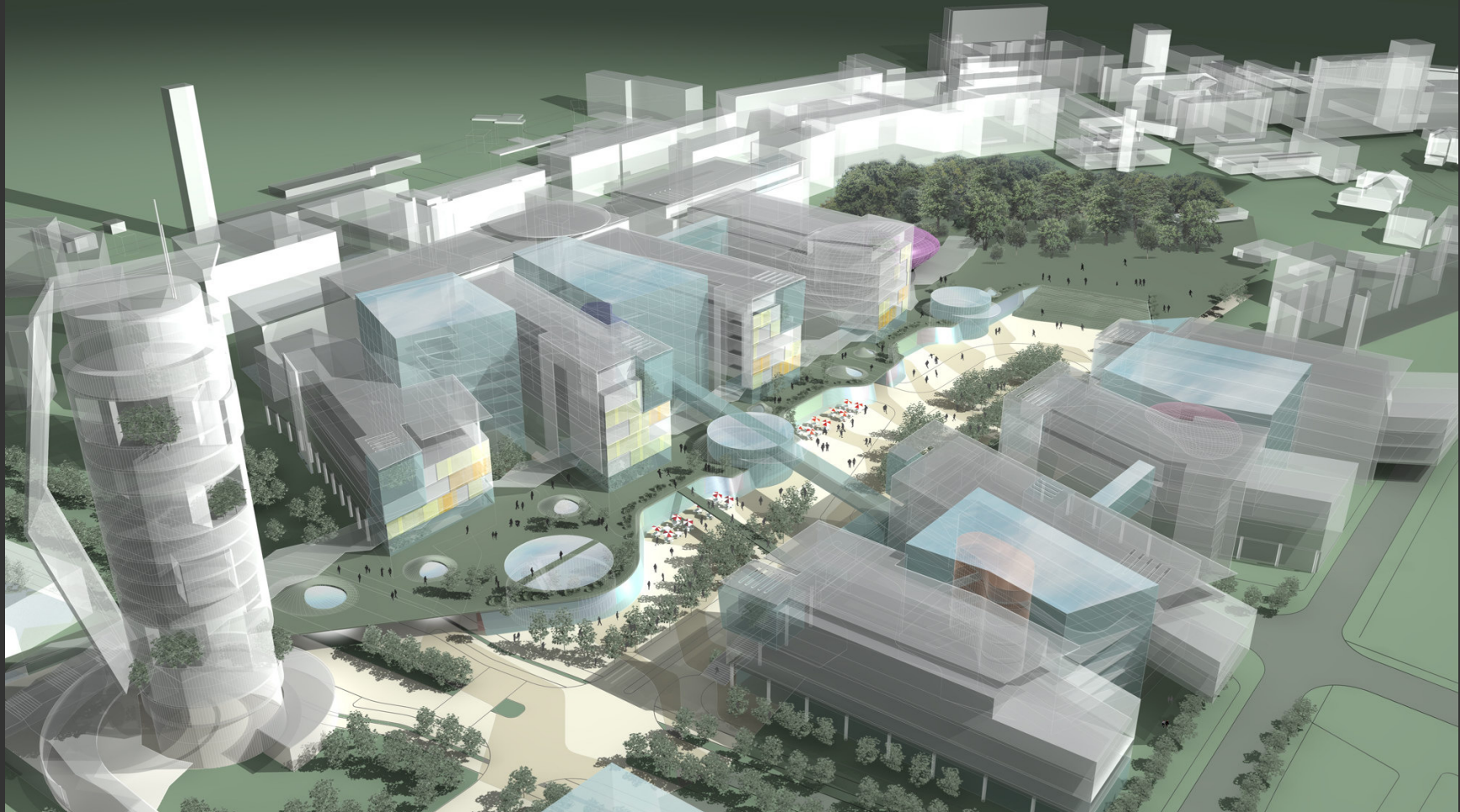


Designing the Hospital of the Future



Bill Rostenberg, FAIA, FACHA, ACHE • Principal and Director of Research • Anshen+Allen

Presentation Framework

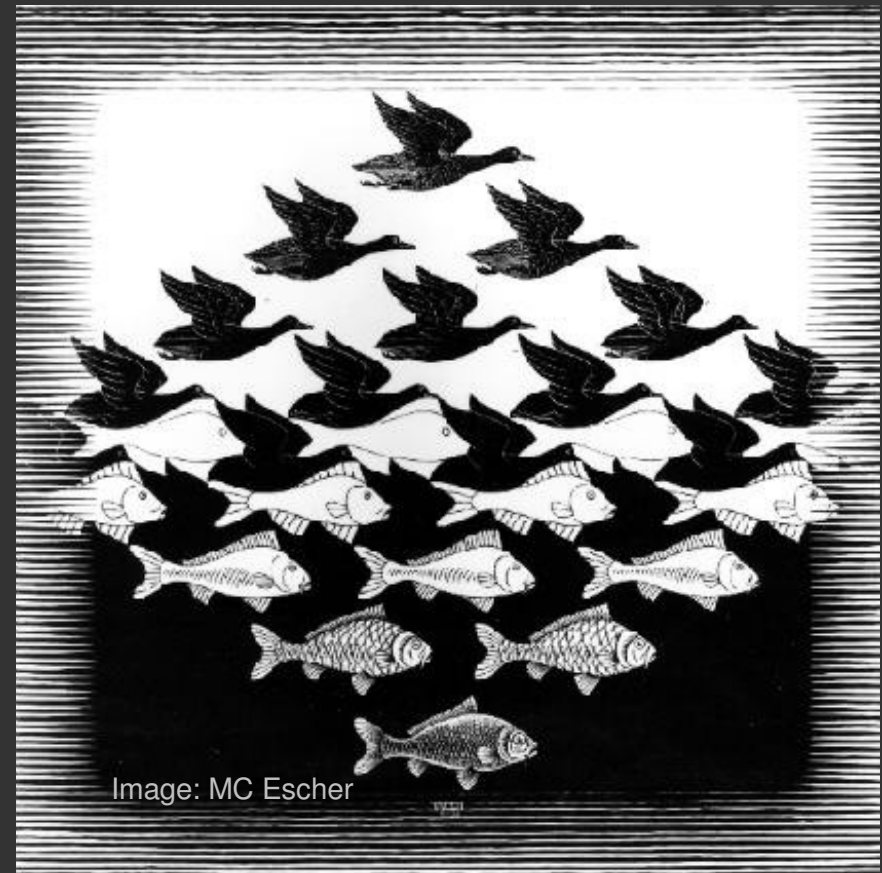
1. IOM & THE ROLE OF THE BUILT ENVIRONMENT

2. INTERSECTING DESIGN DRIVERS

- Sustainable design
- Evidence-based design

3. HOSPITAL OF THE study)

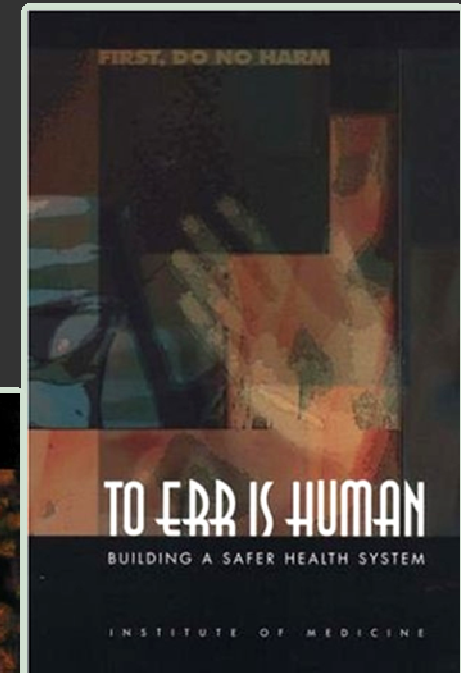
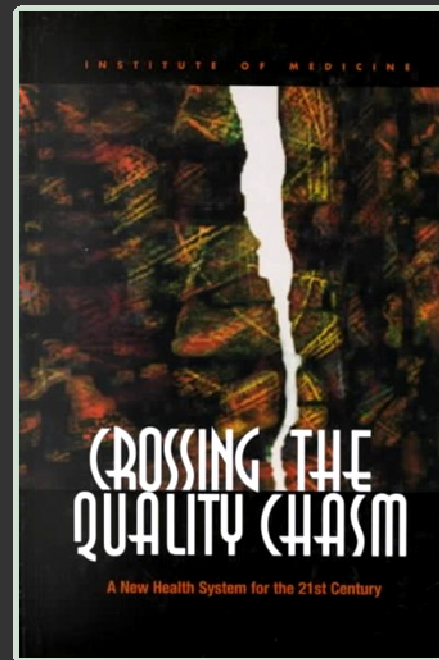
- Patient - centered
- Safe
- Cost-effective
- Flexible / regenerative
- Lean staff / high throughput
- Intelligent



IOM and the role of the built environment

SIX AIMS OF THE IOM

- Patient-centered care
- Effective care delivery
- Equitable care delivery
- Avoidance of waste
- Safety
- Fewer delays; less waiting



IOM and the role of the built environment

SAFETY

- Patient falls / staff Injuries
- Wrong patients / procedures
- Radiation Safety
- MRI Safety



Patient Lifts



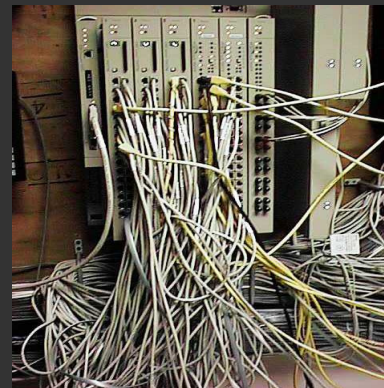
MRI Projectiles

INFECTION CONTROL

- Surgery / Interventional
- Nursing Units

COMMUNICATIONS

- Work spaces
- IT Infrastructure



Smart Bldgs & Equip.



Private Patient Rooms

IOM and the role of the built environment

Traditional Film Reading Room



Soft Copy Reading Room



TRANSITION FROM PAPER & FILM DIGITAL PROCESSES

- Improved diagnostic accuracy
- Reduced physician fatigue
- Fewer repetitive workplace injuries

Healthcare *[Facility Design]* Reform

*sustainable
design*

flexibility

throughput



*evidence-
based
design*

cost

safety

Sustainable Design: improving building performance

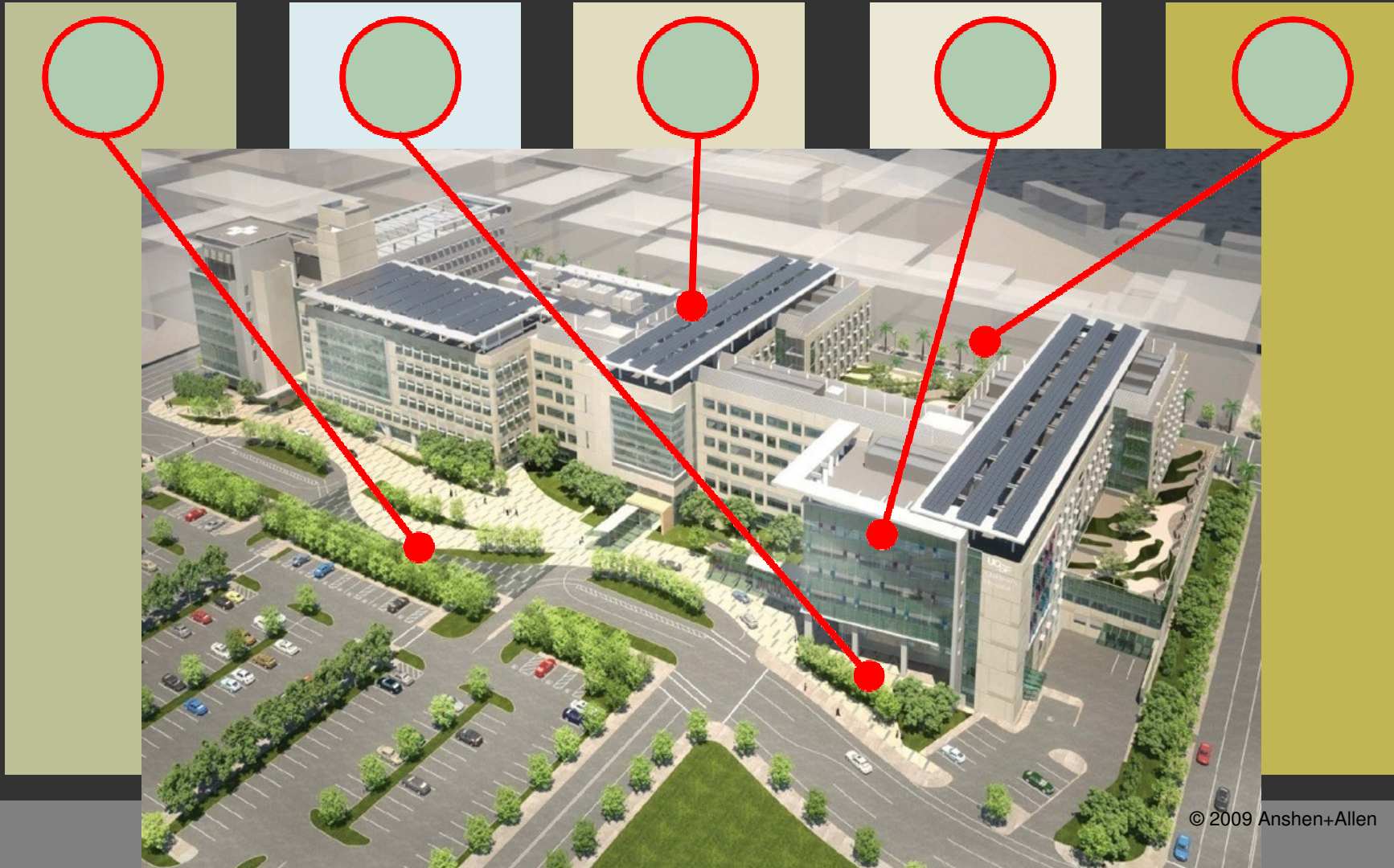
SITE

WATER

ENERGY

MATERIALS

**ENVIRON-
MENTAL
QUALITY**



Evidence-based Design: improving clinical outcomes

SIX AIMS OF THE IOM

- Patient-centered care
- Effective care delivery
- Equitable care delivery
- Avoidance of waste
- Safety
- Fewer delays; less waiting



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edac™

1

An Introduction to
Evidence-Based Design

EXPLORING HEALTHCARE
AND DESIGN

Are Sustainability + EBD Considered Together?

SUPPORTIVE and DISRUPTIVE INTERSECTIONS	Sustain. Design	EBD
<ul style="list-style-type: none"> Day-lighting 	▲	▲
<ul style="list-style-type: none"> Acoustics 	▼	▲
<ul style="list-style-type: none"> Materials and 	▼	▲ Finishes
<ul style="list-style-type: none"> Energy Management 	▼	▲
<ul style="list-style-type: none"> Building Massing 	▲	▼



Infection control & hand-washing



Ceiling lifts in patient rooms



Acuity adaptable patient rooms



Are Sustainability + EBD Considered Together?

POTENTIAL AREAS OF CONFLICT

- Do water conservation solutions compromise incentives to promote hand-washing?
- Does the use of HEPA filters negate energy inefficiency?
- Are principles of Sustainability and EBD valued equally?
- Are they considered in unison?
- What are the best examples of HC projects driven by Sustainability and EBD?

BSA & AIA COF Upjohn Grant

"A growing scientific literature is confirming that the conventional ways that hospitals are designed contributes to stress and danger, or more positively, that this level of risk and stress is unnecessary: improved physical settings can be an important tool in making hospitals safer, more healing, and better places to work."

Chick A. Young, D., et al. (2008) *Qualitative Research on the Role of the Physical Environment in the Design of the 21st Century Hospital: A Case Study in an Academic Hospital*. *Journal of the American College of Healthcare Design*, 10(1), 1-10.



RESEARCH ON
eco-effective design & evidence-based design
removing barriers to integration

abstract

Eco-effective design and evidence-based design are two powerful trends currently shaping healthcare architecture. Eco-effective design addresses the design and operation of buildings to support improved ecological health and indoor environmental quality, while evidence-based design addresses the design and operation of buildings to support positive health outcomes in the built environment through a growing collection of solutions informed by research and practical knowledge. Although several trends within the two sets of design criteria overlap, evidence-based design and eco-effective design are most often executed separately and are considered by many to be at odds with one another. This study will begin to bridge the gap between both goals by proposing a structure through which design teams can effectively and simultaneously integrate them into the design process. The lessons learned will extend beyond healthcare architecture; the perceived eco-effective design/evidence-based design conflict is representative of challenges facing integrating sustainability into other types of projects.

method

An email survey was sent to 50 experts to identify facilities demonstrating exemplary practice in eco-effective and evidence-based design. Web-based surveys will be distributed to administrators in 15-20 facilities identified by this group of specialists, with follow-up surveys and interviews as necessary. Focus groups will generate survey content. The following questions will be addressed:

1. What are the conflicts and synergies between eco-effective design and evidence-based design?
2. What are the successes and challenges of these two design goals in built projects, both individually and in relation to one another?
3. How can design teams effectively and simultaneously address the human and environmental health intentions of both criteria?
4. How can design teams overcome challenges to effectively and simultaneously integrate sustainable design goals with potentially conflicting typology-specific criteria?

participants

- Administrators at identified centers of excellence for both evidence-based design and eco-effective design.
- Some subject hospitals will be identified under both categories; these will be of special interest.

apparatus

Techniques
Web-based surveys, interviews

Infrastructure
Green Guide for hospitals, US Green Building Council's LEED Building for Health, Center for Health Design's Positive Projects®, & Planetary Projects

Principal Investigators:
Bill Rasmussen, Architecture Architect
Mark Rouse, Architecture Architect
Michelle McCleskey Shapley, AIA + Science

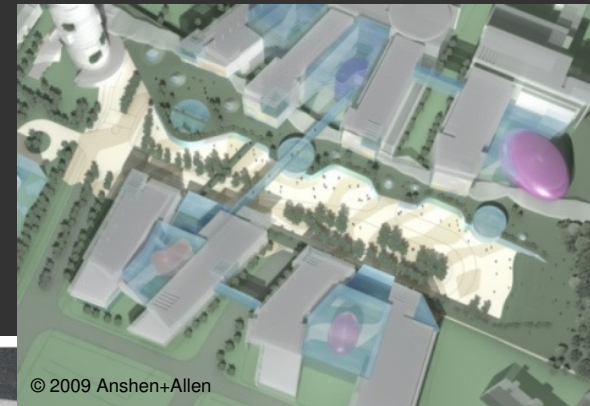
Research Team:
Rachel Grayling, Architecture Architect
Linda Hines, Architecture Architect + Planner
Michael McCleskey, AIA + Science
John Wood, Architecture Architect

Funding:
This project is funded by the Boston Society of Architects, the AIA Board Knowledge Committee / AIA College of Fellows (upjohn initiative) and Anshen+Allen Architects.

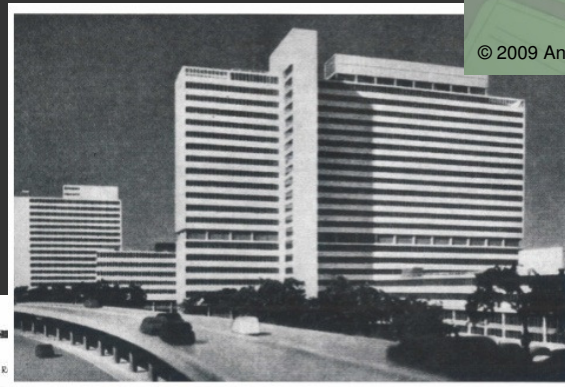
ANSHEN + ALLEN
ARCHITECTS

Building Massing: Daylight vs. Regeneration

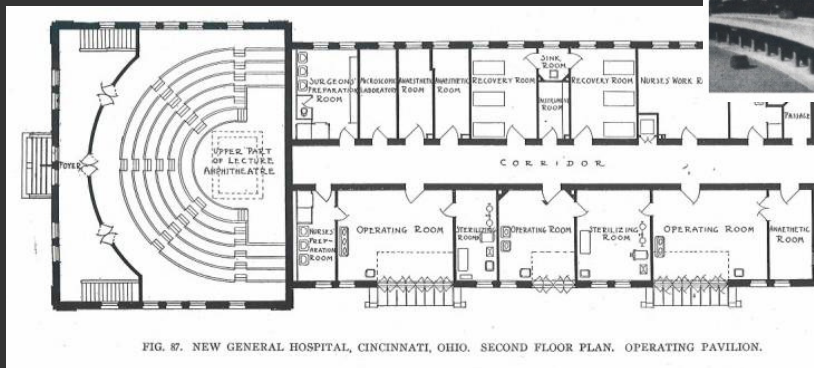
- Narrow vs. Deep Floor Configuration
- Environmental Quality vs. Clinical Efficiency
- Day-lighting Interiors vs. “Regenerative Flexibility”
- Patient towers: narrow
- Diagnostic / Treatment: ???



Present & Future:
hybrid configuration



Hill-Burton Era:
deep configuration



19th and Early 20th Century: narrow configuration

Building Massing: Daylight vs. Regeneration

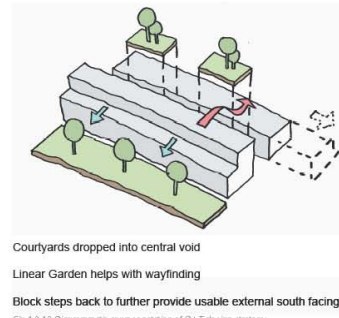
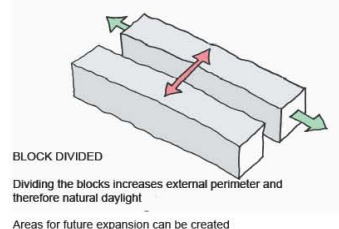
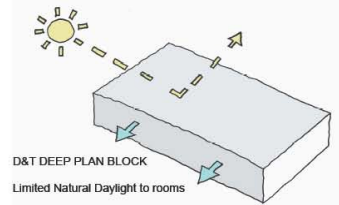
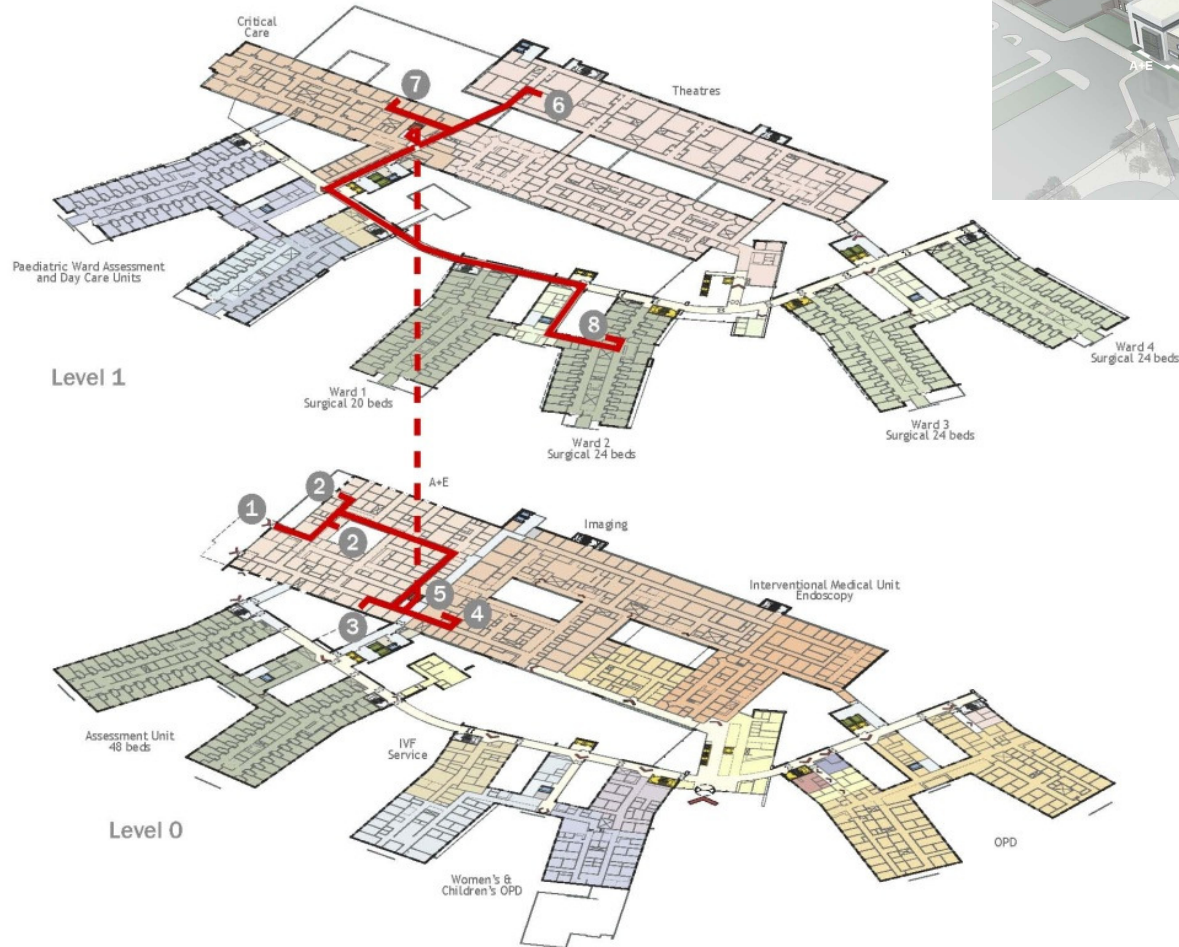
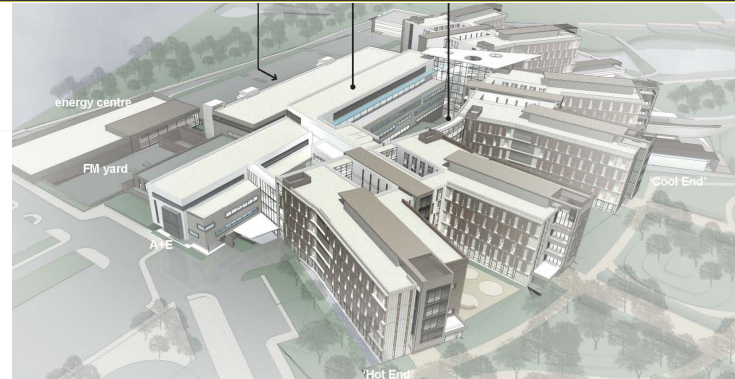
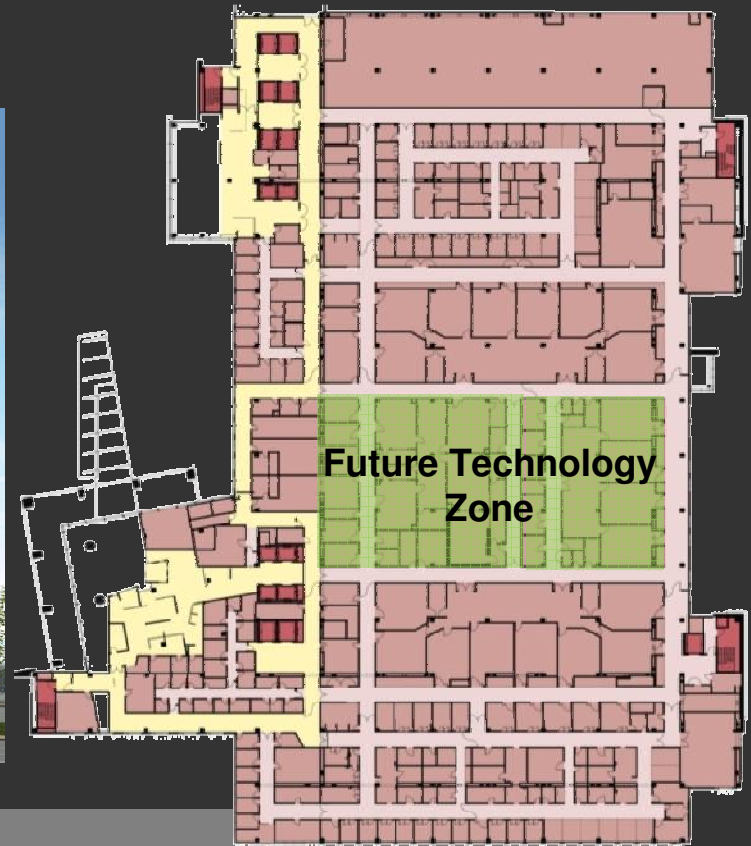
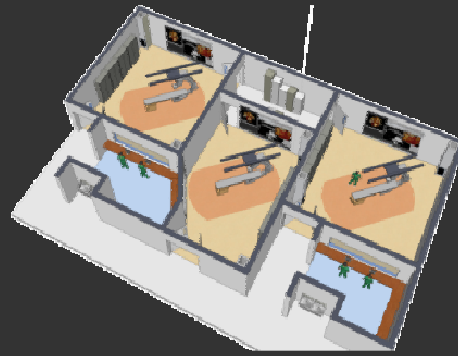
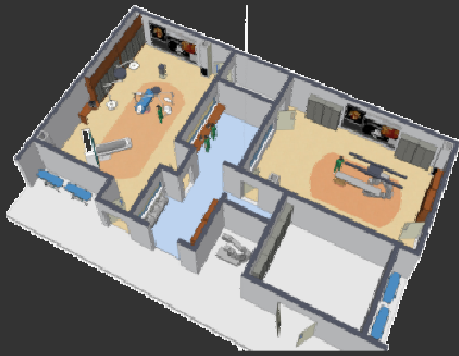


Fig. 1.82 Eisenmann's original

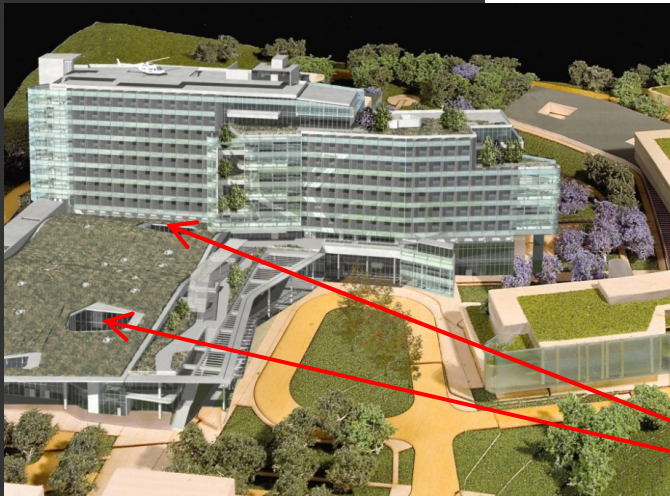
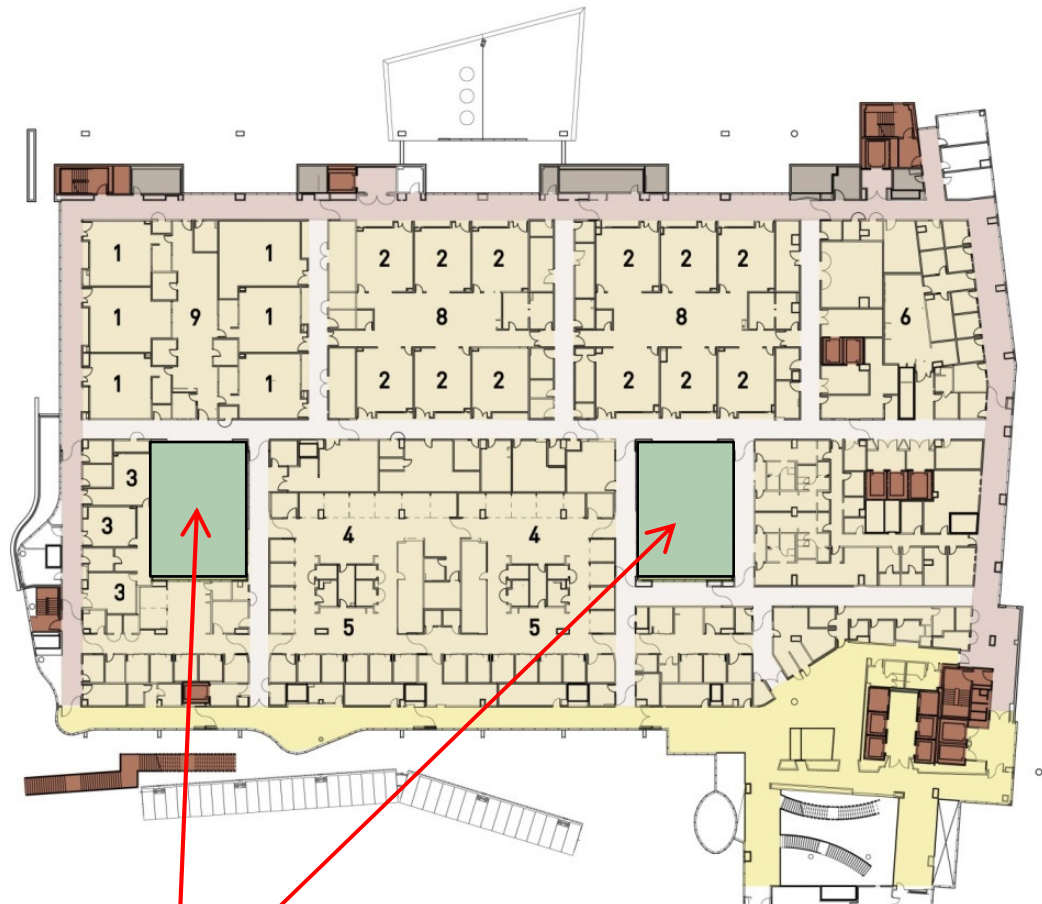
Fig. 1.2.13 Diagrammatic representation of D+T design strategy

Building Massing: Daylight vs. Regeneration



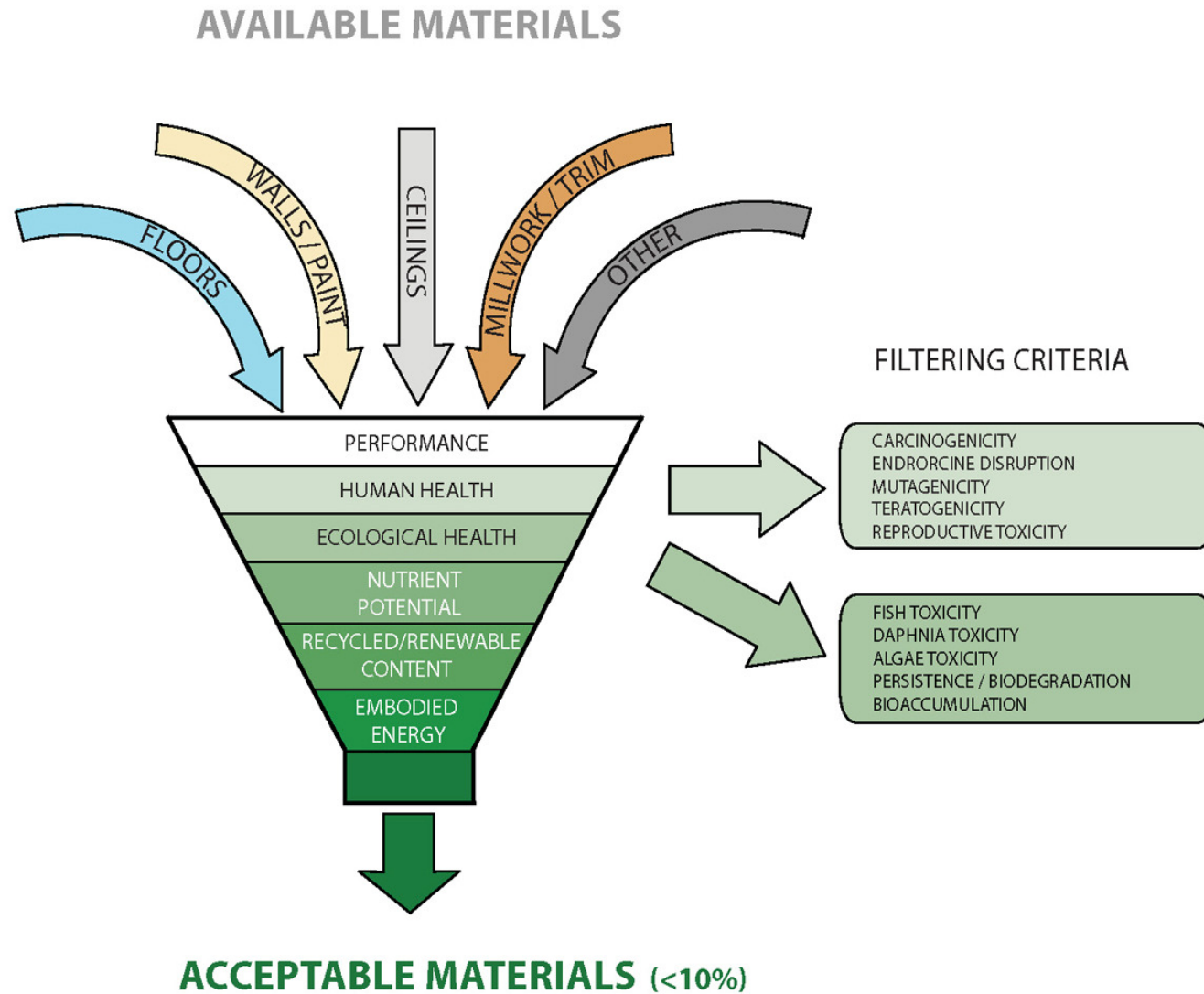
Building Massing: Daylight vs. Regeneration

- 1 IR / CATH
- 2 OR
- 3 ENDOSCOPY
- 4 PACU
- 5 PRE-OP
- 6 PATHOLOGY
- 7 LIGHT COURT
- 8 CLEAN CORE
- 9 STAFF CORE



Courtyards

Materials and Finishes: *Are they both safe and healthful?*



Materials and Finishes: *Are they both safe and healthful?*

15 common building materials reviewed by MBDC* and ranked per risk

Little to no risk

Low to moderate risk

High hazard and risk

* McDonough Braungart Design Chemistry (MBDC)

Paint

Low VOC paints are a step in the right direction from a human health perspective. VOCs are the most common exposure hazards, but the pigments themselves may contain toxic heavy metals and/or halogenated organic molecules.

Hence, even low VOC paint needs to be evaluated for its effects on human health.

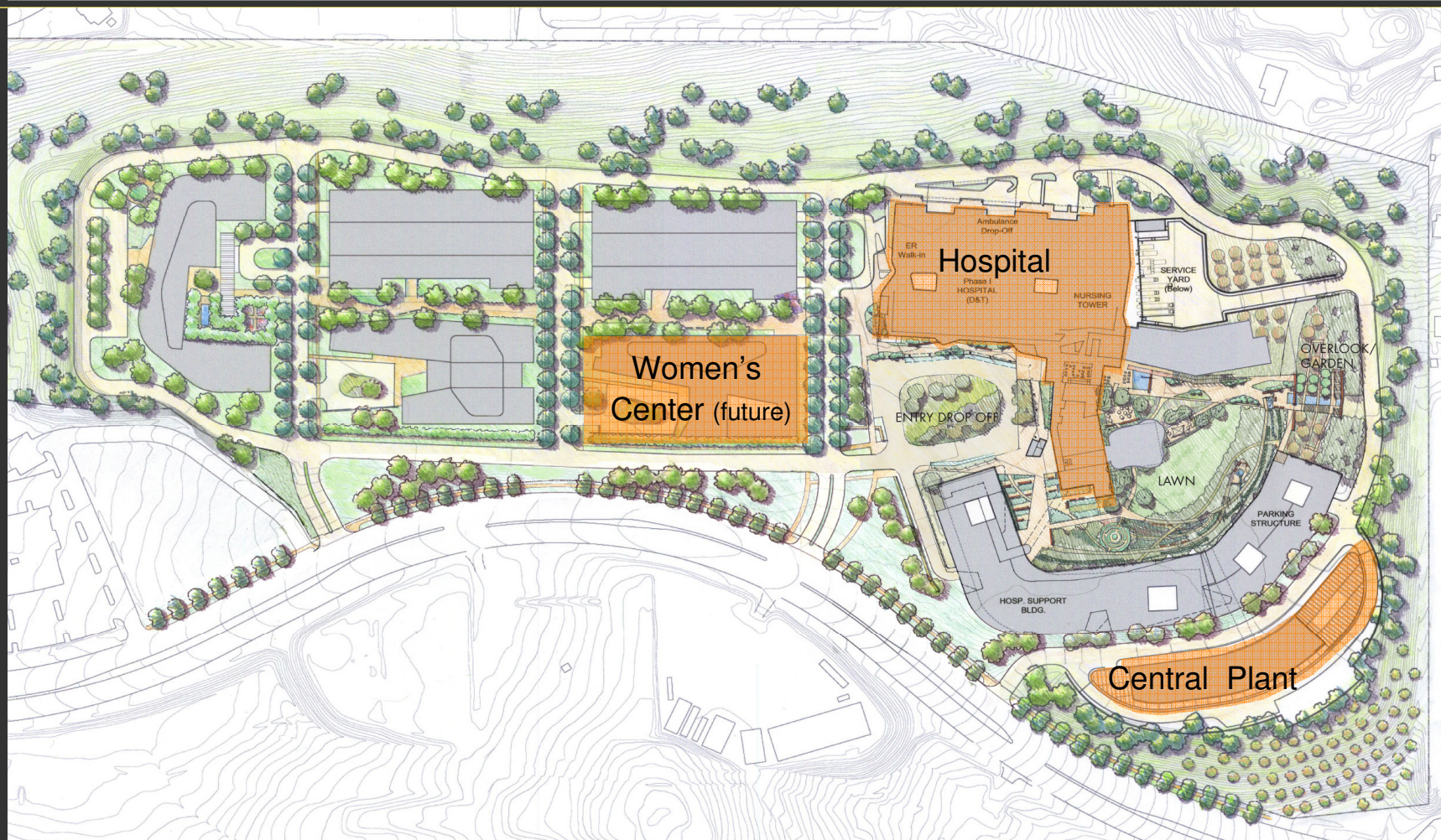
Designing the Hospital of the Future

PALOMAR POMERADO HEALTH

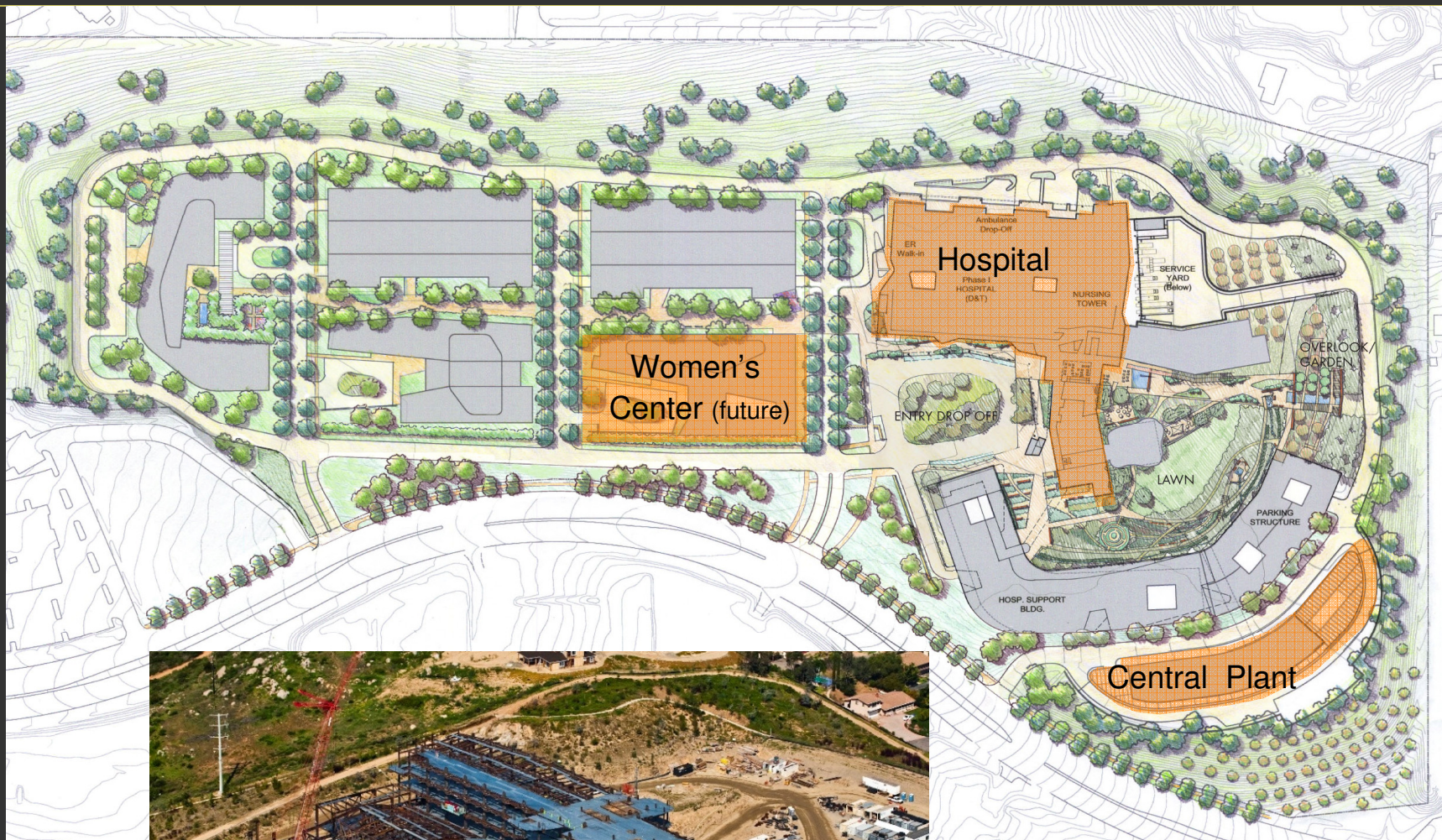
- District hospital in San Diego County
- 775,000 gross building area (365 beds)
- Scheduled completion date: 2011



Hospital of the Future: CASE STUDY



Hospital of the Future: CASE STUDY



Hospital of the Future: CASE STUDY



Hospital of the Future: CASE STUDY

PROJECT INNOVATIONS

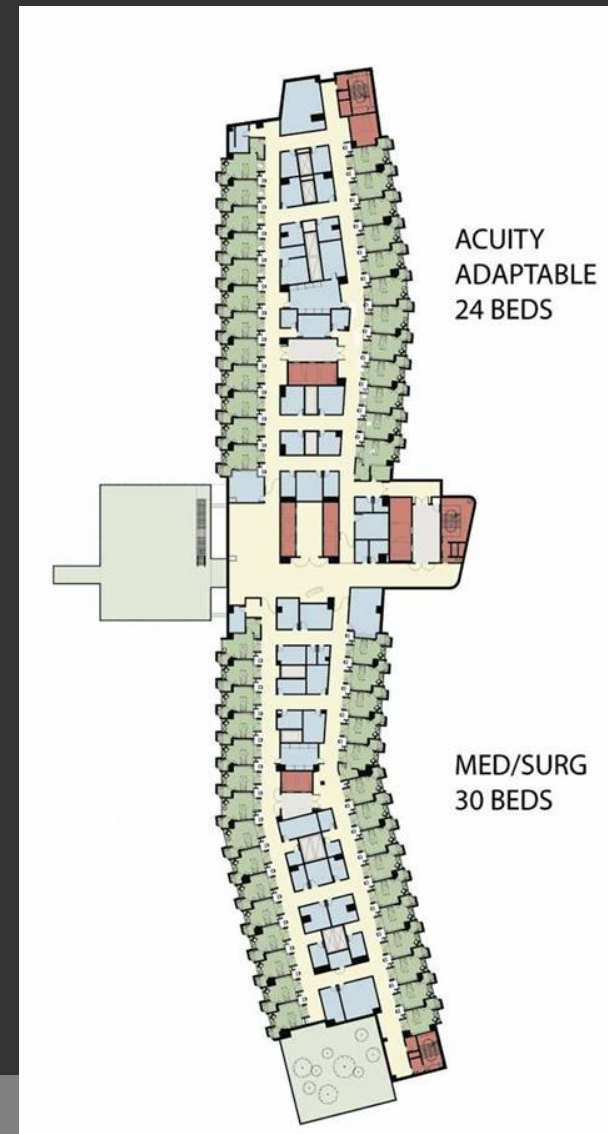
- Acuity adaptable patient rooms
- Acuity adaptable nursing units
- Same-handed room design
- Integrated interventional platform
- Universal procedure room design
- Sustainable / evidence-based design
- Intelligent technology and infrastructure



Hospital of the Future: CASE STUDY

ACUITY ADAPTABLE PATIENT ROOMS

- Minimize transferring patients
- Improve care continuity
- Reduce medical errors
- Reduce operational costs
- Improve operational efficiencies
- Improve patient room availability



Hospital of the Future: ACUITY-ADAPTABLE PATIENT ROOM

PATIENT ROOM AREA COMPARISON



ACUTE CARE ROOM
240 NSF

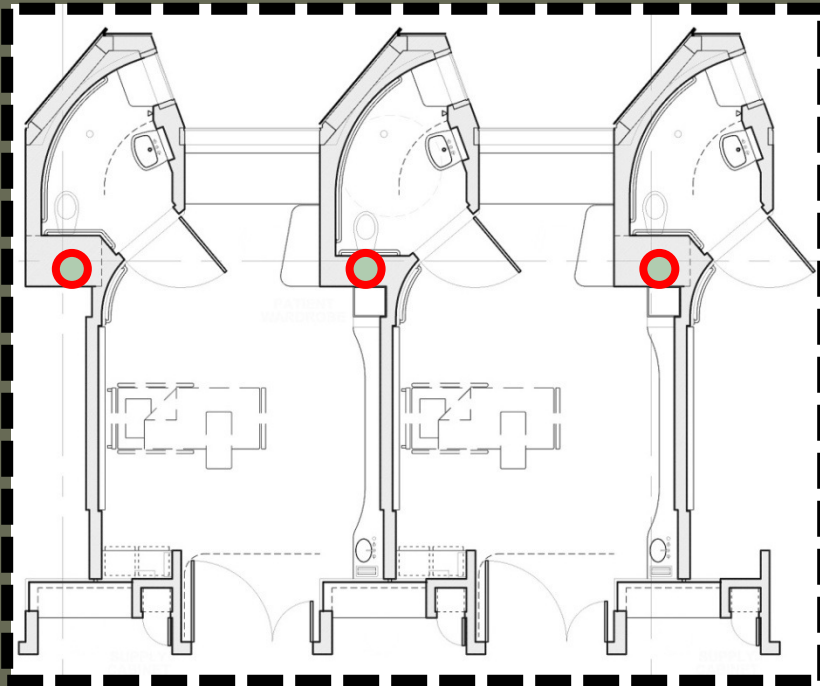


CRITICAL CARE ROOM
280 NSF

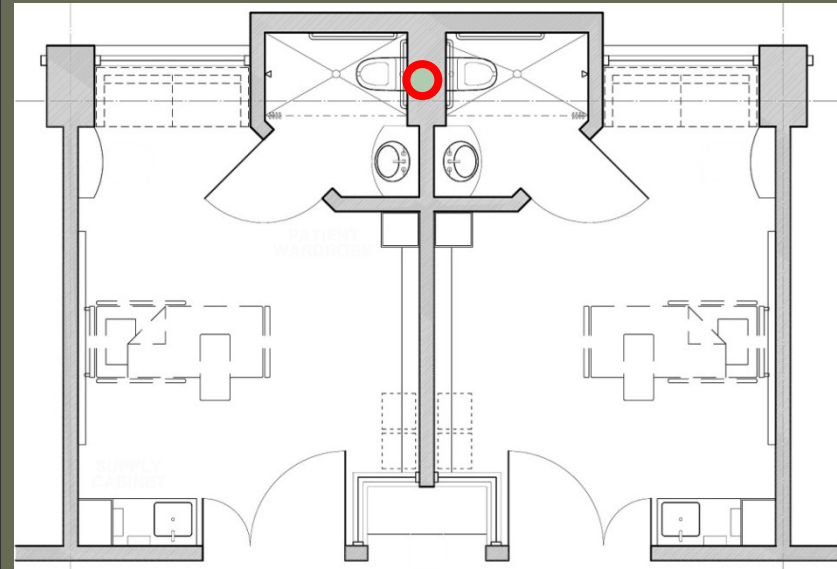
PREMIUM: $\$384 / \text{SF} \times 40 \text{ SF} = \$15,360 / \text{room}$

Hospital of the Future: SAME-HANDED PATIENT ROOM

“HANDED” vs. “MIRRORED” ROOMS:



“SAME HANDED” PATIENT ROOM



TRADITIONAL “MIRRORED” ORIENTATION

PREMIUM* (non-shared plumbing wall) = \$987 / room

* Potential offset savings for “same-handed” rooms when casework variations are eliminated

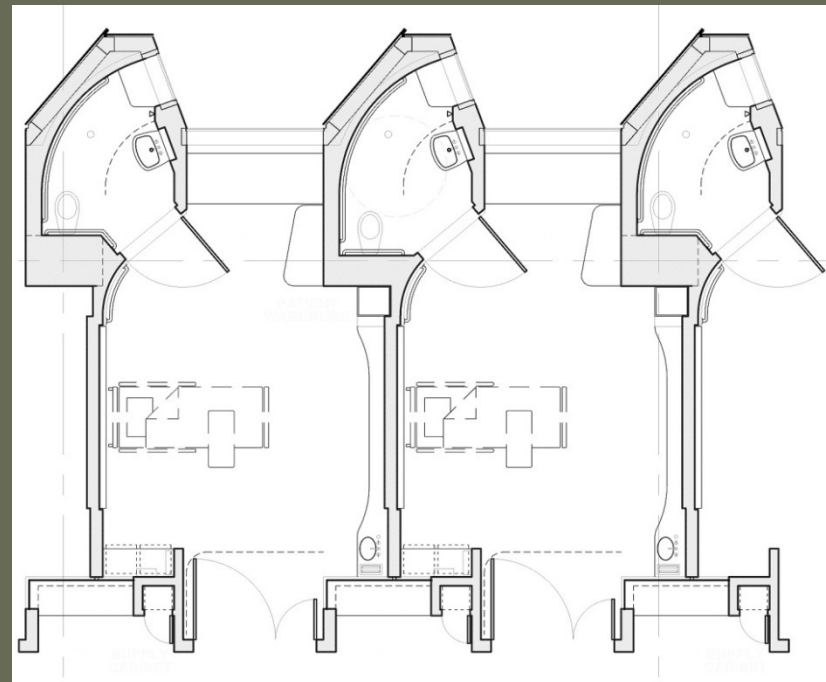
Hospital of the Future: SAME-HANDED PATIENT ROOM

ASSUMED BENEFITS:

- Consistent approach and care practice
- Reduced errors during emergency activities (due to consistent configuration and location of supplies)
- Most appropriate for high stress / high acuity areas (ICU, Surgery, etc.)

CAUTION:

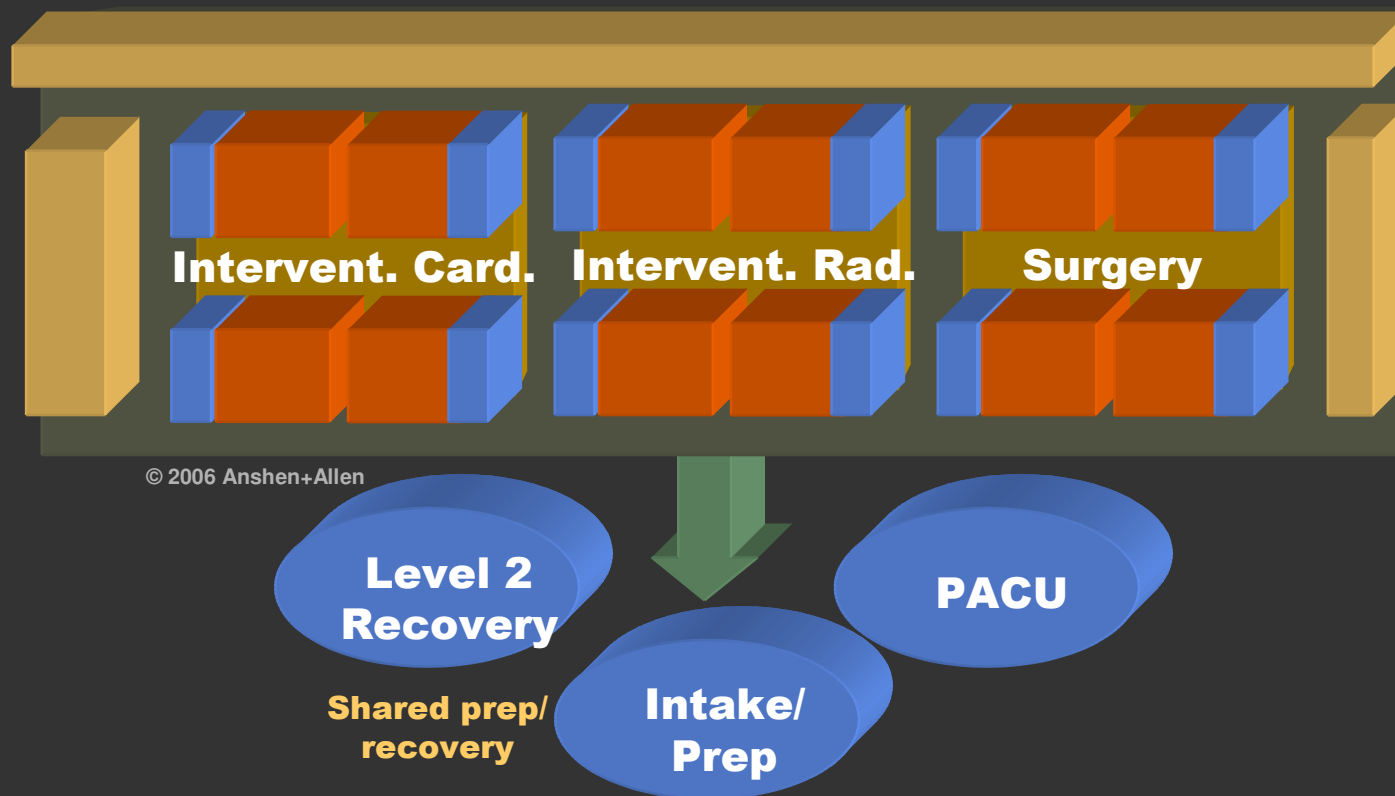
- Provide design landmarks to prevent “wrong-patient” treatment!



“SAME HANDED” PATIENT ROOM

Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

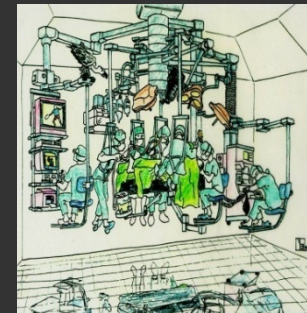
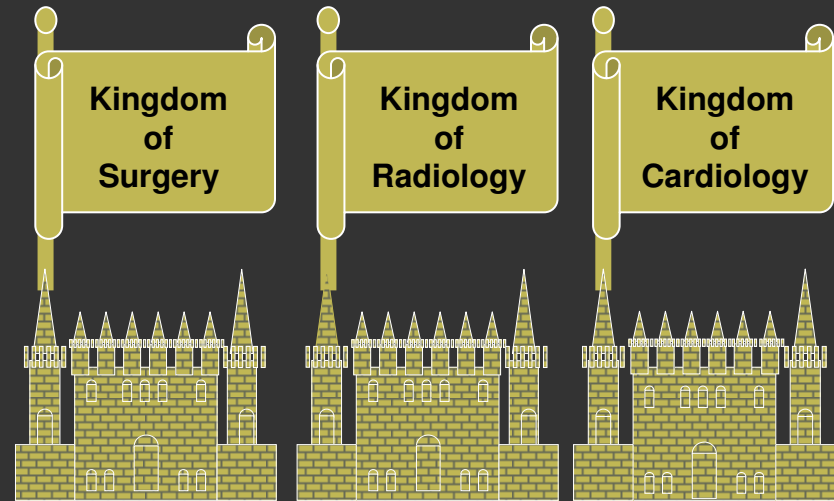
DEFINITION: The integration of various interventional services within a common area and operated in a collaborative manner



Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

CHALLENGES:

- Requires collective vision to minimize turf battles
- Limited availability of large contiguous space
- Different protocol for infection control (Surgery, IR, Cath)
- Cross-training for some support staff
- Cost of excess infrastructure capacity for areas of future change



Lower middle image, courtesy of: CIMIT

POTENTIAL BENEFITS:

Improved flexibility, efficiency, capacity, throughput, collaboration

Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

CLINICAL PROGRAM:

3 IR; 2 Cath; 1 EP; 12 OR; 3 Endo; 53 pre-op / PACU beds

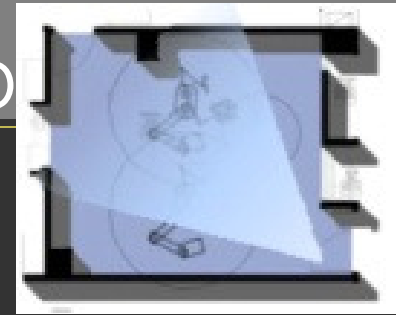


Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

UNIVERSAL PROCEDURE ROOMS:

Room Size:	<600 NSF; 600-750 NSF; > 750 NSF
Room Configuration:	Square; rectangular; “handed” vs. mirrored
Universal vs. Dedicated:	A question of flexibility
Table Orientation:	Parallel; perpendicular; diagonal to corridor
Orientation of patient’s head:	Head to corridor; feet to corridor; head to side
Room “zoning” and workflow:	Sterile; circulation; anesthesia; documentation zones

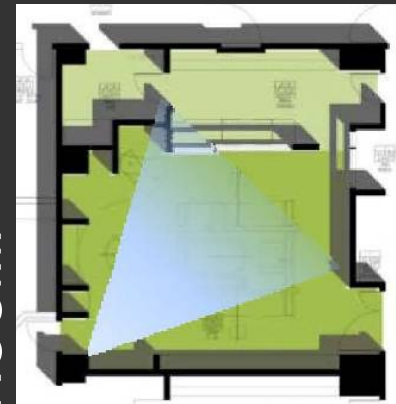
OPERATING ROOM:



ROOM:



INTERVENTIONAL ROOM:

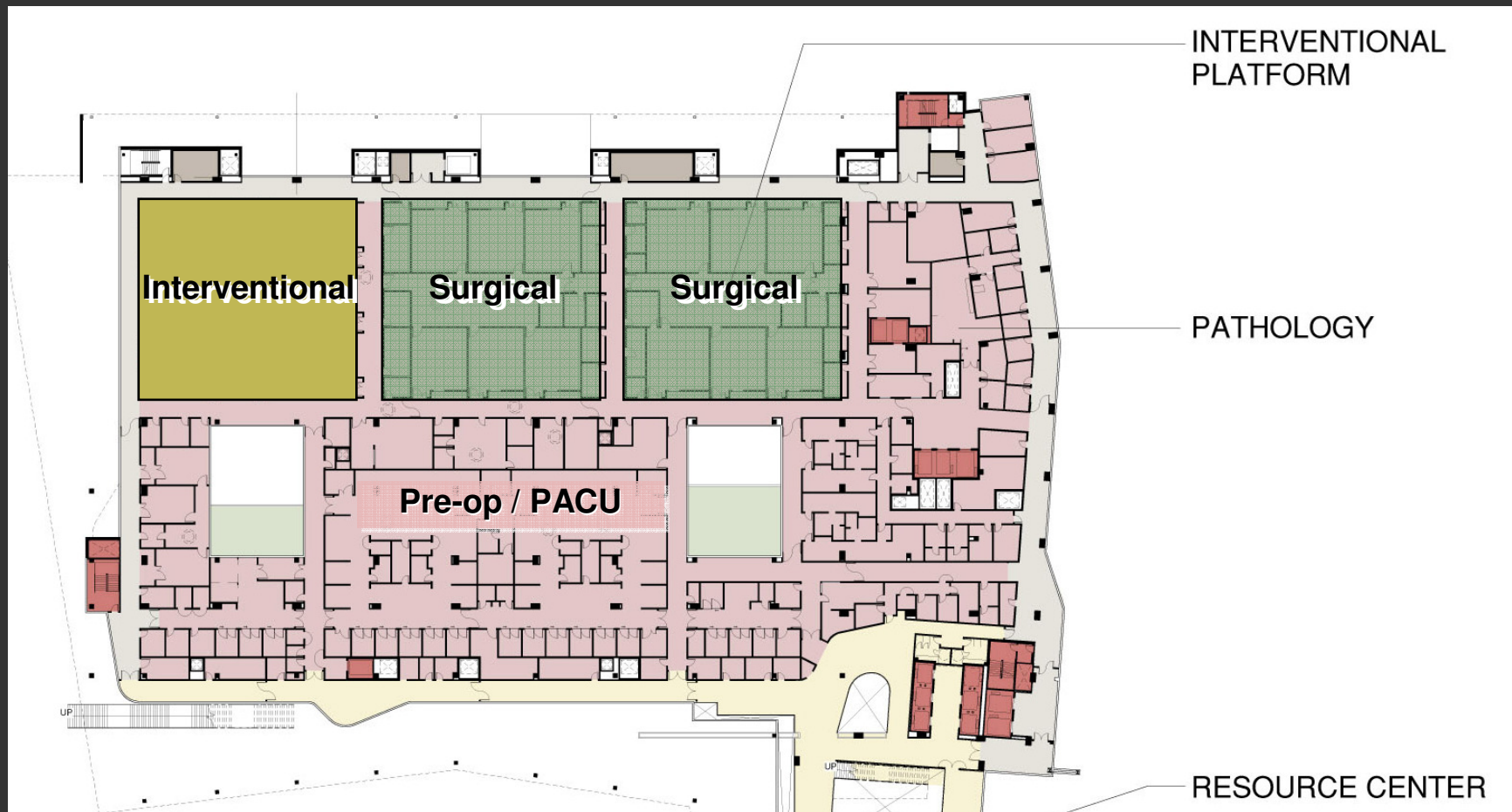


ROOM:



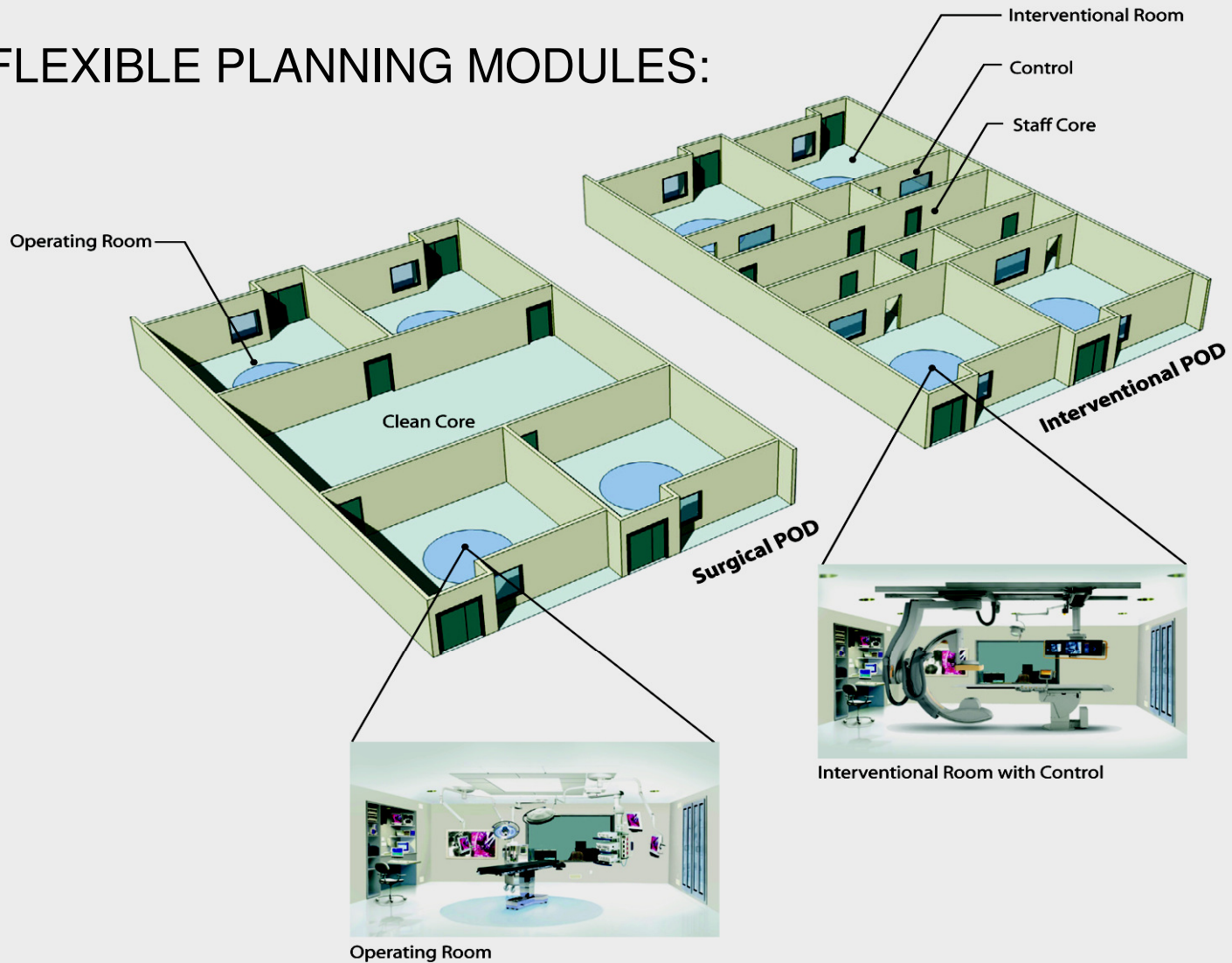
Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

FLEXIBLE PLANNING MODULES:



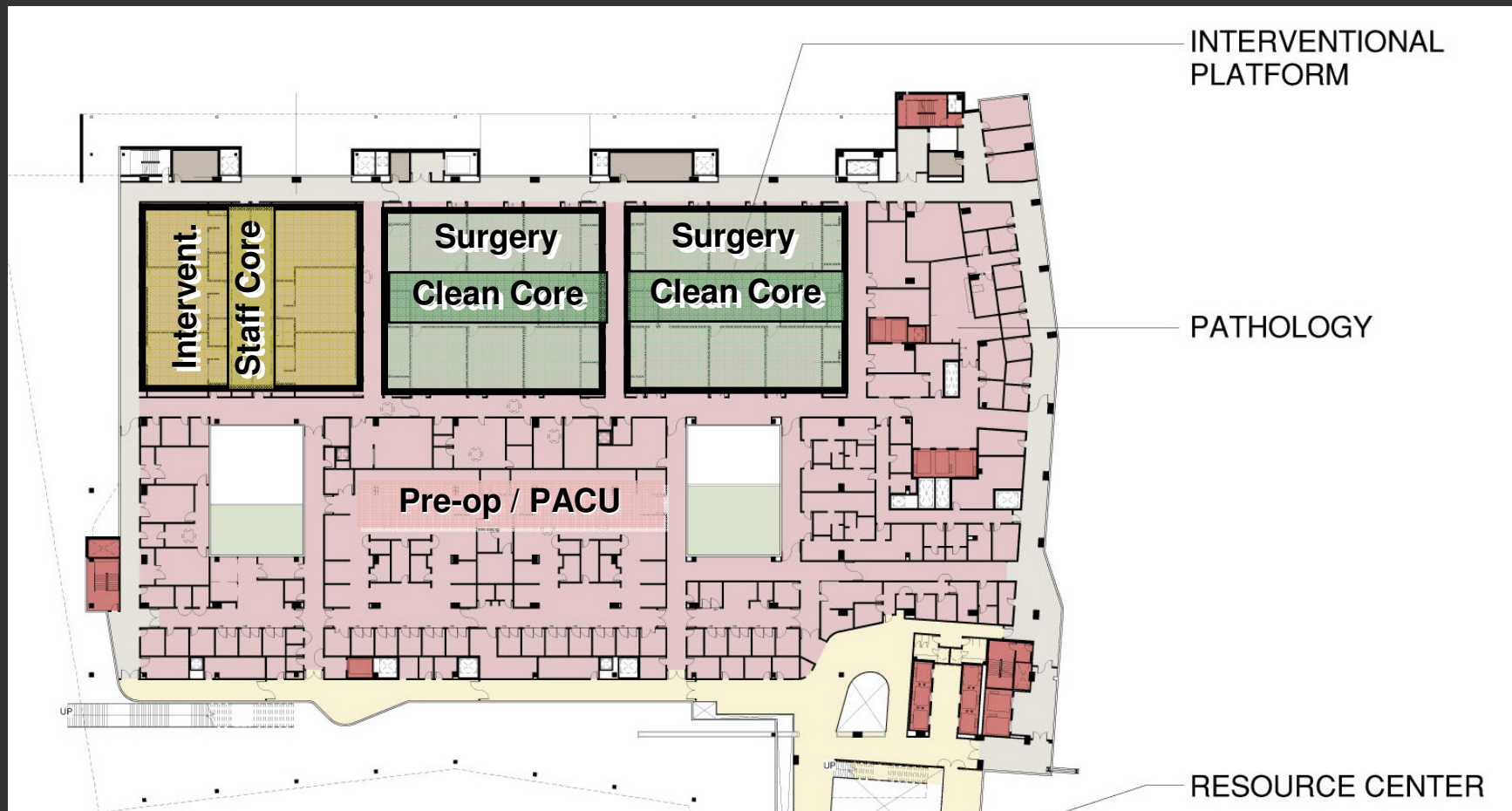
Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

FLEXIBLE PLANNING MODULES:



Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

SURGERY = CLEAN CORE; INTERVENTIONAL = STAFF CORE:



Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

INTERVENTIONAL = COLLABORATIVE STAFF CORE:



Hospital of the Future: VIRTUAL "RED LINE"



Hospital of the Future: VIRTUAL "RED LINE"



Hospital of the Future: VIRTUAL "RED LINE"



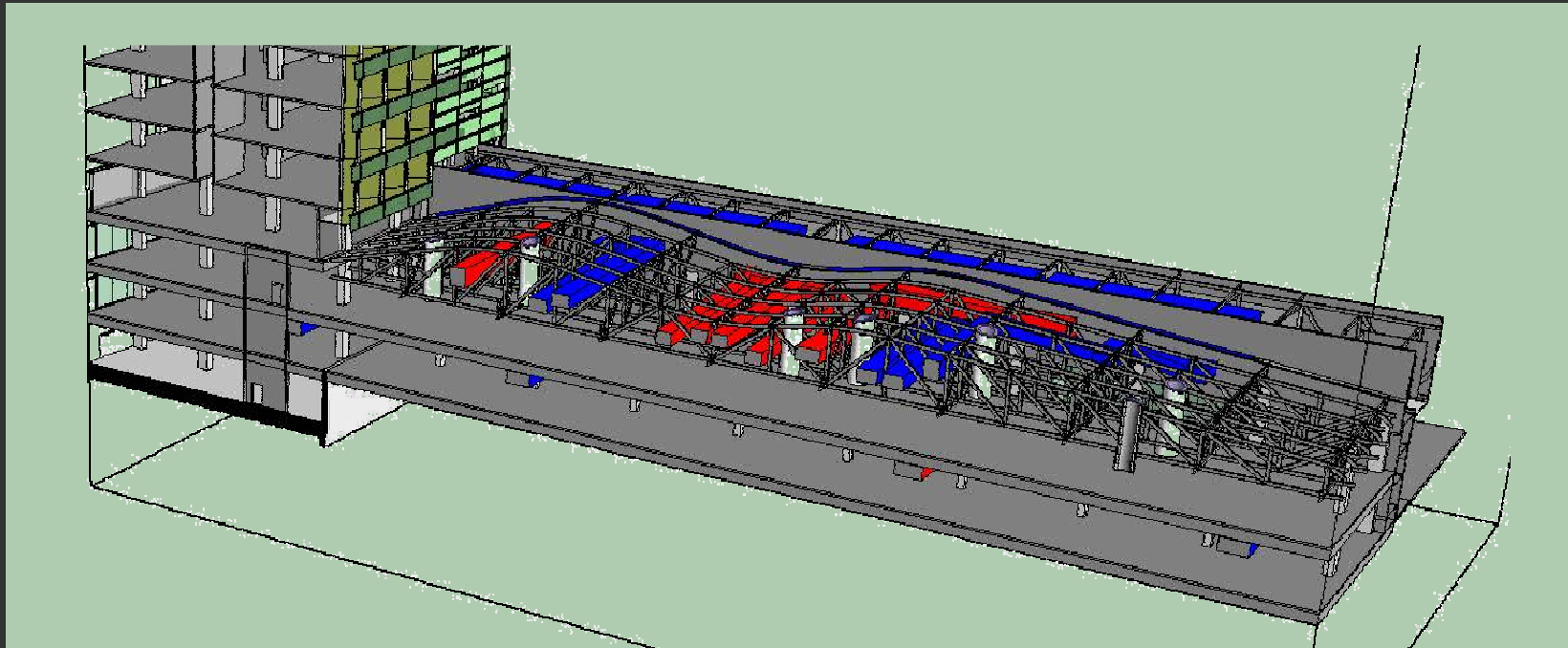
Hospital of the Future: VIRTUAL "RED LINE"



Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

ROBUST INFRASTRUCTURE:

- High floor-to-floor height
- Robust floor loading & vibration control (I-MRI)
- “Loose fit” programming
- Strategic placement of soft space
- Long structural spans (optional)
- “Future Technology Zone”



Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

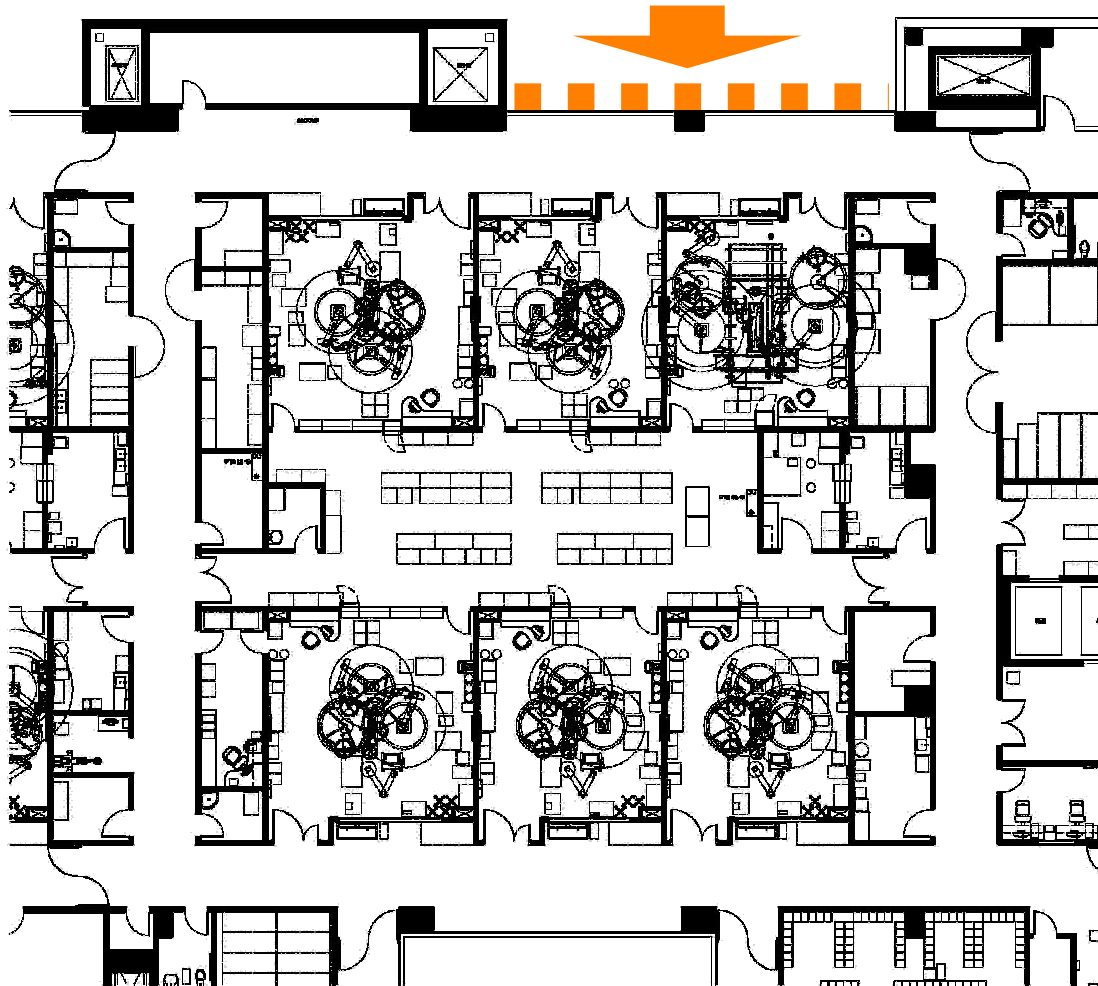
DAYLIGHTING THE DEEP FLOOR PLATE:

1. Perimeter daylight
2. Internal courtyards



Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

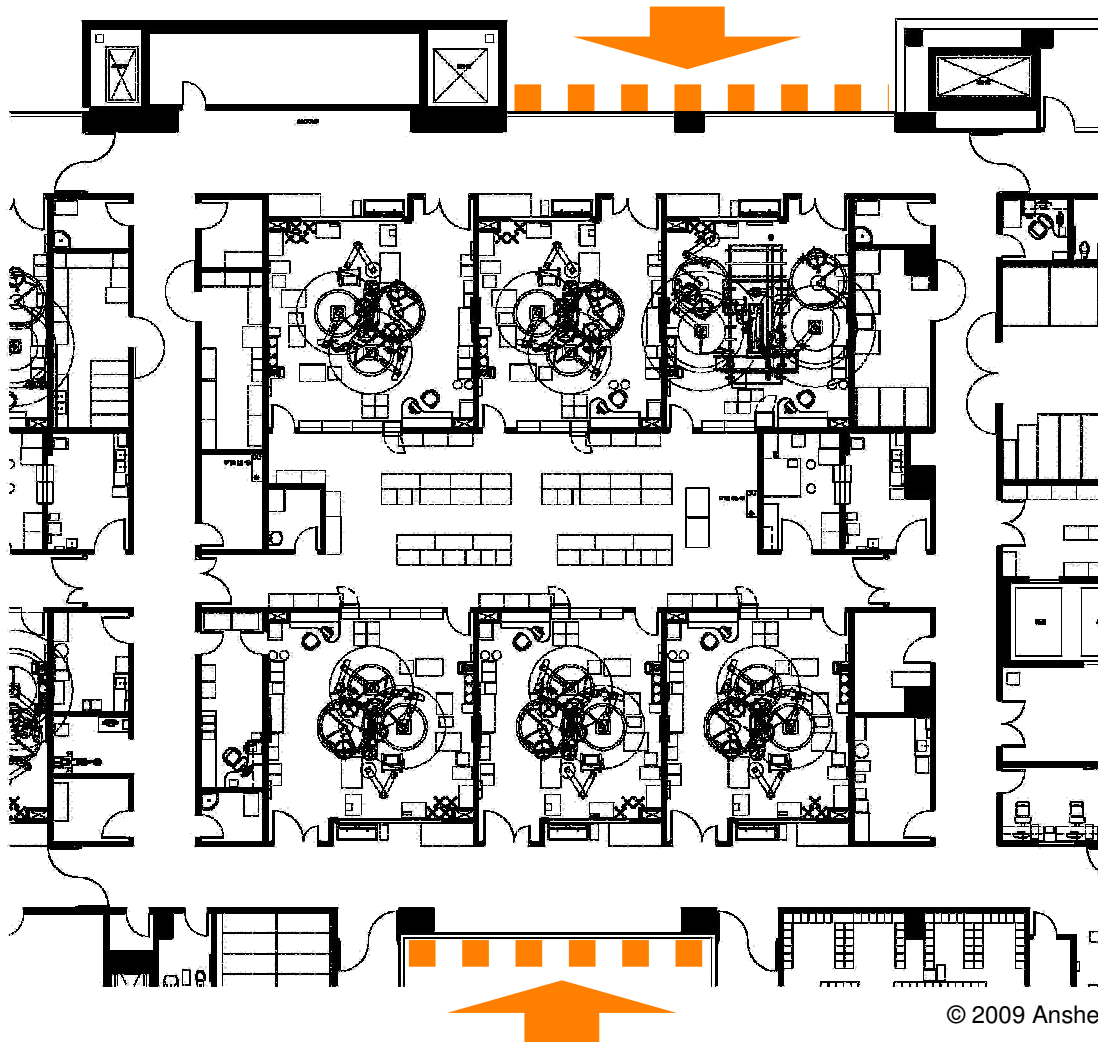
DAYLIGHTING THE DEEP FLOOR PLATE:



**Borrowed light from
exterior into corridors**

Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

DAYLIGHTING THE DEEP FLOOR PLATE:

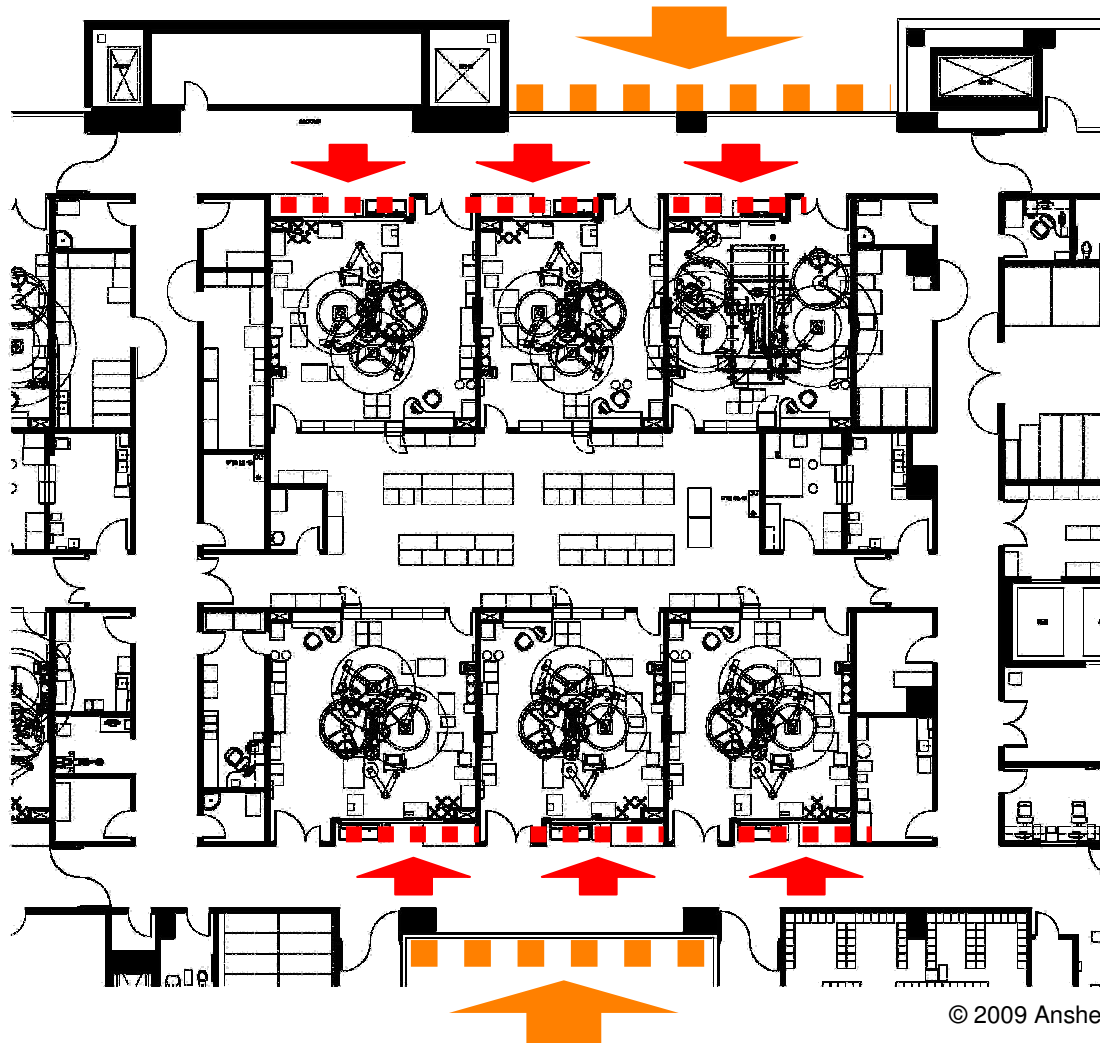


**Borrowed light from
exterior into corridors**

**Borrowed light from
interior courtyards into
corridors**

Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

DAYLIGHTING THE DEEP FLOOR PLATE:



Borrowed light from exterior into corridors

Borrowed light from interior courtyards into corridors

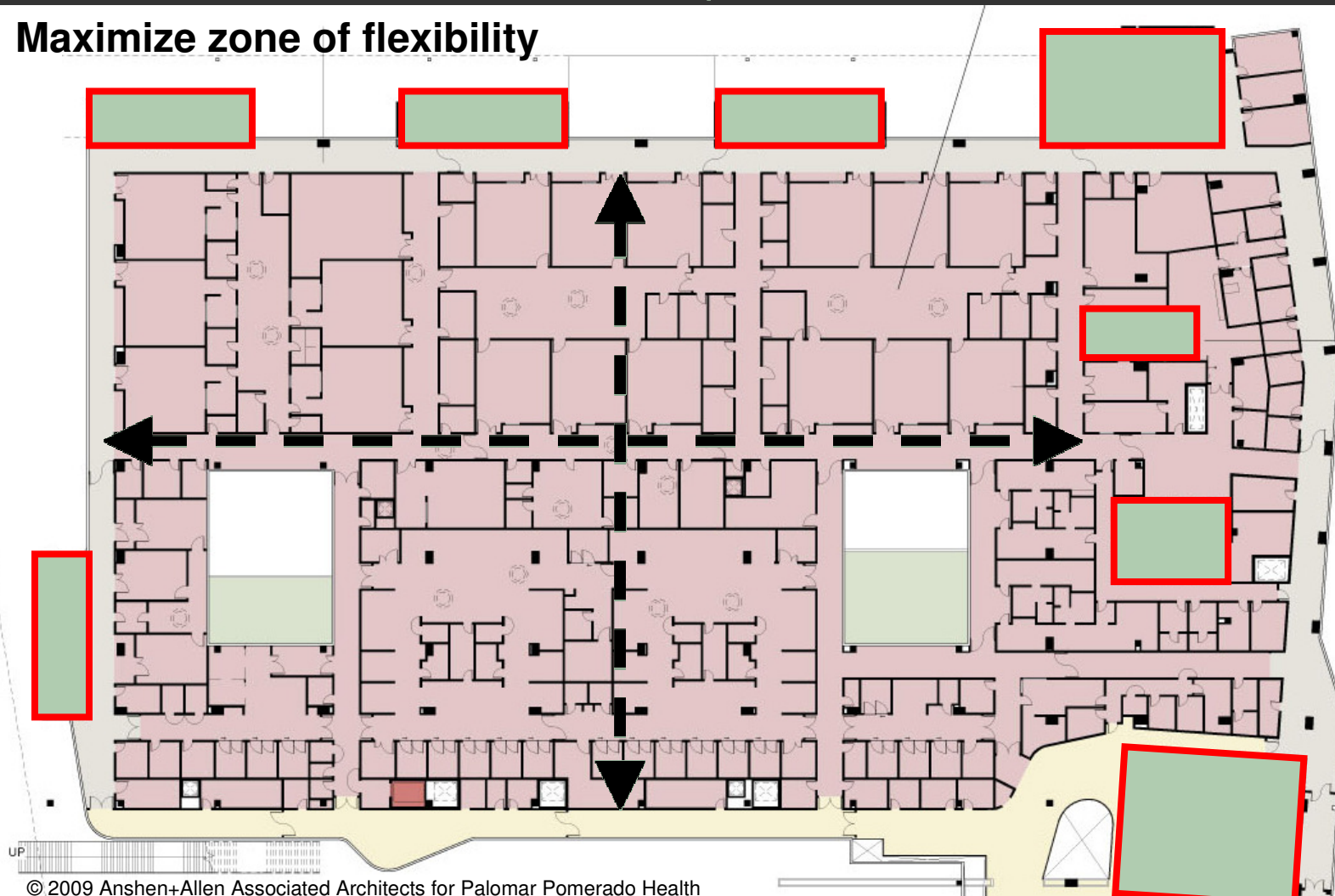
Borrowed light from corridors into procedure rooms

Hospital of the Future: INTEGRATED INTERVENTIONAL PLATFORM

HOSPITAL DESIGNED LIKE A RESEARCH LAB:

Locate vertical “fixed” elements at perimeter

Maximize zone of flexibility

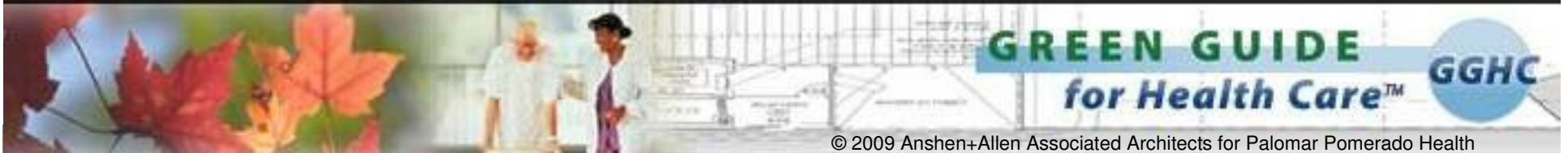


Hospital of the Future: SUSTAINABILITY

KEY FEATURES

- Sustainable site
- Water conservation
- Energy + atmosphere
- Materials + finishes
- Environmental quality Innovation

Cost Premium for Sustainable features = 2% +/- of construction cost



GREEN GUIDE
for Health Care™ GGHC

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Best Practices for Creating High Performance Healing Environments™

Hospital of the Future: SUSTAINABILITY

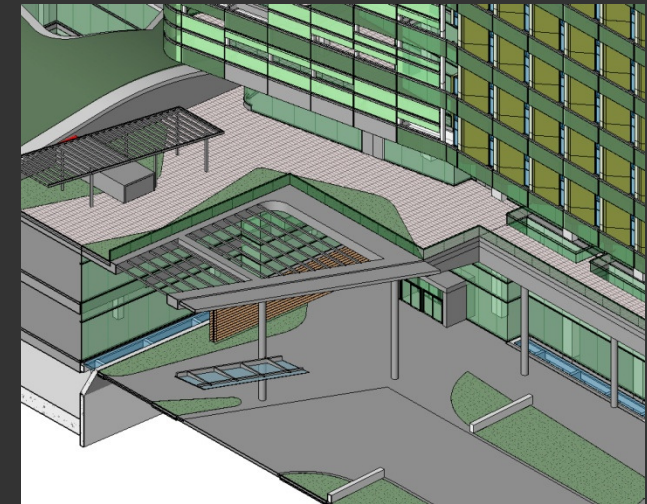
GREEN (planted) ROOFS and GARDENS:



PREMIUM: approx. 0.5% of construction cost

Hospital of the Future: SUSTAINABILITY

COURTYARDS, SKYLIGHTS AND LIGHT WELLS:



PREMIUM: approx. 0.3% of construction cost

Hospital of the Future: SUSTAINABILITY

SUNSCREENS



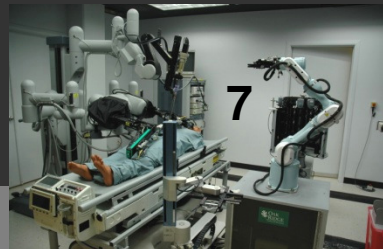
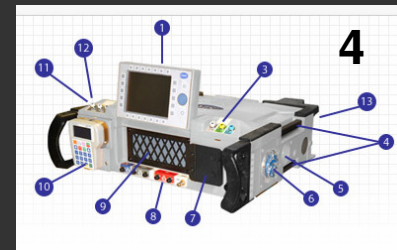
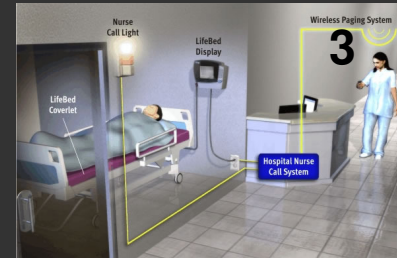
PREMIUM: approx. 0.3% of construction cost

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Hospital of the Future: Intelligent Technology

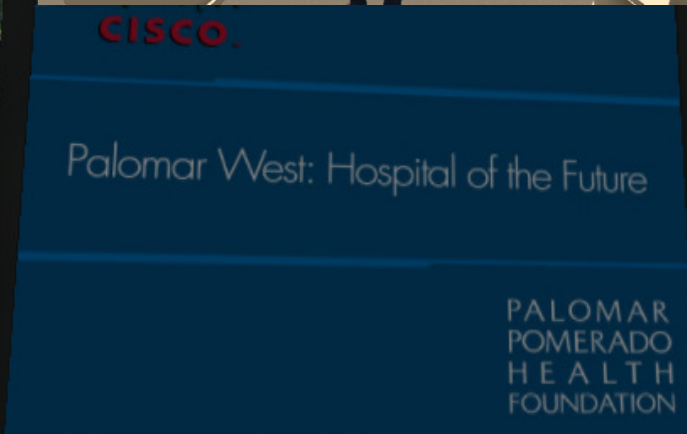
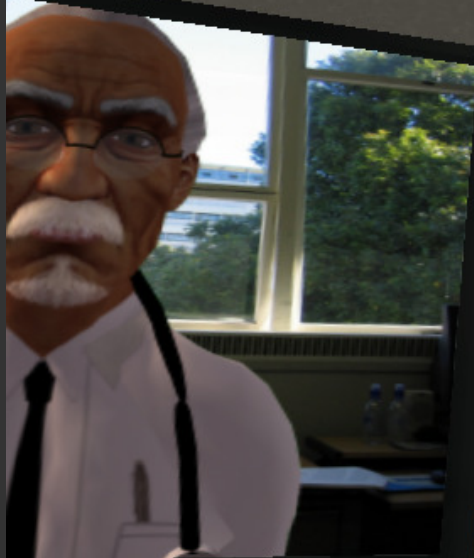
Smart Medical Devices:

1. Wireless documentation “smart” bed
2. L-STAT bed
3. Non-invasive bed monitoring
4. Portable “ICU in a suitcase”
5. Robotic clinical lab
6. Robotic medications dispensing
7. Robotic surgery
8. Remote tele-presence robots
9. Vocera



Hospital of the Future: INTELLIGENT TECHNOLOGY

PALOMAR POMERADO HEALTH and SECOND LIFE



Questions?

