicate that all **contractors have the ability and capacity** to complete the project if appointed.
- The **GMP is locked in, in the majority, at 2016 prices**. Retendering the works would likely see an increased cost at least in inflationary terms of the current climate. However the 'GMP 2016 lock in' assumption should be further tested and it needs to be understood what percentage of cost is fixed/locked in and what elements are in fact not.
- The **relationship with BAM** while strained throughout the GMP process, should improve on the agreement of the GMP.
- The **supply chain is already in place**, meaning there are limited risks to timescale increases, excluding unforeseen circumstances in Phase B works.
- The **knowledge and working relationship between the contractors** has been developed to a good standard, which would take a significant amount of time for new third parties to achieve.
- While the **cost increases** are significant, it is highly likely that any other option to complete the project to a reasonable timescale would see even higher cost increases.
- The **scarcity of M&E resource** is mitigated as contractors are already identified.

Risks

- Despite the conclusion of the GMP, there is still the potential **risk that relations do not improve** and the entirety of the Phase B works are difficult in that context.
- The **GMP does not restrict further cost increases**.
- There is a **loss of political confidence** in the programme and the contractor to deliver.

Phase B Delivery Options

Option 2 - Instruct a new main contractor to complete Phase B

Deliverability and Benefits

- If a new main contractor can be procured then in theory the **project would be deliverable, albeit with a material time delay**.
- A new main contractor would allow for a **new positive relationship** to be built by the NPHDB.
- This option **aligns with the original tender** process.
- The **design is now fully completed** which allows for a fixed price tendering process to be undertaken. There is potential to demonstrate greater value for money when competing a completed design.

Risks

- There is a significant risk that if Phase B works were tendered, that there would be **no bidders** (experience from the Carillion liquidation has shown, particularly in terms of hospital construction projects, that where there are already any works completed on site, there is very low appetite, if any, in the market to bid for projects).
- Due to foundational works being undertaken in Phase A, if a new contractor is procured, they are highly unlikely to take any **risk with regards to previously completed works**. If they are willing to take the risks, a significant price premium is likely to be applied.
- The **warranties** for the works undertaken become very complicated when using different contractor sets, with no party wishing to take responsibility.
- A **tendering of the Phase B works would add significant time** to the programme (NPHDB believe this to be 2 years) as OJEU regulations would need to be followed and a new contractor would need to upskill themselves with knowledge of what seems to be a complicated site with poor access and residential build surrounding three sides.
- The **same contractors could be appointed** without the benefit of having them locked in at significantly lower 2016 market rates.

Phase B Delivery Options

Option 3 - Instruct a management contractor to complete Phase B

Deliverability and Benefits

- If a management contractor can be procured who is sizeable enough to guarantee the value of the project, **the project could be delivered, but with a material delay**.
- This option has a **smaller delay** than option 2, by about 6 months (as outlined in the NPHDB report "Process to Guaranteed Maximum Price").
- Smaller packages of work may solicit **interest from SME or local firms**. However, discussions have led us to believe that the market has a lack of capability for this type of project.
- There is **potential to demonstrate greater value for money** when competing on the basis of a completed design.

Risks

- Due to foundational works being undertaken in Phase A, a new contractor is highly unlikely to take any **risk with regards to previously completed works**. If they are willing to take the risks, a significant price premium is likely to be applied.
- The **warranties** for the works undertaken become very complicated when using different contractor sets, with no party wishing to take responsibility. For example, clients still try to contact Carillion to ascertain who holds which warranties and which contractors can carry out remedial works on specific sections of the build without voiding current warranties held.
- Due to the complexity of the project and the inherent interfaces in a hospital build, the risk of something falling through the **gaps in discrete work packages** is high.
- Previous Carillion projects have found that management contractors often engage with the existing supply chain and utilize them going forwards. If a difficult relationship was previously present between the supply chain and the main contractor, **suppliers are reluctant to return to the project even under new management**.
- **Cost certainty is not gained until all packages are procured.**
- **Additional management resource** is needed to manage packages due to there being more under this model.
- Option 3 is likely to add a **delay which NPHDB believe to be 1.5 years**.

Option to Progress

Based on the balance of delivery, benefits and potential risks, instructing BAM to complete Phase B works is the only viable option to ensure project completion; unless there is the ability or will to significantly extend the timescales of the project and accept the associated risks with the other two potential options.

Based on the discussions conducted, it is believed that there is a relatively low risk of legal challenge if appointing the current contractor to continue with Phase B. However, it would be beneficial to seek written legal advice on the matter.

It must be recognised that none of the potential options are without their downsides. There are a number of factors which should be addressed in order to mitigate any potential issues and to increase the likelihood of success of the programme:

- Strong capability at the Development Board
- External advisory expertise to support a well resourced management team
- Department of Health confidence and commitment to continue
- A viable model to deliver the project
- A keen and capable contracting partner
- Improved contractor/client relationships
- Strong systems to identify cost pressures and manage cost risk
- Continuation of the role of the Independent Expert

Further Observations

- The **GMP is not the total figure** which will be payable for the project. As such, any risks and uncertainties that could have a financial impact need to be understood and, to the extent possible, quantified (e.g. provisional sums, other contractual terms that could lead to an additional liability).
- Significant funds have been invested to date in the project. These funds would be unrecoverable if the project was not going forward with the project into Phase B. Further to this, the cost base worked up as part of the GMP process would also be unrecoverable.
- There is **a lack of individual accountability** for the success of the NCH project. It would be beneficial for there to be a single point of accountability for the project in the role of Senior Responsible Owner; one individual needs to feel that he or she is on the hook for the performance of the project in terms of commercials/budget, timetable, and quality.
- In previous examples of such material and surprising cost increase, individuals may well have been changed to rebuild the **credibility in the programme**.
- The **governance structure** in place on the NCH, with the NPHDB reporting directly to the Department, while being funded by the HSE is seen less frequently on major projects.
- It is unclear that appropriate **scrutiny and management of advisors** has taken place consistently across the project. It would be of benefit to input this rigor into the project going forward.
- The 2 Stage tender process appears to have been followed correctly. The mechanism of the GMP meant there was a potential risk that price increases could occur prior to the GMP being locked in; this risk always sat with the public sector. It is a possibility that, even though BAM priced the original tender significantly lower than other bidders, that if another bidder had won the tender at their bid price the same issue would arise at the same delta due to the inflationary environment and the significant changes required to the BOQ.
- On projects of this scale elsewhere **Gateway Reviews**, also widely known as peer reviews, have been undertaken to ensure a further level of scrutiny has been undertaken on the details of the project.

Senior Level Meeting

Should BAM and contractors be requested to reduce the GMP at a senior level meeting:

Benefits

- Potential headline GMP decrease.
- Political value in demonstrating that the Public sector have negotiated commercially to achieve a revised GMP.
- Potential to wrap in the discussion about descoping or further value engineering of the project, however the Authority would need to have their view of where cost reduction and descoping options lie.

Risks

- Any reduction to the GMP is likely to be small.
- A meeting of this kind undermines the outcome of the GMP process.
- Contractors may seek to recover any losses with further claims.
- The ability to put pressure on preserving the GMP past this point will be reduced.
- This activity is likely to reconfirm the entrenched behaviours already seen in the relationship between project teams and BAM, and works against a move to a more collaborative approach.
- BAM are likely to understand that the other options open to the Authority are less attractive than continuing with themselves, meaning discussions do not start from a position of strength for the Authority.

On balance, the risk of pushing the relationships backwards with an unpredictable outcome suggests that there may be limited benefit from this approach at this stage. Energy may better be placed on maintaining pressure to stick to the current GMP.

Benchmarking NCH Costs

A large degree of caution is required when benchmarking the NCH construction costs with other hospital builds and global city centre construction projects. The like for like basis and therefore comparability of the benchmarks are difficult to obtain due to local factors, market conditions, and the uniqueness of the NCH design specifications. However, the below is useful context of construction costs achieved for projects elsewhere.

Global Top 5 Forecasted Tender Cost Escalation Locations (18/19)

1. Buenos Aires 35%
2. Dublin 7%
3. Johannesburg
4. San Francisco
5. Dar es Salaam

Dublin ranks second worldwide with regards to tender cost inflation, illustrating the volatile market conditions and cost climate within which contractors are operating.

Source: *Turner & Townsend, International Construction market Survey 2018.*

Hospital Comparisons

NCH Costs

- C. €6,500 per sq.m (full fit-out). Price base date: October 2018.

London

- C. €9,044 per sq.m (full fit-out). Price base date: October 2018.

North of England

- C. €4,205 per sq.m (full fit-out). Price base date: March 2013.

North West England

- C. €3,222 per sq.m (full fit-out). Price base date: July 2013.
- Re-costed as at August 2018 C. €4,240 per sq.m (full fit-out).

Wales

- C. €5,653 per sq.m (full fit-out). Price base date: February 2018.

Potential Descoping Options

Descoping can be done under any of the three delivery solutions outlined and it must be therefore noted that it is not an option in itself. With this context, the below could be considered to descope any of the three delivery options:

- Descoping the fit out, from a standard of finish and quality perspective, can be done and has been used elsewhere to stem cost overruns. However in the NCH context, as seen with the value engineering works, these changes would be costed at current market rates rather than the 2016 tendered rates, often meaning lower quality elements are more expensive at current prices than better quality product at 2016 tendered prices.
- Delaying the fit out and mothballing elements of estate (grey space/shell & core) can be done, with delivery milestones deferred over a number of years. However, it should be recognised that with tender price inflation and the premium paid for fitting out within a live hospital it is likely to lead to a higher headline price. Also the true cost of the mothballed space is never fully realised as the contractors are unlikely to offer savings in programme or preliminaries.
- There are examples of mothballing space where capacity is not immediately required, but savings are normally more significant in revenue costs rather than in capital terms.
- A number of projects have been delivered on a modular basis, in some cases with an ability to cancel subsequent phases. However, the NCH design solution appears is an integrated facility, meaning developing the build on a modular basis has the potential to be very difficult, and would require a significant redesign and revised planning submission. This assumption could be further tested with the design team.
- There is an option to descope the project contractually. For example, the Authority could revisit the risk balance of the contract to ensure risk sits with the appropriate party. This is only possible with option 2 and 3 where a new form of contract can be tendered.

Given the nature of the design solutions, descoping options that will have a significant short term capital reduction appear limited, particularly when the impact on the delivery of clinical services is examined.

Phase B Conditions

What conditions may be attached to the decision to progress with Phase B?

i. Agreement to support and engage with a series of relationship development activities

ii. Reconfirmation meeting with DoH

iii. Commitment to work with NPHDB to maintain a GMP (i.e. GMP is a maximum price)

iv. Participation in additional DoH and HSE assurance activities

v. Work with the NPHDB to deliver any recommendation on the control, reporting and management review process to be undertaken by DoH and HSE.

Relationship Development

In advance of Phase B, relationships between BAM and the NPHDB need to be reset. If Phase B is to be a success, the relationship will need to be constructive, collaborative and trusting - and not combative or hostile.

- The collaborative nature of the relationship must still enable the NPHDB to hold BAM to account, within the context of the contractual mechanisms.
- Mediation is a process that will take time. It is not a one off event; behaviours will not change as a consequence of a single meeting - other activities need to supplement the initial mediation meeting.
- A neutral, external mediator should be considered as a way of diffusing potential areas of tension and to create a "safe" environment in which to explore (and mitigate) potential barriers to the type of relationship that BAM and the NPHDB team need going forwards.
- While it is important to understand historical events to enable the relationship to move forward, emphasis must be put on the relationship needed to deliver Phase B successfully, rather than damaging the relationship by debating historical events.
- Collaborative ways of working should be promoted, which could take the form of creating a joint working space for project teams, and the creation of joint working groups as phase B progresses.

A key first step will be to develop a plan to deliver the above.

Management, Governance and Assurance

The Authority's ability to influence outcomes will diminish significantly once Phase B commences and it therefore has a limited window in which to establish the changes required for the management, oversight and assurance of the project. In recognition of this time constraint, a two stage approach could be adopted by the Authority, as set out below.

Stage 1 Before commencement of Phase B	Stage 2 After commencement of Phase B
Rapidly assess readiness to commence Phase B: • Prioritise critical gaps that threaten successful delivery • Establish and implement high priority, rapidly addressable changes (prior to Phase B) • Develop plans to enhance control, visibility and oversight (in conjunction with Phase B)	**Implement changes to the management, oversight and assurance of the project to ensure that:** • ***The project control environment is effective:*** risks, cost, schedule and quality are adequately managed • ***Reporting is timely and accurate:*** Performance and potential issues are reported accurately and escalated quickly • ***The right structures are in place:*** There is accountability for performance and a structure by which the delivery team are held to account • ***There is an appropriate assurance regime:*** Stakeholders are confidence in management forecasts through a robust project assurance regime

Assessing readiness

The stage 1 readiness assessment would critically review the maturity of the delivery organisation (NPHDB) and establish the gaps that will need to be addressed to position Phase B for success.

It would focus on four key areas: project controls; reporting & insight; organisation & people; and assurance. A minimum level of maturity will be required across these areas for the Authority to take confidence in Phase B and by identifying critical gaps early, mitigation plans can be put in place to de-risk construction.

Given the likely timescales for the commencement of Phase B, it is likely that only the highest priority and rapidly addressable changes will be implemented before its commencement. Other changes will need to be implemented in parallel with mobilization for Phase B.

Key Components of an Effective Delivery Environment

Following completion of the readiness assessment, capability should be built to provide the following:

Project controls

A robust control environment that ensures that the performance of the project is managed and understood.

Reporting

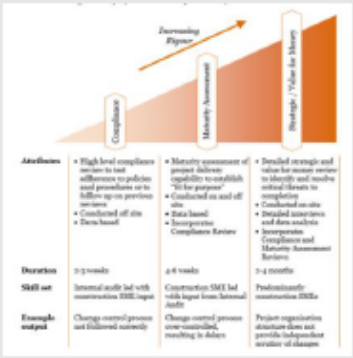
Transparent, timely and accurate reporting that provides stakeholders with visibility of performance and early warning of potential issues so that appropriate, proportionate interventions can be made.

Structure

An organisational structure that drives accountability, provides clear and open lines of communication and holds the delivery team to account.

Assurance

An assurance regime that subjects the project to periodic independent scrutiny, giving enhanced confidence to stakeholders.



working together for our children

Process to Guaranteed Maximum Price

28th November 2018

NATIONAL PAEDIATRIC HOSPITAL DEVELOPMENT BOARD

DESIGN
BUILD
EQUIP

NCH
the new children's hospital

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NATIONAL PAEDIATRIC HOSPITAL DEVELOPMENT BOARD

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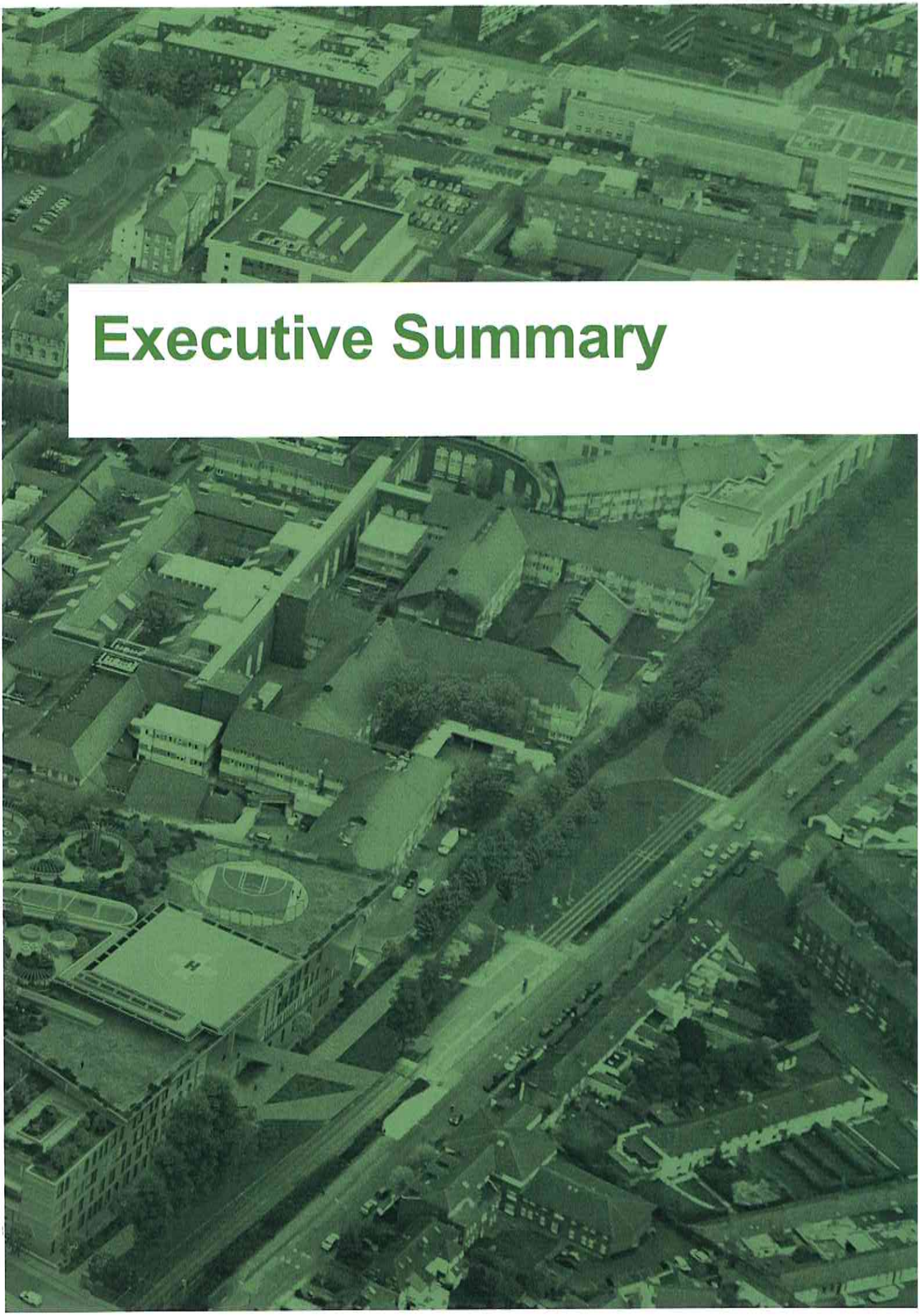


Executive Summary

1.0
Introduction

1.1 Purpose of the report

This report provides a look back at the process that the National Paediatric Hospital Development Board (NPHDB) has followed to design, build and equip the Children's Hospital since its inception in 2013, up to the conclusion of the Guaranteed Maximum Price (GMP) process on the 1st November 2018.

Its purpose is to describe that process, the challenges and key decisions made, and to record the financial position at each step.

It gives an analysis of the GMP process in particular, drilling into the contributing factors to cost escalation since tender, records the budgetary outcome, and reviews the options available.

It further records the key lessons learnt at this stage of the project, and concludes with a recommendation for proceeding with the next stage of the project.

1.2 Vision for the hospital

The vision for the new Children's Hospital was clearly articulated and defined by the NPHDB, and agreed and signed off in the project brief by all parties.

The National Paediatric Hospital Project encompassing the Children's Hospital and two paediatric outpatients and urgent care centres at Connolly and Tallaght Hospitals represents a 'once-in-a-lifetime opportunity', being the most significant capital investment project ever undertaken in healthcare in Ireland.

The project vision to create "one of the finest children's hospitals in the world" recognises the importance the buildings play in supporting the work of clinicians and creating an environment that is welcoming to children and their families and makes a real long term impact on health outcomes.

The new Children's Hospital has a strong identity that is unlike any other hospital. It breaks with the institutional mould of traditional hospital designs and creates an innovative environment – one that not only meets the highest clinical standards but is also uplifting, engaging and child and family-centred. These qualities are an essential part of the new hospital's status as a national centre of paediatric excellence – a civic building which is expected to contribute to its urban context and reflect its status through an attractive and appropriately scaled public realm.

The design has evolved out of extensive dialogue with many stakeholders. This process which also fostered integration and alignment of new ways of providing clinical care has led to the development of a world class building to deliver the best possible clinical care for children and young people.

There will be glimpses and sounds of life and activity in and around the numerous gardens, which give a tangible sense of this being a special place – a children's and young person's realm, elevated above the world of adults.

Once inside, visitors will find themselves in what instinctively feels like the heart of the hospital – a four-storey high 'great living room' that visually connects all the building's principal levels with the 'biome' and 'concourse' intuitively orientating people.

There will be glimpses and sounds of life and activity in and around the numerous gardens, which give a tangible sense of this being a special place

The design has been influenced by a number of key considerations, drawn from the design brief, clinical consultation process, and site context:

- The creation of a child and family-centred identity which permeates every aspect of the design, from its external form and scale through to the quality of the building's public spaces, bedrooms, interior finishes, play and learning spaces
- The importance of arranging the key functional zones so that a lean approach is adopted to clinical work flows
- Segregation of public, patient, staff and facilities management flows with intuitive wayfinding to support the hospital's infection control policy and the privacy and dignity of patients and families transferring between clinical areas
- The design maximises the therapeutic benefits of outdoor space, daylight, natural ventilation, and break-out spaces for patients, families and staff that offer opportunities for learning, play and distraction as well as respite from the clinical environment
- Integrated and sustainable mobility including high quality improvements to public realm, entrances directly into the hospital from LUAS and bus, the South Circular Road and the underground car park that will make access as convenient as possible for patients, their families, visitors, students and staff
- The hospital is designed to be part of a coordinated masterplan for the campus, aimed at integrating it with the existing adult and future maternity hospitals. This 'tri-location' represents the optimum clinical

model, that will enable significant operational synergies between all three services

The project's scale and national importance is being harnessed as a catalyst for regeneration of surrounding neighbourhoods and businesses.
The NPHDB and Children's Hospital Group (CHG) are sponsoring an initiative with DCC and IDA, 'The Dublin 8 Health and Innovation Hub', 'to become the State's Silicon Valley of health innovation'.

Sustainability is embedded in the design of the hospital, which is targeting a BREEAM Excellent rating and will be the first large hospital development in Ireland to achieve this. This additional 3% capital investment will deliver reductions in operational costs over the long term.

Being the first smart digital public hospital in Ireland requires a capital investment in ICT data infrastructure that is world class. The hospital is future proofed now to facilitate the optimum delivery of current and developing clinical best practice to meet rapid healthcare innovation.

The building has been designed with a level of clinical, ICT, and engineering resilience that is unprecedented, and far exceeds other healthcare buildings in Ireland. Flexibility is also enhanced through the incorporation internally of 'soft space' for shorter term expansion of critical clinical areas, and designated areas externally for larger scale long term expansion.

1.3 Context and Background

In compiling this report we are looking back at a process which commenced in 2013, and taking a look forward to a project completion in 2022, a period of just under a decade from inception to completion. An unusually lengthy timeline for any construction project, and one which reflects the size and complexity of the Children's Hospital, comparable with some of the largest infrastructure/construction projects undertaken anywhere in the world.

In the project's life so far there have already been substantial and hugely challenging upheavals and changes in the Irish construction industry, as it emerged from a period of effective collapse and below cost bidding, to one of hyperinflation, accompanied by huge shortages of skilled labour and sub-contractor capacity.

This is all compounded further by a strong portfolio of new major, high profile projects in the industrial and commercial sector. The Intel multi-billion project, for example, was recently announced, and is scheduled to start in 2019.

The project has been successfully tendered and work commenced on the Phase A works. The site was cleared and made ready for the Children's Hospital, which involved the decanting and relocation of up to 40 key existing hospital activities. The substructure works are now nearing completion, and the site/ground risks around disposal of contaminated soils, for which there is limited disposal facility availability, archaeology and any unforeseen ground issues have been greatly mitigated as a result.

The main hospital project will comprise a gross floor area of approximately 123,000 square metres, together with a three level basement for just under 1,000 cars of approximately 35,000 sq.m. A total overall gross floor area for the project of 158,000 square metres or just over 1.7m sq.ft., makes it one of the largest children's hospitals in the world, and the largest public building project in Ireland.

Planning guidelines and requirements around specific height restrictions on buildings in the area proved a design challenge, and future requirements for available expansion space on the site mitigated against utilising a high level multi-storey car park on the site. Hence the more expensive basement solution which was adopted, which also includes 10,000 sq.m. of clinical space.

The challenges around executing a project on an active brown field city centre hospital campus are being met, working closely with all the key stakeholders on and around the St. James's Hospital (SJH) campus.

The specific issues are dealt with in more detail in this report. In setting a general context and background to the project itself, it is important that the scale and significance of the challenges met to date, and which have still to be met, are understood.

More challenges remain as we move towards Phase B, but the foregoing work has the site well positioned to deliver this hugely significant project.

It is important that the scale and significance of the challenges met to date, and which have still to be met, are understood.

2.0
The Procurement Approach

NATIONAL PAEDIATRIC HOSPITAL DEVELOPMENT BOARD

DESIGN BUILD EQUIP

2.1 Procurement Strategy, Key Objectives and Deliverables

In order to deliver the vision set out above, a strategy was developed to deliver the key objectives and deliverables for the project. In particular value for money, compliance with strict public and EU procurement rules, reduction of risk, and to ensure that the project would be delivered on time.

The pressing need to replace the existing hospitals with a new facility, which could deliver 21st century health care to the children of Ireland, as speedily and efficiently as possible was considered paramount.

This is magnified by the already substantial delays around historical planning issues and subsequent site suitability/ selection issues, all of which have impacted very negatively on timely delivery.

As such, the need for an approach which could deliver the development in the shortest feasible timeline was required.

The key points in the procurement strategy are set out below.

- **Full Participation of suitable main contractors and specialist sub-contractors in the tendering process**

  This was absolutely essential. Core to this was the development of a collaborative (ultimately 2 stage) tendering process. It quickly became evident that only two Irish main contractors would have anywhere near the contracting capacity to undertake this project, and even they would have challenges in resourcing and undertaking it.

  To achieve competition it was essential that the contract, the tendering strategy and the terms and conditions of contract would encourage international contracting interest in the project. Market intelligence at the time also made it abundantly clear that neither domestic nor international contractors/specialist sub-contractors were willing to tender utilising the standard form of government contract which existed at the time.

  This required the development of bespoke/project specific tendering and contract conditions, which were formulated and drafted after lengthy consultation and engagement with the Government Contracts Committee for Construction (GCCC) and the various stakeholders involved.

  The result was the receipt of tenders from large contractors of international standing and the largest domestic contractors, and ultimately a tender which was particularly competitive at the time.

  The resultant successful tenderer is one of the largest domestic contractors and is supported by a large international parent company, which has extensive experience and resources around the delivery of very large and critical infrastructure projects around the world.

- **Timelines and the need to facilitate an early start on site**

  By breaking the work into sections, this approach ensured that early phases of work could commence whilst the detail on later phases was being finalised and agreed. The effect of this can be seen in the timeline below which sets out the original envisaged timings for both the traditional procurement approach and the "fast track" approach chosen.

  This shows a 24 month saving in total delivery time. A hugely significant saving in time, but also in cost, which at the time of agreeing the strategy in a low tender inflation environment was budgeted as delivering savings of up to €50m. In reality it will deliver savings of between €150m and €200m in the current hyper inflationary Irish tender market.

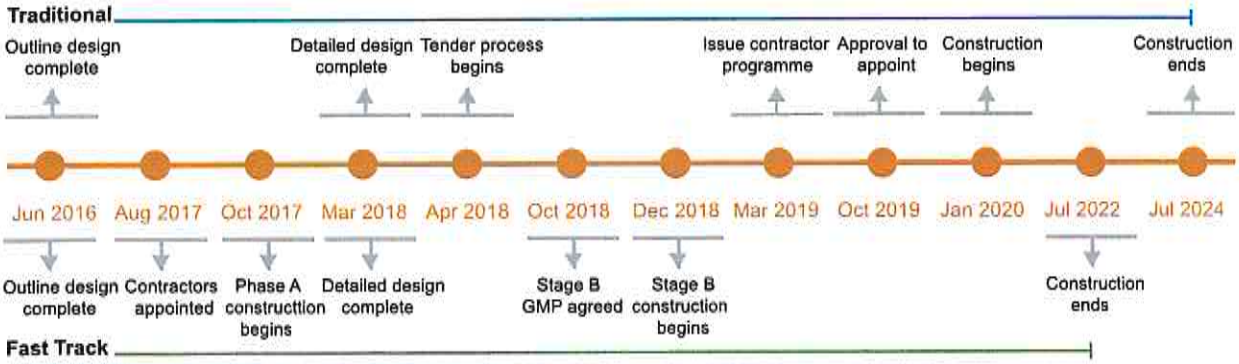


Figure 1: Traditional Procurement V. Fast Track Timeline

Form of Contract, Conditions, Phasing and 2 Stage Tendering

In recognition of the key deliverable around tendering interest, contractor collaboration and the early commencement of the works on site, a 2 stage tendering strategy was arrived at.

The key components of this 2 stage strategy were to tender the substructure (Phase A works) on the basis of a full design, with a full Bill of Quantities (BOQ) reflecting same. At the same time, tendering the main project works (Phase B) on a preliminary 1st Stage design with an approximate and re-measurable BOQ reflecting this preliminary 1st Stage design.

Having started the Phase A works on site, the 2nd phase design for the Phase B works could be completed, and the BOQ updated to reflect this.

Then by agreeing a GMP with the contractors involved, reflecting this detailed design, which requires the contractors to take all risk for quantities thereafter and limits their recovery of additional costs to clearly defined scope changes and inflation in excess of 4% which may occur post July 2019.

Decant

The proposed site contained over 40 active clinical and administrative units which had to be moved. This in many cases involved new accommodation being created elsewhere on the campus, prior to relocation and demolition of the existing buildings.

At all times essential services were fully maintained. Despite some very challenging timelines these services were decanted in full, without delay to the overall programme for the project.

Early Stage Enabling Works Contract

This allowed for clearing the existing site and the diversion of key services. These works were successfully tendered and competitive tenders received.

This strategy proved to be particularly effective in that it enabled difficult and time consuming demolition and service diversion works to proceed, whilst the main project works (both Phase A and Phase B) were out to tender in the marketplace.

Employer's Design

At an early stage in the process and prior to the appointment of a design team for the project, it was determined that going to the market on the basis of a design & build / government form of contract, simply was not sustainable or realistic.

The difficulties around adopting a design & build tendering strategy on a large public sector project had already been recognised by the Government's Contracts Committee, and a move to employer design contractual / tendering requirements was already in hand on larger public sector projects generally.

Hence the strategy was to change from the original design-build approach (set by the Transitional Board prior to the current Board) to an employer-design approach.

Planning Permission

A key risk to the project was a delay in planning permission, or more critically a planning refusal.

A specific sub-committee was set up to ensure the design evolved in such a way that the risk of a planning refusal was minimised.

After an extensive oral hearing with An Bord Pleanála a very effective planning permission was achieved with very limited conditions attaching to same.

After an extensive oral hearing with An Bord Pleanála a very effective planning permission was achieved with very limited conditions attaching to same.

Site De-risking

Asbestos removal and disposal, aspergillus (infection control), archaeological concerns, the potential for contaminated soil and the ability to dispose of the soil removed, all needed to be actively managed to ensure that there were no delays in delivering the site ready for construction to begin.

All of these de-risking strategies were successfully delivered on time and in line with the programme requirements for delivery of the overall project.

3.0
Financial Analysis

3.1 Inception to GMP

The brief for the Children's Hospital was based on the accommodation brief for the proposed scheme at the Mater Hospital. This had been developed to planning stage and a detailed project budget prepared for the Mater Project Board.

The interim board of the Children's Hospital then engaged Quantity Surveyors Davis Langdon in April 2013 to prepare an Order of Magnitude cost. This came in at €750m, assuming completion in 2019 and annual inflation of 3%.

This was prepared at the height of the recession in the Irish construction industry and reflected the exceptional competitiveness and in many cases the below cost tendering which bedevilled the construction industry at the time.

A number of design changes were then introduced for the St. James's Hospital site which increased this cost to €790m. This was to be funded through €650m of Exchequer funding, €45m of education funding, €30m of commercial funding for the car park, and €65m for equipment funding.

As the programme progressed to the Definitive Business Case these costs increased to €983m, the amount approved in the project brief. This cost escalation is set out in Figure 2.

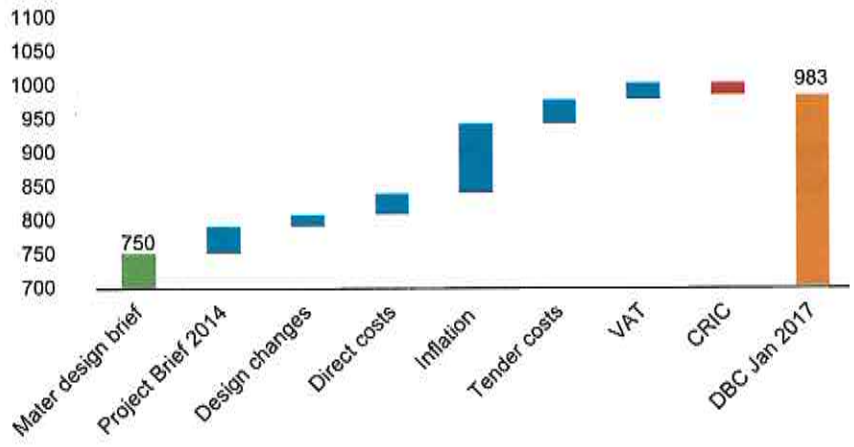


Figure 2: Cost growth up to March 2018 (€m)

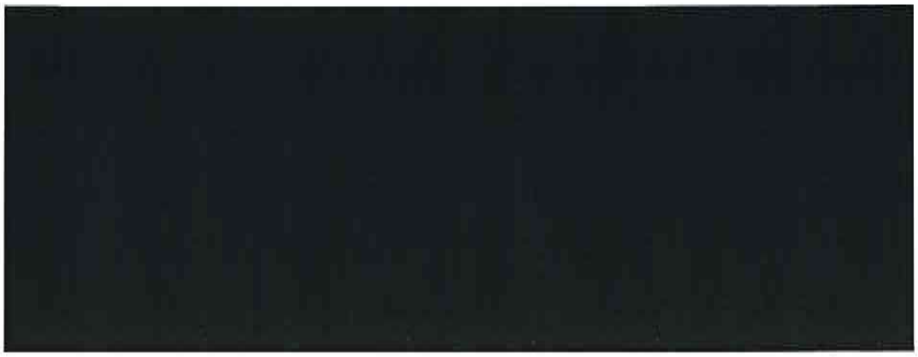
This cost growth, post project brief 2014, was primarily driven by:

- **Direct costs**: There were a number of additional costs such as for decant or design changes which led to direct costs increasing by €31m
- **Inflation:** The Preliminary Business Case introduced a total of €60m for inflation as of May 2015. By the time of the Definitive Business Case, in February 2017, this had been increased to €160m, with Linesight reporting construction inflation in 2016 at 9.6%

Tender costs

Final tender costs for the construction of the main hospital came in €35m (excluding VAT) over the original budget estimate.

Four tenders were received for the Main Contractor role:



BAM provided the lowest total bid at €636m. This figure includes €243m for the Mechanical and Electrical contractor work. As this was significantly over budget a Value Engineering (VE) target of €70m was imposed, and an overall budget of €575m (out of the total budget of €983m) was set for the construction of the main hospital.

Subsequent to the approval of the Definitive Business Case, a further €61m of costs were identified. This included €41m of contractor costs, programme alignment (i.e. costs associated with bringing together the three contractors onto a single agreed work programme) and for the additional sprinkler requirements that were set out in the grant of a fire certificate.

This meant that the total cost for the construction of the main hospital at the beginning of the GMP process stood at €606m.

3.2 The GMP Outcome

Following the completion of the GMP process it has now been confirmed that the forecast overall outturn costs have risen from €983m to €1,433m. This is primarily due to the cost increases associated with the GMP process (€330m including the 2.5% GMP allowance), with the remainder being other project costs. This is set out in Figure 4 below.

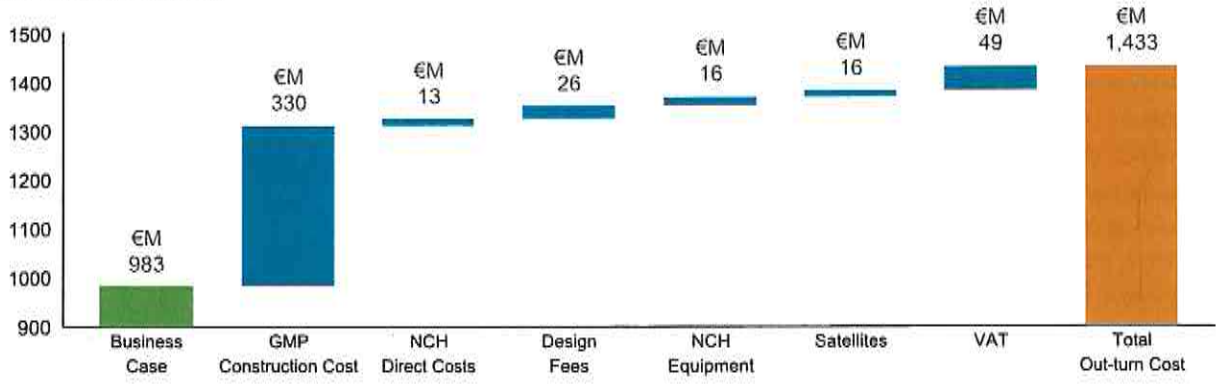


Figure 4: Costs arising from the GMP process

The current proposed budget position is:

	Cost Category	A	B	C	D	
Ref	Capital Cost	Business Case Feb 2017	Previous Projection	Current Projection	Budget Variance (C-A)	Comment / Description
1	The Children's Hospital Project Direct	32,500,000	44,225,000	44,000,000	11,500,000	Extension of NPH Team And Construction Management Team
2	The Children's Hospital Planning Fees / Contributions	13,700,000	12,532,000	12,399,905	-1,300,095	Re-forecast of Planning Contributions
3	Specialist Consultants	19,500,000	20,143,000	22,046,590	2,546,590	Legal fees , audit/procurement & Independent Conciliator
4	The Children's Hospital Design Team Fees	40,500,000	47,336,081	67,336,081	26,836,081	Design Fees - extended GMP period & overall Project Duration
5	Decant Project (NPH Allocation)	16,000,000	14,500,000	14,500,000	-1,500,000	Complete
6	Aspergillus Project	3,800,000	3,800,000	3,800,000		Complete
7	The Children's Hospital Construction Costs	571,200,000	609,377,235	890,000,000	318,800,000	GMP now determined at €890M. Prog 56.75 months
8	The Children's Hospital Risk (includes 2.5% GMP)	38,000,000	38,000,000	49,250,000	11,250,000	2.5% GMP increase on Adj Contract Sum - Client Conting €20M
9	The Children's Hospital Inflation	Incl in 7 above	Incl in 7 above	Incl in 7 above		Included in line item 7 above
10	The Children's Hospital Equipment - MES / Leasing	52,600,000	52,600,000	68,600,000	16,000,000	Medical Equipment market tested
11	The Children's Hospital Equipment Capital	15,500,000	15,500,000	15,500,000		Furniture, Fixtures and Equipment
12	Paediatric outpatients and urgent care centres Design Team Fees	3,200,000	4,000,000	4,000,063	800,063	Design Team Fees variations
13	Paediatric outpatients and urgent care centres Construction	38,000,000	42,553,912	53,400,000	15,400,000	Contract Signing + Service Diversions + M&E Claims
14	Paediatric outpatients and urgent care centres Equipment	3,500,000	3,500,000	3,800,000	300,000	Medical Equipment PO placed
15	Paediatric outpatients and urgent care centres Planning	1,200,000	1,200,000	1,200,000		
16	Paediatric outpatients and urgent care centres Risk	1,000,000	2,000,000	2,000,000	1,000,000	
17	Paediatric outpatients and urgent care centres - Aspergillus	3,000,000	2,000,000	2,000,000	-1,000,000	
18	VAT	129,800,000	130,928,771	179,524,779	49,724,779	VAT on Above; Car Park Rebate (€5M)
19	**Total**	**983,000,000**	**1,044,195,999**	**1,433,357,418**	**450,357,418**	

Table 1: Overall Project Budget (€)

Exclusions to this budget are:

Exclusions	
Mater Site Costs	Decant Provision for NPH allocation only
ICT part of National strategy and separate HSE funding	Ronald Mc Donald House
CHG Programme; investment case	CRIC (separate procurement)
Sectoral Employment Order	Change in legislation for Class C cabling
Hyperinflation post July 2019 and above 4% allowance in Contract	

Table 2: Exclusions

The associated cash flow is as follows:

1	Year	up to 2016	2017	2018	2019	2020	2021	2022	2023	Total
2	Approved Business Case - Cashflow submitted	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)
2.1	HSE Funding	62.1	80.7	156.9	173.5	188.0	169.6	75.3	11.9	918.0
2.2	Equipping - MES									65.0
2.3	Other Funding									
2.4	**Total**	**62.1**	**80.7**	**156.9**	**173.5**	**188.0**	**169.6**	**75.3**	**11.9**	**983.0**
3	HSE Funding Profile - Letter 12/03/18	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)
3.1	HSE Funding	60.0	67.8	120.0	150.0	165.0	165.0	79.0	87.2	894.0
3.2	DOES - school				2.5	2.5				5.0
3.3	DOES - 3rd Level								17.0	17.0
3.4	Philanthropic						5.0	5.0	10.0	20.0
3.5	Commercial							47.0		47.0
3.6	**Total**	**60.0**	**67.8**	**120.0**	**152.5**	**167.5**	**170.0**	**131.0**	**114.2**	**983.0**
4	NPHDB Current Cashflow GMP	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)
4.1	Exchequer (HSE / DOES)	59.0	69.0	105.0	252.0	274.0	276.0	193.0	69.0	1,297.0
4.2	Philanthropic						5.0	5.0	10.0	20.0
4.3	Commercial							47.0		47.0
4.4	Equipment						14.0	41.0	14.0	69.0
4.5	**Total**	**59.0**	**69.0**	**105.0**	**252.0**	**274.0**	**295.0**	**286.0**	**93.0**	**1,433.0**

[redacted]

Table 3: Project Cashflow

3.3 Steps to a GMP

Arriving at the eventually agreed GMP has been tracked across three specific steps which have been referred to in the main body of this report and the executive summary as the three step process.

The €284m cost growth driven by the GMP process can be broken down into three categories, as shown below.

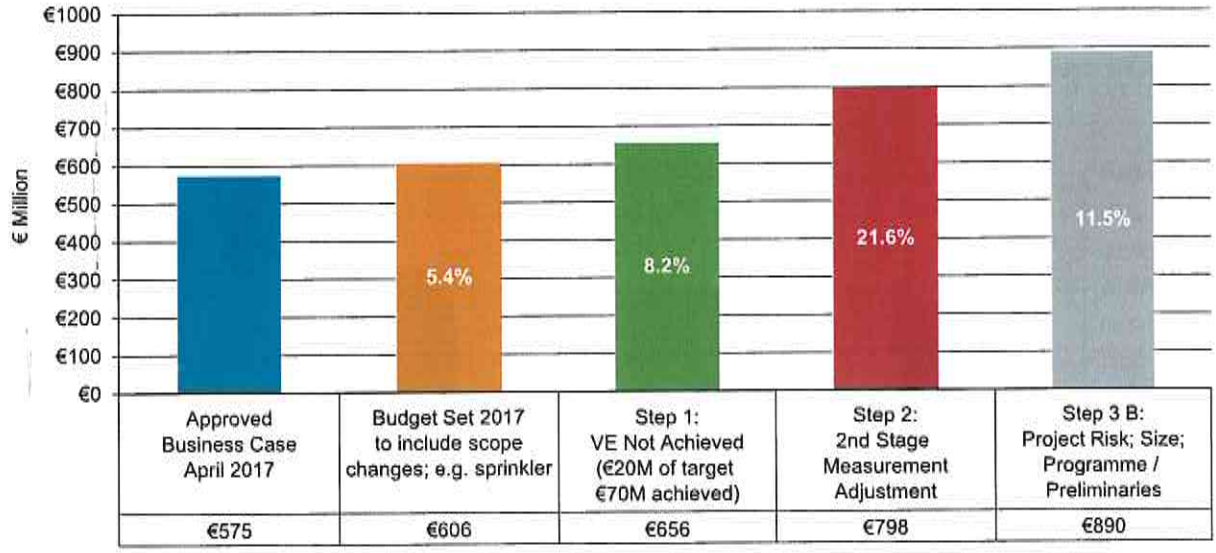


Figure 5: 2017 Target Budget: 3 Step Adjustment to GMP for 2022 Outturn (€m)

The above chart highlights the costs associated with each of these steps;

- Step 1 the VE not achieved moving the budget +€50m, from €606m to €656m
- Step 2 moving the budget +€142m from €656m to €798m
- Step 2 of €142m is further broken into 4 key categories as set out below, in the Step 2 section
- Step 3 then moves the budget +€92m. Each of these steps are described below

• Step 1: Value Engineering not achieved

A VE target of €70m was set as part of the Definitive Business Case (DBC) approval process. Only €20m of this was achieved, meaning €50m of anticipated savings had to be added back to the forecast.

Previously options were discussed around descoping and a Capital Budget Backstop Plan 12th December 2017 set out an extensive de-scoping plan, typically deferring construction of Tallaght paediatric outpatients and urgent care centre, shell/core educational spaces and shell/core 20% of clinical departmental space resulting in a saving of €49m.

The implications of incorporating the de-scoping would not support the aspirations contained in the Approved Project Brief, and would certainly prove to be very disruptive and pose significant risk to the operation of a live hospital, the provision of services in an effective manner and be significantly costlier to retrofit at some future date.

This backstop plan was rejected by the CHP&P Board with an instruction that alternative options (based on 2022 activity and workforce) be examined.

In hindsight, and in the context of the exceptionally competitive lowest tender received for the project, this €70m VE target was extremely ambitious.

Whilst clear strategies were developed around delivering this VE, unfortunately in many cases moving to alternative designs and specifications to achieve these savings simply gave the contractors the opportunity to move from their 1st Stage tender rates and apply higher current market rates.

Step 2: 2nd Stage Measurement Adjustments

Table 4 below describes how the €142m increase at this step breaks down.

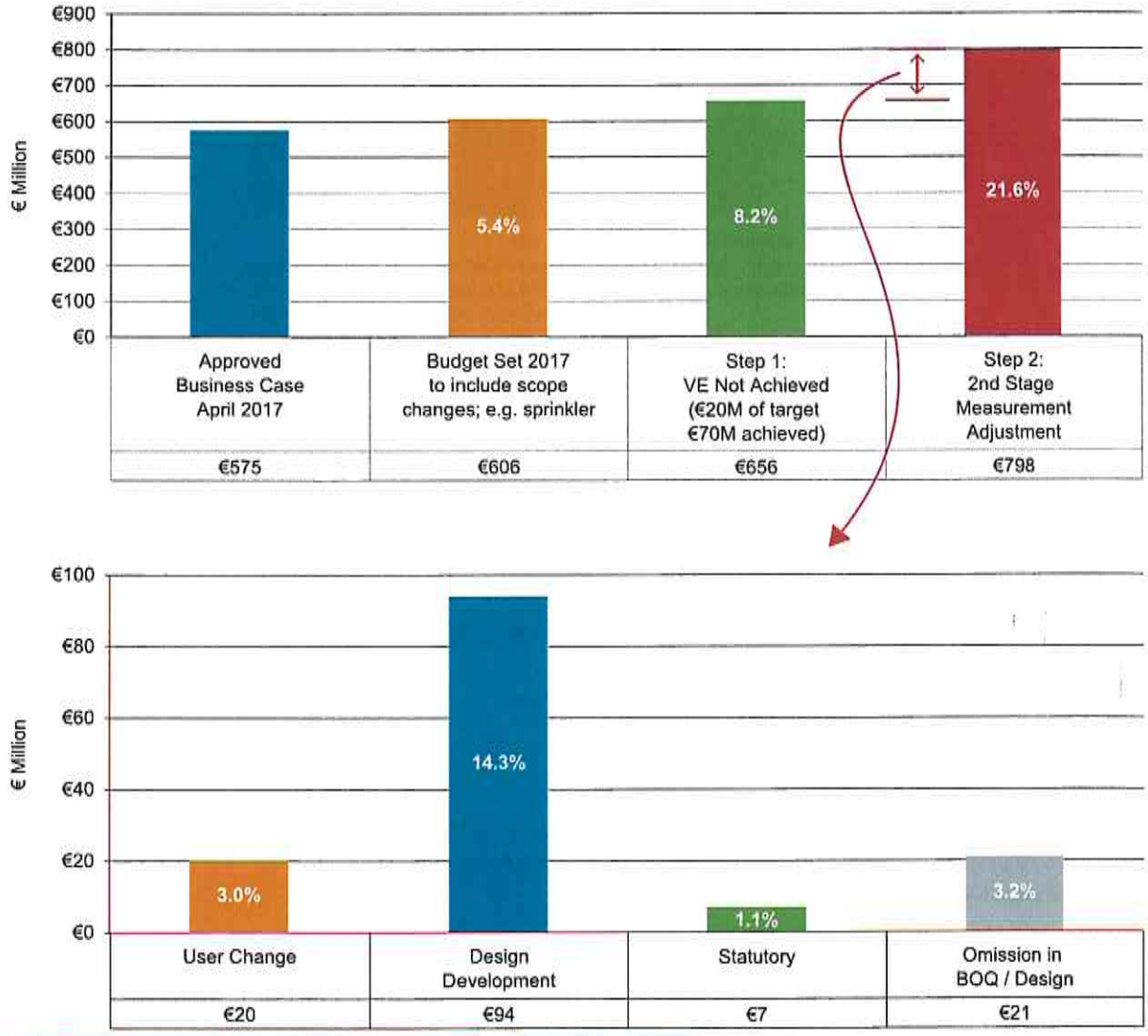


Figure 6: 2017 Target Budget: 3 Step Adjustment to GMP for 2022 Outturn (Top) 2nd Stage Measurement Adjustment; 4 Adjustment Categories (Bottom)

This Step 2 was the primary driver of cost growth. This category represents all cost growth due to changes in design, specifications or quantities. In arriving at this adjustment, the original quantities measured in the 1st Stage tender documents and BOQ are re-measured to reflect the updated 2nd Stage design.

The rates obtained in competition as part of the 1st Stage tender are applied to these updated quantities.

This is a rigorous and clearly defined process with clear guidelines and procedures for its implementation.

The Independent Expert, appointed under the contract, provided invaluable guidance and direction with regard to the process and procedures, and had a central and critical role to play in ensuring it was in strict accordance with the contract conditions.

The types of increase are broken down into 4 categories, as described below - Civil, Structural and Architectural (CSA), Mechanical and Electrical. These are further divided into discipline. The profit on services reflects the Main Contractor's percentage additions as per their tender.

Contract	1. User change	2. Design Development	3. Statutory	4. Omissions in Design/BOQ	Total
CSA	€5,625,380	€33,595,044	€780,000	€3,408,608	€43,409,032
Mechanical	€5,993,576	€30,942,150	€3,722,561	€3,514,717	€44,173,004
Electrical	€7,130,388	€22,871,110	€2,062,210	€11,699,546	€43,763,254
Profit on Services	€1,640,496	€6,726,658	€723,096	€1,901,783	€10,992,033
Total	**€20,389,840**	**€94,134,962**	**€7,287,867**	**€20,524,654**	**€142,337,323**

Table 4: Step 2 2nd Stage Measurement Adjustments

The original contractors' submission for measured works was for €880m and concluded at €798m.

User Engagement

- At the time of the preparation of the tender documentation the User Engagement process had not concluded
- As a result the tender document reflected the output from the process at that time. The User Engagement process continued after the issue of the tender documents with the developed design reflecting the output from this process
- Examples include:
  - Group 1 Fittings tendered during the Pre-Phase B period adjusted
  - Additional data/ sockets/ medical gas outlets etc. together with associated infrastructure incorporated into developed design on which GMP is based

Design Development

- The project was tendered on the basis of a 2 Stage process
- This process involves taking provisional quantities identified and priced in Stage 1 (in approximate BOQ) and applying tendered rates to re-measurement quantities which reflect the developed design
  - This would include for example taking quantities for elements of the Mechanical and Electrical installation generated from typical room designs and updating to reflect completed system designs during Stage 2

- It would also reflect the outcome of the contractors interrogation of the quantities and the BIM Model to assess all buildability and risk; thereby excluding this as a basis for post GMP claims

Statutory Issues

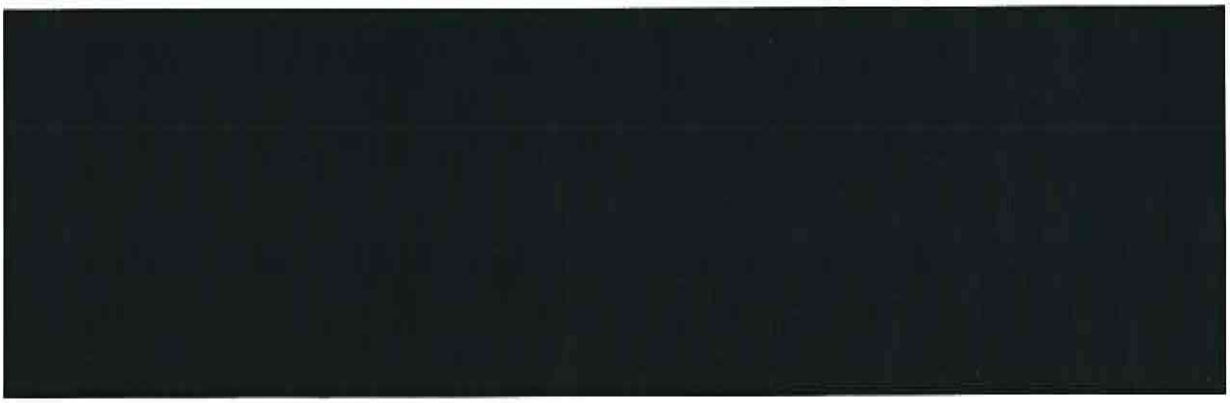
- This category represents the incorporating of the impact of two key events during the detailed design;
  - Conditions attached to the Fire Certificate affecting the detailed design which were addressed during the Pre-Phase B period
  - Changes incorporated during the detailed design period to reflect the outcome of the Grenfell fire as advised by the Fire Consultants

Omissions in design

- Any omissions to the design or Stage 1 quantities are reflected under this category. Examples of these would include;
  - Stage 1 design assumptions that needed to be changed (Secondary containment in lieu of conduit)
  - Items not measured in Stage 1 BOQ (Cladding to sections of ductwork)

- **Step 3: Programme and Preliminaries Adjustment**

Changes in this category Step 3 are primarily due to changes in the timeline leading to additional programme costs. These result from the increase in quantities, and follow finalisation by the Main Contractor and the Mechanical and Electrical (M&E) sub-contractors of the coordinated programme. This is a key deliverable of the contractor agreement prior to award of Phase B.



This process was overseen and closely monitored by the Independent Expert, who sat in and officiated on the final resolution of this step, as the discussion had become particularly protracted and adversarial at this point and had the potential to substantially de-rail any overall agreement on a GMP.

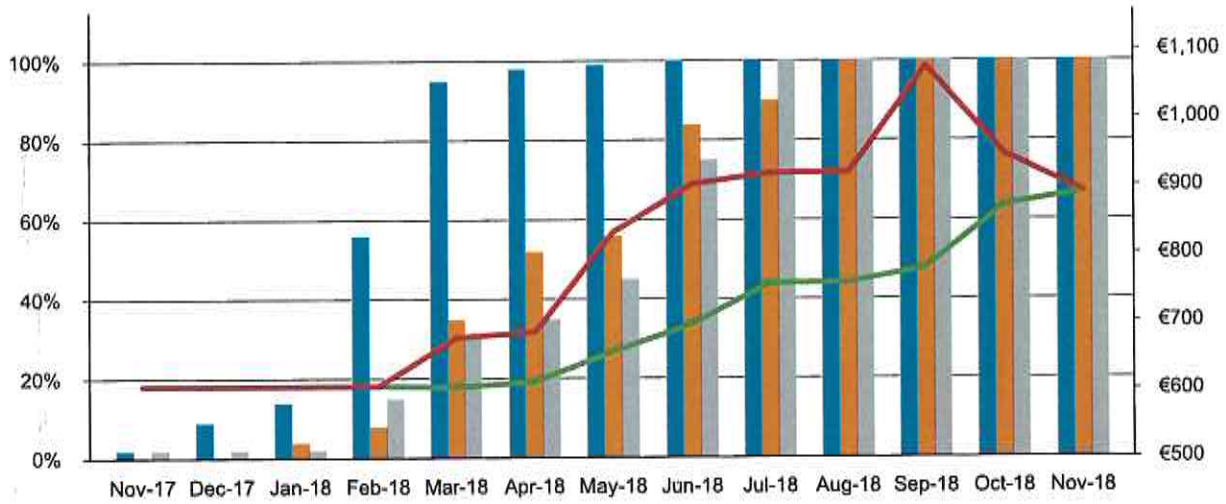
To put the settlement of this figure in context, the original submissions received from the contractors involved totalled €283m, and the Independent Expert adjudicated on a full and final settlement of these submissions at €92m.

3.4 Cost Trending

During the entirety of the GMP process Linesight issued tracking reports on cost, comprising a current valuation based on measured packages that had been issued, in addition to the contractors' submissions.

The complexity and extent of the services design drove a longer than expected design release for M&E, which in turn slowed the rate at which the measured value was computed.

Figure 7 flags the delivery of design packages which were developed and delivered during the 2nd Stage design process. It also shows the value of that design as it was measured, and the risk allowance identified as the process progressed.



	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18
CSA design %	2%	9%	14%	56%	95%	98%	99%	100%	100%	100%	100%	100%	100%
Mechanical design %	0%	0%	4%	8%	35%	52%	56%	84%	90%	100%	100%	100%	100%
Electrical design %	2%	2%	2%	15%	30%	35%	45%	75%	100%	100%	100%	100%	100%
Measured Packages Trending Report €m	€606	€606	€606	€606	€604	€612	€656	€696	€756	€757	€778	€870	€890
Contractors Submissions €m	€606	€606	€606	€606	€677	€685	€832	€902	€918	€919	€1,075	€945	€890

Figure 7: Design Information Development and Cost Reporting / Trending (€m)

From this table it is clear there was a significant divergence between what the contractors were submitting versus the measured package trend as illustrated below.

[redacted]

4.0
Value for Money

The agreed GMP figure of €890m represents a considerable uplift on the adjusted tender budget for the project. Having concluded the final step of the GMP process, NPHDB have sought to establish a validation of whether we are getting value for money at that price.

Two external studies by independent experts were commissioned, the first an evaluation of the quality and content of the M&E design by DSSR (see section 3.9 of the main report), which concluded the design was aligned with current international practice, delivering a cost effective modern hospital.

The second was an international cost benchmarking study by AECOM (see 4.2 and Appendix 6.1) which concluded that in terms of cost per square metre the Children's Hospital was aligned with similar completed projects. It reflects that the NPH cost/m2 of €6,500 matches international norms.

Linesight have updated the base construction budget of €360m to take into account scope changes and market inflation since 2014. This results in an outturn cost of €782m.

A workgroup was established by the NPHDB to look at alternate procurement options to complete Phase B. This group examined several approaches and focused on the most appropriate two:

- Re-tender to the EU market for a fixed price lump sum based on the completed design
- Procure a Management Contractor, including the concrete frame, who would then tender the remaining packages under EU procurement rules

The costs for these options ranged from €1,120m to €1,160m.

In summary:

GMP Comparators	Value	%
Original budget adjusted for inflation	€782m	-
Agreed GMP	€890m	**+14%**
Alternative options to complete	€1,120m - €1,160m	**+43% to +48%**

Table 7: GMP Comparators

The AECOM Benchmarking report (see 4.2 and Appendix 6.1) confirms that the NPH cost of €6,500 per sq.m. matches international norms.

4.1 Inflation

The initial budget provision at Stage 1 (2013/14) was €360m, excluding contingency.

Subsequent to this there were a number of approved scope changes and contingency allocation which increased this sum to €441m.

A comprehensive analysis of the impact of inflation on the above sum has been carried out. This analysis reflected actual tender inflation which has occurred in the industry from 2014 up until the end of 2018 and utilized the most recent market intelligence and trending around likely levels of inflation over the period 2019 to 2023.

This analysis identifies a revised cost of €782m, incorporating the impact of inflation of €341m.

The calculation also reflects movements in the timeline for the start of the works on site since the initial budget was established.

A copy of the inflation analysis is included at Appendix 6.2

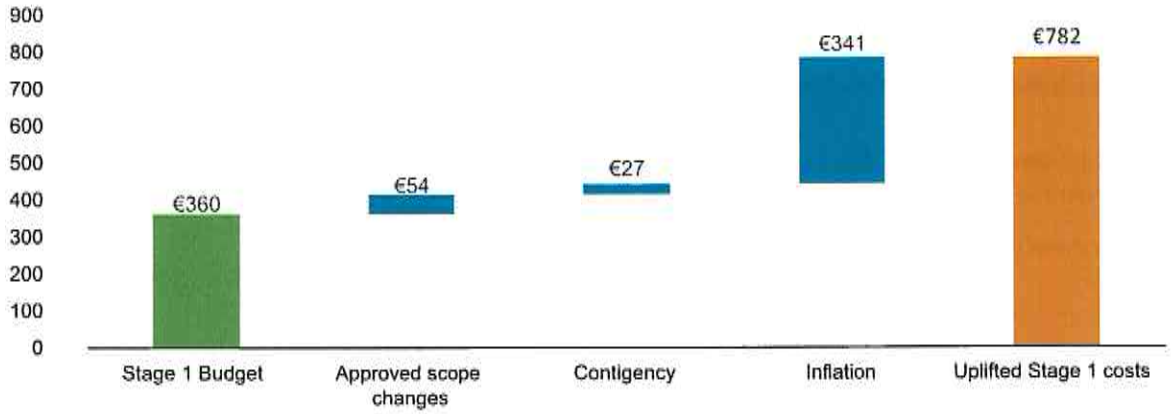


Figure 8: Stage 1 Budget Including Inflation (€m)

The chart opposite demonstrates the significant percentage increases in tender inflation generally in the construction industry in the context of the timelines for the procurement of the Children's Hospital, particularly as it relates to Dublin City brownfield sites.

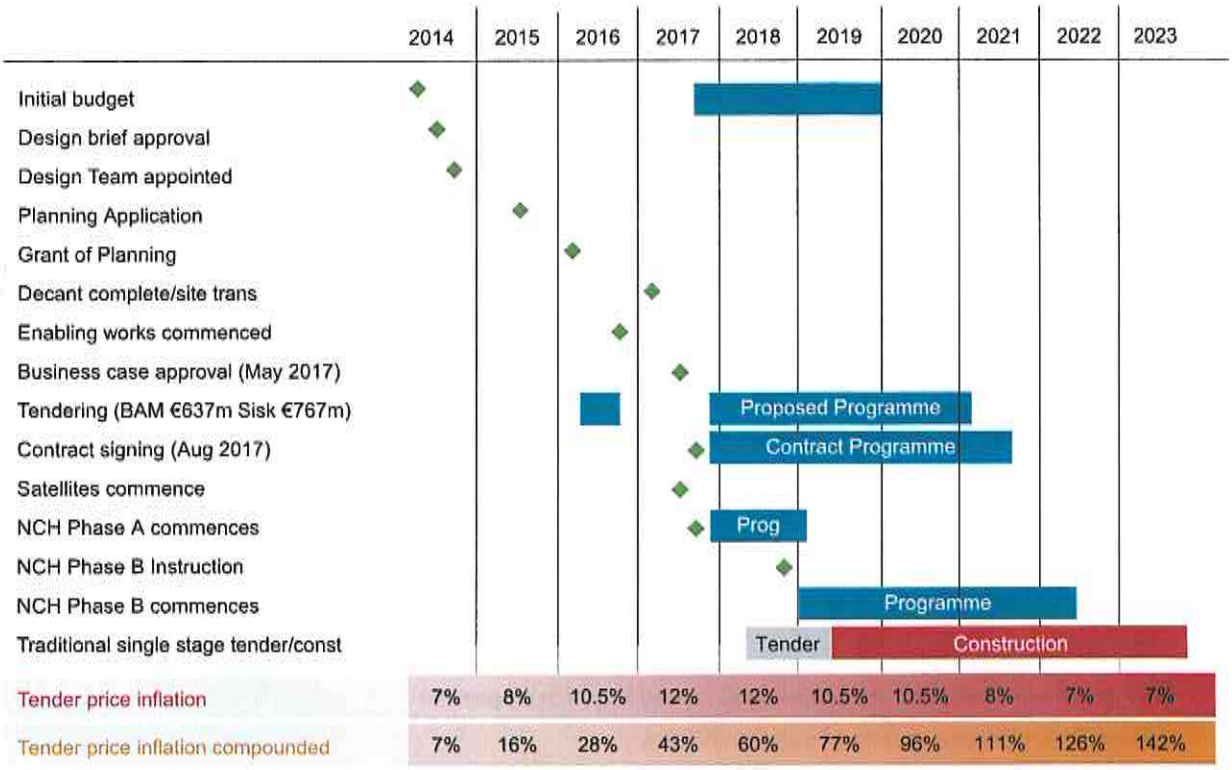


Figure 9: Original costs uplifted for inflation (€m)

4.2 Benchmarking

Figure 10 shows the cost per square metre of the main hospital building, compared to other similar projects in different international locations. These costs have been adjusted to allow for difference in factors such as exchange rates, time period and local cost factors. Whilst Europe 1 and 2 and ANZ1 all provide significantly lower costs per square metre, these are all in planning phases and costs may well rise. Focusing on the USA projects, which are all children's hospitals which are all complete (or nearly complete), the cost of the Children's Hospital sits in the middle of the range of potential costs.

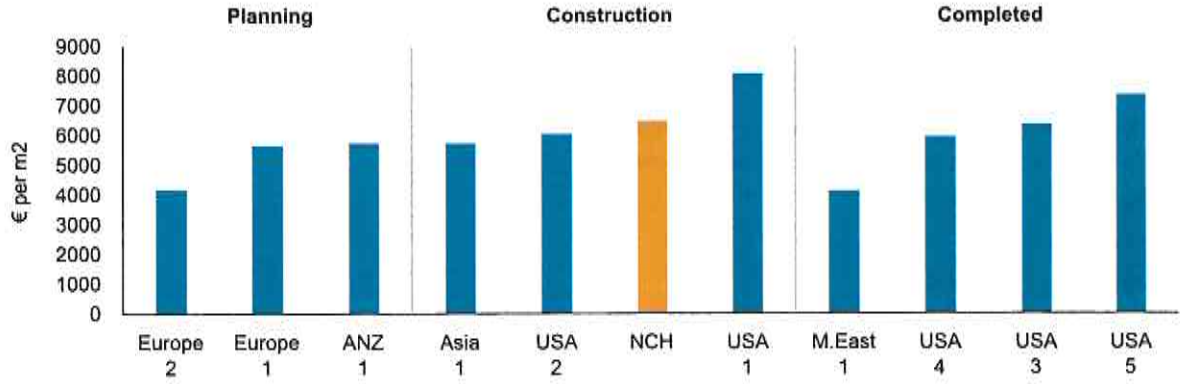


Figure 10: Benchmark Costs (€per m2)

The full AECOM Benchmarking Report is included at Appendix 6.1.

4.3 Options to complete

As cost has risen very significantly since project approval in 2017, NPHDB undertook to assess alternate strategies. After a wide ranging review of alternate procurement strategies, three options were considered to be worthy of a more detailed assessment. All three of these options assume that Phase A would be completed by BAM.

These were:

- Option 1: Continue with the existing contractual framework and instruct Phase B
- Option 2: Re-tender the Project; Fixed Price Lump Sum based on finalised design
- Option 3: Management Contracting; Procure Management Contractor and Frame

4.3.1 Option 1: Complete the GMP process

Accept the GMP adjustments and approve Phase B.

- Keeps momentum in the Project
- GMP based on a completed design and an aligned 56.75 month programme
- 2 Stage Tender Process approved by all stakeholders
- Seamless single point of responsibility between Phase A and Phase B

4.3.2 Option 2: Re-tender Project; Fixed Price Lump Sum based on finalised design

Complete the design, create new tender documents and re-tender the Main and M&E contracts.

As the building design is now finalised, it would allow for a Fixed Price Lump Sum.

- Timeline extended by 1 to 1.5 years
- Highly competitive market could drive a higher tender price than GMP
- Break between responsibility for Phase A and Phase B
- Risk of lack of market interest
- No GMP

4.3.3 Option 3: Management Contracting

Tender the Phase B works as a management contract, breaking the design into packages to be procured by the Management Contractor. Retain the Frame Contractor

- Timeline extended by 12 months
- No cost certainty
- Public procurement challenges
- Needs a level of co-operation from BAM
- More attractive to contractors from risk perspective

4.3.4 Implications

Should the decision be made in favour of Option 2 or 3 this would mean a further 1 to 1.5 year delay, whilst the contract is re-tendered and a replacement contractor brought onto site.

There are a number of additional costs that would need to be considered should this option be chosen. In particular the very substantial costs which are likely to be incurred by inflation, which would mean substantially increased construction costs of circa €150m above the 2016 tendered rates.

The total costs of Options 2 and 3 have been estimated through taking a bottom up approach based on the finalised design.

The construction costs for the three options are set out in the table below.

Figure 11: Options Costing (€m)

The NPHDB would also experience direct programme extension costs of around €60m if options 2 or 3 were to be utilised.

It is also important to appreciate that Option 1 represents a GMP with the contractors assuming substantial risk around the final outturn costs for the project.

The other options represent much less cost certainty for the client.

The other options represent much less cost certainty for the client, and whilst the figures noted above reflect likely tender returns, the actual outturn/final account costs cannot be guaranteed, and could be considerably in excess of this. Some public sector projects undertaken in recent years have seen cost growth of between 10% and 30% (between the contracted amount and the final account amount).

4.3.5 Alternative Options Conclusion

The current process, despite the very significant additional costs, will deliver best value for money, with the Children's Hospital complete by mid-2022, well ahead of the other options and for substantially less money. It also benefits from the cost certainty provided by a GMP.

5.0
Impact of Not Instructing Phase B on the 3rd December

The following are the key consequences of not instructing the Main Contractor by the 3rd December 2018:

- Contractual Compensation Event if Phase B Instruction not issued by 3rd December 2018
- Purchase Orders and Sub-contracts for Phase B cannot be placed, and quotations will expire and are no longer valid
- Contractors will no longer stand over their tendered rates and prices start to escalate and the GMP number starts to increase further
- Monthly run on costs will be €15m and upwards, as estimated below

6.0
Lessons Learned; Positives and Negatives

This report sets out the challenges and the key considerations informing tendering and contractual strategies in seeking to successfully deliver on those challenges.

Ultimately, given the size and complexity of the Children's Hospital, it represented a particular and unique set of challenges around attracting tender interest and delivery. This was particularly in the context of a public sector project operating under strict public procurement / EU tendering requirements and protocols.

Ultimately after extensive engagement with all the various stakeholders and extensive engagement in particular with the GCCC a specifically tailored and bespoke set of tendering and contractual arrangements were agreed upon and put in place to facilitate the delivery of these key objectives, which were based at the time around substantial amendments and alterations to the existing government form.

Inevitably given the unique and bespoke nature of these procedures and documentation, there have been lessons learned, some positive and some less so:

2 Stage Tender Process will deliver the project 2 years earlier than traditional procurement

The Positives

1. 2 Stage Tender Process delivered the following:
    a) Project delivery 2+ years earlier than traditional procurement
    b) Saving of 18% to 22% tender inflation as a result of this earlier delivery
    c) Early contractor involvement in design development, project planning, risk management
    d) The majority of the GMP locked in at 2016 tendered rates
2. A GMP in place prior to award of Phase B
    a) Based on a robust/complete design and a fully aligned 56.75 month programme
    b) Only adjustable for clearly defined scope changes
    c) Preempts traditional post contract award, cost/programme challenges which often result in a 20% to 30% increase in post contract out-turn costs
    d) Accelerated the design freeze/design development and gave the project early momentum
    e) The role of the Independent Expert in resolving measurement and contractual disputes worked very well
    f) Greatly reduces the potential for contractor insolvency/non- performance as it encourages the early identification of risk and potential problems at an early stage in the process and fosters thereafter an environment for problem solving rather than problem identification
3. The project has been substantially de-risked in relation to ground conditions (contamination; soil disposal; archaeology; piling; rock anchors; adjoining owners) in parallel with the GMP process

The Challenges

1. The project targets for programme, budget and inflation were overly optimistic
    a) The overall timeframe through planning; site decanting; public procurement of design team and contractors was underestimated
    b) Using tender costs as a basis for formulating a project budget during a recessionary period, with below cost bidding (circa 20% to 30% below cost in some instances), leads to significant underestimation of the project costs
2. There was inadequate design and estimation of quantities at tender stage for M&E services to adequately capture the overall scope and complexity of the services installations (using typical rooms and factoring these up did not work). However the tender was sufficiently well described to ensure competitive rates were obtained which could thereafter be applied to the updated 2nd Stage design quantities
3. While it was well intentioned to aspire to achieve Value Engineering in order to reduce project costs, this proved very difficult to achieve in the context of a contractor who was €130m lower than the next tenderer
4. Original estimates should have been more reflective of the scale and complexity of the project relative to the capacity of the Irish construction market on a difficult congested site in a city centre location
5. More robust early warning process during the design development phase

Recommendation

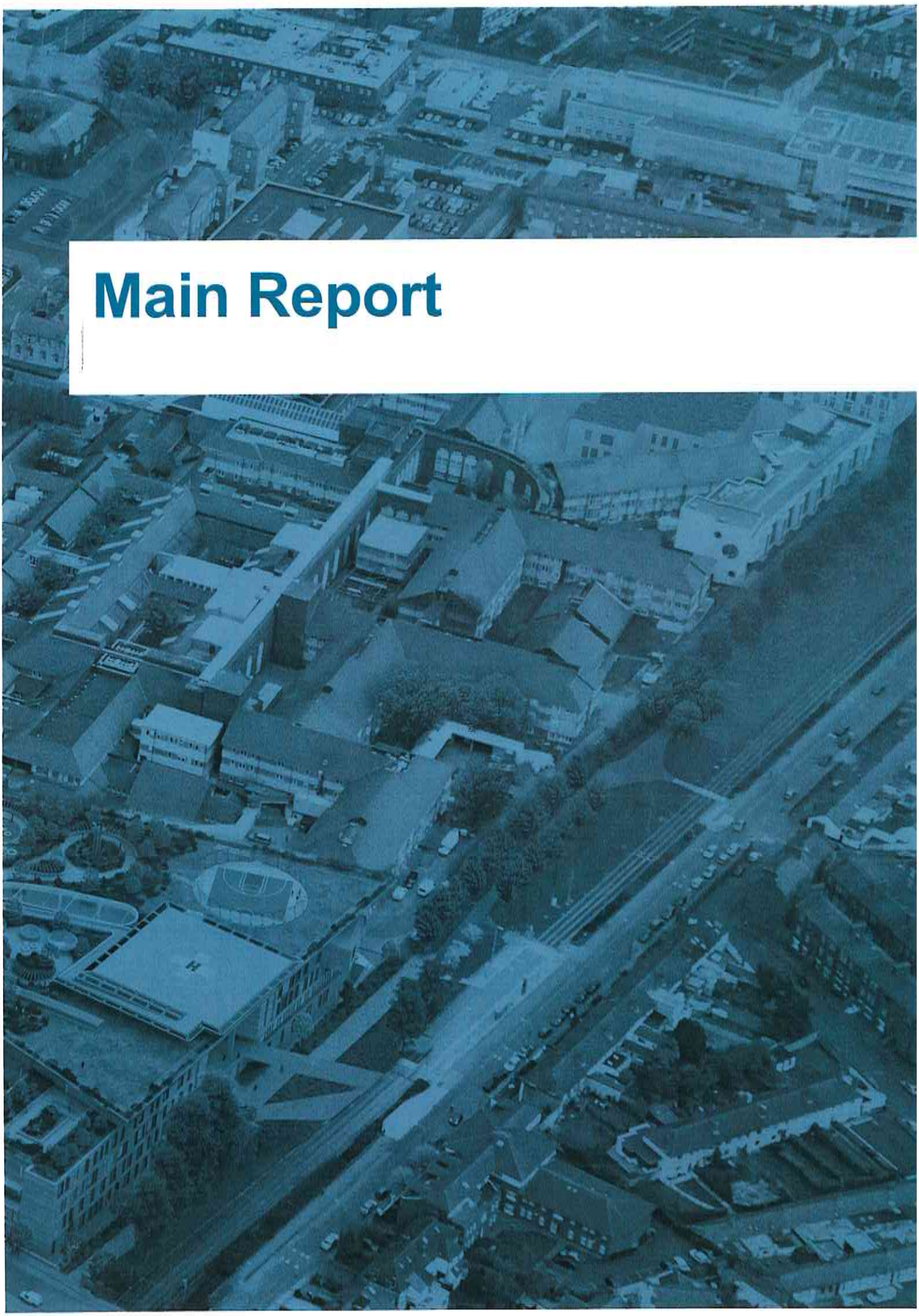
The date for awarding Phase B is now 3rd December 2018. It is appreciated that the delays in completion of the GMP process have considerably reduced the timeframe for review and final decision by the CHP&P, HSE and Department of Health.

However, there are very significant contractual risks to the project if this is delayed, including potential additional costs of more than €15m per month.

Of the three options examined to complete the project, Option 1, the existing 2 Stage procurement with a GMP, delivers value for money with a significantly shorter programme than Option 2 or 3. While very significant cost increases have arisen since tender, particularly in relation to Mechanical and Electrical systems, the M&E design has been independently reviewed and found to be appropriate.

Subject to the overall capital funding being provided, the NPHDB at its 7th November Board meeting, recommends that the Phase B Construction Works are awarded to BAM based on the determined GMP value.

Main Report



1.0
Introduction

1.1 Purpose of report

This report prepared by NPHDB contains a detailed review of the progress of the project since August 2013. In particular, it deals with the significant cost increases now projected following completion of the GMP process and the updating of overall project costs.

The procurement of contractors for the Children's Hospital is being delivered in a 2 Stage process, with the objective to deliver a GMP (Guaranteed Maximum Price) ahead of instruction to proceed with Phase B of the project. This is facilitated through early contractor involvement in design development and project planning over a period of 12 months while Phase A (Basement and Groundworks) is progressing.

The contractual date for instruction to proceed with Phase B is 3rd September 2018. This was extended by agreement of all parties to 3rd December 2018 in order to provide sufficient time to complete the process, given the complex and challenging nature of many of the issues raised to date.

This report presents the process of procurement from early budget formation in 2013 up to completion of the GMP process on 2nd November 2018, and the financial detail behind the capital costs associated.

This is not a comprehensive analysis or commentary on the project reporting to date, but rather examines the key activities and strategic decisions that have occurred during the various approval stages, and their impact on the project. Nor does it address implications to revenue costs or other costs associated with this or other options, other than those captured in the capital budget (design team etc.)

The GMP process is now complete, and the NPHDB would like to formally present here the outcome to our key stakeholders; CHP&P, HSE and Department of Health (DOH).

1.2 Project Vision

The National Paediatric Hospital Project represents a 'once-in-a-lifetime opportunity' for all those involved in its design and implementation. Encompassing two new paediatric outpatient and urgent care centres at Connolly and Tallaght Hospitals as well as the Children's Hospital at St. James's, it is the most significant capital investment project ever undertaken in healthcare in Ireland and is a core part of our transition to a new model of care for paediatric services.

It is the most significant capital investment project ever undertaken in healthcare in Ireland

To achieve this, the NPHDB set the vision to create "one of the finest children's hospitals in the world" – an aspiration which recognises the importance that the building itself can play in supporting the work of clinicians and creating an environment that is welcoming to children and their families and makes a real long term impact on health outcomes.

The design concept gives the new Children's Hospital a strong identity that is unlike any other hospital. Deliberately so, as the intention is to break with the institutional mould of traditional hospital designs and create an innovative environment – one that not only meets the highest clinical standards but is also uplifting, engaging and child and family-centred.

The design, now completed in great detail and under construction, has evolved out of extensive dialogue with many stakeholders over the course of three years, including staff from the three children's hospitals, with families, young people and children who are former or current users of the service, and with local residents and businesses. This process, which also fostered integration and alignment of new ways of providing clinical care, has led to the development of a world class building, expressly designed for staff to deliver the best possible clinical care for children and young people.

On approaching the new hospital, the first impression will be of a 'floating' garden about halfway up the building, a 'flying carpet' of trees and plants.

On approaching the new hospital, the first impression will be of a 'floating' garden about halfway up the building, a 'flying carpet' of trees and plants, surrounding a curvaceous three-storey pavilion. There will be glimpses and sounds of life and activity in and around the garden, which give a tangible sense of this being a special place – a children's and young person's realm, elevated above the world of adults. Below the floating garden, the elements which will be distinguishable immediately are the main entrance, the outpatient 'houses' and the parents' hostel,

which forms the north side of a generous entrance piazza just off the South Circular Road. On either side of this, wings project out like welcoming arms, drawing visitors towards the hospital's front door.

The curved form of the ward pavilion reveals itself most clearly above the main entrance, extending down to ground level as a triple-height glazed screen that allows the piazza and entrance concourse to feel like an uninterrupted public space. Once inside, visitors will find themselves in what instinctively feels like the heart of the hospital – a four-storey high 'great living room' that visually connects all the building's principal levels. Two key features will orientate people: the 'biome' and 'concourse'. The biome is the main focus of vertical public movement, a structure reminiscent of botanical gardens that extends down from the ward levels introducing daylight and glimpses of the outdoors. The concourse, a vertical cleft in the centre of the building flows into the biome from the south, creating a multi-level day-lit atrium connecting the main entrance with the hospital's other principal public entrance from the Rialto LUAS stop. The concourse extends down to a lower ground level, providing access to a number of clinical areas as well as the main visitor car park below the entrance, so that pools of light guide people intuitively from their car towards lifts and stairs and on to their ultimate destination as directly as possible.

The concourse's organic form, both in plan and section, ebbs and flows to create a range of larger and smaller spaces and diverse vistas, which enliven the experience of moving through the hospital's heart. The sense of animation is further enhanced by the visible movement of people on different floors, the criss-crossing of bridges across the space and the dynamic of the panoramic public lifts. The choice of materials encourages multiple interpretations, stimulating the imagination of patients and families. Associations with geology, landscape and townscape as well as science and technology intermingle, providing interest and stimulus for different age groups as well as inspiration for artists' interventions now being finalised.

A key contributor to the building's sense of place and the quality of patient experience is the way that its form has been broken down to reduce its perceived scale and make it more 'legible'. The introduction of the 'floating garden' halfway up literally elevates the importance of nature and the therapeutic environment, making it a central part of the architecture's character. It also articulates the hospital's mass into three zones: a three-storey podium roughly equivalent in height to neighbouring houses, the floating garden itself sitting above a projecting interstitial floor and the ward pavilion, also three storeys high.

Once the new hospital is complete, however, there will be open views from the floating garden and the wards towards Kilmainham and Phoenix Park beyond

The oval's form alludes to the architecture of Dublin's best-known civic spaces and buildings, most notably its Georgian squares (with their strong geometric stamp and landscaped heart) and the nearby Royal Hospital at Kilmainham (Ireland's oldest hospital, now the Museum of Modern Art), with which the oval is axially aligned. The relationship between the St. James's site and Kilmainham used to be largely obscured by existing buildings, now demolished as part of the recent enabling works. Once the new hospital is complete, however, there will be open views from the floating garden and the wards towards Kilmainham and Phoenix Park beyond, creating a strong landscape and architectural axis that will 'ground' the new building in its context.

The design has been influenced by a number of key considerations, drawn from the design brief, clinical consultation process and site context:

- **Child and family-centred identity:**
  This is the overriding principle at the heart of the Children's Hospital's model of care which permeates every aspect of the design, from its external form and scale through to the quality of the building's public spaces, bedrooms, interior finishes, play and learning spaces
- **Departmental adjacencies:**
  The importance of arranging the key functional zones (Emergency, Imaging, Outpatients, Operating Theatres, Critical Care, Inpatients and Non-clinical), so that a lean approach is adopted to clinical work flows
- **Ward design:**
  The optimum ward arrangement in terms of flexibility groups 4 wards per floor, so that nursing patterns can flex as much as possible, unimpeded by formal ward boundaries. The hospital's 384 bedrooms are all single occupancy and are set to become a benchmark for quality both in terms of their clinical effectiveness and the patient and family experience
- **Segregation of flows:**
  The importance of keeping public, patient, staff and facilities management flows separate has had a big influence on our approach to access and circulation.

This supports the hospital's infection control policy, protects the privacy and dignity of patients and families transferring between clinical areas and aids the clarity of wayfinding

- **Nature & Wellness:**
The design maximises the therapeutic benefits of outdoor space, daylight, natural ventilation, and break-out spaces for patients, families and staff that offer opportunities for learning, play and distraction as well as respite from the clinical environment

- **Transportation and access:**
Entrances directly into the hospital from the LUAS, the South Circular Road and the underground car park will make access as convenient as possible for patients, visitors and staff

- **Campus context:**
The Children's Hospital is part of a coordinated masterplan for the St. James's campus, aimed at integrating the Children's Hospital with the existing adult and future maternity hospitals. This 'tri-location' represents the optimum clinical model, that will enable significant operational synergies between all three services

- **Urban context:**
The project's scale and national importance is being harnessed as a catalyst for regeneration of surrounding neighbourhoods and businesses. Significant high quality improvements to the surrounding transportation network and also to the public realm on and adjacent to the campus have been developed with local stakeholders as part of this long term vision. The NPHDB and CHG are also sponsoring an initiative with DCC and IDA, ' The Dublin 8 Health and Innovation Hub', which sets out a vision ' to become the State's Sillicon Valley of health innovation, generating significant growth in high value jobs as well as other benefits for Ireland over the medium to long term'. This initiative seeks to capitalise on the significant investment being made by the hospital in state-of-the-art ICT and medical equipment

- **Sustainability:**
Sustainability is embedded in the design of the hospital, which is targeting a BREEAM Excellent rating and will be the first large hospital development in Ireland to achieve this. It is recognised that this additional 3% capital investment will deliver reductions in operational costs over the long term. A whole-life costing approach has been adopted from the design of engineering services, maintainable building assets to clinical equipment selection. These capital investments are expected to pay for themselves within four years

- **Technology:**
Being the first smart digital public hospital in Ireland requires a capital investment in ICT data infrastructure that is world class. Healthcare innovation is evolving at a rapid rate and it is essential that the hospital is future proofed now to facilitate the optimum delivery of all aspects of current and developing clinical best practice. The supporting infrastructure is designed to optimise the integration of clinical equipment with an EHR supported by a clinical command centre

- **Future Expansion & Resilience:**
The building has been designed with a level of clinical, ICT, and engineering resilience that is unprecedented, and far exceeds other healthcare buildings in Ireland. Flexibility is also enhanced through the incorporation internally of 'soft space' for shorter term expansion of critical clinical areas, and designated areas externally for larger scale long term expansion. The Children's Hospital was designed 'to be one of the finest hospitals in the world'. It was designed to replace the three existing paediatric hospitals in Dublin and to provide world class tertiary and quaternary paediatric services across Ireland

2.0
Pre-Construction

2.1 Project Objectives

The key project objectives are to:

1. Deliver the best possible clinical outcomes for children and young people
2. Develop an employer design that will deliver the project objectives
3. Develop a procurement and contract strategy that will support:
   - Delivery of a quality product
   - Meaningful engagement from the international market being mindful of the size of the project and Irish market conditions
   - Effective programme delivery with an optimum duration
   - Delivery of value for money
   - Compliance with EU requirements and minimise risk of legal challenge
   - Provision of time for design development and contractor engagement, which is likely to include approximate Bills of Quantities and convert to GMP (2 Stage)
   - Include contract provision for Independent Expert and client determination
   - Enable one main contractor to undertake the entire project
4. Obtain stakeholder approval of the project brief and sufficient funding for the project
5. Obtain planning permission for the project taking into account the size and location of the project
6. Develop an appropriate execution strategy to enable the entire site be made available for construction, including:
   - Decant of SJH facilities in a timely manner without compromising the operation of the existing hospital
   - Transfer agreement for site transfer to HSE
7. Develop an Enabling Works Contract that will de-risk the site before the main construction contract commences including:
   - Diversion of services (Drimnagh Sewer, Utility Tunnel)
   - Asbestos
   - Archaeology
   - Soil Contamination

2.2 Pre-Construction

2.2.1 The Project Boards

The NPHDB was set up by statutory instrument in August 2013.

The Board is responsible for the design, planning, building and equipping of the Children's Hospital - in other words the building board. A transitional Board of officials from the Department of Health and the HSE had been in place since January 2013 and had progressed the project on a number of fronts. These included:

- Reconciling the brief with the new site
- Publishing the contract notice for the procurement of a new design team, which was published on 3rd July 2013
- SJH leading on the decant work required for the site

At the same time as the announcement setting up the NPHDB Board, nine members were appointed to the Children's Hospital Group Board (CHG).

The CHG is the end user and client of the NPHDB and will oversee the operational integration of the three existing hospitals in advance of the move to the new hospital.

The initial priorities of the new Board were to put in place a management structure to deliver the project, including the setting up of a project governance and sub-committee structure. The project was seen as a priority project within the Government, so the early development of the Project Brief between the CHG and the NPHDB was essential to the timely delivery of the project.

The initial focus of the new Board to the end of 2013 was:

- Development of Decant Plan for the SJH campus
- Development of Project Brief with CHG
- Development of Initial Project Budget

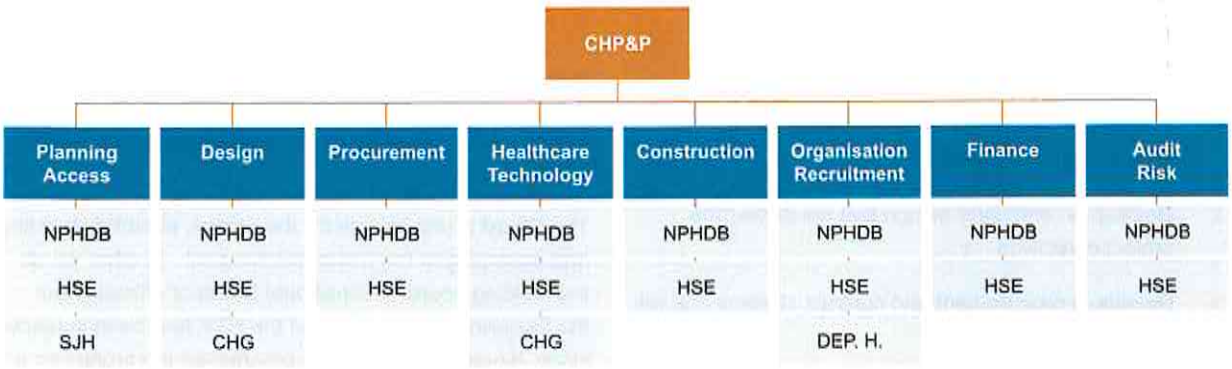


Figure 12: Organisational Chart of Sub-Committee

2.2.2 Initial Project Budgeting

The brief for the Children's Hospital, now to be located on the SJH campus, was initially based on the accommodation brief for the proposed scheme on the Mater Hospital site.

The Mater scheme had been developed to planning stage, and detailed project budgets had been prepared by the Mater team and approved by the Mater Project Board.

The Interim Board of the Children's Hospital engaged Davis Langdon as Quantity Surveyors in April 2013, to prepare an Order of Magnitude Cost for developing the new Children's Hospital on the SJH campus. The total cost was circa €750m, with a gross floor area of 114,000 sq.m and a project completion date in 2019, and assumed an annual inflation rate of 3%.

The recently formed NPH team received a briefing from Davis Langdon on the costings for the SJH scheme in October 2013. They presented their projections for construction costs, equipment (medical), risk provisions, other project costs and future inflation predictions. The presentation also included an analysis of benchmarking costs for other hospital projects.

The NPH produced a number of project cost reports in late 2013 for discussion with the HSE and Department of Health, with the aim of arriving at an agreed project budget and funding strategy that could be incorporated into the Project Brief.

The NPHDB approved a capital project cost report at the December 2013 Board meeting. This report was based on a gross building area of circa 116,000 sq.m, a project completion date of May 2019 and a future annual inflation rate of 3%. The total cost was €755m with a range of €720m to €795m given. The Board's key action item was for the team to continue discussion with the HSE and the Department of Health; "Agreed Chairman should meet Department of Health to discuss broad Project Costs".

The Chairman of the Board received correspondence from the Department of Health (DOH) in March 2014, outlining that €650m Exchequer funding would be made available for the project (€450m of existing funding and €200m from sale of National Lottery), and that should the business case/budget developed by the Board set out requirements in excess of this figure, it should consider alternatives to Exchequer funding, including philanthropic or commercial sources of funding.

The correspondence also referred to the priority status of the project and the Minister's wish to see it delivered as quickly as possible, to optimum design and value for money.

The Project Brief was submitted to the Department for Health and HSE on 21st May 2014, and contained the following cost breakdown in Appendix B of the submission:

	€m
Core Hospital Building (including two paediatric outpatients and urgent care centres)	650
Research and Education Block	45
Equipment is procured through MES - Capital cost	65
Car park is self-financing - Capital cost	30

Table 9 Cost breakdown per Project Brief 2014

The cost report noted that inflation was provided at an average of 3% per annum.

The gross floor area of the scheme was 116,150 sq.m. (excluding paediatric outpatients and urgent care centres).

2.2.3 The Project Structure

The early engagement with the Department of Health and HSE around the funding structure set the parameters for shaping the structure of the project.

The key components of the project are:

- Core hospital based on the SJH campus
- Two remote paediatric outpatients and urgent care centres to be opened in advance of the Children's Hospital
- Education and Research component of the Children's Hospital on the SJH campus, which is separately funded outside of the core hospital funding of €650m
- Requirement for circa 1,000-space car park to be attached to the Children's Hospital, but funded outside of the €650m Exchequer funding
- The NPHDB brief was to build and equip the new facilities, but again funding was to be outside of the Exchequer funding envelope of €650m

Taking the above parameters, the most appropriate structure emerged as:

1. Decant project on SJH campus to be managed by SJH project office, as determined prior to the NPHDB appointment; made up of various projects and design teams
2. The Children's Hospital with one design team, incorporating car parking and Education and Research all on SJH campus
3. Paediatric outpatients and urgent care centres at Connolly and Tallaght Hospitals to have separate design teams to the Children's Hospital, and separate procurement process due to different programme requirements
4. Equipment work stream as potential procurement through Managed Equipment Service (MES)

2.2.4 Stage Approval

The Project Brief was submitted to the Minister for Health on 21st May 2014, prior to its approval by the HSE. The Minister gave consent in a letter dated 24th June 2014 to the Director General of the HSE, and copied to the NPHDB and CHG.

The consent, followed by HSE approval allowed:

- The project to proceed to the next stage, including appointment of design team
- Design development and submission of the Planning Application

A final Project Brief was required in due course, and consent is subject to:

- The CHG in collaboration with the NPHDB was required to submit a detailed Definitive Business Case. This provided funding plans around non-Exchequer elements of the project and was to be submitted in early 2015 as part of an updated Project Brief
- The HSE working with the CHG and NPHDB was required to examine MES for the new hospital

In a letter to the NPHDB dated 26th June 2014, the HSE gave its approval for:

- The project to proceed to the appointment of the design team
- Completion of Stage 1 of the design development

The HSE expected the following items to be resolved in the final brief:

- The total available funding from the Exchequer is €650m; the total capital cost as contained in the project brief is €790m
- The project brief included additional funding streams for:
  - Procurement of equipment through MES.
  - Self-financing car park
  - Separate funding for Research and Education block

  These funding streams were to be confirmed in the final project brief.
- Following the appointment of the design team, a detailed programme timeline for the project was to be developed and included in the final project brief

2.2.5 Procurement Strategy

Procurement Strategy: Construction

There were a number of key considerations that informed the development of the early procurement strategy for the project, and whilst we acknowledge the large numbers of procurements on a project of this scale, we are focusing on the primary design team and construction processes.

The first consideration has to be that the project is a public sector-funded project, and therefore comes under the direction of the Capital Works Management Framework and European directives for public procurement. This means that public advertising and tendering are required for most contracts (unless no market response is received).

The project Boards have to take into account the unique requirements that a project of the size, scale and value of the Children's Hospital, and the ability of the design and construction markets to adequately respond to the challenges and risks that the project will involve.

The project team needed to consider the information available from the previous Mater scheme brief, and the Government's requirement for the priority status and programme delivery objectives.

The NPHDB set up a procurement subcommittee that focused on the following objectives:

1. Develop a contract strategy that will support:
   - Delivery of a quality project
   - Get meaningful engagement from the market
   - Support effective programme delivery
2. Start work on-site shortly after planning approval received to achieve programme efficiency
3. Appoint a suitable main contractor to undertake the entire project
4. Split tender into two categories:
   - Enabling Works to de-risk site and achieve quality site set-up
   - Entire project
5. Tender package to be based on Bill of Approximate Quantities, design drawings and specifications subsequently to be converted into a GMP
6. The five points above should then reduce overall project programme by up to 2 years with corresponding inflation saving of circa €50m
7. By achieving a GMP, the project should be de-risked by reducing the number and extent of post-contract claims
8. Obtain international interest in tendering for the project which could be hindered by scale and complexity, and the limited pool of Irish contractors capable of delivering a €600m project
9. Promote early contractor and specialist involvement and seek a collaborative approach to project delivery
10. Tenders to be procured by the employer for specialist Mechanical and Electrical sub-contractors simultaneously with the seeking of tenders for the main contract, so that the overall contract is awarded as one with an integrated programme
11. Post-tender award, engage with the main and specialist contractors to develop the detailed design, adjust the Bill of Approximate Quantities to reflect updated design, and agree an overall contract sum, the GMP
12. Provision in the contract for determination of the adjusted contract sum by an independent expert to assist in the delivery of the GMP (if required)
13. Include provision for the employer to have an entitlement to determine the contract in the event that agreement on the finalisation of the GMP cannot be reached
14. Separate consideration to be given to the Children's Hospital at SJH campus and the paediatric outpatients and urgent care centres

Taking the above objectives into account, consideration needed to be given to the most appropriate form of contract to be used for the projects, and what amendments should be made to the existing Government forms of contract.

The NPHDB procurement sub-committee considered the optimum solutions to deliver on the objectives set out above during the period from October 2013 to June 2014.

A number of procurement strategy reports were considered by representatives of:

- Government Contracts Committee on Construction (GCCC)
- HSE
- NPHDB

Discussions also took place with the lead partners of the construction contracts divisions of four leading legal firms, with extensive experience of the workings of the current public works contracts.

Representations were also received by major Irish construction firms.

Following extensive consultation it was agreed that:

- The standard public works contract would not achieve the project's primary objectives

- A management contract would not be appropriate as the objective of tendering the entire project would not be met, which would also eliminate New Engineering Contract (NEC) target cost contracts
- A 2 stage procurement strategy would enable the detailed design to develop while engagement of the main contract proceeded
  - If the contract was split between a below ground basement phase and the remainder of the project, this would deliver both early main contractor and specialist contractor involvement, and also maximise programme critical path activity
  - The team were also very aware that major service diversion works needed to be undertaken (Drimnagh Sewer and Utility Tunnel), and archaeological and ground contamination de-risking would be very beneficial in the successful delivery of the project
- The procurement strategy would be outlined in the tender documents for the design team, and an early task for the selected design team would be the verification and development of detailed contract conditions for incorporation in the construction tender documents

The outcomes of the early procurement strategy discussions were:

- A standalone lump sum contract using PW-CF1 for the enabling works tendered in advance of the main works tender
- A single contract for the main works based on amended PW-CF1 in two parts:
  - Phase A - basement works; lump sum contract
  - Phase B - remainder of project; 2 stage GMP process
- Separate tenders for Mechanical and Electrical works tendered at same time as main works
- Once the design team procurement process was complete the early procurement strategy would be validated by the appointed design team in conjunction with the NPHDB team and their advisors

2.2.6 Decant

Site Transfer

The site required for the Children's Hospital is located on lands that required a transfer agreement from SJH to HSE. The site size and legal agreement discussions commenced in early 2013 and had to be concluded prior to the NPHDB going to tender for the construction of the new hospital.

The final legal agreements were concluded in March 2017, with a License to Build Agreement in 2016.

Decant

The site proposed for the Children's Hospital on the SJH campus contained a number of active clinical and administrative service accommodation units that required redeployment before work could start on the new project.

The planning of this work was under the leadership of SJH. A decant project team, including representatives from the HSE (funders for the programme), was set up in early 2013, with the objective of setting out an agreed decant plan by September 2013.
The initial Children's Hospital project milestone programme had a target completion of Q4 2014 for the decant project.

During 2014, 2015 and early 2016 the decant steering group (comprising SJH as decant project lead, HSE as funder and NPHDB as end user) discussed numerous project scopes and budgets, culminating in the agreed Decant Strategy Report Rev 6, with cost apportionment as follows:

	€m
HSE	23
SJH	11
NPHDB	9
Total	**43**

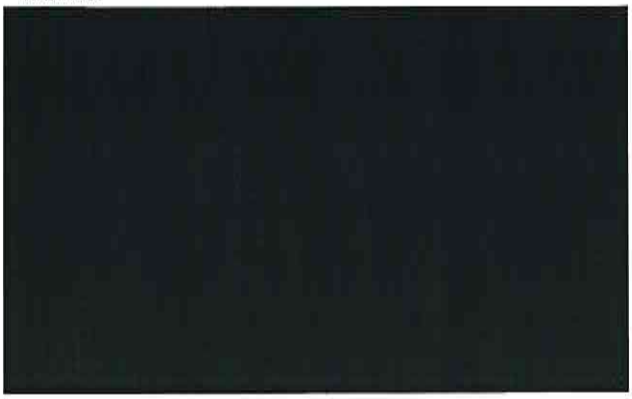
Table 10: Cost apportionment per Decant Strategy Report Rev 6

The projected completion date for all decant works was December 2016.

Subsequent to the Rev 6 report, briefings were held with the Department of Health in January 2016, where it was outlined that the delivery of the decant plan now involved the NPHDB providing Project Management resources to assist the SJH project team. Furthermore, it outlined the

key task of finalising an agreed decant plan and programme was a primary concern.

Decant Strategy Plan Version 13.4 was agreed by the steering group in March 2016, and re-apportioned as follows:



The NPHDB agreed at its Board meeting on 6th January 2016 to fund the additional decant costs on the proviso that the available funding for the Children's Hospital project would be increased at a future date and reflected in a Memorandum for Government.

The Board also agreed that the tender process for the main project would not commence until there was confirmation of dates for vacant possession of the entire site, and agreement on a new decant budget.

The decant stage of the project had major implications for the logistics and operations of the SJH live campus. It was on the critical path of the overall the Children's Hospital project and involved circa 40 different projects.

The decant plan completion date was revised to March 2017. This was now impacting on the start of the Children's Hospital construction, as the Enabling Works Contract was due to start in August 2016 and be complete by the end of July 2017.

The actual completion date for the decant works was April 2017; the delay in final completion meant that partial possession of the site was given to the Enabling Works contractor initially.

The decant stage of the project had major implications for the logistics and operations of the SJH live campus. It was on the critical path of the overall the Children's Hospital project and involved circa 40 different projects, from new builds to renovations and the introduction of modular units.

It proved to be a very significant undertaking over a period from early 2013 to its completion in April 2017. The agreed project budget was €49m, of which the NPHDB allocation was €16m. Whilst there was only a partial handover of the site to NPHDB initially, the outcome was very successful, particularly given the risks associated with working alongside an operating hospital, and the avoidance of potential delays to starting the Children's Hospital.

2.2.7 Design Team Appointment

Employer Design

In July 2013, during the Interim Board's term, a contract notice for the procurement of the design team was published in the OJEC on 3rd July 2013, comprising principal services, procured as independent appointments.

The target timetable was that tender documents would be issued to shortlisted candidates in September 2013, and that the tender process would be completed and awarded by Q4 2013.

The notice specified that the project procurement approach would be a design build contract with employer design.

When the NPHDB Board was formed and a procurement group put in place, one of the early considerations was a review of the design team procurement approach.

The outcome of the review was that a recommendation was put to the NPHDB Board that the design team procurement process be withdrawn from the market and a new procurement strategy based on employer design be initiated. This was with a view to going to the market as soon possible, once the Project Brief and Scope of Services was sufficiently developed.

The Board approved this strategy. The primary reasons for recommending this change were:

1. The complexity of a healthcare project of this size, as well as the high level of services involved require the employer to have control over the quality of the design and specifications. This may be put at risk in design and build contracts
2. The project scope and brief is primarily based on the

previous Mater scheme, which needed to be validated by the NPHDB team. This process is more suited to employer design contracts

3. The Irish construction market has very limited expertise in delivering design and build projects on complex healthcare projects (they have been used on education projects with mixed results). Design and build procurement is more suited to standard units in the industrial sector

The NPHDB therefore set about preparing a set of technical requirement documents setting out the scope of the project, the proposed procurement approach for construction, and the services that would be required from the principal design team members.

These included:

- Architectural services
- Civil and Structural Engineering
- Mechanical and Electrical services
- Quantity Surveying
- Fire Safety
- Planning
- PSDP

The above services were issued in individual lots and subject to direct employer appointments. The scope of services included the Architect taking on the role of design team leader and employer's representative, appointed to administer the construction contract.

The Quantity Surveyor's role included being responsible for Cost Management of the main contract and the Mechanical and Electrical services.

The scope of the project was set out in the Preliminary Design Brief issued with the tender.

Prior to the issue of the tender documents a market engagement event was held to outline the new approach to the design team procurement, and also the new approach to the construction procurement.

Very positive feedback was received to the employer design and amendments under consideration to the public works construction contracts.

In accordance with Government procurement guidelines, a pre-qualification process took place and firms were shortlisted and invited to submit tenders.

The tender documents were issued in March 2014; a tender evaluation process followed and interviews were conducted prior to the final identification of the most economically advantageous tenders.

The technical requirement document included the following target project programme:

Action	Date
Submit Planning Application	Feb - 15
Tender Enabling Works Contract	May – 15
Tender Main Works and Specialists	Aug - 15
Commence Main Works	Dec – 15
Agree GMP	Q3 - 16
Contract Completion	Q3 - 19

Table 12: Target Project Programme per technical requirement document

Appointments were made for all lots in August 2014, except for Fire Safety consultant, where a legal challenge was taken. This appointment followed in January 2015.

A separate procurement process was undertaken for the appointment of the paediatric outpatients and urgent care centres design team. This contained the same lots as the The Children's Hospital, except for the planning services, which were to be the same firm across all projects, as one planning application was to be submitted.

This process started on 4th October 2014 and was concluded in January 2015.

2.2.8 Planning

The design team were appointed in August 2014 and one of the key deliverables during this stage of the projects development was the planning process.

The planning application was going to constitute the largest application ever submitted for a State-funded healthcare development. It was going to encompass the Children's Hospital on the SJH campus, as well as the paediatric outpatients and urgent care centres at Tallaght and Connolly Hospital in Blanchardstown.

The design documentation was developed by two separate design teams.

The NPHDB set up a planning sub-committee under its governance structure to advise the Board in relation to this key specialist task. This sub-committee would lead and liaise with the design team in relation to all planning matters.

One of the first tasks was for the team was to open dialogue with the Planning Authority to establish that the proj-

ects constitute Strategic Infrastructure Development (SID). This was established and agreed at an early stage. It was also established that the planning submission would be supported by an Environmental Impact Statement (EIS).

During the development of the planning scheme a number of cost effectiveness studies were carried out around multistorey car parking in favour of basement option, and the brief requirement for 20% expansion space.

It was decided that the planning risk was too high, and that the basement car park option had to be included in the planning scheme if the brief requirements were to be met.

Following extensive consultations and the development of a very comprehensive Planning Application package, a planning submission was made to An Board Pleanála on 10th August 2015.

This was just 12 months after the appointment of the design team, a considerable achievement considering the size and scale of the project, and the volume of information submitted.

During the process, the planning board decided that an oral hearing would be held prior to a decision being announced. A ten-day hearing took place in December 2015.

The planning application received significant public, media and lobby group interest during the planning process and the oral hearing, not least as it followed the failed application for a children's hospital on the Mater site in February 2012.

A grant of planning was issued on 26th April 2016, a period of nine months from application - an excellent outcome for a project of this size

A grant of planning was issued on 26th April 2016, a period of nine months from application - an excellent outcome for a project of this size, comparing very favourably with other large planning applications in the State, which often result in failure, appeal or judicial review. A further very positive outcome of the planning permission was it contained very reasonable conditions and financial contributions. The NPHDB did not appeal any of the conditions attached to the permission.

2.2.9 Pre-Tender Engagement

Market Engagement

The NPHDB and design team recognised at an early stage that there was a need to engage with the construction sector for a number of reasons including:

- The project was of a size, scale and complexity not experienced in the Irish public sector previously
- The public sector contracts had received very negative commentary from the industry, which was particularly concerned about risk transfer and the confrontational nature of the contract
- The recession had seen a large number of leading Irish firms exiting the market, and it was considered vital to generate overseas interest in the project (which has proven historically difficult), such that sufficiently capable firms would submit competitive tenders
- The NPHDB had a key objective of developing a collaborative working culture on the project, and this would require amendments to existing forms of contract

A series of workshops and 'Meet the Buyer' events were held in Dublin and London in September 2015 to promote the project, present the project vision, and explain the procurement and contractual arrangements proposed for the project.

The events were very well attended by both main contractors and specialist contractors. They proved to be a major contributing factor in generating significant interest in the tender pre-qualification process, resulting in nine main contractor applications and 14 specialist applications.

The process commenced in August 2015, with submissions in October 2015 and short listing January 2016.

The outcome was qualification and selection of five main contractors, four mechanical and four electrical services contractors.

Prior to the issue of the tendering documentation, a pre-tender briefing was held with all of the selected tenderers on 31st May 2016 to reaffirm the NPHDB objectives for the project, the 2 stage procurement process and changes made to the public works contracts.

Tenders were issued on 17th June 2016 and 1st July 2016 for the main and specialist contracts respectively.

2.2.10 Design Team Stage Reports

Stage 1 Report

The design team's Stage 1 Report summarises the design and consultation work carried out from its appointment in August 2014 up to the Report's publication and recommendation of the preferred design option for the NPH in January 2015.

It describes the key project objectives and constraints, the design principles adopted by each discipline, the options considered, and the evaluation process undertaken to arrive at the recommendation. It also sets the construction budget for the preferred design.

Objectives and Constraints

The Design Brief had identified that the objectives of the new hospital were first and foremost to provide a child and family friendly environment on a human scale. This must prove flexible over the years as needs change.

A set of departmental adjacency requirements had to be met internally.

Externally, the emphasis was on incorporating nature into the design, with green space used for relaxation areas. The overall design was to support the regeneration of the area, both visually and in the provision of public spaces.

The existing "Hospital Boulevard" had to be maintained to give vehicular traffic access through the campus, both throughout the construction and upon completion.

Planning constraints limited the height of the building to seven stories above ground, and similarly plot ratio constraints defined minimum green space requirements. The whole campus was to be considered, with a view to integrating shared services, utilities and future projects, such as the Maternity Hospital.

The site offers both opportunities and constraints. The sharp fall in level (the site falls by 14m S-N) at the north (Mount Brown) end provides an opportunity for a basement level entrance to the car park, and the LUAS at the south end provides an opportunity for a pedestrian entrance that is within a two or three minute walk of public transport.

The existing "Hospital Boulevard" had to be maintained to give vehicular traffic access through the campus, both throughout the construction and upon completion. A helipad would be required, the location of which needed to take into account both flight paths and a balanced approach to noise management for local residents.

Future expansion space to the tune of 20% of the site was required.

The site contains a Utility Tunnel, which links the existing energy centre with the existing hospital. It also is home to the Drimnagh Sewer, and hospital foul and storm water drainage. Each of these services would need to be kept live at all times.

Design Principles

Architecturally the internal design emphasised natural light in the internal spaces, vertical and horizontal logistics efficiencies, wayfinding opportunities, and externally incorporation of landscaping and green space at all available levels.

The three ward floors, designed as an oval for optimum workflow, rise from the 4th floor transit slab as a structure with a separate identity to the Hot Block and Fingers below. This is to maximise visual impact.

Structurally, a concrete, rather than a steel frame was proposed as the most effective option, at a 7.8m grid. A Level 4 transfer slab would allow for a transition to a different spacing for the ward block.

The ground conditions of Dublin boulder clay dictated that the perimeter wall be constructed from secant piling and ground anchors be used in ground bearing slabs in order to combat groundwater conditions.

The Drimnagh Sewer was to be diverted around the perimeter of the site, picking up another diversion of the existing hospital drainage.

Mechanically a mix of ventilation systems were included, in order to utilise low pressure drop mechanical ventilation and extensive heat recovery. The plant would be situated in:

- Basement (boilers, hot water systems, water storage, generators and transformers)
- Level 3 (AHUs serving the floors below) and
- Level 7 (more AHUs and chillers)

The heat demand was expected to be 25 GW/year, and a steam connection to Diageo was to be considered.

Electrically a load of 38 GW/Year was to be expected,

with an 8MVA connection required. Low energy lighting formed part of the energy efficiency approach required to meet a BER A3 rating, which is a statutory requirement.

The standby generators are set up in N+1 configuration to cover the whole hospital load, whilst critical areas will have UPS back up.

A number of service relocations were identified including a new gas main along James's Street, the relocation of the Rialto ESB sub-station, two new 10kV feeds from the ESB110kV network, as well as a replacement utility tunnel around the perimeter of the site.

Options Considered

An alternative multi-storey car park, built adjacent to the hospital, was considered, which would have cost less to construct than a basement car park. However, this sterilised too much footprint which was required to meet the 20% expansion requirement, so the basement option was preferred.

The helipad location was also considered at the north end, but due to the neighbourhood impact on local residents being greater than locating it at the south end, the South end was the preferred location.

Evaluation Process

The Design Brief (which NPHDB produced from the Mater Hospital project) was issued with the design team tender and laid out the basic requirements of the NPH project – net areas per department, adjacencies required, functional requirements etc.

From this - and following several rounds of consultation with both internal Clinical Groups and external agencies such as DCC and An Bord Pleanála - the design team worked up five options for review by the NPHDB team in October 2014. This number was then reduced to three, each of which was scored at a review on 12th November 2014.

Option 3 won out in all categories, scoring an aggregate 80.5%, versus the next best 68%. Cost was reviewed separately, where Option 3 scored as the lowest cost option.

A Peer Review made up of a body of six professionals from each discipline was then convened on 19th November 2014. It agreed with the rankings and made some further design development suggestions. The key suggestion made was to move to a 950 space car park below ground, with 50 spaces above ground adjacent to the Emergency Department, from the previous 750/250 split which required too much above ground space.

Cost

A construction budget of €360m was developed, based on applying circulation allowances to net areas required and typical rates for areas. Circulation, transportation, plant, site specific requirements (Drimnagh Sewer, Utility Tunnel), and site preparation costs were also added.

	Net m²	Circulation m²	Plant & Comms m²	Gross Area m²	Building Works €	Site Works €	Total €
Hospital	65,205	21,518	27,751	114,474	273,442,947	42,196,000	315,638,947
Education	1,986	555	746	3,287	7,942,146	819,665	8,761,811
Research	2,133	806	1,083	4,022	9,718,907	880,335	10,599,242
Car Park (1,000 spaces)							25,000,000
Total							**360,000,000**

Table 13: Construction Budget and Area Assessment for Stage 1

Allowances for inflation, risk, VAT, design team fees, planning fees and contributions as well as NPHDB direct costs were excluded. Other works which were not included were SJH decant costs, paediatric outpatients and urgent care centres, the future Maternity Hospital, as well as ICT hardware and software.

Inflation is a critical factor given the lengthy duration of the project. Table 6 summarises the market view at the time.

Year	SCSI	Bruce Shaw	AECOM
2011	2.10 %	2.00 %	3.00 %
2012	2.96 %	3.00 %	3.00 %
2013	2.68 %	3.00 %	3.00 %
2014	4.38 %	3.00 %	3.00 %
2015	-		

Table 14: Market Views of Inflation at Stage 1

On that basis, various scenarios were run and a figure of €60m was recommended for construction cost inflation.

Stage 2A Report

The design team Stage 2A Report covers the design development over a six month period from January to July 2015. It builds on the previous report, incorporating further consultation with both client groups and external authorities, and includes peer reviews with independent advisors.

Changes

The nature of change was largely around realignment of departmental adjacencies, as more detailed clinical consultation took place.

This gave rise to more design layout work, which in turn pushed out the target date for the submission of a planning application by one month, to July 2015.

It also involved an increase in net floor area of 4,119m2, the largest of which was due to the incorporation of some 1,363m2 of shared energy centre facilities with SJH, 900m2 of additional concourse space was added to improve circulation and allow for wider walkways, 569m2 for larger open plan offices, and 432m2 of shared services area with the CSSD (Central Sterile Supplies Department).

Other increases, albeit on a smaller scale, included fire officer requirements, the addition of ICT hubs, as well as retail and catering concession spaces.

The building height grew by 300mm, to allow for an increase to the height of the plant room floor, from 3.8m to 4.1m. Ground level also rose 500mm, from Ordinance Datum (OD) 20.5 to 21.0m. This was to align entrance levels at the LUAS and Main Rialto entrances, and save excavation volume across the whole footprint.

The roof-based plant on the Fingers was moved due to planning concerns, and specialised cladding was added to the energy centre flues in response to planning concerns.

Ref	Description	Nett Area m²	Gross Area m²	Cost Q3 – 2014 €
1	CSSD – Shared Services	432	758	2,120,000
2	Shared Energy Centre	1,364	1,985	3,044,000
3	Catering	50	88	250,000
4	1:200 Review	36	63	180,000
5	Increased Concourse Area	900	1,580	3,160,000
6	ICT Hubs	250	439	1,098,000
7	Additional Retail	175	307	770,000
8	Larger Open Plan Offices	569	1,000	2,000,000
9	Fire Officer Requirements • Sprinkler Requirement to Ward Block • Additional Staircores to Ward Bock and Between Fingers	343	600	3,168,000
10	Increase Height by 300 mm at Interstitial Plant Level			760,000
11	Planning De-Risk Items • Cladding to Energy Centre Flues			450,000
	Updated Construction Budget	4,119	6,820	17,000,000

Table 15: Area Changes and Associated Costs at Stage 2

Cost

A construction budget of €360m was developed at Stage 1, and increased to €377m at Stage 2A to incorporate the changes outlined in Table 15.

This is comprised:

	€
Stage 1 Approved Construction Budget	**360,000,000**
Add: CSSD Shared Services	2,120,000
Add: Shared Energy Centre	3,044,000
Adjustments from Design Development	
Catering	250,000
1:200 Review	180,000
Increased Concourse Area	3,160,000
ICT Hubs	1,098,000
Additional Retail	770,000
Larger Open Plan Offices	2,000,000
Fire Officer Requirements	3,168,000
Increase Plant Room Floor Height by 300mm	760,000
Cladding to Flues	450,000
Total Approved Stage 2A Construction Budget	**377,000,000**

Table 16: Construction Cost Adjustments at Stage 2A

Allowances for inflation, risk, VAT, design team fees, planning fees and contributions, as well as NPHDB direct costs were excluded.

SJH decant costs, paediatric outpatients and urgent care centres, the future Maternity Hospital, as well as ICT hardware and software.

Stage 2B Report

The design team Stage 2B Report covered the subsequent design development from July 2015 until March 2016. This period included the planning submission, made on 10th August 2015, and was immediately followed by issue of tenders for the construction works.

A Pre-Planning Report was commissioned and produced by GVA prior to submission, and an Oral Planning Hearing was held over 10 days at the beginning of December 2015 after submission.

Contractors were shortlisted during this period, and a project programme developed prior to tender.

A BIM Model was developed, federating the Civil and Structural, Architectural, Mechanical and Electrical models into one entity.

Changes

Client consultation continued, and several changes to clinical interiors were identified. Specialist areas were reviewed, such as the Radio Pharmacy and the Stem Cell Laboratory, which will require further development.

Changes included the incorporation of an FM Yard at Basement 2, restaurant and kitchen modifications, and a crèche at level 00.

Cardiology increased in size, pathology moved location, and the concourse stairs were widened.

A lift core was added from Basement 1 to the Emergency Department and stairs were added in the ward block to give emergency egress.

The link to SJH to accommodate adult patients arriving at the helipad was simplified.

Space savings were made in the basement from the previous Stage 2A, reducing plant rooms by 665m2 and car parking by 67m2, while maintaining the number of car park spaces at 969.

	Stage 1 m²	Stage 2A m²	Stage 2B Nov – 15 m²	Stage 2BFinal m²
Drawn Nett Area	66,363	69,097	69,060	68,713
Departmental Grossing Factor	21,900	22,755	23,866	23,692
Gross Departmental Area	88,263	91,852	92,926	92,405
Plant (including Energy Centre)		12,578	13,506	12,841
Vertical Communication		5,484	6,160	6,130
Horizontal Communication		10,027	9,299	9,514
Risers		2,925	3,151	3,380
	28,244			
The Children's Hospital Gross Internal Area	116,507	122,866	125,042	124,270
Provision for SJH Plant		1,670	1,670	1,670
Total Gross Internal Area	116,507	124,536	126,712	125,940
Basement Area for Cars	29,420	32,245	33,743	32,315
Vertical Communication / Risers		665	1,106	895
Bicycle Parking		207		207
Research & PH Waste		117		
Other Areas		250		
Total Gross Basement Car Park Area	29,420	33,484	34,849	33,417
Total Gross Area (Building & Car Parks)	**145,927**	**158,020**	**161,561**	**159,357**

Table 17: Area Changes from Stage 1 to Stage 2B

Cost

A construction budget of €377m was developed and approved at Stage 2A.

The budget now incorporates inflation, which had been flagged previously (original budget based on 2013 rates) and including a contingency for risk. The aspergillus and enabling works packages , and an allowance for owner controlled insurance were deducted. Some additions were included (outlined in Table 18).

The Children's Research and Innovation Centre (CRIC) was also separated out, as agreed at Stage 2A, as it would be built separately and funded from a different stream.

The Stage 2A budget was therefore approved at an increased €440,720,000.

	€
Stage 2A Approved Construction Budget	**377,000,000**
Add: Inflation Provision	70,000,000
Add: Risk Provision	17,000,000
Adjustments from Design Development	
Basement Works	500,000
Attendance on Group 2/3 Equipment	2,000,000
Deductions	
Owner Controlled Insurance	(1,900,000)
Children's Research and Innovation Centre (CRIC)	(11,786,000)
Aspergillus Prevention	(3,700,000)
Enabling Works	(8,394,000)
Total Approved Stage 2B Construction Budget	**440,720,000**

Table 18: Construction Costs Adjustments at Stage 2B

Allowances for VAT, design team fees, planning fees and contributions, as well as NPHDB direct costs were excluded.

Other works not mentioned here and budgeted separately are the paediatric outpatients and urgent care centres, the future Maternity Hospital, as well as ICT Hardware and Software.

2.2.11 Business Case Reports & Approvals

Capital Update – March 2016

The NPHDB provided a capital update to the Department of Health and HSE in its report dated 9th March 2016. This was reflected in the Draft Definitive Business Case report dated 13th July 2016.

The capital costs may be summarised as follows:

	€m
Preliminary Business Case / Project Brief	790
SJH Shared services, CSSD and Energy Centre Shell - NPH Letter 10th April 2015	10
Stage 2A Design Development - Increase Floor Area	7
Decant scope – NPH Letter 22nd Jan 2016	7
Inflation Projection - Linesight Report 23rd Feb 2016	34
VAT on Above	6
Sub-Total	**854**
Omit CRIC (Separate Procurement)	(18)
Update Total	**836**

Table 19: Summary of Capital Costs at March 2016

The funding model to support this capital budget was:

	€m
Core Hospital - Exchequer Health Funding	707
Education and School - Exchequer Education	22
Stage 2A Design Development - Increase Floor Area	7
Car Park / Commercial	42
Inflation Projection - Linesight Report 23rd Feb 2016	34
Equipment - MES	65
Total	**836**

Table 20: Funding Model for Capital Costs at March 2016

This information was contained in a Government Information Memorandum issued at this time as there was no statutory approval process required at this stage.

The next approval process was prior to the construction investment decision where the Final Project Brief and Definitive Business Case would be required.

Final Project Brief & Definitive Business Case – February 2017

The NPHDB submitted the Final Project Brief and Definitive Business Case to the Department and HSE on 24th February 2017.

The Minister in his letter dated 27th April 2017 gave his consent to the Final Project Brief and approved the construction investment requirement to enable the NPHDB to award the main construction contract in May 2017.

The capital costs / funding may be summarised as follows:

	€m
Exchequer	
The Children's Hospital and paediatric outpatients and urgent care centres	829
Third Level Education and School	22
Equipment - Traditional Sourcing if not MES	65
Non-Exchequer	
CHG Contribution	20
Car Park / Retail	47
Total	**983**

Table 21: Summary of Capital Costs by Funding Source at February 2017

The capital costs in Table 21 are the same as contained in the Definitive Business Case (Pages 245 and 250). Note exclusions and CRIC.

The HSE in its letter dated 3rd May 2017 approved the Final Project Brief and noted the following:

The construction consists of two phases of work:

- Phase A circa €82m paediatric outpatients and urgent care centres circa €40 m (approval to proceed immediately); and
- Phase B works which will be subject to a separate instruction and finalisation of VE and GMP

2.2.12 CHP&P

The Minister's consent letter dated 27th April 2017 to the NPHDB Final Project Brief contained under section (vii) proposed Project Governance structures now that the project was moving to the point of construction investment decision.

The revised governance structures included the establishment of a Children's Hospital Project and Programme (CHP&P) Board chaired by the Secretary General of the Department of Health and a HSE Steering Group.

The CHP&P Board was to meet on a quarterly basis, with the Group CEO of the CHG and the Project Director, NPHDB to be in attendance.

The NPHDB have provided Capital Budget updates at these meetings, and following the award and signing of the Construction Contracts in August 2017 reported that the current estimated capital budget had increased by €61m due to:

	€m
Fire Cert Added Scope with Sprinklers Throughout	20
Programme Alignment - BAM and Specialists	23
Design Team Fees - Extended Timescale	8
NPH Direct Costs – Extended Timescale	4
Paediatric outpatients and urgent care centres - Programme and Liquidations	6
Total	**61**

Table 22: Construction Cost Adjustments at August 2017

Following discussions on the Capital Update the CHG / NPHDB were asked to provide options on how these additional costs could be contained within the approved Definitive Business Case figures.

Options were subsequently discussed around de-scoping, shelling out space, and deferring works. These options were rejected and delivery to the approved Project Brief was re-confirmed.

The agreed strategy was then:

- To seek additional funding for the out of scope Sprinkler works
- Deliver €6m through re-use of equipment and defer fit out of 8 ICU beds
- Further examination of philanthropy and other potential funding streams
- Review Contingency allocation

The CHP&P Board was appraised prior to the July 2018 meeting that:

- The GMP discussions would not be concluded within the June 2018 programme timeline, with contract award of 3rd September 2018
- Significant cost issues had arisen with the Main Contractor (BAM) and specialist contractors (Mercury and Jones Engineering)
- A three month extension to the Phase B contract award period had been agreed with the contractors giving a new date for award of 3rd December 2018

2.2.13 Enabling Works Contract

The procurement strategy for the project included the following key objectives:

1. Develop a Contract Strategy that would support effective programme delivery.
2. Start work on site as soon as possible after Planning Approval is received.
3. Split the tender into an Enabling Works Contract and Main Works Contract.

The first critical activity on the construction programme was receiving a vacated site from St. James's Hospital such that work could commence on the clearing and de-risking the site prior to the Main Works commencing.

To achieve the above objectives a procurement process started for an Enabling Works Contract with the SAQ being issued in August 2015; invitation to tender in March 2016 ; tenders received in May 2016 with work starting on site in August 2016.

Prior to enabling works commencing on site, the Decant of the site needed to be complete and existing St. James's Hospital activities successfully decanted to new or modified facilities.

The total Decant and transfer of the site to the HSE proved very challenging and resulted in partial handover of the site to the Enabling Works contractor.

There was also a requirement to carry out necessary Aspergillums prevention works to some St. James's Hospital buildings adjoining the new hospital construction site, as extensive demolition works formed part of the Enabling Works Contract.

The Enabling Works Contract included:

- Site clearance and demolition of existing buildings
- Asbestos removal
- Ground investigation to determine any archaeology and soil contamination risk
- Initial site services diversions
- Site establishment
- Hoardings

The planning permission grant was received on 26th April 2016 which set the earliest date for commencing Construction Works.

The Enabling Works Contract commenced on the 8th August 2016 with a contract sum of circa €8m excluding VAT, which was very good value for money; the Final Account was delivered for this figure.

The benefit of delivering the Enabling Works Contract for circa €8m prior to the commencement of the Main Works Phase A have had a major impact on the de-risking of the project. This included both removal of potential asbestos in existing buildings which were to be demolished, and archaeology and ground contamination works surveys.

This was all prior to the commencement of the major site excavations, incorporating removal of some 400,000 cu.m of mixed materials, topsoil and sub-soil.

This work is one of the highest risk categories on any major city centre project, and it was carried out on a live Hospital campus without any disruption to the operation of the Hospital.

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2.2.14 Contract Conditions

Central to the procurement strategy for the project were two key considerations, namely ensuring that both domestic and international contractors with the capacity and expertise to undertake the Children's Hospital would be attracted to bidding for the project, and that an early start on site and thus an early handover of this key infrastructure project could be delivered on.

In considering these essential requirements a number of key deliverables became apparent, namely a 2 stage tendering process, to enable an early start on site, and a collaborative procurement process/contract would be

necessary to ensure contractor interest and participation in the bidding process. Also identified was the need to build adequate safeguards/ decision milestones into the procedures and contract.

The government conditions of contract, in use in the Irish construction market and which are required to be utilised on all public works, do not make provision for fast track 2 stage tendering. It has also attracted a good deal of criticism around being an adversarial rather than a collaborative contract.

It became clear at an early stage in the process that contractors with the capacity to undertake the Children's Hospital, and in particular international contractors, would not be willing to tender on the basis of the government form.

This was further compounded by the intelligence from the market that the large Mechanical and Electrical sub-contractors, both domestically and internationally, would not be willing to tender on a domestic basis to the main contractors, which at the time was also the norm for the government form of contract.

It was apparent therefore that substantial amendments would be necessary to the government form, if delivery of the key objectives noted above was to be achieved.

This process also overlapped with the mid-term review of the government form by the GCCC, who had identified a number of issues which had arisen around the implementation of the government form, and which they were seeking to address by way of amendments.

Some of their considerations around:

- Tendering Mechanical and Electrical systems directly to specialist sub-contractors
- The BOQ
- The use of provisional/reserved sums to cover bespoke medical equipment procured later in the construction process

would dove-tail with some of the key considerations being reviewed for the Children's Hospital contract conditions.

However, the Children's Hospital also retained the key objectives of early delivery and 2 stage tendering, which were not considerations for the review of the government form (which does not envisage fast track 2 stage tendering).

In recognition of the fast track procurement and the processes around the 2nd Stage adjustment required to facilitate this, a further key requirement was identified around requiring the contractor/ key sub-contractors to sign up to a GMP undertaking before any award of the main contract (Phase B) works could be given.

A formal GMP agreement is not provided for under the government form of contract and this provision would also have to be provided for by way of amendments to the standard forms.

A GMP is an undertaking from the contractor / sub-contractor that the final cost for the project, excluding only scope changes, will not exceed the GMP figures signed up to by them. A scope change only applies to works which are entirely outside the intent of the original contract. As such it is a very important, reassuring and valuable undertaking for any employer to have on a contract.

As the importance of these key deliverables to the success of the project became more apparent, so did making appropriate alterations to the existing government forms of contract. An immediate engagement with the GCCC was necessary, around the procurement strategy for the project, the logic behind that strategy and the amendments which would be necessary to the government form to deliver on this strategy.

Several procurement strategy reports were prepared and presented as part of this review process, and several presentations also made to the GCCC. This was a positive and constructive engagement, with the GCCC acknowledging the unique and sizeable challenges around the procurement and successful delivery of the Children's hospital, and the need for appropriate amendments to the government form to meet these challenges.

A number of key and technical amendments were ultimately agreed as being necessary and acceptable. The key ones in the context of the government form of contract operational at the time were:

- A 2 stage, collaborative tendering process. Working to achieve an early start on site and early completion of the overall project (by two years) and also attracting contractor tendering interest by way of offering collaboration and the opportunity for contractor input into the 2nd Stage process
- A requirement for the contractor/key sub-contractors to provide the employer with a GMP, prior to any instruction being given to proceed with the main (Phase B) contract works
- Clearly defined processes and procedures to arrive at an appropriate GMP, with also a key provision for the employer to determine the contract at will at that stage if deemed necessary, with important protections limiting the contractors entitlement to recover costs in the event of such a determination
- As part of that clearly defined GMP process, pro-

vision for an Independent Expert to make binding decisions, and thus ensure even where items are in dispute a binding GMP can be arrived at

- Tendering the complex and highly specialised Mechanical and Electrical works on the Children's Hospital directly to the specialist contractors who have the expertise and skillset to undertake these works
- Subsequently appointing them as domestic sub-contractors to the Main Contractor, whilst still providing the sub-contractors involved with important protections around issues such as their cash flow payment to them by the Main Contractor
- In the context of the GMP requirements, clear definitions and examples around what would constitute a scope change and thus avoiding the potential for future misunderstandings or claims around the issue of scope changes
- Bespoke dispute management procedures, to avoid both the potential for disputes arising and where they do arise to work to resolve them speedily and efficiently
- A cap on the unlimited liability under the government form at the time and other considerations around stepped liquidated and ascertained damages
- A cap on the value of the performance bond etc., which given the size of the project would simply have been too excessive for contractors to have assumed responsibly for and would have effectively discouraged contractor participation in the project
- Clearly defined procedures around the recovery of excessive tender inflation (in excess of 4%), only in the later years of the project, reflecting both the considerable timeline for a project of this size and also the volatile Irish construction market as it recovered from a sustained period of recession (at the time of tender)

The above provisions were reviewed and considered at length with the GCCC and ultimately were agreed as both necessary and beneficial to successful delivery of the Children's Hospital.

As a result of the provisions identified:

- Large and experienced contractors/ sub-contractors, both domestic and internationally were successfully encouraged to tender for the project
- Work on the project has commenced approximately two and a half years earlier than would have been achieved using traditional procurement methods
- It also ensures the Children's Hospital will be handed over several years earlier than otherwise would have been the case
- The 2nd Stage adjustment has been completed in line with the process and procedures set out and provided for in the contract. In this regard key provisions around issues such as the Independent Expert have proven to have been absolutely essential and to have delivered on their key objectives
- The safeguard around the employer's ability to determine the contract at will (with key safeguards around cost if this provision is exercised) is enshrined in the contract should the employer require it

2.2.15 Tender Process

Tender Issue

Tender documentation was prepared and issued in accordance with the procurement strategy developed for the project. This procurement was a 2 stage process

1. Pre-qualification; and
2. Tender

Pre-Qualification

Contractor / Specialist selection was based on the outcome of the pre-qualification process. This process resulted in the following:

Service	Number Shortlisted
Main Contractor	5 Contractors Shortlisted
Mechanical Installation	4 Specialists Shortlisted
Electrical Installation	4 Specialists Shortlisted
Lift Installation	4 Specialists Shortlisted
Curtain Walling / Glazing	Inadequate Market Reply – No Specialists Shortlisted
Cladding Installation	Inadequate Market Reply – No Specialists Shortlisted

Table 23: Summary of Contractors / Specialists Shortlisted by Service after Pre-Qualification

In relation to the Curtain Walling / Glazing and Cladding Installation works the market response to the pre-qualification was inadequate to allow the formation of shortlist for tender.

As a result and following agreement from all the Main Contract applicants these works were incorporated into the Main Contract Works.

Tender

Tender documentation was prepared and issued as noted below on the 17th June 2016 to the contractors that had been selected following the conclusion of the pre-qualification process.

Service	Tender Return Date
Main Contract	21st October 2016
Mechanical Installation	20th October 2016
Electrical Installation	20th October 2016
Lift Installation	29th September 2016

Table 24: Summary of Tender Return Dates by Service

As part of the tender documentation an Indicative Timeline Programme identified both overall construction duration, of 48 months, and an outline construction logic.

The programme was prepared to assist the contractor / specialist develop programmes related to their works. The programme for each of the selected contractors would be required to be incorporated into a fully aligned programme for the works prior to contract award.

Key features of this Indicative Programme are as follows:

Project Phase	Date / Time
Phase A Works Commence	Jan 2017
Phase B Works Commence	Oct 2017
Mechanical / Electrical Commence	May 2018
Overall Construction Period	48 Months
ICT Hub Fit-Out Commence	Sep 2019
Client Equipment Installation	Oct 2020

Table 25: Indicative Programme Timeline

Tender Returns

This section of the report sets out details in relation to the receipt and evaluation of tenders.

Service	Tender Return Date
Main Contract	21st October 2016

Tenders were received from the following contractors within the deadline specified:

- BAM Building Ltd.
- Dragados S.A. & Collen Construction Ltd.
- FCC Construction S.A. & Walls Construction Ltd.
- John Sisk & Sons (Holdings) Ltd.

A tender was not submitted from the following:

- Brookfield Multiplex Construction Europe Ltd.

Service	Tender Return Date
Mechanical Installation	20th October 2016

Tenders were received from the following contractors within the deadline specified:

- HA O'Neill Ltd.
- Kentz Ireland Ltd.
- Leo Lynch & Co (Group) Ltd.
- Mercury Engineering

Service	Tender Return Date
Electrical Installation	20th October 2016

Tenders were received from the following contractors within the deadline specified:

- Designer Group Engineering Contractors Ltd.
- Kentz Ireland Ltd.
- Mercury Engineering
- Patrick Lynch Ltd.

Service	Tender Return Date
Lift Installation	29th October 2016

Tenders were received from the following contractors within the deadline specified:

- Kone (Ireland) Ltd.
- Otis Ireland
- Schindler Ltd.

A tender was not submitted from the following:

- Orona Mid-Western Lifts Ltd.

Tender Evaluation

The tender evaluation for each element was carried out in accordance with the Procurement Sub-committee agreed procedures developed prior to the receipt of tenders. The process which was used is summarised below.

Quality: Price

The evaluation consisted of both a Quality and Price assessment. The allocation of Quality / Price was as follows:

Service	Percentage Allocated
Quality	25%
Price	75%

Table 26: Summary of Evaluation Scoring Allocation

The Quality and Price Evaluations were carried out independently of each other by separate teams.

The Financial Evaluation did not commence until the Quality Evaluation had been concluded and signed off.

Quality Evaluation

The Quality Evaluation was carried out by the Quality Evaluation Panel. This panel was supported by separate Technical Support Panels to provide assistance in relation to the following:

- Community Benefits
- Programme & Schedule
- Specification
- Facades / Curtain Walling
- Health & Safety

The Quality Evaluation Panel prepared on Evaluation Report for consideration and sign off by Assessment Panel.

Financial Evaluation

On receipt of the tenders the financial elements were removed from the overall tender submission. The financial elements were opened to verify compliance.

The financial documents were immediately sealed and placed in a secure store pending the conclusion of the Quality Evaluation.

On the conclusion of the Quality Evaluation and sign off by the Assessment Panel the Financial Evaluation commenced.

The Financial Evaluation was carried out by a separate Evaluation Panel and on conclusion of this evaluation a Financial Evaluation Report was prepared. The outcome of this evaluation was then combined with the results of the Quality Evaluation into a combined report.

Following the conclusions / close out of any queries / clarifications in relation to the evaluation the Assessment Panel identified a Preferred Bidder for each element tendered, which was then recommended to the NPHDB.

Tender Evaluation Outcome

The outcome of the evaluation process was the following being identified as the Preferred Bidder:

Service	Preferred Bidder
Main Contract	BAM Building Ltd.
Mechanical Installation	HA O'Neil
Electrical Installation	Mercury Engineering

Table 27: Summary of Preferred Bidders Identified for Main Contract, Mechanical Installation and Electrical Installation

In relation to the Lift Installation we would note that no Preferred Bidder was identified at this stage. This was due to technical compliance issues with the tenders received.

As a result of the above the decision was taken to re-tender these works. The same process was adopted in relation to the re-tender with the outcome of the evaluation identifying the following:

Service	Preferred Bidder
Lift Installation	Schindler Ltd.

Table 28: Summary of Preferred Bidder Identified for Lift Installation

Below is a summary of the marks allocated to each tenderer together with the ranking:

Ranking	No. 1
Main Contractor	Bam Building Ltd.
Marks Awarded	924.23
Mechanical Installation	HA O'Neil
Marks Awarded	956.60
Electrical Installation	Mercury Engineering
Marks Awarded	905.40
Lift Installation	Schindler Ltd.
Marks Awarded	919.14

[redacted]

Table 29: Summary of Marks Awarded and Ranking by Service

Tender Sums

Further to the evaluation process noted above, set out below is a summary of the tenders received from each of the Preferred Bidders identified.

Service	Preferred Bidder
Main Contractor	BAM Building Ltd.
Mechanical Installation	HA O'Neil
Electrical Installation	Mercury Engineering
Lift Installation	Schindler Ltd.

[redacted]

Table 30: Summary of Tender Sums from Preferred Bidders by Service

Note: In relation to the tender amount for BAM Building Ltd the sum of €568,920,321.38 identified is the amount included on the Tender & Schedule and has not been adjusted to reflect the tenders received from the Reserved Specialists.

Adjusted Tender Spread

The table below notes the tender spread received for the works. The tender sum for each of the Main Contractors has been adjusted to reflect the tender amounts for the Preferred Bidders for the Reserved Specialists.

2.2.16 Pre-Contract Engagement

Following the conclusion of the tender evaluation, the following preferred bidders were identified.

Service	Preferred Bidders
Main Contract	BAM Building Ltd.
Mechanical Installation	HA O'Neil
Electrical Installation	Mercury Engineering
Lift Installation	Schindler Ltd.

Table 32: Summary of Preferred Bidders by Service

Having identified the preferred bidder for each element of the works the appropriate Letters of Intent / Unsuccessful Letters were prepared and issued to the tenderers. These letters were issued February 2018.

Following the expiry of the required standstill period pre-contract clarifications discussions commenced with the selected contractors. The NPH Team were very aware of issues of public procurement and the need to avoid any potential for negotiation with the contractors during this period. However, given the scale and nature of the project engagement clarifications on a number of issues was required prior to Contract Award.

These issues included the following:

1. Provision of project insurances
2. Bonding arrangements

3. Collateral warranties
4. Project delivery teams / structure
5. Transfer arrangements in relation to the Enabling Works Contract
6. Potential opportunities to de-risk the works including Scope of Enabling Works and potential early access for excavation works. (We would note that BAM Building Ltd did not avail of the Early Access provided to commence the excavation works during the summer period)
7. Procedures in relation to Pre-Phase B engagement
8. Review of contractor proposals in relation to temporary access road
9. Programme alignment between the Main Contractor and Specialists. The Main Contractor and Reserved Specialists all tendered the works on a high level overall programme for the works. Once the preferred bidders were identified the contractors were required to develop a co-ordinated programme that would form the basis of Contract Award. This alignment included addressing the following;
    - Access dates for each of the plant room areas.
    - Sequence of working
    - Weatherproofing dates for each floor / zone.
    - Handover dates for equipment rooms and ICT hubs
    - Commissioning periods for the building services
    - Implication of the introduction of the requirement for full sprinkler installation
10. Re-tendering arrangements in relation to the Lift Installation
11. Arrangements in relation to Value Engineering to be incorporated Pre-Contract
12. Selection of the Independent Expert
13. Selection of the Standing Conciliator
14. Selection of Project Board Members
15. Contract close-out arrangements
16. Formal contract signing

2.2.17 Contract Award

The tender process was concluded on 20th/21st October 2016 for the Children's Hospital Main and Specialist contracts and the evaluation process to identify the most economically advantageous under the Quality and Price criteria were concluded by 3rd February 2017 (a period of 11 weeks).

The procurement regulations contain a standstill period during which the tendering firms can raise objections to the proposed contract awards.

This was identified as a high risk to the project at an early stage taking into account legal challenges that have taken place on other high profile public projects and the complexity of Public Procurement and EU Requirements.

The NPHDB did not encounter any challenges to the award notifications

The NPHDB did not encounter any challenges to the award notifications and proceeded to engage with the preferred bidders to clarify pre-contract clarifications which resulted in the contract being signed for the Children's Hospital on 3rd August 2017.

The procurement process resulted in the contracts being awarded to Tier 1 Main and Specialist contractors in BAM; Jones Engineering and Mercury Engineering.

A similar process was concluded for the two paediatric outpatients and urgent care centres which resulted in Main and Specialist contract award to BAM for the Main Contract and Patrick Lynch and Mercury Engineering, contracts being signed on 31st August 2017.

The paediatric outpatients and urgent care centres awards under the Specialists was delayed due to the cessation of business of the preferred Mechanical and the Electrical sub-contractors, Walsh Mechanical Ltd and Precision Electric (Ireland) Limited.

3.0
Construction

3.1 Construction Phase A

Following protracted contract discussions and execution, site activity officially began on the 2nd October 2017. This was the beginning of Phase A, the intention being that this ultimately transitions into Phase B.

The objectives of Phase A are:

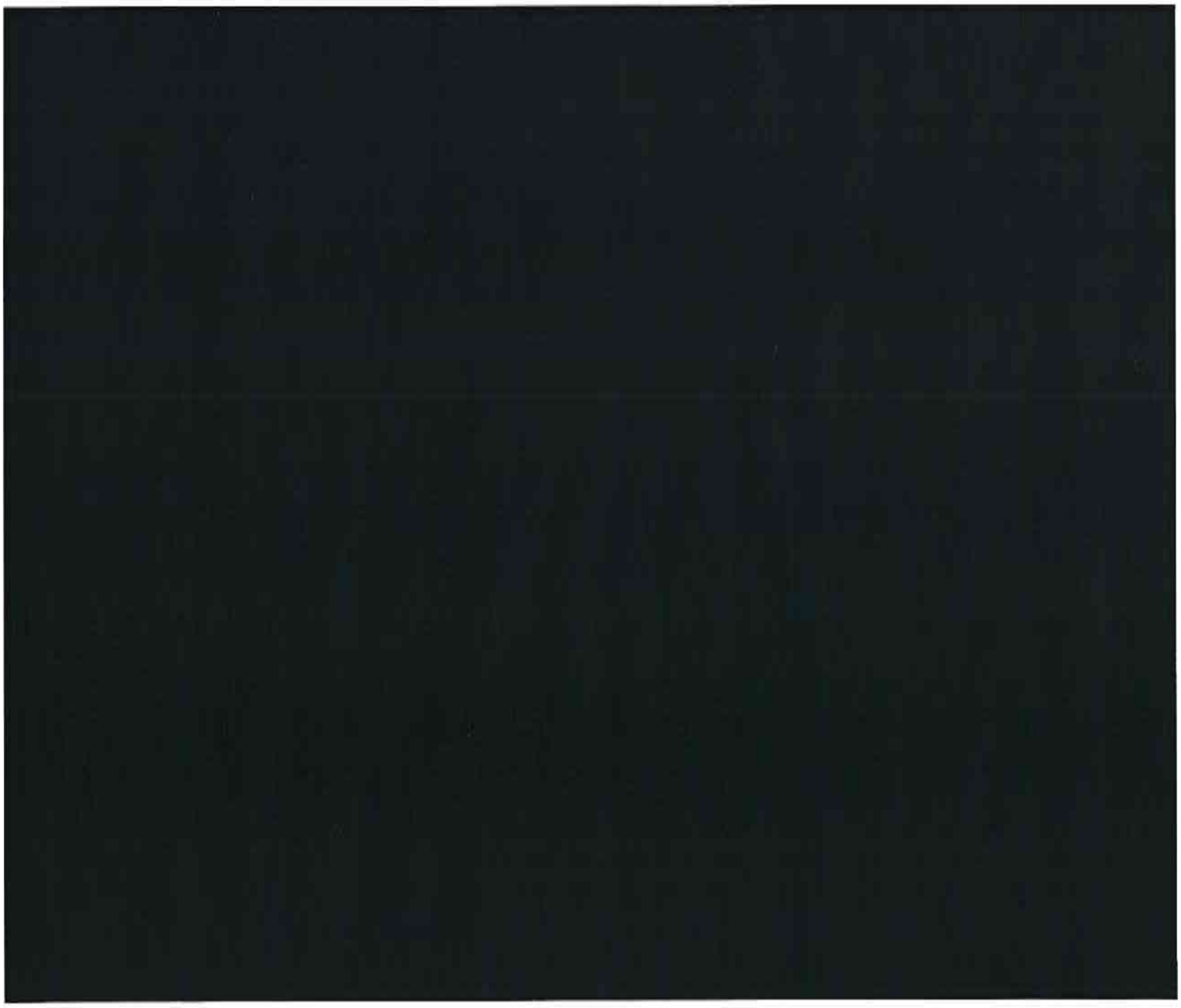
- To divert the Drimnagh Sewer around the site boundary
- Divert the Utility Tunnel around the site boundary
- Excavate and export all but the access road earth-works from the site
- Build the concrete frame to a level that allows the construction of the northern access road, the earliest possible removal of the central access road, and the timely completion of the Hot Block in Phase B

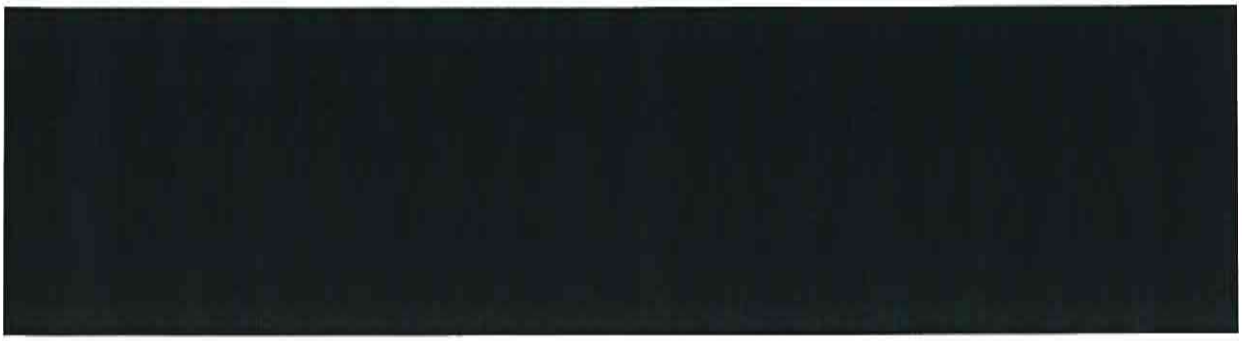
Enabling Works had been progressing for some time, and 2nd October 2017 marked the transition to the Main Build for Phase A. Hoardings were already in place, so now more site cabins were required to house the contractors for the next 4 to 5 years.

Modifications to existing pipework in the Utility Tunnel were immediately planned, to enable easy change over at a later date, and the first piling rig arrived on site to start on the temporary piles required to start the new Utility Tunnel.

The scope of Phase A had been defined in the tender as having a temporary southern access road. However, a proposal from BAM to re-route the temporary access road through the centre of the site was subsequently adopted, so dividing it into a North and South site.

The original tender intent was that Phase A would take the building up to a complete Lower Ground level podium slab. However, the central road initiative meant that the concrete frame would now be built in two parts, eventually joining up when the permanent northern access road was opened, and the temporary central road removed.





3.2 Value Engineering

Significant Value Engineering Analysis has been carried out on the project. This section of the report sets out how Value Engineering (VE) was addressed at each of the following stages:

1. Pre-Tender
2. Pre-Contract Award
3. Post Contract Award

Pre-Tender

As part of the 2 stage procurement strategy adopted for the project it was recognised that there may be a requirement to implement VE to achieve budget targets. As a result, the design team commenced a review of potential VE prior to the issue of the tender documentation.

A schedule of potential VE works was prepared and included within the Stage 2B Report.

The VE Schedule included within the Stage 2B Report had a potential range of €33.10m to €48.02m, however the implementation of these items would be subject to approval.

Pre-Contract Award

The Schedule of Potential VE included within the Stage 2B Report formed the basis of continued VE Analysis.

Following the issue of the relevant Letters of Intent the design team were able to update the VE Schedule based on the tender rates received from the preferred bidder and were also in a position to identify further potential VE items.

The outcome of this VE Analysis is set out in the Report on Tenders (April 2017) where potential VE in the amount of €70,177,740 was identified. The approach proposed by the Procurement Working Group in relation to this schedule is as follows:

Ref	Description	Main Contractor €	Mechanical €	Electrical €	Total €
1	Category A VE Items	19,797,826	6,194,628	11,260,756	37,253,210
2	Category B VE Items	26,657,676	3,345,906	2,920,948	32,924,530
3	**Adjusted Target Budget**	**46,455,502**	**9,540,534**	**14,181,704**	**70,177,740**

Table 35: Value Engineering by Category and Service

In the period between the issue of the above report on tenders and the close out of the contract in August 2017 the analysis and development of the VE continued. During this period discussions were held with the contractors in relation to the extent of the items incorporated into Category A.

The outcome regarding VE at Contract Award was as follows:

Ref	Description	Main Contractor €	Mechanical €	Electrical €	Total €
1	Category A VE Items	16,523,965	5,606,861	11,230,756	33,361,582
2	Category B VE Items	31,352,446	4,590,907	3,659,750	39,603,103
3	**Adjusted Target Budget**	**47,876,411**	**10,197,768**	**14,890,506**	**72,964,685**

Table 36: Value Engineering by Category and Service at Contract Award

At the Contract Award the overall total of the proposed Value Engineering was €72,964,685.

Post-Contract Award

During the period between the Contract Award and the commencement of the Pre-Phase B Engagement process in October 2017 further analysis continued in relation to the Category B Value Engineering Schedule.

Adjustments were made resulting in the position as noted below:

Ref	Description	Main Contractor €	Mechanical €	Electrical €	Main Contractor Profit €	Total €
1	Category A VE Items	16,523,965	5,606,861	11,230,756	2,104,702	33,361,582
2	Category B VE Items	25,915,375	4,240,810	3,559,748	975,070	34,691,003
3	**Adjusted Target Budget**	**42,439,340**	**9,847,671**	**14,790,504**	**3,079,772**	**70,157,287**

Table 37: Value Engineering Adjusted Budget

This sum of €70,157,287 was incorporated into the adjusted budget for the works.

(The eventual VE savings adopted in the GMP are discussed in 3.3 GMP Process – Step 1: Value Engineering Delivery)

3.3 GMP Process

Guaranteed Maximum Price (GMP) - Robustness

A GMP is a guarantee from the contractor that the project on completion will not exceed the GMP arrived at before the work commenced on site. This is generally arrived at after the contractor has been given an opportunity to review the design and collaborate with the design team on arriving at the GMP. During this period the contractor is able to make reasonable submissions and representations around the risks and associated costs.

The GMP is only adjustable after it's signing for what are clear cut "scope changes". These are generally classified as changes clearly outside the scope and intent of the original contract. For example, a substantial increase in floor area. Thus, there is a limited opportunity, and only for very clear cut reasons, for the contractor to vary the GMP. It therefore gives a very high degree of cost certainty for an employer on a construction project.

It is most effective when it is combined with a 2 stage tendering strategy, which facilitates an early appointment of the contractor and thus enables him to be involved in the development of the final design and provide his expertise as part of that process. This should encourage an environment which provides positive engagement and collaboration between the employer's team and the contractor's team.

A GMP provides a number of key advantages:

- It encourages contractors and sub-contractors to look down the line and identify project risks and pinch-points, thus providing an opportunity to address and mitigate these risks before they become an issue and potentially a serious risk to the project
- Contractors assume the risk for all quantities previously measured by the employer's design team after signing of the GMP. This encourages the contractor to carefully check the quantities measured for the project as he will be assuming all risk for them, even where there is a mistake in the measurement of the quantities necessary to complete the finished project
- It should encourage a collaborative and open engagement between all parties in properly assessing project risks/programme and other challenges and working to minimise the potential negative impacts of same, well in advance
- Most importantly it is designed to provide a high degree of cost certainty for an employer before he commits to a construction project
- At the same time this provides the contractor with a reasonable opportunity to identify the cost/quantities risks which he may be taking on board and receive an appropriate/fair allowance for same

The above advantages represent significant benefits for any employer, particularly employers undertaking complex projects, being constructed over a lengthy timeline in a challenging and highly inflationary construction market. Essentially considerations that apply to the Children's Hospital.

Achieving a GMP is challenging on all project types, but on a heavily serviced project it is particularly difficult. It can sometimes be perceived as encouraging contractors to identify cost risks and seek compensation for same in the pre-GMP agreement period, thus creating an environment where earlier cost recovery is encouraged by contractors.

However, this perception is not accurate and can represent a serious misrepresentation of the key advantages of achieving a GMP. The real and unacceptable costs on any construction project relate to those which arise as a result of inefficiencies, unnecessary delays and disruption which need not and should not have happened.

Unfortunately the construction industry, due to the once-off and unique nature of most construction projects, has a poor record with regard to costs being incurred post contract signing, and most worryingly of all, costs which could have and should have been avoided with better collaboration and the earlier identification of potential problems before they become actual problems.

Often money committed in a GMP agreement to address a potential problem before it becomes a serious and disruptive problem is money well spent.

Often money committed in a GMP agreement to address a potential problem before it becomes a serious and disruptive problem is money well spent, and ultimately prevents much more significant costs being incurred further down the line. This combination of early problem solving, and working in a collaborative environment to mitigate the substantial risks which exist on any construction project, are ideally addressed in a 2 stage tendering arrangement, combined with a final GMP undertaking from the contractor before the project commences.

The GMP and Design Completeness

The report highlights the challenges which have taken place around the 2nd Stage design and the delivery of design information in line with the original programme timelines.

On signing of any GMP, the bills of quantities which have formed the basis for arriving at the 2nd Stage package adjustment will become a schedule of rates and the basis for the GMP itself will be the drawings, specifications and supporting documentation produced by the design team as part of the 2nd Stage/GMP process.

This highlights the critical importance of this information being complete and robust and that it is properly assembled and cross checked to ensure a complete set of documents is in place to provide a comprehensive GMP agreement.

Given the flow of information and the timelines for same, particularly around the civil/structural/architectural (CSA) information delivery versus the Mechanical and Electrical (M&E) delivery, different design cut off dates had been agreed for them.

The CSA design cut-off point was the 9th March 2018, with an addendum package being utilised to pick up the comparatively small information drop between then and the 17th August 2018, much of it by way of clarifying RFI's (generally design team responses to contractor requests for information). The M&E design cut-off point was on the other hand the 17th August 2018, reflecting the later delivery of design information for the services installations on the project. Overall however it is the intention that the GMP is based on the information for all packages provided up to the 17th August 2018, both for the CSA and the M&E.

A review of the design information, including supporting clarifying RFI's (Request for Information), issued by the design team, highlights that a comprehensive set of information has been assembled in support of the GMP process.

Given the volume of the information produced, considering both the size and complexity of the project, it will be extremely important that the final assembly of the GMP documentation for GMP signing purposes is carefully quality checked and referenced to ensure no information is inadvertently omitted.

Currently this process is well in hand and the design team have agreed protocols, process and procedures to facilitate this information being gathered, checked and to ensure it is included in the GMP agreement signed off on.

GMP: Public Works Contracts and the Children's Hospital

Whilst a GMP is quite common on commercial projects, its use on Irish public works projects is rare. However, the benefits of an effective and well-constructed GMP are self-evident on any project. On government contracts in recent times, using the standard government form and in the highly volatile tendering market which has existed in the recession / post-recession environment in Ireland, post contract award variations ranging from 10% up to 40% have not been uncommon.

A less than desirable, and often corrosive environment has manifested itself on site post contract, with opportunities for claims being pursued, and often delays and stoppage on site whilst issues were resolved. This has often resulted in crippling cash flow issues, which contributed to contractor insolvencies and huge issues for employers in the public sector seeking replacement contractors in accordance with EU tendering requirements.

On a hugely challenging, heavily serviced and unique project such as the Children's Hospital, collaboration, early problem identification and problem solving, are absolutely essential.

On a hugely challenging, heavily serviced and unique project such as the Children's Hospital, collaboration, early problem identification and problem solving, are absolutely essential if it is to be successfully delivered. A GMP particularly when combined with a 2 stage collaborative process encourages this process and ensures continued pro-active and positive behaviour from the Main Contractor and sub-contractors thereafter as they are assuming and taking the risks for delivering the project for the strict GMP undertaking they have signed up to.

The Children's Hospital has gone through an intensive 2 stage adjustment, with the 2nd Stage adjustment having recently been finalised, and the project re-measured and the costs updated to reflect the now fully developed design. This reflects a structured and well defined process, whereby the contractors have assumed responsibility and the risk for all quantities. The rates from the 1st Stage tender have been applied to the 2nd Stage quantities, which in turn now reflect the full design. The Step 2 adjustment arrived at, at the end of this process is €798m and as noted earlier this has been a clearly defined and formulaic process, which was clearly set out and defined.

The GMP process which runs in parallel with this two stage process requires the Main Contractor and the sub-contractors to address all contract risk around any further design development, resolving issues on site, programme extensions and timeline reviews, and clashes between services etc. In this context the extract from the contract noted below (Ref Clause 5.1 of the Conditions of Contract) gives a sense of the very substantial cost risks the contractors are required to assume responsibility for, as part of the GMP agreement.

> *"The Contractor shall be deemed to have satisfied itself prior to the instruction to commence the Phase B Works of all circumstance that may affect the cost of executing and completing the Works and of the correctness and sufficiency of the Adjusted Contract Sum and the Guaranteed Maximum Price to cover the cost of performing the Contract. The Adjusted Contract Sum and the Guaranteed Maximum Price shall be deemed to have provided allowances for all risks, customs, policies, practises and other circumstances that may affect its performance of the Contract, whether they could or could not have been foreseen, except for events for which the Contract provides for adjustment of the Contract Sum and / or the Guaranteed Maximum Price."*

Getting to the GMP Construction Budget: Three Step Adjustment

The Approved Business Case was set for the project in April 2017.

The tenders from the Main Contractor BAM and the two principle sub-contractors, Mercury (Electrical Installation) and HA O'Neill (Mechanical) were received in the summer of 2016. The updated programme for the project targets a handover for the completed building in mid 2022. The period 2016 to the end of 2018 has been a period of hyper tender inflation in the Irish construction industry, with no sign of the level of tender inflation moderating to any significant degree between end of 2018 and the end of 2022.

The Approved Business Case was updated for approved scope changes such as the full sprinkler installation required for the project and the programme alignment between the Main Contractor and the services installation sub-contractors. This updated budget was set at €606m for the project.

The table below sets out the movement of the Approved Business Case Budget set in April 2017 of €575m to the Budget set for the project in 2017 of €606m. Thereafter it tracks the three step progression to the agreed GMP figure, noting the percentage movement in each step.

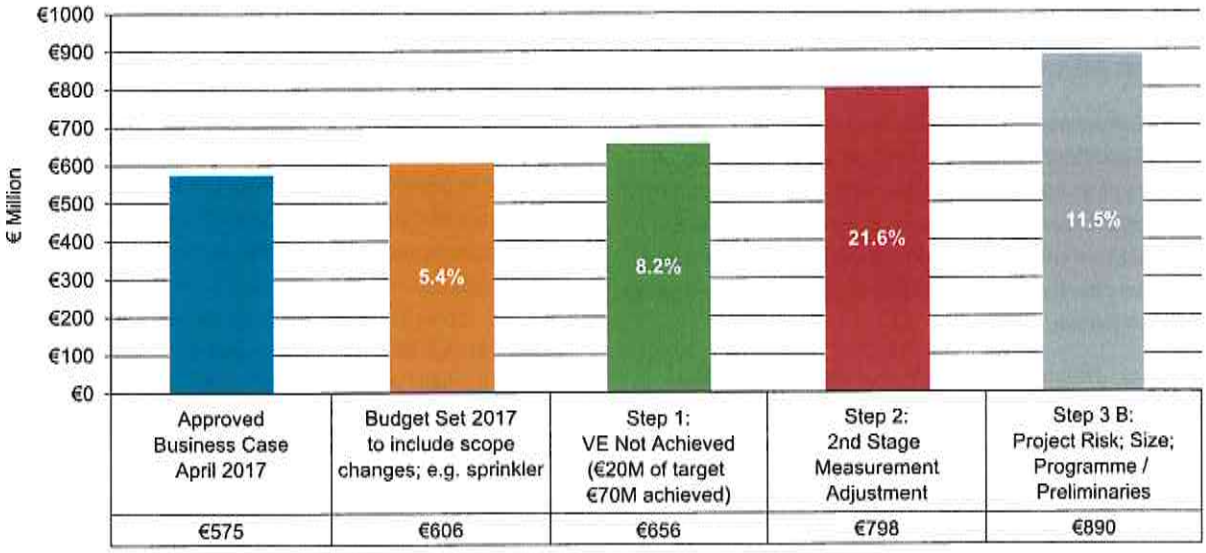


Figure 13: 2017 Target Budget: 3 Step Adjustment to GMP for 2022 Outturn

Step 1: Value Engineering (VE) Delivery: €606m: + 8.2% Step 1 increase

Central to achieving the targeted budget was the successful delivery of €70m in targeted VE. Whilst clear strategies around delivery of this very substantial saving were identified, in hindsight this was a very challenging target to deliver on, in the context of a contractor who was €130m less than the second tenderer €148m less than the third tenderer and €179m less than the 4th tenderer. Of the €70m target, €20m was successfully delivered.

Step 2: 2nd Stage Measurement Process: €798m: + 21.6% Step 2 increase

This is a well-defined and formulaic process, as clearly set out in tender and contract documents. It involves taking the provisional quantities identified and priced in the 1st Stage tender (in approximate bills of quantities) and applying the tender rates associated with same to the quantities measured for the now fully completed design (completed at the end of the 2nd Stage period). At the end of this process the 1st Stage tender is adjusted and the contractors now take responsibility and the risk for all quantities on the project, with the BOQ becoming a schedule of rates. It had been anticipated that this adjustment should not exceed +10%, reflecting a 90% targeted design certainty for the 1st Stage design. Given the early/fast track nature for the 1st Stage tender, the 90% certainty for design, particularly with regard to the Mechanical and Electrical installations was a very ambitious target and one which was not fully delivered on.

Step 3: Guaranteed Maximum Price (GMP) Finalisation: €890m: + 11.5% Step 3 increase

The final step is the GMP finalisation itself and setting the GMP for the project. The GMP is the contract price which the Main Contractor and sub-contractors give an undertaking to deliver the completed project for. The only exception to this strict undertaking being an approved scope change, which is a change clearly outside the scope and intent of the contract. It involves contractors assuming and taking on responsibility for a substantial degree of cost risk, recognising that a well-structured and defined GMP greatly reduces the potential for and the risks around post contract costs arising post the works starting on site. In the context of the Children's Hospital the majority of the costs provided for here relate to the extended and approved programme for the project works and the implications of extended timelines, together with the impact of the cost movements in the 2nd Stage adjustment on contractor's preliminaries costs.

As noted earlier a well-constructed and robust GMP agreement greatly reduces the capacity for a post GMP agreement increase in costs, and the potential for disruptive and wasteful contractual claims and challenges thereafter. As such this should be viewed in the context of greatly reducing the potential for post GMP/contract cost increases, claims for increases, disruption on site as a result and ultimately the potential for disputes and delays to the project.

The "Independent Expert" and the 2nd Stage Adjustment / GMP Process

The contract makes for provision for the appointment of an Independent Expert, who has the authority to rule on matters of disagreement between the contracting parties with regard to any computations and adjustments to the contract sum which may be in dispute. In this regard any decisions the Independent Expert arrives at will be binding on both parties.

The use of the Independent Expert was anticipated as being around occasional items of particular dispute, which simply could not be resolved between the parties as part of the agreed 2nd Stage adjustment/GMP process. This reflects the fact that the processes and procedures around the 2nd Stage/GMP adjustment, were clearly defined in the contract conditions, and followed a clearly defined set of adjustment criteria.

In reality, by April/May 2018 it was becoming apparent that the process was experiencing substantial pinchpoints and blockages around agreeing and resolving key issues

In reality, by April/May 2018 it was becoming apparent that the process was experiencing substantial pinchpoints and blockages around agreeing and resolving key issues around the 2nd Stage adjustment. Key challenges arose around issues such as the interpretation of the rules of measurement and the adjustment of tender rates to reflect issues around design development and new items of work.

To resolve these critical impasses and in consideration of the extremely challenging timelines for agreement of a GMP, it was agreed that the Independent Expert would adopt a much more pro-active approach. This resulted in the Independent Expert becoming immersed in the 2nd Stage adjustment and a key player in keeping it moving and the packages being signed off and agreed in a timely manner. Bearing in mind that there were in excess of 150 packages to be agreed and resolved if the 2nd Stage adjustment milestone was to be delivered on.

The Independent Expert sat in on many meetings and briefed himself and became familiar with the issues impacting negatively on the process and those having the potential to cause delay on the project. In an effort to keep the process moving, the Independent Expert advised that wherever possible he would listen to the various issues and arguments all parties had around various issues of difficulty, and would provide them with verbal guidance around how he felt they could and should be resolved in accordance with the provisions of the contract. He requested that all parties take on board his verbal (non-binding) comments and act on them, in order to keep the process moving and adhering to the tight timelines involved. However, if any party continued to disagree with his verbal advice and guidance he would be happy to put it formally in writing, with his reasoning around his conclusions, in which case it would be formally binding on all parties involved.

In the spirit of the guidance provided by the Independent Expert and in recognition that ultimately he could make his verbal advice binding in writing, all parties generally accepted his verbal guidance and worked to resolve any contentious issues in line with his verbal advice.

The Independent Expert thus became absolutely key to the 2nd Stage/GMP adjustment/process and was a key player, who became a regular and key attendee at all design team/contractor meetings. There is no doubt that without his involvement in all aspects of the process and procedures, the challenges around the 2nd Stage/GMP adjustment would have been greatly increased and very difficult to resolve in the timelines set out.

His involvement in Step 3, the final GMP process which was concluded only in recent days was absolutely key and ultimately it was his guidance and ruling on a number of quite contentious items which enabled the process to be concluded.

The GMP and the Revised Annual Cash Flow Projections for the Project

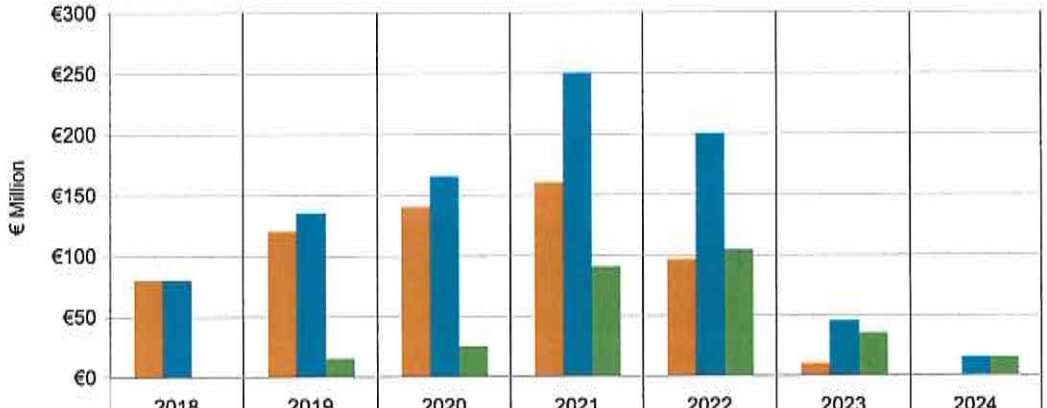
As noted previously in the report the agreed GMP is the end outcome of a clearly established and defined contractual process. The current GMP assessment reflects the 2nd Stage adjustment, which has been particularly impacted by the increase in the Mechanical and Electrical 2nd Stage adjustment and also the longer programme duration agreed as part of the adjustment process.

This impacts on the overall cash flow for the project, but the impact is more pronounced on particular years and is longer in duration, extending now more into the latter period of the contract works.

The chart below demonstrates this, in noting the original construction cash flow projection and comparing it with the updated GMP cash flow, noting the differences between the two.

As is evident from the table the impact of the GMP cash flow is more pronounced in the years 2021/22, reflecting the concentration of services being installed on the Project in these two years, and in turn the more substantial 2nd Stage adjustment relating to the services installations.

Currently the Independent Expert is preparing a report around his considerations and guidance to all parties involved around the finalisation of the process, which will be issued separately.



	2018	2019	2020	2021	2022	2023	2024
Budget of €606M	80	120	140	160	96	10	0
GMP of €890M	80	135	165	250	200	45	15
Variance	0	15	25	90	104	35	15

Figure 14: Cashflow Comparison: Construction Budget v Finalised GMP

3.4 GMP Analysis

This section of the report sets out the development of the costs from Target Budget identified in 2017 to GMP finalisation. Each step in the development of the costs is set out below.

Target Budget Provision

The Target Budget Provision in the sum of €607,115,967 was established. This sum was set out within Section 13.6 of Report on Contract Award 4th October 2017.

Ref	Description	Main Contractor €	Mechanical Installation €	Electrical Installation €	Lift Installation €	Main Contractor Profit €	Total €
1	**Target Budget**	**383,084,603**	**107,954,129**	**86,184,861**	**5,000,000**	**24,892,374**	**607,115,967**

Table 38: Target Budget Provision

In relation to the above sum we would note that this assumed achieving the following Value Engineering:

Ref	Description	Main Contractor €	Mechanical Installation €	Electrical Installation €	Lift Installation €	Main Contractor Profit €	Total €
1	**Targeted VE Delivery**	**42,439,340**	**9,847,671**	**14,790,504**	**0**	**3,079,772**	**70,157,287**

Table 39: Assumed Value Engineering within Target Budget Provision

Step 1 – Impact of VE Not Achieved

As noted above the Target Budget of €607,115,967 was based on achieving VE in the sum of €70,157,287. During Step 1 of the 2nd Stage adjustment €48,555,832 of VE was not realised. Set out below is the Adjusted target Budget reflecting the impact of the VE not achieved:

Ref	Description	Main Contractor €	Mechanical Installation €	Electrical Installation €	Lift Installation €	Main Contractor Profit €	Total €
1	Target Budget	383,084,603	107,954,129	86,184,861	5,000,000	24,892,374	607,115,967
2	Value Engineering Not Achieved	24,740,981	7,106,734	14,062,022	0	2,646,095	48,555,832
3	**Adjusted Target Budget**	**407,825,584**	**115,060,863**	**100,246,883**	**5,000,000**	**27,538,469**	**655,671,799**

Table 40: Adjusted Target Budget due to Impact of Value Engineering Not Achieved

Step 2 – 2nd Stage Measurement Adjustment

In addition to the impact of the VE not achieved the cost assessment was adjusted during the 9 month Pre-Phase B Engagement period to reflect the conclusion of the Detailed Design for the works. These additional costs have been grouped under the following categories

1. **User Change**
   At the time of the preparation of the tender documentation the User Engagement process had not concluded.

   As a result, the tender document reflected the output from the process at that time. The User Engagement process continued after the issue of the tender documents with the developed design reflecting the output from this process.

   Examples of adjustments include;

   - Group 1 Fittings tendered during the Pre-Phase B period adjusted
   - Additional data/ sockets/ medical gas outlets etc. together with associated infrastructure incorporated into developed design on which GMP is based

2. **Design Development**
   As the project was tendered on the basis of a 2 Stage process, this involved taking provisional quantities identified and priced in Stage 1 and applying tendered rates received in competition to re-measurement quantities which reflect the developed design.

   This would include for example:

   - Taking quantities for elements of the mechanical installation generated from typical room designs and updating to reflect completed system designs during Stage 2

3. **Statutory Issues**
   This relates to incorporating the impact of two key events into the detailed design;

   - Conditions attached to the Fire Certificate with the detailed design associated with these conditions being addressed during the Pre-Phase B period
   - Changes incorporated into the detailed design to reflect the outcome of the Grenfell fire

4. **Omissions in Stage 1 Documentation**
   Any omissions to the design or Stage 1 measure are reflected under this category. Examples of these would include;

   - Stage 1 design assumptions that needed to be changed (Secondary containment in lieu of conduit)
   - Items not measured in Stage 1 BOQ (Cladding to sections of ductwork)
   - Items missing from Stage 1 design

Set out below is a summary of the impact of the conclusion of Step 2 2nd Stage Measurement Adjustment:

Ref	Description	User Change €	Design Development €	Statutory €	Omissions in Stage 1 Documentation €	Total €
1	Adjusted Target Budget					655,671,799
2	**Step 2 Adjustments**					
	CSA Adjustments	5,625,380	33,595,044	780,000	3,408,608	43,409,032
	Mechanical Adjustments	5,993,576	30,942,150	3,722,561	3,514,717	44,173,004
	Electrical Adjustments	7,130,388	22,871,110	2,062,210	11,699,546	43,763,254
	Profit on Services	1,640,496	6,726,658	723,096	1,901,783	10,992,033
	Step 2 Adjusted Measure	**20,389,840**	**94,134,962**	**7,287,867**	**20,524,654**	**798,009,122**

Table 41: Adjusted Target Budget due to Impact of Step 2 2nd Stage Measurement Adjustment

The chart below details the percentage breakdown of the Step 2 adjustments across the four Adjustment Categories.

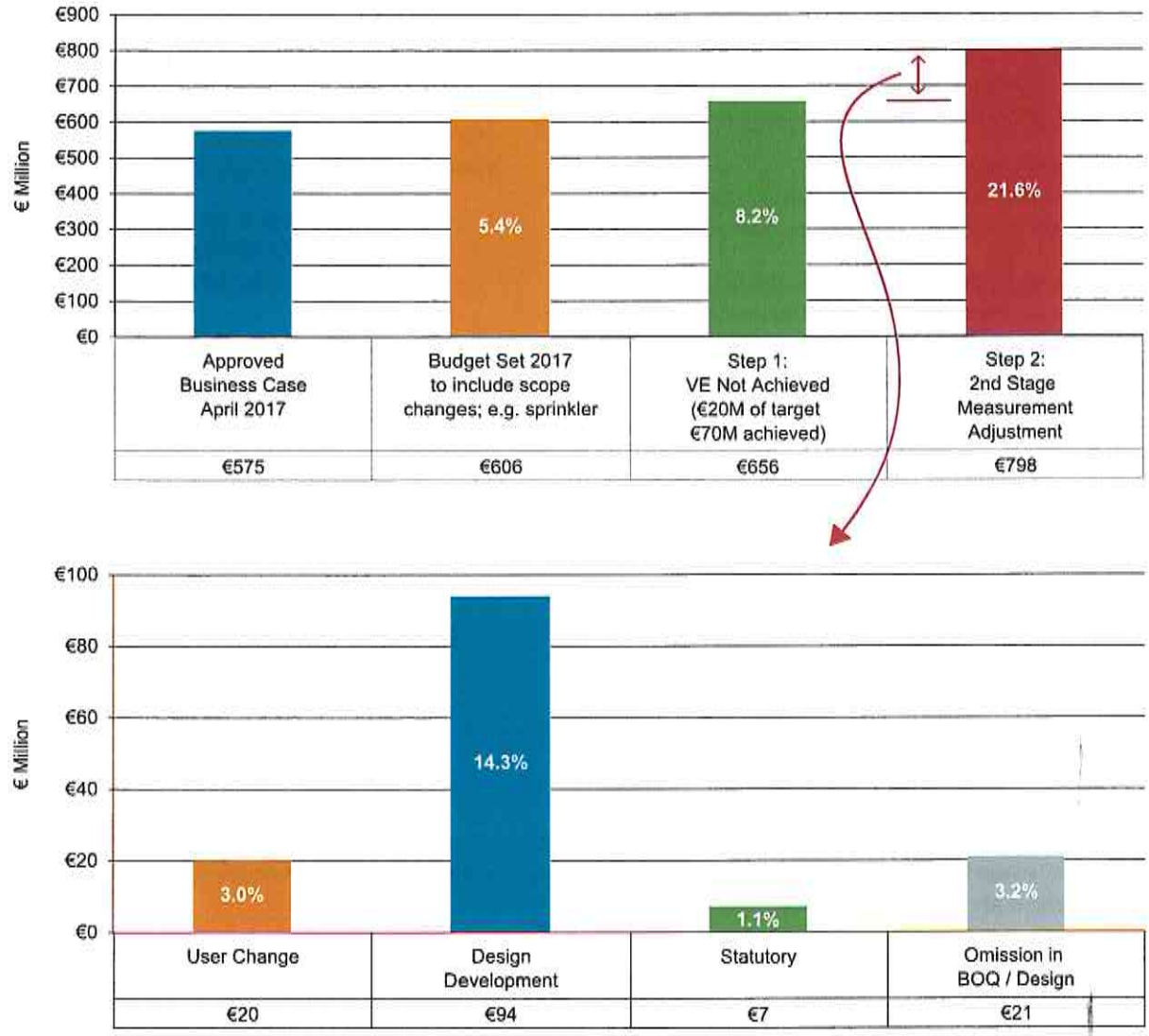


Figure 15: GMP Cost Breakdown (€m); Step 1 to Step 2

The following tables itemise the components of the above categories.

3.5 Overall Project Budget and Cashflow

Set out below is the overall budget to reflect the agreed GMP.

	Cost Category	A	B	C	D	
Ref	Capital Cost	Business Case Feb 2017	Previous Projection	Current Projection	Budget Variance (C-A)	Comment / Description
1	The Children's Hospital Project Direct	32,500,000	44,225,000	44,000,000	11,500,000	Extension of NPH Team And Construction Management Team
2	The Children's Hospital Planning Fees / Contributions	13,700,000	12,532,000	12,399,905	-1,300,095	Re-forecast of Planning Contributions
3	Specialist Consultants	19,500,000	20,143,000	22,046,590	2,546,590	Legal fees , audit/procurement & Independent Conciliator
4	The Children's Hospital Design Team Fees	40,500,000	47,336,081	67,336,081	26,836,081	Design Fees - extended GMP period & overall Project Duration
5	Decant Project (NPH Allocation)	16,000,000	14,500,000	14,500,000	-1,500,000	Complete
6	Aspergillus Project	3,800,000	3,800,000	3,800,000		Complete
7	The Children's Hospital Construction Costs	571,200,000	609,377,235	890,000,000	318,800,000	GMP now determined at €890m. Prog 56.75 months
8	The Children's Hospital Risk (inc. 2.5% GMP)	38,000,000	38,000,000	49,250,000	11,250,000	2.5% GMP increase on Adj Contract Sum - Client Conting €20m
9	The Children's Hospital Inflation	Incl in 7 above	Incl in 7 above	Incl in 7 above		Included in line item 7 above
10	The Children's Hospital Equipment - MES / Leasing	52,600,000	52,600,000	68,600,000	16,000,000	Medical Equipment market tested
11	The Children's Hospital Equipment Capital	15,500,000	15,500,000	15,500,000		Furniture, Fixtures and Equipment
12	Paediatric outpatients and urgent care centres Design Team Fees	3,200,000	4,000,000	4,000,063	800,063	Design Team Fees variations
13	Paediatric outpatients and urgent care centres Construction	38,000,000	42,553,912	53,400,000	15,400,000	Contract Signing + Service Diversions + M&E Claims
14	Paediatric outpatients and urgent care centres Equipment	3,500,000	3,500,000	3,800,000	300,000	Medical Equipment PO placed
15	Paediatric outpatients and urgent care centres Planning	1,200,000	1,200,000	1,200,000		
16	Paediatric outpatients and urgent care centres Risk	1,000,000	2,000,000	2,000,000	1,000,000	
17	Paediatric outpatients and urgent care centres - Aspergillus	3,000,000	2,000,000	2,000,000	-1,000,000	
18	VAT	129,800,000	130,928,771	179,524,779	49,724,779	VAT on Above; Car Park Rebate (€5m)
19	**Total**	**983,000,000**	**1,044,195,999**	**1,433,357,418**	**450,357,418**	

Table 47: Overall Project Budget

Note: The above budget includes a client contingency provision of €20m.
This excludes the 2.50% GMP adjustment as contained in the contract.

The figures in Table 47 exclude:

Exclusions	
Mater Site Costs	Decant Provision for NPH allocation only
ICT part of National strategy and separate HSE funding	Ronald McDonald House
CHG Programme; investment case	CRIC (separate procurement)
Sectoral Employment Order	Change in legislation for Class C cabling
Hyperinflation post July 2019 and above 4 % allowance in Contract	

Table 48: Exclusions

Set out below is the agreed cashflow to reflect the agreed GMP.

1	Year	up to 2016	2017	2018	2019	2020	2021	2022	2023	Total
2	Approved Business Case - Cashflow submitted	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)
2.1	HSE Funding	62.1	80.7	156.9	173.5	188.0	169.6	75.3	11.9	918.0
2.2	Equipping - MES									65.0
2.3	Other Funding									
2.4	**Total**	**62.1**	**80.7**	**156.9**	**173.5**	**188.0**	**169.6**	**75.3**	**11.9**	**983.0**
3	HSE Funding Profile - Letter 12/03/18	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)
3.1	HSE Funding	60.0	67.8	120.0	150.0	165.0	165.0	79.0	87.2	894.0
3.2	DOES - school				2.5	2.5				5.0
3.3	DOES - 3rd Level								17.0	17.0
3.4	Philanthropic						5.0	5.0	10.0	20.0
3.5	Commercial							47.0		47.0
3.6	**Total**	**60.0**	**67.8**	**120.0**	**152.5**	**167.5**	**170.0**	**131.0**	**114.2**	**983.0**
4	NPHDB Current Cashflow GMP	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)	(€m)
4.1	Exchequer (HSE / DOES)	59.0	69.0	105.0	252.0	274.0	276.0	193.0	69.0	1,297.0
4.2	Philantrhropic						5.0	5.0	10.0	20.0
4.3	Commercial							47.0		47.0
4.4	Equipment						14.0	41.0	14.0	69.0
4.5	**Total**	**59.0**	**69.0**	**105.0**	**252.0**	**274.0**	**295.0**	**286.0**	**93.0**	**1,433.0**

[redacted]

3.6 Project Programme

The original tender enquiry had included a high level programme for the works, an identical version of which had been supplied to all contractors. Once tenders had been received, whilst all were compliant in supporting a 48 month programme, a difficulty arose in integrating them into a single programme.

The enquiry programme could not have been sufficiently specific about access dates for M&E sub-contractors. To achieve the 48 months both preferred M&E sub-contractors, Jones Engineering and Mercury Engineering, had assumed earlier access dates than BAM were offering.

This meant that integrating the programme resulted in extending by several months, which by discussion was fixed at 52 months, plus 2 months of thresholds.

Once the contract was awarded in August 2017, the conditions required that a detailed (Level 3) programme be produced by BAM within 60 days. This had to integrate all contractors, achieving a 52 month duration from start on site of 2nd October 2017, hence setting a date for Builder's Completion of 1st February 2022. The date for Substantial Completion of 3rd April 2022 included the two thresholds in the contract, equivalent to two months. This programme was issued on 5th November 2017.

Although a separate programme had been issued in parallel for the Phase A works, this Integrated Programme superseded all others.

As the Phase A works progressed into 2018 it became clear that milestones for key activities were being missed – the new Utility Tunnel and Drimnagh Sewer should have completed in April 2018, whereas it was August 2018 and October 2018 respectively when these were completed to a stage to allow changeover to occur.

Excavation, particularly in the north end of the site, lagged badly behind, and hence subsequently impacted on frame construction.

A revised GMP programme therefore was produced, initially at 62 months then formally at 60 months duration.

This was reviewed by NPH and rejected in terms of programme logic and structure, and in relation to the duration of 60 months it was made clear to BAM that this was not acceptable.

The programme was then resubmitted, and a programme duration of 56 months and 3 weeks has now been agreed by all parties, based on the actual position on site as of 23rd October 2018.

This programme retains the two further months of thresholds contained in the original contract programme.

3.7 Benchmarking Report

The NPHDB appointed AECOM to prepare a benchmarking report on the construction costs of large International healthcare projects.

AECOM note in their report the confidentiality restrictions in relation to naming of projects and how this restricts the collection of relevant data from sources outside AECOM.

The sources of the information are:

1. Internal database of healthcare projects from AECOM global network of offices
2. Projects previously utilised by NPHDB in earlier benchmarking studies
3. Data provided by other Children's Hospital project team members or their contacts

The report has commentary on the methodology used to bring the project data to a common factor and the large number of variables; volatility across different geographies that will occur in a time span of circa 15 years.

The data has been brought to a common factor taking into account:

1. Programme alignment and Inflation using the Children's Hospital completion date of Q2 2022
2. Currency conversion to € in 2017
3. Location factor and Purchasing Power Parity (PPP)

The costs are construction costs only and exclude basement car parking.

The report states that the most widely used form of cost measure is cost per sq.m

AECOM sourced cost data was provided in relation to 10 projects ranging in size from 45,000 to 350,000 sq.m.

Region	Number of Projects	Stages of Projects	Completion
Europe	2	Cost Plan	2026, 2027
Australia / ANZ	1	Cost Plan	
Asia	1	Construction	2025
Middle East	1	Completed	2013
United States	5	3 Completed 2 Construction	2012, 2017, 2018 2019,2021

Table 50: AECOM Sourced Data on Large International Healthcare Projects

Notes: All, except one European project, are Employer Design.

All US projects are children's hospitals.

Benchmarking Results

The average of the 10 projects is €5,930 per sq.m with a range of €4,000 to €8,000.

The US children's hospitals are €6,750 with the completed projects being €6,600 and are identified as the most relevant from a benchmarking perspective.

This compares with the Children's Hospital current costing of €6,500.

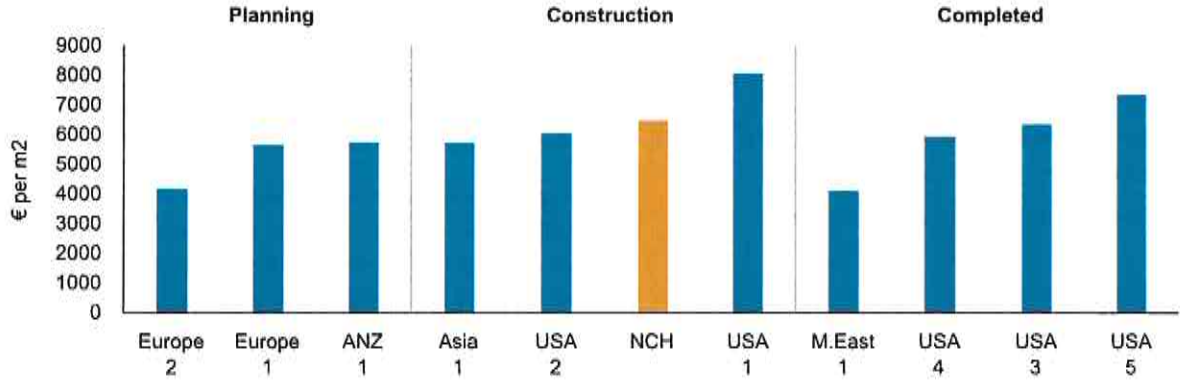


Figure 16: Benchmarking Costs (€per m2)

The previous children's hospital projects analysed by Linesight (Middle East) average €5,800 per sq.m.

European data sourced through HSE; 7 projects averaged €3,100 to €6,300 per sq.m (due to time constraints and confidentiality, detailed data not analysed by AECOM).

UK Health agency data for a children's hospital project equates to €4,000 per sq.m but this project is at Definitive Business Case stage and due to tender in 2019/2020, therefore does not provide a strong comparator.

3.8 Project Cost Trend Reporting

Original Timelines and Milestone for Agreement of GMP and Completion of Full Design

The cost trending for the 2nd Stage adjustment process is closely tied to the delivery of the 2nd Stage design development.

The initial programme for the 2nd Stage adjustment had a milestone date for the agreement of a GMP in June 2018. To facilitate this GMP delivery date in the programme showed finalised and full design for the Civil Structural and Architectural (CSA) being fully competed on the 2nd March 2018 and the design for the Mechanical and Electrical (M&E) Installations was being fully completed on the 26th January 2018. In this original programme therefore the M&E was scheduled to complete in advance of the CSA.

Milestone	Date
Mechanical and Electrical (M&E)	Full Design 26th January 2018
Civil Structural and Architectural CSA	Full Design 2nd March 2018
Agreed Adjusted Contract Sum M&E	13th April 2018
Agreed Adjusted Contract Sum	20th April 2018
Conclude GMP Process	29th June 2018

Table 51: Design Development Completion Dates per Original Programme

In working to deliver a full design by these dates a structured delivery of the information required was to take place largely over the period November 2017 to March 2018.

Delivery and Assessment of Design Information for GMP

In reality the delivery of design information by the agreed dates proved very challenging, particularly so with regard to the M&E services installations. As noted separately in this report the increase in the 2nd Stage development costs related particularly to the growth in value of the M&E and in this regard there were particular challenges around early trend profiling of accurate cost information.

The delivery of design information was and is of course critical to the GMP process, but there were also a number of key issues and factors which were identified as causing additional challenges around both the agreement of the GMP and in particular the speedy and early identification of cost challenges.

Rather than the M&E information being delivered in advance of the CSA information the reverse proved to be the case, with the final M&E design information being delivered several months after the full CSA design and several months after the 9th March original date identified for same.

The M&E information was delivered on a floor by floor basis rather than on a full system by system basis (for understandable logistical reasons given the volume of information to be processed). This made a ready and speedy comparison of any cost changes versus the originally tendered systems challenging until the final floor design had been delivered (later in the process) and full system design for comparisons/trending purposes could be completed.

On both the CSA and the M&E the process included timelines around getting the design information; allowing a period thereafter to assess and measure the design; agree the quantities with the contractor and agreed a revised costing to reflect the now updated 2nd Stage design; a period of approximately 2 months was identified to complete this process after the delivery of full design.

In reality there was a very substantial delivery of the M&E design information between the periods of March 2018 and June 2018; and as noted above this was delivered on a floor by floor basis rather than on system by system basis, making trending on cost movements difficult.

Many of the cost challenges which arose as part of the process were not fully identified and appreciated until the contractors had had an opportunity to review the design information involved and prepare any arguments around making a case for recovery of additional costs; for example their challenges around methods/rules of measurement. Their argument being that they should be allowed to go back to the market around more substantial alterations to the design/specifications rather than using adjusted 1st Stage tender rates/star rates.

A number of contractual/claim type issues began to arise during the process in particular as the more detailed information and scope of works for the M&E installations became more apparent. This coincided with the more intensified involvement of the Independent Expert in the process which reflected the increasing contractual approach being adopted with regard to the 2nd Stage process by the contractors involved.

Table 52 sets out on an approximate percentage basis the level of design information delivered over the various months of the GMP process, which was extended from June 2018 to October 2018 to reflect the later delivery of full design information.

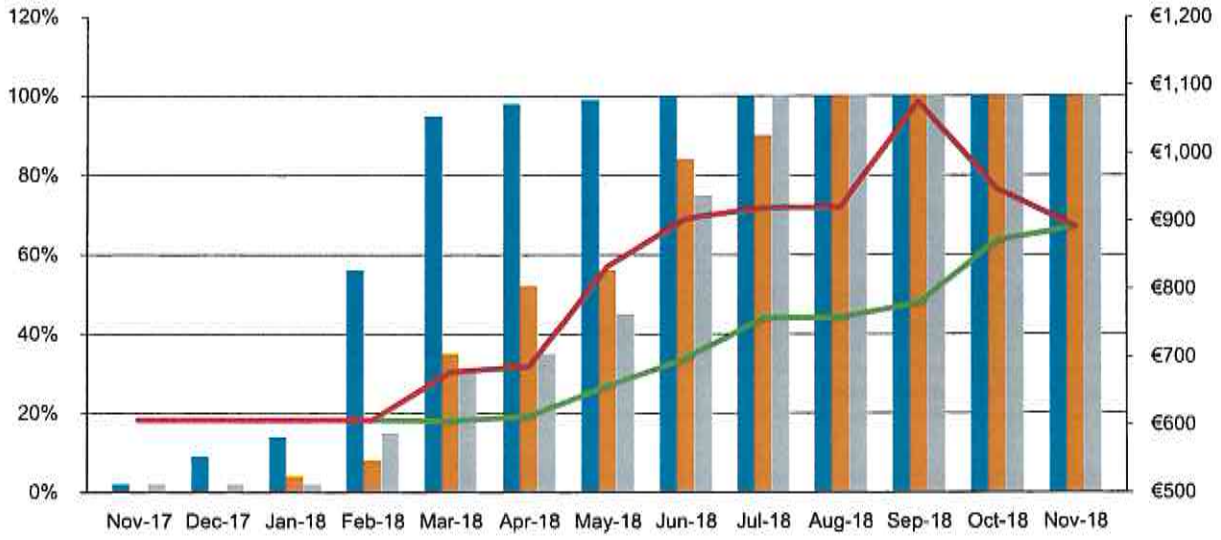
				Original Target for Full / 100% Design			Original Target for Full Agreed GMP			Achieved Date for Agreed GMP		
	Nov 2017	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018	Jul 2018	Aug 2018	Sep 2018	Oct 2018
CSA Design %	2%	9%	14%	56%	95%	98%	99%	100%	100%	100%	100%	100%
Mechanical Design %	0%	0%	4%	8%	35%	52%	56%	84%	90%	100%	100%	100%
Electrical Design %	2%	2%	2%	15%	30%	35%	45%	75%	100%	100%	100%	100%

Table 52: Design Development Timeline

The table above describes an overview of the timelines around the achieving full design of the 2nd Stage process and highlights in particular the challenges around the M&E design information. Combined with the challenges noted earlier, for example the delivery of the M&E information on a floor by floor basis rather than a system by system basis, the difficulties in early (pre-June 2018) accurate cost trending are apparent.

2nd Stage Package Design Development and Cost Trending during this period

The table below combines the design information flow and timelines for same noted in the preceding sections and compares this directly with the cost trending reports issued separately.



	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18
CSA design %	2%	9%	14%	56%	95%	98%	99%	100%	100%	100%	100%	100%	100%
Mechanical design %	0%	0%	4%	8%	35%	52%	56%	84%	90%	100%	100%	100%	100%
Electrical design %	2%	2%	2%	15%	30%	35%	45%	75%	100%	100%	100%	100%	100%
Measured Packages Trending Report €m	€606	€606	€606	€606	€604	€612	€656	€696	€756	€757	€778	€870	€890
Contractors Submissions €m	€606	€606	€606	€606	€677	€685	€832	€902	€918	€919	€1,075	€945	€890

Figure 17: Design Information Development and Cost Trending from Nov 2017 to Oct 2018

In the context of concluding the overall GMP progress, BAM Building issued a document on 24th August 2018 outlining overall cost submission of €1,075m, causing a sudden and unexpected sharp upturn in total potential cost very late in the GMP process.

3.9 M&E Design Review (DSSR)

Appropriateness of Design

The NPHDB commissioned International Consulting Engineers DSSR to undertake a Mechanical and Electrical Peer Review of the Children's Hospital Design completed by its consultant Arup.

The purpose of the first section of the review was to consider the Mechanical and Electrical (M&E) design as to its:

- Robustness
- Compliance with relevant HTM's considering larger UK Healthcare facilities as a benchmark
- That it delivers appropriate engineered solutions to satisfy clinical requirements whilst also delivering value
- That it delivers appropriate specification requirements for M&E equipment and systems when benchmarked against other UK Healthcare Facilities
- And to set out where possible appropriate Value Engineering proposals where the opportunity arises

The M&E review has focused solely on the design information prepared to arrive at the adjusted contract sum/ GMP and has not considered the 1st Stage tender documentation or its adequacy.

The review was undertaken over a period of 6 weeks, and DSSR used their extensive healthcare experience to focus on key systems within the design. The depth of the review was based on firstly completing a strategic review of all systems within the building, and then focussing in detail where required to arrive at their findings, conclusions and recommendations.

The Value Engineering undertaken as part of the Pre-Phase B Process is acknowledged and the resulting design has not been over-designed.

Design Suitability

The review has concluded that the M&E design issued by Arup is generally very robust, reflects the complexity of the building layout and specialist areas contained within, and has been executed in accordance with the appropriate and relative standards. The Value Engineering undertaken as part of the Pre-Phase B Process is acknowledged and the resulting design has not been over-designed. It also concludes that any further Value Engineering would likely impose a reduction in quality or require further derogations from standards. The derogations, from NHS Health Technical Memorandum documents, included within the design and agreed to by the NPHDB/CHG; are those that would normally be accepted by clients when benchmarked against equivalent healthcare projects in the UK.

It is acknowledged that the design includes for some contractor design items as would be normal, and the approach taken by Arup in the review of the contractor design items is robust.

The report highlights some minor opportunities that would require further investigation with relevant stakeholders. The financial impact of these opportunities in terms of the total M&E package is negligible.

The report also highlights some minor risks which require to be mitigated and closed out. These mitigation measures require specialist inputs from suppliers and will be dealt with post GMP. The potential financial impact of these risks in terms of the total M&E package would be considered negligible.

Cost of Design

The study also considered the cost derived during the GMP process of the designed facility, The key findings are extracted below:

It is clear that there has been significant growth in costs from the initial target cost to the final predicted cost and this has been documented and comments included below.

The questions to consider are:

- Are the current costs excessive?
- Was the initial target cost adequate?
- Is the scheme overdesigned?
- Was the initial design inadequate?

Whilst the predicted final cost may be considered to be high this only partially explains the change in cost, most of which appears to be due to the initial target cost being too low. DSSR's Benchmarking exercise found the package of M&E outturn cost to be slightly high, approximatedly 12%.

The design reviews carried out do identify some overly complex design solutions but generally, the scheme content is not considered outside the norms for complex hospital design.

Clearly basing a cost or BOQ of a Stage 2B design will always leave some pricing risk but the designs prepared at that stage are considered appropriate to the stage with enhanced detail for pricing as would be considered reasonable.

Typical Elemental Cost Breakdown

The cost split between M&E services is broadly consistent with anticipated norms showing that the over pricing is not distorted by overdesign or over pricing of either service.

Reasons for Cost Growth

Possible contributory factors include:

- The 2 stage tender process
- The use of a BOQ for pricing
- Inadequate design detail at initial Bill pricing Stage 2B
- Potential for under measure of the initial Bill of Quantities
- Over engineering in the Arup Stage 2C design
- Growth in the contractor design elements
- The risk of contractors taking advantage of the BOQ process

The 2 Stage Tender Process

The application of a 2 Stage tender process carries some inherent risk and may not always generate the lowest cost outcome.

Achievement of a robust final price will be dependant on the completeness of the design at the initial tender stage. Contractors can allow for future design development but without this being defined all tenderers will assess the risk differently and in a competitive situation will not include anything not measured unless identified as provisional sums or below the line costs.

The development of the 2nd Stage GMP will inevitably include all anticipated risks and will be "loaded" where the level of detail has been enhanced or scope definition changed.

Clearly the GMP should be based on the Bill rates but this will not always be possible and the scheme development will increase their understanding of the scope and is inevitably likely to lead to additional costs.

The Use of a BOQ for Pricing

The use of BOQs for pricing of M&E services is unusual as much greater risk is retained by the client. Whilst with a detailed and fully coordinated design and comprehensive Bill this risk can be managed, reliance on a measure of an incomplete, Stage 2B design, is very likely to result in inadequate quantities.

With the Stage 2B design developed in the way that we understand, by use of standard rooms and main distribution design there is a considerable level of detail which will not be available for measurement.

Inadequate Design Detail at Initial Bill Pricing Stage 2B

Following the review of the Arup design information for both Stage 2B and 2C it is clear that considerable design development has taken place, with far more detail included as would be expected between the two design stages.

The Stage 2B design period was clearly constrained by the programme and a strategy was proposed by Arup to provide an adequate level of information for initial pricing whilst recognising that a complete design would not be practical.

The strategy involved the production of main distribution layouts combined with standard room designs to be applied to each room on the project. Plant selections were defined in detail at that stage also.

The drawings produced at Stage 2B were in some cases less complete than would be expected in relying on the standard rooms, which may not have fully reflected the final installation in all cases. Conversely the level of detail included in much of the design exceeds that expected of a design at that stage.

It must be recognised that however accurate the Bill, or comprehensive the contractors assessment, there is a level of design development which must be priced which will add to the initial evaluations.

Examination of the Arup Stage 2C design shows a scope which could not be quantified from the initial drawings and would have had to be assessed either by quantity surveyor or contractor.

It does not appear that this design development was allowed in the initial target price.

Potential for Under Measure of the Initial BOQ

Based on the points noted above with respect to the level of design detail available for production of BOQ there is

considerable risk in any preliminary Bill and the likelihood of the quantities being inadequate is high.

Based on the design information available, at best there would have been a likely shortfall in quantities and without a deliberate attempt to quantify the risk and level of contingency required the short fall is likely to be significant.

Over-Engineering in the Arup Stage 2C Design

It must be acknowledged that the Children's Hospital is a high tech complex hospital largely made up of clinical and laboratory areas with fewer beds than would be expected for the area and therefore the cost of the project should be expected to be at the upper end of the range for typical projects.

The Stage 2B and 2C design proposals have been reviewed and whilst the engineering systems are complex in some cases and could be argued to be above the minimum e.g. ward bedroom ventilation strategy, Aspergillus treatment, integrated data systems, internal plant areas and degree of resilience, all these factors were included in the Stage 2B design.

The potential for Value Engineering has been considered in the design report and whilst there are elements where costs could be reduced these are small in comparison to the increase in projected project cost and would require fundamental changes to the approach to the building.

Growth in Contractor Design Elements

It is clear from the design review that substantial elements of the scheme are subject to contractor design and whilst it is appropriate to take this approach it may have contributed to the cost risk.

The Risk of Contractors Taking Advantage of the BOQ

It is very likely that any contractor when pricing the 2nd Stage will attempt to enhance the margins on any elements which cannot be readily related back to the Bill, hence any changes or newly identified equipment is likely to attract a premium.

3.10 Alternative Options

In parallel with the Adjusted Contract Sum/GMP Process (in brief, "the GMP Process") a Working Group was established, by the NPHDB Board, to examine alternative procurements strategies/options in the event that a decision being made not to proceed with the issue of an instruction to the contractor to proceed with Phase B of the Project.

This Working Group was chaired by Tim Bouchier-Hayes, NPHDB, and the other members consisted of Tom Costello (NPHDB Board Chairman), Kevin Kelly (McCann FitzGerald), Stephen Proctor (McCann FitzGerald), Clare White (Employer's Representative), Peter McHale (Linesight), Austin Duffy (Blackrock Services), Brian Barry (Blackrock Services), Declan Holmes (NPHDB).

Following a wide-ranging review of relevant alternate procurement strategies, the following options were deemed viable taking EU Procurement and GCCC guidelines into consideration:

- **Option 1:** Continue with Phase A Works, complete the GMP Process by end October 2018 and instruct BAM to proceed with the Phase B Works by end December 2018
- **Option 2:** Continue with Phase A Works, and not issue an instruction to BAM to proceed with the Phase B Works and re-tender Phase B Works to the market as a Fixed Price Lump Sum based on the completed design
- **Option 3:** Continue with Phase A Works, and not issue an instruction to BAM to proceed with the Phase B Works. Instead procure the Phase B Works on the basis of a Management Contracting Procurement Model – EU tender for a Management Contractor, including the concrete frame, who would in turn tender out the remaining packages under EU Procurement

Option 1: Continue with Phase A works, complete the GMP and award Phase B works to BAM in October 2018

Pros

- Guaranteed Maximum Price based upon a robust design and aligned 56.75 months programme
- Aligns with the 2 Stage process as set out in the Contract and the original 2016 tenders
- Tendered rates from 2016 considered good value in current inflationary climate
- Main Contractor single point of construction responsibility
- Seamless responsibility between Phase A and Phase B
- Design has been interrogated by the contractor and principal sub-contractors for the past year accordingly there is a very good understanding by them of the Project
- 56.75 months GMP Programme agreed for the increased construction scope
- GMP Programme aligned between the M&E sub-contractors and the contractor with access dates agreed for the M&E sub-contractors
- Several issues that would have surfaced during construction were resolved during the GMP Process
- Independent Expert played a crucial role in resolving disputes and arriving at a GMP
- Project maintains certainty, momentum, credibility and knowledge

Cons

- Costs are significantly higher than projected in the Definitive Business Case
- 2nd Stage process adjustment of the contract sum based on original rates or, where none exists, fair valuation with the re-tender option the only leverage
- Inflationary background and ultra-busy construction sector put pressure on the GMP Process
- Value Engineering was counterproductive as the contractor's approach was to seek an opportunity to move away from tendered rates to current market rates
- Limited opportunities to change the design to bring the Project back within cost parameters as change priced by the contractor at significantly higher current market rates
- Contractor and principal sub-contractors forensically challenged the tendered design and Bills of Quantities/ methods of measurement in an effort to increase the GMP

Option 2: Continue with Phase A works, fail to award a GMP in December 2018 and re-tender Phase B works to the market.

Pros

- Aligns with the process as set out in original 2016 tenders, i.e. if GMP not satisfactory can be re-tendered
- Avoids additional contractual commitment to current contractors
- Building is fully designed allowing for Fixed Price Lump Sum re-tender arrangement
- Opportunity to capture missed VE and close off Agreed Rules of Measurement (ARM) issues exploited by contractors
- Re-tendering would be perceived as fully reflecting the current market with a completed design
- Achieves a "true" market price
- In the event of a falling construction market, (e.g. potential Brexit impact) better value might be obtained

Cons

- Overall Project Costs are expected to increase by €330m (over and above current contract sum), due to:
  - Construction costs inflation due to 1.5-year delay in a rising market
  - Under the contract BAM entitled to recover their de-mobilisation costs, e.g. cranes, site cabins, hoarding, staff, etc
  - Design team fees, amended scope and 2-year delay
  - NPH Project costs increase due to 2-year delay
  - Maintain site security, hoarding, insurances, etc for vacant Children's Hospital site from completion of Phase A, April 2019 to Main Contract award, say mid-2020
  - Project attracts an extra risk/cost premium to takeover partially completed works with a perceived high level of risk/ legacy issues
  - Potential increased costs for SJH due to unoccupied Children's Hospital site (security, shared services, insurances etc)
  - CHG operational costs extended for a further 2 years
  - Existing children's hospitals (Crumlin, Temple St, Tallaght) unable to defer Crumlin/Temple St, Tallaght capital project investment any longer
- This is not a GMP, so there is a risk of price increase due to post contract claims
- A new Contractor Pre-qualification, tender and approvals process (NPH, HSE, DoH) would need to be carried out for Main and M&E sub-contractors following latest Governments Contracts Committee for Construction (GCCC) process (now the Main and M&E programme alignment adds to re-tender duration period)
- Risk of limited interest from capable contractors in re-tendering due to buoyant status of the current construction market and a hospital project that is considered high risk when compared to other types of available work
- Risk of challenge from existing contractors that process was not followed to letter of the contract
- Due to 3 years of high construction inflation since tender it is foreseeable that the new tenders would come in higher than the current GMP

	• New tender documents would need to be produced to reflect the site status incl. clarity on scope of BAM Phase A works (with central road, stair cores etc), contractual responsibilities (construction liabilities, contractors design responsibilities, Building Control Amendment Regulations (BCAR) etc.) • Contractor owns agreements with boundary neighbours for tie-back anchors under their properties. • The overall project could be delayed by up to 2 years, extending completion and opening of the hospital to 2024 • There is a significant risk that overseas contractors (JV with Irish) are unlikely to respond • Risk of limited response from M&E market (Jones & Mercury only companies capable of delivering a project of this scale in Irish Market), significant semi-conductor and pharma projects pulling from same M&E resource pool • The difference between the 1st and 2nd ranked main tenders in October 2016 was €131m. There is a very high risk that the market, which is approaching full capacity, would add a premium to this complex project. The current contractors would have a perceived commercial advantage (knowledge of project, site, supply chain, risk). NPH could end up appointing the same contractors with a 2-year delay to the Project at a higher cost than the current GMP • Split construction responsibility/ liability for Phase A and B • Creates uncertainty and the project loses momentum and credibility. Loss of political support & risk of reopening the Children's Hospital location debate • Loss of Pre-Phase B Engagement value/costs from contractors

Option 3: Change to a Management Contractor Procurement Model – EU tender for a Management Contractor including Frame who would then tender out the remaining packages under EU Procurement

Pros

- Allows for the Project to continue with minimum unavoidable delay to overall programme of approximately 1.5 years
- Management Contractor would be required to include the fixed price for the concrete frame as this is on the critical path
- Management Contracting breaks the Project down into smaller packages to solicit interest from mid-size construction companies
- All contacts openly tendered demonstrating current value for a completed design
- Requires additional management resources to manage multiple smaller packages

Cons

- Overall Project Costs are expected to increase by €290m (over and above current GMP), due to
  - Construction costs inflation due to 1-year delay in a rising market
  - Great risk of gaps between packages
  - Under the contract BAM entitled to recover their de-mobilisation costs, e.g. cranes, site cabins, hoarding, staff
  - Design team fees, amended scope and 1-year delay
  - NPH Project costs increase due to 1.5-year delay
  - Maintain site security, hoarding, insurances, etc for the vacant Children's Hospital site from completion of Phase A, April 2019 to Management Contract + Frame Contractor say early-2020
  - Project attracts an extra risk/cost premium to take-over partially completed works with a perceived high level of risk/ legacy issues
  - Potential increased costs for SJH due to the un-occupied Children's Hospital site (security, shared services, insurances etc)
  - CHG operational costs extended for a further 1.5 years
  - Existing children's hospitals (Crumlin, Temple St, Tallaght) unable to defer capital project investment any longer
- Issue of overall costs certainty deferred until all the packages are procured
- Risk of gaps in interfaces between Purchase Order (PO) packages
- High risk of a legal challenge from incumbent contractors and potential risk of challenge associated with each Management Contract Package tendered
- Facility for Independent Expert to resolve cost issues will be lost
- Split construction responsibility/ liability for Phase A and B
- Public works construction contracts don't exist for this scenario and a bespoke contract would have to be developed

Construction Management was considered as another option, but was discounted as an unacceptable risk due to the State/Employer holding all the individual package contracts.

Option	Viable (Y/N)	Programme Length	Construction Cost €m
Option 1 Continue with Phase A Works, complete the GMP Process by end October 2018 and instruct BAM to proceed with the Phase B Works to BAM by end December 2018	Yes	56.3 Months	890
Option 2 Continue with Phase A Works, and not issue an instruction to BAM to proceed with the Phase B Works and re-tender Phase B Works to the market as a Fixed Price Lump Sum based on the completed Design	Yes	80 Months	1,160
Option 3 Contractor Procurement Model – EU tender for a Management Contractor including Concrete Frame who would then tender out the remaining packages under EU Procurement.	Yes	74 Months	1,120

Table 53 Summary of Programme and Costs under each option

These costs exclude other project costs of €60m which options 2 and 3 would incur.

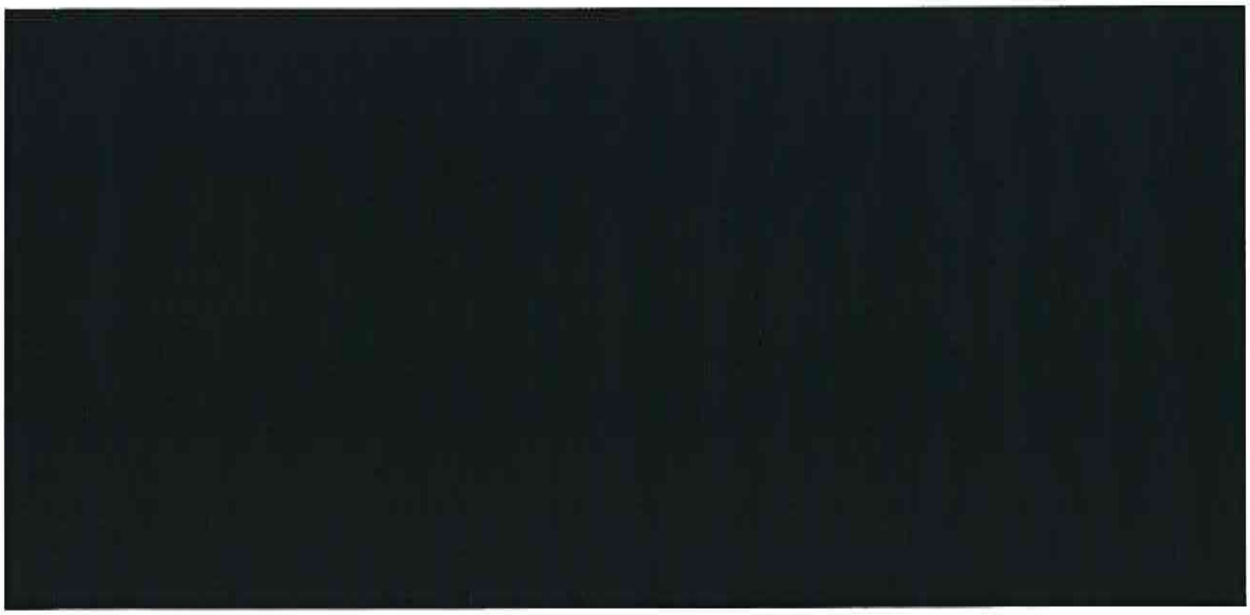
Consequences of No Decision on GMP in December 2018

The above options have been evaluated against Option 1 - issuing an instruction to proceed by the end of December 2018.

The current GMP Process envisaged reaching a conclusion to the GMP Process by the start of December 2018 at the latest and the contractors are contractually obliged to stand over their tendered rates up to this point. If the Phase B Works are not instructed by end of December 2018, then Purchase Orders (POs) and sub-contracts for Phase B cannot be placed, and quotations expire or are no longer valid. Contractors will no longer stand over their tendered rates and prices start to escalate and the GMP costs will increase further.

In effect the contractor will likely claim a compensation event (albeit the consequence of such an event would be lessened by the delay which has occurred to the Phase A Works)

The Project's monthly run rate forecast, below, is approx. €15m per month in January and rising, which includes the contractor's costs, the CHG, NPHDB, design team and Construction Management team costs and the very significant cost from expiry of tendered rates and existing POs.



Should no decision be reached by end of January 2019 the current funding approved for Phase A will be consumed and effectively the Project will come to a stop. This means the contractors will begin to demobilise, redeploy staff and sub-contractors and remove plant and materials from Site. The responsibility for securing the site will fall to NPHDB and the project will lose momentum which is very difficult to gain back.

3.11 Value for Money

In reviewing the finally agreed GMP for the project with regard to value for money, a number of key comparators have been used, namely:

- International Benchmarking against similar projects
- Budget growth indicated by local inflation
- Effect on budget of high impact risk
- Alternative approach for Phase B

The background to each of these is discussed below, but in summary:

Comparator	Capital Cost of Construction €m	Delta €m
Current GMP Construction Outturn Cost	890	N/A
Original Budget Inflated to Today's Prices	782 – 1,002	(102) – 112
Cost of High Impact Risk – Contractor Failure	1,412 – 1,573	522 – 683
Alternative Approach – Option B	1,120- 1,160	230 - 270

Table 55: Summary of Comparators

Benchmarking Against International Hospital Projects

A study was carried out to benchmark cost per square metre against reference hospital projects located around the world, and bring all of them to a like for like commonality for comparison purposes.

AECOM, an international firm of independent cost consultants, were commissioned to undertake this report. Their report and findings are included in Appendix 6.1 of the report.

The report highlights that when the GMP for the Children's Hospital is compared/benchmarked on a like for like basis with similar international projects; of a similar scale and complexity it demonstrates that its cost per square metre is comparable with same.

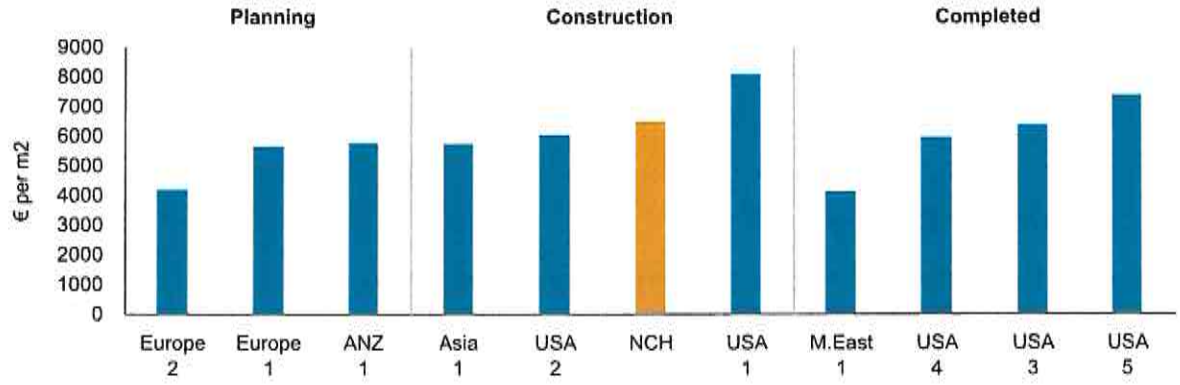


Figure 18: Benchmarking Costs (€per m2)

Original Budget Update for Inflation

Utilising the most recent tender inflation information (please refer to Appendix 6.2 of this report for Linesight's latest tender inflation report), the table below is an updating of the 2013/2014 budget to reflect the latest inflation data and it compares against the 2nd Stage adjustment figure of the GMP.

This report, and the tables below, demonstrate that the 2013/2014 budget, when updated for latest tender inflation intelligence, approved scope changes and the latest updated programme is closely comparable to the 2nd Stage adjustment figure, reported on separately in this report, of €782m versus €798m (See Step 2, Section 3.4)

In addition, by fast tracking the Children's Hospital and achieving a start on site nearly two and a half years earlier than traditional procurement processes would have achieved, a saving on potential tender inflation costs of between €180m and €220m has been achieved.

Linesight's latest report, published in October 2018, has updated the previous report to reflect, the main Phase B works commencing on site approximately one year later than envisaged in the 2016 report and has more accurate tender inflation information, as against that modelled in 2016. Since that exercise the data for years 2016 to 2018 is obviously now historic and more accurate.

Actual tender inflation over these years and in the immediately following years is /will be substantially in excess of the assumptions underpinning inflation calculations in the November 2016 report.

This reflects the continued and indeed increasing pressures being experienced in the Irish construction industry, as a greatly contracted supply chain struggles to cope with increasing demand resulting from Irelands continued economic recovery and success. Linesight's attached report highlights the issues impacting on these trends.

For a very large project such as the Children's Hospital, the impact of this has been dramatic. With the budget being set in late 2013/early 2014, and the project completion now scheduled for late 2022, almost a decade of inflation will impact. This is forecast to amount to a +126% compound increase, from early 2014 to end 2022.

The total effect of this being mitigated somewhat by the S-curve effect of inflation, when the project goes to site between the years 2019 to 2022. Nonetheless, despite this mitigation, the impact of these more up to date assumptions and the increased timeline is an inflation uplift of €181m as against the figures noted in November 2016, or an overall impact of €341m if the budget set in 2014 is updated to reflect current forecast timelines.

Item	Scope Change €m	Inflation €m	Budget €m
Stage 1 Budget 2014			360
Stage 2A Adjustments			
Approved Scope Changes	17		
Risk Allocation	10		387
Stage 2B Adjustments			
Risk Allocation	17		404
Budget Rebased 2016 on Contract Award			
Sprinkler	17		
Programme Adjustment	20		441
Inflation			
Updated from Stage 1 approval in 2014 to Projected State on site for Phase B of early 2019 and October 2017 for Phase A		**341**	**782**

Table 56: Impact of Adjustments and Inflation on Budget

Note 1: This figure is comparable to the actual 2nd Stage adjustment of €798m noted in report, prior to the next Step GMP adjustment (See Step 2, Section 3.4)

Note 2: The above figures are based on the current fast-tracked programme for the project. Current estimates are that this programme has fast tracked the project to start on site approximately 2½ to 3 years earlier than procurement based on full design. A delay between 2½ to 3 years would add to further potential tender inflation uplift to the original budget provision of between +€180m to +€220m given current construction tender inflation and this would be additional to the budget uplifted figures noted above.

Project Risk – Contractor Insolvency

To put the current cost estimate, and alternative approaches in context, we should consider the cost of one of the most expensive scenarios our risk analysis has identified.

The devastating impact of contractor insolvency was all too evident during the recent economic recessions, where some of Ireland's largest contracting organisations went into receivership/liquidation. Unfortunately, this trend of contractor insolvency has continued well into present times, often being most pronounced on government contracts, where contractors tendered at extremely competitive rates and then had to undertake and complete the projects often many years later, in a highly inflationary tender market.

The impact of contractor insolvency on public sector projects is particularly pronounced, as the project must be fully re-tendered in strict accordance with EU procedures. This can often add several years to the process of re-placement - a process which generally takes only months on a commercial project.

The Linesight report attached (ref Appendix 6.3) deals with the issues discussed above in considerable detail: the government form of contract, and the move towards a more collaborative/risk sharing strategy on the Children's Hospital. This collaborative, 2 stage approach had to be adopted to encouraged contractors to tender for a project of the size and complexity of the Children's Hospital.

As part of Linesight's report they undertook an exercise to identify the potential cost and timeline which might flow from contractor insolvency at a key moment in the Children's Hospital programme of works on site.

This study indicated a potential delay of two years, and a potential abortive cost range of between €395m to €499m, on top of Plan B (noted below), in the event of a contractor insolvency or non-performance. A figure which the current bond of €40m would not be capable of covering.

Plan B: Alternative Strategies Around Going Back to the Market

As part of the strategy for the project and prior to any decision to award the Phase B Main Works being arrived at, a review has been undertaken of the potential costs associated with standing down the current process and contractors and going back to the market.

A separate report reviews the pros and cons associated with this potential course of action and the alternative strategies around re-tendering which might potentially be pursued see Section 3.10.

Two potential re-tendering strategies were considered and costed:

1. Going back to the market using management contracting as a tendering/procurement route
2. Going back to the market, using a traditional procurement procedure (now fully competed employer design) and more traditional single stage government form

In assessing the costs around these alternative strategies, the costs of the 2nd lowest tenderer were utilised for the traditional procurement process and updated to reflect the latest design development/package/ services cost information. This more updated information was also used to inform the exercise around the management contracting route.

Both alternatives were updated to reflect the timeline of approximately one and a half years that would be added to the overall project timelines, by having to go back out to tender using under EU/public procurement processes and procedures and the timelines which would apply to same

Applying these criteria to the two options considered, resulted in an analysis of the potential costs associated with each, being:

Traditional Single Stage Tender (Based on Previous 2nd Tender)	€1,160m
Management Contracting Construction Cost	€1,120m

This compares with our current GMP of €890m. The current GMP also provides the employer with a GMP cost undertaking, which would not be the case under the management contracting route.

Also excluded from the above costs are the re-tendering costs themselves and the costs with keeping existing teams in place whilst the project was re-tendered, rental costs for the Herberton building etc., all of which could add a further €60m+ to the above costs.

3.12 Change Management

The management of change during the design process has been ongoing through the Stage Reports issued by the design team. In particular, from the issue of the 1st Stage tender at the end of Stage 2B in June 2016 up to the GMP (Stage 3), a detailed process for design and construction related change has been administered by Linesight on behalf of the design team and NPHDB.

All client instructed change has followed a process laid out by the NPHDB, comprising the design team reviewing the implications of the change from a cost and programme viewpoint, advising the client of the additional cost or saving, and then presentation to the client at scheduled meetings for decision.

The design team are responsible for raising any change associated with additional or enhanced scope and advising the client of the implications of this change.

Change also arose due to statutory approvals, such as planning, fire certificate application, disabled access certificates, known changes in legislation, and changes in hospital policies.

Change was captured on a Change Management Log. At key milestones any change that was approved was incorporated within the construction budgets prepared by Linesight and in budget updates issued by the NPHDB.

Change Management is reported on continually at interface meetings with the design team and the contractors, and under the governance of the NPHDB's Finance and Construction Sub-committees.

Design development was the detailing out or finalising of the tender design to full detailed design.

Stage 2B

The BOQ and 1st Stage tender was based on a package of information frozen in October 2015 to enable the design team prepare for a release date of March 2016, later delayed to June 2016 to facilitate an assessment of the planning conditions associated with the grant of planning permission in April 2016. The 1st Stage tender information reflected the beginning of the Clinical Engagement process which was not finalised until the end of 2016.

Prior to the award of the contract to BAM, the approved change management log at that time, the impact of the completion of the clinical engagement process, and any other changes to the building since the 1st Stage tender was assessed, and associated costs, were included in the Definitive Business Case issued in February 2017.

GMP Process

Since approval of the Definitive Business Case a new Change Management Log was established where all client instructed change was captured under the same process. All client approved changes have been incorporated into the GMP process and are within the GMP. The extent of this change is limited.

During the GMP process many provisional sums have been converted to measured items following the procurement process set out within the contract. The determination of the price for these provisional sums has led to a higher than expected cost, based on current market rates.

There has been significant design development during the GMP Process. The programme for the release of final design deliverables including Value Engineering for the purpose of arriving at the adjusted contract sum was between November 2017 and March 2018.

Following the release of the documentation Linesight on a package by package basis remeasured all of the information and determined the assessment for the revised design, which was then subject to scrutiny by all parties in accordance with the GMP process.

The NPHDB only became aware of significant challenges to the budget for some early packages in February 2018 and for the majority of packages between April 2018 and May 2018, as the revised design information was not available until this juncture. Details of the project cost trending are set out within Section 3.8. All design development is included within the GMP.

Risk of Future Change

There are a number of specialist areas that have not been procured as part of the GMP process. These are elements of the works significantly impacted by advances in technology and workflows, and strategically it is in the best interest of the project to procure these after the GMP, and closer to the time for installation, in order to get greater market interest and value for money.

There is also a substantial amount of Group 2 equipment that requires integration into the hospital. Extensive design reviews have been undertaken to futureproof the hospital for the successful integration of the equipment and specialist areas, but the final details will be vendor-specific so some level of change will result.

Healthcare facilities are subject to change in healthcare policy, these will have to be considered on a case by case basis.

Given the scale of the project the construction programme for the delivery of the hospital is twice as long as most typical large healthcare developments in Ireland, therefore any statutory or legislative changes can impact on the design of the hospital and result in additional costs.

4.0
Lessons Learnt

A full Lessons Learnt workshop on the entire process to date is proposed but has yet to be held with all parties. However, summarising the key learnings from the foregoing:

Key Negatives

- The project targets for programme, budget and inflation were overly optimistic
- The overall timeframe through planning; site decanting ; public procurement of design team and contractors was underestimated
- Using tender costs as a basis for formulating a project budget during a recessionary period, with below cost bidding (circa 20% to 30% below cost in some instances), led to significant underestimation of the project costs
- There was insufficient design at tender stage for M&E services, requiring an approach using typical rooms and factoring these up
- While it was well intentioned to aspire to achieve Value Engineering in order to reduce project costs, in the context of a contractor who was €130m lower than the next tenderer, this proved very difficult to achieve
- In selection of preferred bidder the quality / price ratio needs to be reviewed in the context of placing greater emphasis on quality and reduce the potential for exceptionally low bidding
- A more robust change management tracker process during the design development phase is required

Key Positives

- 2 Stage Tender Process worked well
- Project delivery 2+ years earlier than traditional procurement
- Additional costs arising from 18% to 22% of tender inflation were avoided as a result of this earlier delivery
- Early contractor involvement in design development, project planning, risk management
- The tender was sufficiently well described to ensure competitive rates were obtained which could thereafter be applied to the updated 2nd Stage design quantities
- A GMP in place prior to award of Phase B
- Based on a robust/complete design and a fully aligned 56.75 month programme
- Only adjustable for clearly defined scope changes
- Pre-empts traditional post contract award, cost/programme challenges which often result in a 20% to 30% increase in post contract out-turn costs
- Accelerated the design freeze/design development and gave the project early momentum
- The role of the Independent Expert in resolving measurement and contractual disputes worked very well
- The project has been substantially de-risked in relation to ground conditions (contamination ; soil disposal ; archaeology ; piling ; rock anchors ; adjoining owners) in parallel with the GMP process

Other Aspects

- Decant Programme – the works undertaken in conjunction with SJH not only created valuable new facilities for the Hospital, in use today, but also hastened the start of works on the site although the time estimated to execute was underestimated for such a complex and critical item
- Enabling Works – the approach of issuing an Enabling Works package was beneficial overall in that it allowed siteworks to commence before design was fully developed, thereby reducing the overall timeline
- Enabling Works Scope – could have been larger in retrospect, and should have included the realignment of the Drimnagh Sewer and Utility Tunnel
- Employer Design – the right approach for a project of this complexity, allowing control of change and quality as the clinical consultation process develops - Design and Build was considered at an early stage but managing change and quality with this approach is always problematic on complex projects
- Planning Application Strategy – a great deal of effort went into the planning process, a Planning Committee was set up, engagement with authorities was comprehensive, the application was very detailed including a full Environmental Impact Statement (EIS). The result was a judicial review was avoided and planning granted without onerous conditions
- Early Market Engagement During Procurement – roadshows and engagement with international contractors helped ensure sufficient bids were returned for the Main Contractor role – if this had not been the case, re-tendering may have been necessary
- Contract Amendments – the Government standard form of contract would not have allowed GMP (cost certainty), an Independent Expert to determine issues, or an instruct or walkaway option at the end of Phase A. These have been crucial leverage advantages in closing contract issues

- 2 Stage Design – proved beneficial (timewise) in getting to market and into construction early – it allowed tenders to be issued prior to completion of design. However, more time should have been allowed to allow completion of the 2nd Stage. A better understanding of the risks associated with the BOQ at tender stage would have been beneficial – particularly in respect of the M&E design and BOQ status
- 2 Stage Construction Contract – Following on from Enabling Works with Phase A allowed a quick start once contract was awarded, reducing timeline. Better definition of Phase A and its links to overall programme would have been beneficial
- Contract Awards – defined procurement processes, coupled with sound expert advice, has ensured that contracts awarded to date have been without challenge
- M&E Design – a more robust Peer Review at 1st Stage tender would have identified shortcomings in scope, more time should also be allowed for 2nd Stage design completion
- Value Engineering – any change (including Value Engineering) should be avoided during the GMP process as this allows new costs and rates be introduced
- Equipping – we included the Group 3 & 4 equipping in our budget and construction programme - this will prevent potential delay post Substantial Completion


NCH

5.0
Recommendation

The date for awarding Phase B is now 3rd December 2018. It is appreciated that the delays in completion of the GMP process have considerably reduced the timeframe for review and final decision by the CHP&P, HSE and Department of Health.

However, there are very significant contractual risks to the project if this is delayed, including potential additional costs of more than €15m per month.

Of the three options examined to complete the project, Option 1, the existing 2 stage procurement with a GMP, delivers value for money with a significantly shorter programme than Option 2 or 3. While very significant cost increases have arisen since tender, particularly in relation to Mechanical and Electrical systems, the M&E design has been independently reviewed and found to be appropriate.

Subject to the overall capital funding being provided, the NPHDB at its 7th November Board meeting, recommends that the Phase B Construction Works are awarded to BAM based on the determined GMP value.

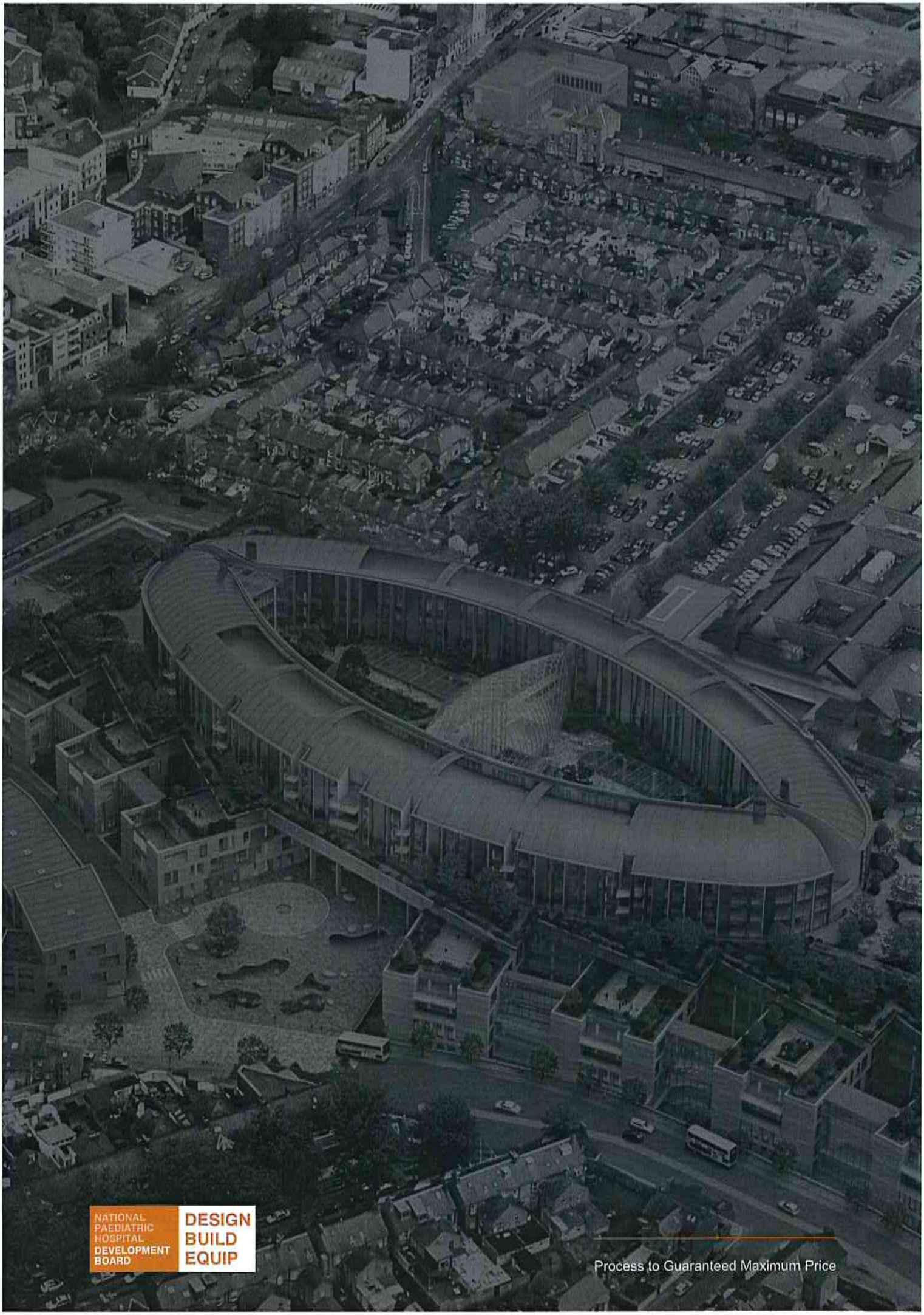
Indices

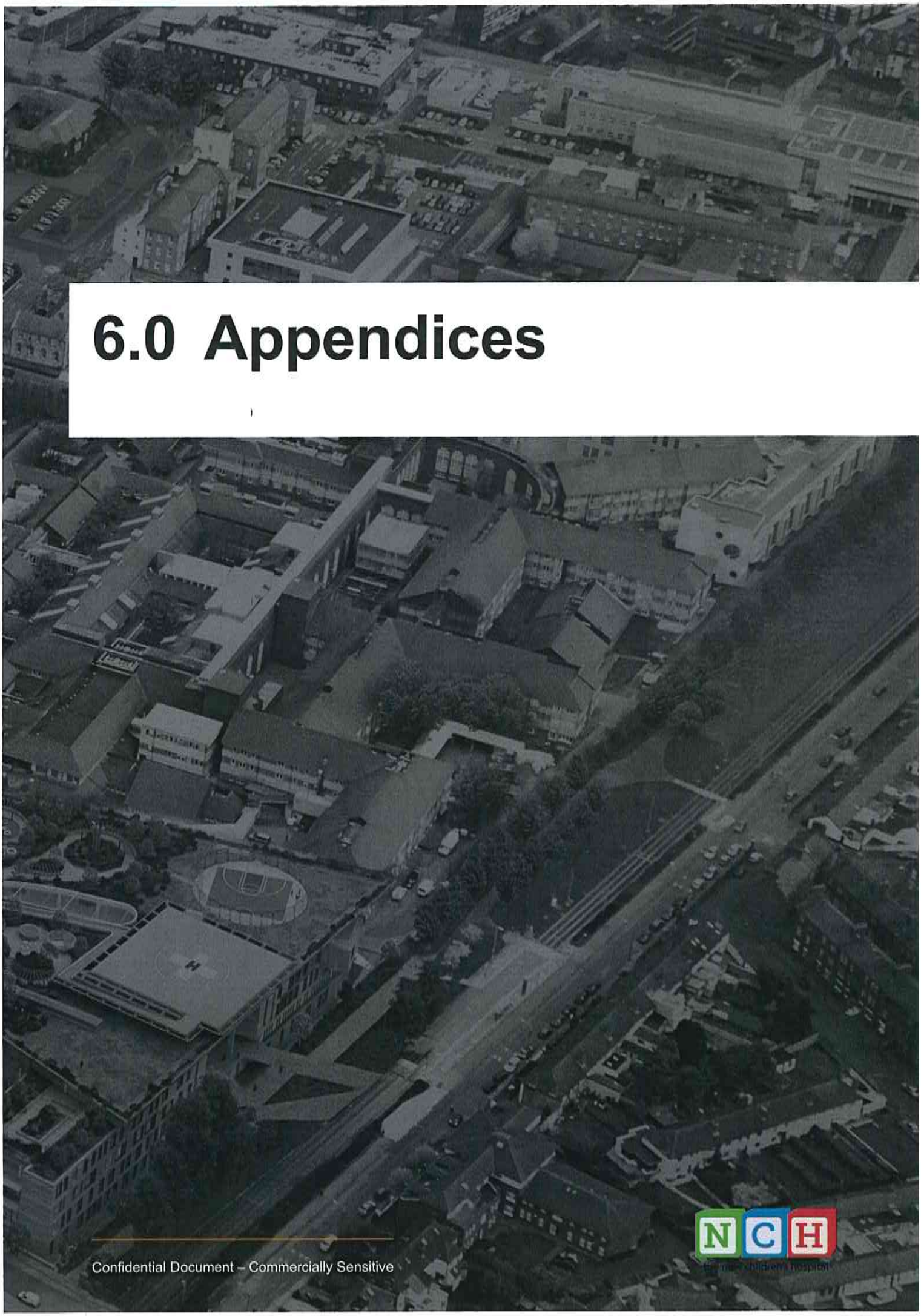
Figures

Tables

Glossary

AHU	Air Handling Unit
ARM	Agreed Rules of Measurement
BCAR	Building Control Amendment Regulation
BER	Building Energy Rating
BIM	Building Information Model
BOQ	Bill of Quantities
BREEAM	Building Research Establishment Environmental Assessment Method
CHG	Children's Hospital Group
CHP&P	Children's Hospital Project & Programme Board
CM	Construction Management
CRIC	Children's Research and Innovation Centre
CSA	Civil, Structural and Architectural
DBC	Definitive Business Case
DCC	Dublin City Council
EIS	Environmental Impact Statement
FM	Facilities Management
GCCC	Government Contracts Committee for Construction
GMP	Guaranteed Maximum Price
GW	Giga Watts
IDA	Irish Development Agency
M&E	Mechanical and Electrical
MC	Management Contractor
MES	Managed Equipment Service
MVA	Mega Volt Amp
NEC	New Engineering Contract
NCH	The Children's Hospital
NHS	National Health Service
NPHDB	National Paediatric Hospital Development Board
OD	Ordnance Datum
PW-CF1	Public Works - Contract Form 1
RFI	Request for Information
SAQ	Suitability Assessment Questionnaire
SJH	St James Hospital
UPS	Uninterruptable Power Supply
VE	Value Engineering


NATIONAL
PAEDIATRIC
HOSPITAL
DEVELOPMENT
BOARD
DESIGN
BUILD
EQUIP
Process to Guaranteed Maximum Price



6.0 Appendices

Appendix 6.1

AECOM Benchmark Report

International Hospital Construction Costs Benchmarking Report

For

National Paediatric Hospital Development Board (NPHDB)

25 October 2018

AECOM

Document Issue Sheet

Document Number	Document	File Path	Issue Date	Parties to	Sent	Prepared By	Checked By	Reviewed By	Approved By
	NPHDB Report		25/10/2018	NC		TK	DM	PJ	TK

Contents

1.0 Introduction

1.1 Introduction

1.1.1 The National Paediatric Hospital Development Board (NPHDB) is responsible for overseeing the building of the New Children's Hospital (NCH) in Dublin.

1.1.2 As part of its ongoing oversight role the NPHDB reviews and reports on progress at agreed intervals. As part of their current review and reporting cycle the NPHDB wish to identify capital construction costs for similar large scale international hospital projects to provide additional context. AECOM were appointed by the NPHDB to prepare a benchmarking report in this regard.

1.2 Objective

1.2.1 The objective of this cost benchmarking study is to provide high level capital construction cost data from a sample of large international hospital projects.

1.2.2 It should be noted that significant limitations exist with using international construction cost benchmark data due to a large number of variables. These variables impact construction sectors and geographies in different ways and on different timelines. Accordingly, the output from this report should be used in order to provide a context for any review of project costs for the NCH development in Dublin as opposed to any direct comparison for validation.

1.3 Overview of Contents

1.3.1 We outline the methodology adopted and reasons for same in Section two of this report.

1.3.2 Section three summarises the capital construction cost benchmark data obtained and analyses the same in line with the proposed methodology.

1.3.3 For the purposes of comparison, projects have been adjusted for location, time frame and foreign exchange. This is to ensure, as far as possible, data is presented on a common basis, albeit as noted variances will still exist which will require interpretation for which we comment on in this report.

1.3.4 Section four sets out the reasons for the significant limitations in the usage of cost benchmarking data and illustrates the potential impact of some of the variables on analysis of benchmark cost data.

1.4 Sources of Information

1.4.1 In compiling this cost benchmarking of large scale international hospital projects, AECOM have utilised a number of sources of construction cost data, namely;

(a) internal database of healthcare projects from AECOM global network of offices,
(b) projects previously utilised by NPHDB in earlier benchmarking studies,
(c) data provided by other NCH project team members or their contacts.

Further details of information sources are set out in Section three of this report.

2.0 Methodology

2.1 Selection of Methodology

2.1.1 Typically when undertaking international cost benchmarking studies there are three broad methodologies[1] (as put forward by Jim Meikle, former Head of Research at Davis Langdon and renowned expert in this area) to consider;

(a) Comparative Method
The comparative method consists of getting respondents in the selected locations to provide cost data for the exact same building specification. This has limitations as the construction technology and specification likely varies between regions and as such enforcing the pricing of set materials will result in an outcome that is not representative of the building type in a number of regions.

(b) Representative Method
The representative method gets respondents to provide cost data for typical buildings in a given sector in the selected locations. This approach similarly has limitations as by pricing buildings typical in each region they are not like-for-like as specification and standards will vary and as such are not comparable.

(c) Hybrid Method
The hybrid method, as the name suggests, is a mix of the above two approaches where respondents are asked to provide cost data on similar buildings with local modifications. Whilst on the face of it this method might appear to provide the optimum solution in reality it results in the data being neither fully comparable nor fully representative.

2.1.2 Having regard to the purpose of the report, namely setting the context for a review of the NCH project costs, the representative method provides the optimum approach and is the methodology we have adopted. The reasons it represents the optimum approach for this report are threefold;

(1) The comparative and hybrid methods rely on having cost data on identical or very similar buildings across the range of geographies which in this case of large acute hospitals would not be feasible given the time and cost involved

(2) If a smaller scale hospital was selected to make the exercise more feasible it would lose representativeness also, plus as a research exercise it would not be truly market tested and as such would not be comparable with basis of the NCH costs

(3) It is not intended that the output be utilised as a direct comparison for validation but rather to be representative for setting the NCH in context.

2.2 Type of Information Utilised in Report

2.2.1 The Representative method sources data from existing / previous projects, as they are not be required to be directly comparable, and thus in this regard previous projects, market tested tenders and cost plans were utilised in compiling this report. This information was sourced through a combination of Global Unite, AECOM's international database of construction project data, and direct contact with our network of offices and global healthcare team.

2.2.2 One significant consideration regarding access to this data relates to confidentiality and due to the nature of the data confidentiality regarding the source of same has to be maintained.

2.2.3 In relation to the form of capital construction cost data utilised, the key cost measure which is widely used and obtainable globally from high level cost data is construction cost's per sq. m.

2.2.4 Other possible options such as cost per bed were considered however the variability of functional units, such as the numbers of beds, can often be dramatic depending on the particular brief. In a similar manner

[1] Meikle, J. L. (1990). International comparisons of construction costs and prices. Habitat International, 14(2), 185-192. doi:http://dx.doi.org/10.1016/0197-3975(90)90049-7

the level of diagnostic / treatment rooms being provided etc., can vary significantly. It is beyond the scope of this report to examine the efficiency and otherwise interrogate the brief of the projects other than to ensure they are all major acute hospitals in major urban centres providing a wide range of inpatient services.

2.2.5 In sourcing the information a template was provided to AECOM team members and NPHDB project team members who had suitable project data to ensure consistency of data received and inclusions / exclusions pertaining to same.

2.3 Sources of Information

2.3.1 The primary source of information has been the internal database of healthcare projects from the AECOM global network of offices.

2.3.2 In addition, a number of projects previously provided by the NCH cost consultants (Linesight) in an earlier benchmarking study have been updated by them and provided for reference. We have reviewed their methodology and it is broadly in line with that utilised in this report.

2.3.3 Reference will also be made to other data, where available and appropriate to the methodology, from project team members of the NCH (or their contacts) which they may have available from other project experience.

2.4 Representative Model Methodology

2.4.1 As part of our Representative Model methodology there are a number of key factors considered namely;

(a) inflation,
(b) currency and
(c) location

2.4.2 As outlined at the outset there are significant limitations with benchmarking and in addition to those associated with choosing the primary methodology there are also challenges associated with adjusting for these factors.

2.4.3 To illustrate this, and primarily to assist in addressing these limitations and risks, our methodology included running three scenarios utilising some or all of these variables. Each scenario is aimed at bringing the cost of the benchmarked projects to alignment with the timing of the NCH project.

2.4.4 Firstly, we outline below our approach to each of the three variables and the reasons for same.

2.5 Inflation: Programme Alignment & Inflation Considerations

2.5.1 Inflation is a key factor for consideration as it relates to the programme / timing of the projects to which the benchmark data belongs. Inevitably when taking a sample of any range of construction projects across multiple jurisdictions they will all have different start and completion dates and as such without adjustment would not be directly comparable. Accordingly we have made inflation adjustments to align the benchmarked projects.

2.5.2 When considering inflation adjustments to align projects with the NCH project the primary options are to adjust projects by an appropriate inflation factor over the required time period to align with either;

(a) the projects tender / start date
(b) the mid-point (or 65% through programme in case of complex projects) or
(c) the projects completion date.

For the purposes of this report we have selected to align the benchmark data to the projected completion date of the NCH. The completion date was selected as the programme dates and durations of the benchmark projects vary considerably and the contract conditions equally may vary with respect to price increases during the construction phase. Accordingly, whilst the tender / contract date is a defined milestone and the mid-point is a traditional cost planning / estimating point to which inflation is often

accounted to, the completion date has been utilised for the reasons above and in order to represent the cost at time the building is handed over and costs concluded.

2.5.3 The options for the adjustment of construction cost to the NCH completion date include using historical indices and projections for future inflation where required. Tender and construction price indices can be more volatile than general consumer indices. As such, the usage of local TPI to adjust historical costs is appropriate to ensure these trends are captured and is the approach we have used for uplifting historical costs.

2.5.4 However, their usage for future inflation escalation is more problematic for a number of reasons. Critically, there are not generally accepted industry wide TPI projections in respect of future tender price movements and even private companies typically do not project beyond 12 months. Risks associated with this include that the costs being adjusted may be at varying stages in a volatile TPI cycle and as such may give a temporary distorted picture of the average movements of construction prices relative to same in other jurisdictions. Figure A below is extracted from The Blue Book 2014, an AECOM publication, and is an illustration of the relative movement in construction prices from 2008 to 2014.

FIGURE A: Example of Tender Price Volatility and Divergence across Geographies

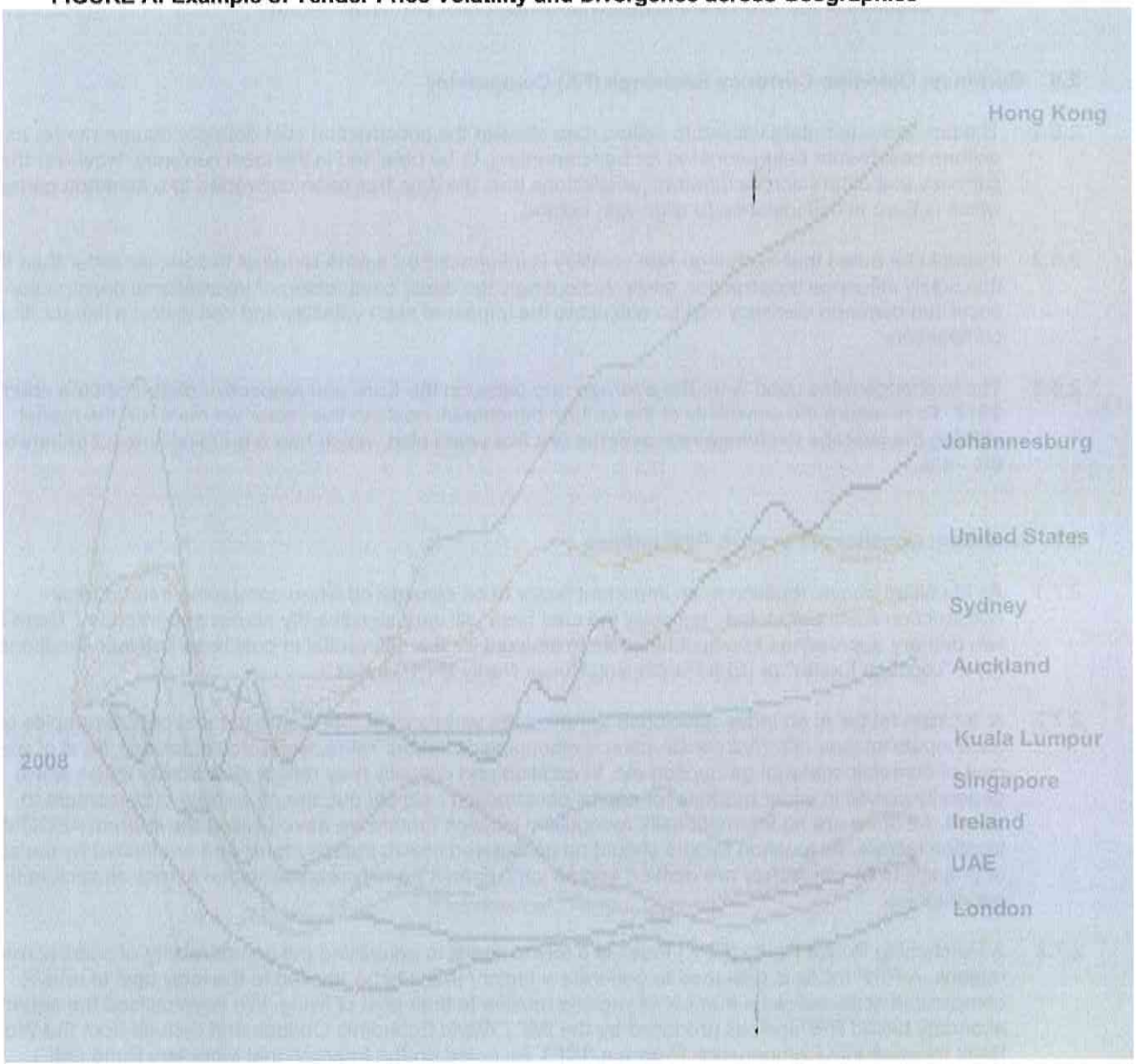


Chart: Indicates relative movement in construction prices from 2008 to 2014.
Source: Based on AECOM Indices for Australia, Ireland, London, New Zealand, United Arab Emirates (U.A.E.), United States (multicity index) and Malaysia Construction Industry Development Board (CIDB), Singapore Building Construction Authority (BCA), Hong Kong Building Works Tender Price Index (BWTPI), Johannesburg Bureau of Economic Research (BER).

2.5.5 To illustrate how this risk could materialise and the magnitude of same we use the following example. If one took the last four years of a given countries tender price indices and they varied from +8% to +2% and averaged at +5% then if this average was projected over a future four years it would result in +20% adjustment. However, if in reality the country was at the end of a growth cycle and the decline from +8% to +2% continued in decline to -4%, over the next four years (average of -1%) it would result in a 24% variance with outturn.

2.5.6 To assist in overcoming an over-exposure to actual erratic tender price movements as per the chart and basing projections on same, where a benchmark project end date is post Q2 2022 (NCH end date) we have de-escalated the costs using a Consumer Price Index (CPI) average. The CPI is an index commonly recognised and adopted worldwide and whilst similar to the TPI in only available historically it is less volatile and therefore less prone to significant error when compared with potentially forecasting tender price indices. For the purposes of de-escalating future costs we have utilised the local country average CPI index (as obtained from the world bank website) over the years 2010 – 2017. This de-escalation methodology has only been required on four of the benchmark projects over an average of 3.5 years. The average CPI rate used is 2% per annum thus conducting sensitivity analysis on this variable indicates if this was to change to a TPI index and doubled to 4% on these four projects it would have a marginal 2.7% reduction in the overall benchmarking average cost per square metre.

2.6 Currency: Common Currency Exchange (FX) Comparator

2.6.1 The pro-forma template utilised to collect data allowed the construction cost data per square metre, as the uniform cost format being adopted for benchmarking, to be obtained in the local currency. However the currency unit differs across different jurisdictions thus the data has been converted to a common currency, which is Euro in this instance to align with Ireland.

2.6.2 It should be noted that exchange rate volatility is influenced by a wide range of factors, far wider than those that solely influence construction costs. Accordingly the direct comparison of international construction costs in a common currency can be subject to the impact of such volatility and can distort a like-for-like comparison.

2.6.3 The exchange rates used were the average rate between the Euro and respective project source country in 2017. To measure the sensitivity of the outturn benchmark costs to this factor we have run the model utilising the average exchange rate over the last five years also, which had a marginal impact of between 0% - 4%.

2.7 Location: Locational Factor & PPP Indices

2.7.1 As identified above, location is an important factor to be considered when comparing international construction costs particularly because the cost base will vary significantly across geographies. There are two primary approaches to adjusting costs to account for the differential in cost base between locations (1) a "Location Factor" or (2) a Purchasing Power Parity (PPP) Index.

2.7.2 A 'location factor' is an index developed to reflect the variances in inputs into the unit cost. Examples of such inputs include different construction methodologies, labour rates, workforce efficiency, level of waste, cost of domestic material production etc. In addition and critically they reflect affordability levels which generally prevail in wider markets for capital construction - simply put, the propensity of customers to spend. As there are no internationally recognised location factors we have utilised the internal AECOM location factors. All location factors should be considered macro industry tools and are limited by the scope of projects from which they are derived and as such cannot be fully representative across all sectors in all geographies.

2.7.3 A Purchasing Power Parity (PPP) Index is a tool to assist in equalising the comparability of costs across regions. A PPP Index is designed to generate a factor / index to be applied to the local cost to reflect comparable costs across a number of regions relative to their cost of living. We have utilised the national economy based PPP Indices produced by the IMF / World Economic Outlook and derived from the World Bank International Comparisons Program (ICP). As noted on the International Monetary Fund (IMF) website it is the rate at which the currency of one country would have to be converted into that of another country to buy the same amount of goods and services in each country. The PPP Index utilized captures both currency and locational factors in one. Similar to the Location Factor, the PPP Index is also a macro tool and in this case at general economy level thus has limitations in its application to specific sectors.

2.7.4 This exercise shows the volatility associated with international cost comparisons and the need to apply caution when viewing same.

2.8 Benchmark Data Cost Conversion

2.8.1 Acknowledging the limitations of these indices, as noted earlier we have run three scenarios to both illustrate and to assist in addressing these limitations by taking an average of the three.

2.8.2 The three scenarios we have run are as follows;

(a) Scenario One: TPI, Foreign Exchange (FX) and a location factor are applied
(b) Scenario Two: TPI and a Purchasing Power Parity (PPP) Index is utilised
(c) Scenario Three: Tender Price Inflation (TPI) and Foreign Exchange (FX) are used

2.8.3 The average for each project from the three scenarios will be combined with the updated benchmark data provided by the NCH cost consultants to provide indicative benchmark cost data for large scale international hospitals.

3.0 Benchmark Cost Data & Analysis

3.1 Sourced Data

3.1.1 As part of the collection of cost benchmark data for this report AECOM have sourced cost data on similar large scale hospital developments where we have had an appointment or have obtained information on same from other sources. Due to confidentiality requirements we cannot identify the project specifics and a number of the project data metrics have been altered to ensure actual project data is not disclosed.

3.1.2 The projects have been sourced from the following geographies;

(a) Europe (2 No.)
(b) Australia / New Zealand (ANZ) (1 No.)
(c) Asia (1 No.)
(d) Middle East (1 No.)
(e) United States (5 No.)

3.1.3 The current stage of the projects benchmarked and their respective costs and their source are outlined in the benchmark data and can be summarised as follows;

(a) Cost Plan Stage (3 No.)
(b) Construction Stage (3 No.)
(c) Completed (4 No.)

(1) AECOM projects (5 No.)
(2) Non-AECOM projects (5 No.)

3.2 Benchmarking Results

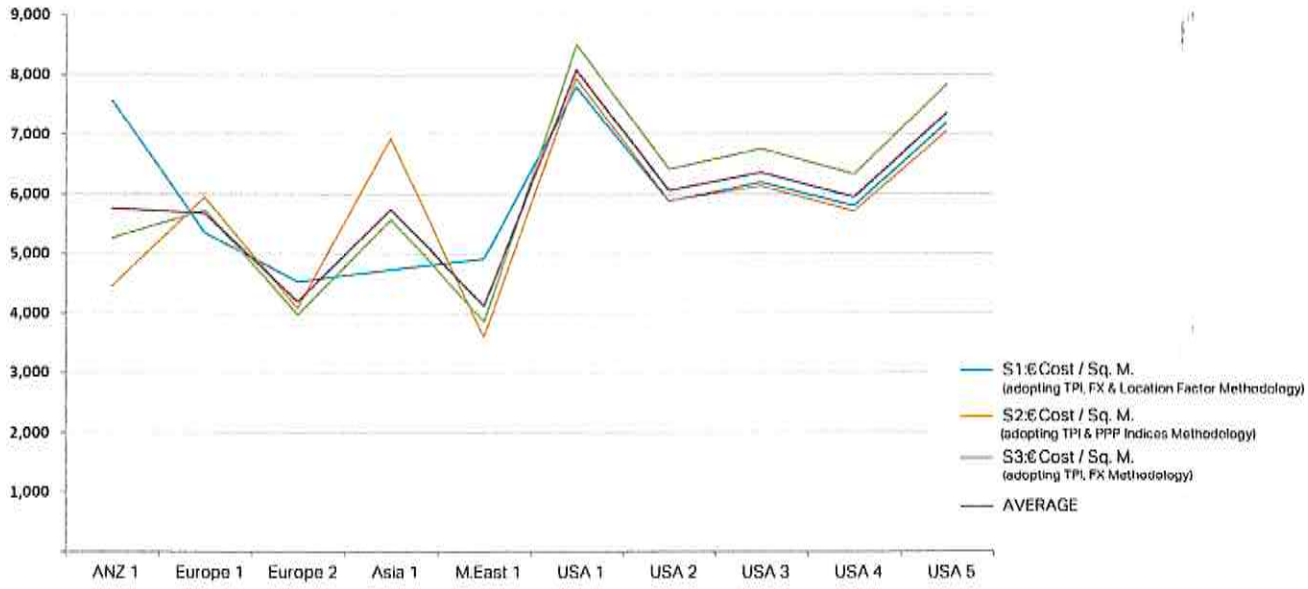
3.2.1 As indicated in the methodology section, we have run three scenarios incorporating tender price, currency and locational adjustments, to obtain project averages and also to highlight the volatility of data and limited usability in turn, of benchmark data.

3.2.2 Summarised on the overleaf is the outline cost data on the 10 No. projects; the costs have been converted to Euro and aligned with a completion date of Q2 2022, all as set out in the methodology in the previous section.

3.2.3 As expected, the size, scale and nature of activities conducted at each of the benchmark projects varied due to their unique nature however all represented acute hospitals in major cities around the world.

3.2.4 The US projects are all Children's hospitals and as such of particular relevance from a benchmarking perspective.

3.2.5 Figure C below summarises the benchmark costs for the 10 No. projects using the three scenarios outlined earlier.



3.2.6 The costs per square metre across the 10 projects ranges from c. €4,000 - €8,000 with an average of the €5,955 / Sq. M. This variance arises from a combination of the variability in the brief for each project and the limitations in cost benchmarking as outlined previously. To minimise the risk of outliers distorting the results we have also looked at the outcome when we omit the two highest and two lowest from the group of 10 projects. When this is done the range reduces to €5,677 - €6,417 a 13% variance and importantly an average of €5,951 which aligns with that of the overall sample size.

3.2.7 Within the group of projects the average of the 5 No. Children's Hospitals (US projects) sub-set is c. €6,809 / Sq. M.

3.2.8 The average of the projects completed or currently under construction (excluding projects at cost plan stage) is €6,273 / Sq. M.

Scenario 1: Costs Adjusted for Inflation, Exchange Rates and Location Factor

	ANZ 1	Europe 1	Europe 2	Asia 1	M.East 1	USA 1	USA 2	USA 3	USA 4	USA 5
Gross Floor Area (Sq. M.)	80,000	55,000	75,000	250,000	350,000	60,000	50,000	45,000	65,000	60,000
Project Stage	Cost Plan	Cost Plan	Part Contract / Cost Plan	Construction	Completed	Construction	Construction	Completed	Completed	Completed
AECOM Project / Market Intelligence	AECOM Project	AECOM Project	AECOM Project	AECOM Project	AECOM Project	Market Intel.	Market Intel.	Market Intel.	Market Intel.	Market Intel.
RAW COST IN LOCAL CURRENCY										
Total Construction Cost (Local Currency & Start Date - Fixed Price)	657,102,508	301,249,457	313,687,500	12,722,222,222	1,292,291,000	500,159,926	344,208,175	274,118,575	309,214,527	441,813,195
STEP 1: ADJUST FOR INFLATION										
Years Escalation / (De-escalation)	-2.50	-3.75	-5.10	-3.25	9.25	3.00	1.00	5.00	10.00	4.00
CPI Average Annual Rate 2010 - 2017	2.24	2.23	0.99	1.19	1.93	5.00	5.00	5.00	5.00	5.00
Inflation Adjustment to align with Q2 2022 Completion Date	620,257,831	276,073,609	297,917,981	12,230,144,841	1,522,997,251	575,183,915	361,418,584	342,648,219	463,821,791	530,175,834
STEP 2: ADJUST FOR CURRENCY CONVERSION										
EURO Conversion Rate 2017 Average	0.680	1.141	1.000	0.114	0.887	0.887	0.887	0.887	0.887	0.887
FX Conversion to Euro	421,527,222	315,082,810	297,917,981	1,391,790,483	1,350,898,561	510,188,132	320,578,284	303,928,970	411,409,928	470,265,965
STEP 3: ADJUST FOR LOCATION FACTOR										
location factor	1.4385	0.9350	1.1402	0.8500	1.2721	0.9167	0.9167	0.9167	0.9167	0.9167
Adjusted for Location Factor (Estimate) (€)	606,350,696	294,602,428	339,699,162	1,183,021,910	1,718,490,007	467,672,455	293,863,427	278,601,556	377,125,768	431,077,134
€ Cost / Sq. M. (adopting TPI, FX & Location Factor Methodology)	7,579	5,356	4,529	4,732	4,910	7,795	5,877	6,191	5,802	7,185

Scenario 2: Costs Adjusted for Inflation and PPP Factor (incorporating FX and Location)

	ANZ 1	Europe 1	Europe 2	Asia 1	M.East 1	USA 1	USA 2	USA 3	USA 4	USA 5
Gross Floor Area (Sq. M.)	80,000	55,000	75,000	250,000	350,000	60,000	50,000	45,000	65,000	60,000
Project Stage	Cost Plan	Cost Plan	Part Contracted / Part Cost Plan	Construction	Completed	Construction	Construction	Completed	Completed	Completed
AECOM Project / Market Intelligence	AECOM Project	AECOM Project	AECOM Project	AECOM Project	AECOM Project	Market Intel.	Market Intel.	Market Intel.	Market Intel.	Market Intel.
RAW COST IN LOCAL CURRENCY										
Total Construction Cost (Local Currency - Start Date - Fixed Price)	657,102,508	301,249,457	313,687,500	12,722,222,222	1,292,291,000	500,159,926	344,208,175	274,118,575	309,214,527	441,813,195
STEP 1: ADJUST FOR INFLATION										
Years Escalation	-2.50	-3.75	-5.10	-3.25	9.25	3.00	1.00	5.00	10.00	4.00
CPI Average Annual Rate 2010 - 2017	2.24	2.23	0.99	1.19	1.93	5.00	5.00	5.00	5.00	5.00
Inflation Adjustment to align with Q2 2022 Completion Date	620,257,831	276,073,609	297,917,981	12,230,144,841	1,522,997,251	575,183,915	361,418,584	342,648,219	463,821,791	530,175,834
STEP 2: ADJUST FOR PPP INDEX										
PPP Converter Factor	1.74275	0.84420	0.97464	7.06884	1.20773	1.20773	1.20773	1.20773	1.20773	1.20773
PPP Conversion to Ireland Base	355,906,780	327,022,816	305,670,494	1,730,148,630	1,261,041,724	476,252,281	299,254,587	283,712,725	384,044,443	438,985,590
€ Cost / Sq. M. (adopting TPI & PPP Indices Methodology)	4,449	5,946	4,076	6,921	3,603	7,938	5,985	6,305	5,908	7,316

Scenario 3: Costs Adjusted for Inflation and FX

	ANZ 1	Europe 1	Europe 2	Asia 1	M.East 1	USA 1	USA 2	USA 3	USA 4	USA 5
Gross Floor Area (Sq. M.)	80,000	55,000	75,000	250,000	350,000	60,000	50,000	45,000	65,000	60,000
Project Stage	Cost Plan	Cost Plan	Part Contracted / Part Cost Plan	Construction	Completed	Construction	Construction	Completed	Completed	Completed
AECOM Project / Market Intelligence	AECOM Project	AECOM Project	AECOM Project	AECOM Project	AECOM Project	Market Intel.	Market Intel.	Market Intel.	Market Intel.	Market Intel.
RAW COST IN LOCAL CURRENCY										
Total Construction Cost (Local Currency - Start Date - Fixed Price)	657,102,508	301,249,457	313,687,500	12,722,222,222	1,292,291,000	500,159,926	344,208,175	274,118,575	309,214,527	441,813,195
STEP 1: ADJUST FOR INFLATION										
Years Escalation	-2.50	-3.75	-5.10	-3.25	9.25	3.00	1.00	5.00	10.00	4.00
CPI Average Annual Rate 2010 - 2017	2.24	2.23	0.99	1.19	1.93	5.00	5.00	5.00	5.00	5.00
Inflation Adjustment to align with Q2 2022 Completion Date	620,257,831	276,073,609	297,917,981	12,230,144,841	1,522,997,251	575,183,915	361,418,584	342,648,219	463,821,791	530,175,834
STEP 2: ADJUST FOR CURRENCY CONVERSION										
EURO Conversion Rate 2017 Average	0.680	1.141	1.000	0.114	0.887	0.887	0.887	0.887	0.887	0.887
FX Conversion to Euro	421,527,222	315,082,810	297,917,981	1,391,790,483	1,350,898,561	510,188,132	320,578,284	303,928,970	411,409,928	470,265,965
€ Cost / Sq. M. (adopting TPI & FX Methodology)	5,269	5,729	3,972	5,567	3,860	8,503	6,412	6,754	6,329	7,838

Summary: Scenarios 1 - 3

	ANZ 1	Europe 1	Europe 2	Asia 1	M.East 1	USA 1	USA 2	USA 3	USA 4	USA 5
Gross Floor Area (Sq. M.)	80,000	55,000	75,000	250,000	350,000	60,000	50,000	45,000	65,000	60,000
Project Stage	Cost Plan	Cost Plan	Part Contracted / Part Cost Plan	Construction	Completed	Construction	Construction	Completed	Completed	Completed
AECOM Project / Market Intelligence	AECOM Project	AECOM Project	AECOM Project	AECOM Project	AECOM Project	Market Intel.	Market Intel.	Market Intel.	Market Intel.	Market Intel.
S1: € Cost / Sq. M. (adopting TPI, FX & Location Factor Methodology)	7,579	5,356	4,529	4,732	4,910	7,795	5,877	6,191	5,802	7,185
S2: € Cost / Sq. M. (adopting TPI & PPP Indices Methodology)	4,449	5,946	4,076	6,921	3,603	7,938	5,985	6,305	5,908	7,316
S3: € Cost / Sq. M. (adopting TPI, FX Methodology)	5,269	5,729	3,972	5,567	3,860	8,503	6,412	6,754	6,329	7,838
AVERAGE	**5,766**	**5,677**	**4,192**	**5,740**	**4,124**	**8,078**	**6,091**	**6,417**	**6,013**	**7,446**

3.3 Benchmark Data provided by Third Parties

3.3.1 In addition to sourcing data internally, AECOM also sought any cost data available from the NCH project team consultants and public health client bodies on the island of Ireland.

3.3.2 The NCH project team cost consultants, Linesight, provided an update (updated to align with current NCH programme) on the 4 No. Middle East projects included in the original cost benchmarking review. Table A below summarises the updated data received. The average of the 4 No. Middle East projects is €5,811/ Sq. M.

Benchmarking of Hospital Sq.m Costs for Projects in the UAE -v- Projects in Europe: Provided by Linesight

Cost Per Sq.m

Ref	Project	Area ; SQ.M	Procurment Method	Nr of Beds	Timeline	US$/sq.m ; US Dollars Per Sq.m	Convert to Euro (0.90)	Bring to European (1.46 Ref T+T) ; more heavily serviced projects say 35%	No. of years inflation to base date to align competion date of Q2 2022	Tender Inflation Rate*	Total at completio n date
						US$	€/Sq.m	€/Sq.m	Years	%	€/Sq.m
1	UAE Healthcare	308,000	Traditional	838	Work not Started ; Postponed ; Cost plan Q1 , 2017 at rates & the time ; inflation excluded.	3,500	3,150	4,253	5.25	4%	5,146
2	UAE Healthcare Clinic	409,000	Traditional	520	Commenced 2012 / completed 2015 , Q3 2015	3,750	3,375	4,556	6.75	4%	5,736
3	UAE Healthcare Hospital	308,000	Traditional	1,120	Commenced 2009 / completed 2013 , Q4, 2013	3,800	3,420	4,617	8.50	4%	6,187
4	UAE Healthcare ; Medical Centre	234,000	Traditional	1,095	Commenced 2012 / completed 2015 , Q4 2015	4,000	3,600	4,860	6.50	4%	6,124

Costs above are for building costs only and exclude Equipping ; Professional Fees ; Maintenance ; LA contributions ; Planning / Fire Cert Charges etc.

* Similar to other geographies, tender inflation rates in the Middle East have varied across regions / cities and have also been cyclical. For the purposes of this exercise an average rate of 4% per anum has been applied.

3.3.3 The NCH design team did endeavour to obtain data on other projects they are involved with or have contacts with however due to confidentiality reasons the data was not available.

3.3.4 A further source of cost benchmark data explored was through the HSE and contacts they may have internationally. The HSE provided high level data from a European source in respect of a range of healthcare hospital projects across Europe. This range included 65 projects from 13 No. countries however a lot of the projects were pre - 2010 or did not have a date listed. In addition a number of the hospitals were small in scale and as such are not a strong comparator.

3.3.5 When these projects were omitted along with clear outliers, the most relevant project in each country was identified (6 No. remaining) and adjustments made for inflation and location factors (costs had been converted to Euro prior to being issued to AECOM). The cost range was €3,100 - €6,300 (inclusive of inflation to completion of Q2 2022). It is noted that the information provided was "costs of the building" thus it is likely they exclude External Works. It is not clear whether Group One equipment is included. Due to time constraints it was not possible to make contact with the respective hospitals or estates agencies to obtain further detail to verify the basis of the costs and as they had not been collated using the template designed for this study the information should be treated as additional market information but not directly comparable.

3.3.6 A UK public health sector agency was also contacted in respect of a planned Children's hospital project and they provided preliminary cost data. When adjusted for currency, location factor and inflation the cost per square metre equated to c. €4,000. However, the project is still at business case stage and a programmed tender date in 2019 / 2020 thus considerable design is still required and thus it is not a strong comparator at this point for this benchmarking study.

4.0 Conclusions

4.1 Limitations & Other Considerations

4.1.1 Significant limitations exist with using international construction cost benchmark data due to a large number of variables. These variables impact construction sectors and geographies in different ways and on different timelines.

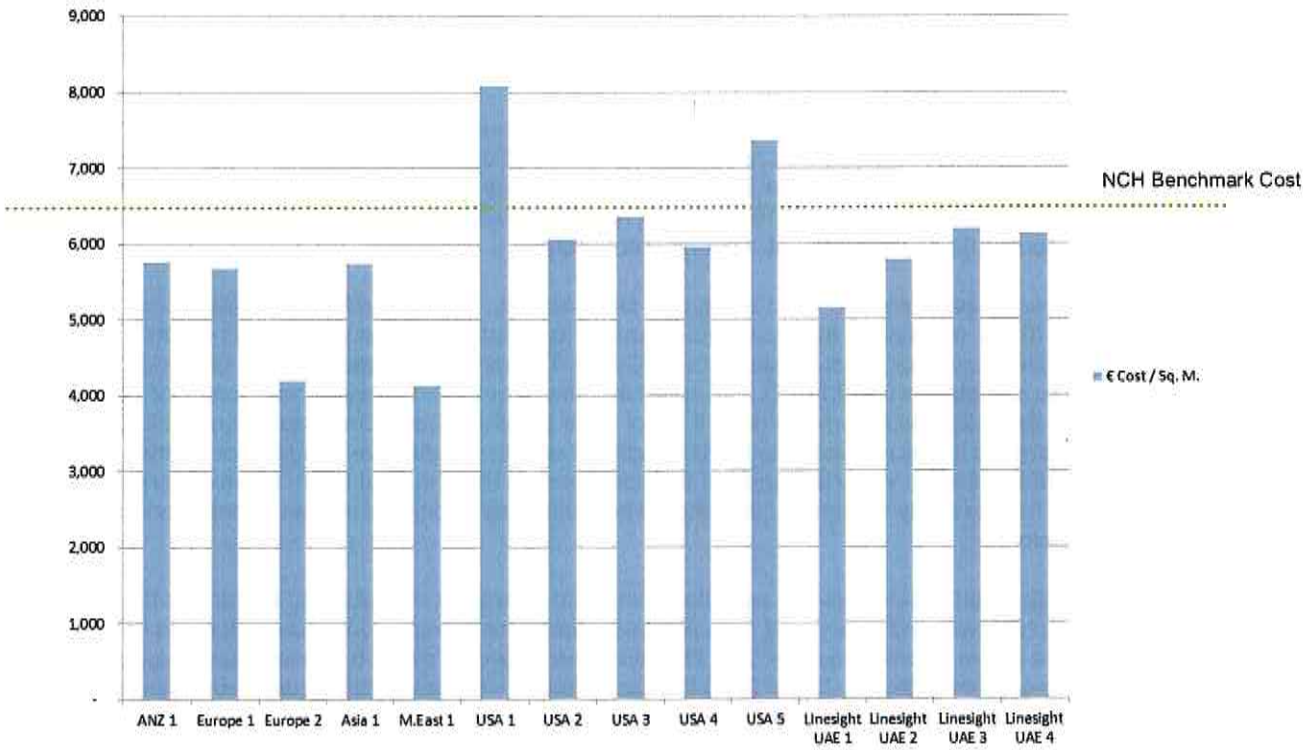
4.1.2 In our report we have applied indices and run three separate scenarios, to obtain average values to optimise the alignment and reduce risk of distortion, of the projects to a point where they can be compared. The tools and indices available and utilized in this analysis are macro tools and as such cannot be fully representative of all sectors (and projects therein) thus the benchmark costs should be carefully considered.

4.1.3 As set out in the objective, the output from this report should be used in order to provide a context for any review of project costs for the NCH development in Dublin as opposed to any direct comparison for validation.

4.1.4 A further consideration which is relevant when considering benchmark costs for projects of significant scale relate to its potential market disruption impact and the implications for project costs. In this context, the NCH represents a €1+ billion project (over five years) in an overall construction industry of €20+ billion per annum and as such it represents a significant draw on the industries' resources concentrated to one project. There is anecdotal evidence that where significant construction projects are undertaken the project will incur additional costs through having to pay premium labour rates to secure and hold the required resources. As an example, in Hinkley Point, a nuclear power station being built in UK, the contractors reached an agreement with over 1,000 employees to pay 36% more than the agreed industry minimum pay rates.

4.2 Benchmark Costs

4.2.1 The benchmark costs for the 10 No. projects analysed as part of this study and the updated UAE projects received from Linesight are set out in Figure A below along with the NCH benchmark cost per square metre as advised by the NPHDB.



4.3 Conclusion

4.3.1 The benchmark costings indicate that the NCH benchmark costs of €6,500 / sq. m. are approximately 10% higher than the c. €5,900 / sq. m. average of the combined 14 No. projects listed above. It should be noted that the sample of 10 No. projects analysed for this study contained projects ranging from €4,000 - €8,000 / sq.m. This range is inevitably impacted by the individual briefs (the detailed analysis of same which is beyond the scope of this report) for each of these projects and the limitations of international cost benchmarking generally.

Contact:

Tomás Kelly
Director
T +353 (0)91 530199
E tomas.kelly@aecom.com
aecom.com

www.aecom.com

Appendix 6.2

Linesight Inflation Report

Strategy | Management | Consultancy

Linesight

National Paediatric Hospital

Construction Inflation Overview in the Irish Construction Industry & its Specific Impact on the National Paediatric Hospital

October 2018 (Update of Previous Report Dated November 2016)

Private & Confidential

Note: **This is an update of the report dated November 2016 to reflect more recent and up-to-date intelligence with regard to construction inflation in the industry and the most recent project timelines.**

Construction Inflation Overview in the Irish Construction Industry & its Specific Impact on the National Paediatric Hospital Project

Linesight

Introduction

This report is an update of the Linesight report issued in November 2016 which provided a Construction Industry Inflation Overview in the Irish Construction Industry and its specific impact on the National Paediatric Hospital at that time in November 2016.

This October 2018 report is an update report which reflects more current / actual tender inflation modelling for the period since November 2016 and going forward. It also reflects the most recent information around programme dates for the National Paediatric Hospital.

Essentially the majority of the uplifted tender inflation as noted since the November 2016 is attributed to two factors;

- The main "Phase B" works commencing on site approximately one year later than envisaged in the 2016 report
- Actual recorded higher levels of tender inflation as against those assumed / modeled in the 2016 report.

This report undertakes a review of tender inflation and its potential impact on hospital/healthcare projects in general and the National Paediatric Hospital in particular. It updates previous tendering inflation exercises to reflect market intelligence and feedback from the marketplace, in July 2018.

The report maps the extraordinarily severe contraction in the Irish Construction industry between 2008 and 2013 and the extremely negative impact it had on resources, numbers employed in the industry, and tendering levels generally at the time. Construction activity has begun to recover in the interim as the wider economy has improved and as it seeks to compensate for the very limited construction activity during the extended downturn. As the industry expands from a very low base it places inevitable pressure on available resources and on tendering levels, which were often artificially at or below cost during the recession.

Between 2013 and 2018 the construction industry in Ireland has experienced very high levels of tender inflation. Whilst all projects are attracting varying levels of tender inflation particular tender inflation patterns are becoming evident for more complex, heavily serviced projects, located in specific parts of the county. This has become particularly noticeable during the mid/latter part of 2016 and has continued into the period 2017 and 2018 with clear indications it is likely to continue into 2019 and beyond.as the industry enters a sustained period of reasonably buoyant activity.

This report reviews the above and models the potential impact of this latest market intelligence on the tender inflation/future tender inflation on the National Paediatric Hospital project.

This report is based on and utilizes much of the information reported on and set out in reports prepared by Linesight in November 2016 which dealt with inflation trends and modelling for hospital / healthcare projects in general. This report was based on the latest market intelligence / feedback around tender inflation applicable to large / more complex and heavily serviced healthcare projects and provided a general commentary with regard to this particular sector of the market and how it was likely to be impacted by the latest construction tender inflation trends. It reflected the most current information available as of October 2018.

Construction Inflation Overview in the Irish Construction Industry & its Specific Impact on the National Paediatric Hospital Project

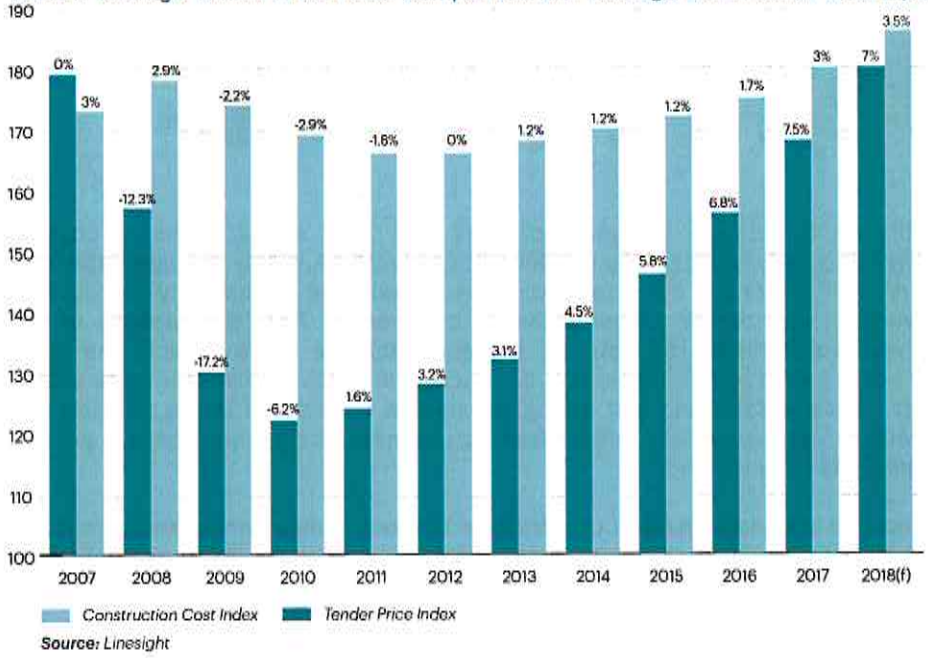
Linesight

General Construction Industry Tender Inflation Overview

When inflation in the construction industry is considered there are two general indices which are relevant and which track costs, the Construction Tender Price Index and the Construction Input Cost Index.

Tender indices measure the actual prices being submitted by contractors and sub-contractors for work. In this regard it is a reflection of the price that contractors are actually charging to undertake construction work. This is the index which is of most relevance to businesses or authorities undertaking or contemplating undertaking construction work, as it reflects the actual costs which the market will charge them to undertake this work. Construction cost indices on the other hand measure construction input costs such as labour and material increases. In the construction industry these two indices can display quite different patterns and rates of increase/decrease, particular so in the last nine years. Table 1 demonstrates this.

Table1. Average Tender Price Index Comparison with Average Construction Cost Input Index



Source: Linesight

These two indices, as measured in Table 1 above, in general and under normal market conditions would be expected to generally track each other reasonably closely, and display similar patterns of increase and decrease over the years. But this has not been the case in the Irish construction industry in recent years, for a number of reasons, most of which are closely linked to what was effectively a collapse in construction industry output from 2009 on, as evidence in Table 2. Below

While overall national GNP fell by approximately 4% in the period 2007 to 2014, output in the construction industry fell by over 70%, a dramatic fall off in activity. This resulted in artificially low tendering strategies being adopted by many contractors. With contractors seeking to maintain workload, aggressively chasing an ever shrinking volume of work. Often submitting tenders which were below cost, a situation which was simply not sustainable in the longer term.

Construction Inflation Overview in the Irish Construction Industry & its Specific Impact on the National Paediatric Hospital Project

Linesight

Table2. Average Tender Price Index Comparison with Average Construction Cost Input Index

Table 2 highlights this point. Between the years of 2007 and 2010 actual tendering costs fell by approximately 35%, while constructor input costs reduced by only 2%. A wholly unsustainable situation. During this period most contractors and sub-contractors downsized quite dramatically and several went into liquidation/receivership, and are no longer active in the market. Thus the capacity of the Irish construction market was substantially reduced. As the economy has improved and the volume of construction projects being tendered has increased, contractors and sub-contractors have endeavored to recover margins that were eroded and lost during the severe contraction in the industry, and are submitting tenders which more accurately reflect their actual input costs, with specific project risks being properly assessed and included for.

This in turn is resulting in a situation whereby construction tenderer indices are currently substantially outstripping actual construction input cost indices on an annual basis, as is clearly evident from Table 1. Effectively reflecting the reality of the current construction industry whereby tender indices recover ground lost to input cost indices since the collapse of the construction industry in 2009.

Construction Inflation Overview in the Irish Construction Industry & its Specific Impact on the National Paediatric Hospital Project

Linesight

The table below sets out three of the main tender inflation indices which are used extensively to track and report on tender inflation in the construction industry generally.

Whilst these are useful with regard to indicating an average for construction projects across a range of construction types, located through all regions of the country, they are an average and as such should be utilized with caution when dealing with a specific project in a specific location.

Year (Estimates)	SCSI	AECOM	Linesight (Dublin)	Linesight Assessed Brown Field City Centre Site Heavily Services Project
2013 / 2014	3%	3%	3%	7%
2015	5.5% to 6%	5% to 7%	6%	8%
2016	5% to 6%	5% to 7% (Dublin 8%)	5.5% to 7.5%	10.5%
2017			9%	12%
2018			9%	12%
2019				10.5%
2020				10.5%
2021				8%
2022				7%

NOTE:

1. **These tables were compiled in late 2015 / late 2017 and reflected the market view in late 2015. In actual fact 2016 to 2018 has seen a substantial uplift in tender levels, particularly for large complex projects, in the Greater Dublin / Leinster area where inflation varies between 9% and 12%.**
2. **These tables represent a range and mix of different project types across all areas of the country.**
3. **Latest Market Intelligence in 2018 clearly demonstrates that large, heavily serviced projects in the centre area of Dublin, particularly those with substantial basements and a high percentage of mechanical and electrical services are attracting premiums of between 3% and 5% above the rates operating in the Dublin region generally for more conventional / less serviced projects.**

Healthcare / Hospital Projects Tender Inflation Overview

However the impact of tender inflation on construction projects is not uniform across all project types, and the various indices quoted are a reflection of up to date tender returns for a wide range and mix of different construction projects located in all geographic regions of the country. Construction tender indices as measured and published by various professional firms/professional bodies active in the industry, are an average measurement of actual tenders being received across a very wide range and mix of actual projects for which tenders have been received located in all areas of the country. There are three principle areas where acute hospital projects in particular have been impacted by higher levels of tendering inflation, than would be the norm in many other sectors. These are;-

1. More highly serviced buildings with more specialist works, which in turn attract higher levels of tender inflation.

2. More structured pricing of risk by contractors. Hospital projects often located on active hospital campuses with work adjacent to existing building, patients etc. Higher contractor management costs associated with complex hospital projects

3. Longer pre-construction lead in times for hospitals attracting more pronounced tender inflation

1. More Highly Serviced Buildings/ More Specialized Works

Some specialized services such as mechanical and electrical installations have tended to attract higher tender inflation increases, reflecting the skill/training levels involved and the shortage of skilled workers whose services are in high demand across a range of highly serviced buildings such as pharmaceutical facilities, electrical manufacturing and industrial projects generally. All project types which are experiencing increasing levels of construction activity as the economy recovers. As a result heavily serviced buildings will tend to see more noticeable increases in tender inflation than less heavily serviced buildings

For example hospital buildings where the service costs/specialist installations costs are often in excess of 30 % of the overall construction costs, are more severely impacted by construction tender inflation than many other project types. Table 3 below sets out the typical expenditure spread for an acute hospital project.

Higher Inflationary pressures are also being experienced in other specialist areas such as cladding /glazing

Table3. Analysis of typical percentage make up of expenditure for an acute hospital type project

a.	Main Contract Works	Approx. 51%
b.	Mechanical and Electrical (services Works)	Approx. 40%+
c.	Specialist Cladding	Approx. 7%+
d.	Lifts	Approx. 2%

Note: Percentages have been updated to reflect recent trending information on large heavily serviced hospital projects. Reflecting both the increasing service complexity on modern hospitals and also the very substantial inflationary pressure on services works in the current economy.

As evidenced in Table 3 the total percentage expenditure associated with specialist works, attracting higher levels of tender inflation, for a typical acute hospital is approximately 49%+ of the total construction expenditure. These are the areas which are attracting particularly high levels of tender inflation, when compared with other sectors of the construction industry and this in turn is resulting in disprapoartinatley higher average tender inflation levels being experienced for acute hospital projects.

2. **More structured pricing of risk by contractors. Hospital projects often located on active hospital campuses with work adjacent to existing building, patients etc.**

As contractors begin to more accurately price for risk and actual management costs in their tenders, the tenders for more challenging projects on restricted center brownfield sites are attracting higher increases in tender inflation, as against more straightforward projects located for example on more straightforward sites. Again this has had a disproportionately higher impact on tenders being received for hospital projects which are generally viewed as complex, heavily serviced projects, often constructed on active hospital campuses with challenging issues around service diversions, infection control, maintaining activity for existing staff and patients and safeguarding their health and safety etc.

In tender documents for construction works, contractors generally price their site overheads/ temporary works management/specialist attendances and work generally associated with the management and administration of more complex projects in what is known as the "Preliminaries" section of the pricing document. These "Preliminaries" costs are then generally expressed as a percentage of the overall construction value for the project. This provides very useful cost information for cost control professionals in the industry and this information is tracked within the industry, with patterns and trends carefully noted. Essentially this information indicates the percentage applied by contractors, to oversee, manage and administer a project.

These "Preliminaries "costs are closely linked to the difficulty and challenges presented by particular projects and the risks involved in undertaking a particular project. They can range from a low of 6 to 7% for more straightforward, less complex projects, to a range of 14% to 20% for what are perceived to be particularly challenging and difficult projects, requiring a large amount of specialist on-site management by contractors and careful control of potential risks to the project.

During the very severe and protracted downturn in the Irish Construction Industry, and as contractors chased an ever shrinking workload, many contracting organizations began to take a less structured approach to properly pricing for appropriate administration costs and the risk costs associated with projects, and the "Preliminaries" percentage included for in tenders generally began to fall to historically low levels across most construction sectors. With "Preliminaries" percentage for some very complex projects falling as low as 5 to 6%. A situation which was clearly unsustainable in the longer term.

As the industry has recovered and as the volume of work has increase, contractors who in turn have downsized quite dramatically are looking in much more detail at the costs and risks associated with undertaking more complex and challenging projects, particularly heavily serviced projects with complex issues such as working on active campuses for example. The combined effect of the above has resulted in a situation whereby the "Preliminaries" tender inflation for more complex hospital projects is quite substantially above the average for construction works as a whole.

There has been a noticeable and established increase in the percentage for "Preliminaries" being applied to more complex hospital projects in recent years. This particular trend has become particularly evident during during the period 2016 to 2018. Whilst in previous years, during the downturn in the industry, it was not unusual to see "Preliminaries" percentages for quite complex, acute hospital projects fall to substantially under 10%, these are now generally in the range of 14% to 20%++ and on more complex healthcare projects with a lot of challenging issues to be addressed they can reach the high teens percentage wise.

Certainly as the industry enters a sustained period of recover, average patterns around increases of 30 to 60%+ in the "Preliminaries" percentages for challenging hospital projects on active hospital campuses are being observed. Increases in "Preliminaries" percentage generally are also being observed across other project types, but the percentage increases for these projects is much less pronounced than that for more complex/challenging projects.

3. Longer pre-construction lead in times for hospitals attracting more pronounced tender inflation

When calculating construction inflation, there are generally two separate calculations applied, depending on whether the period involved is pre-construction (before construction has started on site) or post-construction (after construction has started on site). These are;-

a. Straight Line Inflation (Pre-Construction) *Note this has had a particular impact on the nearly 1 year delay in starting the Phase B Works against the date noted in our previous inflation report.*

b. S-Curve Inflation (Post-Construction)

The impact of these two inflation types on the eventual outturn construction costs for a project can be quite different. Straight Line Inflation is applied to the total construction costs and becomes cumulative over the years, as inflation percentages are applied to the previous year's amounts. S-curve inflation on the other hand is applied to a reducing balance as construction spending has begun and the amount payable to the contractor in the future reduces. It generally approximates to 50% of the amount that would be calculated using a straight line inflation calculation over the same post-construction period.

The effect of this is that large, more complex projects which have lengthier design/planning periods prior to work actually starting on site are more heavily impacted by the more expensive straight line inflation.

Table 4. Straight Line (Pre-Contract) Construction Inflation – v- S-curve (Post Contract Construction Inflation)

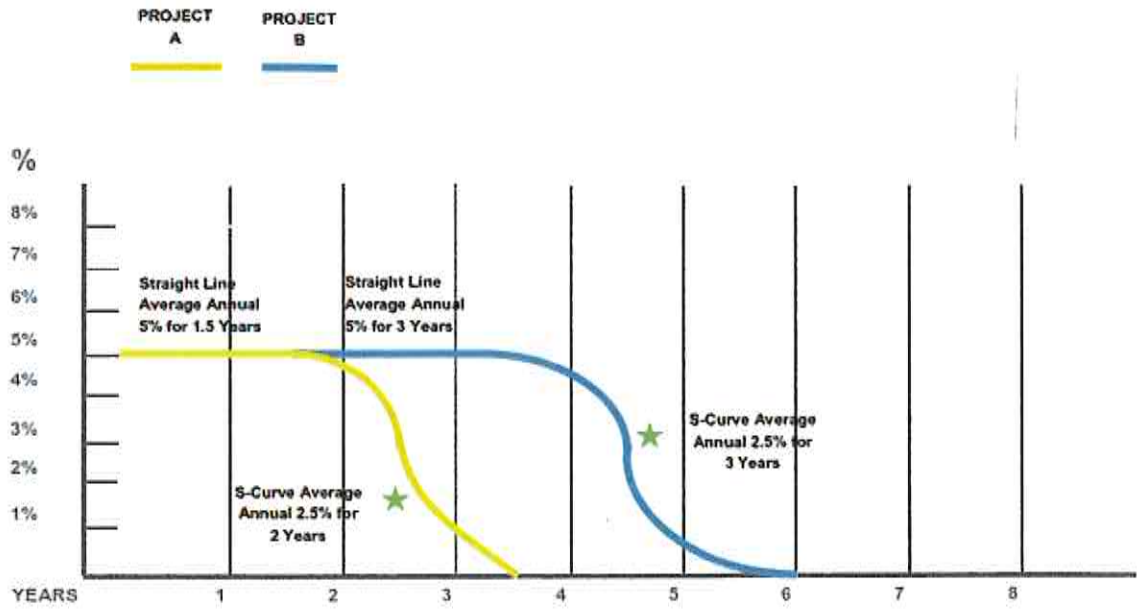


Table 4 demonstrates the impact of the two inflation types. With Project B attracting a greater overall percentage as a result of its greater pre-planning/tendering requirements (prior to any work starting on site) Complex Hospital projects in general often have much lengthier pre-construction periods as against other project types. Reflecting the complexity of the services installations required the complex often active hospital sites, planning issues and also the extensive engagement generally required with a wide range of user groups and interested parties. This results in hospital projects generally carrying a higher proportion of the more expensive straight line pre-tender inflation, with a consequently a more substantial impact on end of day out-turn construction costs.

For example, a delay of a year in commencing a project attracts straight line inflation which will have a more substantial impact on the cost of completing a project, than an increase of 1 year in the building period on site as this latter period will be impacted by S-Curve inflation.

Tender Inflation Factors; with the potential to impact specifically on the National Paediatric Hospital Project

The factors noted above all impact directly on the construction inflation as applicable to the National Paediatric Hospital. However the National Paediatric Hospital is also impacted by regional factors and in particular tender inflation with regard to geographical location, with projects in the greater Dublin/greater Leinster area attracting higher levels of construction tender inflation than in the rest of the country.

This is reflecting the fact that a lot of the economic activity and consequently construction activity is occurring in the greater Leinster area and this in turn is resulting in higher levels of tender inflation in this region. There are clear indications that construction inflation in the greater Dublin/Leinster area is outstripping that in the rest of the country. Again it is important to note that the tender indices published for the construction industry are an average of a wide mix of project types, ranging from more straightforward project types to complex/heavily serviced projects such as hospitals. Also that they reflect projects located around the country. As such in considering tender inflation modelling for a specific project it is important that the unique features and geographical location of that project are reviewed and suitable adjustments made to any modelling to reflect these unique factors.

In this regard the National Paediatric Hospital has several important factors impacting on how tender inflation influences outturn costs.

1. Highly serviced facility with a substantial specialist mechanical and electrical / services content.
2. Given its size and very complexity a substantial lead in period, from the work starting on site, attracting more expensive straight line inflation.
3. Located on an active hospital campus with more complex management of issues around infection control, monitoring services etc.
4. Definite emerging trends in 2016 onwards around making appropriate risk provisions around more complex / highly serviced projects.

   Clear indications being received that such projects have tender inflation levels which are above average levels measured for a wide range and mix of projects across the country.
5. Located in the Greater Dublin / Leinster area, where the great majority of construction activity is taking place. This area is recording higher levels of tender inflation than the country generally.
6. Later start of main contract works, being impacted by straight live inflation, which is likely to be recorded at higher levels for 2016. , 2017 and 2018 and similar high inflation trends also being predicted for 2019.

Construction Inflation Modelling on the National Paediatric Hospital Going Forward

Inflation modelling going forward is always challenging and is informed by a number of modelling techniques and reviews of patterns and historical data. However there is no doubt that the Irish construction industry will continue to face substantial tender inflation challenges in the coming years as the industry recovers from a spectacular collapse in activity and an associated artificial reduction in tendering levels.

Complex, heavily serviced and challenging projects, such as hospitals, will in particular face inflationary challenges as the skillsets required for same become scarcer in a recovering market, and contractors begin to reflect the actual cost and risk associated with more complex/challenging projects in their tender returns. Equally tender indices still have some way to go before they recover the disparity between tender indices and actual construction cost indices since 2008/2009.

Current indices have recorded that tender inflation for more complex hospital projects has operated within the range of 9% to 12% for the years' 2016, 2017 and 2018 with particular large/complex projects such as the National Paediatric Hospital located in the greater Dublin/Leinster operating at the upper end of this range. There is now clear evidence that tender inflation as applicable to projects such as the National Paediatric Hospital will operate at the higher end of the inflation scale and operate between 10% and 12% for the years 2016, 2017 and 2018. All current indications are that these levels will continue into 2019 also and possibly beyond.

Going forward indications are that inflation in the healthcare sector, across the country generally is likely to operate at an average of between 8% to 9% in the years' 2020 to 2021 and given the greater inflation pressure applicable to larger/more complex healthcare projects in the greater Dublin/Leinster area it is anticipated that the National Paediatric Hospital will operate at the higher end and perhaps marginally over these ranges for these periods.

In making reasonable and prudent allowance for the impact of construction tender inflation on the National Paediatric Hospital the construction tender modelling has factored in the following tendering inflation.
Programme; -

- Base cost plan date Nov 2016.
- Tender return date October 2016.
- A start on site Phase A works in August 2017; assumed for previous repost but actual start on site October 2017.
- A GMP agreement and commencement of Phase B works in December 2018. Assumed for previous report but actually scheduled to be November 2018 an additional period of a year.
- Overall project completion was assumed for the previous report in March/April 2021, but anticipated in February 2022.

Table 5 undertakes a review of the calculation of tender inflation and the tender percentages used at the various design/cost milestones on the project. We would note that Column A and B relate to the previous report issued November 2016.
Column C has been added to reflect updated market information and project timeline.

- Column A highlights the calculation around the circa € 90M inflation figure noted in Linesights February 2016 report.

- Column B reflects the extended timeline, which is assumed for the column B exercise, but applied tender inflation annual percentage assumed for our November 2016 report, which were based on the most up to date market intelligence but allows slightly greater percentage allowances for post 2019 period reflecting contractor risk around recovery of inflation based on average country wide indices. This revised calculation results in an overall tender inflation provision of circa € 160M

- Column C is an update of Column B with the project period extended to 90 months to reflect the contract construction period and start on site date. This revised calculation results in an overall tender inflation provision of circa € 341M

Effectively the tenders being received for this project will have included in their bids the risk around inflation for the contract duration. To reflect the project timeline and the substantial risks involved in projecting potential tender inflation over an extended contract period such as that for the Children's hospital, provision was made in the contract documents that if tender inflation from 2019 onwards went above 4% the contractors would be entitled to recover an amounts in excess of the 4% allowance.

However the industry indices used to measure tender inflation are average indices for a large number of projects located around the country, so if for example in 2019 the average tender indices noted measure 4% tender inflation, but tender inflation for large heavily serviced projects in the Dublin region were circa 10.5% (which current trending suggests) then the contractors would not be entitled to any additional recovery and would effectively have to absorb the potential +6.5%. For the purposes of this particular exercise we have factored in this additional potential percentage.

The above exercises indicates that the impact of the current trend inflation levels in the industry combined with the lengthier 9 month period for the main contract is that the inflation construction budget for the National Paediatric Hospital project will be in the order of €341m .

Note: In order to be consistent with previous inflation analysis the base for the calculation of inflation does not include for the following;

- Programme Alignment
- Sprinkler Installation.

Construction Inflation Overview in the Irish Construction Industry & its Specific Impact on the National Paediatric Hospital Project

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Table5. Inflation Modelling for National Paediatric Hospital

		COLUMN A						COLUMN B						COLUMN C				
Project Stage	Stage 1		Stage 2A			Stage 2B			Stage 2C					Stage 2C				
Overall Period Q4 2014 to Project Completion	65 Months		65 Months			71 Months			80 Months					90 Months				
Budget Amount	€360m		€377m			€377m			€377m + €27m Risk					€377m + €27m Risk				
YEAR	%	COST	%	COST	Movement	%	COST	Movement	%	COST	Movement	%	COST	%	COST	Movement	%	COST	Movement
2014	4.00%	€6.00	5.00%	€7.85	€1.85	5.00%	€7.85	€0.00	5.00%	€8.42	€0.57	7.00%	€11.78	€3.36				
2015	4.00%	€14.64	4.00%	€15.45	€0.81	5.00%	€19.21	€3.76	5.00%	€20.58	€1.37	8.00%	€33.20	€12.62				
2016	4.00%	€14.66	3.00%	€11.64	-€3.02	5.00%	€19.22	€7.58	9.50%	€40.99	€21.77	10.50%	€46.99	€6.00				
2017	4.00%	€13.05	4.00%	€14.01	€0.96	5.00%	€16.59	€2.58	6.50%	€29.08	€12.49	12.00%	€57.62	€28.54				
2018	4.00%	€9.33	4.00%	€9.83	€0.50	5.00%	€13.06	€3.23	6.50%	€25.91	€12.85	12.00%	€60.88	€34.97				
2019	4.00%	€3.50	4.00%	€3.49	-€0.01	5.00%	€8.38	€4.89	6.00%	€18.48	€10.10	10.50%	€51.69	€33.21				
2020						5.00%	€2.74	€2.74	6.00%	€13.07	€10.33	10.50%	€46.54	€33.47				
2021									6.00%	€5.37	€5.37	8.00%	€29.66	€24.29				
2022												7.00%	€2.87	€2.87				
TOTAL		€61.18		€62.27	€1.09		€87.05	€24.78		€161.90	€74.85		€341.23	€179.33				

Construction Inflation Overview in the Irish Construction Industry & its Specific Impact on the National Paediatric Hospital Project

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Conclusion / Summary

Tender Inflation in the Irish Construction Industry in recent years has been substantially above inflation in the wider economy. This reflects a recovery within the industry from historically low output and tendering levels which occurred in the wake of the very severe recession in the industry in 2008/2009. And resultant artificially low tendering levels during this period.

Whilst tendering inflation across most construction sectors has been above that for inflation in the wider economy in recent years, the impact on more highly serviced, complex projects such as hospitals has been more pronounced. Reflecting a host of unique factors, which are applicable to hospital construction projects.

On a large, heavily serviced, complex hospital project over a relatively lengthy timespan the cumulative effect of tender inflation can have a significant impact on the capital costs for that project. Even changes of 1 or 2% per annum can impact quite dramatically on capital expenditure.

This serves to highlight the quite dramatic impact a change in average construction tender inflation percentages can have on a project and the potential for construction tender inflation to have a very serious impact on the capital outturn costs for heavily serviced, complex projects in the healthcare sector.

The National Paediatric Hospital is the largest capital healthcare project undertaken in the history of the state. The timeline from date of cost planning to overall completion is just under 10 years.

The initial construction inflation report undertaken in Summer 2016 took an overview of potential construction tender inflation in the industry going forward from 2016 to 2019 a timespan of approximately 5 years.

This updated report reflects actual tender inflation for the years 2016, 2017, 2018 and more accurate predictions around 2019 and also reflects a period nearer 7 years going from 2016 to 2022.

Allowing for the actual recording of inflation and the current timelines being indicated for the project, indications are that a tender inflation allowance of €341m would be appropriate.

Appendix 6.3

Linesight Industry Report

Strategy | Management | Consultancy

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Irish Construction Industry; Recent Challenges around Contractor Insolvency; Public Contracts and Contract Conditions; Collaborative Contracting and the NPH

National Children's Hospital

Prepared for:
NPHDB

November 2018

Irish Construction Industry; Recent Challenges around Contractor Insolvency; Public Contracts and Contract Conditions Collaborative Contracting and the NPH

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Irish Construction Industry; Recent Challenges around Contractor Insolvency; Public Contracts and Contract Conditions Collaborative Contracting and the NPH

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1. Recent Contractor Insolvencies and Challenges Posed

Recently there has been considerable negative publicity generated with regard to the number of Irish contractors and sub-contractor working on public sector projects in particular, who have become insolvent, and been unable to complete a number of key projects such as schools and other important infrastructure projects.

The problem created by such insolvencies and the inability of contractors to deliver on their contractual undertakings as a result is recognized as a very serious issue both at government level, and by all parties who are involved in the Irish construction industry generally, including of course the end users, for whom such facilities have ultimate been designed and commissioned.

The fallout from the failure of contractors/sub-contractors to complete public sector projects in particular is quite dramatic, with hugely negative implications for many parties. On public sector projects the effects are particularly strongly felt as compared to the private sector, as they must be re-tendered in accordance with EU procedures. On private projects, clients are less constrained and can immediately re-negotiate with the second previous bidder for example, retain and negotiate with existing sub-contractors etc. This is not possible on public sector projects however and bond companies view public sector projects as being high risk for bond providers as a result.

The negative impact of contractors becoming insolvent can include;-

- Projects often being completed years later than they were contracted for. Particularly public works contracts where there is a requirement under EU procedures to re-advertise the project to the contracting industry and undertake extensive new selection and tendering procedures.
- Huge disruption and expense caused to the intended users, who often have to remain in sub-standard accommodation and are prevented from disposing of existing facilities, etc. In turn losing valuable potential offsetting revenue.
- Substantial additional costs to have the work completed by alternative contractors, even where performance bonds are in place. In most cases such bonds will only cover a small percentage of the additional cost involved, particularly on public sector works given the timeliness necessary to re-tender etc. Particularly in a high tender inflation environment which exists at the moment.
- The loss of employment in the firms affected.
- The knock on effect to the supply chain/sub-contractors that have not been paid by the contractor who has become insolvent, with the huge ripple effect involved into the wider industry and supply chain. An obvious and dramatic example of this effect can be witnessed by the collapse of the Carillion group.

Irish Construction Industry; Recent Challenges around Contractor Insolvency; Public Contracts and Contract Conditions Collaborative Contracting and the NPH

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This can often result in sites being picketed by disgruntled suppliers etc. and work that was completed and paid for being removed by such suppliers. All very distressing scenes.

- Work which was partially completed now falling into disrepair and ultimately having to be removed. A typical example being partially competed glazing works, which the sub-contractor involved refuses to maintain as they have not been paid by the contractor and whose contracts are automatically terminated, when the main contractor becomes insolvent and cannot meet their contractual obligations to such sub-contractors.
- Very substantial security and monitoring costs as abandoned and often derelict sites are protected whilst the works are re-tendered.
- New replacement contractors often refusing to accept responsibility for work undertaken by the previous contractor, with significant legal and warranty implication as a result

All of the above contribute to huge uncertainty and upset, both personal and financial and it is highly desirable as an industry to ensure procedures and processes are in place to minimize the potential for such insolvencies, whilst also ensuring value for money. Whilst also ensuring fair and reasonable recompense is received for the investment and expertise required in completing and delivering often complex projects, completed over often lengthy periods, in a volatile and highly inflationary market, with limited and scarce resources. It is absolutely in the interests of all parties involved to ensure that the potential for contractor insolvencies in the construction industry are minimized.

The recent collapse of the Carillion group has served to highlight the hugely negative effects of a major construction group becoming insolvent and the disastrous implications it has had for employers, government, contractors and sub-contractors, the supply chain in general, and the wider image and viability of the construction industry. Its impact has not been lost on the contractor and sub-contractors operating in the Irish construction market and ultimately the disastrous consequences that can flow from unrealistic bidding for work and thereafter seeking to recover costs.

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2. The Government Forms of Contract in Use in the Public Sector; Contractor/Sub-contractor insolvencies

The bodies' representing the majority of the contractors/sub-contractors in the industry have suggested that the terms and conditions imposed by the government form of contract, combined with the lengthy timelines around EU tendering have been one of the primary contributors to the abnormally high number of contractors and sub-contractors becoming insolvent in recent times. Such a suggestion would appear to be borne out by the number of contractors who have a particular reliance on public sector projects such as schools experiencing quite severe cash flow and financial difficulties. And ultimately becoming insolvent.

Given the timeline between tendering for public works contractors and when they start on site, it is not hard to appreciate how problems could arise for contractors emerging from a depressed/low bidding market (when they might have tendered for a public contract) and then having to undertake these works in a buoyant/high tender inflation market, when they are actually awarded the contract and given the green light to start on site, often some considerable time later.

The industry also notes one of the primary concerns around the award of government contracts is what they describe as the tendency to award government contracts to the lowest bidder rather than actively assessing the quality, resources, project approach, etc., of the bidding contractors and marking these appropriately.

The challenges posed by the Government Form and the issues raised by the industry were recognized by the Governments Contracts Committee (GCC). And as part of their mid-term review of the contracts they considered and ultimately implemented several key measures to address some of the more pressing concerns and issues raised. Which was recognized by the industry as a progressive and pro-active measure to address some key challenges. This mid-term review was under consideration and had not been fully completed when the tendering strategy around the Children's Hospital was being considered, however a number of the key provisions under review at that time were ultimately incorporated into the contract / tendering conditions for the Children's Hospital.

It is considered by many in the industry that the introduction of the government form of contract combined with contractors tendering in the deeply recessionary times when the contract was introduced, resulted in a situation across the industry, where contractors submitted low tenders to win a contract and then spent the duration of the contract aggressively pursuing claims and opportunities seeking to recover and get additional monies. This was a most unfortunate and undesirable situation as it created an often confrontational and poor relationship between contractors and employers and their design team. It was also a high risk strategy for contractors and their supply chain, as whilst they pursued claims and additional

cost recovery opportunities, their cash flow often came under considerable pressure and there were unacceptable delays (by the main contractors involved) in paying sub-contractors and suppliers who had undertaken work for the contractors involved. It also resulted in quite a number of well-established and reputable sub-contractors refusing to bid as domestic sub-contractors (directly to main contractors) on government work, as was required by the public works form of contract at the time. The GCC did recognize many of these challenges and for example the ability to bid work directly for specialist works to specialist suppliers has now been provided for in the amended government forms.

3. Moves towards more collaborative and contractor de-risked construction contracts

As the construction industry worldwide emerges from a prolonged period of recession, the problems caused by contractor insolvency has become increasingly recognized, with a determined effort to ensure tendering and contractual arrangement to minimize the risk of same, being actively explored and developed.

There has been a concerted drive to facilitate more collaborative tendering and contractual arrangements, with a particular effort to ensure measures which will facilitate early contractor involvement and risk/ gain reward provisions.

This has resulted in measures such as two stage tendering and target cost arrangements becoming increasingly prevalent, particularly on large and complex infrastructure projects, which in most cases are undertaken over substantial time periods. Contract conditions such as the NEC 3 and 4, target cost contracts, which are extensively used in the UK on large/complex infrastructure, generally adhere to the principle of two-stage tendering with extensive periods built in to facilitate contractor input around methods of working/programme, design development etc. Ultimately working to establishing a jointly agreed target cost, with pain/gain sharing mechanisms built-in to the process. But the actual works themselves often then being valued on an open book, cost reimbursable basis, after actual contract award.

On large infrastructure / civils projects in Ireland, where there are a number of particular challenges around establishing the full extent and scope of the works, the use of the NEC form of contractor has been considered and approved.

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4. Considerations around the NPH and tendering / contract provisions

As the largest healthcare capital project undertaken in the history of the state the need for developing particular tendering/contractual strategies to encourage tendering interest and ensure a process which would be viewed as collaborative was realised at an early stage.
This in turn resulted in extensive and very positive collaboration with the GCC (Governments Contracts Committee), who recognised the challenges a project of the size and complexity of the Children's Hospital would face in attracting contractors with the skill and capacity to undertake it.

Whilst the public form of contract was to form the basis of any contractual arrangement, substantial amendments and concessions were agreed to try and ensure the contract would not be viewed in a particularly negative light, with too much risk on a project of this size, with the timelines involved being moved to the contractors.

In light of the comments earlier around timelines on EU / public sector tendering and the risk this can pose for tendering contractors, a few key milestones on the Children's are worthy of note.

- Tendered Summer 2016
- Start on site for approximately 20% of the contract late 2017
- Start on site for 80% of contract scheduled for early 2019
- Bulk of high value and complex mechanical/electrical works taking place principally over the years 2020, 2021, and into 2022 (4 to 6 years after the contract was tendered originally by them in 2016). All during a period of unexpectedly high inflation in the Irish Construction Industry
- Overall project completion in 2022, some six years after the tender date.

Unfortunately the years of 2016, 2017, 2018 and in all likelihood 2019 were years of exceptional and unprecedented construction tender inflation. The extent of which was not fully appreciated or predicted by most observers in the industry, who while anticipating sustained tender inflation growth did not anticipate the extent of this

To put this in perspective from the beginning of 2016 to the end of 2022, recorded tender inflation and predicted modelling suggests Irish construction tender inflation (on a compounded basis) will have risen by 126%. Reflective of an industry emerging from a sustained period of recession, to an industry which is now extremely buoyant and struggling to meet demand. With a workforce and skillset greatly reduced as a

result of the sustained recession noted. All resulting in huge inflation pressures on contractors and sub-contractors.

Despite the substantial amendments permitted to the public works contract on the Children's Hospital, several large overseas and international contractors still viewed it as a high risk contract for them and declined to become involved in the tender process itself, despite being invite to attend workshops and briefings on the projects. One of the largest UK hospital contractors who applied and was selected to tender withdrew from the tender process having had the opportunity to fully assess the tender documentation and contract provisions.

Those who declined to participate, despite the amendments to the public works contract, highlighted it as being in their opinion, still a high risk contract form for them and one which posed an unacceptable financial risk to their companies. They advised that in the UK market they were principally tendering on the NEC form, where the financial risk to their companies was greatly reduced and the process in many cases permitted them to recover their actual costs where it could be shown they were incurred properly and reasonably and their actual tender was used primarily only for the calculation of pain/gain sharing mechanisms.

5. Contractor Strategies Behaviour in the Second Stage Process on the Children's Hospital

A second stage process on a major construction project will of its nature involve, design development, pursuit of value engineering targets, clarification on products and samples/ sample rooms, design input from specialist sub-contractors who have a design responsibility under the contract (e.g. the cladding, sprinkler, medical gases, sub-contractors, etc.),. These are all core principles of two stage tendering.

Where such developments result in additional quantities for various elements of the work being incurred, contractors are entitled to recover additional costs. It is becoming increasingly apparent that the main contractor/sub-contractors who tendered on the Children's Hospital are extremely concerned around the impact the very overheated construction market is having on their tenders prices submitted in 2016 and that given the size of the Children's Hospital, they have stated that they believe it has the potential to be severely damaging to their firms financial wellbeing. Availability of resources for example, and the demand for these limited resources from large commercial projects in the wider economy are already resulting in challenges for resourcing the programme peaks on the project and at this point the contractors involved

are looking for substantially increased programme timelines to undertake the project. These have been assessed at the moment with regard to their validity and supporting documentation.
The two stage process of its nature is intended to be collaborative, but given the contractors/sub-contractors heightened concerns around the financial viability of the project for them, in an overheated high inflation construction market, it has become less collaborative than one would have wished for.

Contractors view the requirement of a fixed price GMP agreement being reached in late 2018 (tendered in 2016) as having a number of significant risks for them.

- After GMP they have greatly limited rights to recover extras and additions as would have been the norm under the standard form of contract. After GMP they will be entitled to recover clearly defined scope changes only. This contrasts with, and limits an established (and unfortunate) pattern of behaviour on government contracts undertaken over the last 8 years, whereby contractors have often submitted low bids and then used all available opportunities over the contract period (and several years after practical completion during the final account period) to pursue opportunities for extras and claims.

- As such with a GMP scheduled to be agreed in late 2018, on a project scheduled to be completed in 2022, and with a final account which under normal contractual arrangement could be anticipated to extend into 2023/2024, contractors are undertaking a root and branch review of all information, drawings, risks, issuing RFI's etc. The main contractor for example has argued that they are being instructed to compress a normal 5 to 6 year process on a large and highly technical project into a very challenging 9 month pre GMP engagement period and as such take a view on and predict issues/ risks etc. which would normally unfold and which they could then address over a much greater period.

- The construction market, over this period, resources available, tender inflation are all viewed by contractors and sub-contractors as more high risk and unpredictable than ever.

- Issues such as the industry SEO (Sectoral Employment Order) have been introduced by way of legislation. Contractors across the industry argue that this has and will have significant impacts on their cost of labour. But recovery under the government form of contract at the moment is not viewed as being permissible.

In this environment and with the risks in the market and the GMP as expressed by contractors/sub-contractors on the Children's Hospital, there has been a significant impact on the contractors/ sub-contractors approach to agreeing a GMP.

- Contractors are reviewing and assessing all documents and potential future scenarios, effectively looking at what might be claim/extra opportunities which would normally unfold for them over a much lengthier period.

- Contractors are issuing a large number RFI's (requests for information) seeking clarification or further detailing of details/design. All perfectly understandable and to be anticipated under a two stage process. However where such normal clarification/detailing is provided, in many cases contractors/sub-contractors are arguing that this represents a new element of work and their

original rates for the work tendered in 2016 are no longer applicable. And that in such a scenario current market rates/quotes from the actual market should be obtained and used. The employer/design team on the other hand would have a strong preference to use star rates based on the original tender rates where appropriate. This has had a number of very negative effects on a GMP process to be completed in a limited timeline. Firstly contractors are refusing to agree and sign off on many rates that involved design clarification/minor development and secondly they are insisting on tendering such items of work back to the market, which is time consuming and slowing and delaying the GMP agreement process.

- The downside and undesirable nature of this is highlighted in particular around the VE exercise undertaken by the design team. As part of the second stage process the employer and design team identified VE opportunities which they committed to look at delivering. However when drawings were changed to pursue these VE opportunities contractors claimed they were no longer bound by tender rates and that they could revert to the market. In nearly all cases claiming that efforts to deliver VE had instead resulted in additional costs, even where the design team were adamant the VE changes had greatly reduced the costs of the original detailing. This situation become so severe that it was decided not to give the contractor an opportunity to increase rates by way of well-intentioned VE changes and simply run with the original detailing for the purposes of obtaining a GMP. And thereafter (post GMP) look at how VE opportunities might be delivered.

- Contractors are assessing and reviewing all potential opportunities, which might traditionally under a more traditional government contract unfold over a reasonable lengthy contract period on site. And are presenting them now and arguing that they must be assessed and reasonably valued under the GMP process.

- Contractors are reviewing all programmes and float in a highly conservative manner and in light of what they view as an overheated construction market which may struggle to provide the resources necessary to deliver the project on time and on budget.

- Contractors are not willing to sign up to any packages, where they feel there is an exposure on rates/risk to them, even where the design team feel they have been properly valued in accordance with the contract provisions. They are in many cases using the arguments around design clarification/ response to RFI's to argue the original rates are no longer applicable, even as a basis for updating them.

- This has resulted in a situation whereby a large number of issues, and more than anticipated are being referred to the Independent expert, for resolution. But this has become now a very large and time consuming exercise for the Independent Expert. However on a positive note the involvement of the Independent Expert has proven to be a very successful provision of the contract conditions in getting these issues resolved and incorporated into a GMP

In justifying their approach to this process the contractor (as noted earlier) argues they are being requested do compress a 5 to 6 year process into a 9 month period, in a highly volatile construction market and that of its nature this requires them to anticipate and resolve now issues that might be expected to unfold over this lengthier period. An exercise which they argue imposes a huge risk on them, which ultimately given

the size of the project has the potential to cause serious damage, potentially to their firms longer term viability. With what they consider very serious risks to their workforce and shareholders.

6. Potential Implications of Contractor Insolvency on the Children's Hospital

In the event of contractor insolvency on a government project with EU tendering requirements, the contractor's contract will be determined (in most cases work will already have stopped on site in any case). Thereafter the site must be made safe with appropriate security put in place to prevent theft / risk to the public and also against sub-contractors/suppliers, etc. who have not been paid coming on to site to remove work completed and materials.

As the work will be tendered under EU requirements, new advertisements in EU journals must be placed, contractors shortlisted, tendered to etc.

For a project of the size and complexity of the Children's Hospital, if there were contractor insolvency, there would be a requirement to survey the work completed, compile new tender documents to reflect the survey and the works still to be completed, whilst adhering to EU requirements around advertising the work, selecting and scoring contractors. The timeline to undertake all of this would in all likelihood add a further two plus years to the overall contract duration. A significant factor both time and cost wise in a highly inflationary construction tender market Below we set out other areas of cost risk and further additional timelines that would in all likelihood result in a substantial extra costs, which would be in addition to those note above.

For the purpose of this exercise we have assumed a scenario whereby any difficulty on the project occurs whilst the frame is largely complete and the building is say 30% enclosed.

Security costs for up to 2 to 3years whilst the work is re-tendered to the market.	€7M to €10M
Protections and regular maintenance of the existing partially completed works to prevent damage and deteriorating (as far as possible).	€ 8M to € 15M (depending on stage contractor enters insolvency)
Costs associated with inspecting the existing works (often involves detailed structural testing to satisfy potential future tendering contractors), assessing works still to be done, preparing new tender documents, re-tendering in	€ 30M to € 50M

accordance with EU requirements, selecting contractor/sub-contractors.	
Extension of existing client teams, rental of office space etc.	€ 15M to € 25M
Premium to be paid to new main contractor to take responsibility for existing works completed to date by previous contractor (in actual reality this can be very difficult to resolve and often compromises are required which impinge on warranties etc. at the end of the day).	€ 20M to € 25M (insurances may be required)
Premium to be paid to new sub-contractors who are required to undertake new works and who must also take responsibility for partially competed service undertaken to date, again in reality this can be hard to achieve).	€ 6M to €15M (again insurances may be required)
Risk around need to remove partially completed works. For example a substantial risk would relate to the cladding on several fronts. The partially competed cladding may have been badly compromised by exposure for 2+ years while new contractors are identified) ; new sub-contractors may refuse to warrant the existing cladding ; they may be proposing a new cladding system which is not compatible with the one in place. The costs therefore under this heading could be over quite a range.	€ 10M to € 60M
Legal/ dealing with Liquidators / Issues with unpaid sub-contractors taking legal action etc.	€ 6M to € 8M
Impact of a potential two year delay in getting a new contractor to undertake the works. Assuming going back to tender to new contractors (utilizing information from 2nd lowest tenderer in assessing potential new costs)	€ 320M

The above suggests a potential range of € 422 M to € 528 M

for abortive, disruption and inflation costs in the event of contractor insolvency at a critical stage in the construction process and having to re-tender and identify a replacement contractor. These costs would be in addition to the agreed/original contract sum (previously singed off with the original contractor)

The above serves to highlight the huge disruption, delays and additional costs which inevitably flow from a major contractor insolvency. In actual reality standard bond amounts on government projects where contractor insolvency occurs at a critical stage in the project, only cover a small percentage of the additional and abortive costs which flow form such an event. There is a performance bond provision on the


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