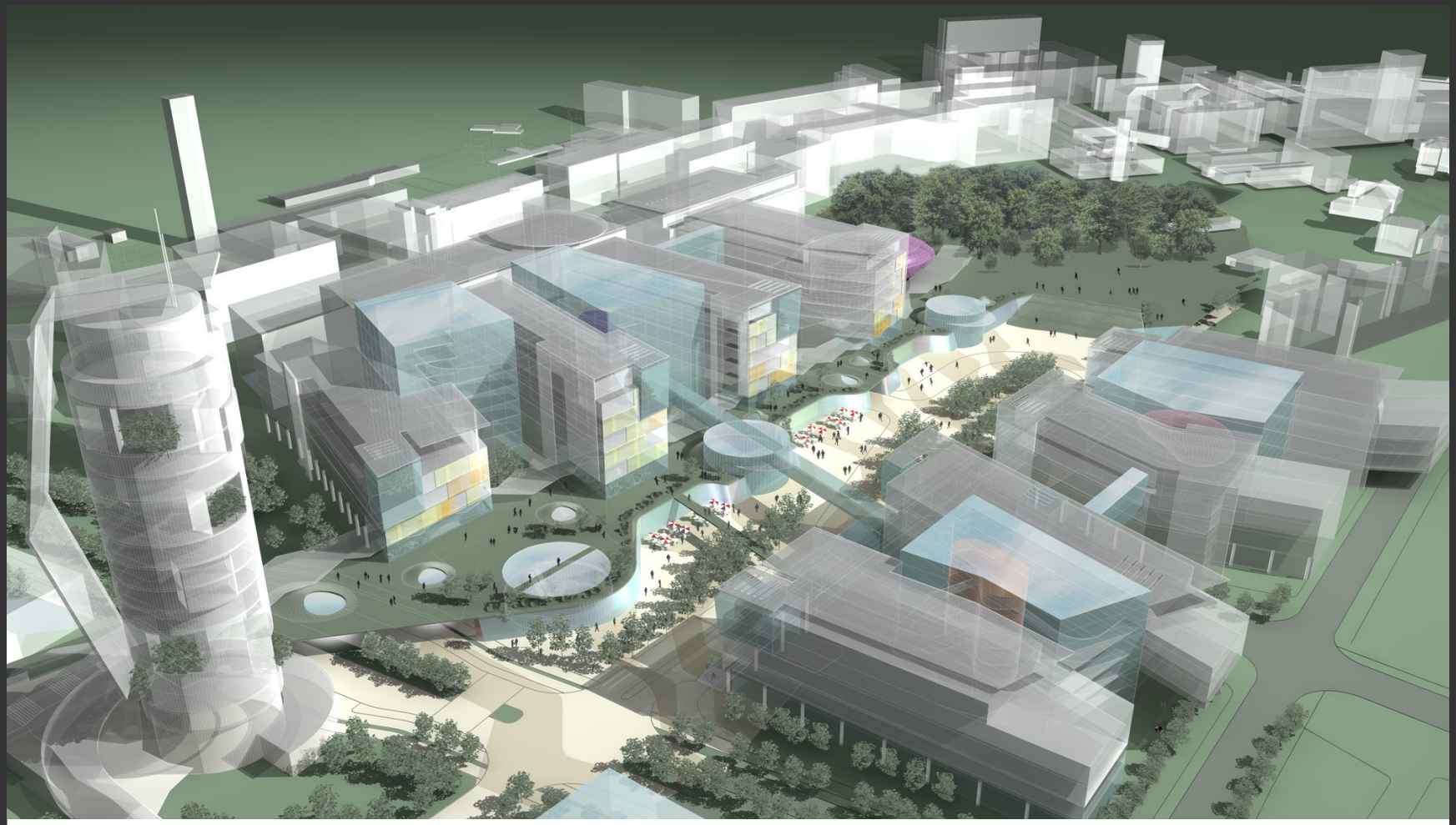
Designing the Hospital of the Future



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

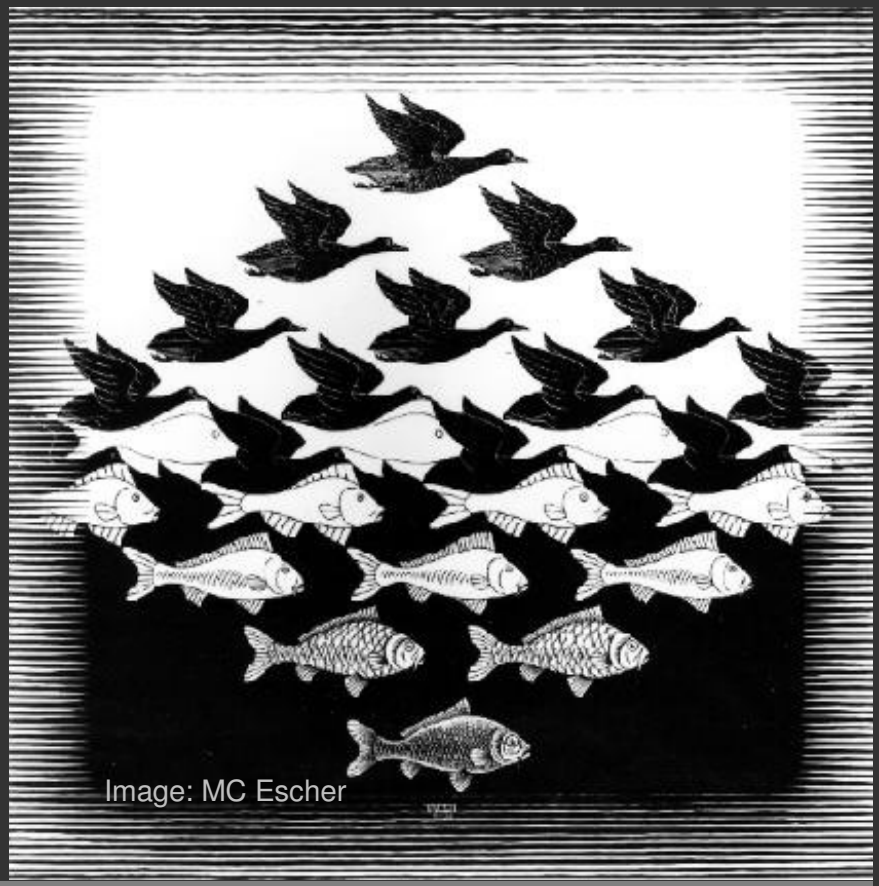
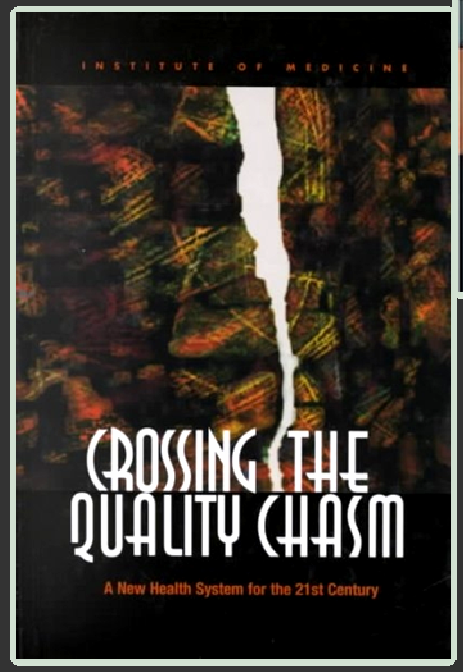


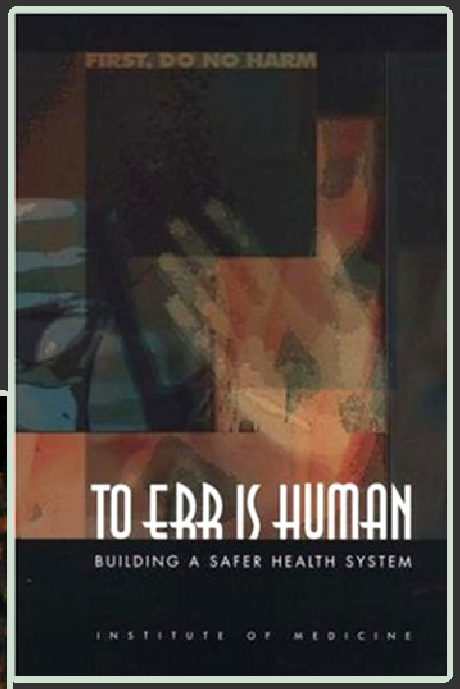
Image: MC Escher

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

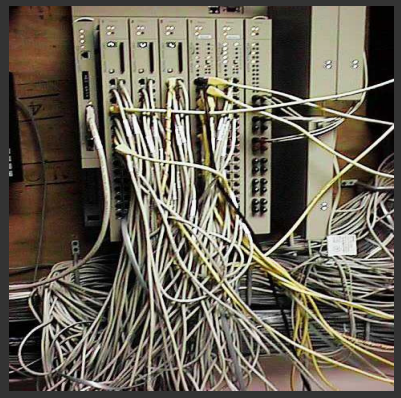
- Patient falls / staff Injuries
- Wrong patients / procedures
- Radiation Safety
- MRI Safety

Patient Lifts

MRI Projectiles

INFECTION CONTROL

- Surgery / Interventional
- Nursing Units



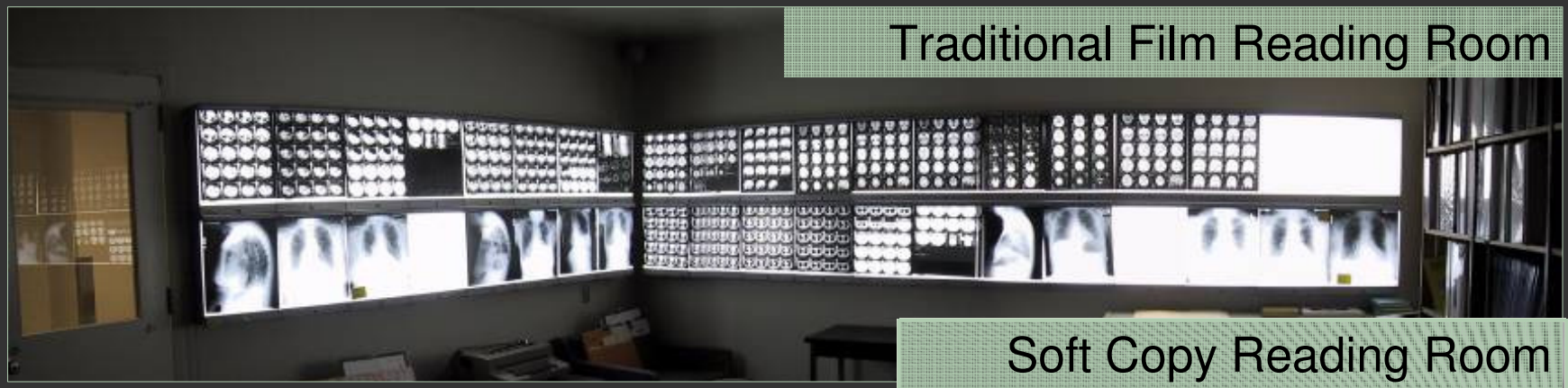
Smart Bldgs & Equip.

Private Patient Rooms

COMMUNICATIONS

- Work spaces
- IT Infrastructure

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

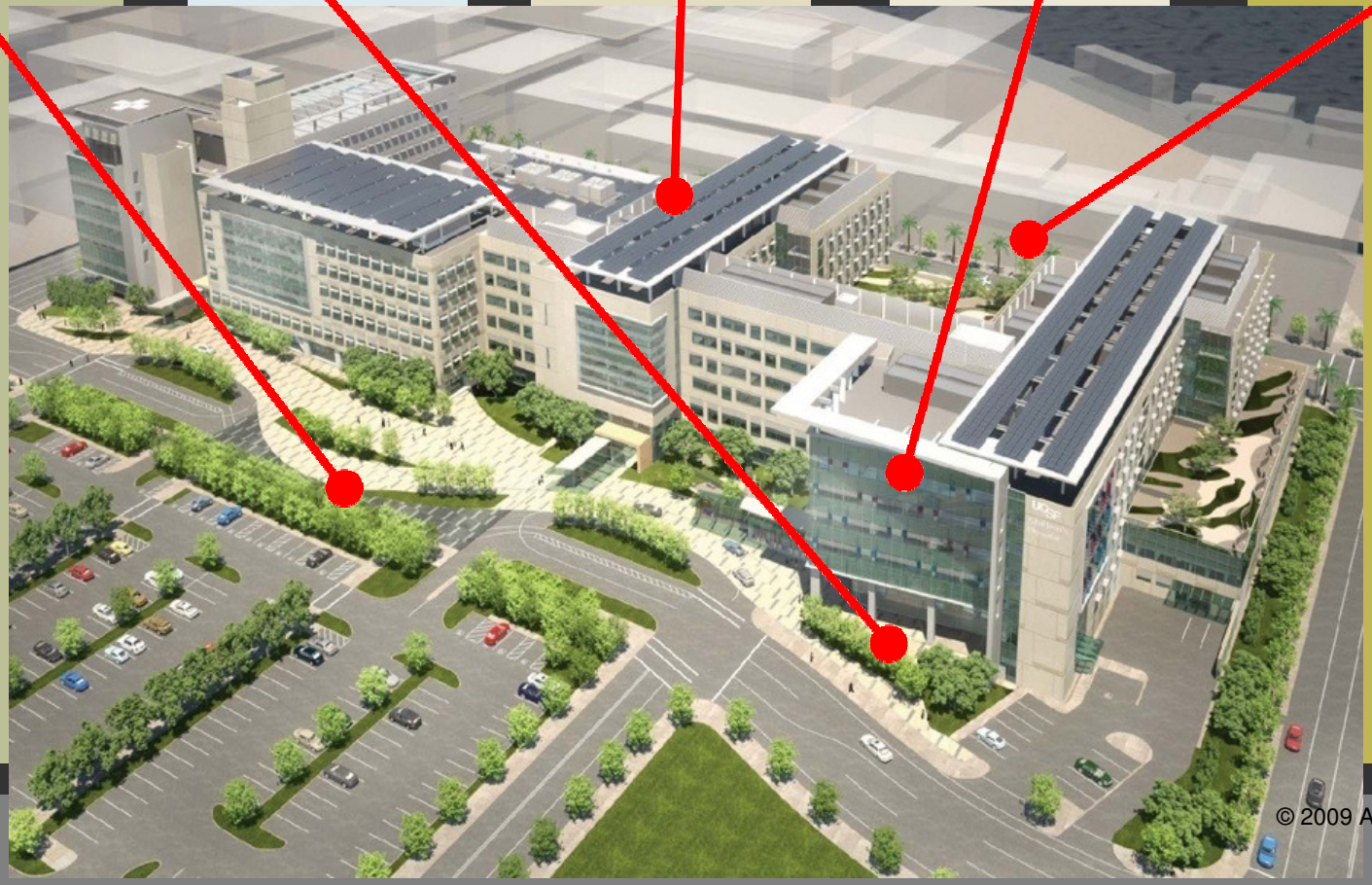
SITE

WATER

ENERGY

MATERIALS

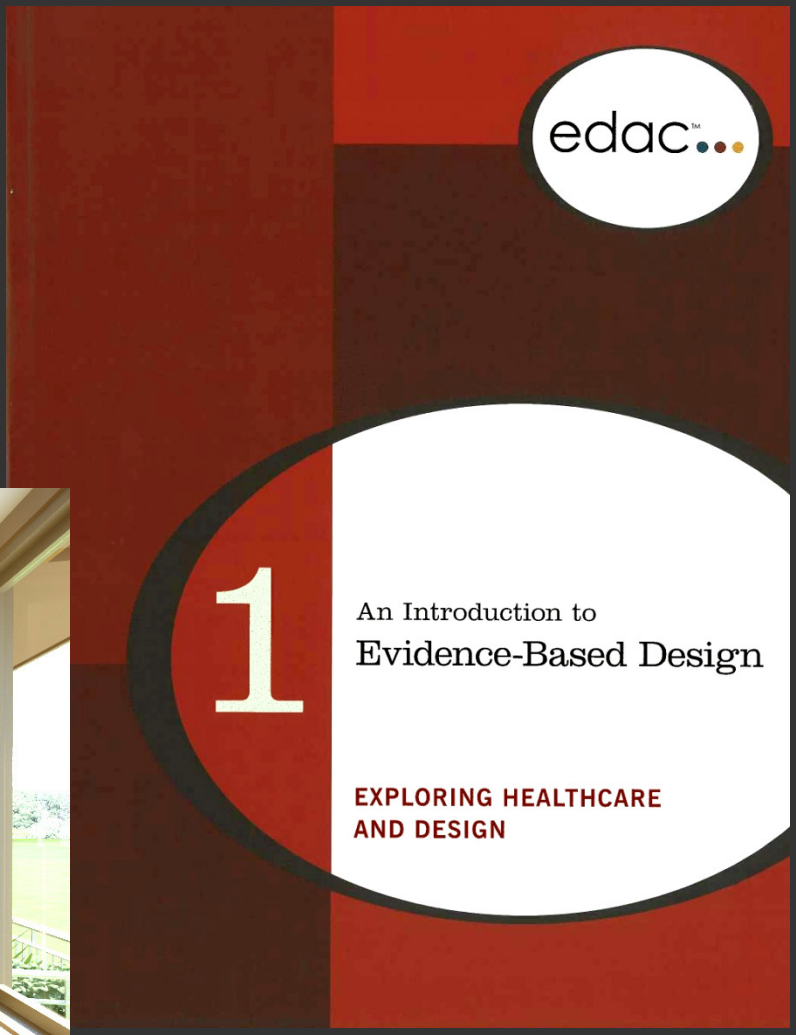
ENVIRON-MENTAL QUALITY



Evidence-based Design: improving clinical outcomes

SIX AIMS OF THE IOM

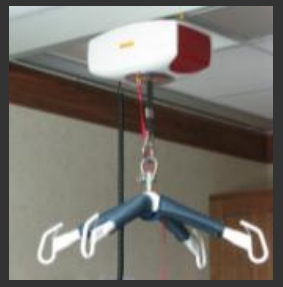
- Patient-centered care
- Effective care delivery
- Equitable care delivery
- Avoidance of waste
- Safety
- Fewer delays; less waiting



Are Sustainability + EBD Considered Together?

SUPPORTIVE and DISRUPTIVE INTERSECTIONS	Sustain. Design	EBD
■ Day-lighting	▲	▲
■ Acoustics	▼	▲
■ Materials and Finishes	▼	▲
■ Energy Management	▼	▲
■ Building Massing	▲	▼

Infection control & hand-washing



Ceiling lifts in patient rooms

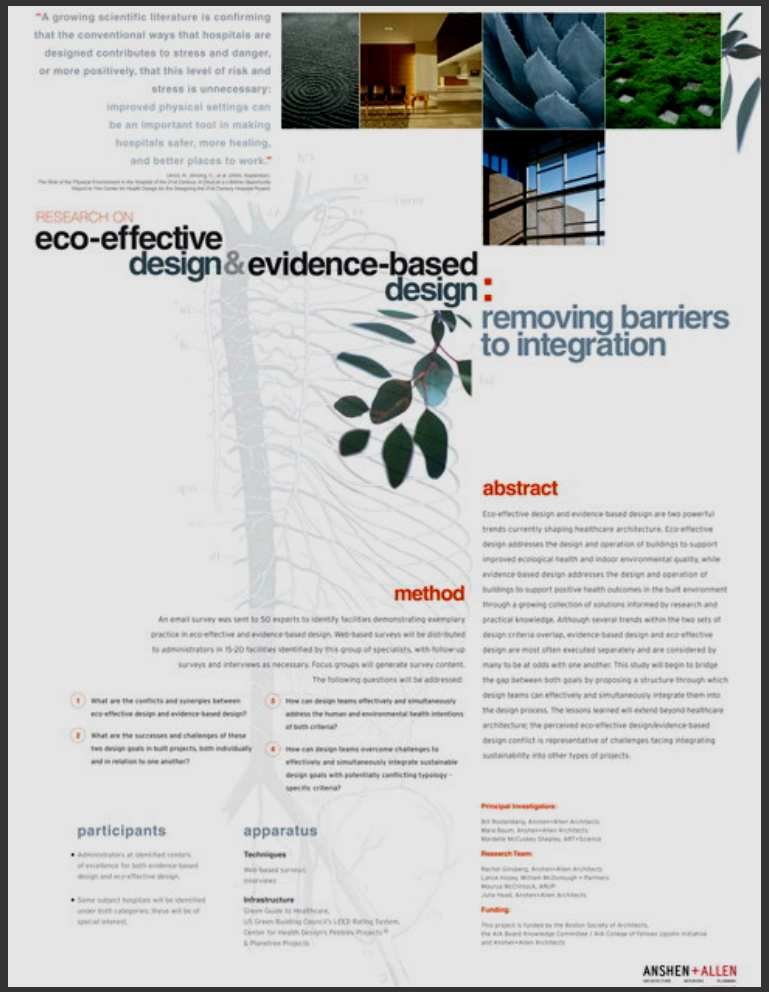
Acuity adaptable patient rooms

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 inefficiently?
- 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



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

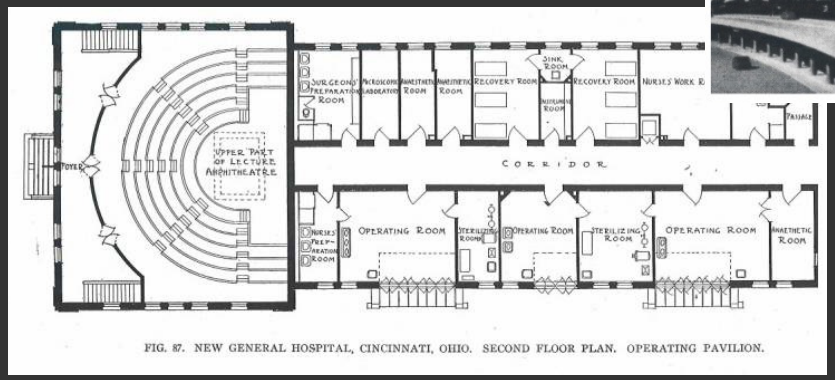
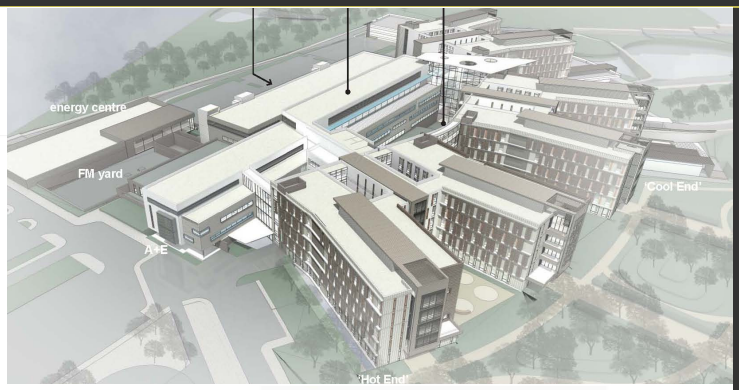
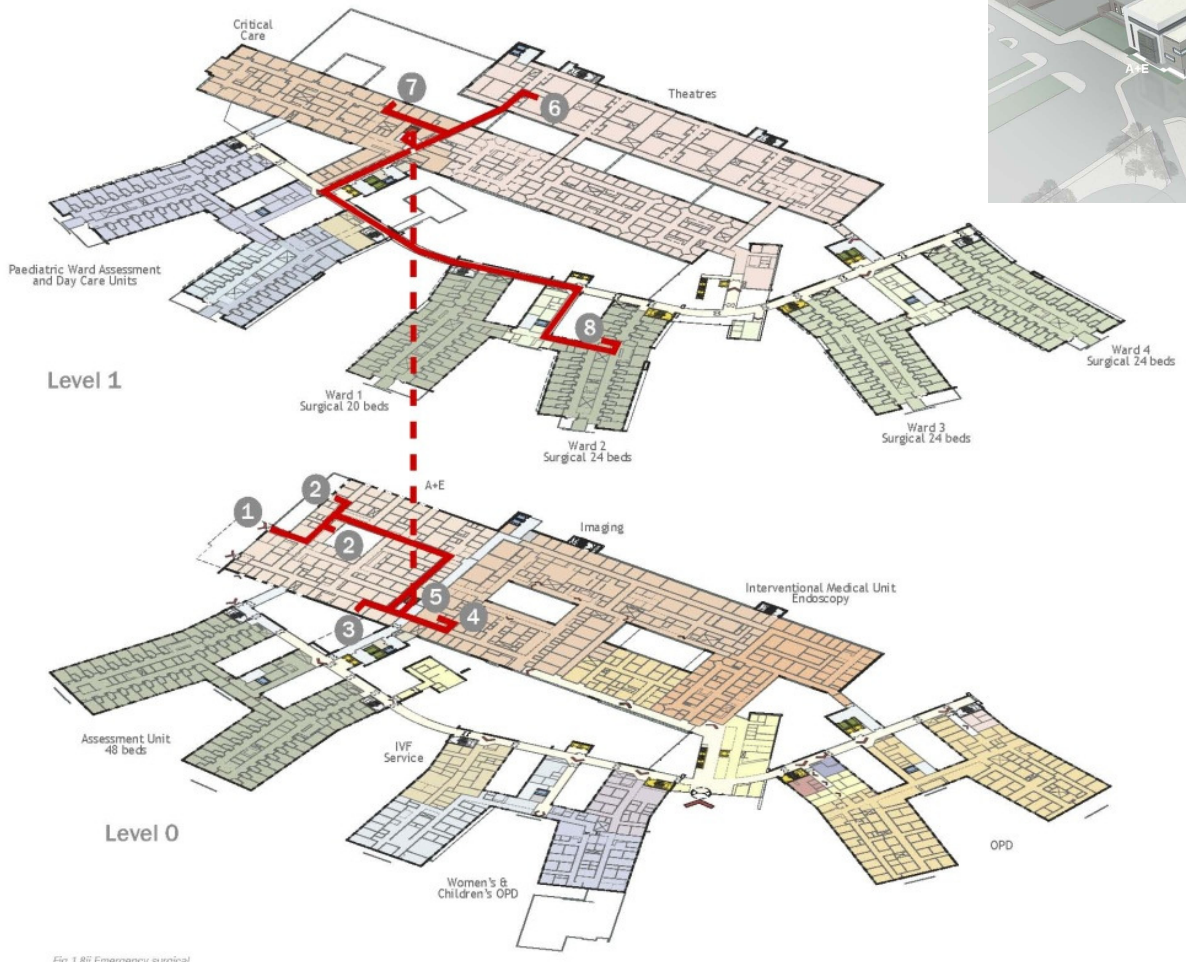


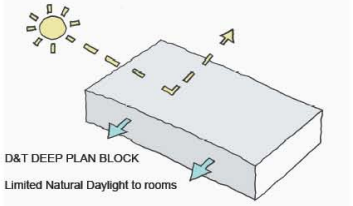
FIG. 87. NEW GENERAL HOSPITAL, CINCINNATI, OHIO. SECOND FLOOR PLAN. OPERATING PAVILION.

19th and Early 20th Century: narrow configuration

Building Massing: Daylight vs. Regeneration

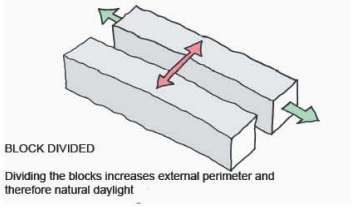






D&T DEEP PLAN BLOCK

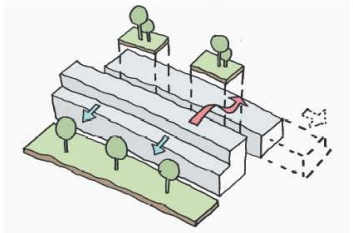
Limited Natural Daylight to rooms



BLOCK DIVIDED

Dividing the blocks increases external perimeter and therefore natural daylight

Areas for future expansion can be created



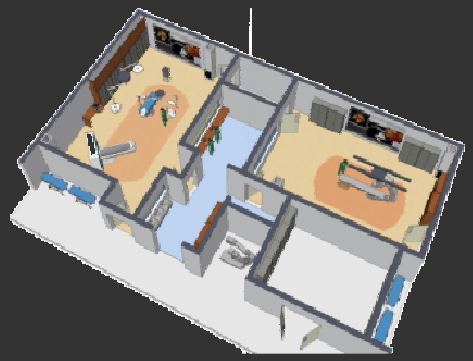
Courtyards dropped into central void

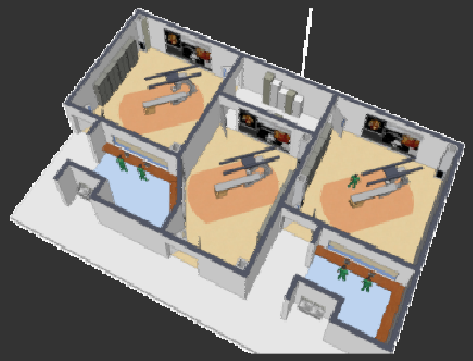
Linear Garden helps with wayfinding

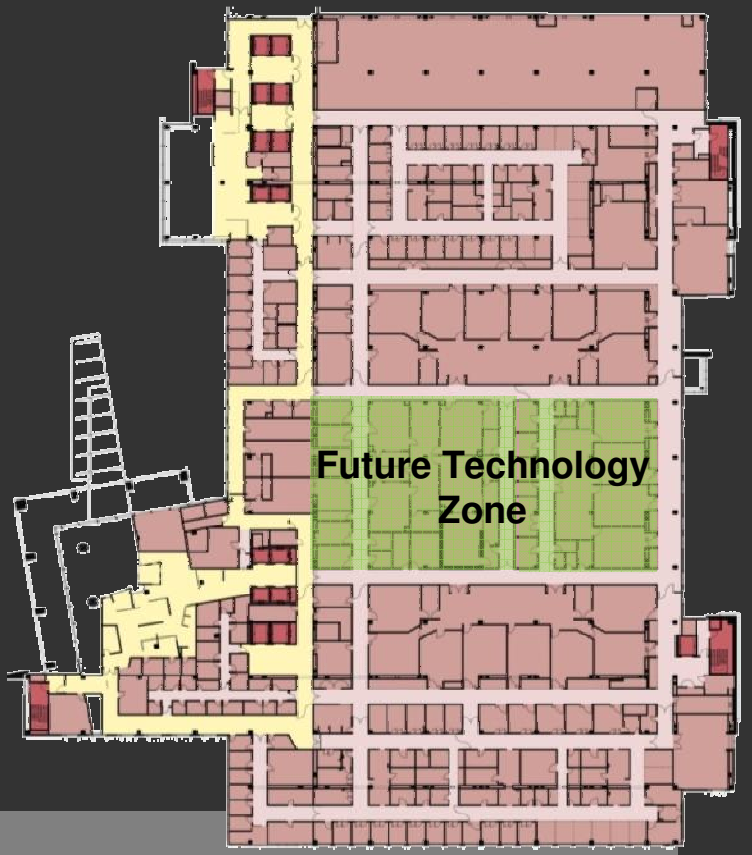
Block steps back to further provide usable external south facing space

Fig 1.2.13 Diagrammatic representation of D+T design strategy

Building Massing: Daylight vs. Regeneration

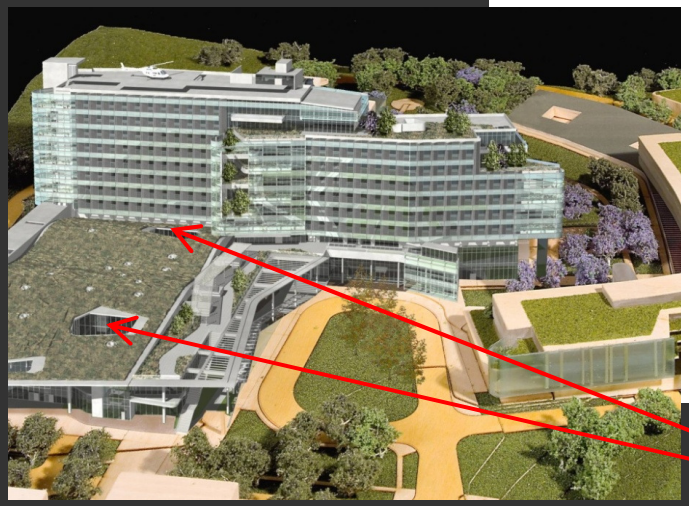


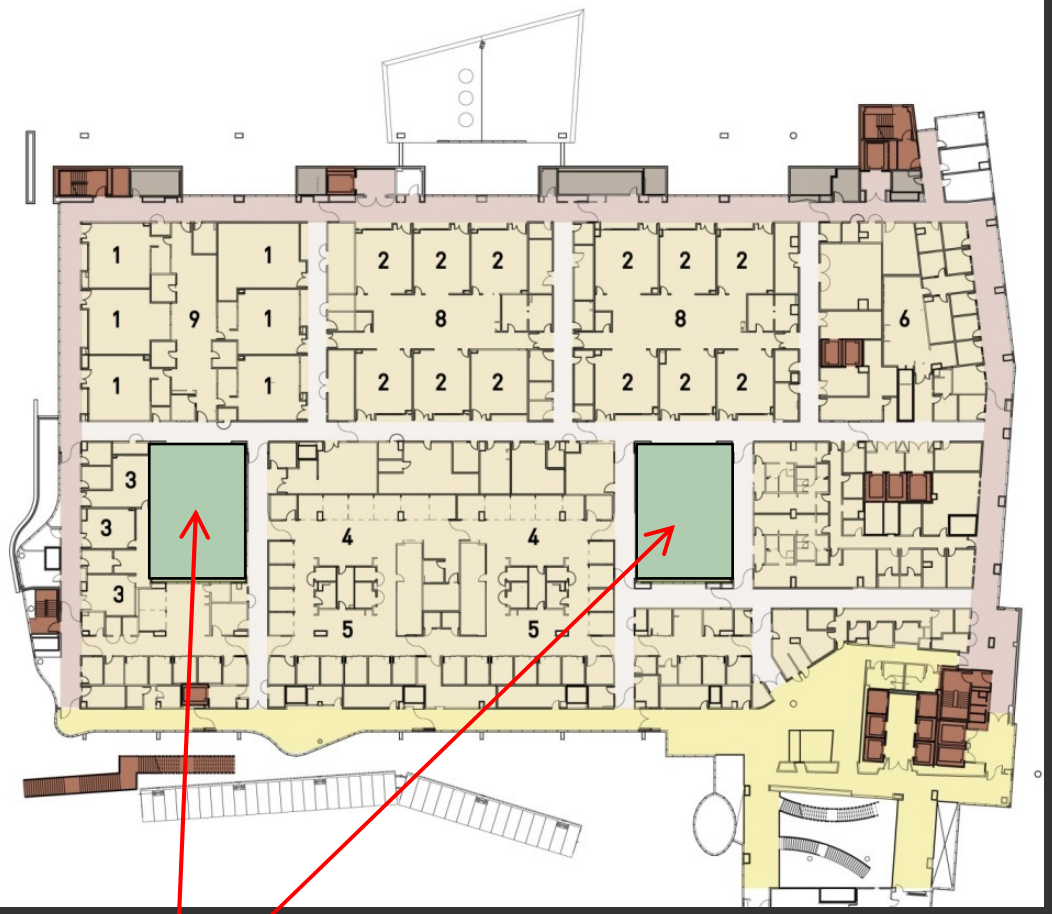




Building Massing: Daylight vs. Regeneration

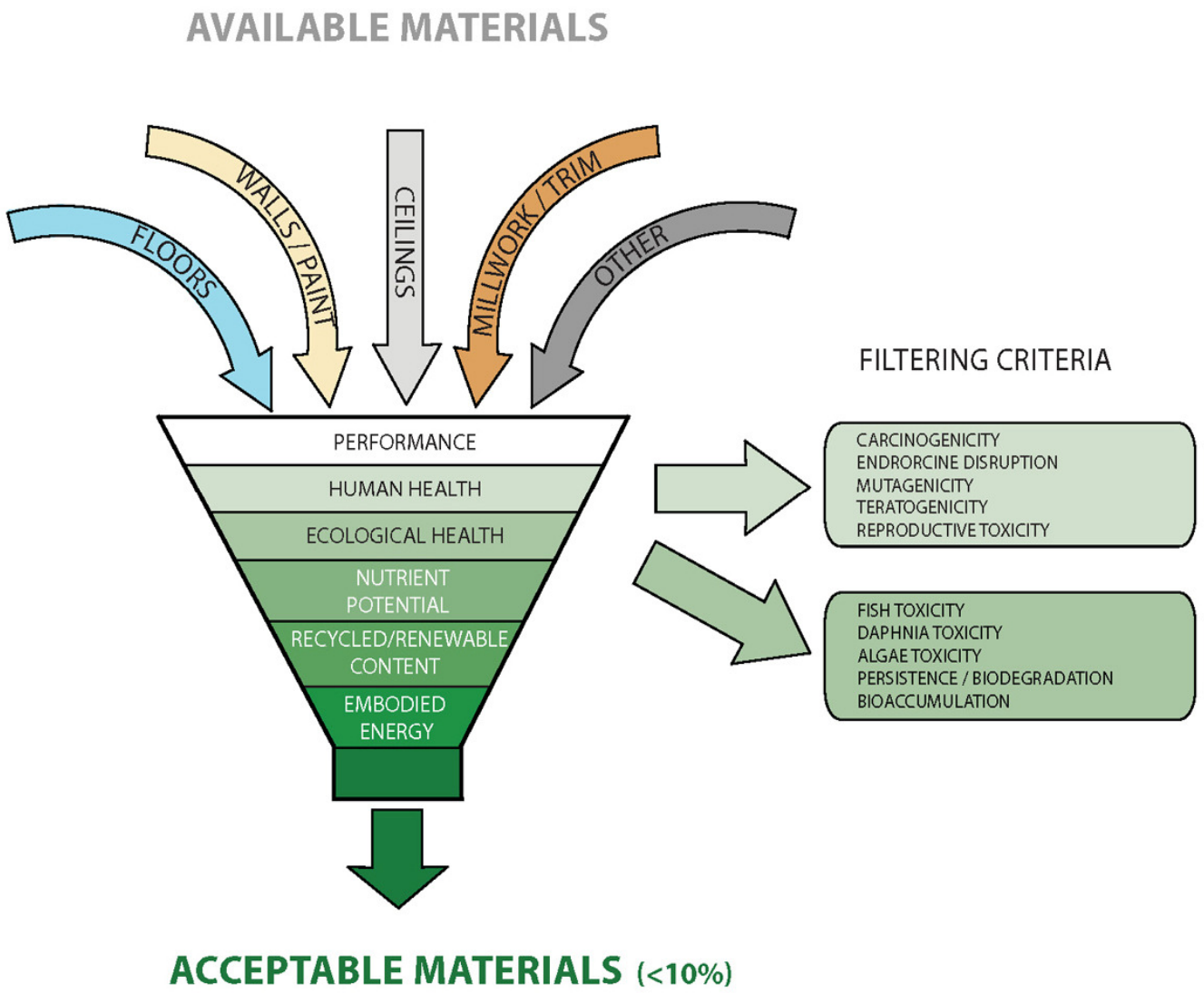
1 IR / CATH
2 OR
3 ENDOSCOPY
4 PACU
5 PRE-OP
6 PATHOLOGY
7 LIGHT COURT
8 CLEAN CORE
9 STAFF CORE





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.

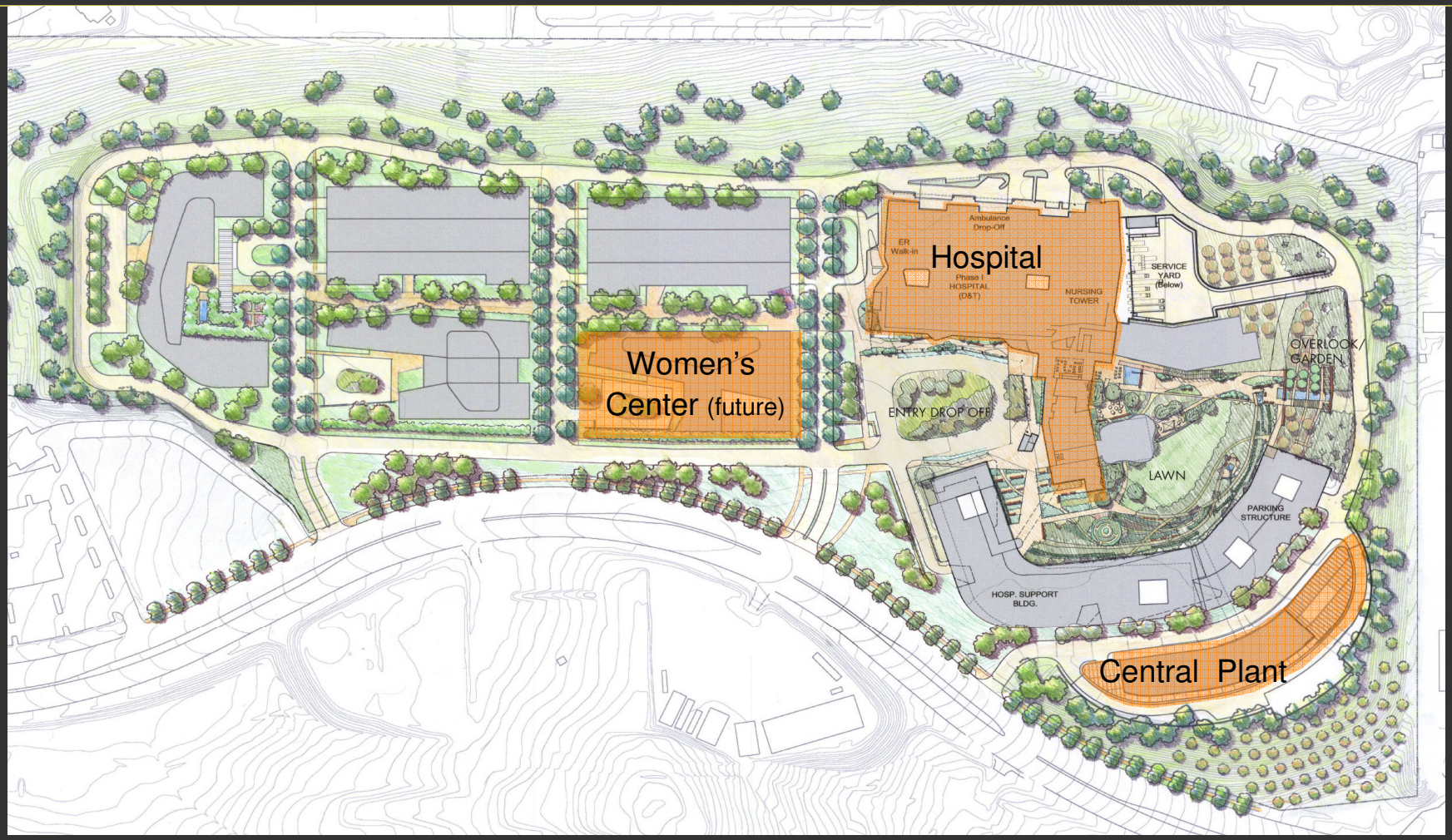
Hence, even low VOC paint needs to be evaluated for its effects on human health.

Designing the Hospital of the Future

PALOMAR POMERADO HEALTH

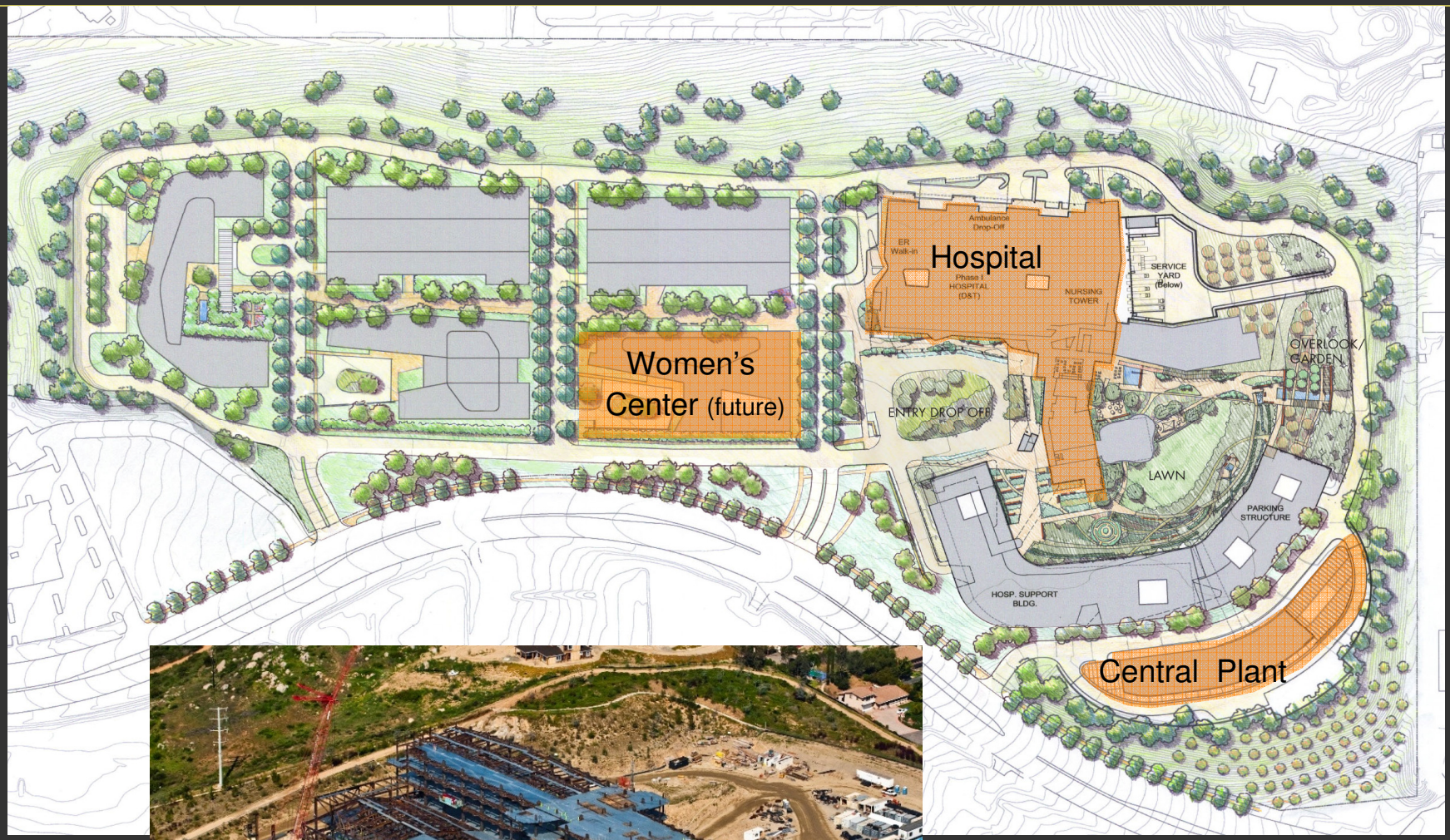
- District hospital in San Diego County
- 775,000 gross building area (365 beds)
- Scheduled completion date: 2011

Hospital of the Future: CASE STUDY



for Palomar Pomerado Health

Hospital of the Future: CASE STUDY



Hospital of the Future: CASE STUDY

Hospital of the Future: CASE STUDY

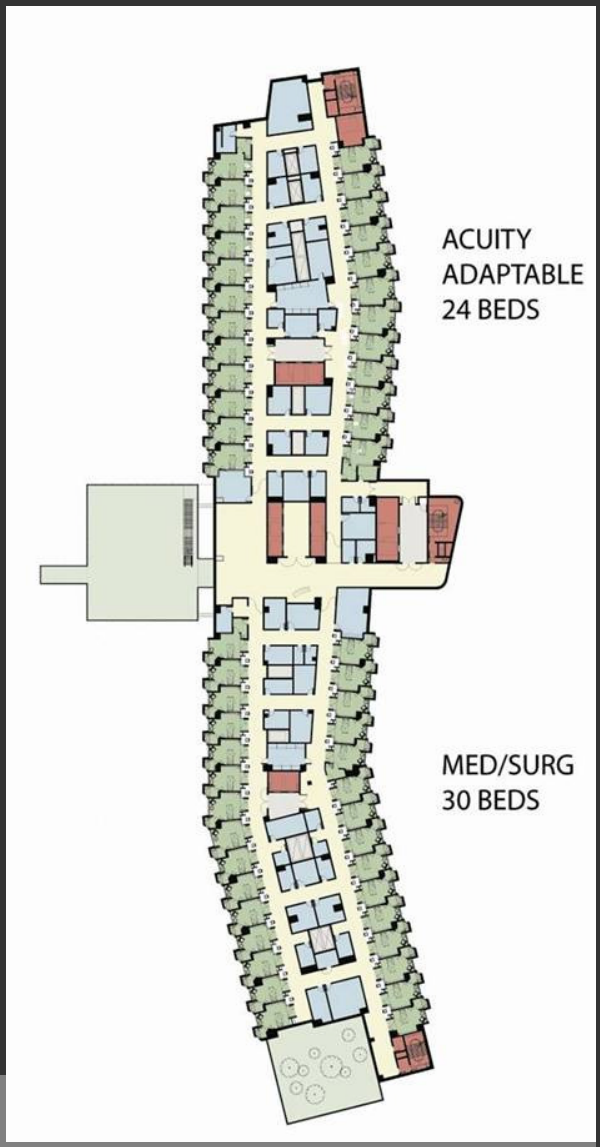
PROJECT INNOVATIONS

- 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 ROO

PATIENT ROOM AREA COMPARISON

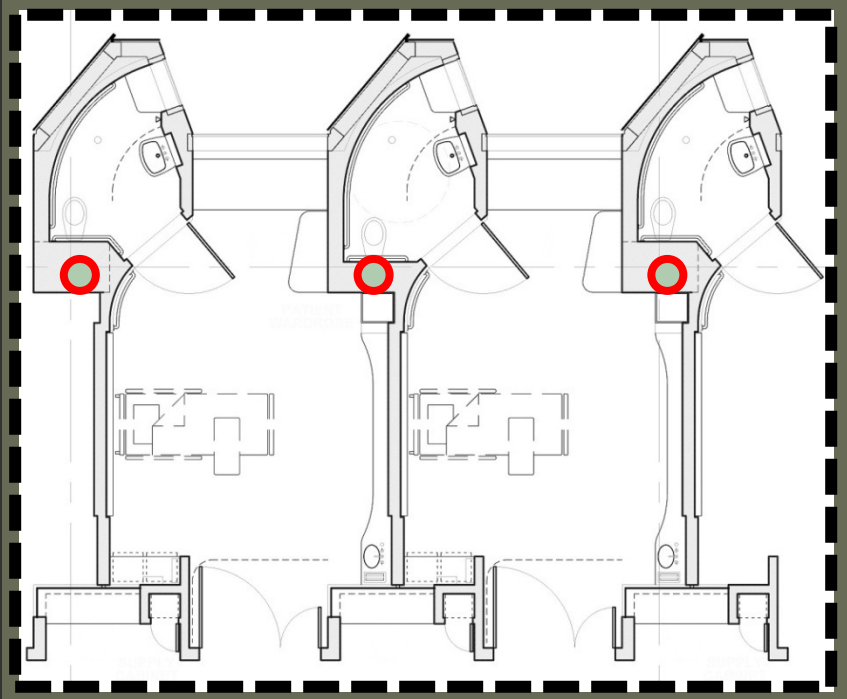
ACUTE CARE ROOM
240 NSF

CRITICAL CARE ROOM
280 NSF

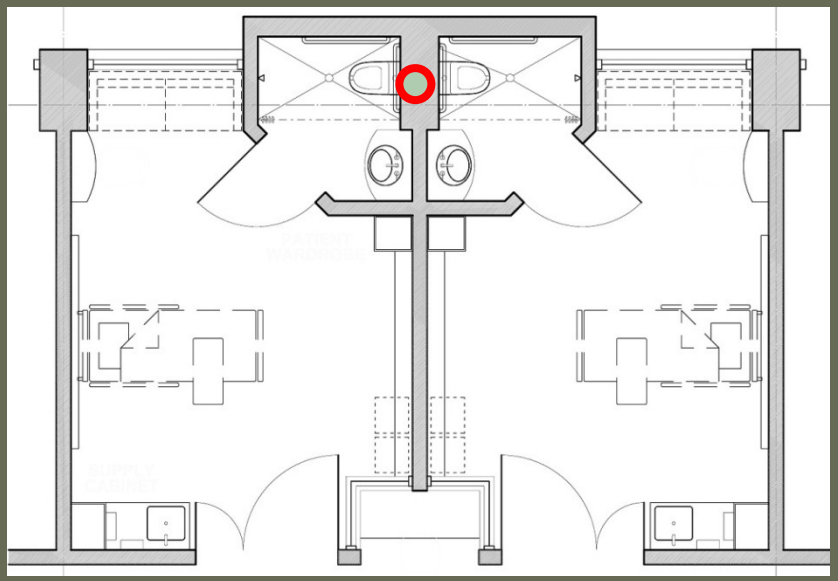
PREMIUM: $384/ SF x 40 SF = $15,360 / room

Hospital of the Future: SAME-HANDED PATIENT ROOM

“HANDED” vs. “MIRRORED” ROOMS:



“SAME HANDED” PATIENT ROOM



TRADITIONAL “MIRRORED” ORIENTATION

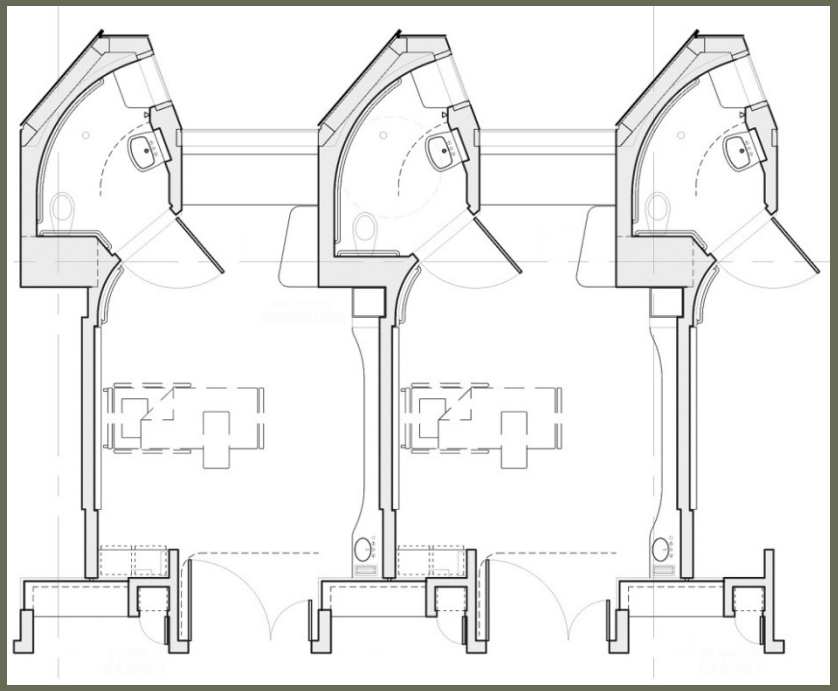
PREMIUM* (non-shared plumbing wall) = $987 / room

* 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.)



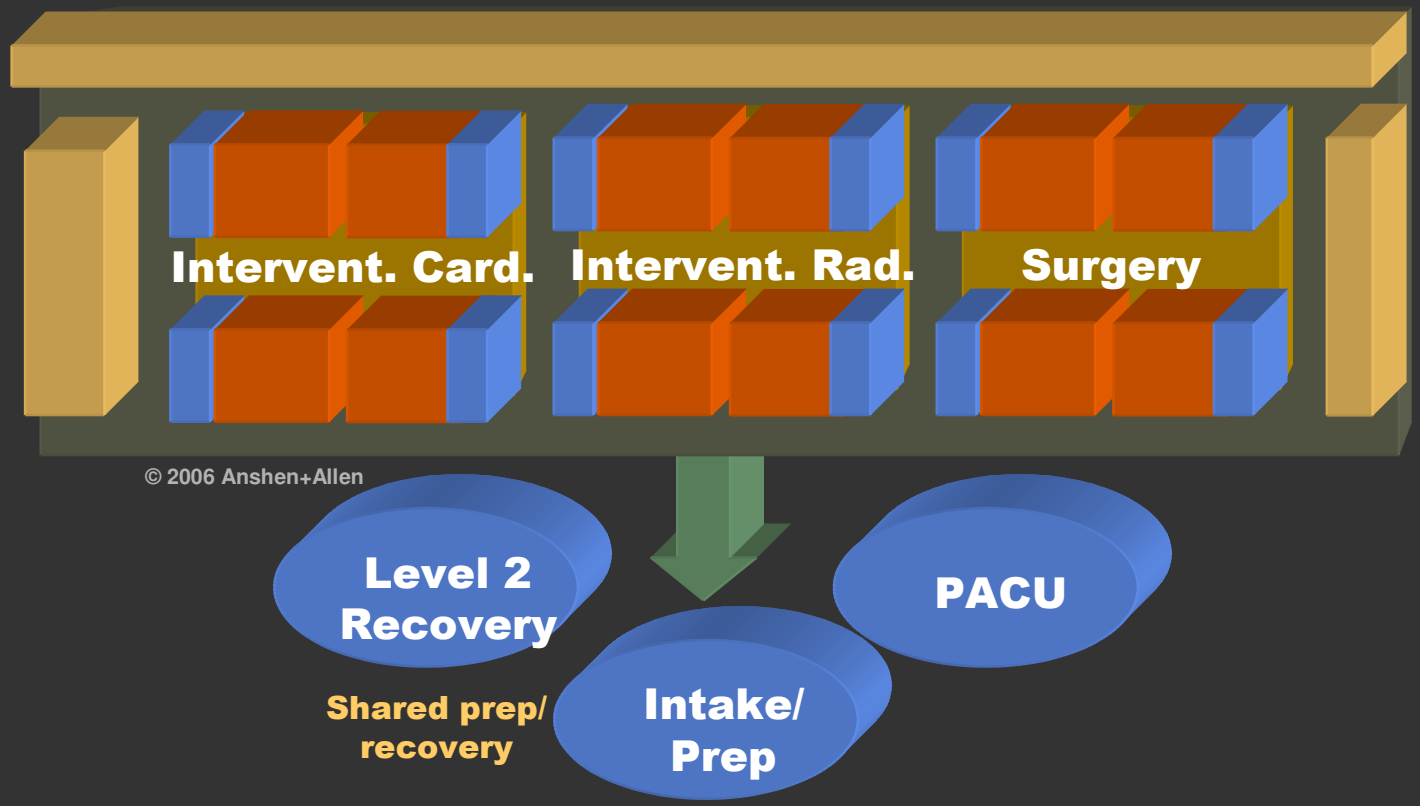
“SAME HANDED” PATIENT ROOM

CAUTION:

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

Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFORM

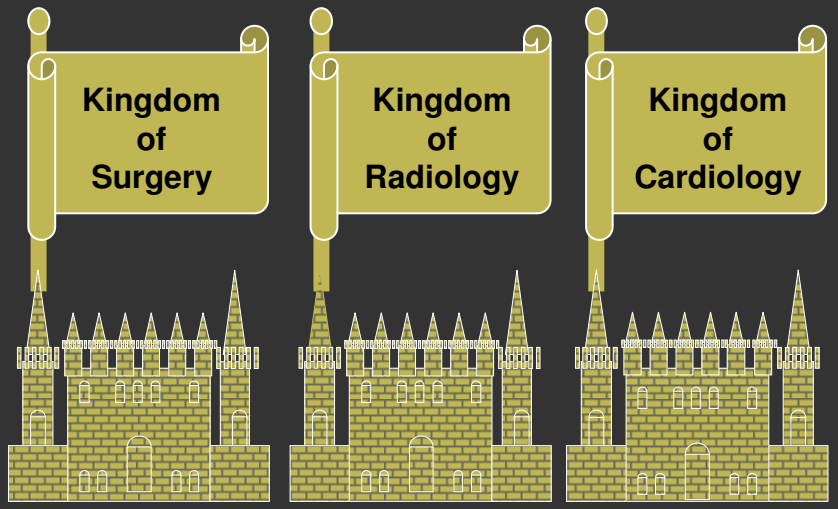
DEFINITION: The integration of various interventional services within a common area and operated in a collaborative manner

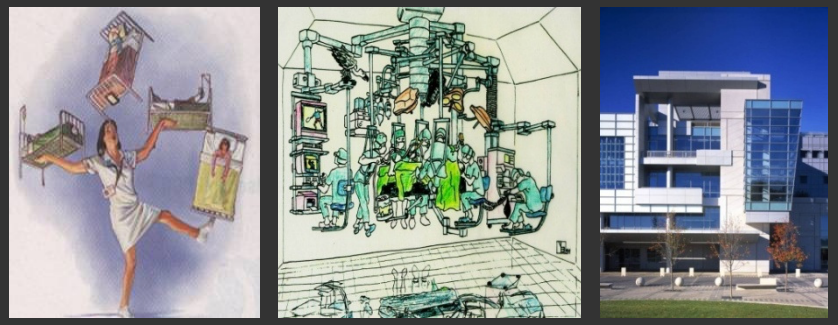


Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFORM

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 infra-structure capacity for areas of future change





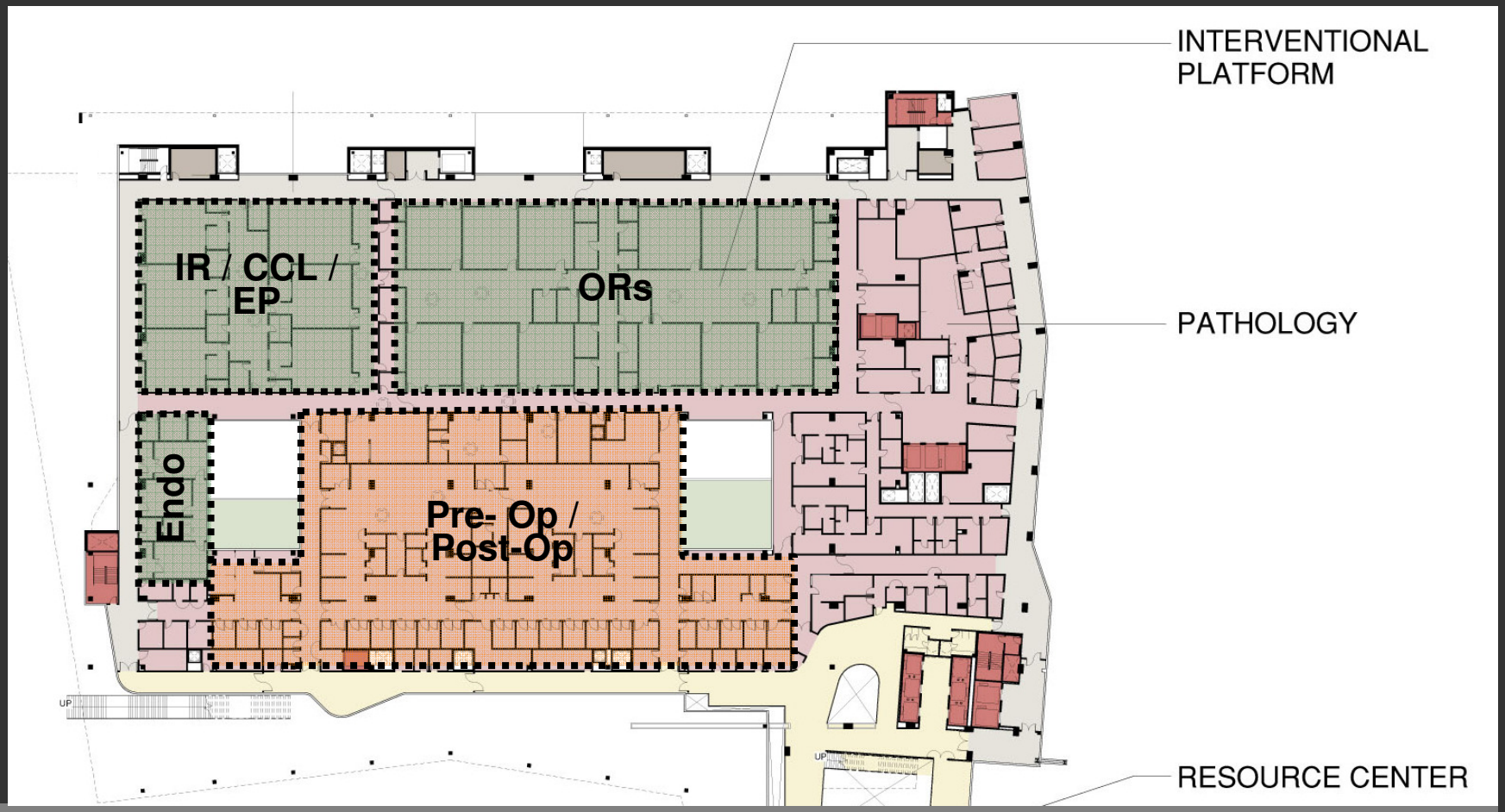
Lower middle image, courtesy of: CIMIT

POTENTIAL BENEFITS:

Improved flexibility, efficiency, capacity, throughput, collaboration

Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFORM

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

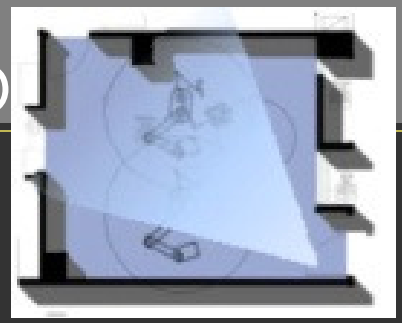


Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFO

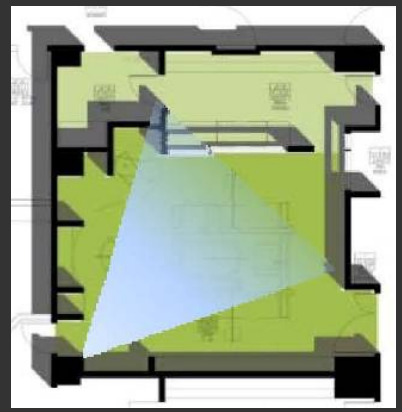
UNIVERSAL PROCEDURE ROOMS:

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:

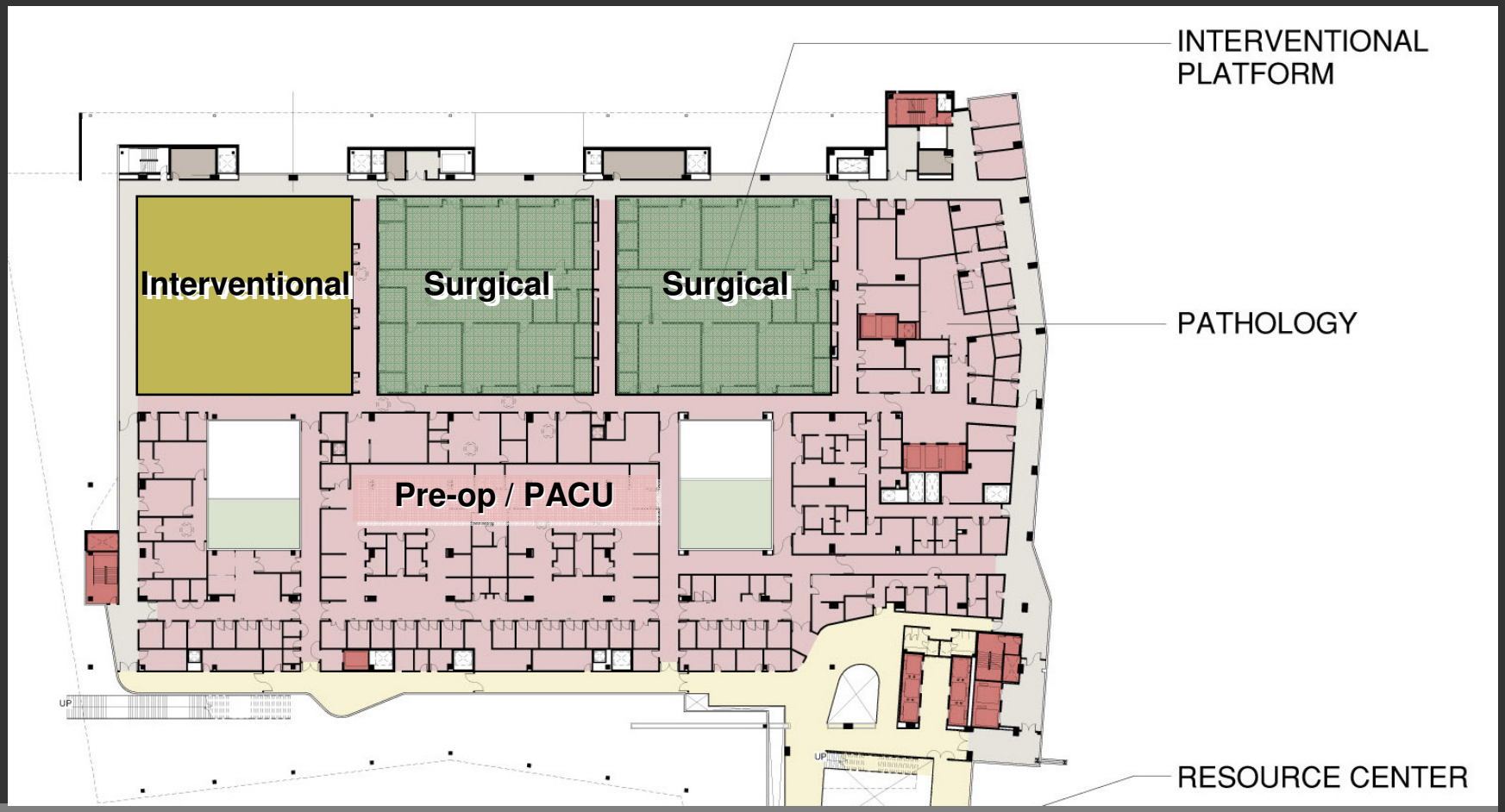


INTERVENTIONAL ROOM:



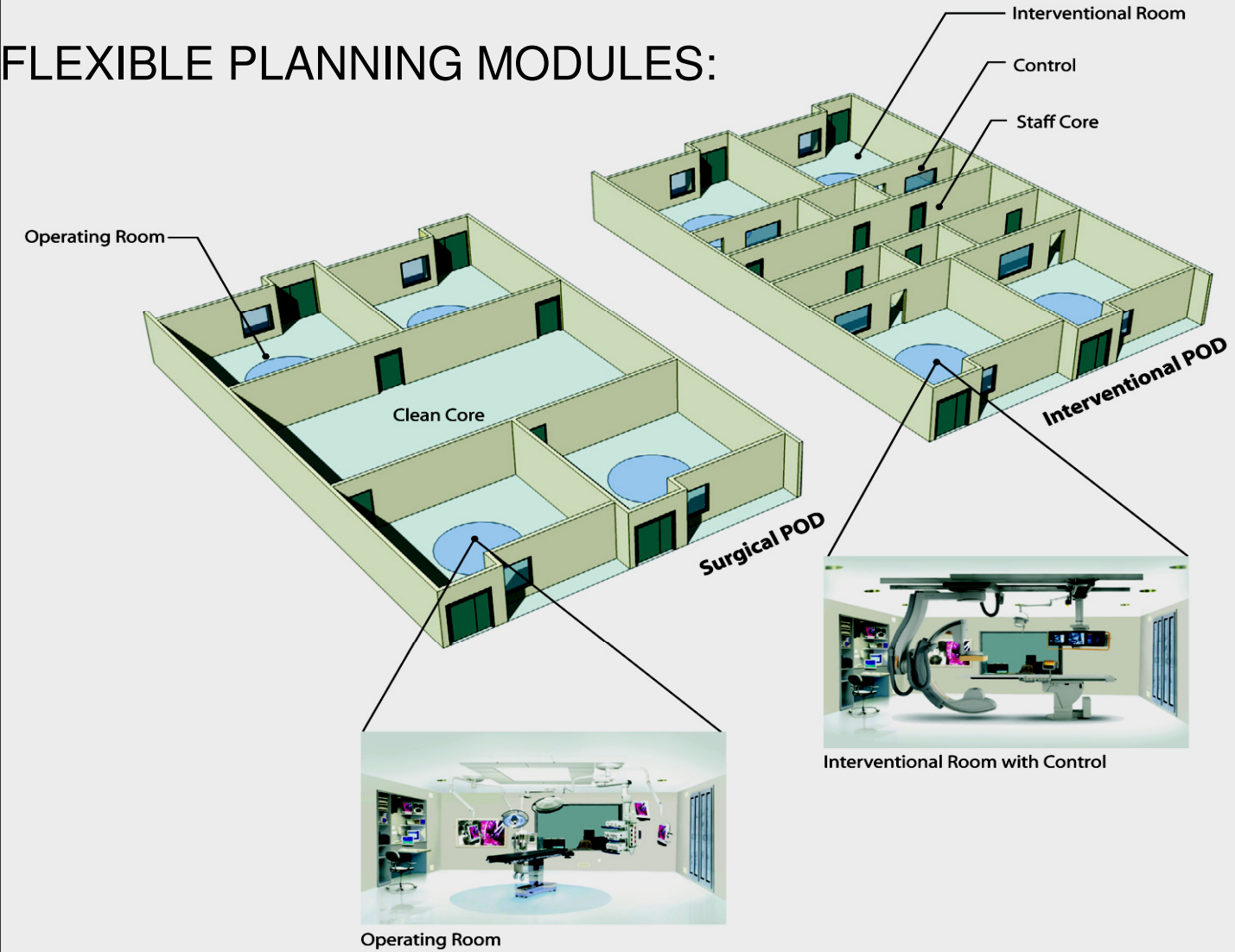
Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFORM

FLEXIBLE PLANNING MODULES:



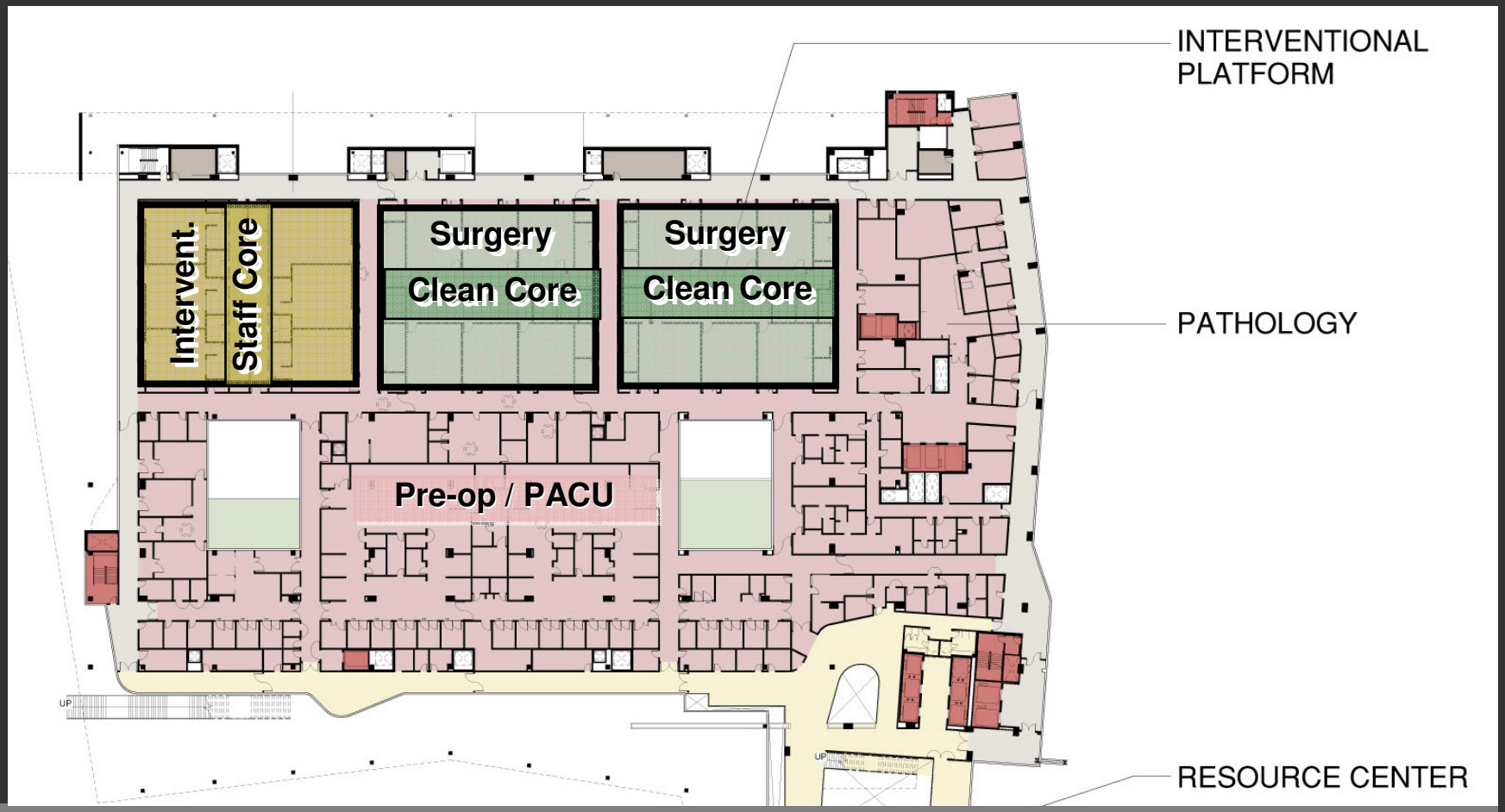
Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFORM

FLEXIBLE PLANNING MODULES:



Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFORM

SURGERY = CLEAN CORE; INTERVENTIONAL = STAFF CORE:



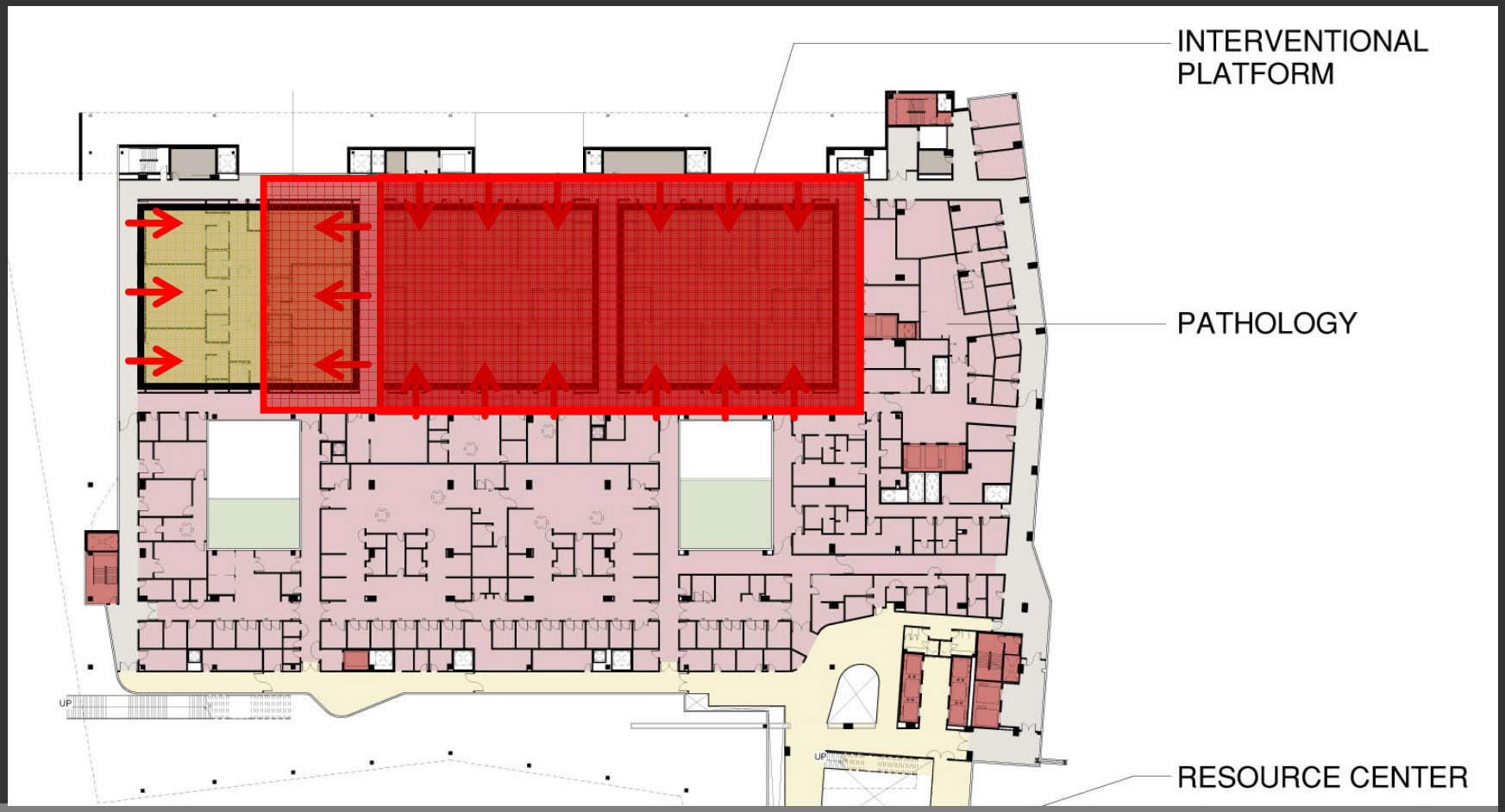
Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFORM

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”

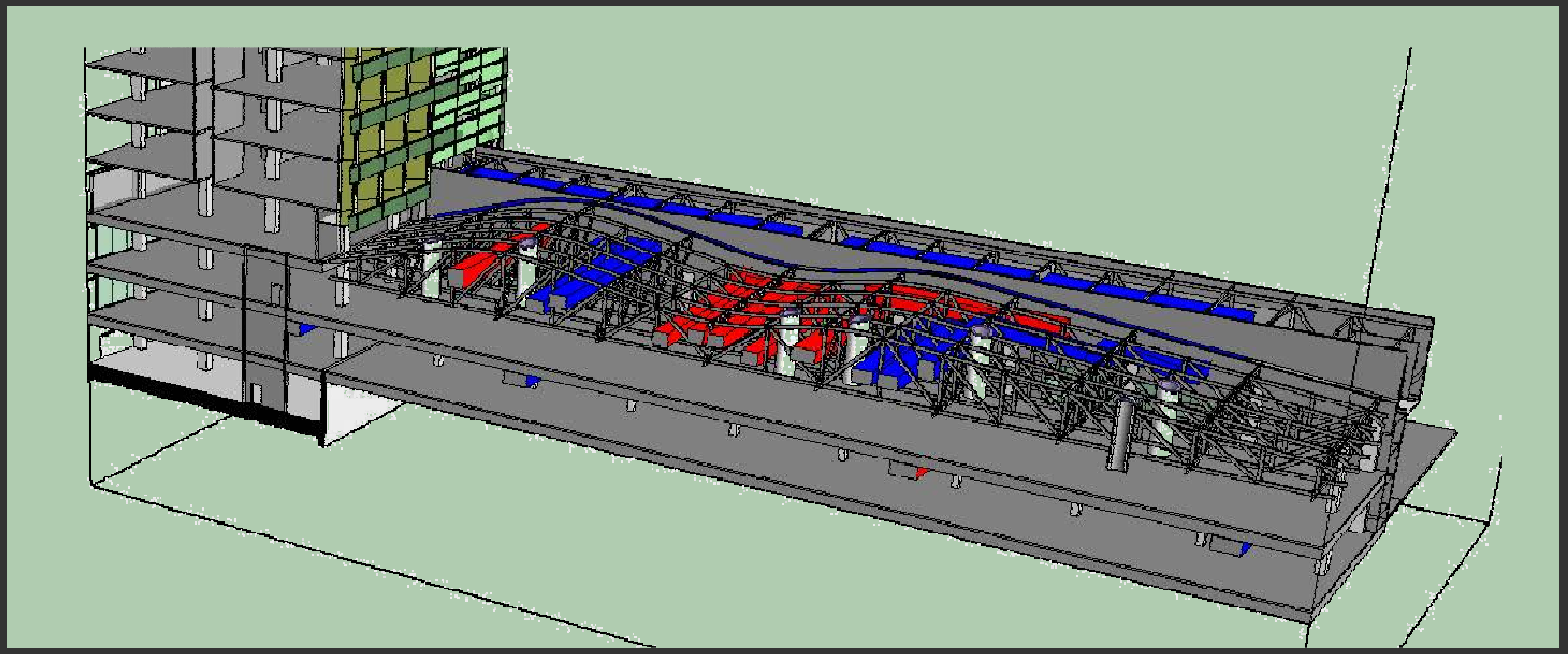


Hospital of the Future:
VIRTUAL “RED LINE”

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"



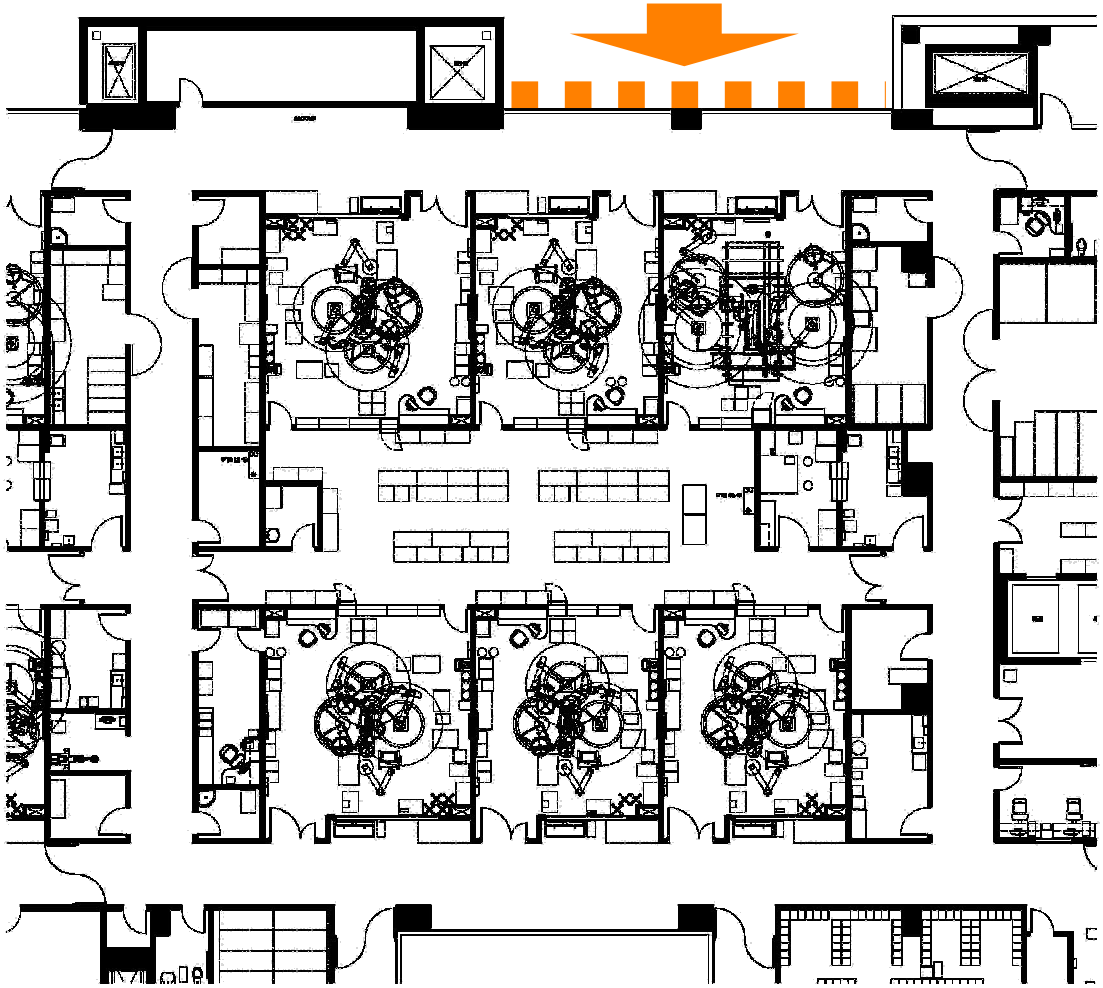
Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFORM

DAYLIGHTING THE DEEP FLOOR PLATE:

1. Perimeter daylight
2. Internal courtyards

Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFORM

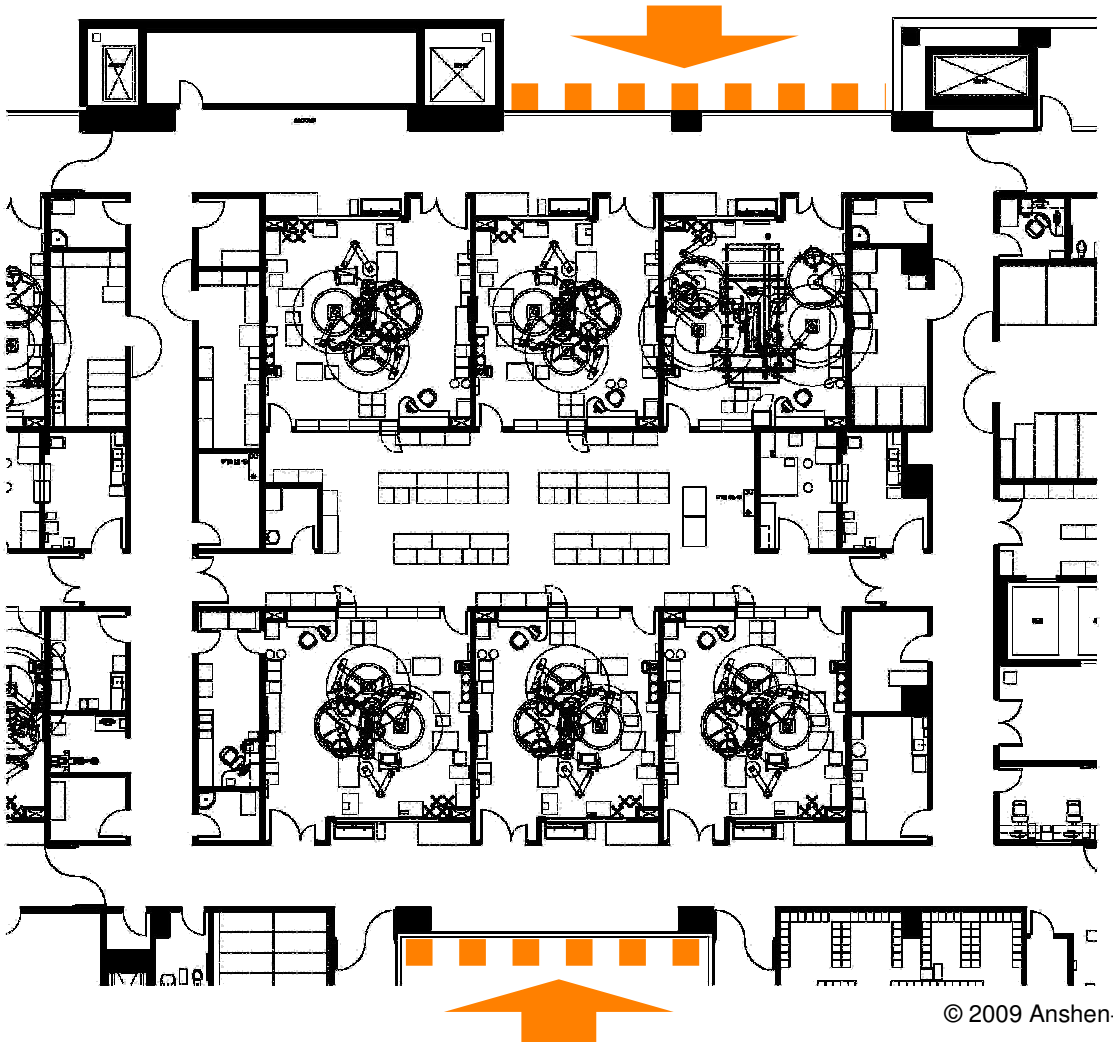
DAYLIGHTING THE DEEP FLOOR PLATE:



Borrowed light from exterior into corridors

Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFORM

DAYLIGHTING THE DEEP FLOOR PLATE:

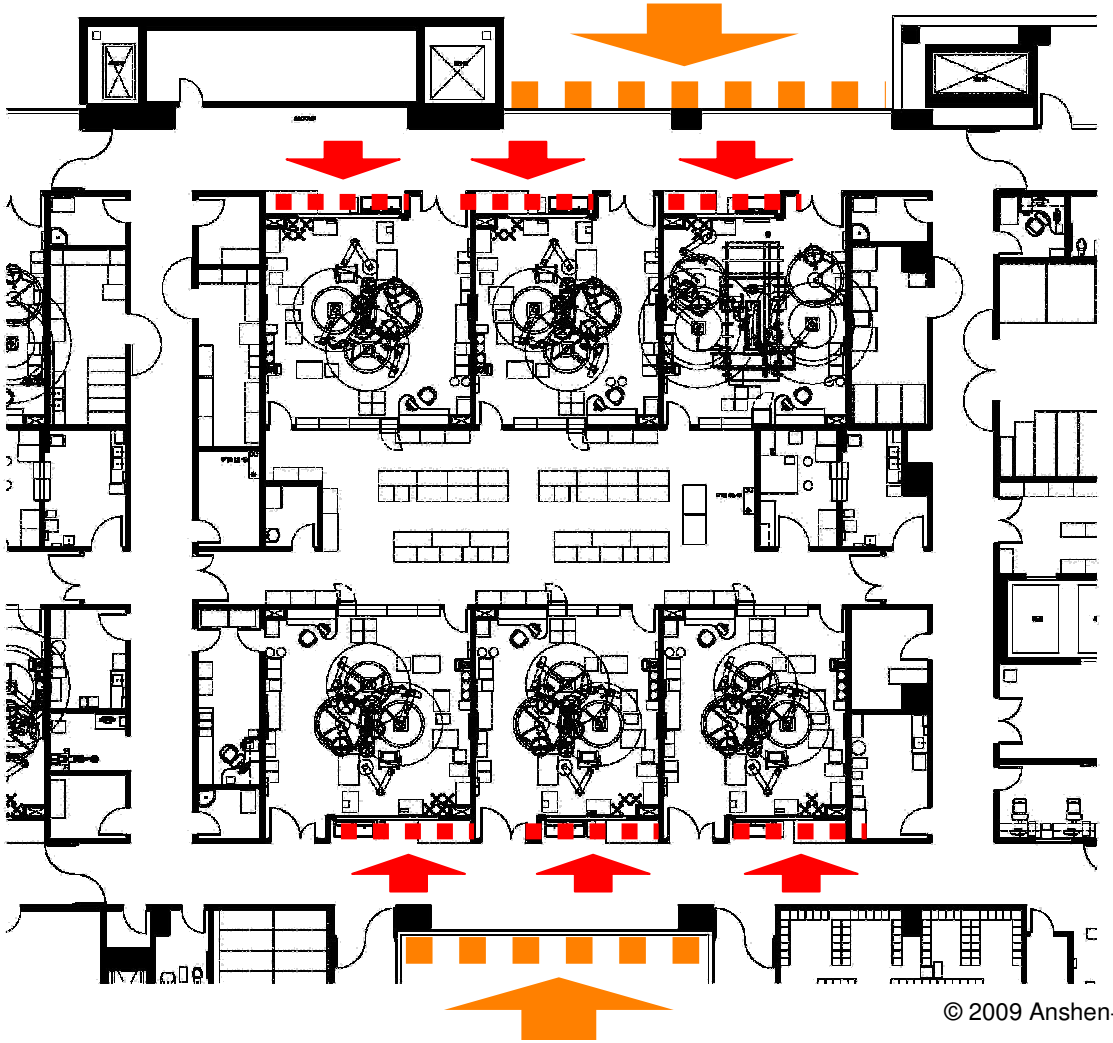


Borrowed light from exterior into corridors

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

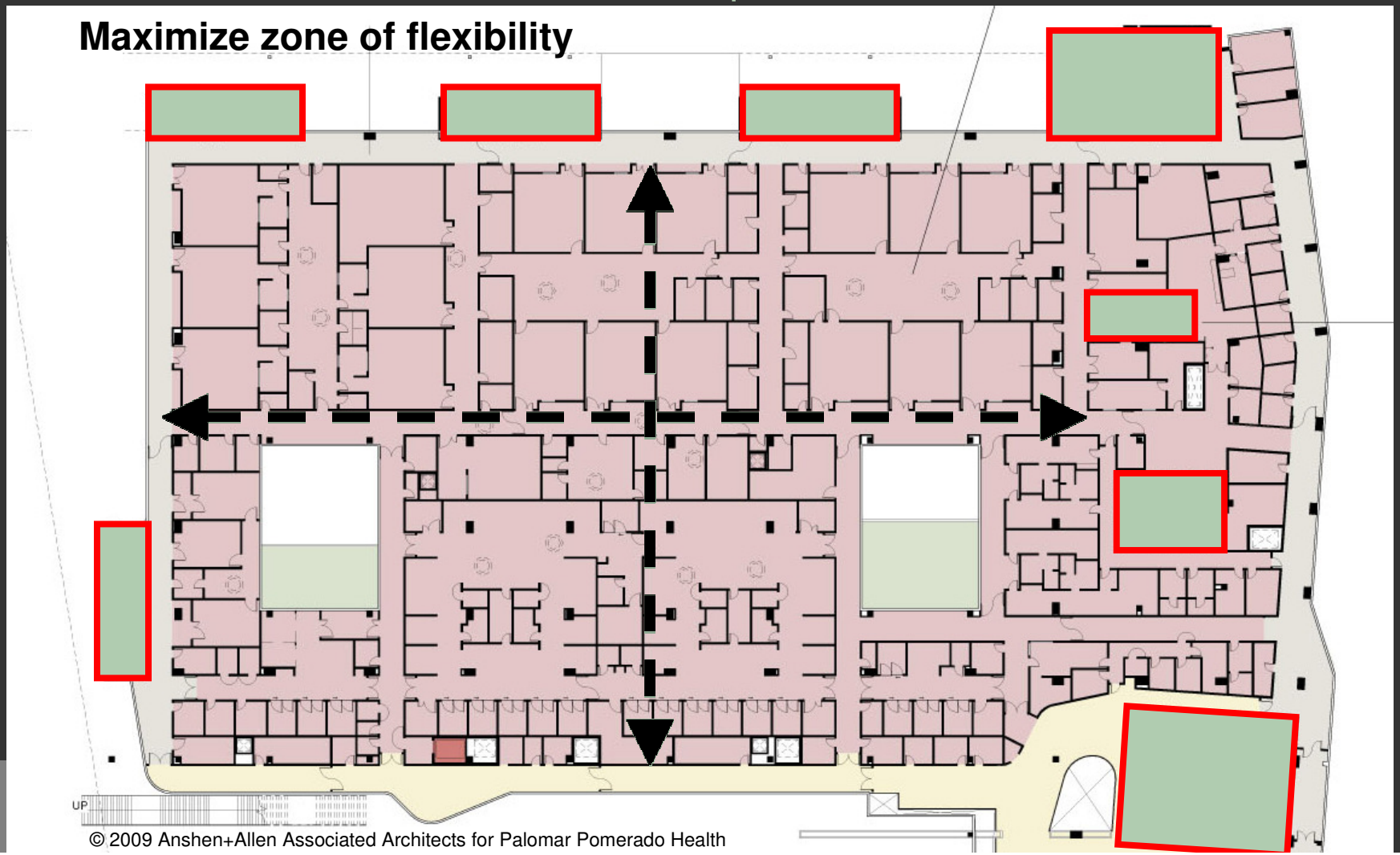
Borrowed light from corridors into procedure rooms

Hospital of the Future:
INTEGRATED INTERVENTIONAL PLATFORM

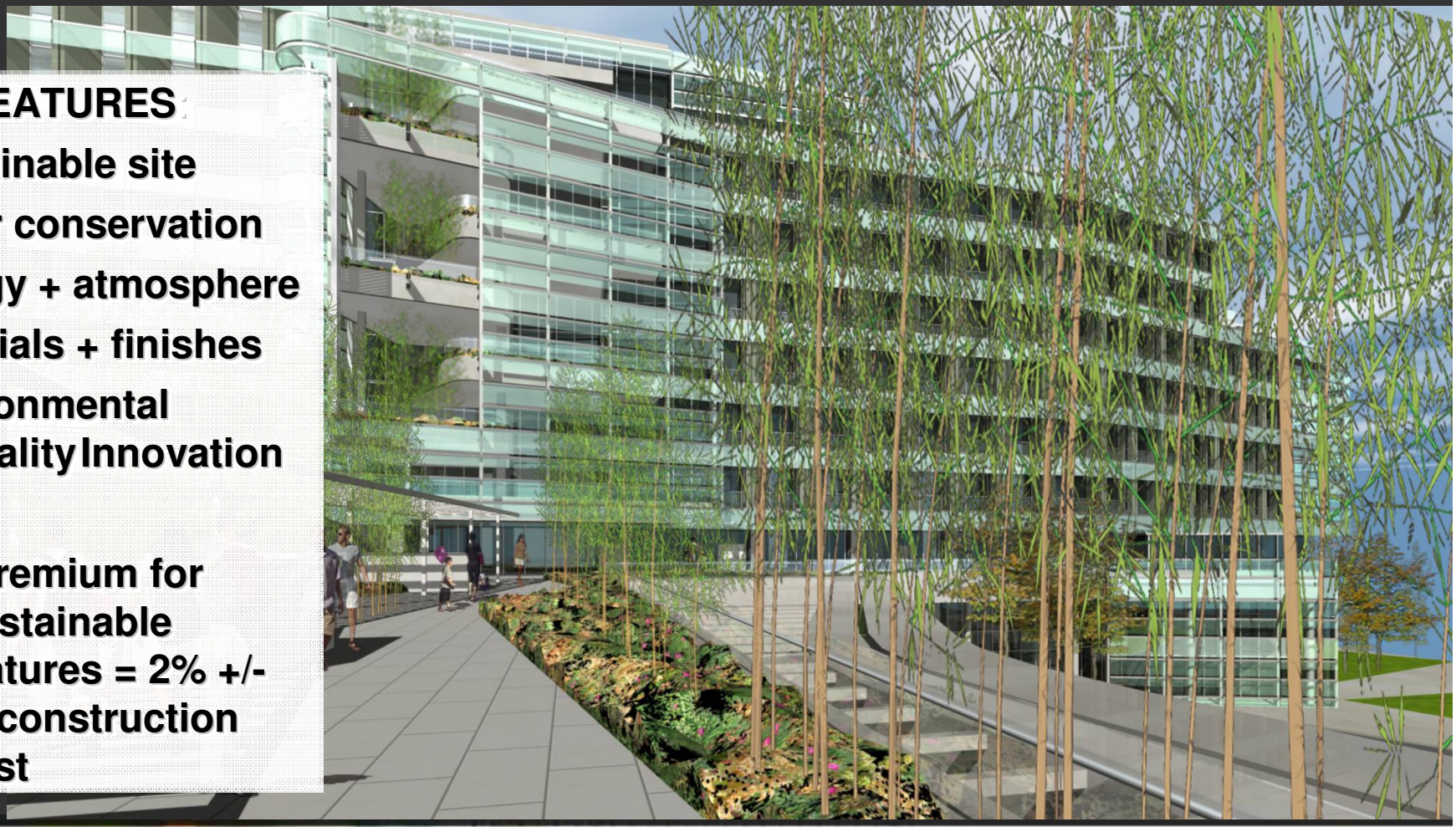
HOSPITAL DESIGNED LIKE A RESEARCH LAB:

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

Best Practices for Creating High Performance Healing Environments™

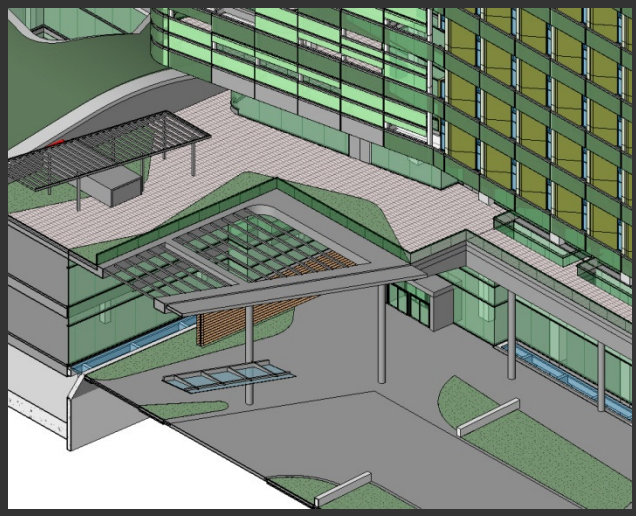
Hospital of the Future: SUSTAINABILITY

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

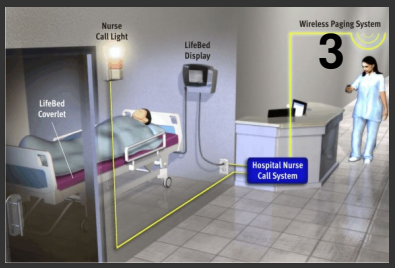
Hospital of the Future: SUSTAINABILITY

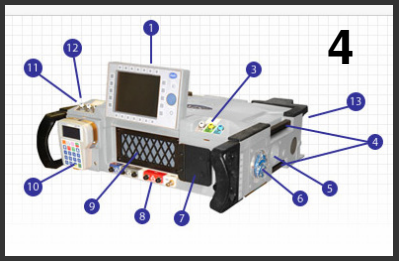
PREMIUM: approx. 0.3% of construction cost

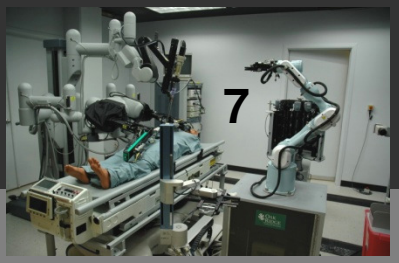
Hospital of the Future: Intelligent Technology

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?