

Critical Care Design: Design Competition Winners & Future Trends

SCCM 25 Years of Winning ICU Designs



Photo: D. Kirk Hamilton

The Swedish Medical Center
Englewood, Colorado, USA
1992 ICU Design Competition Winner



Photo: Courtesy of the Architect

University Medical Center Utrecht
The Netherlands
2011 ICU Design Competition Winner

The Society of Critical Care Medicine (SCCM)

The largest **multi-professional** organization dedicated to ensuring excellence and consistency in the practice of critical care.

With **16,000 members in 100 countries**, SCCM represents all professional components of the critical care team.

Now in its 25th year, the design competition is sponsored by:

- Society for Critical Care Medicine (SCCM)
- American Institute of Architects / Academy of Architecture for Health (AIA/AAH)
- American Association of Critical-Care Nurses (AACN)

www.sccm.org

<http://www.sccm.org/Membership/Awards/Pages/default.aspx>

http://www.sccm.org/Membership/Member_Demographics/Pages/default.aspx

Why is this study important?

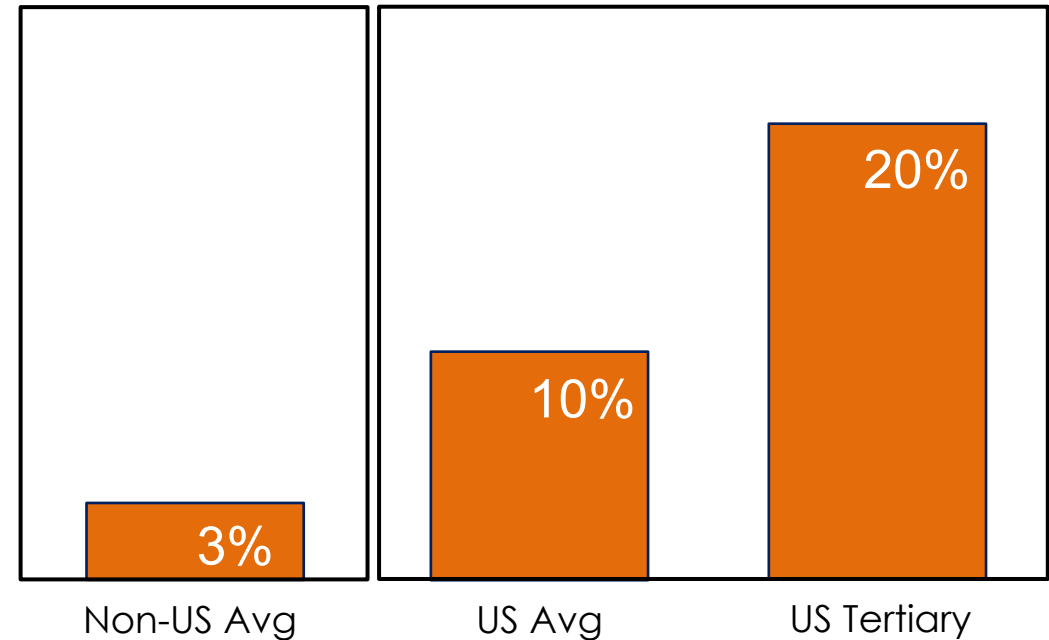
ICU Space Demand

In the United States, approximately **40 – 50%** of all hospital space is allocated to inpatient bed units. ¹

Of all US hospital beds, **10% to 20%** are ICU beds. ²

In the US, an ICU bed unit occupies **30% to 40%** more space than an acute bed.

Estimated ICU Beds as % of Total



Advisory Board, 2006

¹ Uhlenhake, R. (2006). *Study of Critical Care Unit Projects*. WHR Architects, Inc.

² Society of Critical Care Medicine Tele-ICU Committee. (2010) *Telemedicine in the Intensive Care Unit*. <http://www.learnicu.org/SiteCollectionImages/Tele-ICU%20Paper.pdf>. Accessed February 8, 2010.

Why is this study important?

ICU Associated Costs

- ICU beds make up $\leq 20\%$ of all beds but consume **33%** of operating budgets. ^{1, 2}
- ICU: **50%** more costly to build. ³
- Cost/patient day **2-4 times** non-ICU patient day. ³

“No other space has more impact on efficiency of care.”

Paula Buick, RN; Joseph O’Leary; Michael Roughan, AIA

¹ Buick, P, et al. Critical Care Tertiary Facility Design presentation. Design Symposium 2006.

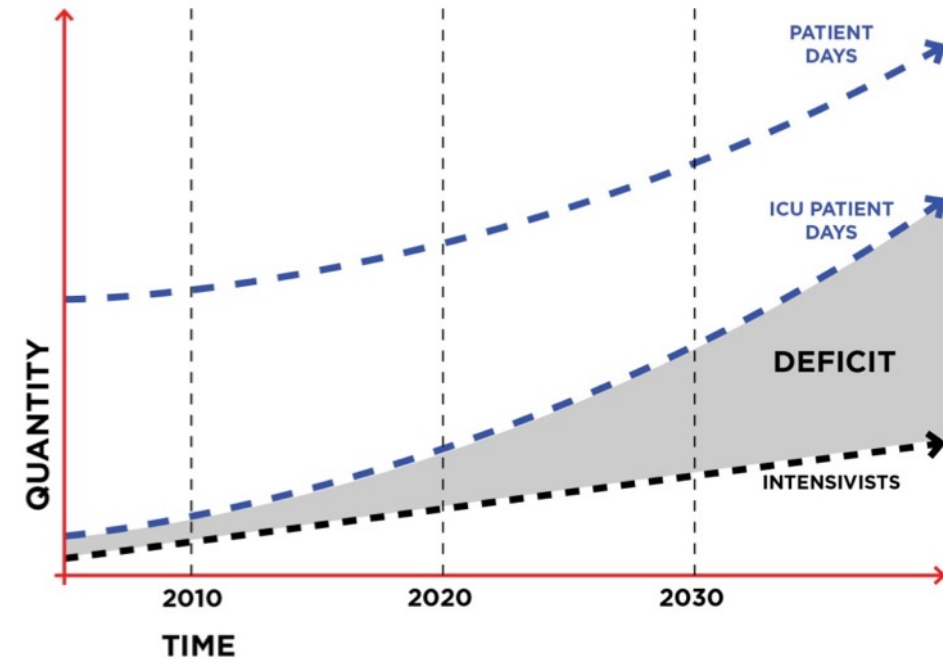
² Society of Critical Care Medicine Tele-ICU Committee. Telemedicine in the Intensive Care Unit. <http://www.learnicu.org/SiteCollectionImages/Tele-ICU%20Paper.pdf>. Accessed February 8, 2010.

³ Advisory Board, 2006.

Why is this study important?

ICU Future Projections

- By 2020, there will be a possible **22%** deficit of intensivists to demand; by 2030, this deficit may increase to **35%**.^{1, 2}
- ICU patient days are projected to grow up to **30%** more rapidly than non-ICU days.³

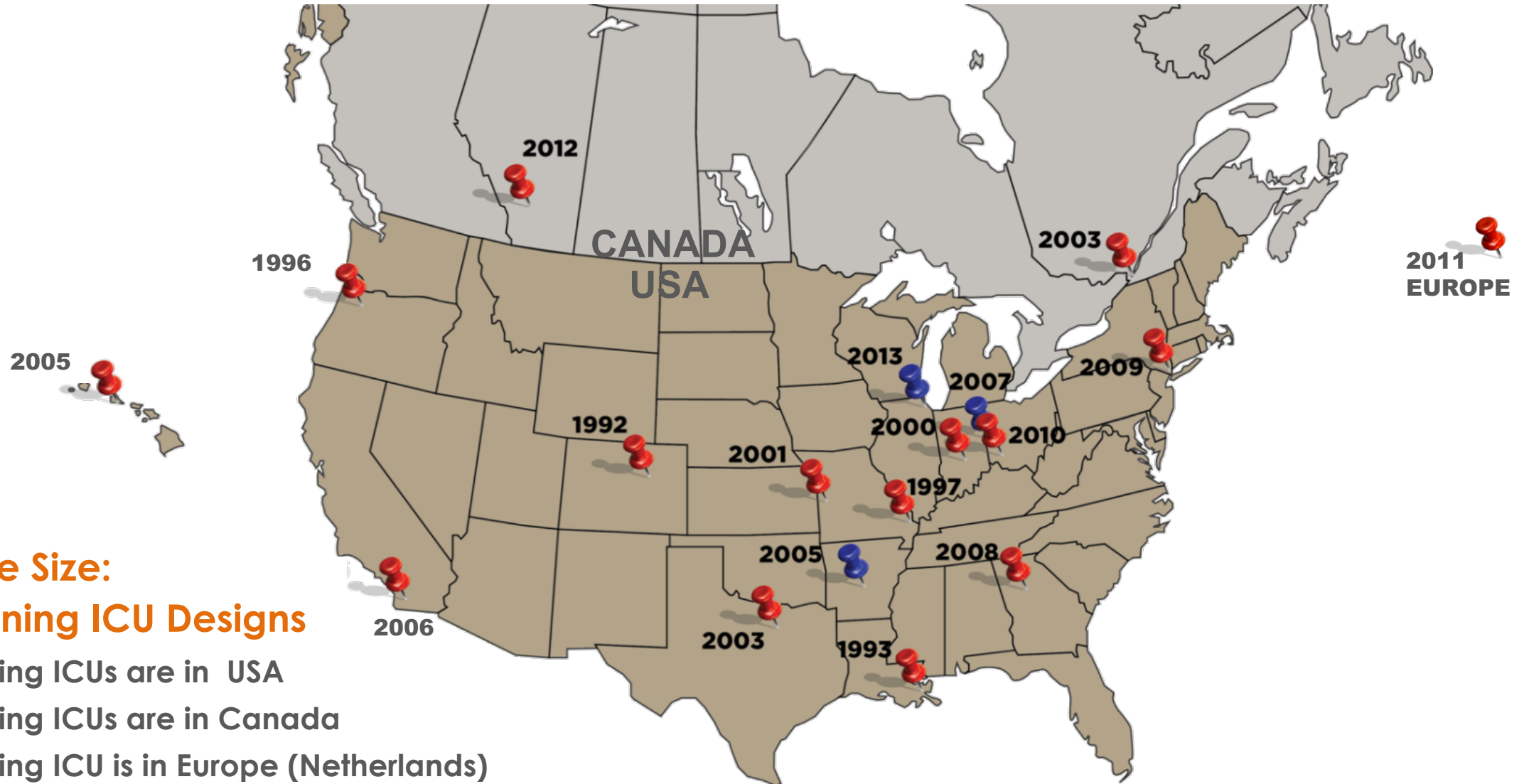


1 Katz, J., et al. (2006). *Cardiology and the Critical Care Crisis*. Journal of the American College of Cardiology.

2 Advisory Board (2009). *Hospitalist Programs with Regional Operations: Hospitalist and Intensivist Supply and Demand*. The Advisory Board Company, Washington, D.C.

3 Advisory Board, 2006.

SCCM: ICU Design Citation Award



Sample Size:

18 Winning ICU Designs

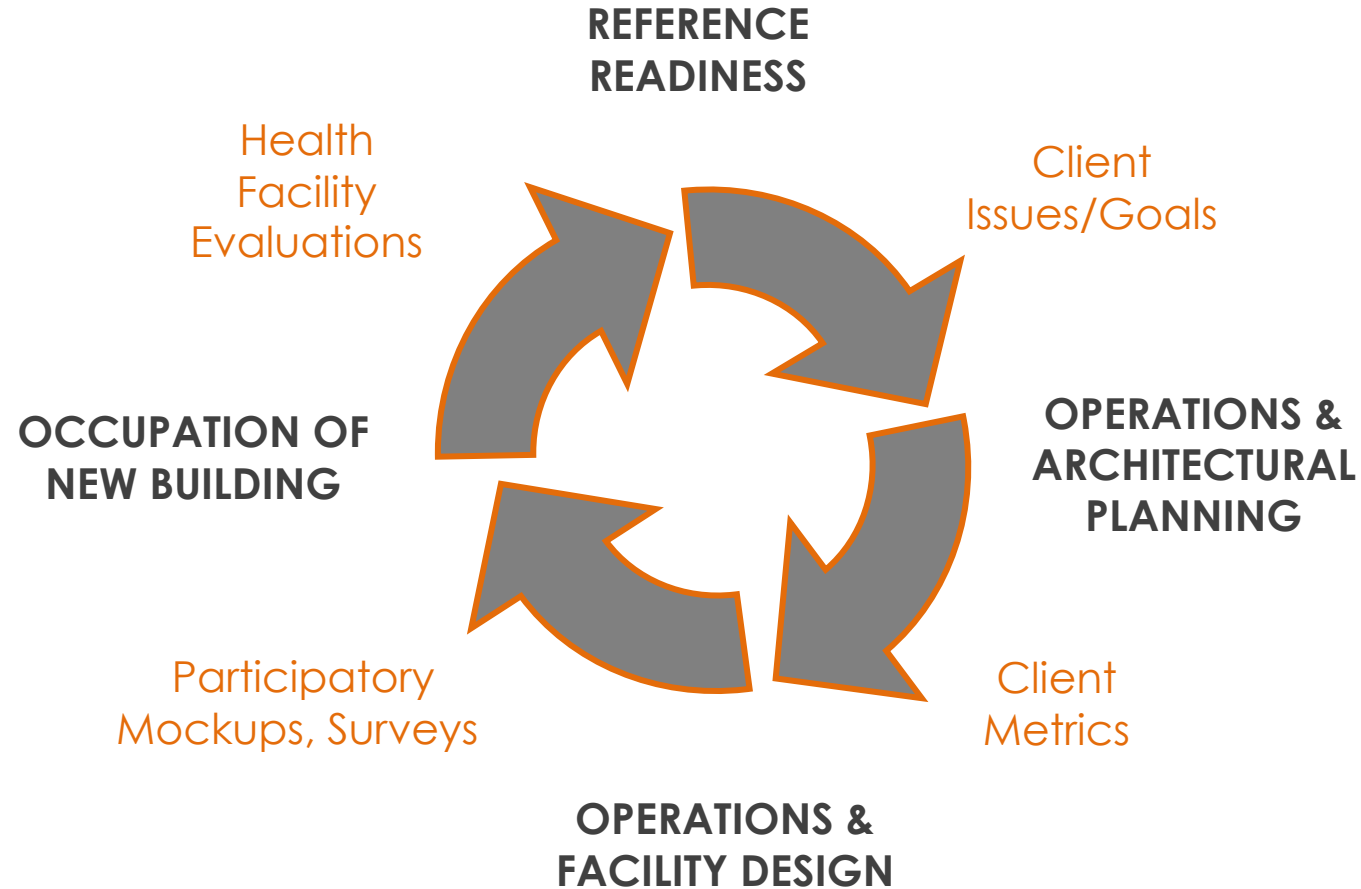
15 Winning ICUs are in USA

2 Winning ICUs are in Canada

1 Winning ICU is in Europe (Netherlands)

How Do We Use This Information

EBD Process & Practice Model – *For us, it is a continuum in learning*



Data Collected on the Winners - -

Client: Emory University Hospital

Emory Healthcare
Atlanta, Georgia, USA

Medical Director: **Owen Samuels, MD**
Evidence-Based Design Consultant:
Craig Zimring, PhD, Georgia Tech University

Architect: HKS Architects

Atlanta, Georgia, USA

Completion Date: 2007

SCCM Award Date: 2008

Emory Neuro ICU, 20 Beds

Atlanta, Georgia, USA

Program Characteristics:

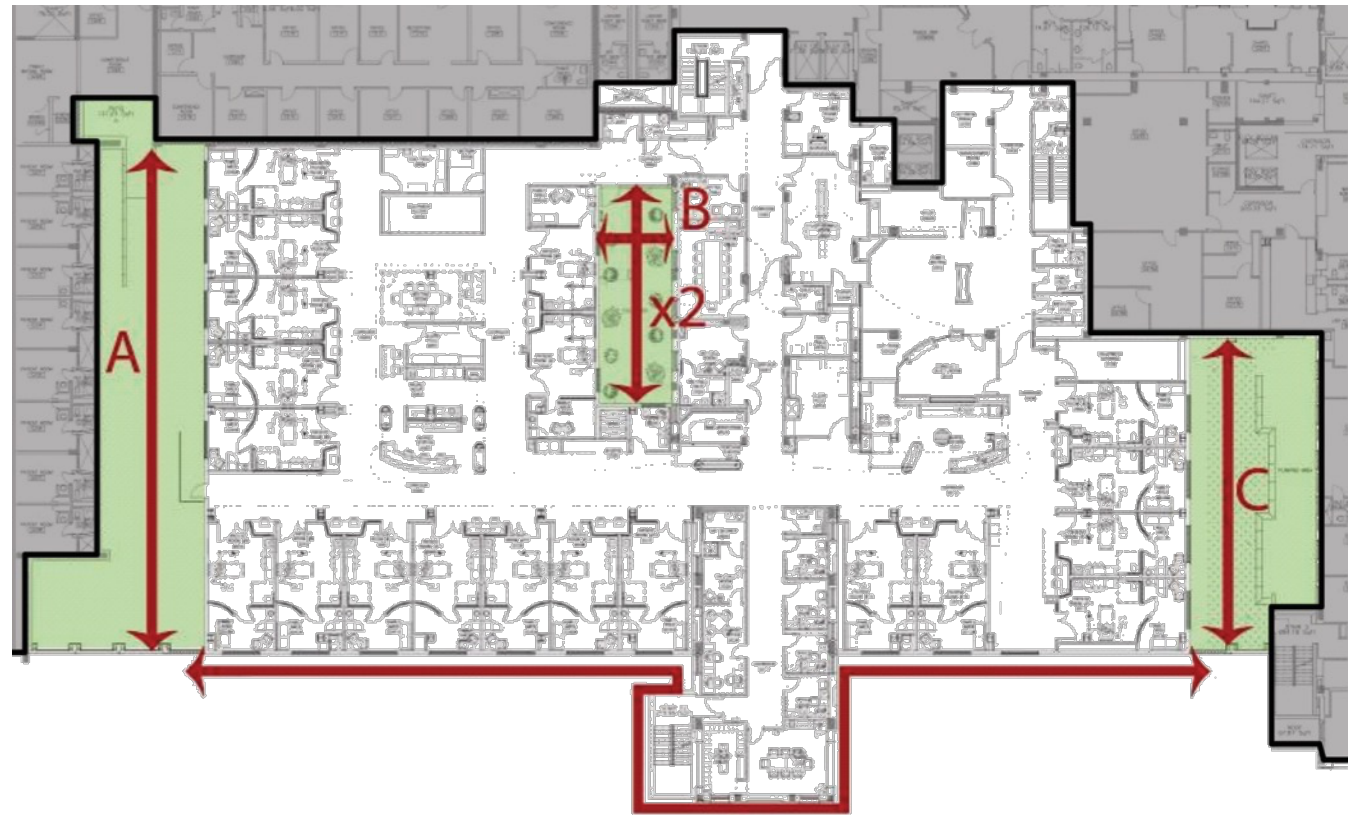
- Specialty ICU
- National & International Referrals
- Teaching & Research Programs

Project Characteristic:

- Vertical Expansion on Hospital



Exterior Perimeter Dimensions



$$A + B + C + D = 34.4\text{m (113ft)} + 11.6\text{m (125ft)} + 21.6\text{m (71ft)} + 96.6\text{m (317ft)} = 164.2\text{m (625ft)}$$

Data Analysis: Case Study

Roof Gardens (Area & Dimensions)



		width x height
A =	257.3 SM (2770 SF)	6.8m x 33.5m
B =	69.4SM (748 SF)	4.8m x 14.3m
C =	116.7 SM (1795 SF)	8.3m x 20.7m

Area Summary (20 Beds)



Floor Departmental Gross	=	2,384 SM (25,658 SF)	=	115.4 SM/Bed (1,242 SF/Bed)
Departmental Gross	=	2,053 SM (22,097 SF)	=	102.6 SM/Bed (1,104 SF/Bed)
Departmental Net	=	1,325 SM (14,269 SF)	=	66.2 SM/Bed (713 SF/Bed)

Area Groupings By Function



Patient Room Groupings:	A	= 14 Patient Rooms	671 SM (7,222 SF)	33% of DGSM
	B	= 6 Patient Rooms	418 SM (4,499 SF)	20% of DGSM
Common Support:	C	= Admin, Family, Diag.	964 SM (10,376 SF)	47% of DGSM
		TOTAL	= 20.53 DGSM (22,097 DGSF)	

Patient Rooms



DNSM%
□ Patient Room- Patient 452 SM (4,868 SF) **34%**

Patient Rooms - Family Accommodations



DNSM%


□ Patient Room- Patient 452 SM (4,868 SF) **34%**

□ Patient Room- Family 237 SM (2,550 SF) **18%**

Public, Family, & Visitor Spaces






DNSM%

	Patient Room- Patient	452 SM (4,868 SF)	34%
	Patient Room- Family	237 SM (2,550 SF)	18%
	Public/Family/Visitor	126 SM (1,354 SF)	9%

Patient Care Support



DNSM%




	Patient Room- Patient	452 SM (4,868 SF)	34%
	Patient Room- Family	237 SM (2,550 SF)	18%
	Public/Family/Visitor	126 SM (1,354 SF)	9%



DNSM%

	Patient Care Support	286 SM (3,081 SF)	21%
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Administrative Support






DNSM%			
	Patient Room- Patient	452 SM (4,868 SF)	34%
	Patient Room- Family	237 SM (2,550 SF)	18%
	Public/Family/Visitor	126 SM (1,354 SF)	9%

DNSM%			
	Patient Care Support	286 SM (3,081 SF)	21%
	Admin. Support	187 SM (2,017 SF)	14%




Diagnostic Imaging Spaces



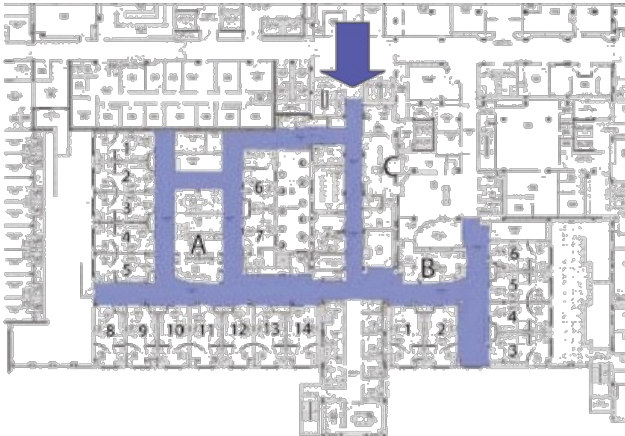
DNSM%

 Patient Room- Patient	452 SM (4,868 SF)	34%
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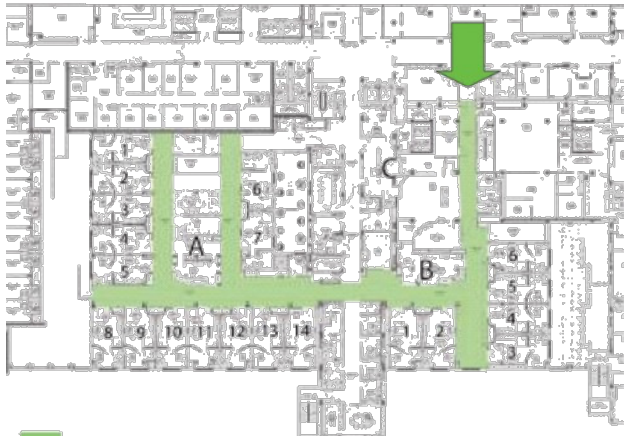
DNSM%

 Patient Care Support	286 SM (3,081 SF)	21%
 Admin. Support	187 SM (2,017 SF)	14%
 Diagnostic/Imaging	73 SM (783 SF)	5%

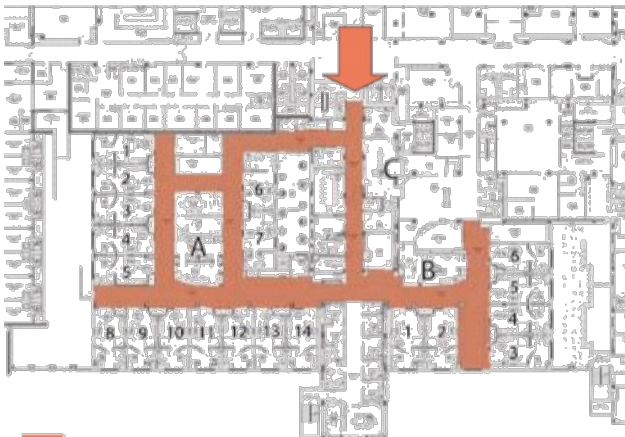
Circulation Paths, By User



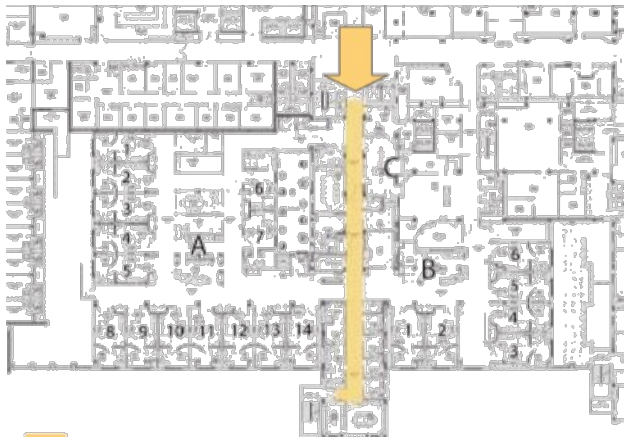
■ Patient



■ Family/Visitor



■ Patient/Service



■ Administrative

Patient Rooms

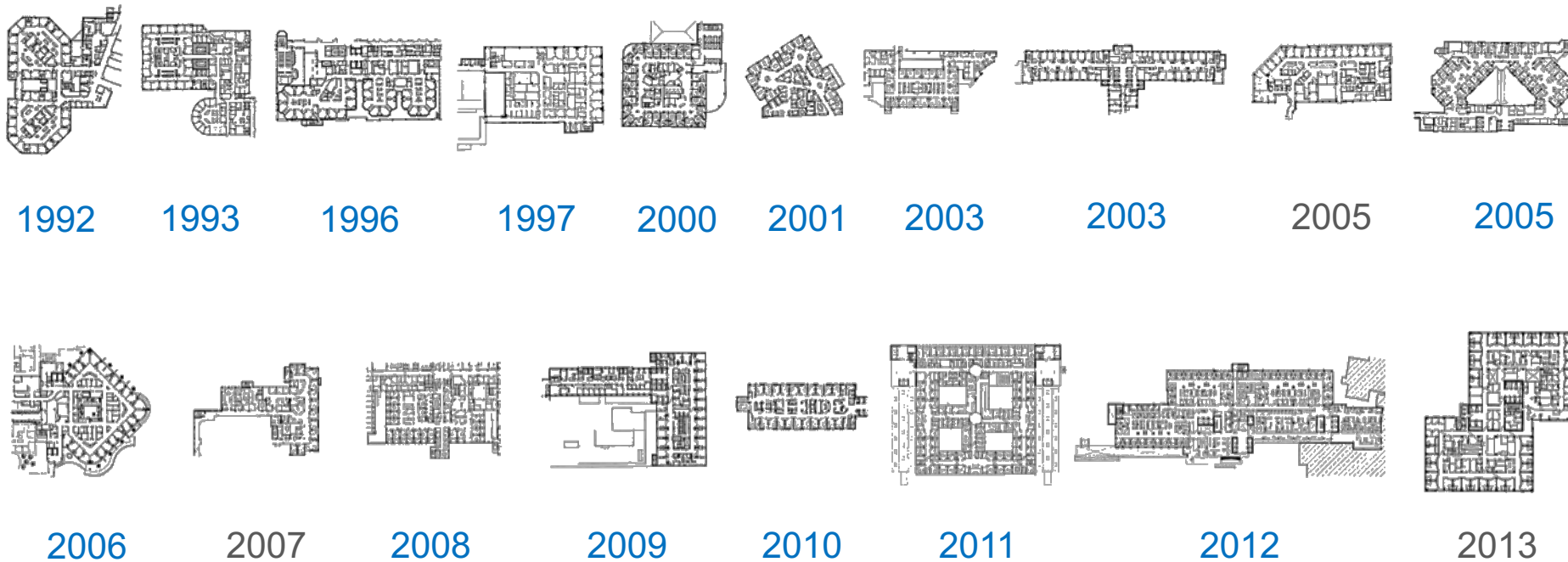


Emory University Hospital
Neurosciences ICU

Unit Configuration & Geometry

Winning ICU Designs 1992-2013

Color Legend: ADULT / PEDS



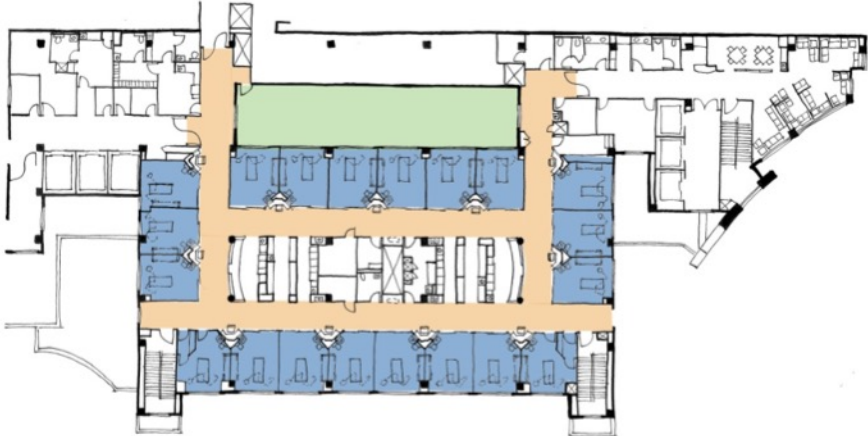
Unit Configurations By Type



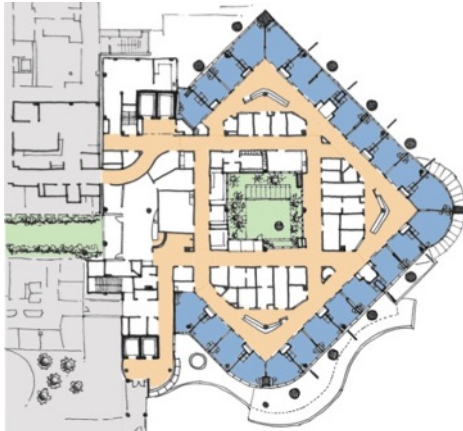
Linear



Pod

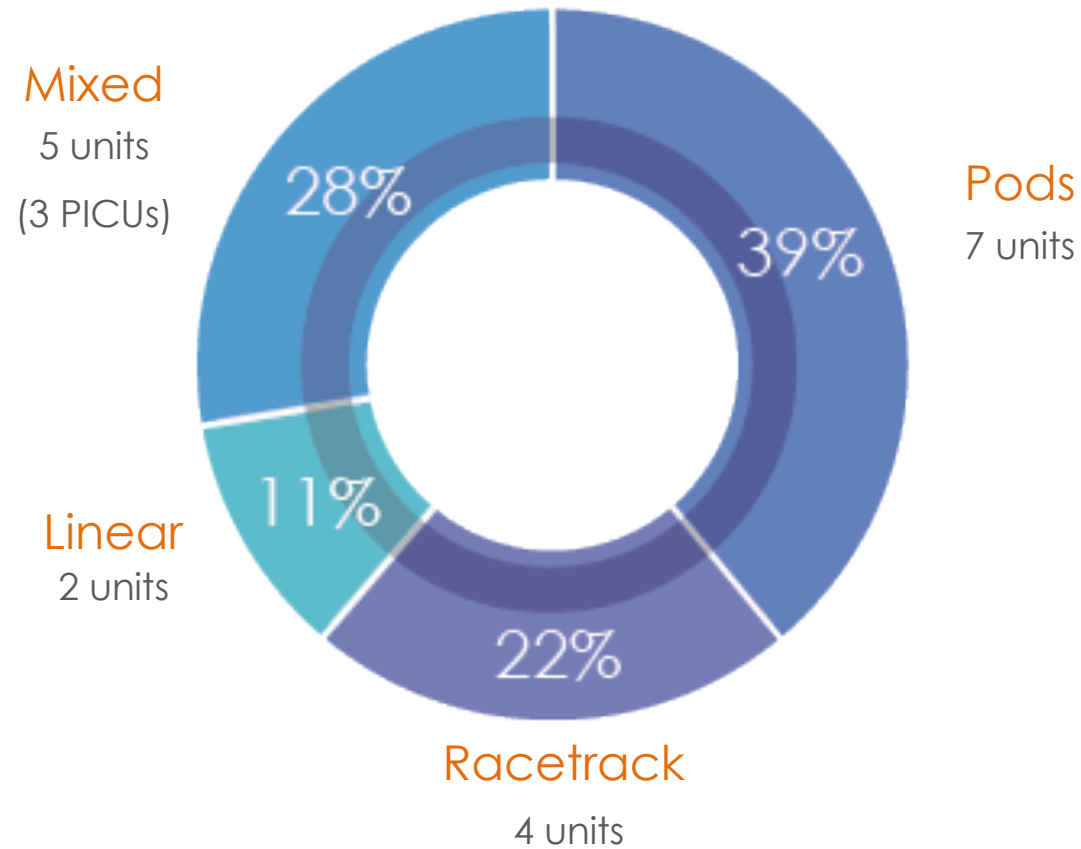


Racetrack



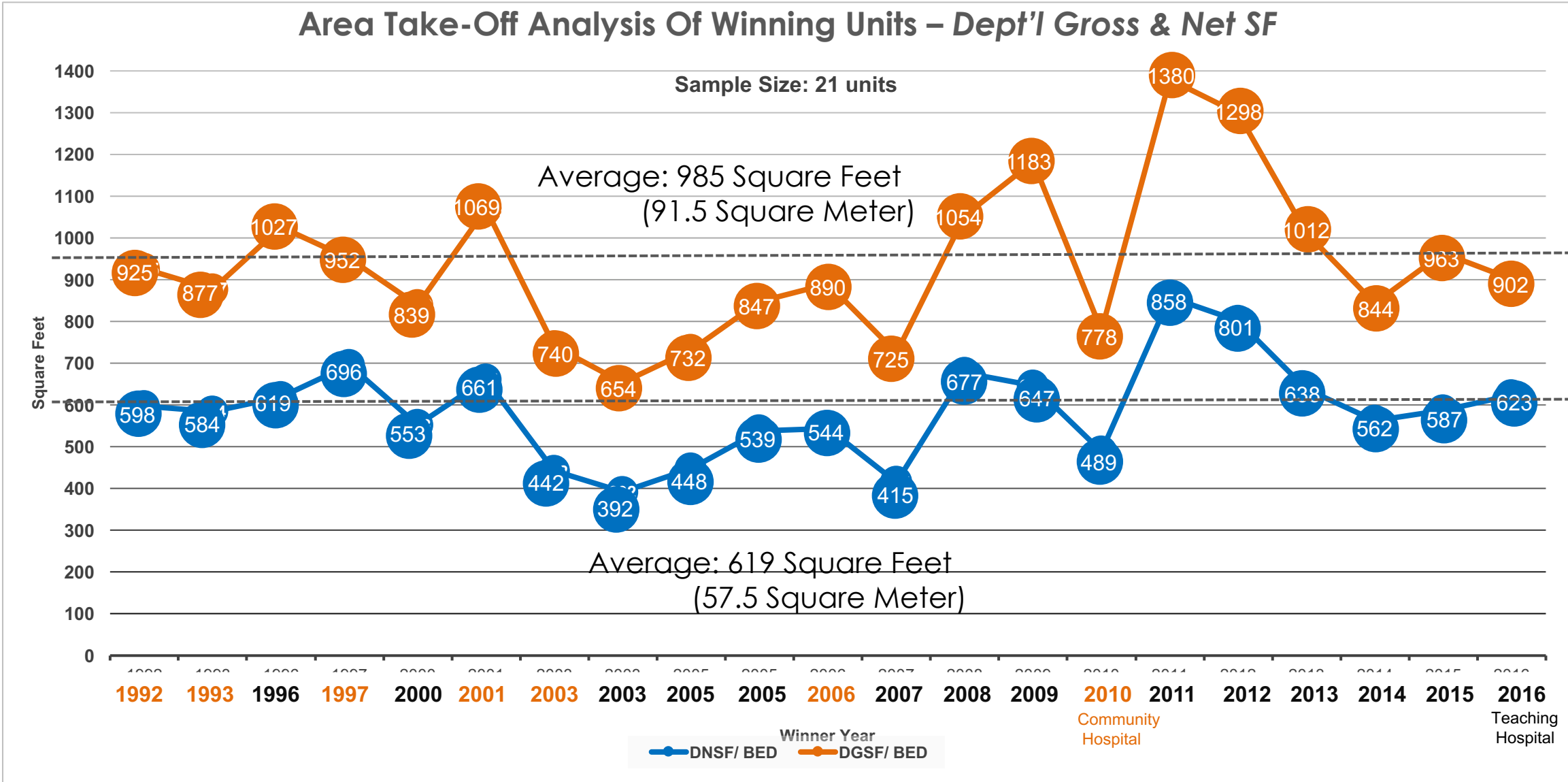
Mixed

Unit Configurations By Type

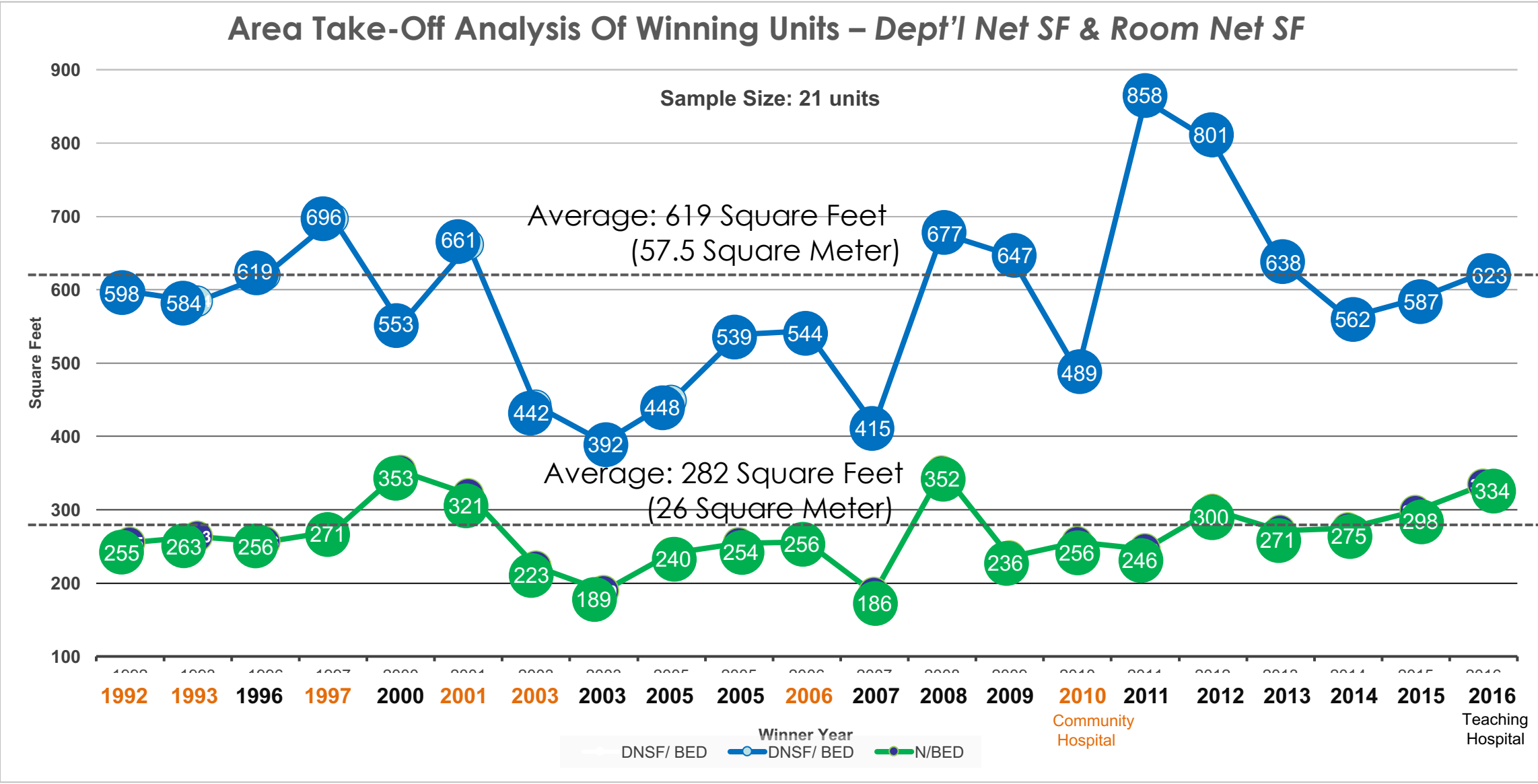


Categorization of ICUs on the basis of unit configuration

SCCM ICU Winners



SCCM ICU Winners



Area Take-Off Analysis of Winning Units – Dept'l Net:Gross SF Factors

Unit Departmental Area per Bed and Average Grossing Factors

Construction Type	Average Dept Area / Bed		Avg Net to Dept'l Gross Factors
	DGSF / Bed	DGSM / Bed	
New Construction	990	92	1.57
New & Reno. Construction (Mixed)	1027	95	1.66
Renovation Construction	814	76	1.69

Average unit departmental area per patient bed & average net to departmental area grossing factors by construction type

Sample Size: 18 Units

- 12 New Construction
- 1 Mixed (New & Reno.)
- 5 Renovation

Area Take-Off Analysis of Winning Units

Unit Departmental Area per Bed and Average Grossing Factors

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12% Loss in Usable Area (New vs. Reno)

Average unit departmental area per patient bed & average net to departmental area grossing factors by construction type

Sample Size: 18 Units

12 New Construction

1 Mixed (New & Reno.)

5 Renovation

Area Take-Off Analysis of Winning Units

	Percentage Values of Net Areas	Range	% of Net Area Recommended
1 Patient Care Includes patient room & toilet	20.2% - 43.0%	22.8%	30 to 35%
2 Staff & Material Support Includes centralized & decent. charting, clean & soiled, etc.	9.9% - 20.7%	10.7%	15%
3 Staff Facilities Includes staff lounge, lockers, toilets, on-call rooms, etc.	1.8% - 6.3%	4.5%	4%
4 Diagnostic & Treatment Includes imaging suites, dialysis, pharmacy, lab, etc.	0.0% - 4.9%	4.9%	2 to 4%
5 Administration & Education Includes classrooms, conference spaces, offices etc.	1.9% - 14.1%	12.2%	7%
6 Public & Family Includes waiting areas, family sleep rooms, amenities, etc.	3.0% - 18.5%	15.5%	10%

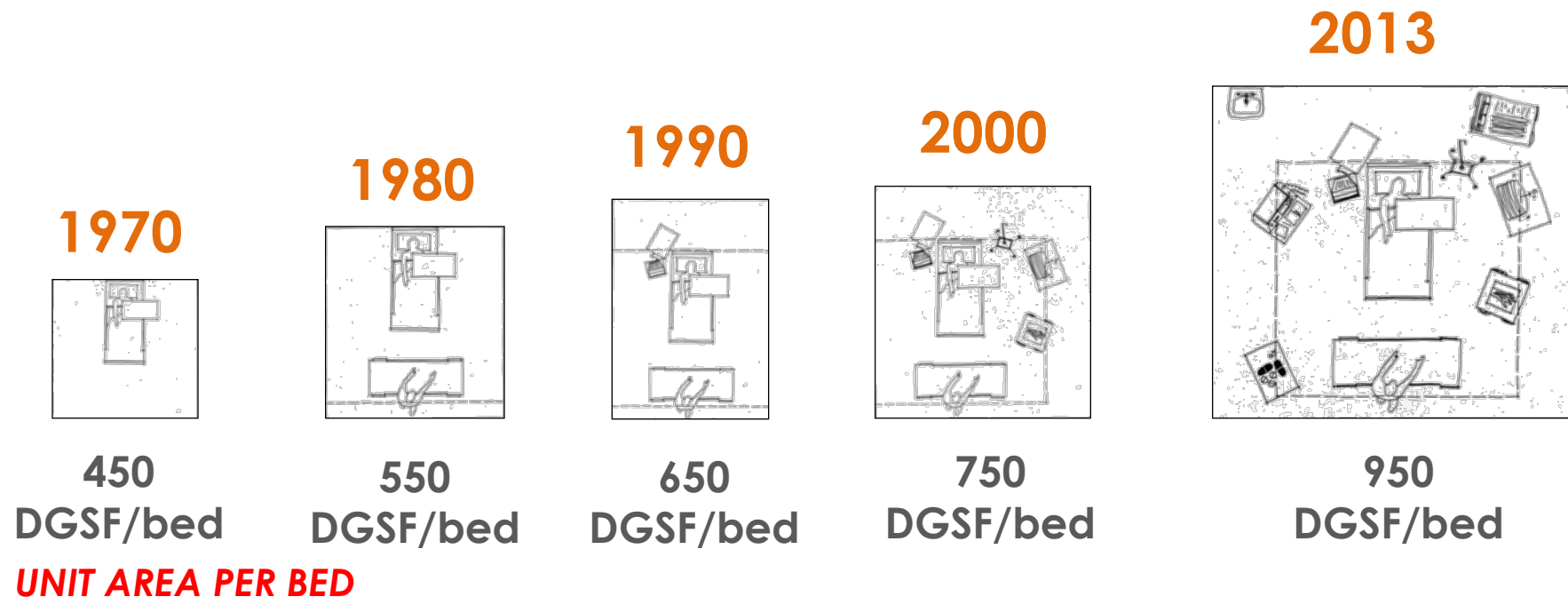
Program categories used during area take-off analysis of ICU designs & percentages of total department area

10 Best-Practice Critical Care Design Trends

- 1. Larger, Consolidated Units**
- 2. Stabilized Patient Room Size**
- 3. Defined In-Room Family Space**
- 4. Remote Technology & Support Systems**
- 5. Continued Design for Interdisciplinary Teams**
- 6. Integration of Diag. & Treatment Facilities**
- 7. Integration of Admin. & Support Spaces**
- 8. Variable Unit Geometry**
- 9. Segregated Circulation**
- 10. Visual & Physical Access to Nature**

(1) Larger Units – Beds & Areas

More units, and larger units, will likely be needed in the future as demand grows. Area for **support spaces** will likely increase.



10 Best-Practice Critical Care Design Trends

Wider, Flexible Corridors...

Rounding & Collaboration



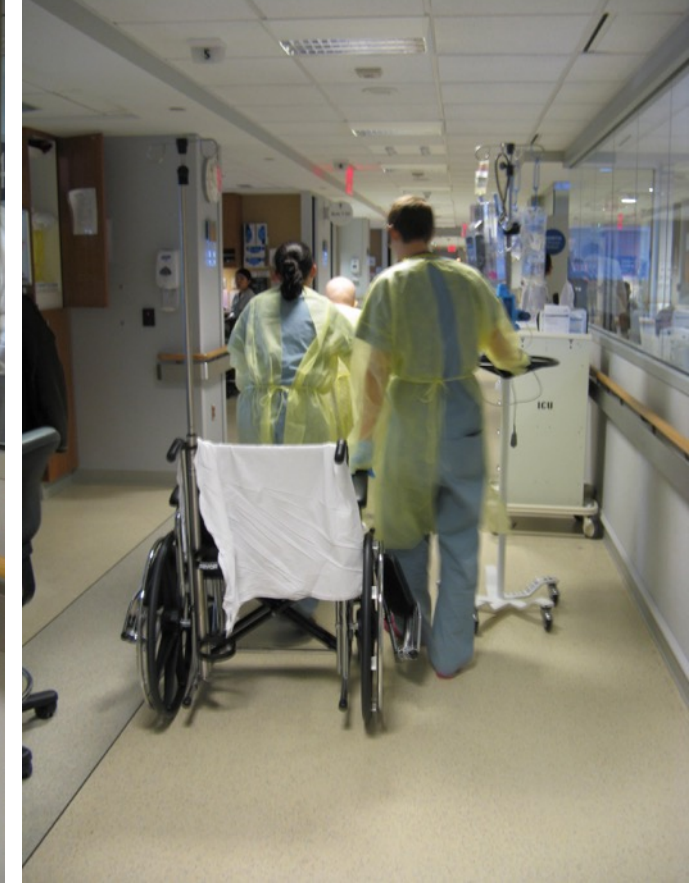
Emory

Rounding & Computers



MS-KCC

... and Ambulation in the ICU



MS-KCC

(2) The Patient Room

All-private rooms in critical care will become the design standard, with a stable clear patient room area of 250 to 300 SF (23 SM);

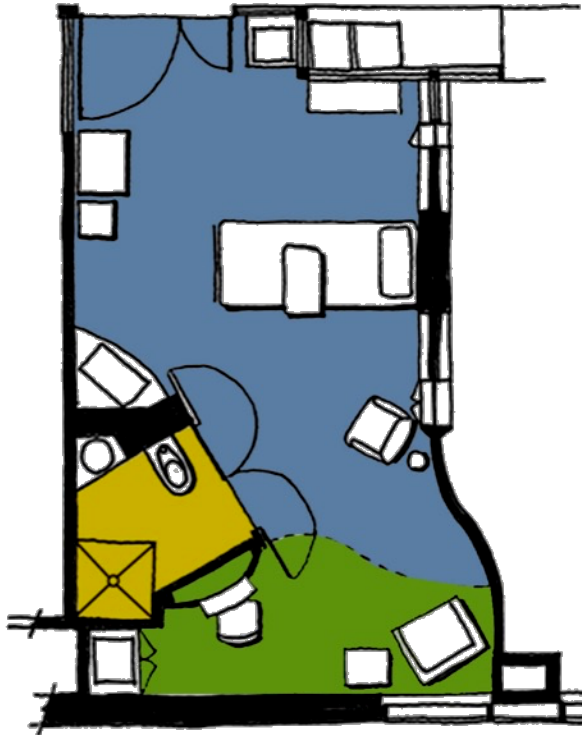
family space is in addition to this (sitting, sleep)

.

10 Best-Practice Critical Care Design Trends

The Patient Room

Private toilet facility within acuity adaptable room and flat headwall



Clarian Health Group Methodist Hospital

Indianapolis, Indiana

2000 Winner

Architects: BSA LifeStructures

Photo: BSA LifeStructures

10 Best-Practice Critical Care Design Trends

Patient Room as Procedure Room

Example of the ICU Room as a Procedure Suite – a potential case for additional clearances



**Emory University
Neurosciences ICU**

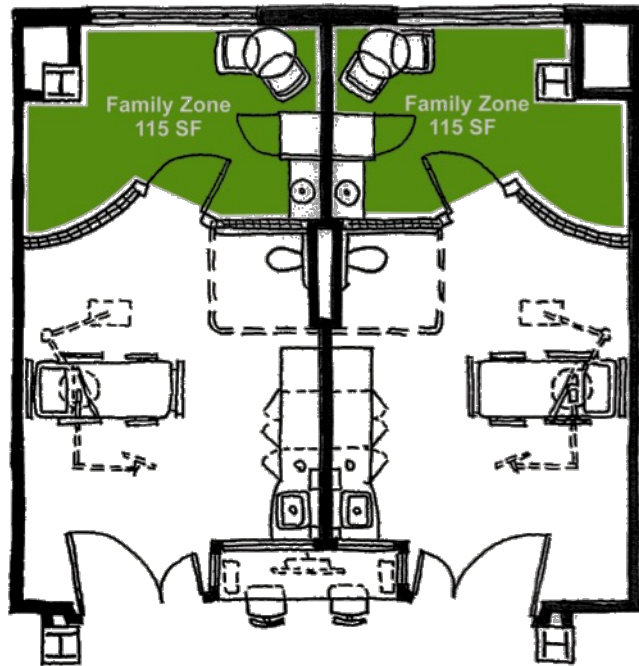
(3) The Family Zone

Recent units, where possible, incorporate designated **family and visitor space** and amenities into the unit or within the patient room itself.

10 Best-Practice Critical Care Design Trends

The Family Zone

115 NSF



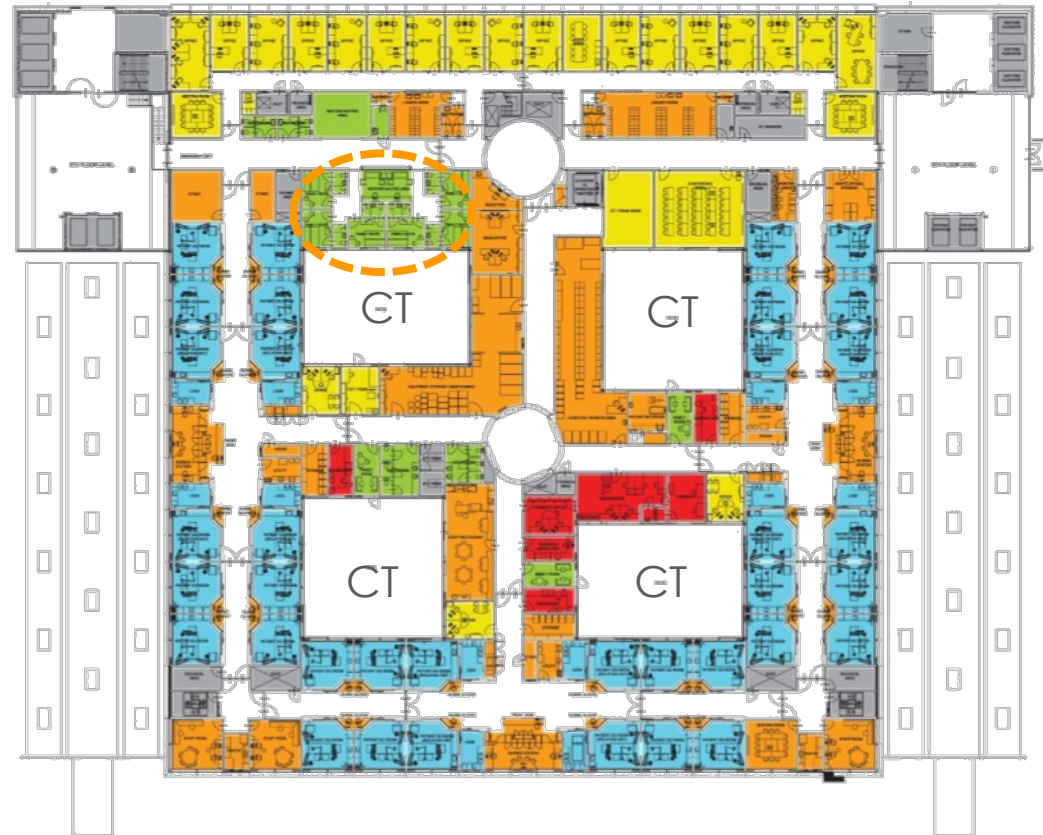
Emory University Hospital ICU

Atlanta, Georgia
2008 winner



University Medical Center Utrecht

- 36 Bed ICU
- Teaching Program
- Large Regional Referral Hospital

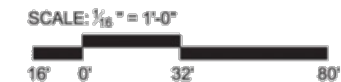


Green areas are family spaces.

CT = Courtyard

LEGEND	
Yellow	ADMIN SUPPORT
Orange	CARE SUPPORT
Blue	PATIENT ROOMS
Green	PUBLIC FAMILY VISITOR
Red	DIAGNOSTIC & TREATMENT
Grey	MECHANICAL

2010 SCCM ICU DESIGN COMPETITION WINNER
University Medical Center Utrecht, Division of Intensive Care Medicine, The Netherlands

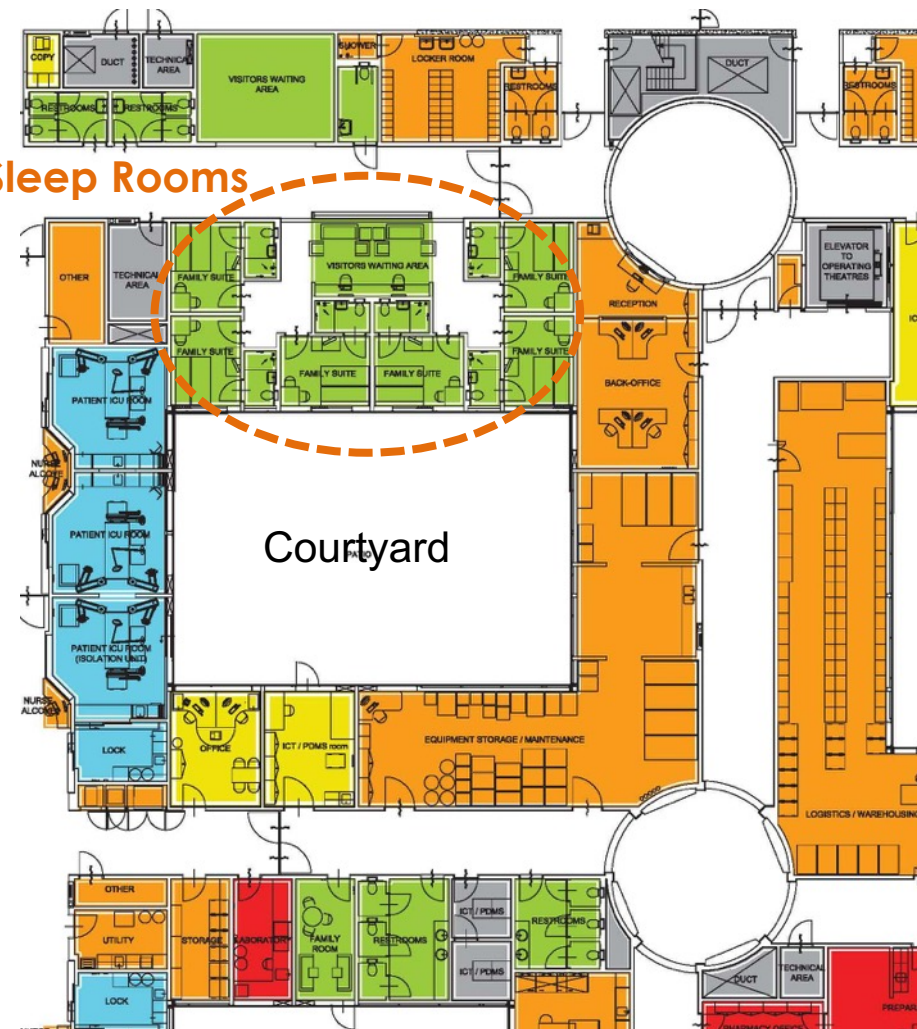


University Medical Center Utrecht

Family Space Design:

- Family Sleep Accommodations (6) are Separate from Patient Rooms
- Decentralized Consultation Rooms (3)
- Primary Waiting Room Near Sleep Rooms

Family Sleep Rooms



(4) Technology & Life Support Systems

The majority of units, notably recent ones, employed **ceiling mounted booms** rather than the traditional headwall unit within the patient room design.

- E-Glass
- Dedicated Lab Label Printers
- Ceiling Booms
- Wireless IR Transmitter
- Web cam
- Remote monitoring
- E - ICU
- Robots

10 Best-Practice Critical Care Design Trends

Technology & Life Support Systems



Photo: Memorial Sloan-Kettering Cancer Center, Neil Halpern, M.D., ICU Medical Director

- 1 Nurse server
- 2 E-glass slide, break away doors
- 3 Inside opening of nurse server
- 4 Wireless clock
- 5 Storage cabinets

- 6 Computer & double monitor
- 7 Lab label printer
- 8 Twin BOOMS
- 9 Wireless IR transmitter
- 10 Web cam

- 11 Patient closet & DVD player
- 12 Flat screen TV
- 13 Toilet
- 14 Nursing work area

10 Best-Practice Critical Care Design Trends

E- Glass (For Privacy)

E- Glass Off



E- Glass On



MS-KCC

10 Best-Practice Critical Care Design Trends

Technology – IT in Many Forms...



- Hospitals with an eICU had a lower mortality rate (Critical Care Medicine, 2004 32:31-38)
- Technology enables physicians to respond any time, any where to patient needs
- Knowledge-sharing is faster
 - Research → education → care

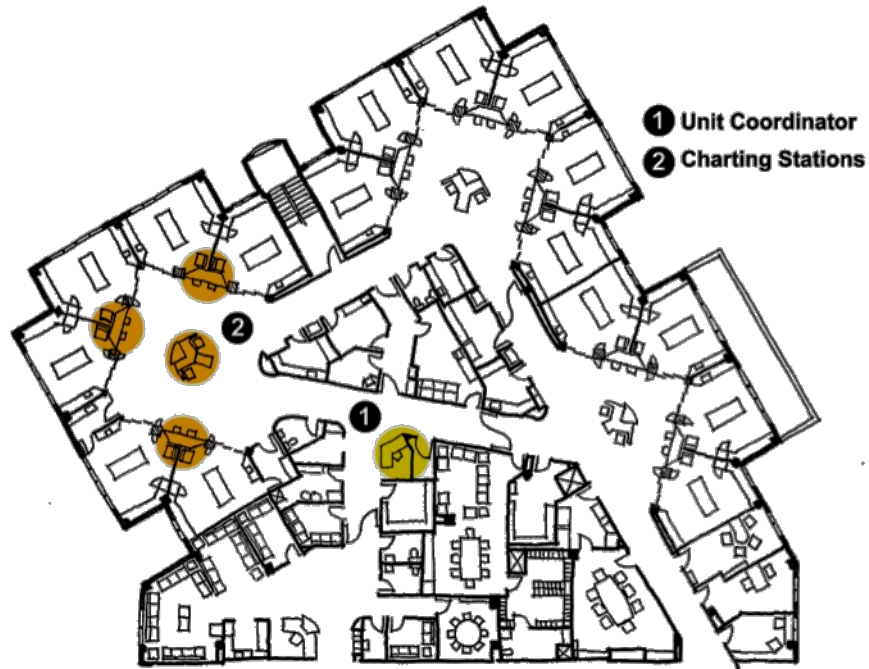


(5) Design for Interdisciplinary Teams

All units showed some **combination of centralized & decentralized** layouts for staff work stations, while only one design was fully decentralized.

10 Best-Practice Critical Care Design Trends

Design for Interdisciplinary Teams



St. Joseph's Health Center

Kansas City, Missouri

2001 winner

Architects: Hart Freeland Roberts, Inc



Emory University Hospital

Atlanta, Georgia, USA

2008 winner

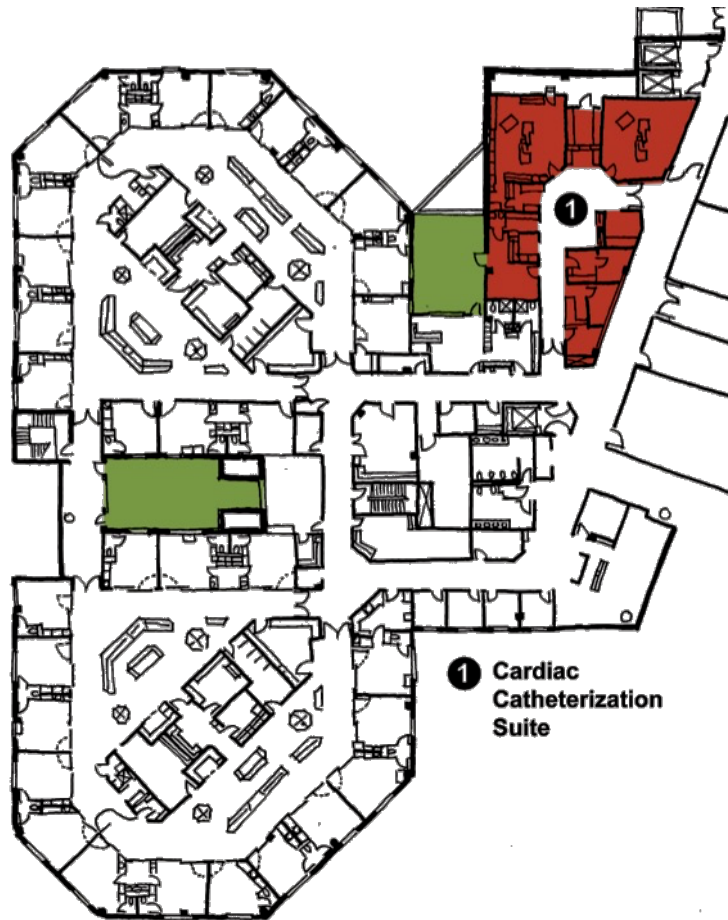
Architects: HKS

(6) Proximity to Diagnostic & Treatment

Winning units are **incorporating diagnostic and treatment modalities** into their designs, when possible, often as shared services with the entire hospital.

10 Best-Practice Critical Care Design Trends

Proximity to Diagnostic & Treatment



Proximity of ICU to cardiac catheterization suite

Swedish Medical Center ICU

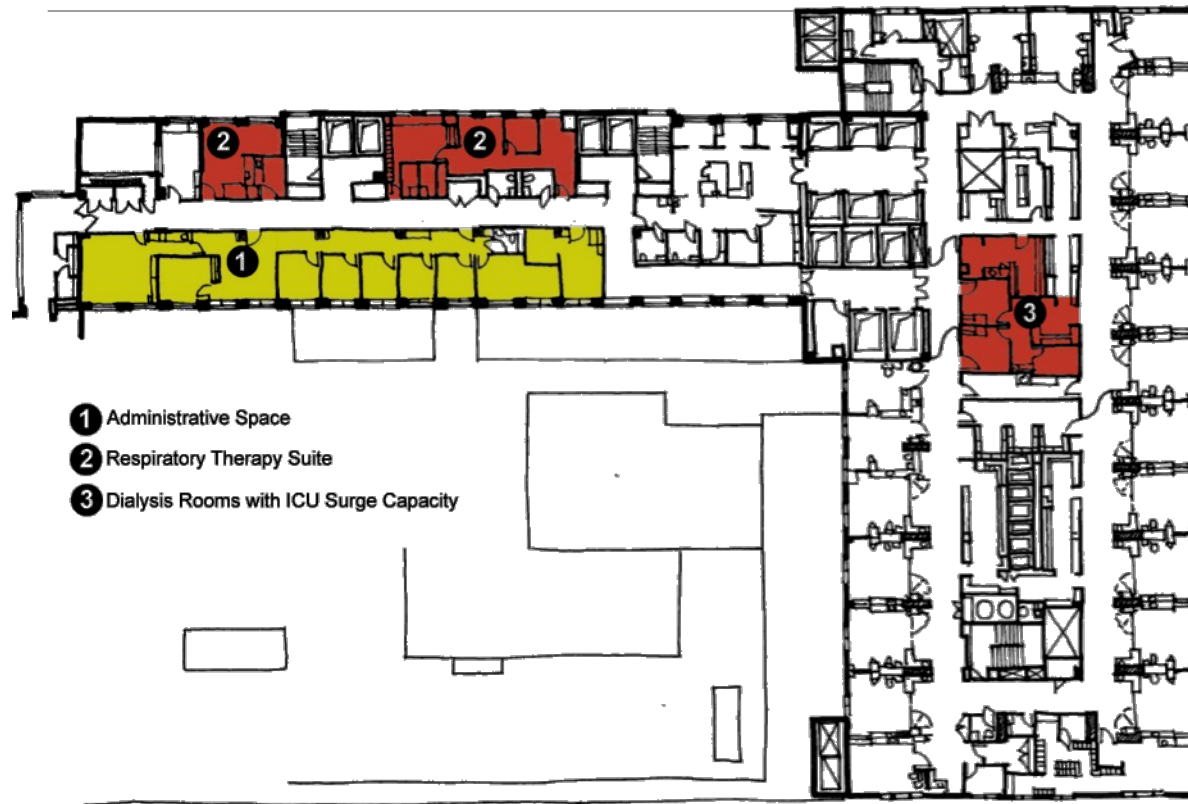
Englewood, Colorado, 1992 winner
Architects: WHR Architects & H+L Architects

(7) Administrative & Support Space

An increase in **administrative and education** space within the unit has been noted over the last several years, particularly within teaching hospitals.

10 Best-Practice Critical Care Design Trends

Administrative & Support Spaces



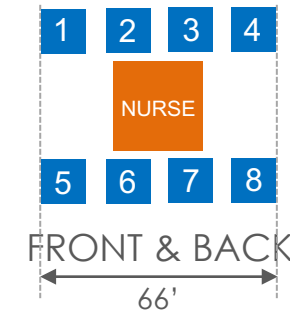
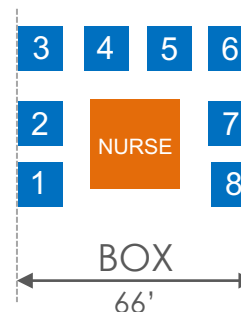
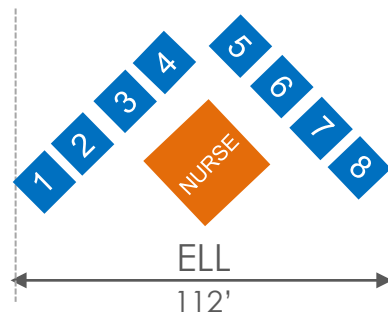
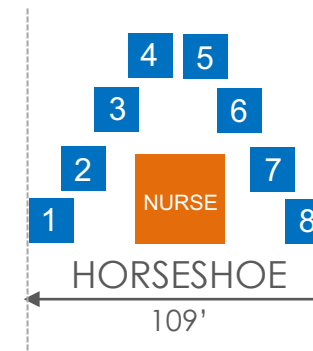
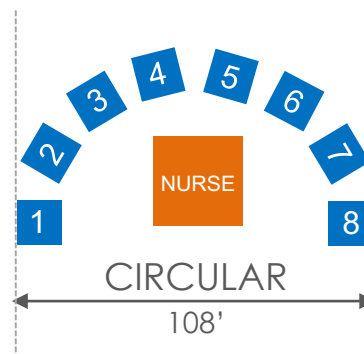
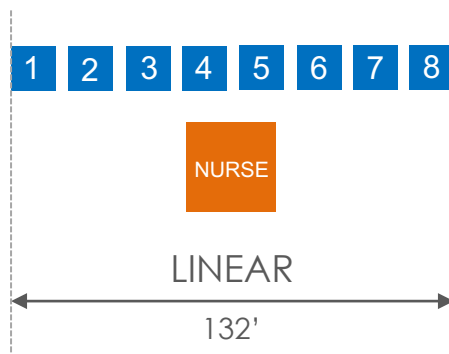
Memorial Sloan-Kettering Cancer Center

New York City, New York, 2009 winner

Architects: daSILVA Architects

(8) Variable Unit Geometry

No single ICU geometry has been noted as superior to another; **the pod concept** is seen in recent years, along with a combination of different **configurations**.



(9) Segregated Circulation

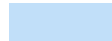


Distinction of circulation regarding **on-stage** and **off-stage** separations are becoming more common and will likely continue to be seen in future designs.

10 Best-Practice Critical Care Design Trends

Unit Geometry & Circulation

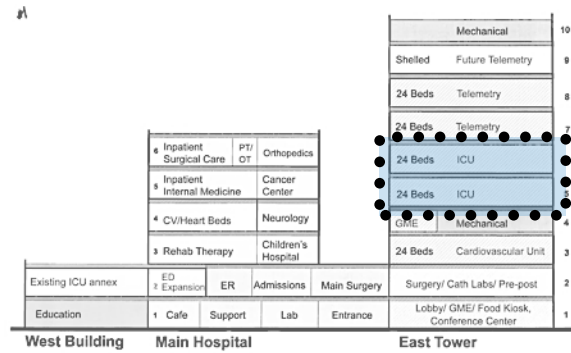


Tall building geometry and off-set vertical cores allow onstage/off-stage access and circulation

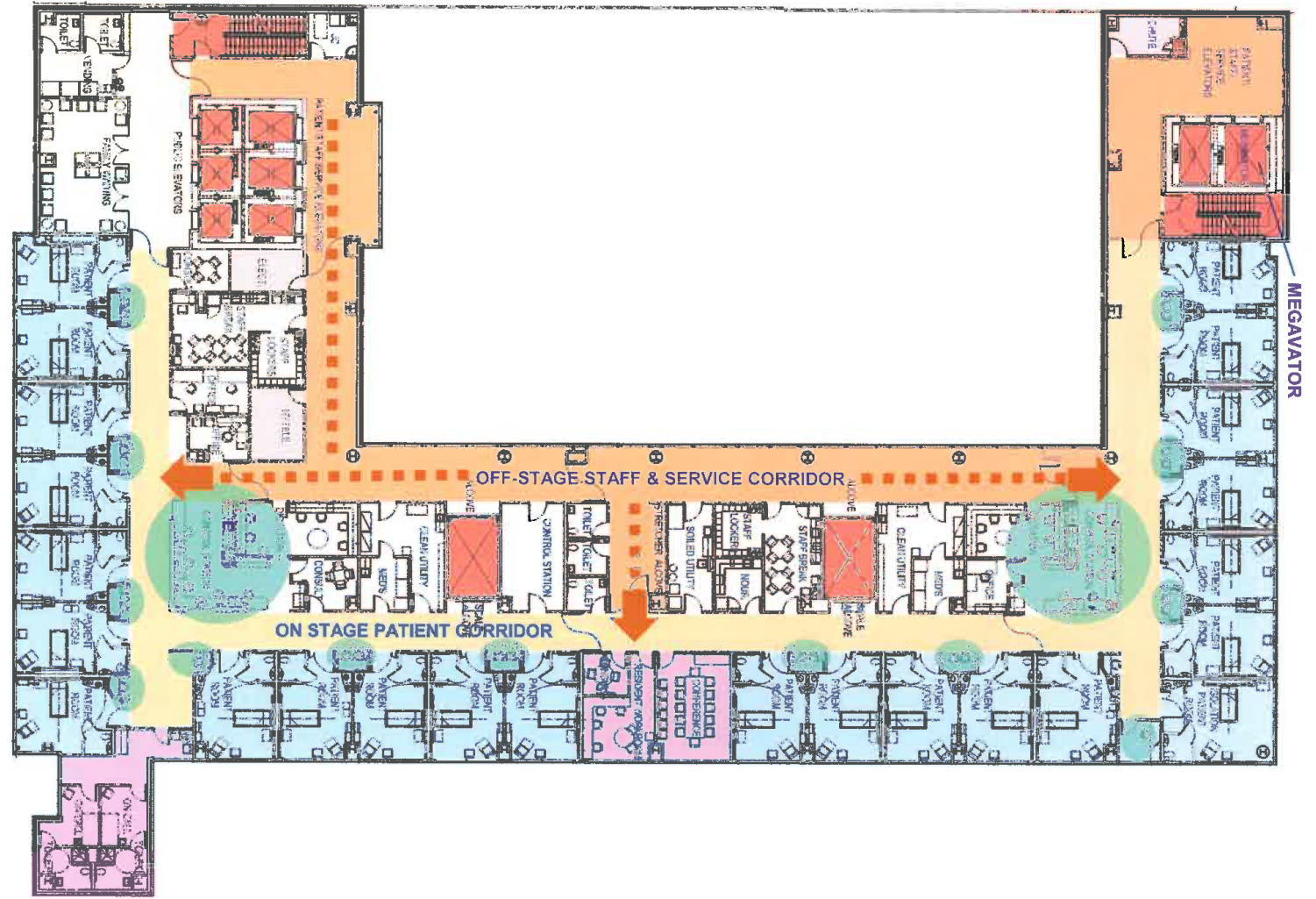
-  Patient
-  Visitor
-  Service

**Ann & Robert H. Lurie
Children's Hospital** PICU,
Chicago, Illinois,
2013 winner
Architects: ZGF

ENTRY 01 ICCU – A Cardiac ICU



- CAREGIVER WORK AREA
- PUBLIC AREAS
- PATIENT/ ESCORTED AREAS
- SERVICE/ STAFF AREAS
- ICU PATIENT ROOMS
- SUPPORT SERVICE SPACES
- RESIDENTS SUPPORT SPACES
- VERTICAL CIRCULATION



(10) Visual and Physical Access to Nature

The importance of **nature for patients, families and staff** is increasingly recognized and incorporated into critical care units where possible.

“Nature serves as a positive distraction that reduces stress and diverts patients from focusing on their pain or distress.”

– Ulrich, 2008

10 Best-Practice Critical Care Design Trends

Access to Nature



Legacy Good Samaritan

Multidisciplinary ICU
Portland, Oregon, USA
1996 winner

Architects: Tom Sagerser Architects



Photo: Kirk Hamilton, FAIA, FACHA

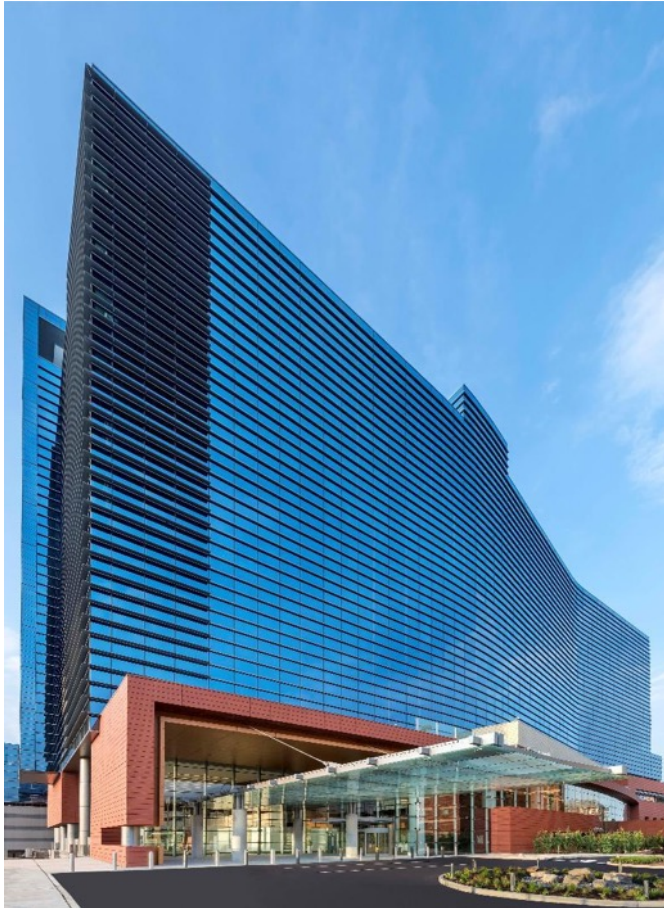
Stamford Hospital

WHR Architects

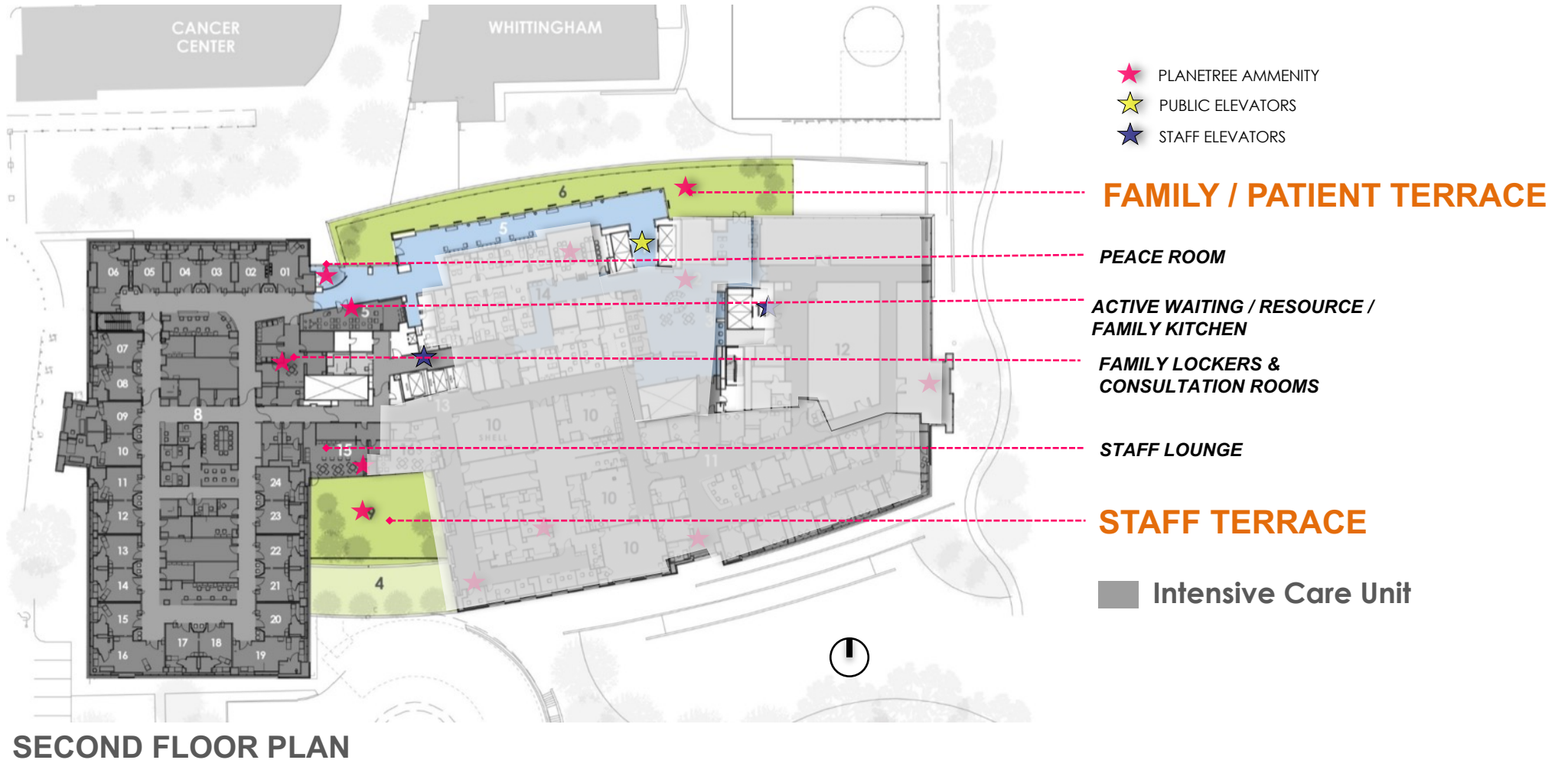
Stamford Hospital, CT

(Under Construction)

A Planetree Hospital



Example of Green Terraces for Families & Staff



Example of Green Terraces for Patients and Families



10 Best-Practice Critical Care Design Trends

Best-Practice Critical Care Design Trends

1 Larger Units

More and larger units will likely be needed in the future as need grows. Area for support spaces will likely increase, given the trend observed among best-practice units.

2 The Patient Room

All-private rooms in critical care have become the design standard with a stable room size of about 250 SF (23 SM); family space will likely be in addition to this.

3 The Family Zone

Recent units, where possible, incorporate designated family and visitor space and amenities into the unit or within the patient room itself.

4 Technology & Life Support Systems

The majority of units, notably recent ones, employed ceiling mounted booms rather than the traditional headwall unit within the patient room design.

5 Design for Interdisciplinary Teams

All units showed some combination of centralized & decentralized layouts for staff work stations, while only two designs were fully decentralized.

6 Proximity to Diagnostic & Treatment

Recent units appear to be incorporating diagnostic and treatment modalities into their designs, often as shared services with the entire hospital.

7 Administrative & Support Spaces

An increase in administrative and education space within the unit has been noted over the last several years, particularly within teaching hospitals.

8 Unit Geometry

No single ICU geometry has been noted as superior to another; the pod concept is seen in recent years, along with a combination of different configurations.

9 Unit Circulation

Distinction of circulation regarding on-stage and off-stage separations are becoming more common and will likely continue to be seen in future designs.

10 Access to Nature

The importance of nature for patients, families and staff is increasingly recognized and incorporated into critical care units where possible.

THANK YOU!

Charles D. Cadenhead, FAIA, FACHA, FCCM.

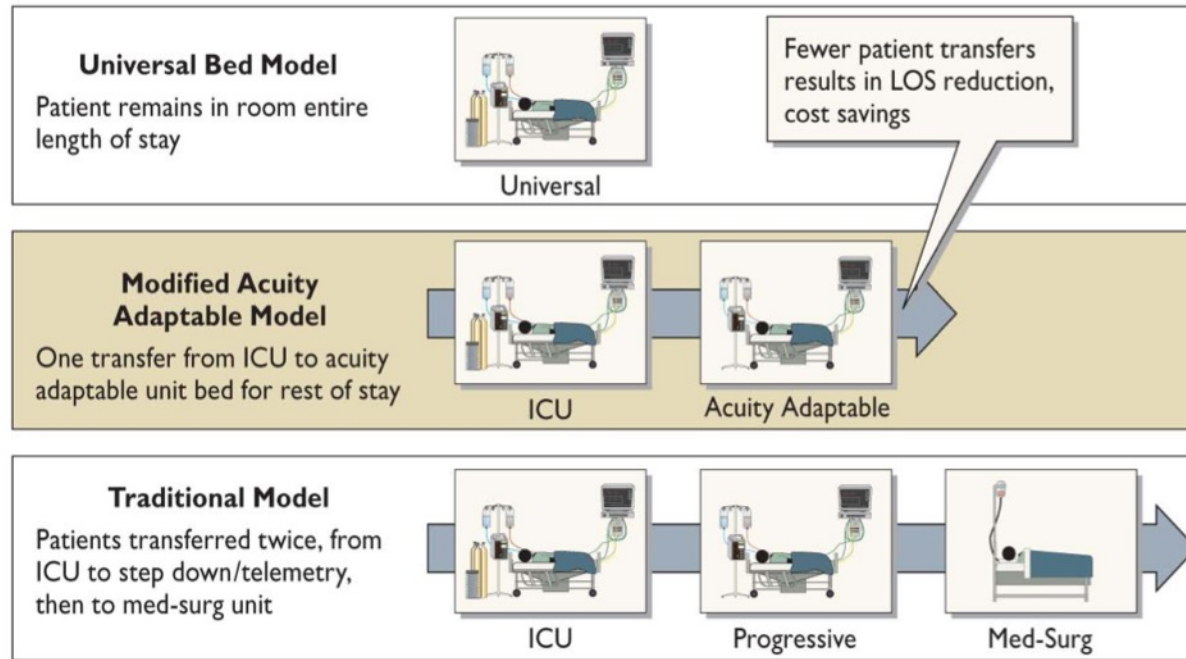
713-665-5665

CCadenhead@WHRarchitects.com

Acuity-Adaptable Rooms

A New Middle Ground

Three Models for Placing Critically Ill Patients



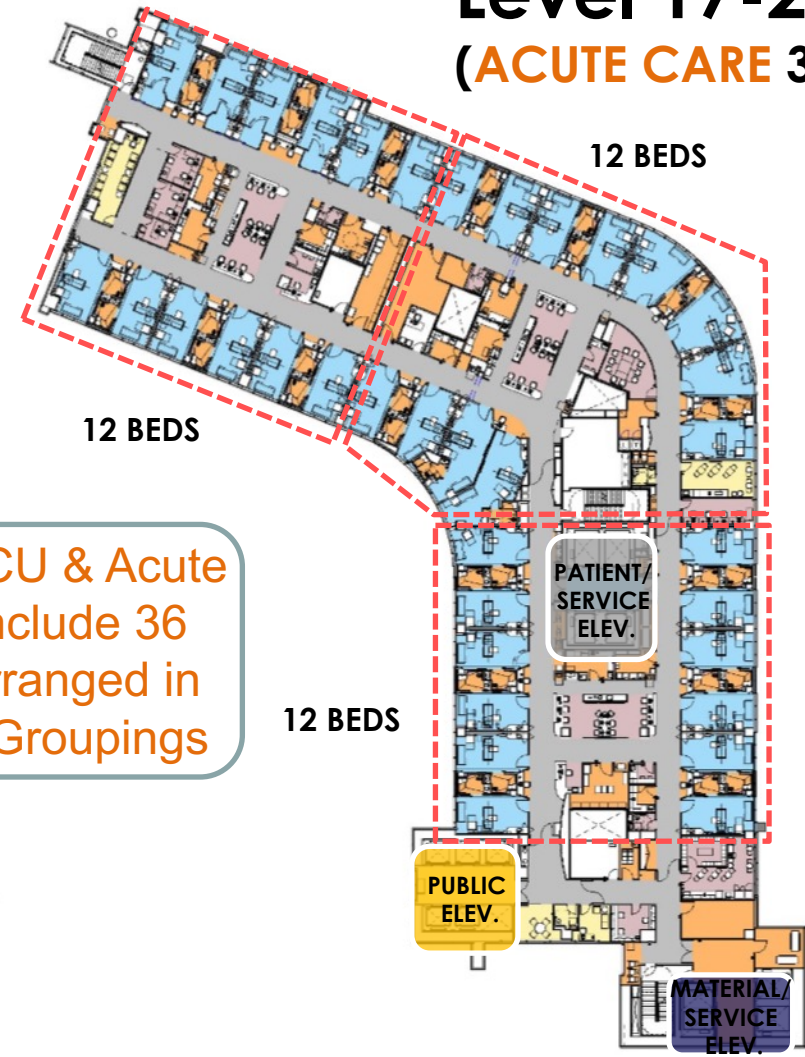
Source: Advisory Board Company

HMH Michael DeBakey Heart Center

Level 9-10 (CVICU 36 Beds)



Level 17-21 (ACUTE CARE 36 Beds)



Both ICCU & Acute Floors Include 36 Beds, Arranged in 12-Bed Groupings

WHR Architects
Cardiac Care Floors for
HMH Michael DeBakey
Heart Center,
Houston, Texas
(currently in design)



12 Bed Nursing Pod (CVICU)

CHARTING STATION

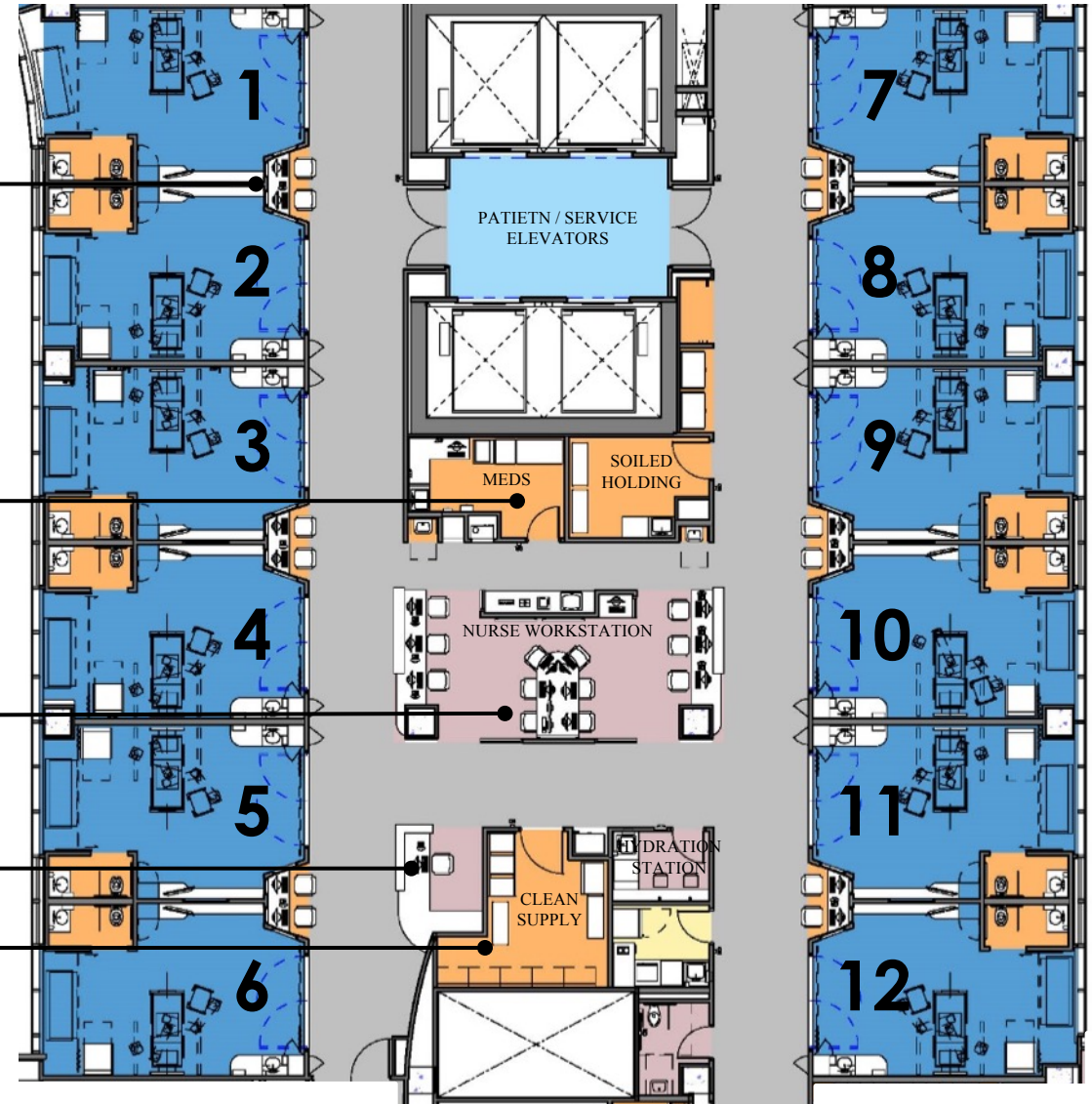
MEDICATION /
SOILED

NURSE WORKSTATION /
PHYSICIAN WORKROOM

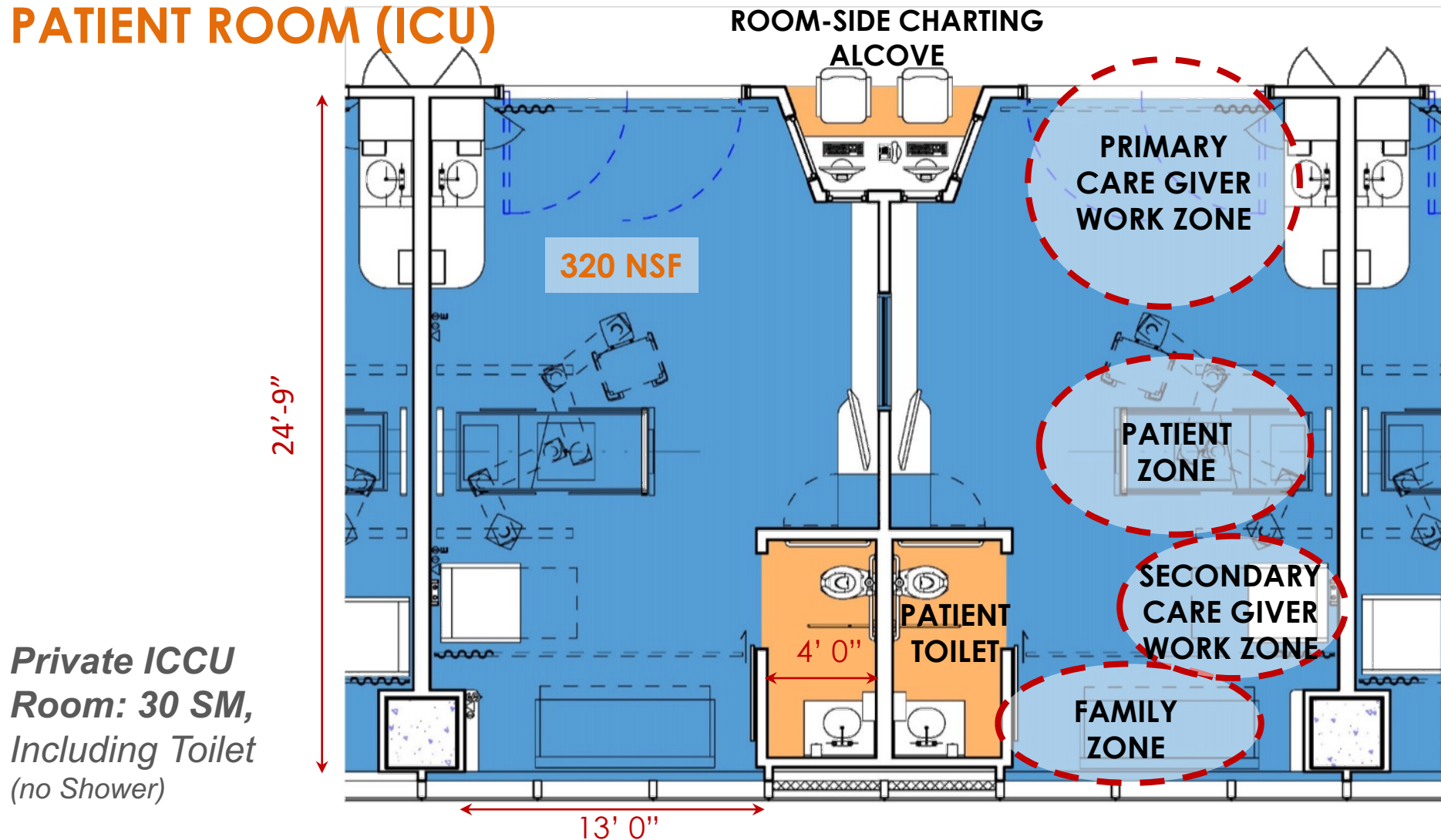
UNIT SECRETARY

CLEAN SUPPLY

WHR Architects
**Cardiac Care Floors for
HMH Michael DeBakey
Heart Center,
Houston, Texas
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PATIENT ROOM (ICU)



Private ICU Room: 30 SM, Including Toilet (no Shower)

HMH Michael DeBakey Heart Center

PATIENT ROOM (Typical Acute Care)

*Private Acute
Room
(Stepdown):
32 SM,
Including Toilet
& Shower*

