

# Modular hospital design

*Vice President Jukka Vasara, Granlund Group*



# Jukka Vasara

*Vice President in Granlund Group*

*Director of Granlund Groups' Hospital business*



## **Hospital HVAC design**

- 30 years of project management experience in dozens of hospitals
- Representative of Finland in the European CEN/TC156WG18 standard working group developing hospital ventilation "Ventilation in Hospitals"

## **Clean room design**

- Dozens of cleanroom design projects in Finland, the UK, China, India and Russia
- Representative of Finland in the ISO/TC 209 working group on clean room standards

**IHDA business consortium** consists of forerunners from different areas of healthcare. Together they form a comprehensive offering of the design and construction management of smart, customer-oriented and functional hospitals.



Healthcare  
analysis



Service  
design



Architecture and  
master design



Structural  
design



Modern project  
management



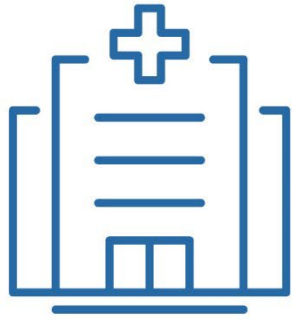
MEP design



Digital solutions

# Investments in Healthcare Projects in Finland

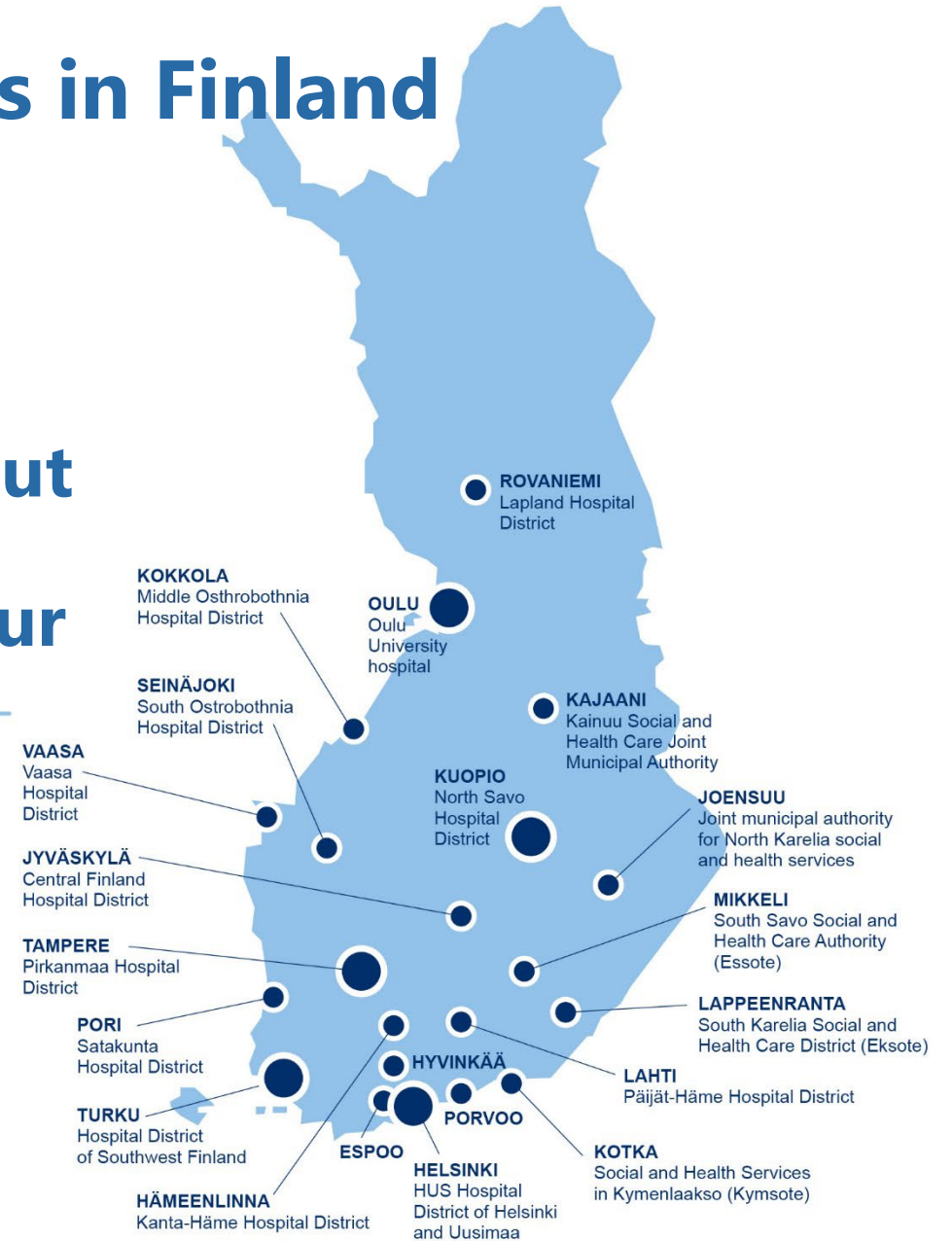
PROJECTS IN TOTAL



**300**  
healthcare  
projects

Building cost  
altogether about  
**10** billion Eur

**IHDA** companies  
have participated in  
most of the projects



# Highly experienced team from Finland



- The leading HVAC, electrical design and building automation company in Finland
- Over 200 hospital designers from personnel of 1,400 experts
- More than 60 years of experience in hospital design projects
- <https://granlundgroup.com>

- One of the largest structural engineering offices and the leading construction consulting company in Finland
- 150 experts in hospital construction, design and integrated project delivery from personnel of 1,300 experts
- Key structural and geo designer in 400 hospital projects during 60 years
- <https://ains.fi/en/>

- One of the most acclaimed Finnish award-winning architecture practices, more than 50 prizes and awards
- 15 highly qualified and experienced architects
- Functionality and unique spatial experiences, as well as profit for clients.
- <https://k2s.fi>

- Raami is an architecture office specialized in hospitals and healthcare and is focused in healing environments and conceptual design with an innovative approach.



- The leading social and healthcare advisory and solutions company in the Nordics
- More than 200 experts in Finland, Denmark, Sweden and the UK
- Over 3.000 customer projects
- <https://nhg.fi/en/>



- Architecture and interior design specialists for public sector buildings, such as hospitals, healthcare centers, nursing homes & wellness centers
- Over 60 highly qualified and experienced hospital architects and designers
- Over 30 state of the art hospital projects delivered globally
- <https://aw2.fi>



- Leading expert in integrated project delivery (IPD-projects) and lean construction from major hospitals to real estate and railway projects
- Over 20 lean construction and integration experts
- 80 IPD-projects in Finland, 67 project alliances
- <https://vison.fi>



# Modular hospital design





# The cost of planning and construction processes are minimal compared to hospital operational cost in 20 years

Careful **service system and functional design** can have a sizable impact on **construction and operating cost** of a hospital – up to 5-15%\*

- 5-12 % in operating cost  
- 380 - 900 M€

**Cost of designing the service system**  
"Ensuring right services and operating model"

~0,5 %



~1,5 - 2  
M€

**Cost of architectural and Technical design**  
"Designing right kind of spaces"

~10 %



~30 - 40  
M€

**Construction cost**  
"Realisation of the functional plans"



\*Architectural and technical design cost ~10%; Construction cost 5 - 15%; Operating cost 5 - 12%

Sources: Aalto University, applied ERDF project Interreg 3C: Network for Future Regional Health Care and process by Skåne Region Fastigheter

# IHDA's modular approach enables alignment of each hospital's capacity for local needs and accelerated design to secure EU funding

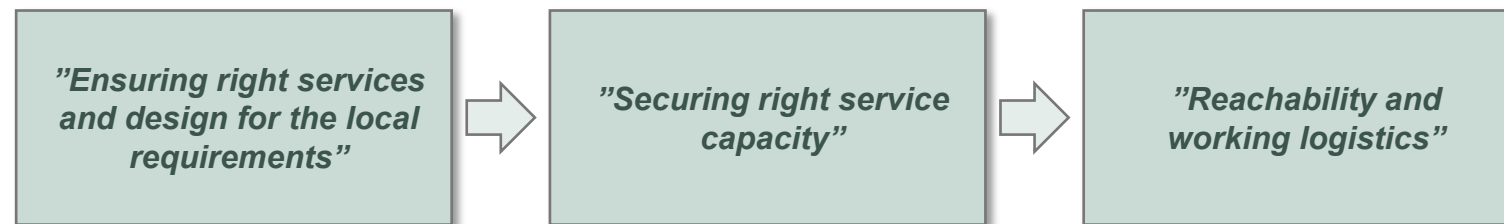
IHDA proposes modular design and construction approach for the preparation and implementation of national hospital network investment program. This helps to fast track start of the implementation program and built perfectly fitting solutions for your needs.

## Implementation of the investment program

During the implementation of the hospital network development program modular approach enables aligning each hospitals services and capacity for the areal needs. This helps to manage amount of overall investment cost for new facilities and a hospital's lifecycle operating cost. Considering operating costs already at the design phase is important as they typical are up to 20 fold to the design and construction costs of a hospital\*

## Accelerated design for fast start

Our approach enables architectural and technical design of the hospital simultaneously with capacities requirements definition. Similarly this allows preparation of the construction tendering documentation together with requirements definition and the design process. This gives a fast start for the construction tendering process and beginning of the construction work to secure EU funding for the first construction projects.



Sources: Aalto University, based on ERDF project Interreg 3C: Network for Future Regional Health Care and process by Skåne Region Fastigheter





# Secure right capacity to match catchment area's population and demand forecast plus scaling the modular hospital to correct size

**Implementation of the investment program**

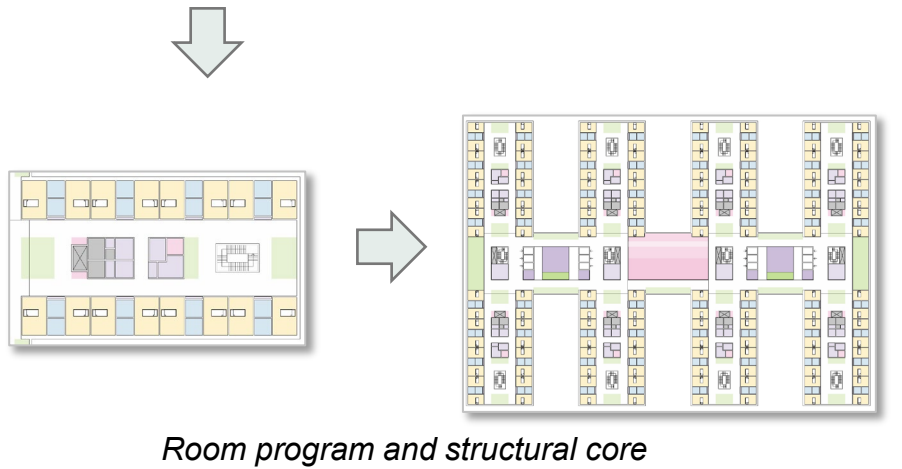
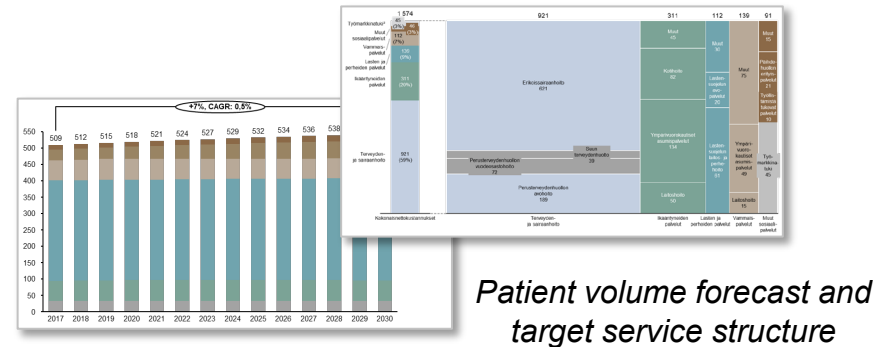
**IHDA's modular approach enables optimising the size of a hospital for the patient volumes and national service structure targets**

- What is the size of the catchment area's population and how to service demand develops during the lifecycle of the hospital
- What are the capacity requirements, optimal spaces per functions and functional layout considering the hospital's role in the service network
- What are personnel needs by profession to operate the hospital

**Accelerated design for fast start**

**IHDA's modular approach allows alignment of a hospital's sizing and layout planning with the patient volume forecast**

- Bottom up – creating room program for the service need by using the type rooms
- Top down – Scaling the logistical, technical and structural core to serve the room program
- Designing future expanding directions from the core



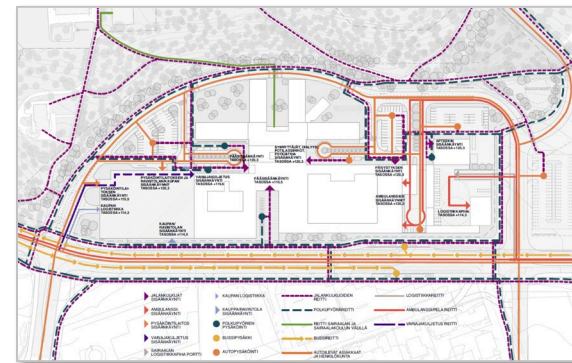
**”Securing right service capacity”**

# Ensure the hospital's reachability and working safe people flows and material logistics together with choosing the correct general contractor

**Implementation of the investment program**

IHDA's modular approach allows flexible logistics solutions based on the local traffic conditions and a plot features

- What kind of traffic infrastructure is in the area and how the hospital is reached using different modes of transportation
- What kind drop of locations and parking facilities are needed and how they can be positioned on the plot
- How are elective, emergency and support services logistics organized on the plot in a safe and working way



*Reachability and logistics plan*

**Accelerated design for fast start**

IHDA's modular approach allows using the BIM model to ensure correct accurate material for choosing the construction company

- Bottom up – detailed mass lists based on type rooms and technical descriptions
- Top down – ensuring that the core together with all the type rooms fit's in the site
- Ensuring correct information for choosing the general contractor



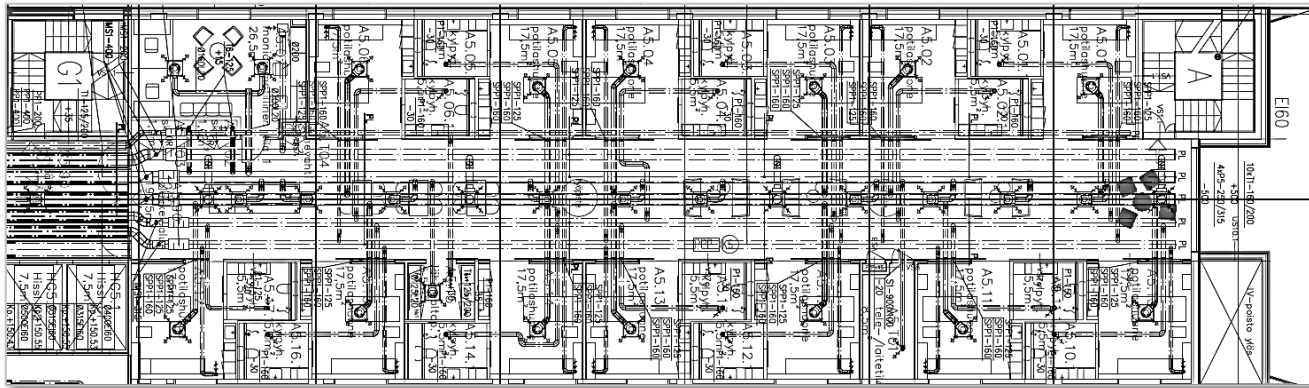
*Massing and detailed mass list*

Class	Sk	Series	Product	Unit	Vol	Area
Chut	275	PK	80K-1-011		8,6	
Chut	160	PK	80K-1-016		10,1	
Chut	250	PK	80K-1-015		6,8	
Chut	310	PK	80K-1-011		21,7	
Chut	400	PK	80K-1-040		2,6	
Chut	500	PK	80K-1-050		16,6	
Chut	610	PK	80K-1-063		0,6	
Chut		SK			1,1	
200x50						
Remd-45	160	PK	80B-45-016		2	
Remd-45	310	PK	80B-45-011		4	
Remd-60	315	PK	80B-60-011		1	
Remd-60	125	PK	80B-60-011		1	
Remd-60	160	PK	80B-60-016		3	
Remd-60	250	PK	80B-60-016		2	
Remd-60	310	PK	80B-60-011		11	
Remd-60	400	PK	80B-60-040		1	
Remd-60	500	PK	80B-60-050		5	
Remd-60	50	SK			1	
Remd-60	310/315/250	PK	80B-1-011-015		1	
Remd-60	400/400/315	PK	80B-1-040-011		2	
Remd-60	500/500/125	PK	80B-1-050-011		2	

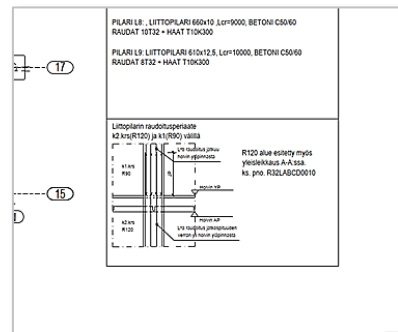
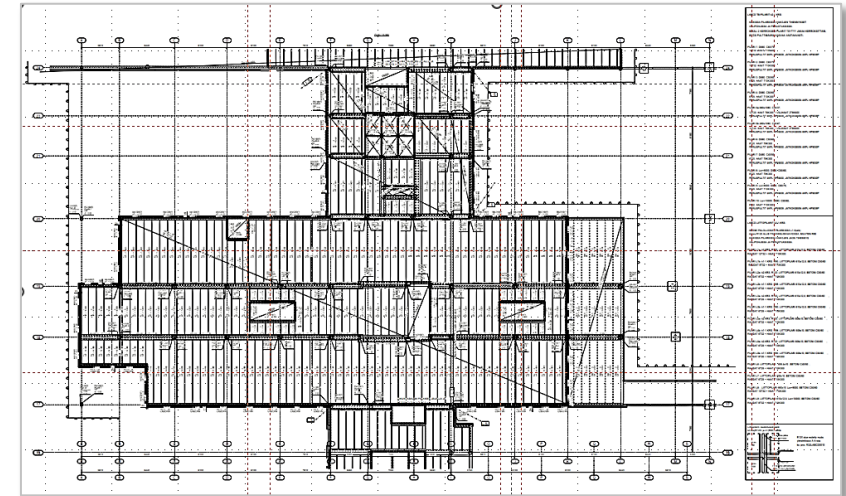
**” Reachability and working logistics ”**

# Examples of technical and structural design documents from IHDA companies' previous hospital construction projects

Technical design



Structural plan



Detail at Tender document

# Modular hospital ward's type rooms

## Type rooms

01 Modular hospital

01.01 WARD

01.01.01 Patient rooms

01.01.01.01 Patient room 2 p

01.01.01.02 Bathroom

01.01.01.03 Patient isolation 1p 14.6/17.8 m2

01.01.01.04 Sluice 6.7/8.2 m2

01.01.01.05 Bathroom shared

01.01.02 Examination rooms

01.01.02.01 Examination room

01.01.04 Employee rooms

01.01.04.01 Office 1-2 p

01.01.04.02 Open office

01.01.04.03 Silent workspace

01.01.04.04 Nursing station

01.01.04.05 Staff canteen/break room

01.01.04.06 Staff wc

01.01.04.07 Phone/meeting

01.01.04.08 Office/meeting

01.01.04.09 Back office

01.01.05 Supporting rooms

01.01.05.01 Storage linen

01.01.05.02 Janitor

01.01.05.03 Storage equipment

01.01.05.04 Utility dirty

01.01.05.05 Utility clean

01.01.05.06 Medication room

01.01.05.07 Storage nursing accessories

01.01.05.08 Kitchen

01.01.05.09 Dining

01.01.05.10 Waste

01.01.05.11 Accessible wc





# Patient room for two patients



VAATIMUSTILAKORTTI		Type rooms	modelspace			
Projektin tunnus	Projektin nimi	Asiakas				
	E3 kehityshanke	AINS Group				
Tunnus	Nimi	Huonenumero	kpl	Tav. ms.	Tav. 0m <sup>2</sup>	
01.01.01.01	Patient room 2 p		28	21,90	613,20	

## GENERAL INFORMATION ☰

Vaatusus Kommentti

The patient's room is the patient's own space during his or her stay in the hospital. You need to be able to place two bed patients in a room. The patient may be self-sufficient or fully assisted. The patient is interviewed, examined, guided and rehabilitated in the room. His condition can be monitored with various monitoring devices and he can undergo treatment procedures (e.g. bladder catheterization, wound treatment) as well as medication and fluid therapy. The patient's clothing and other personal belongings are stored in the room. The patient can enjoy their meals in their room, watch TV, listen to the radio, and socialize with their relatives. Room structures soundproofed to adjacent rooms and hallways. The room must be able to move around with an assistive device (wheelchair, walker). Hand washing facility.

## DOORS, WINDOWS ☰

Vaatusus Kommentti

The room must have a window out (nature light requirement). Visual protection in the window. Free door opening width of at least 1100 mm. Soundproof door. Closed door. Creepy protection. There must be no threshold. There must be no lock on the door.

## SURFACE MATERIALS ☰

Vaatusus Kommentti

Acoustically pleasing sound environment. Easily kept clean surfaces. Surface materials are resistant to detergents typically used in hospital environments.

## AIR CONDITIONING, AIR QUALITY ☰

Vaatusus Kommentti

The room ventilation should be designed so that there can normally be four people (patients, relatives, carers) for a longer period (more than half an hour). The interior temperature of the room should be pleasant.

## WATER AND SEWER ☰

Vaatusus Kommentti

Hand washing facility (not electronic)

## GAS SYSTEMS ☰

Vaatusus Kommentti

In both places of treatment, the possibility of oxygen administration. In both places of treatment, the possibility of suction.

Hand washing facility (not electronic)

## GAS SYSTEMS ☰

Vaatusus Kommentti

In both places of treatment, the possibility of oxygen administration. In both places of treatment, the possibility of suction.

## ELECTRICAL SYSTEMS ☰

Vaatusus Kommentti

Medical devices are safe to use. At both places of treatment, the possibility to plug in at least four medical devices. Part of the plugs in reserve power. At both treatment sites, a USB plug. At both treatment sites, an electrical plug for an electric hospital bed.

## LIGHTING ☰

Vaatusus Kommentti

Lighting with a dimmer. Adjusting the lights on the doorpost and at the treatment site. Nighttime dim light. Safety light to guide going to the toilet at night. Additional light for reading.

## TELE- AND SECURITY SYSTEMS ☰

Vaatusus Kommentti

The patient and staff have the opportunity to call for help by a caller device/caller baton. Audio connection. Possibility to watch TV. Possibility listen to the radio. Callback button for the callback system near the door. Wireless network. Possibility to add a camera surveillance for patient monitoring. Wall clock.

## ICT REQUIREMENTS ☰

Vaatusus Kommentti

Both places of treatment have the possibility to connect two medical devices or computers that can be connected to the information network.

## MEDICAL EQUIPMENTS ☰

Vaatusus Kommentti

Various medical devices are used in patient care, which can be connected to the power outlets (for example, a monitoring monitor and an infusion machine).

## FIXED FURNITURE ☰

Vaatusus Kommentti

For patients own lockable wardrobes. Pool furniture with waste storage.

## LOOSE FURNITURE ☰

Vaatusus Kommentti

Patient bed space reservation 2100 mm x1000 mm. At both treatment sites, space reservation for a patient table.

## ACCESSORIES ☰

Vaatusus Kommentti

Patient locations should be able to be separated by visual protection.



# Operating theatre

VAATIMUSTILAKORTTI		Type rooms	modelspace		
Projektin tunnus	Projektin nimi	Asiakas			
	E3 kehityshanke	AINS Group			
Turnus	Nimi	Huononumero	kpl	Tav. m <sup>2</sup>	Tav. 3m <sup>2</sup>
01.02.01.01	Operating theatre type 1		4	60,00	240,00

## GENERAL INFORMATION

Vaatusuus Kommentti

In the operating room, surgical procedures are performed on a patient who has been sedated or anaesthetized. The surgical team typically consists of at least five people. Aseptic and sterility are emphasized in the operation. The staff wears sterile protective clothing and works in such a way that harmful contamination does not occur in the surgical area. The equipment needed for surgery is gathered around the operating table. In terms of operation, it is important that there is enough room to move around the sterile operating tables. In the operating room, it must be safe to use a mobile imaging device (e.g. C-arm) so that the x-ray radiation does not affect people in the adjacent rooms. In addition to good general lighting, separate ceiling-mounted, movable surgical lights are needed above the operating table. It must be possible to connect devices to electrical plugs or hospital gases from above so that the connection points are easily accessible. The staff must have the opportunity to view different image

## DOORS, WINDOWS

Vaatusuus Kommentti

Operating room doors must be touch-free. Side and full opening functions in the door. The width of the free passage of the patient door is 1700 mm. The width of the free access opening of the logistics door is 1100 mm. The doors must not have thresholds. Door frame protection.

## SURFACE MATERIALS

Vaatusuus Kommentti

The surfaces of the operating theater must be easy to keep clean and must be resistant to conventional detergents used in operating theater cleaning.

## AIR CONDITIONING, AIR QUALITY

Vaatusuus Kommentti

The ventilation of the operating theater should support maintaining the sterility of the operation.

## GAS SYSTEMS

Vaatusuus Kommentti

The following hospital gases are always needed in the operating room: oxygen and compressed breathing air. Depending on the needs of the operation, carbon dioxide, nitrous oxide and instrument compressed air may also be needed. The gas points are placed near the operation area, e.g. in the ceiling supply units. In addition, spare points for both walls on the sides of the operating table. Anesthesia gas extraction points are required in all operating theatres, if necessary, a gas target removal system is planned. Alarm if there is a malfunction in the operation of the hospital gases in the operating room. Possibility to close the entry of hospital gases into operating points of the operating room.

Vaatusuus Kommentti

Electric plugs for ceiling supply unit and side walls. The part of the electrical supply of the devices in use at the time of surgery must be uninterrupted. Part for backup power. Operating room doors must be touch-free. You must be able to film the operations of the operating theater with a ceiling-mounted camera. Separate sockets are needed for devices used by maintenance. The ceiling supply units electrically adjustable in height wall clock with seconds display.

## LIGHTING

Vaatusuus Kommentti

Efficient general lighting in the operating room. In general light, the possibility to choose different situations (e.g. lighting of scoping surgery).

## TELE- AND SECURITY SYSTEMS

Vaatusuus Kommentti

The operating room must be able to make announcements within the operating unit. Warning lights for corridors when the mobile imaging device is in use. Alarm if there is a malfunction in the operation of the hospital gases in the operating room.

## ICT REQUIREMENTS

Vaatusuus Kommentti

ATK plugs for ceiling supply units and side walls. Wireless data network.

## OTHER SYSTEMS

Vaatusuus Kommentti

Reservation for space reservation screen.

## MEDICAL EQUIPMENTS

Vaatusuus Kommentti

Several different medical devices are used in the operating room. Some of the devices are for maintaining vital functions, e.g. a ventilator. Different types of fixed hospital equipment attached to the ceiling are needed in the operating area. The well-equipped operating room has, for example, the following fixed hospital equipment: two operating lights, 2-4 ceiling supply units and 2-4 monitor arms. In addition, there are wall-mounted monitors on both side walls, warming cabinet for intravenous fluids and medicine refrigerator if needed.

## LOOSE FURNITURE

Vaatusuus Kommentti

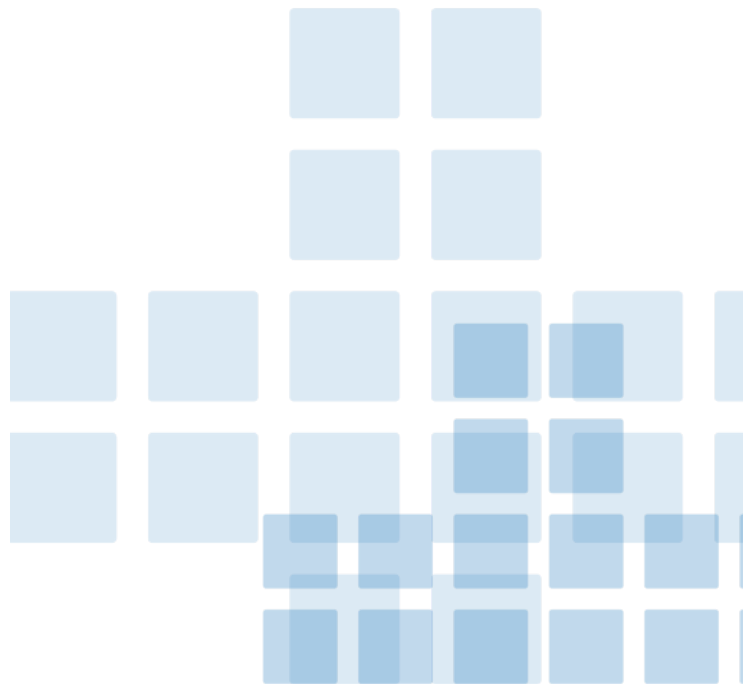
The operating theater must have space outside the operating area for mobile storage furniture.

## FIXED FURNITURE

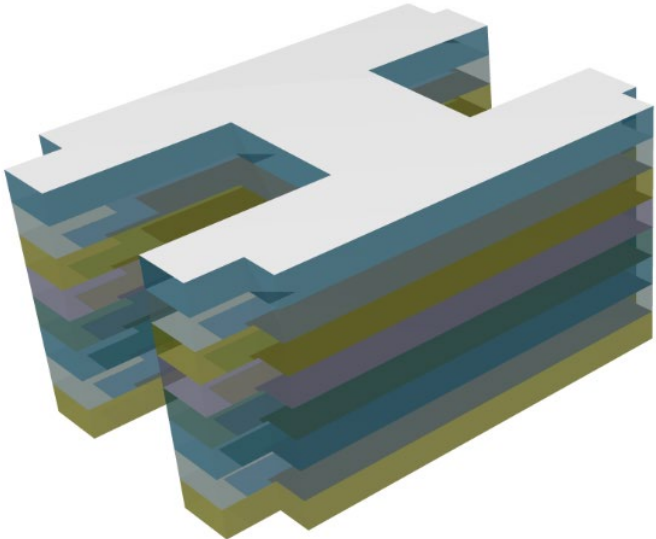
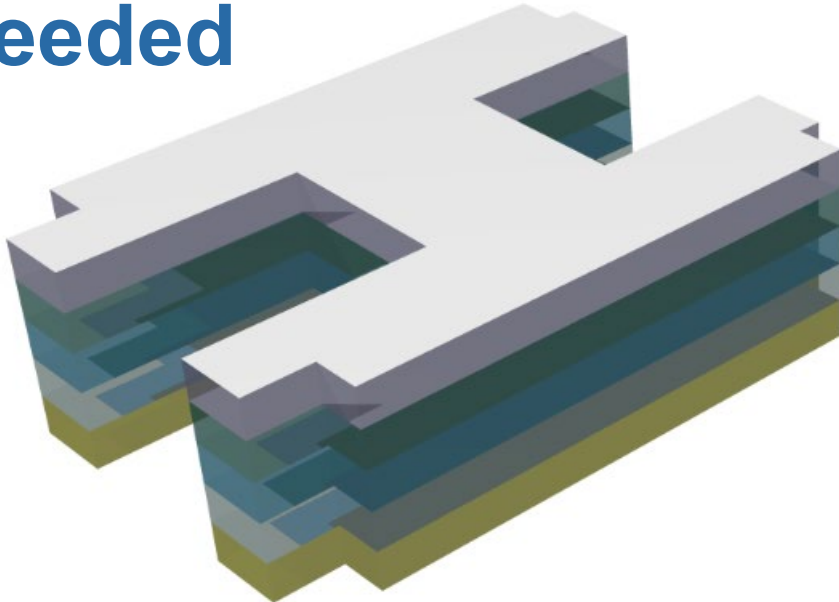
Vaatusuus Kommentti

One walk-through cabinet is needed in the operating room, through which the equipment needed in the operating room can be delivered during the operation without entering the operating room. In the cabinet space for roller coaster,



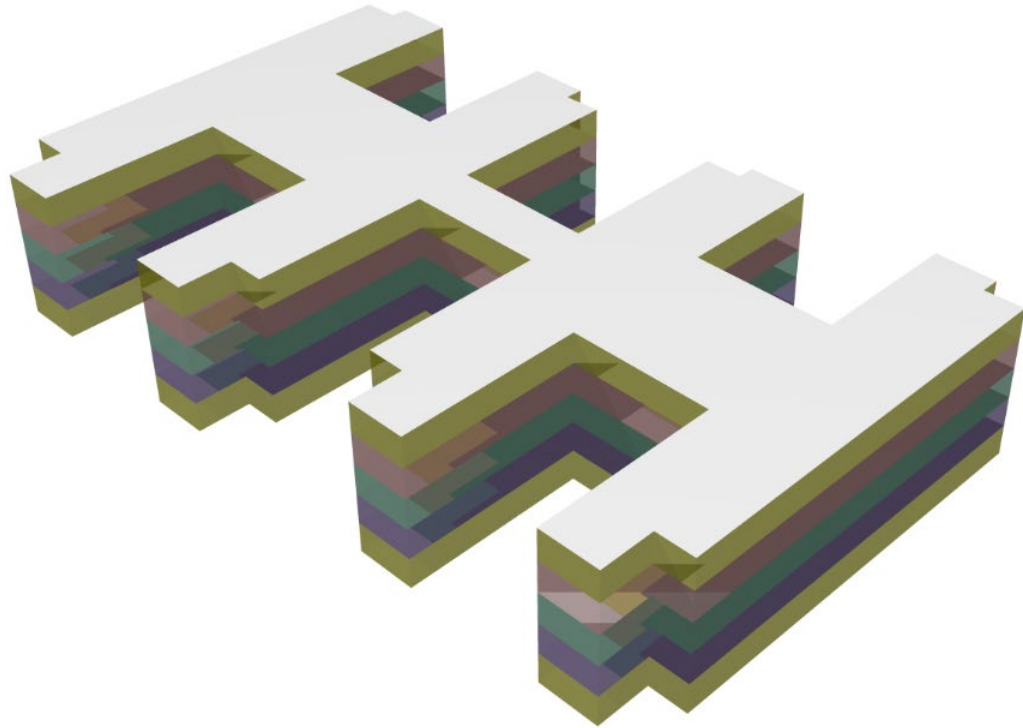


# Duplication of the type section as needed





# Merging the functional needs into a project entity





Granlund-ENG  
Lentol Films



# OYS Hospital of the Future 2030

MEP design

<https://vimeo.com/771087121/238951bb36>

Granlund-ENG



