

Neonatal Intensive Care Units

Can we Make Them Safer for Patients
and Their Families?

The Seventh Annual Quality Colloquium



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Roles of the Reviewing Authority Having Jurisdiction

- Typical Role of AHJ:
 - Reviews plans to meet minimum adopted design requirements
 - Interprets design criteria requirements
- Atypical Role of AHJ:
 - Advocates for change
 - Serves on code writing committees
 - Works *with* (not against) health care organizations such as ASHE, AHCA, AHA²

What makes NICU Design Unique?

- Narrow patient base of similar ages and clinical conditions
- Strong connection between scientific research, published data, and design implications
- Good Environment for Evidenced Based Design Data such as single room vs. open design
- High acuity patients with dramatic results from clinical interventions

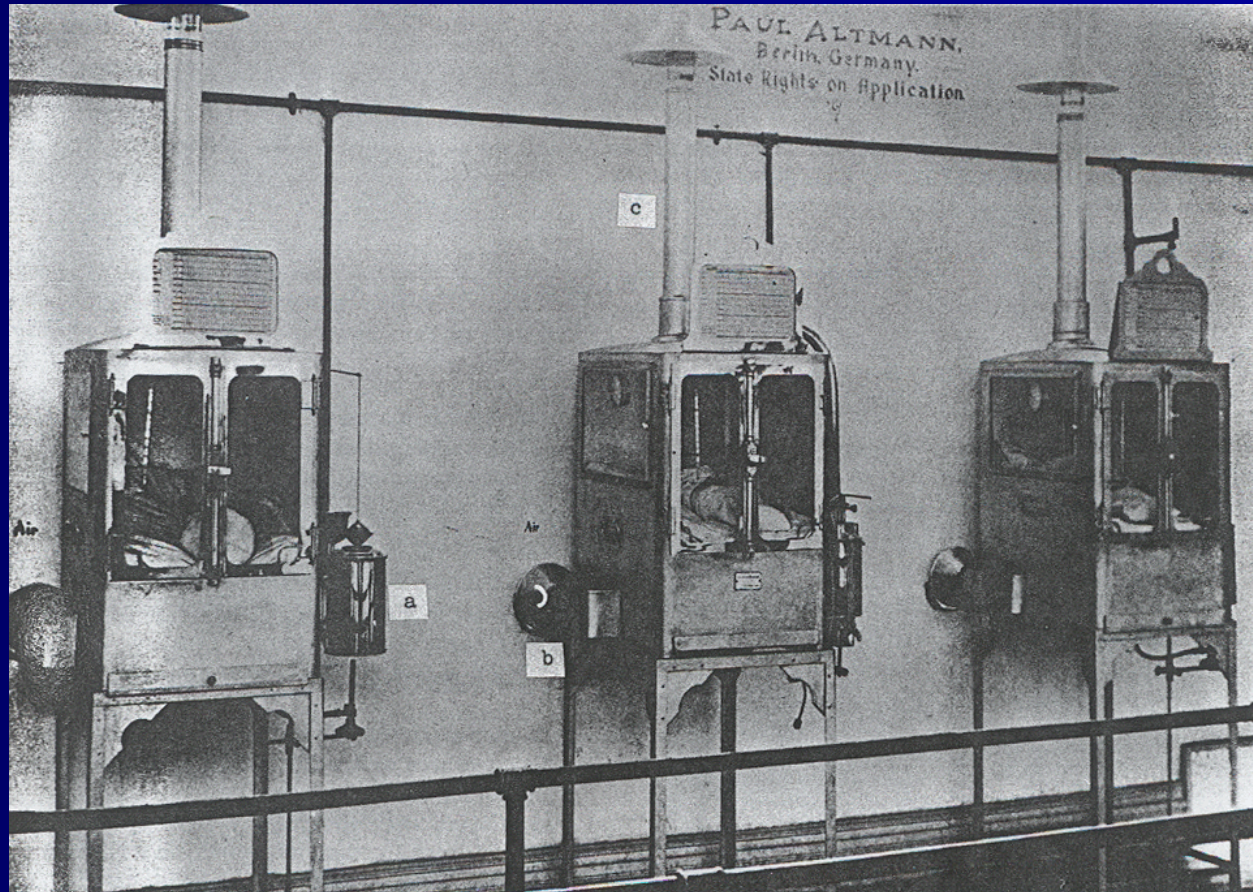
A Brief History of NICU Design

- **1878:** Chick Incubators adapted for warming of preterm infants
- **1896-1939:** Preterm infants displayed in incubators at Worlds Exposition in Berlin, Coney Island, and various worlds fairs

Infants on Display



Preterm Infants on Display at Trans-Mississippi Exposition Omaha, Nebraska 1898



Incubator-Baby Side Shows by William A. Silverman, M.D.
Greenbrae, California

A Brief History of NICU Design (cont.)

- **1939-1990** NICUs continued to be designed as multi-patient wards because:
 - Infants needed constant visual supervision
 - More efficient to have them in one room
 - Staff interaction easier in single large room
- **1977-1988:** Ross Planning Associates published books on the planning and design for perinatal, pediatric, and obstetrical units

Further Design Developments

- **1985-1992:** Joint Committee on High-Risk Infant Environment formed. Results published as Physical and Developmental Environment of the High-Risk Infant
- **1992 – Present:** The Graven conferences on High Risk-Infant designs sponsored by the University of South Florida College of Medicine
- **1992 – Present:** Recommended Standards for Newborn intensive care unit design

Unfortunate Impact of Technology on NICUs

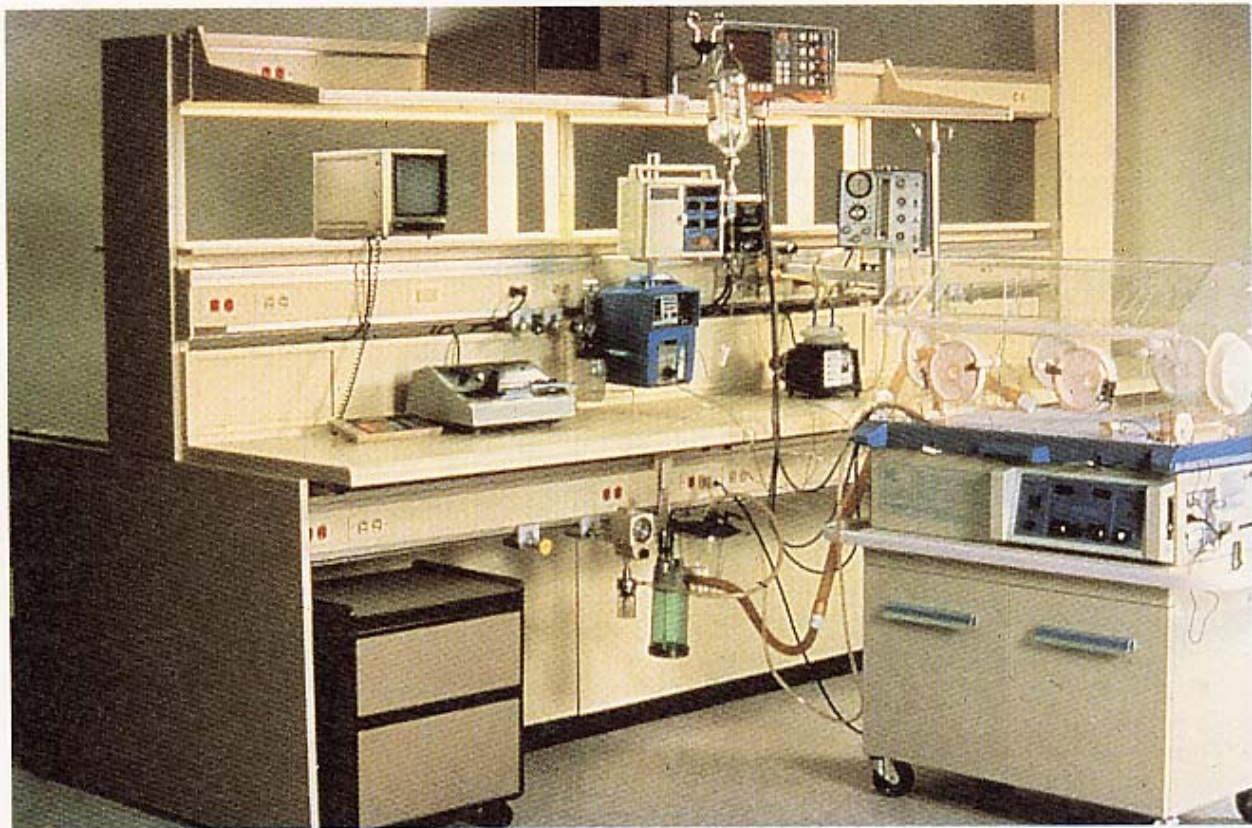


Image courtesy of Anne Marie Dazé Floyd.

Specific Areas of Research Translated into Design

- Potential Damage from Ambient Sound Levels
- Impact of Lighting Levels & Circadian Rhythms
- Use of Interior Finishes
- Size and Type of Infant Bed Area
- Importance of Family-Centered Care
- Improvements in Infection Control

Infant Station with new Technology but added Ambient Noise



An Overly Well Lit NICU circa 1990



Stations with Headwall Shelving but poorly placed direct Lighting and Hard Surfaces



Sometimes you just got to wear Shades

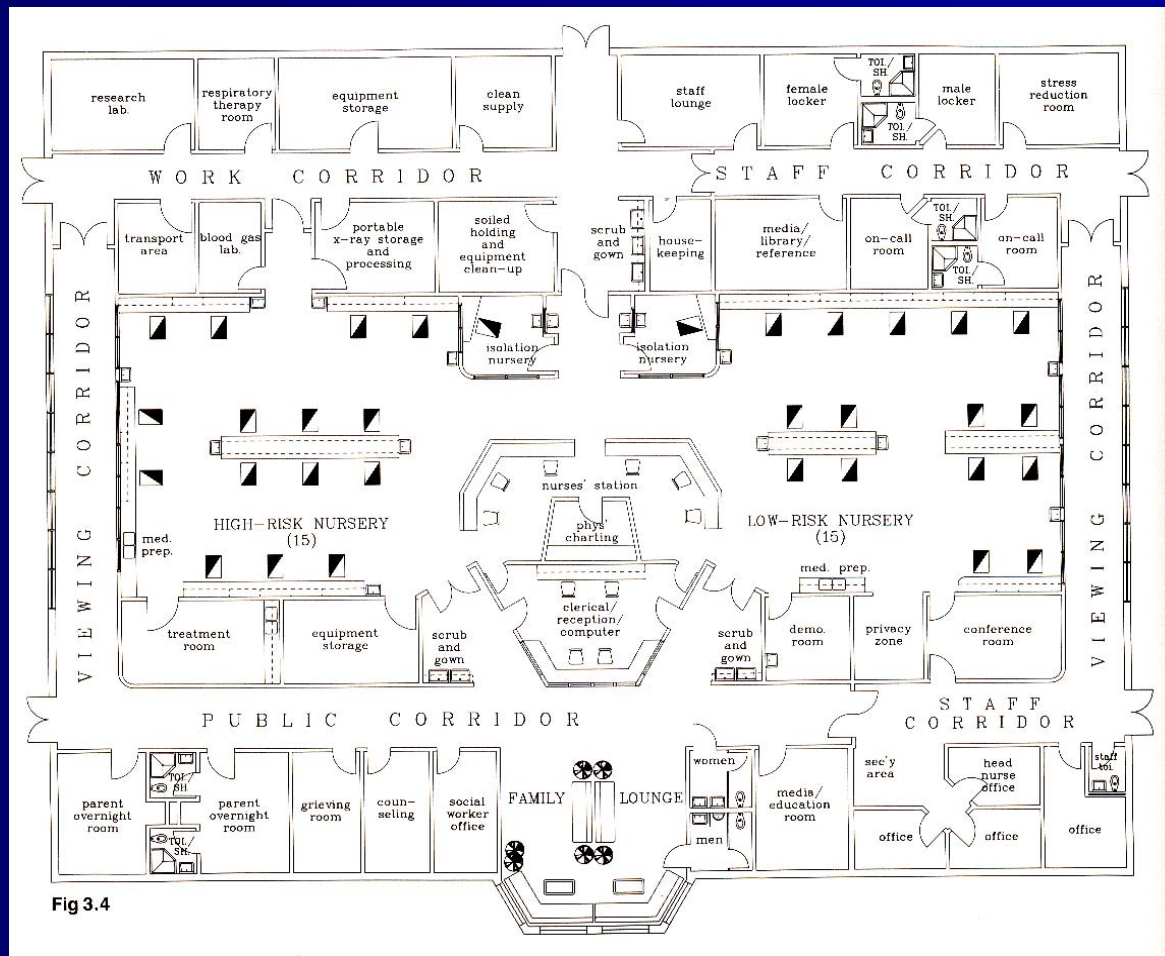


Example of Indirect Lighting and Softer Interior Surfaces



Perspectives in Perinatal and Pediatric Design, Ross Planning Ass. 1988

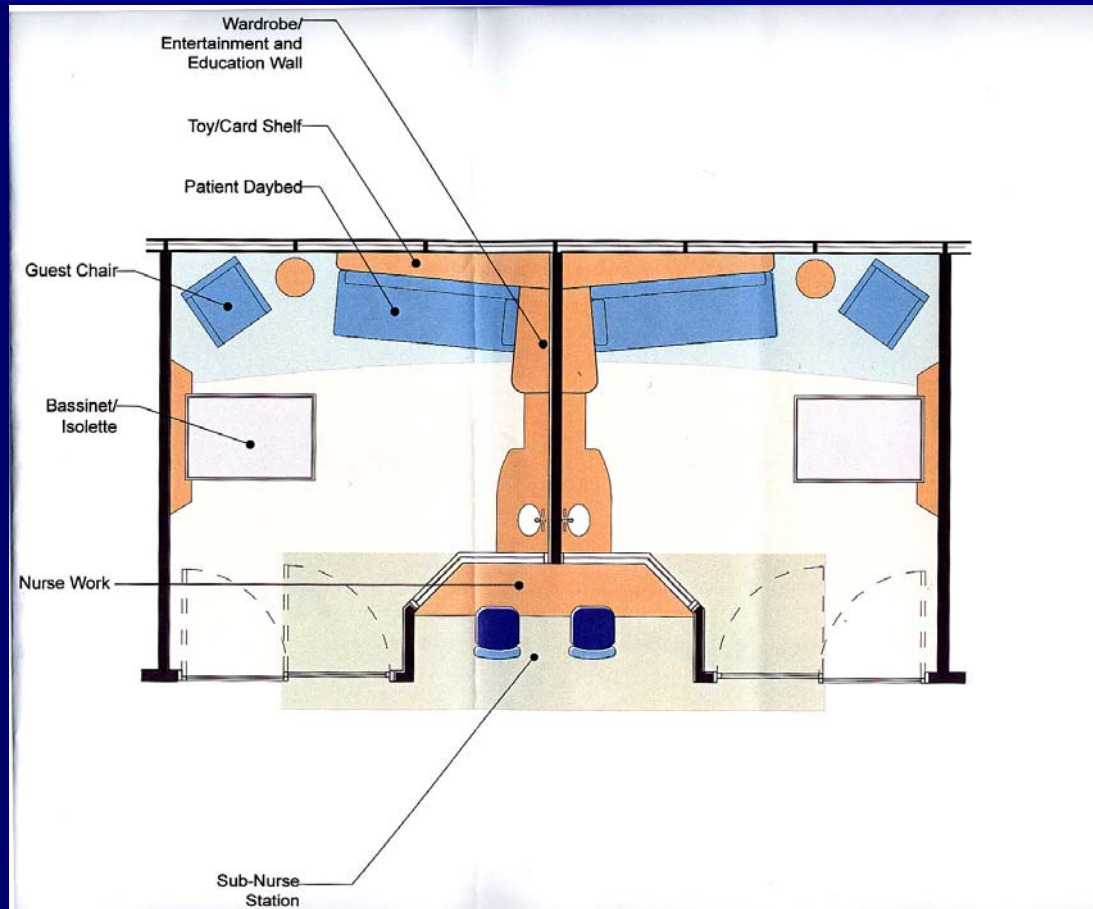
Large Open Bay NICU circa 1990



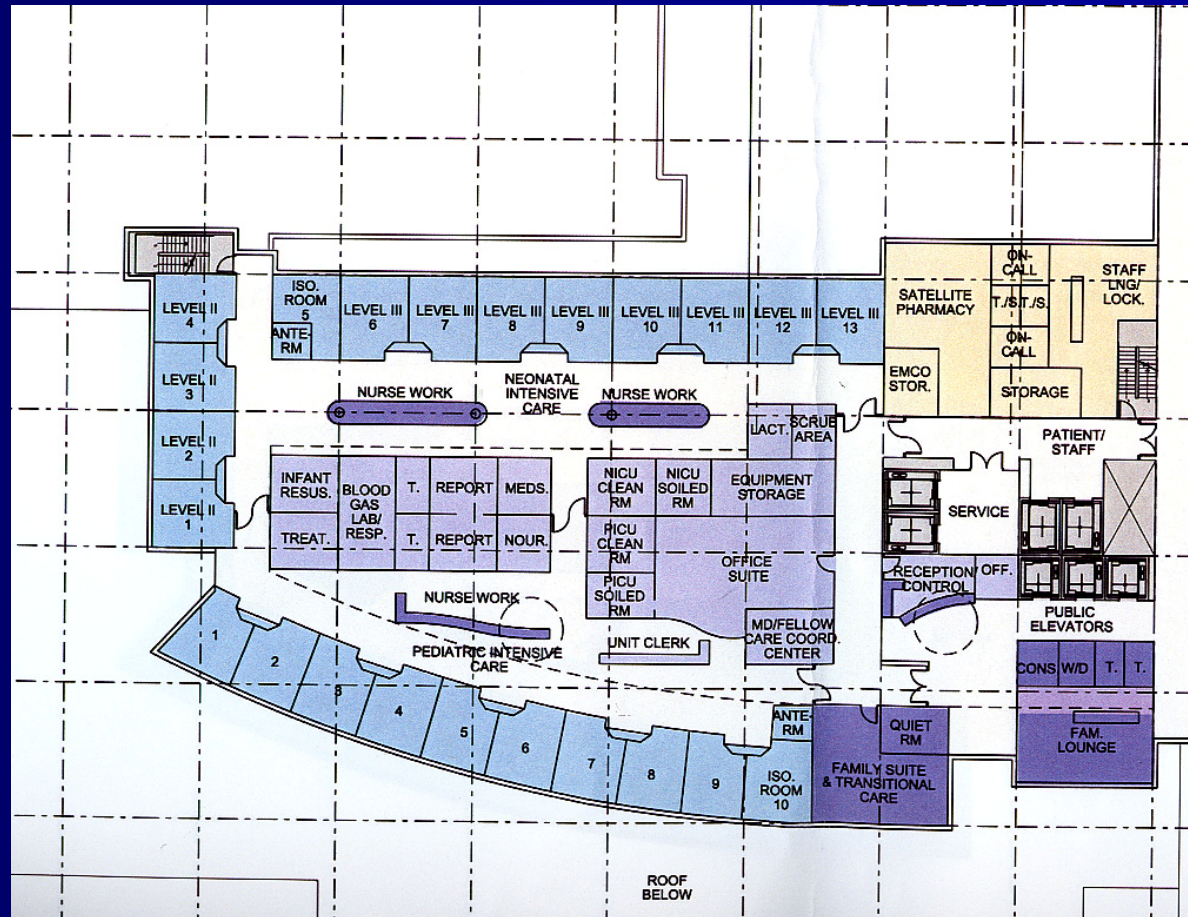
Typical Pinwheel Design circa 2000



Typical Single Patient Room Plan circa 2007



Single Patient Room NICU circa 2007



How are New Design Ideas Communicated to Designers?

- Symposiums such as the Graven's conference on the Environment of the High-Risk Infant
- Publishing of Recommended Standards on Websites
- Seminars/Conventions such as ASHE, AHCA
- Organizations such as Robert Wood Johnson Foundation, Center for Health Design, Institute for Family Centered Care
- Adoption of these Ideas into Codes and standards as minimum requirements

NICUs Gone Wild (without design criteria)



From Research to Design Ideas to Recommendations to Codes and Standards

- Federal Minimum Standards for design criteria repealed in 1984. Fire Safety criteria retained
- States adopt various design criteria for NICUs or none at all
- *Guidelines for the Design and Construction of Hospitals and Health Care Facilities* continues publication.

Evolution of NICU Design Criteria in the Guidelines

- **1987 Guidelines :** NICU was combined with pediatric with few significant requirements
- **1996-97 Guidelines:** New members on committee, NICU given separate section, space requirements for infant area, mention of family areas, sound, lighting concerns
- **2001 Guidelines:** Increase infant area to 120 SF, additional detail information on sound and lighting, requirement for family area

Evolution of NICU Design Criteria in the Guidelines

- **2006 Guidelines:** Increased clearances around infant area, sound and lighting control requirements moved from appendix to the main text.
- **2010 Guidelines:** Increasing size of single patient room to 150 sf, new section on infant formula facilities, reduction of allowable ambient sound

Lost in Translation

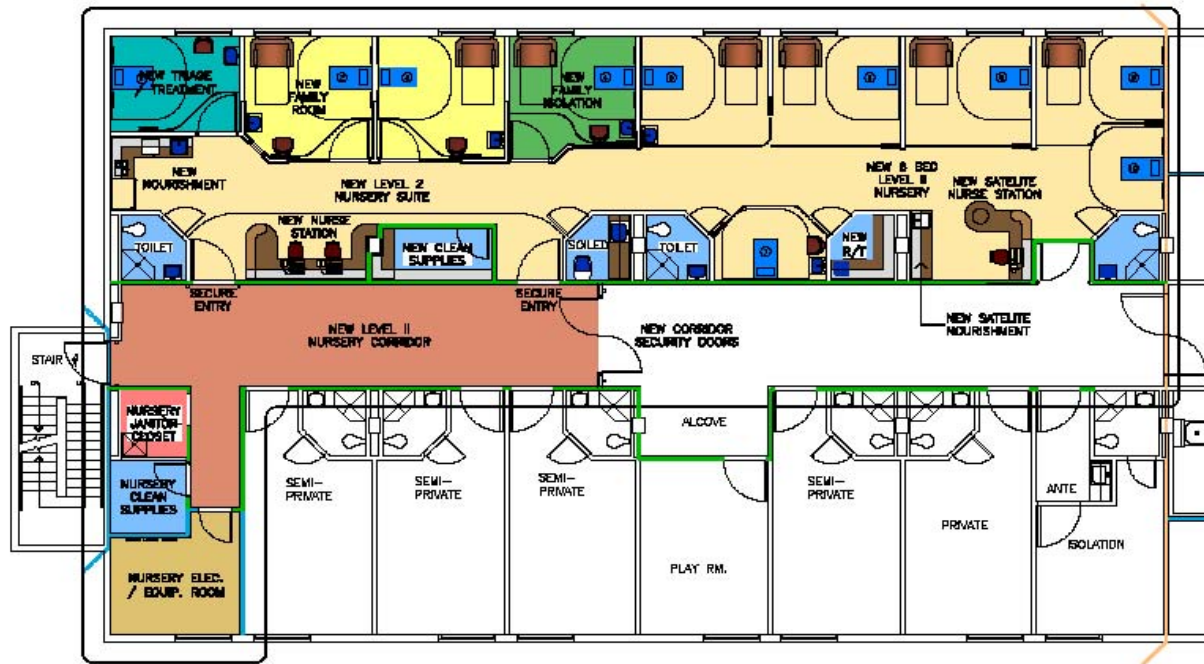
Issues of Turning Codes into Designs

- Problems in writing minimum design criteria
 - Language barriers: Describing three dimensional space... Punctuation, intent, and word meanings
 - Shall and Should: What do they mean
 - Consensus Standard: Committee must agree on language

Obfuscation of Code Intent with non-specific Language

- Each patient care space shall contain a minimum of 120 square feet (11.15 square meters) of clear floor area per bassinet excluding sinks and aisles.
- At least one source of daylight shall be visible from newborn care areas.
- The following shall be provided and may be located outside the unit if conveniently accessible
 - (1) Visitor waiting room
 - (a) This room shall be designed to accommodate the long stays and stressful conditions common to such spaces, including provisions for privacy, means to facilitate communications, and access to toilets.

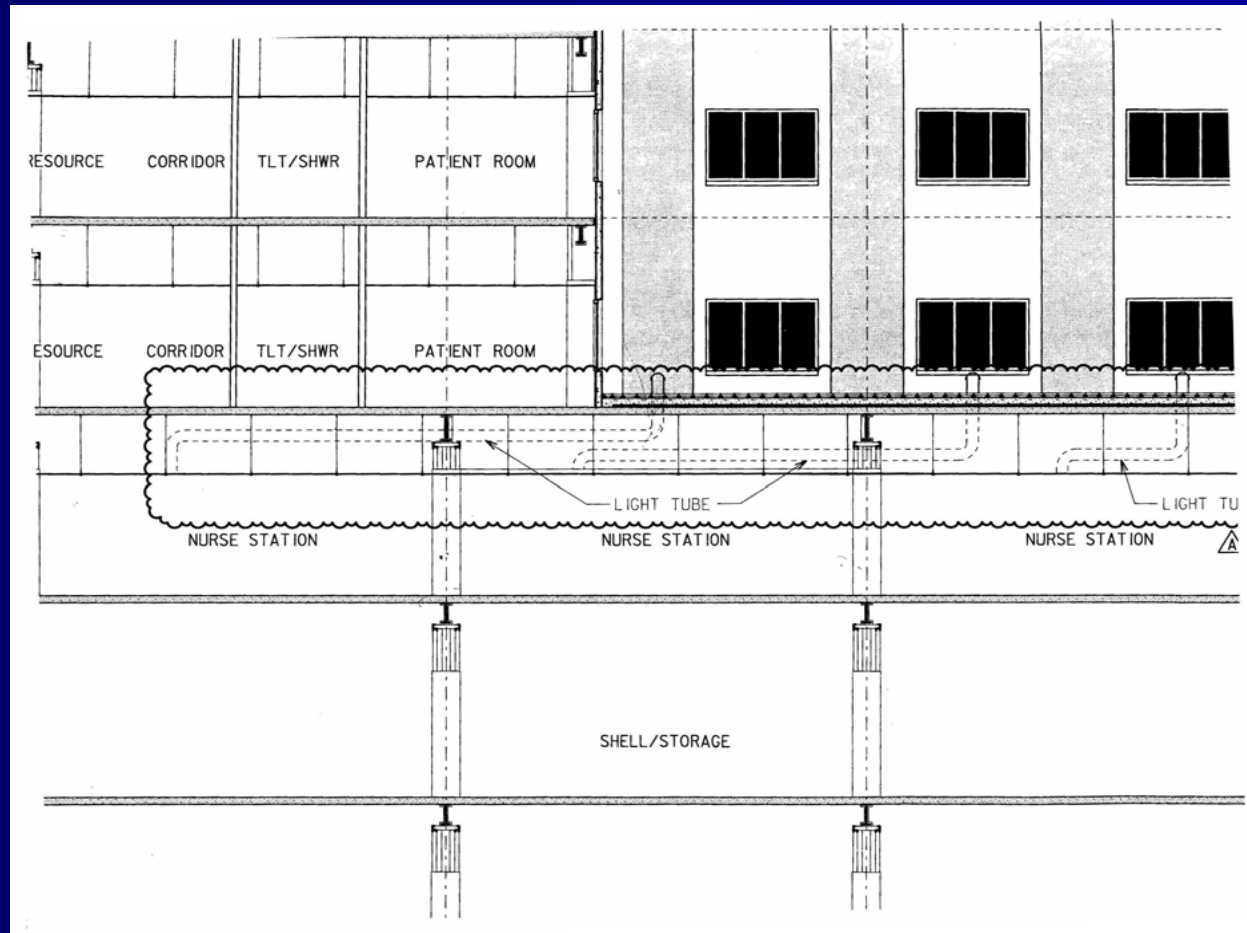
Attempted Single Patient Room Renovation Without Sufficient Area



Floor Plan Details:

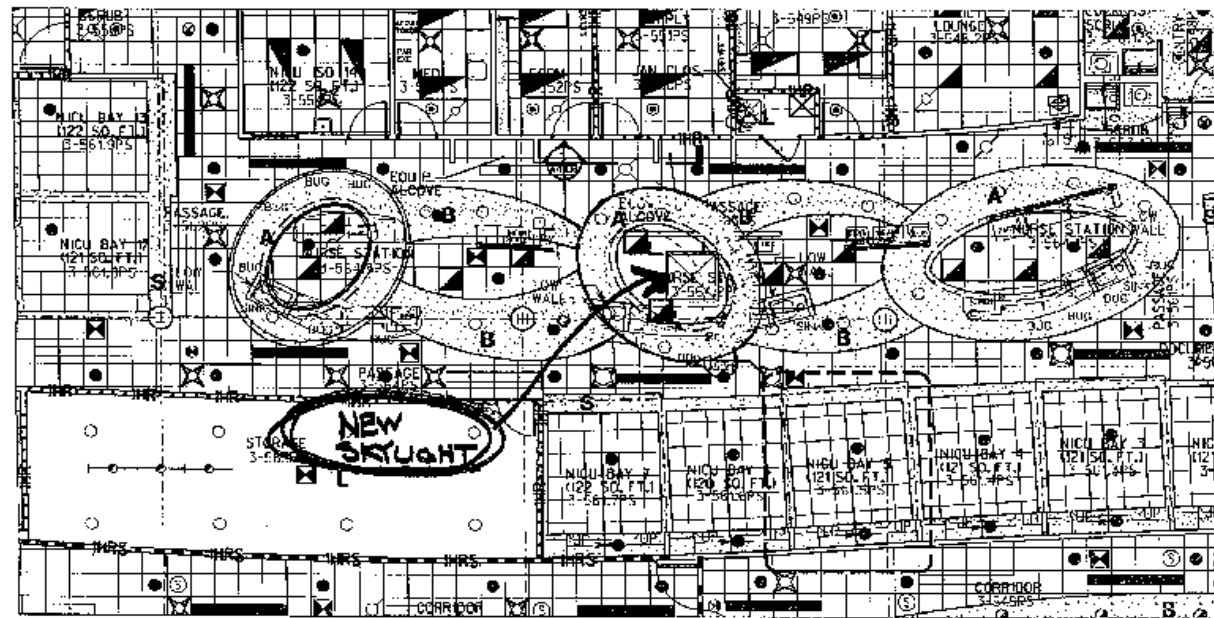
- Left Wing:**
 - LDRP #6 (2-203), LDRP #7 (2-204), LDRP #8 (2-205), LDRP #9 (2-206)
 - Childbearing Room (2-207)
 - Lactation (2-312, 120 SF)
 - Tilt. Shwr. (2-311T, 72 SF)
 - Family (2-311, 225 SF)
- Top Right Wing:**
 - Bed 10 (2-313, 120 SF)
 - Sto. (2-314, 69 SF)
 - S.L. (2-315, 66 SF)
 - J.C. (2-316, 51 SF)
 - C.L. (2-317, 60 SF)
 - Work
- Right Wing (Beds 2-301 to 2-310):**
 - Bed 9 (2-310, 121 SF)
 - Bed 8 (2-309, 122 SF)
 - Bed 7 (2-308, 124 SF)
 - Bed 6 (2-307, 120 SF)
 - Bed 5 (2-306, 120 SF)
 - Bed 4 (2-305, 122 SF)
 - Bed 3 (2-304, 125 SF)
 - Bed 2 (2-303, 121 SF)
 - Bed 1 (2-302, 152 SF)
- Central Corridor and Utility:**
 - Corridor (2-208)
 - Corridor (2-217)
 - Corridor (2-225)
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First Attempt at Day Lighting in NICU (Building Section)

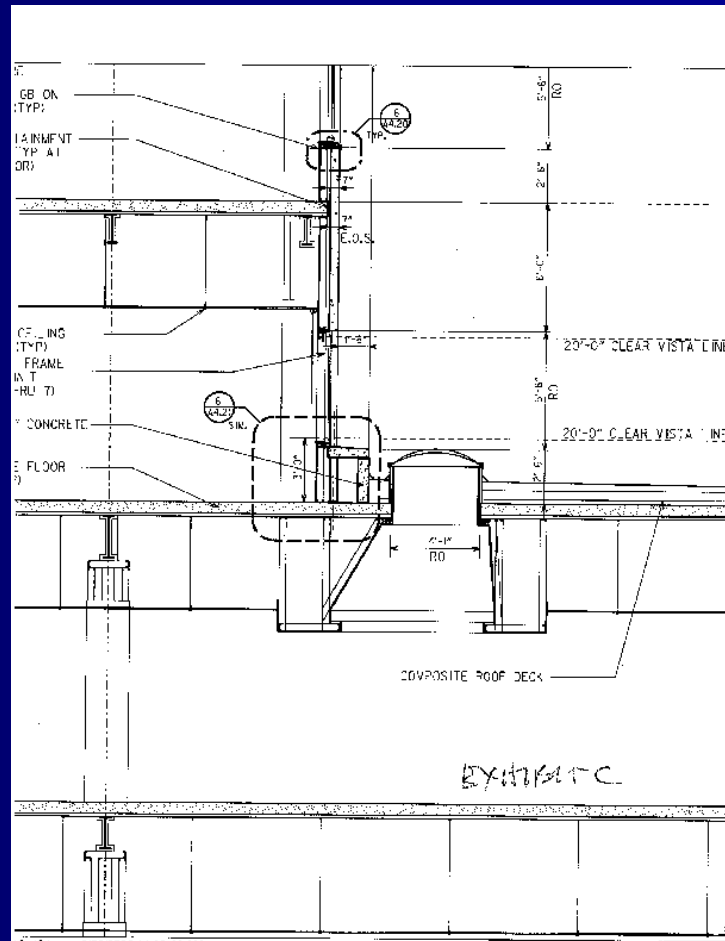


From public records AHCA files

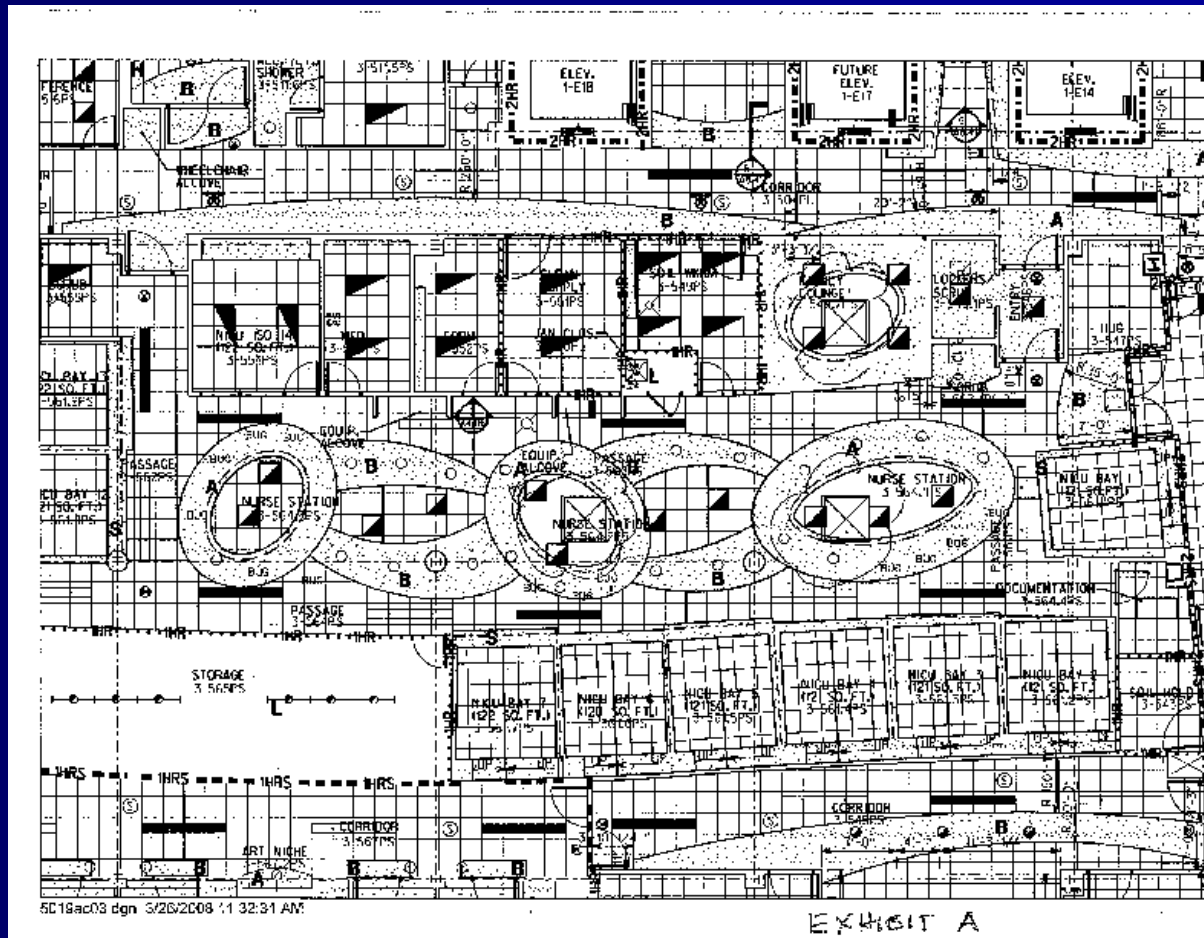
Second Attempt at Day Lighting (Reflected Ceiling Plan)



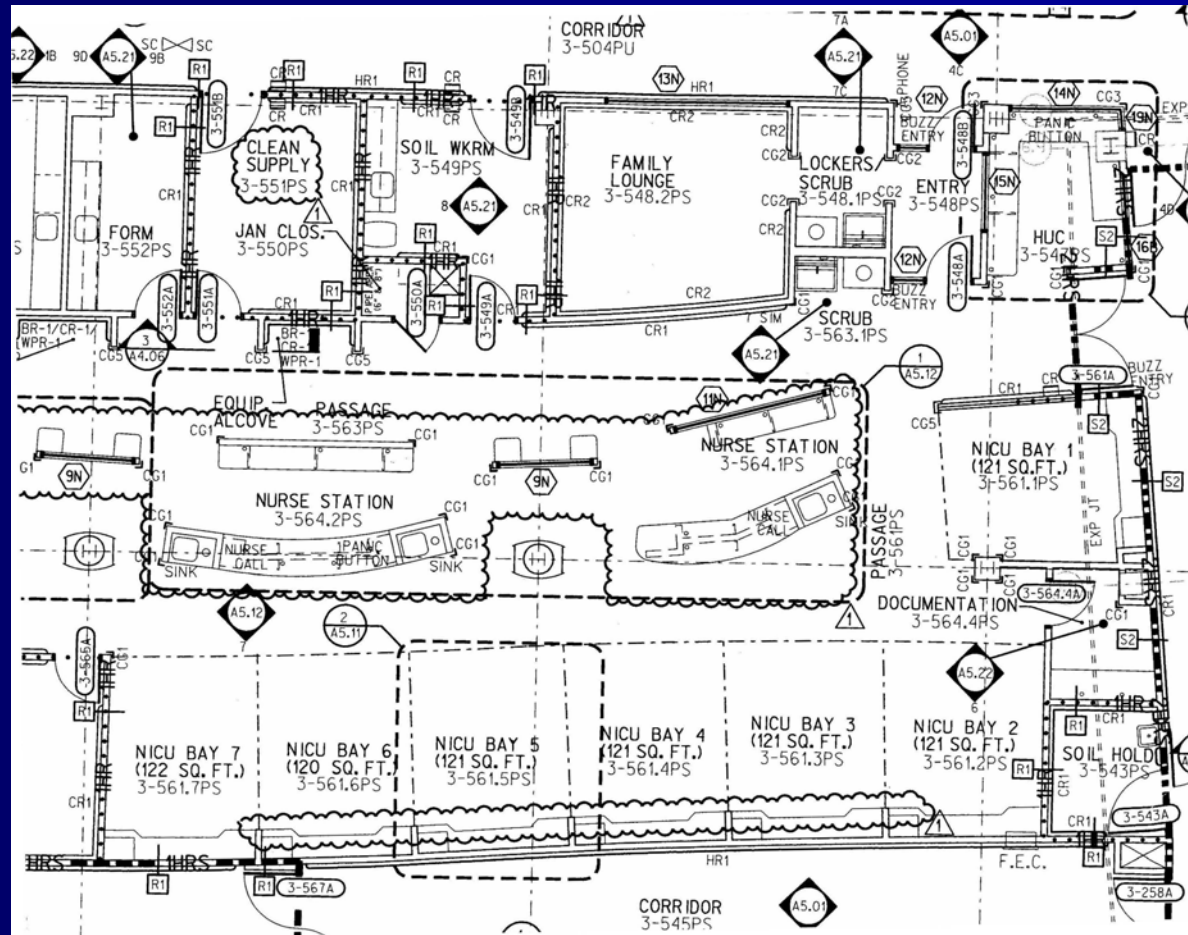
Small Single Sky Light Over Nurse Station (Roof Section)



Final Attempt at Day Lighting (Reflected Ceiling Plan)

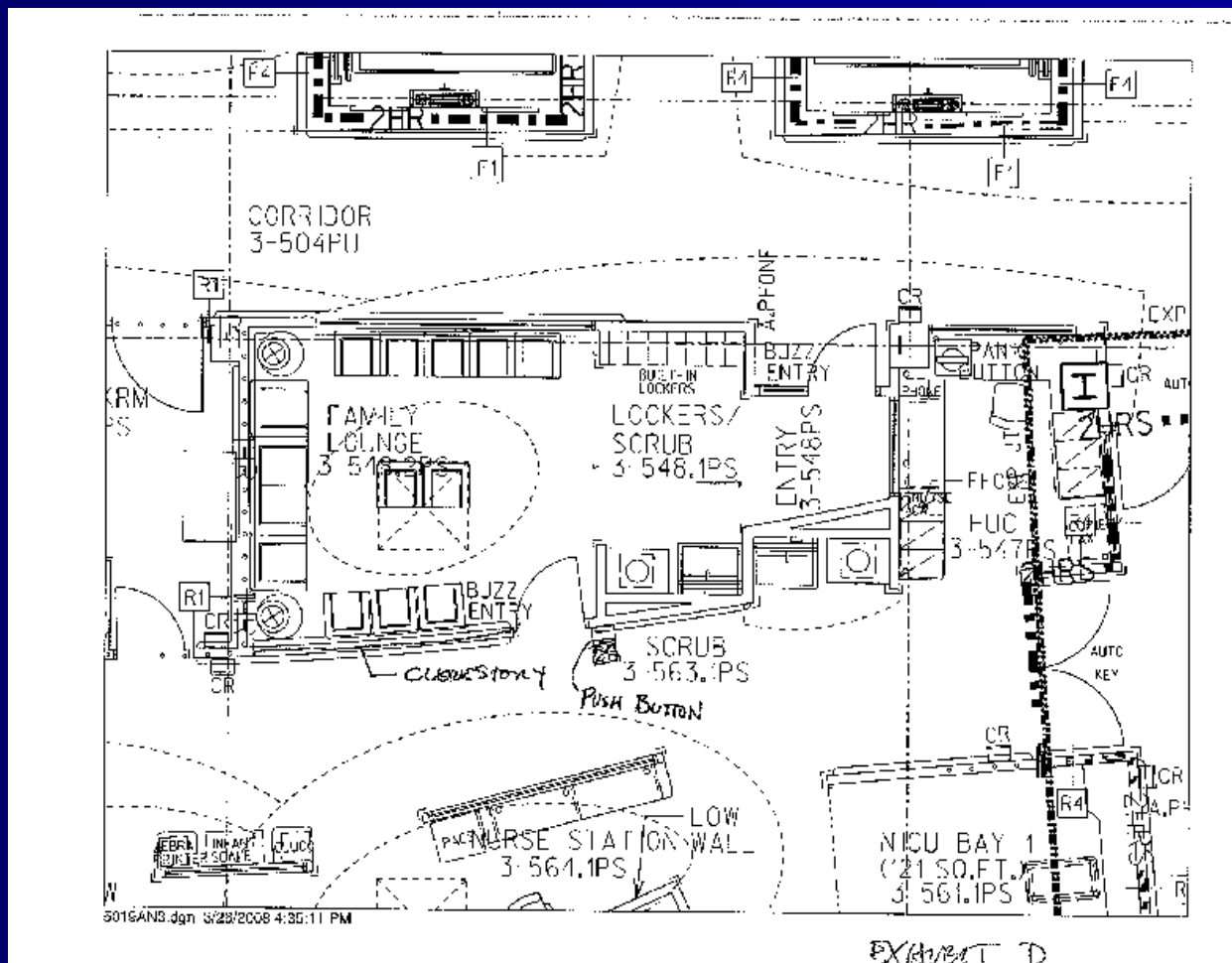


First Attempt at Providing a Family Respite Area



From public records AHCA files

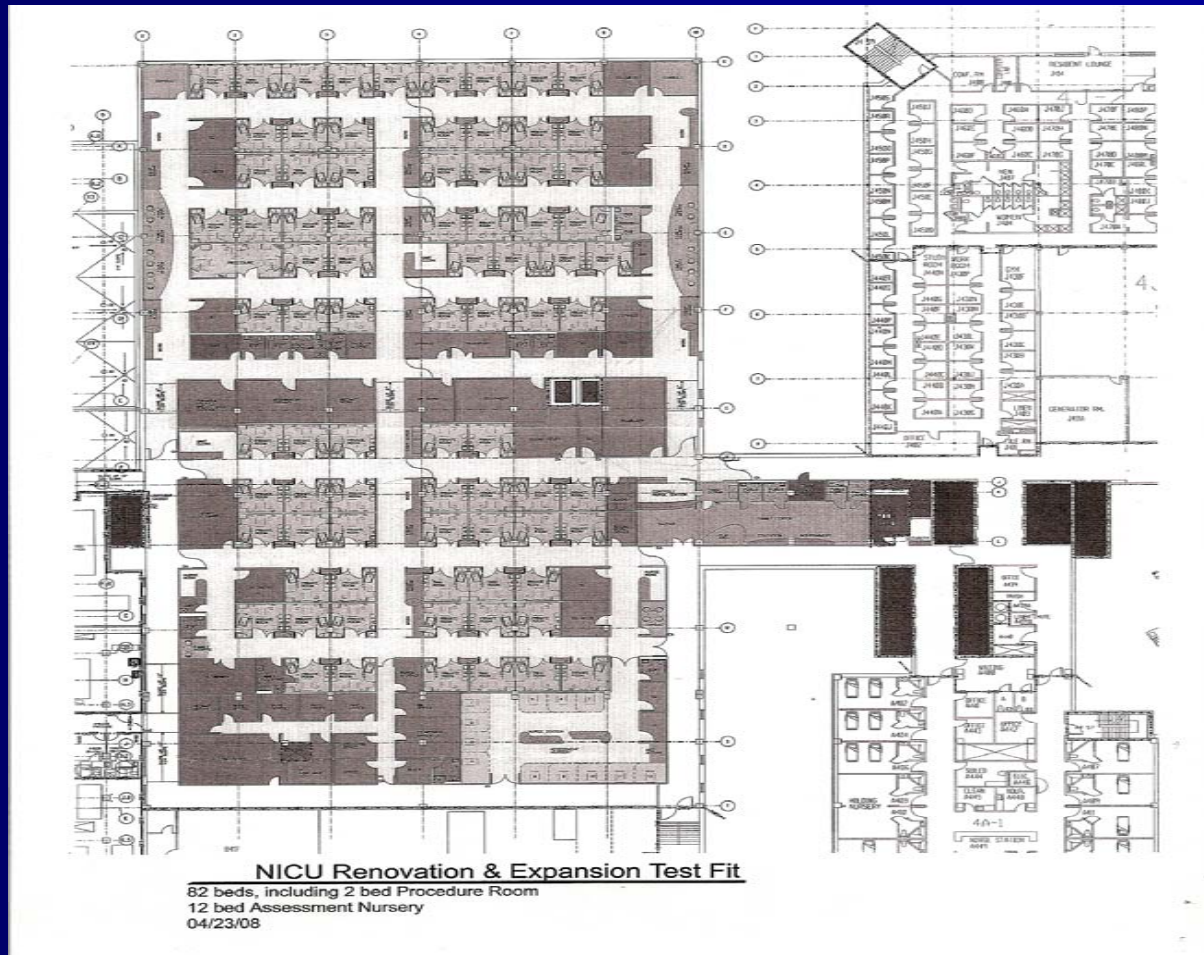
Final Attempt at Providing a Family Respite Area



From public records AHCA files

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Large Single Patient Room NICU Layout



Barriers to Better NICU Design

- Lack of consistent information flow from clinicians and researchers to designers
- Lack of consistent Interpretations of Code Criteria
- Lack of consistent training for designers
- Lack of consistent training for code reviewers



Footsteps to the Future of NICU Design

- Continue Research and refine areas of unknowns
- Continue Revisions to NICU Design Criteria
- Publish Handbook on NICU Design Criteria
- Publish Handbook on *The Guideline* Requirements
- CMS should adopt and enforce the Guidelines (not just fire codes) for consistent minimum hospital design for the United States.

Some Useful Email Addresses

- *The Guidelines for the Design and Construction of Health Care Facilities*
<http://www.fgiguilines.org/>
- *The 22nd Annual Graven's Conference on the Physical and Developmental Environment of the High Risk Infant:*
<http://www.cme.hsc.usf.edu/hri09/>
- Recommended Standards for Newborn 2006:
<http://www.nd.edu/~nicudes/>
- Institute for Family-Centered Care:
<http://www.familycenteredcare.org/>

Question?

Thank You

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