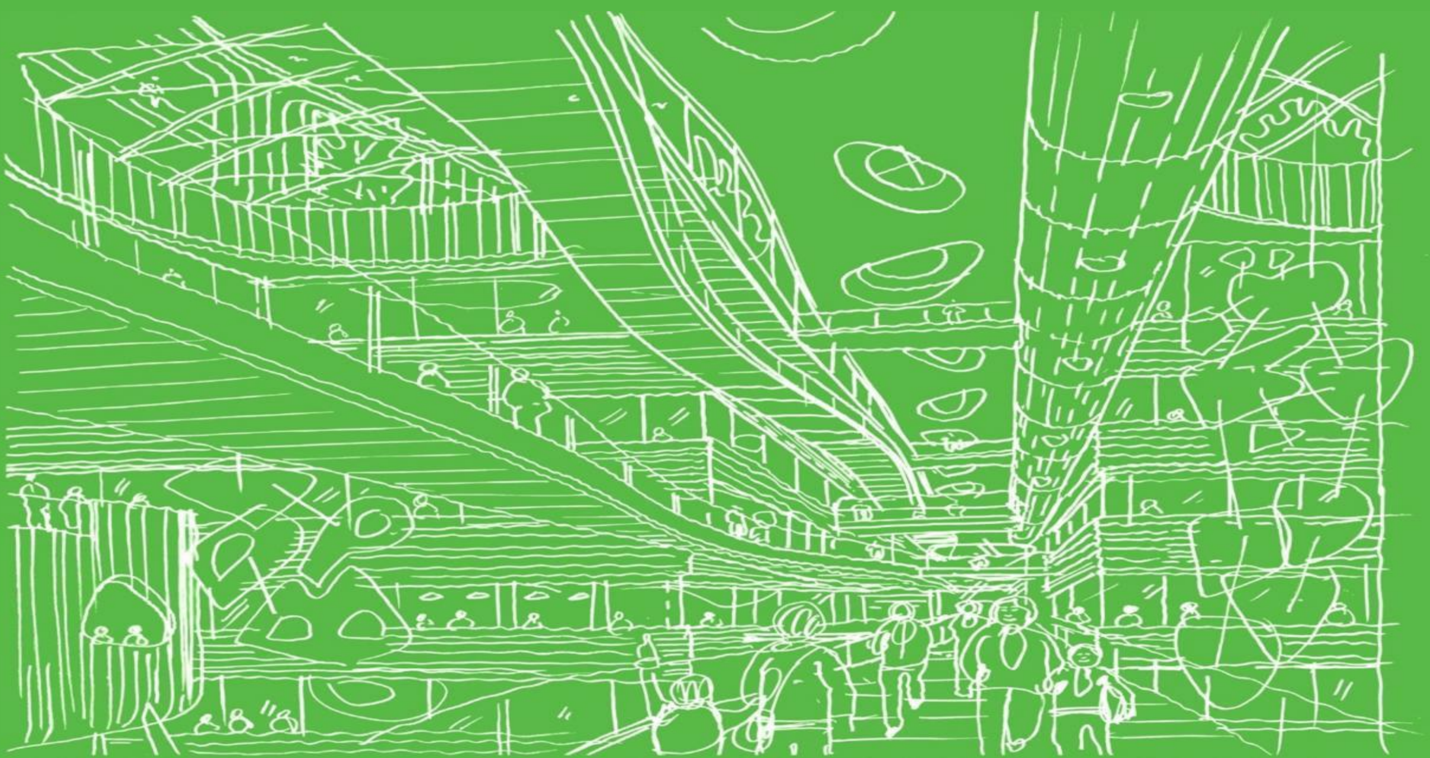
National Paediatric Hospital Project

Planning Application



ethos ENGINEERING

National Paediatric Hospital Project

M&E Engineering Report

14_D110 NCH satellite Centres - Connolly Hospital

July 2015

FIRST ISSUE – Rev 02

ethos
ENGINEERING

National Paediatric Hospital Project

M&E Engineering Report

14_D110 Satellite Centres- Connolly Hospital

CURRENT ISSUE			
Issue No:	First Issue – Rev 02	Issue Date:	28nd July 2015
Sign Off	Originator:	Checker:	Reason For Issue:
Print Name:	Ciaran Berkeley Peter Farrell Mark Jordan	Colm Devin Paul Tighe	Planning

PREVIOUS ISSUES (Type Names)				
Issue No:	Date:	Originator:	Checker:	Reason For Issue:
First Issue Rev 01	22/07/15	CB	PF	Planning w/Comments
First Issue Rev 00	03/07/15	CB	PF	Planning

Executive Summary

This report has been prepared to document the development of the preliminary Mechanical and Electrical services design for the proposed NCH Integrated satellite Centres at Connolly Memorial Hospital campus in Blanchardstown, and at Adelaide and Meath hospital campus in Tallaght.

The design process has been undertaken with input from the National Paediatric Hospital Development Board (NPHDB), the appointed design team, and it has taken account of the existing hospital services, as known to date.

Table of Contents

1. Site Development

1.1. Proposed Site

The proposed site for the new integrated children's hospital at Connolly is positioned to the right of the main hospital entrance. The area is currently a green area, with very little existing landscaping.

The building will be a three storey paediatric day hospital; containing critical care areas such as urgent care, a fracture clinic, radiography and consulting suites. The Connolly hospital will also contain a dentistry facility, including two number operating theatres.

Existing services in the local area, as well as required enabling works are detailed below.

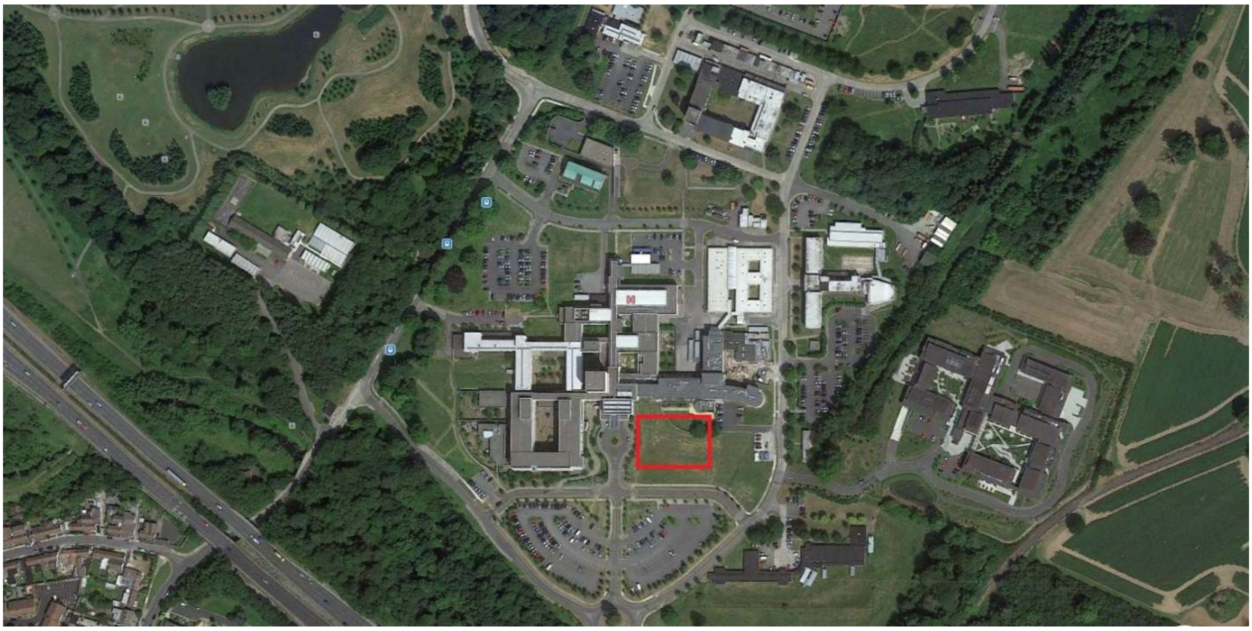


Figure 1 - Site Location

1.2. Enabling Works

As part of the proposed integrated satellite centre an initial enabling works package will be completed. We have developed the Mechanical and Electrical works on information provided by the current utility providers, and the local Technical Services Department (TSD). During the design process a specialist survey contractor may be required to provide verification on the survey information. A selection of surveys has already been completed on site. This includes a detailed survey by Apex, as well as surveys of the existing natural gas, electrical power, and ICT.

1.2.1. Existing Site Services

The host hospital has existing site services which surround the hospital which are as follows,

- Natural gas
- ESB
- Electrical power distribution

It is not expected that there will be any Mechanical or Electrical site services diversions required on proposed site.

Full details can be seen on Ethos Engineering drawing 14_D110-ME1000 – Site Services.

Natural Gas
The Gas Network Ireland supply enters the Connolly Hospital Campus at the back of the site in the North West corner and distributes around the campus to a number meters at various locations / buildings.

Power
The hospital electrical demand is served by means of dual ESB network connections from Finglas and Ballycoolin 110KV substations. These 110KV substations connect to the hospital at Medium voltage 10KV. The hospital is supplied and linked via 5No private MV 10KV ring main substations listed below and located around the hospital campus.

- Central Substation located at the rear of the site
- North Substation
- Northeast substation
- East Substation
- South Substation

ICT
Currently the main hospital is a private WAN severed by 2 vendors (Vodafone and Eircom) Vodafone incomer is located on the roof by means of radios on the water tower structure which provides diverse routes to the existing coms room. A diverse feed telco incomer is provided by Eircom via underground ducting to the main hospital.

Site Lighting
The existing site lighting comprises of 8meter top post lighting column located within the carpark and private roads.

1.3. New Incoming & Site Services

As part of the new development new natural gas, electrical power and ICT services will be provided to the integrated satellite hospital.

Capital contribution may be required by utility companies. This is generally a % of the incurred costs. For example Gas network Ireland would require a standard contribution of 30% of all capital costs, including reinforcement; as well as a supplemental 'economic test' contribution over a set period of time.

Full details of incoming services can be viewed on Ethos Engineering drawing CH-EEL-E-DR-XX-00-1000.

1.3.1. Natural Gas

It is proposed to tie into the main gas network on the eastern side of the campus and extend it to feed a new boiler plantroom within the integrated satellite centre.

The exact tie-in locations will require further analysis by Gas Network Ireland.

Full details can be seen on Ethos Engineering drawing CH-EEL-E-DR-XX-00-2000.

1.3.2. Power

The Integrated satellite Centre shall be fed from the Eastern substation which is served from an existing 10KV MV ring main unit located within its own dedicated room. The existing MV Switch serves 1No 1600kVA oil transformer with space left for a future transformer within the same room, from here it supplies a Low voltage switchboard complete with bus coupler for future Low Voltage extension within a dedicated room adjacent to the transformer room.

The LV distribution boards for the Integrated satellite centre shall provide dual A & B LV cabling supplies to provide resilience to the Integrated satellite Centre.

A shutdown will be required to the east substation LV distribution board side to facilitate connections of both the new diverse LV cabling termination and the new connection of the side B LV distribution board.

1.3.3. ICT Network

Facilities for Public Telecom Operators (PTO) are proposed to provide direct connectivity between the new NCH Integrated satellite Centre and the National and Regional Paediatric Centres.

The internal Structured Cabling System (SCS) shall be a fully integrated design to provide the physical connectivity and resilience for fixed, mobile and wireless ICT systems throughout the new facility.

It is proposed to bring new telecom supplies into the MER and SER via diverse routes. Additional chambers and duct routes shall be provided co connect the MER and SER to the Telco's network. All new ducting shall be sub ducted to allow future expansion.

Full details can be seen on Ethos Engineering drawing 14_CH-EEL-E-DR-XX-00-2000 – Site Services.

1.3.4. Site Lighting

Existing and new external lighting will be relocated during the road alignment at the main road, main entrance and carpark area.

1.4. Building Services Design Strategy

The mechanical and electrical services design will be developed to fully compliment the building aesthetics and form, the future occupant's requirements and the environmental and sustainable design targets.

1.4.1. Plant Strategy

The plant strategy for the integrated satellite centre is indicated on Ethos Engineering drawings 14_D110-SK01 to SK05. The key areas are as follows:

Natural Ventilation

Current calculations show that the majority of non-clinical spaces with external walls will be naturally ventilated. This includes consultancy and therapy spaces, but will not cover high density meeting rooms or clinical spaces such as treatment rooms. This will impact on the overall size of the mechanical plant.

Plant Areas

The main plant areas will be internal on the second floor (heating & water services), and the remaining plant is located on the first floor roof.

LV Switch Room & Medical Gas Storage

These areas will be located on the ground floor.

Generator & Fuel Storage

The NPHDB have advised that the generator and fuel storage will be sited at roof level of the integrated satellite centre.

Future Expansion

Future expansion of services has been omitted due to cost. Further discussions will be required on 'future-proofing' the plant areas.

1.4.2. Fuel Strategy

The existing hospital campus is currently fuelled by natural gas, and it is intended to maintain this strategy for the integrated satellite centre.

Back-up heating supply is confirmed as part of the design. This will require dual fuel boilers (natural gas & oil), and a fuel storage tank. The fuel storage will also serve the back-up generator for the integrated satellite centre.

1.4.3. Redundancy & Resilience

Main equipment and services deemed critical to service will be a minimum of N+1 redundancy. This can be achieved by selecting multiple units to prevent a single point of failure, or by providing replacement parts. Currently this includes the following items:

- Heating: boilers, fuel supply, main pumps
- Ventilation: AHU supply fans, Extract Fans
- Medical Gas: Primary, Secondary and Tertiary supplies
- Primary Electrical Distribution

1.4.4. Noise & Attenuation

Noise protection from M&E equipment will be designed by a specialist consultant. Measures will be taken in design and selection to ensure that breakout noise from main plant is not excessive. Duct attenuation will be required for internal attenuation, and possibly attenuated louvres around external plant. Anti-vibration springs and mats will be utilised where necessary.

2. Mechanical Services Systems

2.1. Ventilation

The design intent for the new integrated satellite centre is to maximise the use of natural ventilation. To this end we shall, in conjunction with the architects and the design team, assess the likelihood of overheating for each space to check what areas can be served via natural ventilation. This analysis will be completed using IES thermal modelling software.

Following the completion of this we shall assess the ventilation openings required to ensure that building regulations are adhered to.

Where spaces are internal and without openable windows mechanical ventilation will be required. This will be delivered by heat recovery air handling units located in the roof top plant area. Air handling units will be provided, in line with requirements set out in HTM 03, will be provided for clinical spaces. This includes

Toilet areas, dirty utilities and cleaners stores will be provided with a dirty exhaust system, by mechanical means. En-suite bathrooms will also be provided with mechanical exhaust systems to ensure appropriate ventilation rates are achieved. Toilet extract fans which exhaust air from multiple toilets shall be provided with twin fans operating on a duty / standby basis.

Isolation rooms will be provided with their own standalone systems to prevent any contamination of other areas.

2.2. Comfort Cooling

Areas that are naturally ventilated are designed to maintain comfortable internal temperatures using the provided opening.

Cooling to clinical areas will be via the AHU and a dedicated cooling battery.

All other areas will be served by a central air conditioning system. This includes internal rooms, and rooms with high internal loads, such as meeting rooms and telecom rooms.

2.3. Heating

A new heating system will be provided within the proposed integrated satellite centre. High efficiency natural gas fired boilers will be located in this plantroom and will generate low temperature hot water, LTHW, which shall be pumped through the building to the various heating appliances, such as radiant panels, low surface temperature (LST) radiators, air handling units etc. The boilers will be configured in a duty / standby arrangement. Secondary heating circuits will be provided with duty / standby heating pump arrangements. A backup system will be considered, such as dual fuel boilers, LPG or oil.

The building will be predominantly heated using radiant panels, which will have a dedicated heating circuit. Stair cores will be heated using LST radiators. The specific type of heating to be utilised within the remainder of the building will be dependent on a number of factors including building use, ventilation type and hours of operation. This will be developed further in the detailed design phase.

The estimated heating load is 600kW. This is based on a rule of thumb calculation based on proposed floor areas. A detailed thermal model will need to be carried out to confirm final loads.

2.4. Water Services

A mains water connection will be provided under the civil engineering package from the existing site mains water system into the integrated satellite centre. This will be extended to deliver mains water to the drinking outlets and sinks within the building and shall also provide water to the cold water storage tanks. If required a mains water break tank will be provided with a mains water booster pump to ensure there is sufficient mains water pressure throughout the building.

Cold water tanks of sufficient capacity to provide 24 hours of storage will be provided in the water tank plantroom. This tank will be divided to accommodate maintenance shut downs.

Hot water will be generated in dedicated hot water Calorifiers which will be either direct gas fired or will utilise LTHW heating coils as the primary energy source.

The hot, cold and mains water will be piped through the building to the various outlets in an efficient manner to minimise dead-legs. The hot, cold and mains water systems will be designed in line with current legionella guidance.

TMV3 mixing valves will be required for all wash hand basins, baths and showers as required in HTM 04.

The use of a water management system to monitor water flow rates, temperatures and general use shall be considered, however the feasibility of such a system will be dependent on cost.

2.5. Above Ground Drainage

The drainage for the new integrated satellite will be a standard single stack system connecting into ground connections and run back to the nearest access junction. All good practise design will be incorporated, including minimum falls, ventilation, number of connections etc.

The location of the required ground connections will be dictated by the final layouts.

2.6. Piped Medical Gases & Vacuum System

The existing campus bulk oxygen store is located at the eastern end of the hospital. The oxygen supply distributes from this location through the hospital down the main hospital street. There is a back-up liquefied oxygen next to the primary VIE. There is no reserve supply at the hospital.

It is proposed to tie into the oxygen line local to the integrated satellite centre and extend it to feed the outlets within the new integrated satellite centre. This is be subject to a network capacity analysis by MPG / BOC to ascertain the viability of these solutions. If the capacity analysis highlights a capacity issue we may need to provide a local medical gas bottle / dewar store within the new integrated satellite centre.

New medical gases systems will be provided throughout the new integrated satellite centre as dictated by the room data sheets. The exact medical gas requirements for the hospital will be determined with the hospital representatives and the design team as part of the development of the room data sheets. However based on the existing medical gases within the hospital we would anticipate the provision of the following:

- Oxygen
- Vacuum
- Nitrous Oxide
- Medical Air
- Surgical Air

The current strategy is to tie into the existing system and upsize the storage as necessary. A run of pipe back to a larger distribution point may be required. If the capacity analysis indicates that the distribution and storage are not sufficient, and need excessive upgrades, it will be necessary to provide a new standalone system for the integrated satellite hospital.

Recent standards dictate that a third reserve supply of medical gas should be installed in all systems. The host hospital does not have this back-up and there is a risk that by extensively modifying the existing system a reserve gas supply may need to be added to the system. However, we may be able to connect into the existing system, and provide a new reserve supply for the integrated satellite hospital only, providing we do not affect the operation of the host hospital.

Manifold rooms and access to the manifolds shall be set-out as per HTM02 and IS EN 7396. The manifolds and cylinders must be located in a suitable location, either internally or externally. Considerations will be required for space, access, noise, escape routes, ventilation, fire rating, and distance to nearby public areas. Internal locations must be at ground floor level. The size of manifold room will depend on the whether it is possible to connect into the existing, or it is just for the reserve supply.

2.7. Pneumatic Tube System

A pneumatic tube system will be provided in the new integrated satellite centre to suit user requirements, which will be determined with the hospital representatives and the design team as part of the development of the room data sheets. This system will link in with the existing host hospital Pneumatic Transport Systems.

2.8. Building Management System

A new Building Management System, BMS, will be provided. This will be a self-contained system and shall be designed to facilitate the management of the building services equipment within the integrated satellite centre Security room. The BMS system will link into the host hospital BMS system. All alarms and monitoring will be linked back to the host hospital BMS front end.

2.9. Fire Fighting

Firefighting systems will be provided to suit the fire engineer’s requirements and will include local fire extinguishers to IS 291.

3. Electrical Services Systems

3.1. Main Electrical Supply

The hospital electrical demand is served by means of two ESB network connections from Finglas and Ballycoolin 110KV substations. These 110KV substations connect to the hospital at Medium voltage 10KV.

The hospital is supplied from a central 10KV substation which links 5No private MV 10KV ring main substations via underground 10KV ring main cables.

The preliminary electrical load for the national children's hospital integrated satellite centre is estimated at 353kVA based upon HTM requirements.

The existing hospital LV distribution board shall be extended to facilitate the national children's hospital integrated satellite centre power supply. The extension to the LV distribution board can be accommodated within the existing switchroom.

The integrated satellite hospital unit shall be served from the eastern Substation which is served from a 10KV MV ring main unit located within its own dedicated room. The MV Switch in turn serves existing 1No 1600kVA oil transformers located within a dedicated room adjacent to the MV ring main switch room. Future space has been allocated within the transformer room to accommodate a new transformer for connection to the existing MV switchboard.

The 1No oil transformer capacity (transformers TJ) is at circa 12% of the estimated electrical load of the existing 1600kVA oil transformer.

A new 1600kVA n+1 oil transformer to match the existing transformer shall be installed within space made available within the existing transformer room. The existing MV switch board has been fitted with a spare 630Amp ACB for future connection to the new transformer. The installation of the new 1600kVA transformer will provide resilience of power to both the hospital and national children's hospital integrated satellite centre.

A new LV distribution board side B, shall be installed within the future space allocated within the existing switch room. This new LV switchboard shall tie into the existing host hospital LV distribution board side A complete with bus coupler, within this LV switch room.

3.2. Standby Supplies

There are 2No existing 800kVA Caterpillar standby generators sets supplying standby power at MV to the Connolly Hospital campus. The 2No existing standby generators are located adjacent to the primary power station at the rear of the site. The 2No existing standby generators are not acting as N+1, and are operating at their maximum load. The hospital use a load shedding strategy on their current load, whereby the hospital shunt trip out the air conditioning plant in the event of a power failure, to facilitate the electrical load on the existing generators.

The main 2No existing 800kVA Caterpillar standby generators are operational and are approximately 20 years old. The central substation and northeast substation are also backed up by existing local standby generation sets.

The NPHDB have confirmed that a full LV stand-by generation sized to cater for the full load of the eastern substation complete with automatic mains failure will now not be provided to accommodate standby power to the east substation.

Therefore an independent new 500kVA full LV stand-by generator shall be provided to cater for the full load of the integrated satellite centre complete with automatic mains failure. The generator shall accept a 50% load at one step. The Bulk oil storage shall be sized in compliance with HTM guideline for continuous operation. A separate generator and bulk oil storage compound shall be provided in space made available at the rear of the MV substation.

UPS support for full load for 30 minutes duration shall be provided to pharmacy fridges, critical life safety electronic equipment/systems e.g. nurse call system, building management systems, critical IT data systems and fire alarm panels.

3.3. Power Distribution

A new distribution infrastructure of cables, cable containment, LV and ELV distribution centres will be provided in the new integrated satellite centre as per the recommendations of the Hospital Technical Memorandums (HTM) recommendations.

3.4. General Lighting and Emergency Lighting

General lighting to the integrated satellite centre will be provided by LED, fluorescent and compact fluorescent luminaires to achieve the required lux levels and colour rendering properties set out in CIBSE Lighting Guides 2 and 3 relative to individual room types. Supplementary lighting in the form of mobile examination lights and task lighting will be provided to the relevant procedure rooms and offices as appropriate and if advised in the ADB sheets.

Emergency Lighting will be provided to IS 3217 throughout with additional considerations made for the particular use and occupants of the building. A fully addressable automatic emergency lighting central battery system shall be considered for the emergency lighting system, cost permitting. Lighting circuit switching and dimming will be considered on a room by room basis where different levels and control of lighting are required where the use of each room varies.

3.5. External Lighting

External lighting will be provided / amended around the building, the main entrances, vehicle routes, pedestrian pathways, and fire tender areas in accordance with CIBSE design guides.

3.6. General Services

General Services throughout the integrated satellite centre will be provided from local Sub Distribution boards and serve essential/non-essential general services socket and power outlets as required and advised in the ADB sheets.

Power sockets, telephone and data outlets shall be grouped to provide safe access and co-ordinated with agreed furniture layouts.

Medical sockets will be provided in accordance with the recommendations of the ETCI guides and as identified in the ADB and schedules.

3.7. Fire Alarm System

The fire alarm system for the new integrated satellite centre will be fully integrated with the existing hospital system. The existing Morley fire alarm system is at full capacity, modifications shall be made to the existing fire alarm system to cater for the communication link with the new hospital integrated satellite centre.

The proposed Fire Alarm design and strategy for the integrated satellite centre will be developed in line with IS 3218 L1/M, the relevant HTM (HTM 05-03) guidance documents and will satisfy the requirements set out by the local fire officer/authority.

The system will consist of manual and automatic fire detection devices (Manual Call Points/Break Glass Units, Smoke/Heat Detectors) and alarm/signalling devices (Sounder/Strobes). The security controlled doors will automatically open on the activation of an alarm.

Detection will cover all en-suites, bathrooms, and ceiling void spaces irrespective of the void depth. A full cause and effect will be developed with the design team and approval by the fire consultant.

3.8. Nurse Call / Cardiac System

The nurse call system in the new integrated satellite centre will be provided in each department and will enable efficient communication and staff working.

The nurse call system shall meet the EU standard VDE0834 and the relevant HTM. All information will be displayed on wall or ceiling mounted displays visible to all staff.

The master station console for nurse's stations will have display and answering/communication with single rooms having speech and terminal units. Each terminal unit will have two way speech, cardiac, assist and presence functions.

Cardiac, assistance calls reset buttons to be incorporated into the bed head trunking.

The nurse call system will be easily modified and flexible in terms of accommodating future requirements. It will have a pager system interface with a staff attack facility. The number of pagers and charging stations will be advised by the ADB sheets.

3.9. Intruder Alarm & CCTV System

An intruder alarm system will be provided in the integrated satellite centre security room for all areas occupied for less than 24 hours per day in accordance with EN 50131. The existing hospital Intruder alarm and CCTV system is at full capacity.

The existing Intruder alarm and CCTV system shall be interfaced with the existing Intruder alarm system central station located on the ground floor of Connolly hospital.

A security IP based public CCTV system will be provided to monitor the external grounds entrances/ exit and exterior areas.

Public security monitoring will be linked back to and recorded at the main campus security room with no links to the medical CCTV system.

3.10. Access Control

Access control devices will be provided to allow easy access from circulation area and working areas. The access control shall be interfaced with the existing hospital Salto system. They will be provided as per the ADB sheets and will protect against unauthorised use by restricting access. The access control devices on doors will automatically open on the activation of the Fire alarm.

3.11. Medical CCTV System

Medical CCTV (if required) will be provided in ward as identified by the ADB sheets and will assist in managing challenging behaviour of patients through the distant monitoring. Medical CCTV will have a recording facility for medical monitoring.

NPHDB to confirm if Medical CCTV is deemed necessary in the Integrated satellite Centres.

3.12. Patient Information Systems

Patient information systems will be provided incorporated into the bed head trunking as detailed in the ADB sheets.

3.13. ICT System

An integrated ICT system for the integrated satellite centre will be provided in-line with the NPHDB strategy and vision, and in partnership with the clients ICT team, to support both the clinical and business needs for the new NCH Integrated satellite Centre.

The system shall specifically support the applications and associated transmission distances described in the industry standards.

In-line with the National Paediatric Hospital Development Boards (NPHDB) strategy and vision, and in partnership with the clients ICT team, an integrated ICT system will be designed to provide a secure and reliable network to support both the clinical and business needs for the new NCH Integrated satellite Centre.

The ICT infrastructure will be flexible, adaptable with expansion for future growth built-in, utilising robust high quality equipment and the latest proven technologies.

For maximum reliability and minimum downtime self-contained; power backed up ICT Main and Secondary Equipment Rooms (MER/ SER) are proposed to be provided within the new NCH Integrated satellite Centre to cater for ICT equipment and linkages to the other NCH Centres and the existing site services.

It is proposed to provide the following connectivity between the new and existing ICT rooms, via separately and diversely routed links, so to provide multiply layers of resilience to the network infrastructure. Spare capacity to house the passive and active equipment associated with links is available at present in the existing ICT rooms.

- Fibre backbone links between the new NCH Integrated satellite Centre ICT MER, SER and the existing Hospital Main ICT Rooms on basement level.
- Multicore copper backbone links between the new NCH Integrated satellite Centre ICT MER, SER and the existing Hospital Main ICT Room on basement level.
- UTP copper backbone links between the new NCH Integrated satellite Centre ICT MER, SER and the existing Hospital Main ICT Server Room on on basement level.

It is proposed to provide multimode fibre, single mode fibre and multicore copper backbone links between the MER and SER.

The Critical Care Unit and Medical Unit shall be fed from the MER and SER to provide resilient data points to critical areas.

Facilities for Public Telecom Operators (PTO) are proposed to provide direct connectivity between the new NCH Integrated satellite Centre and the National and Regional Paediatric Centres.

The internal Structured Cabling System (SCS) shall be a fully integrated design to provide the physical connectivity and resilience for fixed, mobile and wireless ICT systems throughout the new facility.

New duct routes shall be ran to connect the MER and SER to the existing telco ducting on site. This shall consist of one route from “Telco A” to the MER and a separate and diverse route from “Telco B” into the SER. The MER and SER shall house a dedicated cabinet reserved to house the telco incomer.

The cabling installation shall comply with ISO IS14763, EN50174 and TIA/EIA 569. It shall also comply with the channel performance of the proposed new editions of TIA/EIA 568B, IS 11801 and EN50173 standards.

The internal Structured Cabling System's (SCS) topology shall be a fully integrated design to provide the physical connectivity and resilience for fixed, mobile and wireless ICT systems throughout the new facility. The system will support analogue and digital applications, data, local area networks (LAN), and video on a common cabling platform.

3.14. Lightning Protection

A new LPS system designed to IS EN 62305 will be provided to the proposed integrated satellite centre. A risk assessment will need to be carried out and completed to determine the level of protection required based on the location of the proposed development and value of the hospital equipment involved.

The system will consist of the use of building structure as down conductors with adequate earth electrodes and test points. Surge Arrestors will be provided in all distribution boards on all incoming/ outgoing LV and ELV cables.

4. Sustainability, Energy Efficiency & BER

Healthcare facilities care for the most vulnerable. Sustainable features that apply to hospitals, clinics, medical offices, and nursing homes must address the needs of the ill and recovering, creating conditions that are conducive to healing by alleviating stress, mitigating the spread of disease, providing nutritious food, and improving occupant comfort.

Ethos Engineering will strive to follow the latest developments in the area of Health and Wellbeing in our hospital services design and this will encompass the following areas:

- Air
- Water
- Nourishment
- Light
- Comfort
- Mind

Ethos Engineering sees two justifications to a Bioclimatic Design approach, one a comfort-based rationale and the other and a passive, low energy one. The approach we will adopt on this project is a 'comfort-based' approach where occupant comfort is goal of the M&E design. This will be achieved by some of the following techniques: daylighting, good indoor air quality, radiant heating if feasible, views out, little variation in internal surface temperatures between windows, walls and partitions, floors etc. so as to create little radiant temperature asymmetry, separating temperature controls from fresh air supply systems, sound reduction techniques, glare control, visual lighting design, fundamental water quality.

4.1. Sustainability

Our design will strive for long term sustainable and resource-efficient healthcare and this will be achieved through the adoption of the principles contained in CIBSE TM56:2014 Resource efficiency of building services.

We will advocate the bioclimatic design of the hospital in order to promote the physical, social, cognitive, emotional and spiritual well-being of the children, young people, their families and staff. This can be achieved through the following design strategies

- Optimisation of daylight factors and daylight harvesting
- Provide building occupants with a connection between indoor and the outdoors by introducing daylight and views into the buildings regularly occupied areas
- Connect patients, visitors and staff to the natural environment through views of nature from indoor places of respite.
- Passive solar design
- Good indoor air quality
- Glare Control
- Visual lighting design

Our commissioning and handover process will follow the guidance of BSRIA BG38/2012 'Soft-Landings Core Principles' by providing education and instruction to all staff so that they can complete their tasks with increased environmental awareness and decreasing environmental detriment.

Metering Strategy:

- BEMS shall be installed to automatically read and provide trend analysis to a range of energy / water / airflow meters
- All meters, including those of the Utility supply companies and internal sub-meters shall be automatically read by the BEMS

- the BEMS shall be capable of reading the meters on a continuous basis in order to facilitate trend analysis
- the metering strategy shall be in line with CIBSE TM39, Building Energy Metering

4.2. Energy Efficiency & BER

An A3 Building Energy Rating, BER, is required for this building. This will be demonstrated during the design process utilising results from the thermal model built specifically for the project using I.E.S. thermal modelling software.

The insulation values of the proposed building materials, u-values, will need to exceed the building regulations requirements to ensure the thermal losses and gains through the building fabric are minimised as far as is practicable and affordable.

Building material properties we would anticipate being utilised for this project in order to achieve an A3 BER would be in line items below;

The proposed values are in line with the expected fabric U values and efficiencies predicted for the next revision of Part L in 2016 and in 2018. The 2016 and 2018 revision to Part L will demand a 40% and 60% saving in primary energy respectively over the 2005 baseline (current Part L 2008). The 2018 revision will use the same U values but will likely require an MPEPC below 0.4 (60% saving in Primary Energy) and will require the use of mandatory renewables to achieve this. The fabric U values targeted are also consistent with Part L 2011 Dwellings which achieves the 60% saving in primary energy.

Element	**Proposed**	**Part L 2008**	**Part L 2016 (forecast)**
Roof U-value ($W/m^2.K$)	0.15	0.22	0.20
Wall U-value ($W/m^2.K$)	0.20	0.27	0.21
Floor U-value ($W/m^2.K$)	0.15	0.25	0.21
Window U-value ($W/m^2.K$)	1.6	2.2	1.6
g' value (EN410)	0.4	0.72	0.4
Light Transmittance	71%	76%	71%
Roof light U-value ($W/m^2.K$)	1.6	2.2	1.6
g' value (EN410)	0.4	0.72	0.4
Light Transmittance	71%	76%	71%
Thermal Bridging (W/mK)	0.08	0.15	0.15
Air permeability ($m^3/m^2/hr$)	3	10	7
Lighting Luminaire (lm/circuit watt)	70	65	55
Lighting Load ($W/m^2/100lux$)	2.2-2.4	3.75-5.2	-
Maximum Permissible EPC	0.5	1.0	0.6
Maximum Permissible CPC	0.56	1.0	0.68

Please note these figures are not final design figures and will require further development with the design team such that a cost effective and energy conscious solution are provided.

It will be necessary to employ at least one of these technologies to ensure the building achieves the required A3 BER.

In addition to the items above we would expect that the items below will need to be included in the design with a view to minimising energy use and achieving an A3 BER.

Heating efficiency (seasonal)	97%
Central Ventilation SFP* (W/l/s)	1.8
Cooling (air-conditioned) (SEER/SSEER)	4.41
Heat recovery efficiency	80%
Variable speed control of fans and pumps controlled via multiple sensors	To be provided

*Excluding allowance for heat recovery (+0.3) and HEPA filter (+1.0) where applicable

In consultation with the consulting mechanical and electrical services engineer, the entire design team shall have regard to the achievement of economic energy usage, consistent with the following objectives:

- Provision of adequate thermal comfort
- Minimisation of heat transmission through fabrics and openings
- Minimisation of heat loss due to ventilation and infiltration
- Control and optimisation of heat distribution within buildings by heating installations, ventilation and transmission through fabric
- Maximum use of solar and casual heat gains whilst controlling overheating
- Optimisation of relationship between occupancy patterns, thermal response of building and thermal response of heating installation
- Selection of suitable energy sources and systems with low energy usage/cost, with a low level of flue gas emissions that are harmful to the environment and compliance with current legislation, is required
- Provision of overall building energy management control system as described above together with local controls for building users suitable to the building occupancy and use an instruction with the regard to achievement of economical operation
- Provision of adequate flexibility – recommended 25% - within all systems to allow for future changes and developments
- Provision of adequate standards of workmanship, plant installation and commissioning
- Ensuring that the need for maintenance, monitoring and control is incorporated within the engineering services proposals and communication of these aspects to building users together with adequate documentation and instruction
- Allow adequate walkway access between all items of mechanical plant to allow for routine inspection and maintenance.

SBEM simulations shall be conducted in IES to assist with this process, and to assess the impact of different design options on the BER of the proposed design. Additionally, Renewable and Low-Carbon sources of energy shall be considered with respect to achieving the required A3 BER. The system(s) chosen will be examined using life cycle costing techniques in order to determine the most appropriate solution between the competing options. Full detail of the energy strategy proposed and feasibility study of potential Renewable and Low-Carbon technologies is given in a separate Ethos Engineering document "14_D110 NCH Connolly Energy Strategy Report".

5. Vertical Transportation

The lifts shall be designed and installed in accordance with current standards and building regulations including EN 81 and HTM 08-02.

The lifts need to be scaled to accommodate 4 wheelchairs or one bed with support staff in each car. A service lift will also be required (the service lift should have a close proximity to the disposal holds, and would not impact on the clinical areas). A survey of passenger usage will determine the number of lifts required. Lift size requirements TBC by NPHDB including requirement for dedicated service lift.

Standard controls for lifts shall be enhanced as follows:

1. All bed-passenger lifts shall be infra-red and blue-tooth enabled. Hence, in addition to the standard lift wiring, the lift specialist shall provide cabling for an "in-car" infra-red and/or blue-tooth detector with display unit;
2. Cabling for a relay unit and/or blue-tooth detector device to interface with the standard controls; and
3. Cabling at each landing outside the lift for an infra-red receiver to call the lift.

A personnel and goods traffic analysis will be developed to assist in determining the number, type and location of lifts in the new integrated satellite centre.

6. Applicable Standards and Regulations

The standards, rules and regulations that cover the installation of the mechanical and electrical services and equipment in a building of this type include the following:

Electrical Services

- The Building Regulations
- Building Regulations Technical Guidance Documents
- NHS Health Technical memoranda, HTM, and Health Building Notes, HBN
- CIBSE Guides, Codes and Technical Memoranda
- Local Authority / County Council Bylaws
- Fire Officers Recommendations
- Health and Safety Legislation
- Relevant BS & EN Codes of Good Practice
- Irish, British and European Standard applicable and correct at the design stage
- HTM 06-01 Electrical services supply and distribution.
- BS 8300 – Design of Buildings and their Approaches to Meet the Needs of Disabled People – Code of Practice
- 'National Rules for Electrical Installation Fourth Edition ET 101:2008, Electro Technical Council of Ireland'
- CIBSE Lighting Guides
- BS EN IEC 60034-1 – Rotating Electrical Machines
- I.S. 3218:2013, Fire detection and alarm systems for buildings - System design, installation, servicing and maintenance.
- I.S. 3217:2013, Code of Practice for Emergency Lighting
- Code of Practice for the Design, Selection and Erection of Low Voltage Switchgear Assemblies
- IS EN 61439-2010 – Low Voltage Switchgear & Control gear Assemblies
- S.I. 44, 1993. Safety, Health and Welfare at Work (General Application) Regulations
- 2006/95/EC: The Low Voltage Directive
- 89/336/EEC – 92/31/EEC AND R&TTE Directive 1999/5/EEC: The Electromagnetic Compatibility Directive
- EN12464-1:2002 Lighting of work places – Part 1: Indoor work places
- BS 7430:1998 Code of practice for Earthing
- EN62305 – Code of Practice for Protection of Structures against Lightning.
- HTM 05 – Fire Detection and Alarm Systems
- HTM 06 – Electrical services supply and distribution Part A & B
- HTM 08-03 – Bedhead Services.
- EN 81 Vertical transport and HTM 08-02

Mechanical services

- The Building Regulations
- Building Regulations Technical Guidance Documents
- NHS Health Technical memoranda, HTM, and Health Building Notes, HBN
- CIBSE Guides, Codes and Technical Memoranda
- Local Authority / County Council Bylaws
- Fire Officers Recommendations
- Health and Safety Legislation
- Relevant BS & EN Codes of Good Practice
- Irish, British and European Standard applicable and correct at the design stage
- Institute of Plumbing, Plumbing Services Design Guide 1990
- HTM Guidance Documentation.

ethos
ENGINEERING

Penthouse Suite, Apex Business Centre,
Blackthorn Road, Sandyford,
Dublin 18, Ireland

Phone +353 (0) 1 293 2220
Web www.ethoseng.ie

ISO 9001:2008 EQA QUALITY ASSURED COMPANY
ISO 14001:2004 EQA ENVIRONMENTAL APPROVED SYSTEM
OHSAS 18001:2007 EQA OCCUPATIONAL, HEALTH & SAFETY APPROVED SYSTEM