

INVESTIGATING SPACE PLANNING AND ERGONOMIC EFFICIENCIES FOR NURSES IN LEVEL I TRAUMA EMERGENCY CENTERS



MILESTONE REVIEW



MADELINE BORTLE

INTERIOR DESIGN

CLASS OF 2023

ROCHESTER INSTITUTE OF TECHNOLOGY



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Committee Member



SUSAN CLARK

REVIEWER

CERTIFIED INTERIOR DESIGNER, CHID

SUSAN CLARK DESIGN, COMMERCIAL

OVERARCHING QUESTION

How can **organizational strategies** and **space planning improvements** reduce the **mental and physical fatigue of nurses** in level I trauma emergency centers?

“The Emergency Department is the ‘front door’ of the US medical system, handling almost 50% of all care that takes place in the hospital”

ORGANIZATIONAL STRATEGIES

Addressing

- 1) The problems in lines of sight
- 2) Workstation preparation
 - Storage
 - Nurses' Stations
 - Equipment Organization

SPACE PLANNING IMPROVEMENTS

Addressing

- Efficiency of Circulation Paths & Wayfinding
- Spatial Organization
- Furniture Placement
- Acoustics & privacy

MENTAL & PHYSICAL FATIGUE OF NURSES

Addressing

- Ergonomic Efficiencies for Nurses

LITERATURE REVIEW ASPECTS

TRAUMA LAYOUTS



**The Lahey Hospital & Medical Center
Emergency Trauma II**



Trauma II Center (Unprepared)



**Penn Presbyterian Medical
Center (PPMC) Trauma I**



INTERIOR
DESIGN

TRAUMA I SPECIFICS

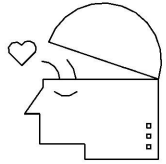
A Trauma I Center includes the following:

- 24-hour in-house coverage by general surgeons, and prompt availability of care in specialties such as orthopedic surgery, neurosurgery, anesthesiology, emergency medicine, radiology, internal medicine, plastic surgery, oral and maxillofacial, pediatric and critical care.
- Referral resource for communities in nearby regions.
- Leadership in prevention and public education to surrounding communities.
- Continuing education of the trauma team - physician's, nurses and EMS providers.
- A comprehensive Quality Improvement program.
- Directs new innovations in trauma care through formal teaching and research.
- A program for substance abuse screening and patient intervention

Trauma Room - Adult & Peds	Amt
Trauma stretchers	4
Glidescope cart	1 locked
Glidescope box (A & B)	2 locked
Glidescope fiberoptic device	2
Airway mayo stand (covered)	2
Adult Ambu bag	2
Peds Ambu bag	2
Rapid infuser	2
Trauma cart (filled as labeled)	2 locked
Scribe cart (filled as labeled)	2
Peds trauma cart	1
Syringe pumps	2
Broslow cart	1 locked
Peds emergency cart	1 locked
Philips transport monitors	4
Zoll monitors	3
Travel med boxes	2
EMTALA bag	1
Foot stools	2
Ultrasound machine	2
I STAT unit	2
IV pumps	2
IV pump channels	4
EZ IO kit	2 locked
O Neg Blood	2 Units

DC DESIGN: Reimagining ED Design

Empathy



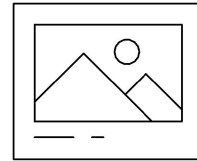
Define



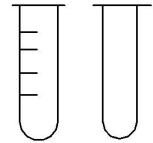
Ideate



Prototype



Test



DC DESIGN: Reimagining ED Design



SELF CHECK IN KIOSK

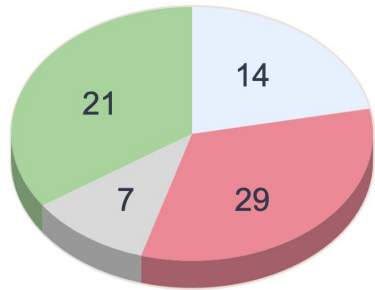


TREATMENT POD



POP UP HALLWAY

ERGONOMIC STRESS & SOLUTIONS



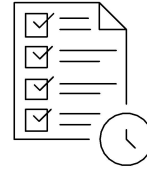
- Severe anxiety
- Obvious anxiety
- Indicated anxiety
- Low/No anxiety

*176 nurses were 17.1 ± 8.1 , and 77.3% of them had anxiety



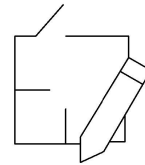
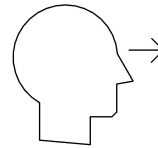
What is it? The force required to complete a task

Dependent on: Environmental stressors

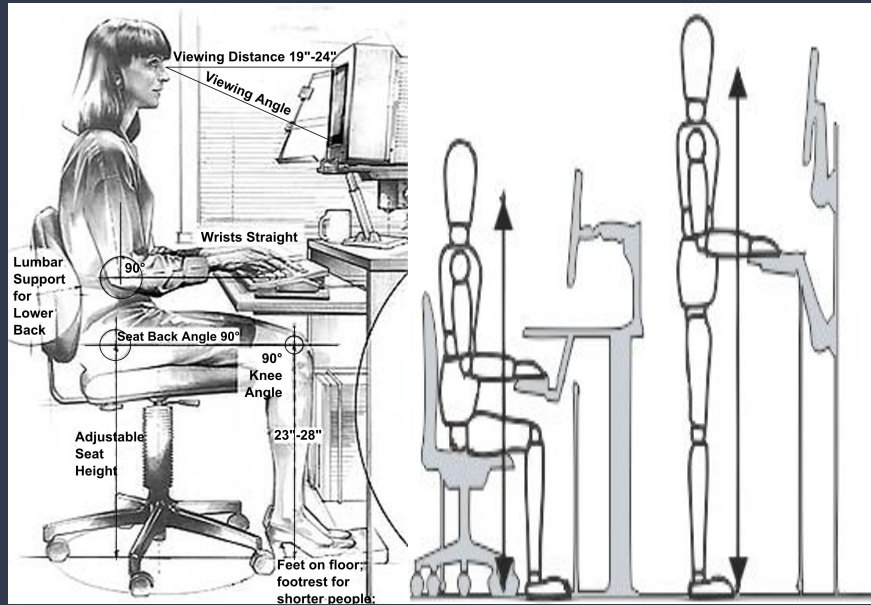


Ways to improve?

- Counter heights, outlets, reach range
- Lines of sight, movement, and communication
- Effective space planning and organization



ERGONOMICS & ANTHROPOMETRICS



ANTHROPOMETRICS

- Study of the human body and movement
- Measurements- height, weight, shape, arm lengths, etc.

ERGONOMICS

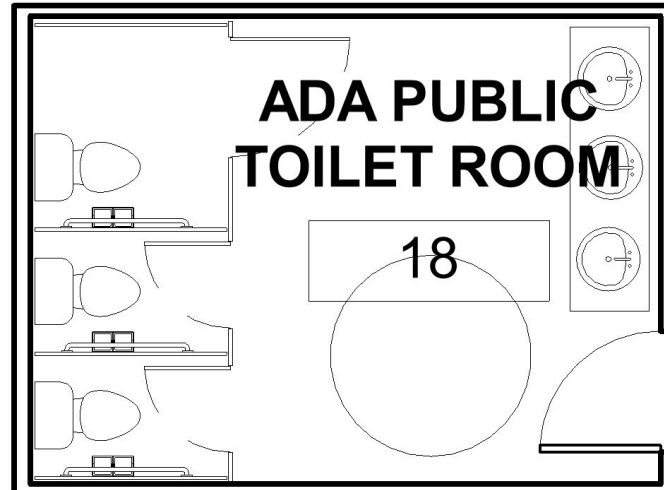
- Scientific discipline involving designing products and environments to match individuals using them
- Using body measurement data to design proper products and environments

HOW THIS WILL BE APPLIED

- Nurses Stations
- Staff Areas- counters, seating, work stations, bending/ reaching for supplies in storage
- Proper Lines of Sight without strain

CODE ASPECTS

- Door clearances 8'
- Turn radius 5-6'- ADA
- Corridor widths 8'
- Typ desk hgt 29", typ standing 42", counter top hgt 36", ADA hgt 32-34" MAX
- Handwashing stations with patient rooms by perimeter or at nurses stations- easy access and per so many patients
- Heights of equip
- Environmental services closet needed
- Acoustics: nrc, cac ratings- ceiling acoustics, stc for walls- patient privacy, all walls 'to deck' hgt- acoustical ceiling at joints
- Operating Bays: 3' clear each side, 2' at foot of bed, 6'8" clear at head of bed if anaesthesia is needed, procedure space needs 3'6" each side of bed and 3' each side, 3' at head, 130sqft clear floor area
- Exam Areas: 80sqft clear floor area, 2'8" each side of bed



TAKEAWAYS

- 1) The problems in lines of sight
- 2) Workstation preparation
- 3) The efficiency of circulation paths

Impacting variables:

- Ergonomic stress
- Wayfinding & circulation
- Acoustics & privacy

Aim:

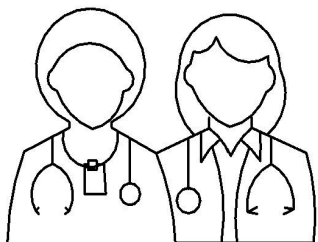
- To identify where workflow may be improved through organization and space planning strategies
- Demographic- Nurses, Trauma I Medical Workers



RESEARCH AGENDA ASPECTS

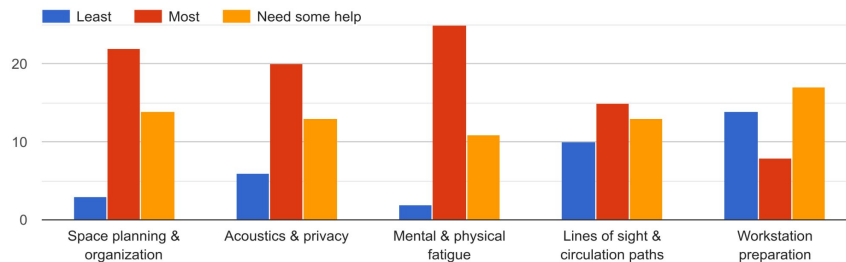
RESEARCH AGENDA: QUESTIONNAIRE

Responses	Position
16	Nurse
12	Doctor
11	N/A
Total: 39	



QUESTIONS: AREA ASPECTS

What aspects of the trauma environment need most to least change?



The most overwhelmingly used areas and equipment of an emergency room are

Triage, trauma rooms

Patient rooms/bays, busy corridors, nurse stations.

Corridors are always pack full of patients and equipment

Nurses station counters

Patient monitors, rooms & nurses station

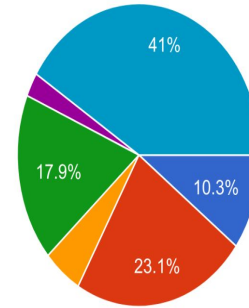
QUESTIONS: NURSES/ STAFF

What aspects do you think contribute to your stress level?

No time for breaks, unsafe patient ratios
lots of people rushing around and appearing as though there is no organization
These are life and death situations, so it is very stressful knowing what is happening in this area.
Noise & Lighting, Scent
noise
Lack of space, resources, organization
How long it took
Fear of lack of knowledge
Convenience of supplies, working equipment

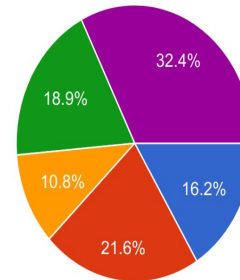
QUESTIONS: OBSTACLES

What ergonomic aspects have most affected your stress levels?



- traumatic events
- spatial organization- organization within the ED in nurses stations, cords, storage for supplies
- occupation related health issues
- no time for eat, sleep, activity
- ill preparation for full trauma rooms
- environmental factors- wayfinding, crowding, noise level

What are the biggest obstacles of nurses stations?



- lines of sight/restricted views
- privacy
- ineffective storage
- counter/usable space
- spatial location

RESEARCH AGENDA: INTERVIEWS

Kristin Merle- Dwyer Architectural **Healthcare Designer**, prior work within U of R (SMH ED)

Key Takeaways:

- Centralized and decentralized nurses stations needed
- Separate ambulance entrance
- Not enough space, Privacy: HUGE issue
- Wellness rooms for workers are important

Alexa Considine- **Nurse** in NYC

Key Takeaways:

- Not enough space & storage
- Respite space is important
- Overworked, barely any days off
- Space allocation for organization and efficiency is currently not working

RESEARCH AGENDA: INTERVIEWS

Andrew Kozminski- Emergency Medicine **Physician Resident** at Strong Memorial Hospital

Key Takeaways:

- Building a new ED continually in crisis at the moment with overflow of patients
- Goal of seeing patients in less ideal areas- waiting room then chair or bed in hallway, half of ED is deemed for only inpatient because of resources and hands on deck
- Walking paths are long to patients

Margaret (Maggie) Coulter- **Safety Nurse** at Strong Memorial Hospital

Key Takeaways:

- Issues: overcrowding, space and organization, equipment storage, borders are narrow, triage not very private
- Helpful new design solutions: portable workstations, portable locked medical drawers, private rooms with more space

RESEARCH AGENDA: SITE VISIT

SITE VISIT

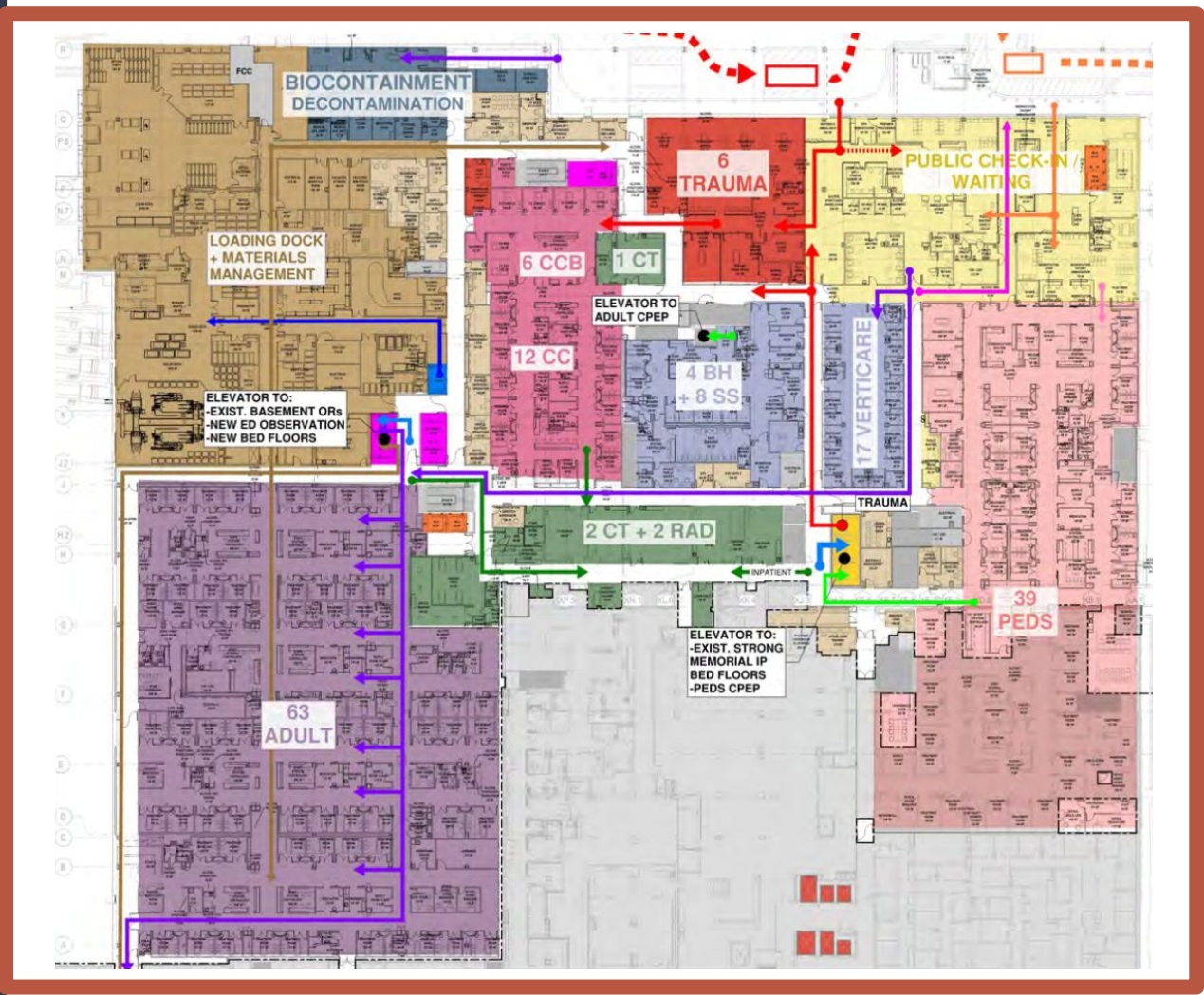
Tour with David Chafetz- Chief Administrative Officer at Strong

Main Takeaways:

- ED is set-up like a racetrack, Pediatric ED is mini version
- Verticare structure in parking lot
 - Helped through Covid-19
 - Extra space for overflow patients
 - Single chair with curtain care cubicles
- Trauma Bays are crowded with equipment
- Main issues: storage, organization, stress on staff, and overcrowding



RENOVATION FLOOR PLAN



CREATIVE AGENDA ASPECTS

PROJECT STATEMENT & OBJECTIVES

Location: Strong Memorial Hospital

Square Footage: Using footprint of new ED but the focus is as a Trauma I center

Design: Theoretical ideal trauma I center spatial organization & design

Strategies to improve workflow:

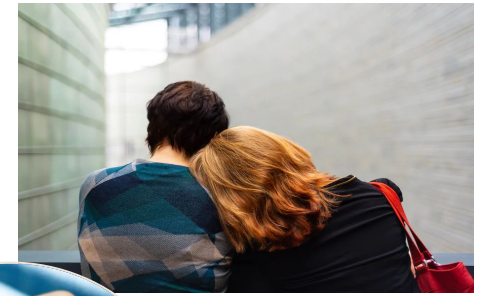
- Wayfinding
- Space planning and organization
- Privacy and acoustic solutions



CONCEPT & MOOD BOARD

Concept

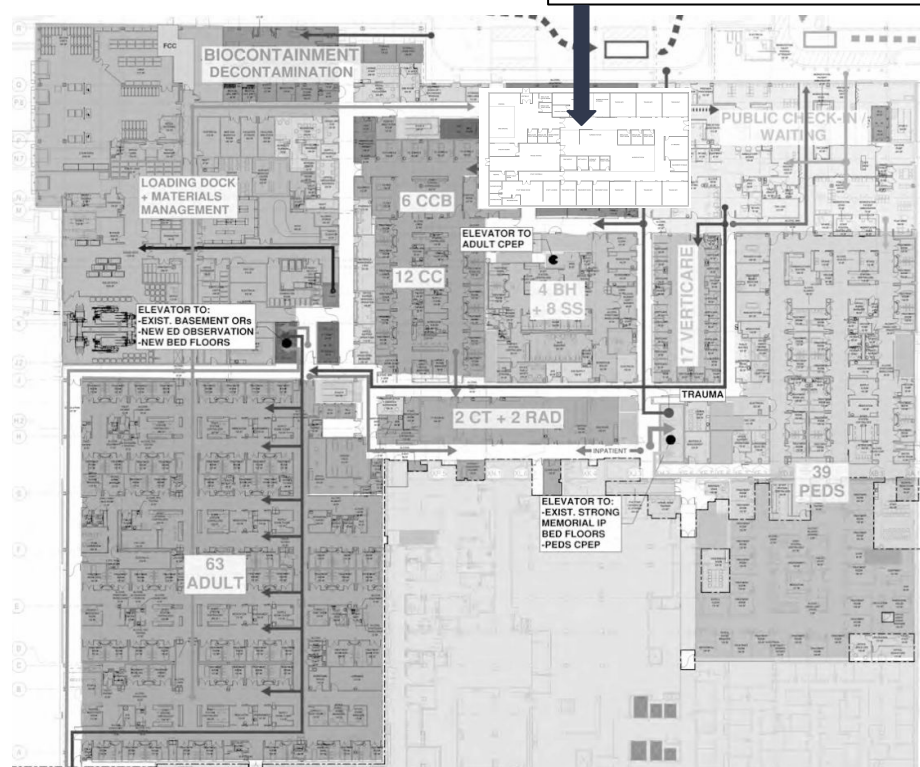
- Captivating care for patients & related to nurse well-being through natural elements
- Captivating this through natural materials, ceiling & wall elements, lighting, open circulation and organization



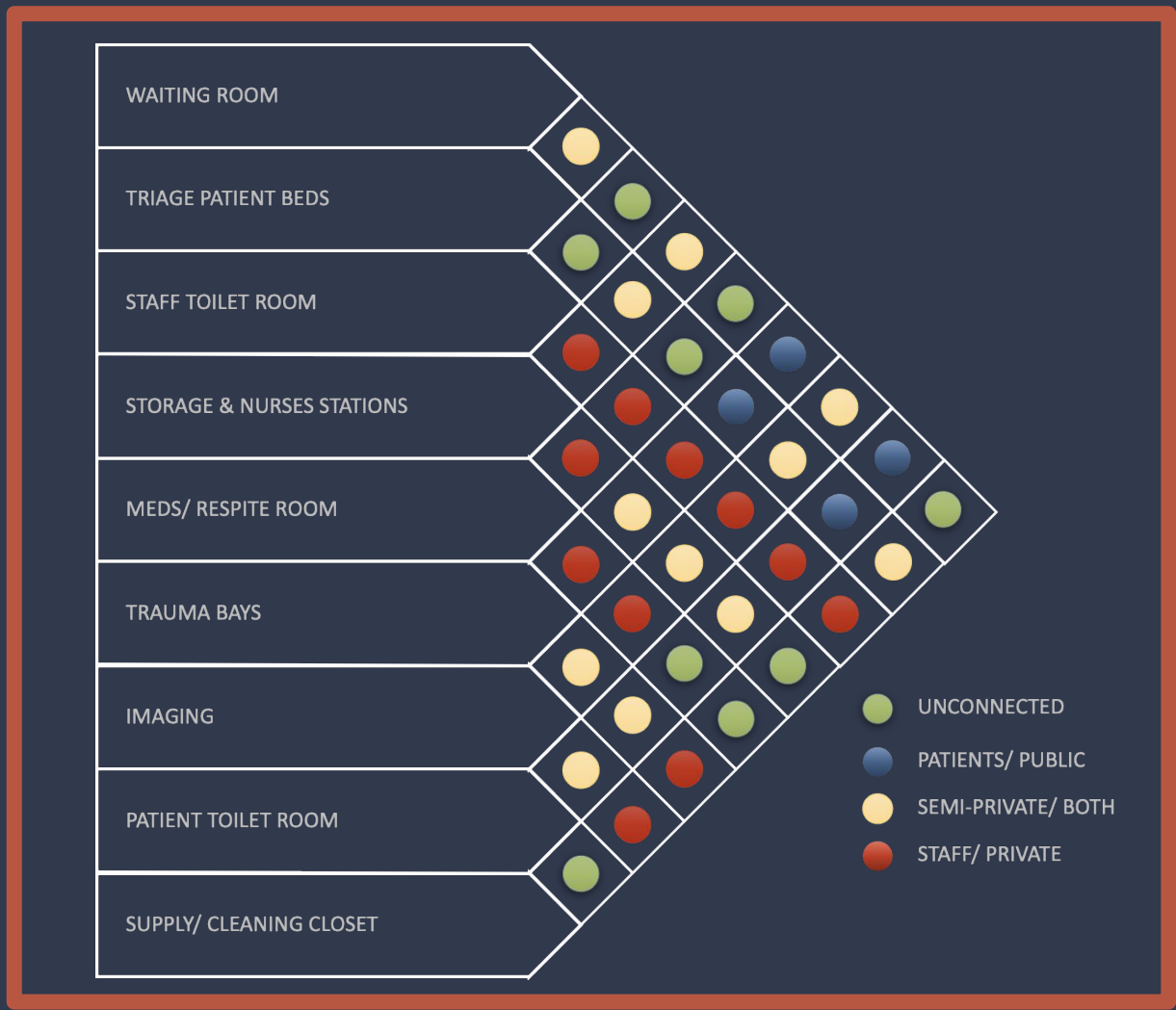
SPATIAL ALLOCATION & AREA OF WORK

PROGRAM			
ABR.	QUANTITY	ROOM TYPE	NOTES
E	1	HOSPITAL CONNECTION	
	1	MAIN ENTRANCE	
	1	AMBULANCE ENTRANCE	
T	6	TRAUMA BAYS	
I	1	CT/ IMAGING SUITE ROOM	
S	1	EQUIPMENT STORAGE	
	2	DRY STORAGE	
	2	WET STORAGE	
	2	CLEAN UP STATION	
P	3	PATIENT TREATMENT ROOMS	
ST	1	STAFF AREA VESTIBULE	
	1	TOILET ROOM	
	1	BREAK ROOM	
	1	LOCKER ROOM	
	3	SHOWER ROOMS	
	1	RESPIRE ROOM	
TR	5	PUBLIC TOILET ROOMS	
D	2	NURSES STATIONS	
	1	NURSE/ STORAGE STATIONS	
	1	MAIN CHECK IN DESKS	
B	1	BEREAVEMENT	
W	2	WAITING AREAS	
	1	MAIN WAITING	
	1	TRIAGE WAITING	

Project Footprint
15,000 gsf

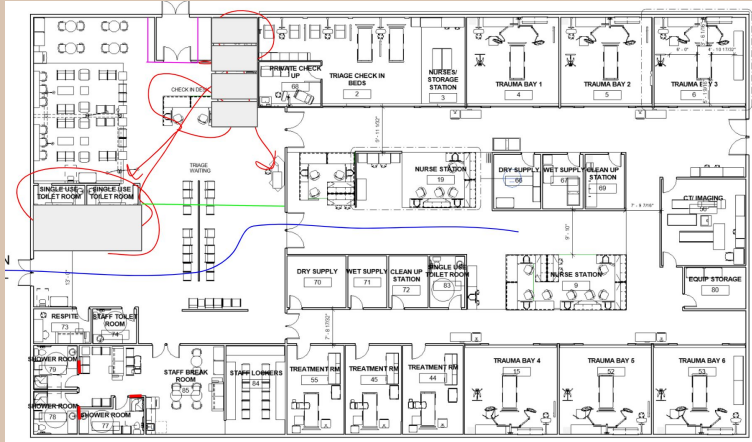
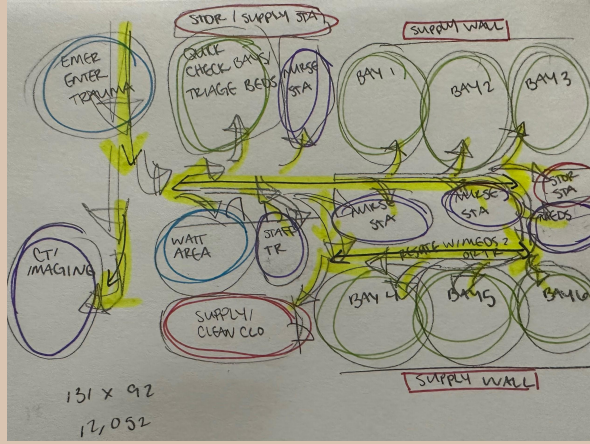


SPATIAL ADJACENCIES

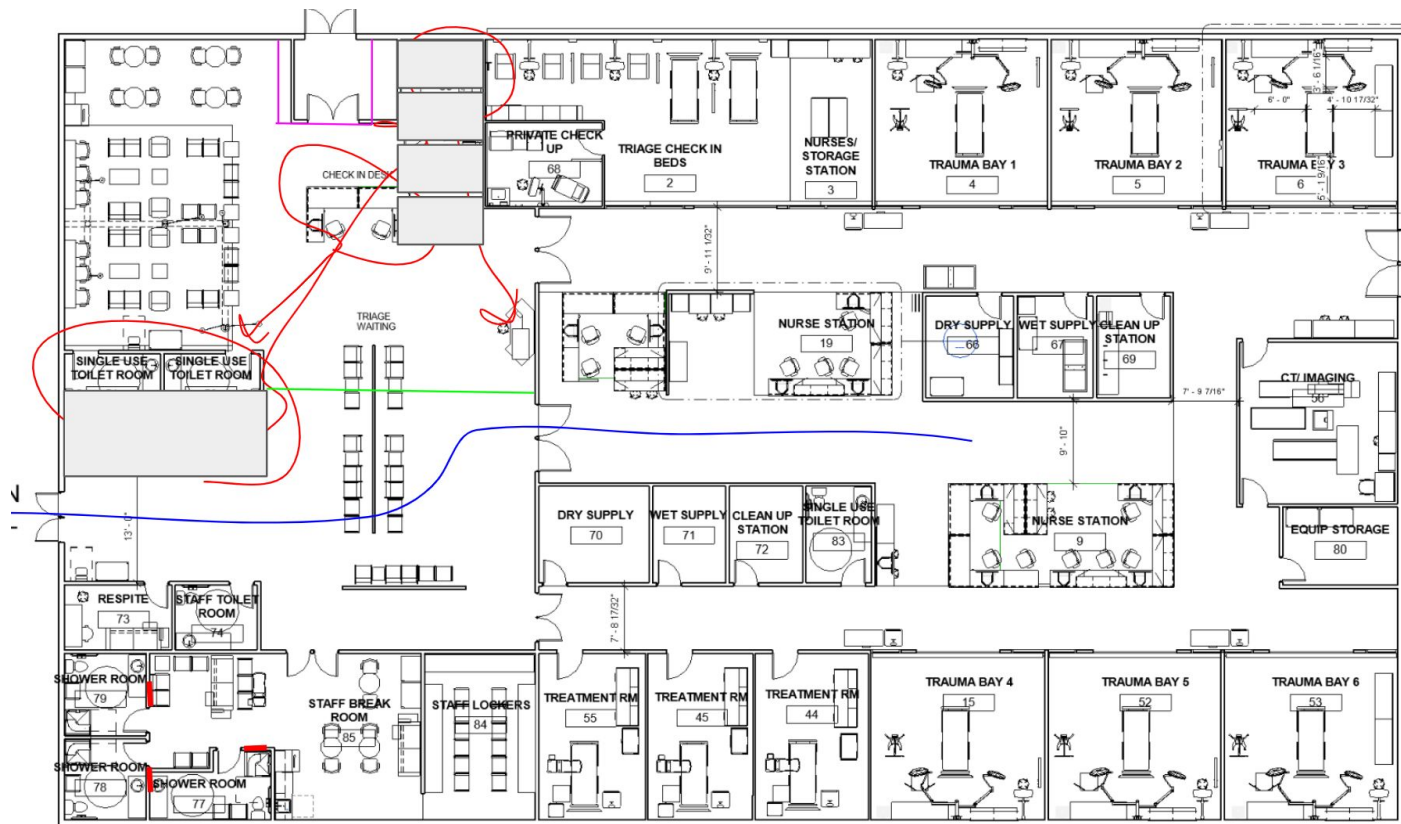


SKETCHES

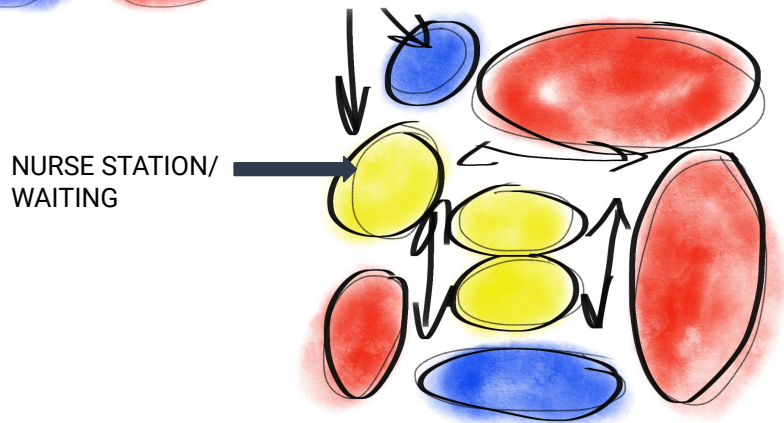
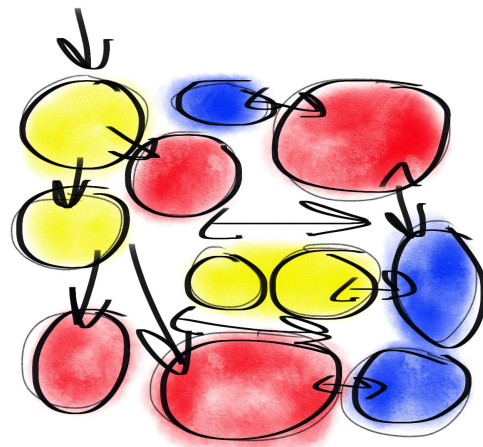
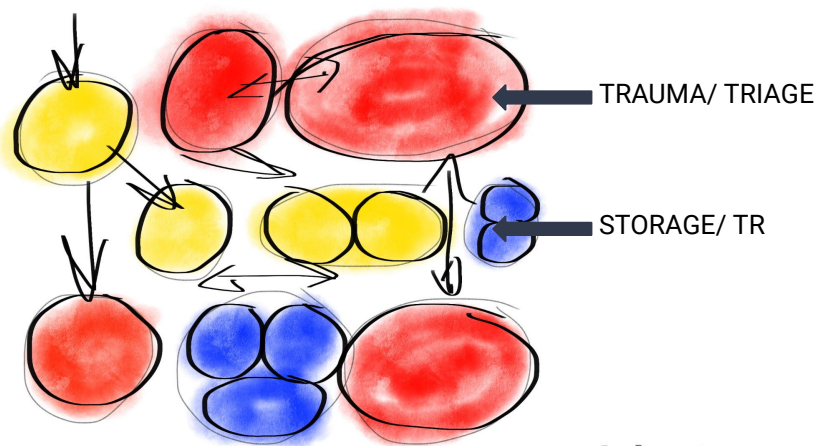
ORGANIZATIONAL DRAWINGS



PLAN RECONFIGURING



SPACE ALLOCATION

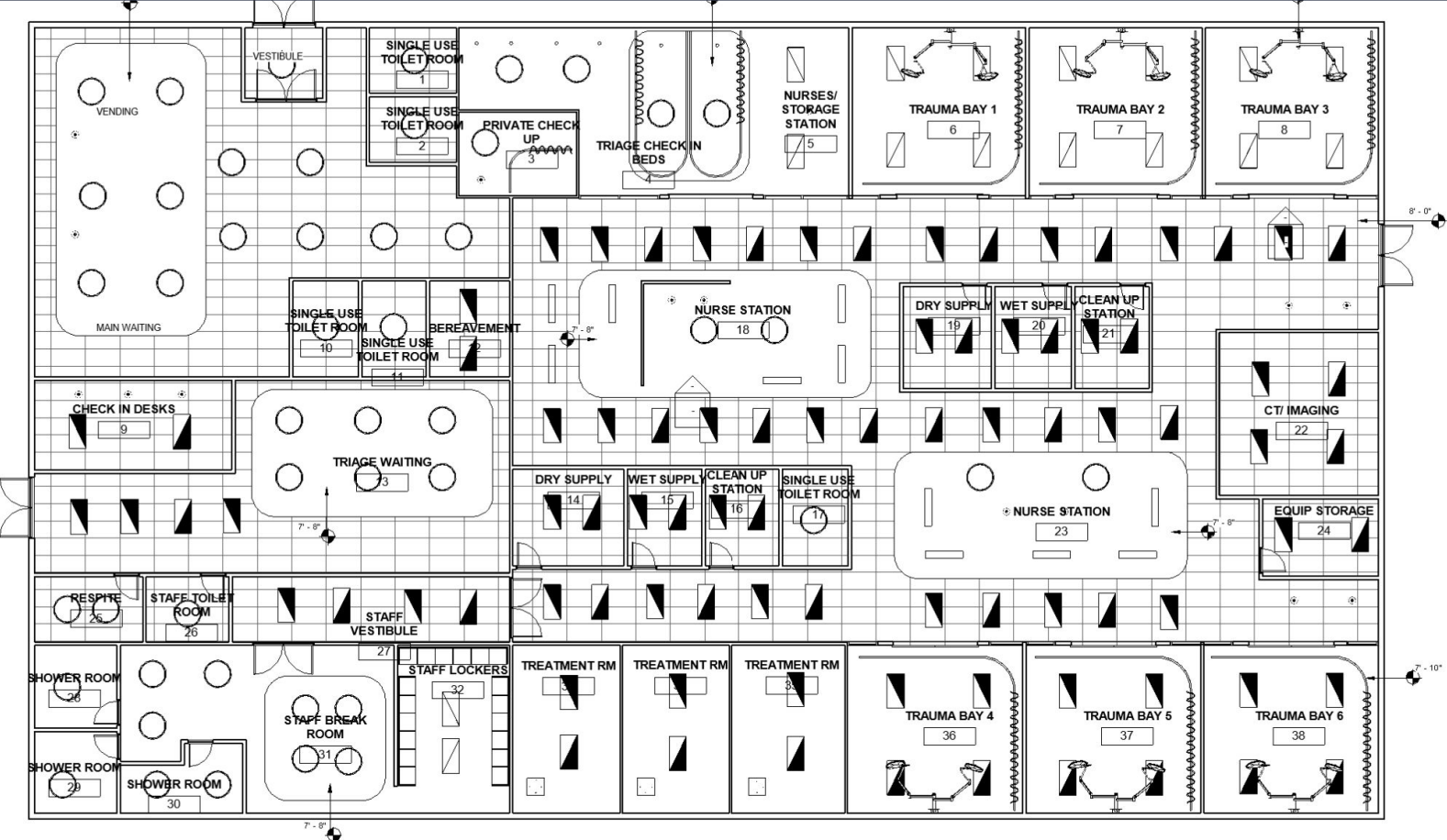


DRAWINGS

FLOOR PLAN



REFLECTED CEILING PLAN

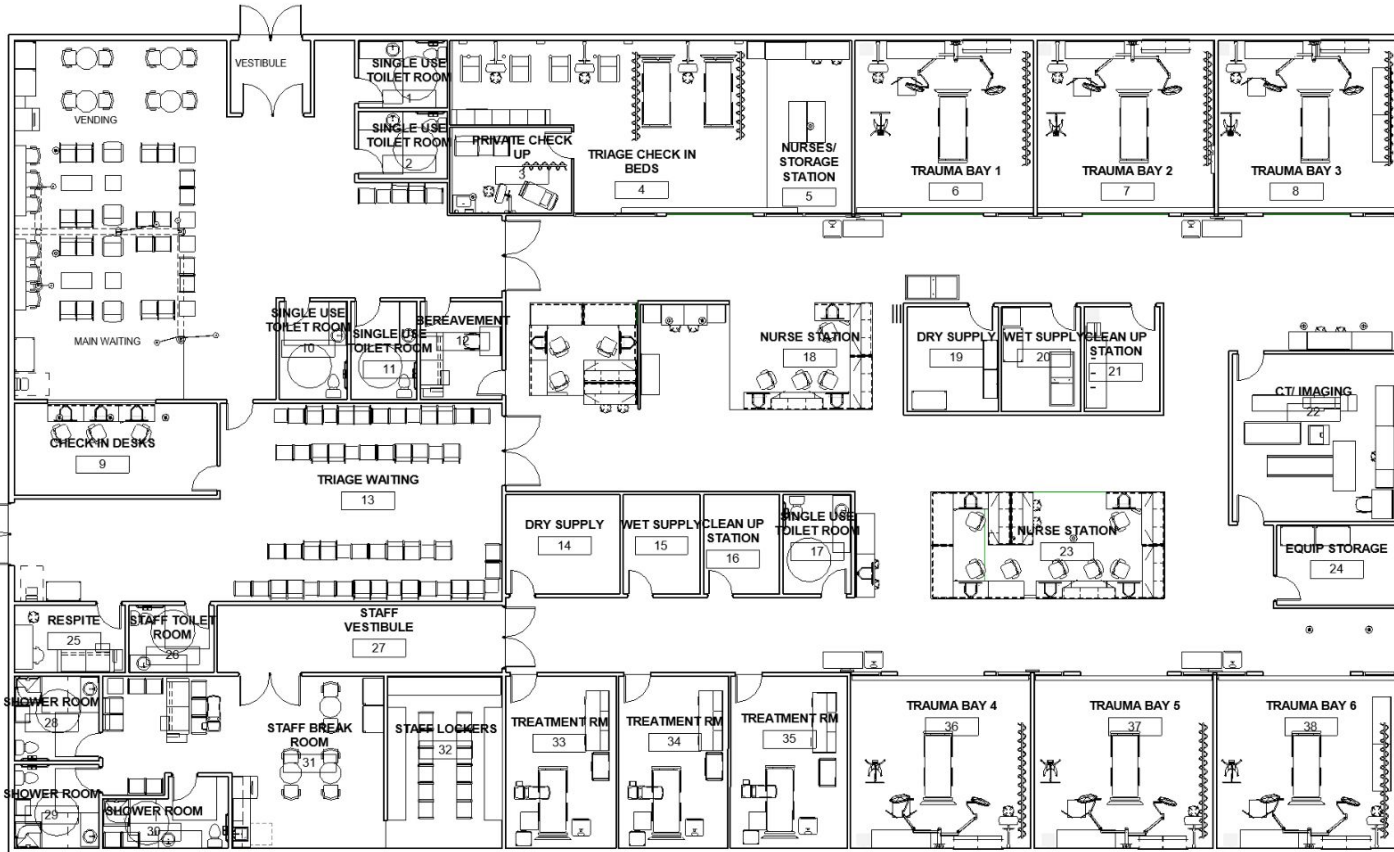


FF&E PLAN

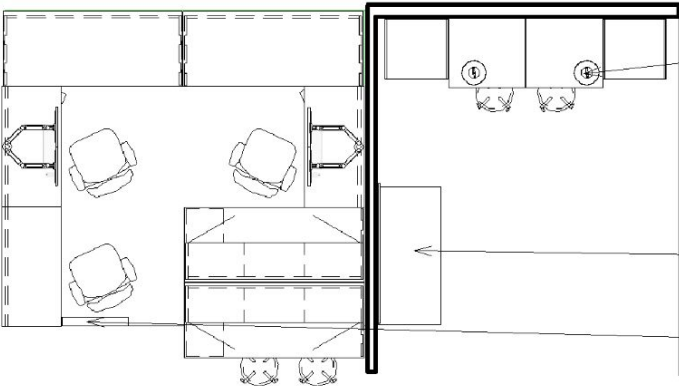
MAIN ENTRANCE

CONNECTION TO HOSPITAL

AMBULANCE ENTRANCE

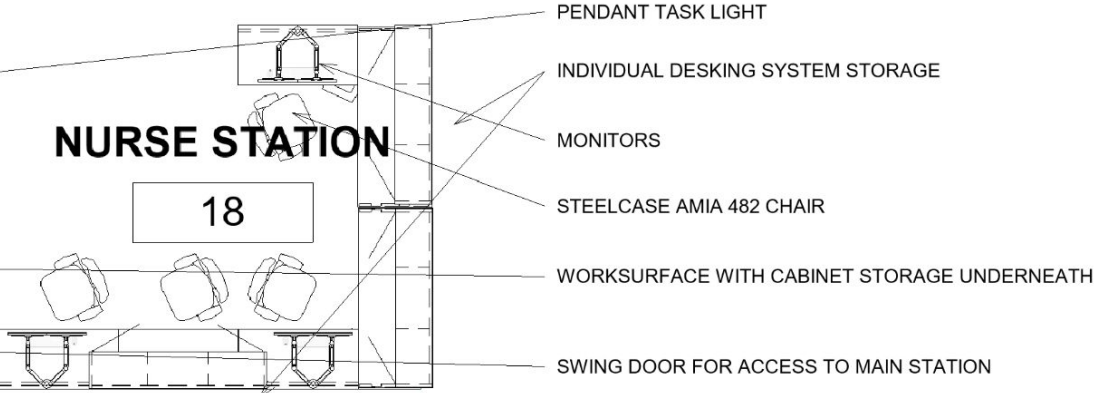


ENLARGED PLANS

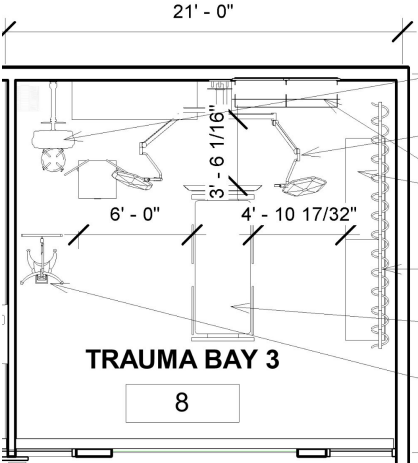


NURSE STATION

18



- PENDANT TASK LIGHT
- INDIVIDUAL DESKING SYSTEM STORAGE
- MONITORS
- STEELCASE AMIA 482 CHAIR
- WORKSURFACE WITH CABINET STORAGE UNDERNEATH
- SWING DOOR FOR ACCESS TO MAIN STATION

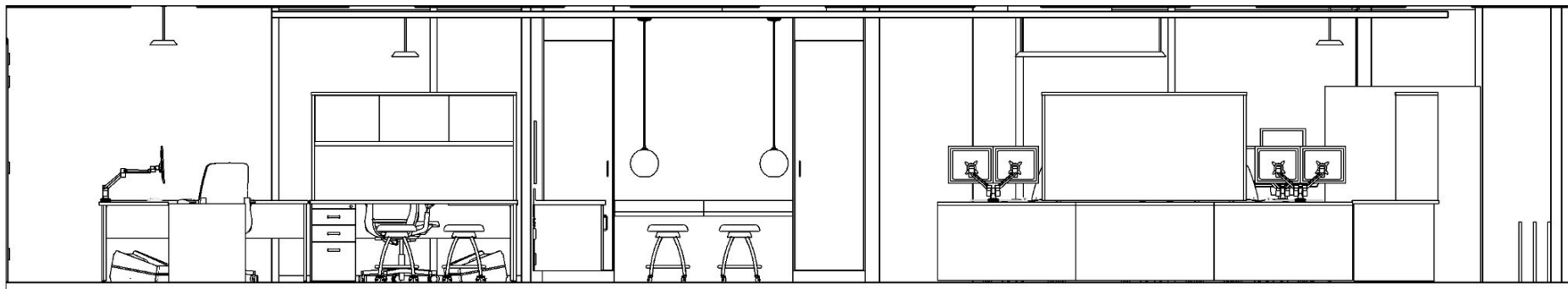


TRAUMA BAY 3

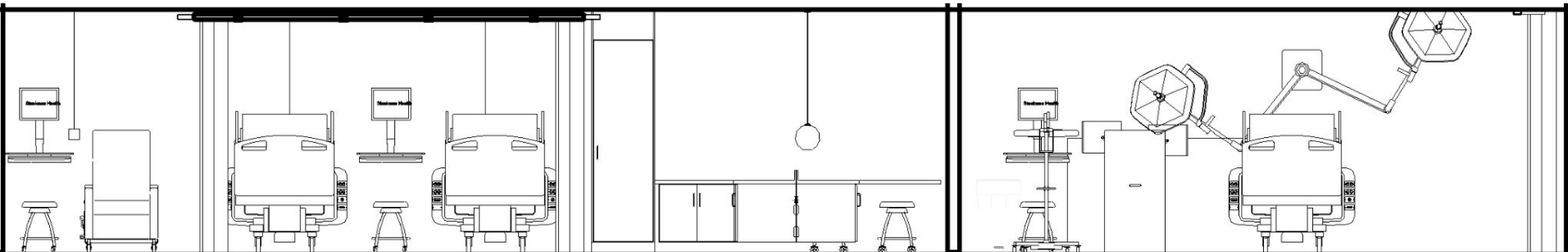
8

- NURSE MONITOR & STATION
- SURGICAL LIGHT
- SEE THROUGH STORAGE CABINETS
- PRIVACY CURTAIN
- PATIENT BED
- STEREOTACTICAL EQUIPMENT

ELEVATIONS

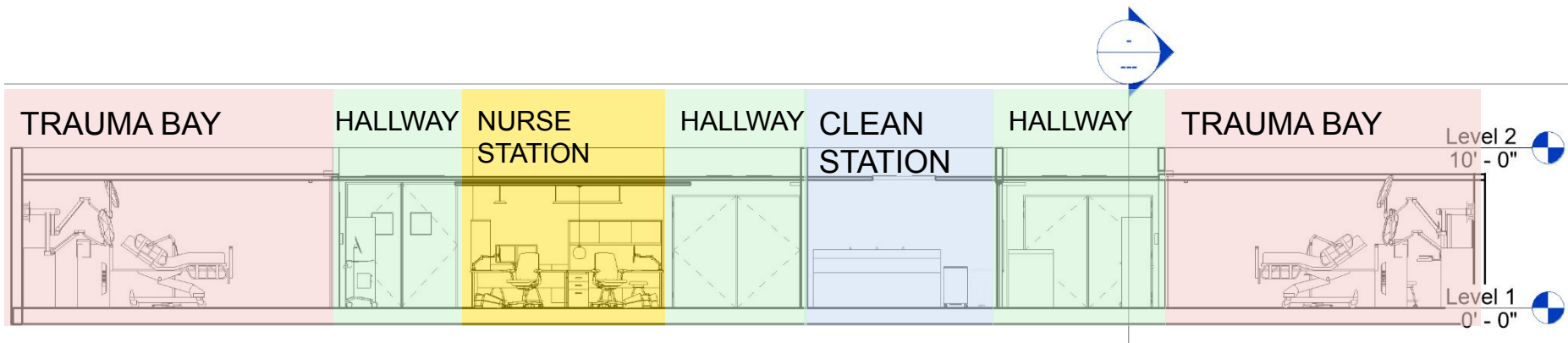


NURSES STATIONS & STORAGE

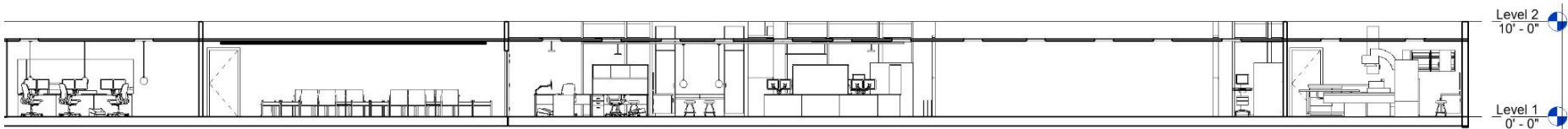


TRAUMA BAYS & TRIAGE

SECTIONS



LATITUDINAL



LONGITUDINAL

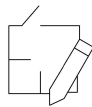


LINES OF SIGHT

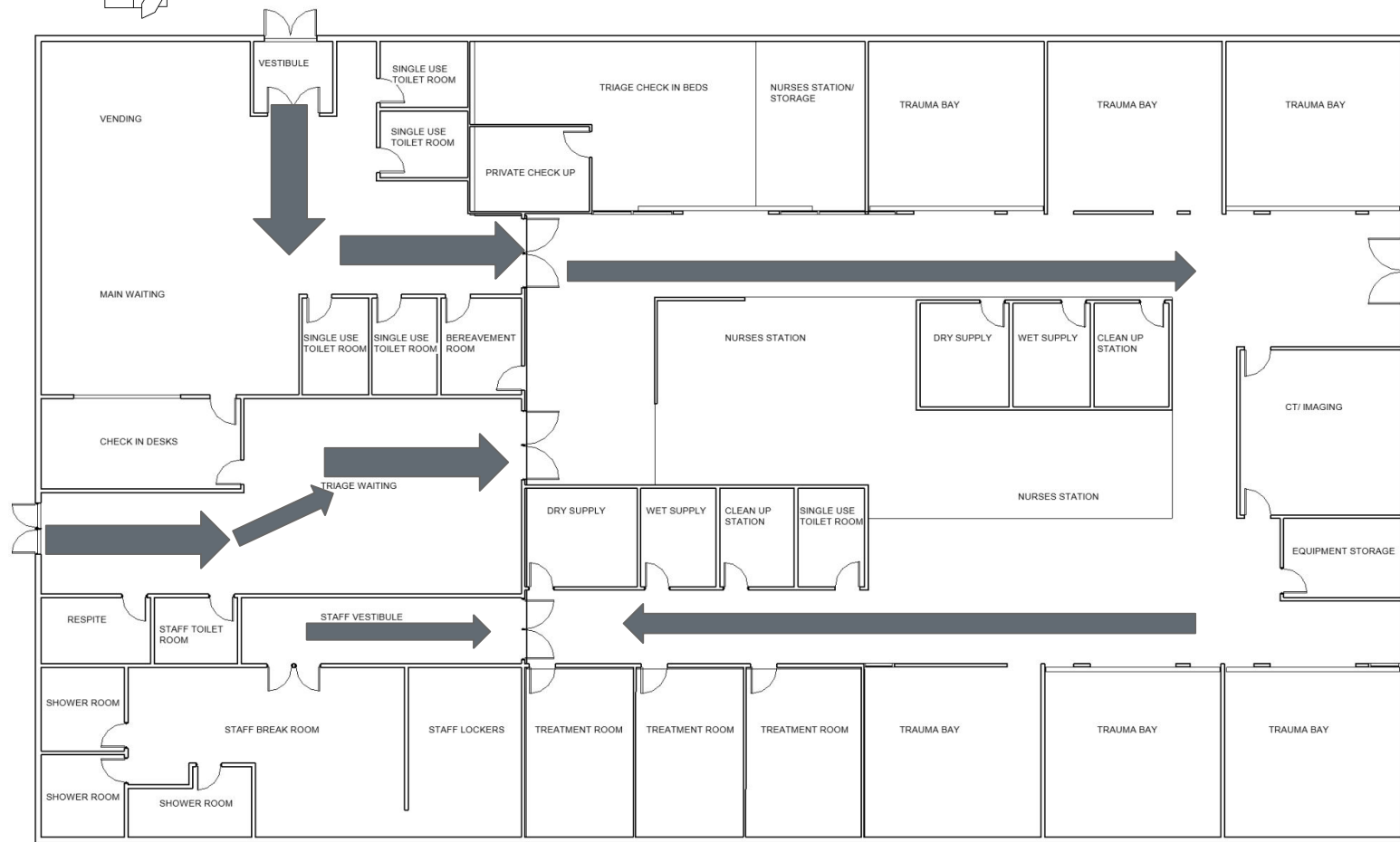


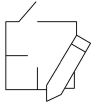
STORAGE & STATIONS



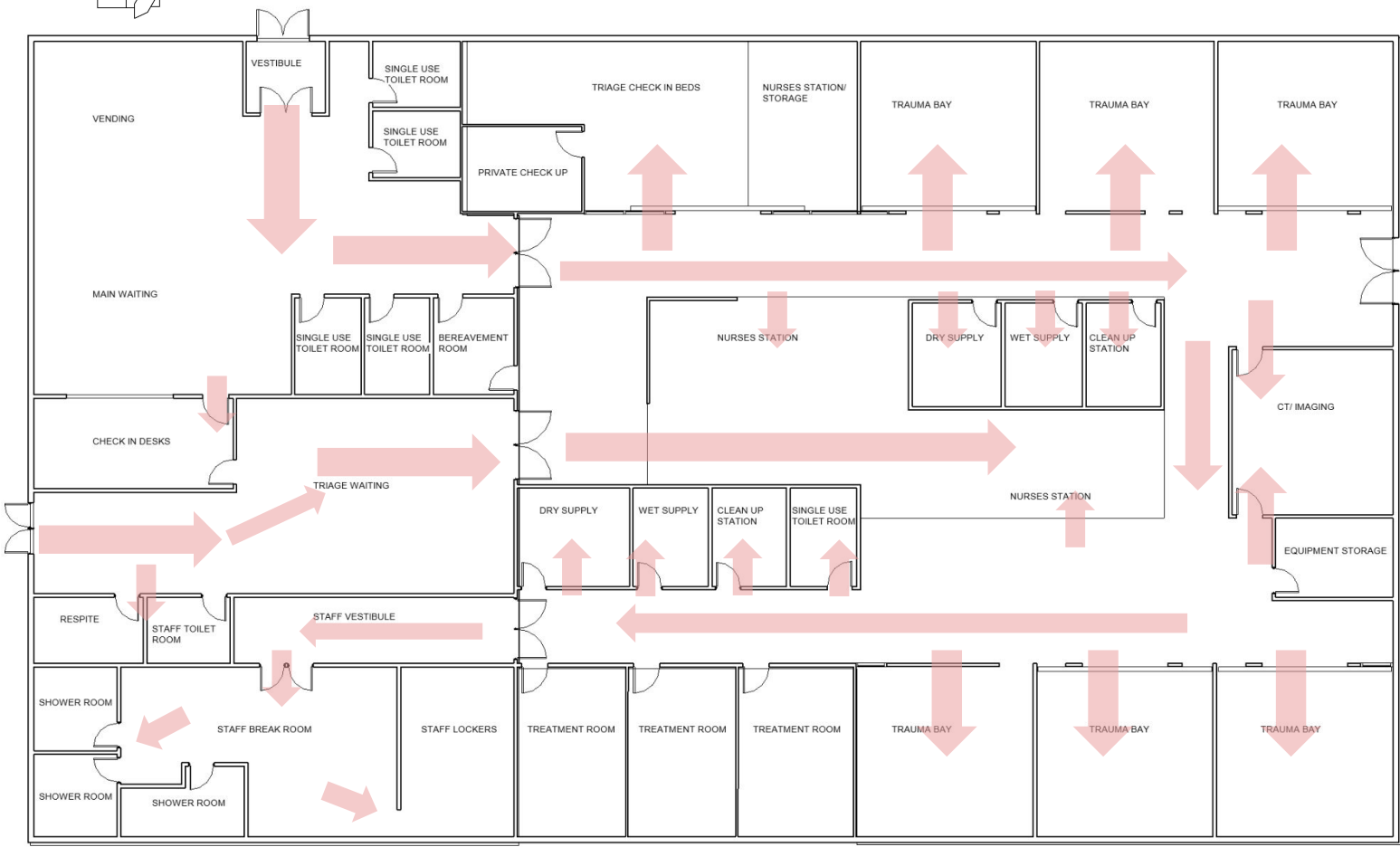


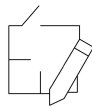
WAYFINDING & CIRCULATION



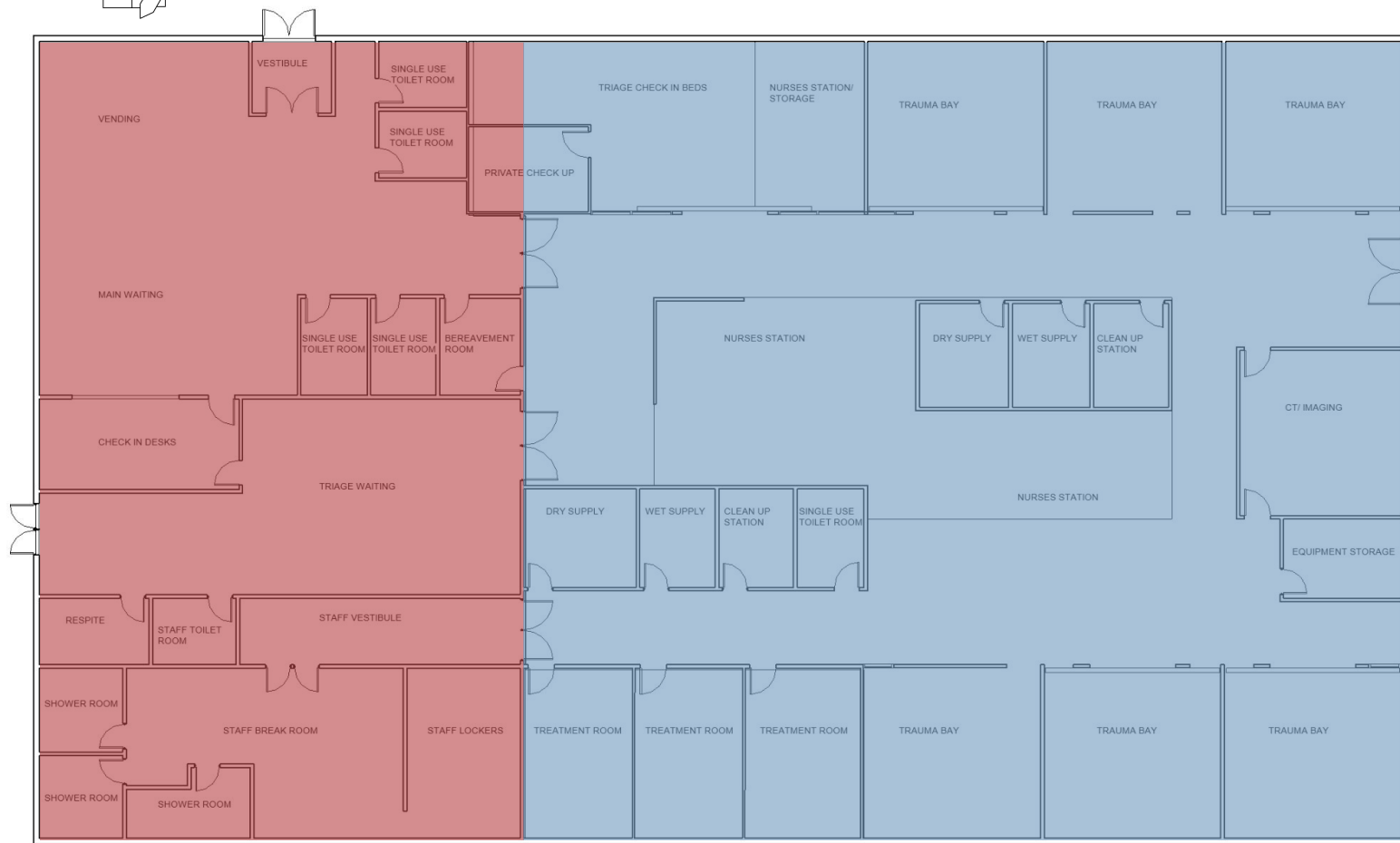


WAYFINDING & CIRCULATION










WAYFINDING & CIRCULATION



FINISH PLAN



- 
INTERFACE RUBBER FLOORING NORAMENT XP BLACK PEPPER
- 
INTERFACE RUBBER FLOORING NORAMENT XP SPIKENARD BLUE
- 
INTERFACE LVT DARK WALNUT
- 
INTERFACE LVT WALKABOUT CARBON
- 
INTERFACE LVT STEADY STRIDES CONCRETE IRON

PATIENT, PUBLIC, & STAFF AREAS



USER PROFILES

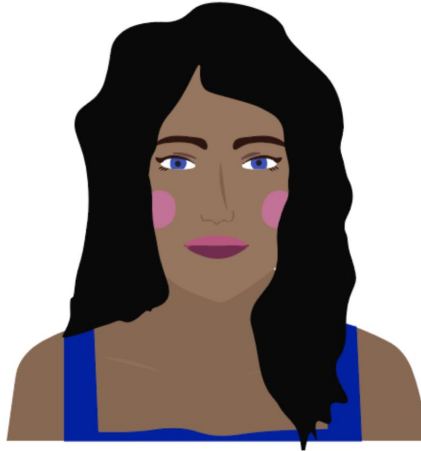
NANCY

Experiencing Environment as a(an):
Nurse

Age: 25

Needs in Emergency Department:

- first responder to receiving patients in ED, need clear system to know where to take them and if they need a CT, what is wrong, what to do
- respite room for a breather from long hours
- staff room for break, locker storage, showers, etc
- nurses stations properly stocked and organized



IAN

Experiencing Environment as a(an):
Physician

Age: 40

Needs in Emergency Department:

- easy access to equipment and supplies
- pathways cohesive to easy treatment of patient
- patient privacy for diagnosis
- proper locations for nurse stations and storage stations for easy care



SHONDA, MIRANDA, LEO, & ABBY

Experiencing Environment as a(an): Patient's Family

Age(s) and relation to Patient: Mother 80, Wife 40, Children 2, 10

Needs in Emergency Department:

- comfortable place to wait together
- quiet space for delivering news
- coffee and snacks close by
- needs for children, ada for elderly parent
- triage for cuts/bruises from crash



DARYL

Experiencing Environment as a(an): Patient

Age: 45

Needs in Emergency Department:

- medical help from accident
- light, noise, and color sensitivity
- needs immediate attention in ED and preliminary surgery



JOE

Experiencing Environment as a(an):
Environmental Services Worker

Age: 60

Needs in Emergency Department:
-easily replicable rooms with placement of
linen bins and storage equipment
-easy access to cleaning supplies and dry
and cold storage
-wide hallways for garbage bin and
cleaning cart with wheels

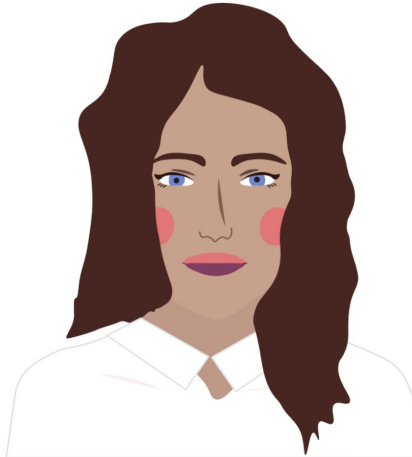


NOEL

Experiencing Environment as a(an):
EMT/ Paramedic

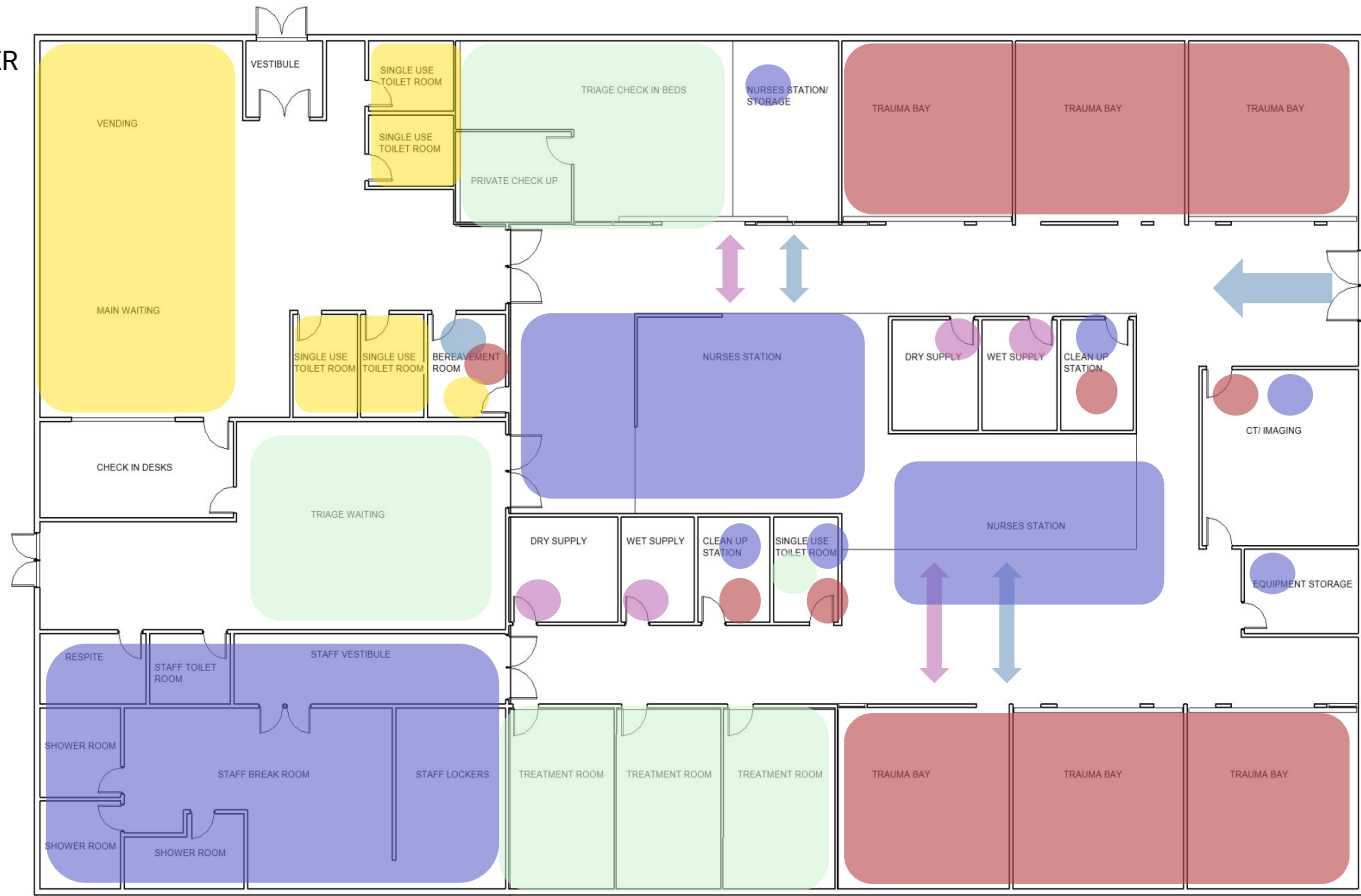
Age: 35

Needs in Emergency Department:
-wide corridors for stretcher moving
-Layout cohesive to handing patients off
-space to tell nurse what is wrong with
patient

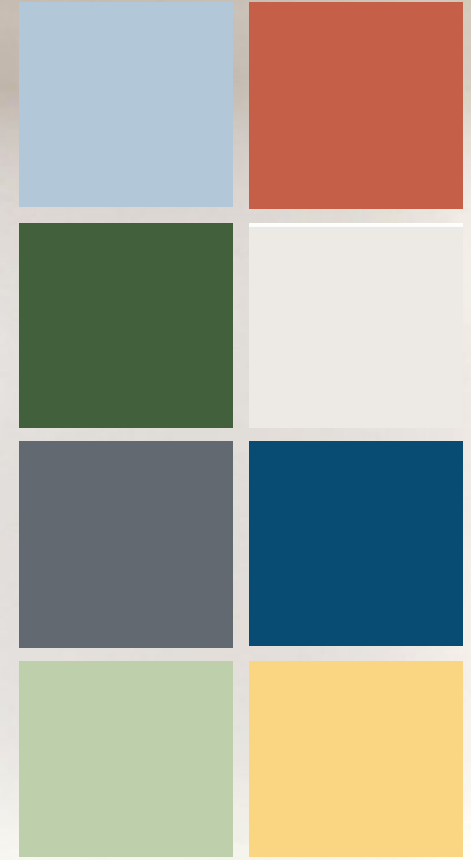
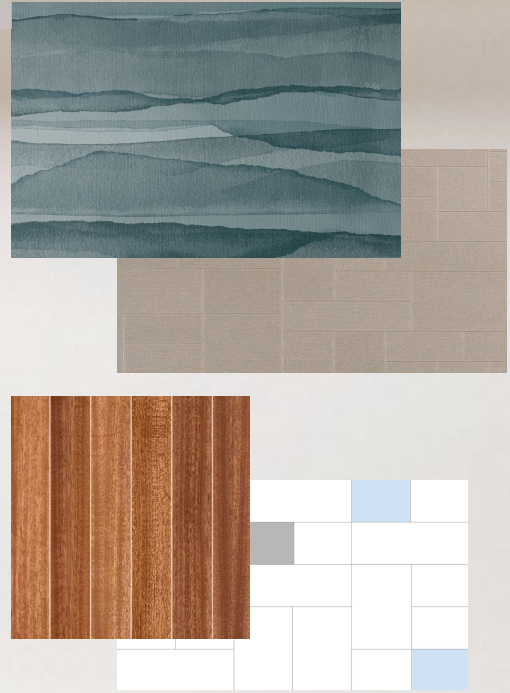


USER APPLICATIONS:

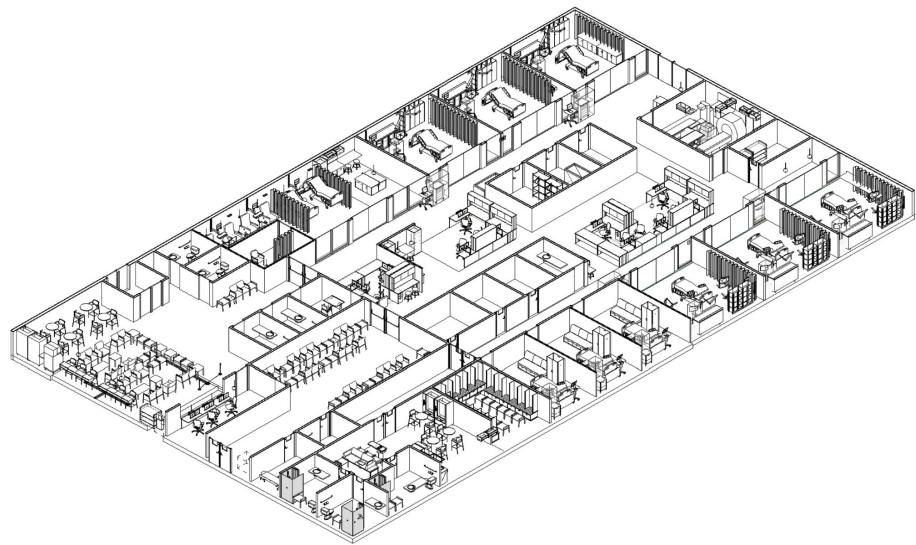
- ENV WORKER
- EMT
- PATIENT
- FAMILY
- PHYS
- NURSE



MATERIAL BOARD



RENDERS & VIDEO



Staff Solutions



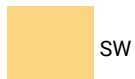
SHOWER ROOM

Lighting



Cooper

Materials



SW



Stinson



Interface

Furniture



Stance & Steelcase



STAFF BREAK ROOM

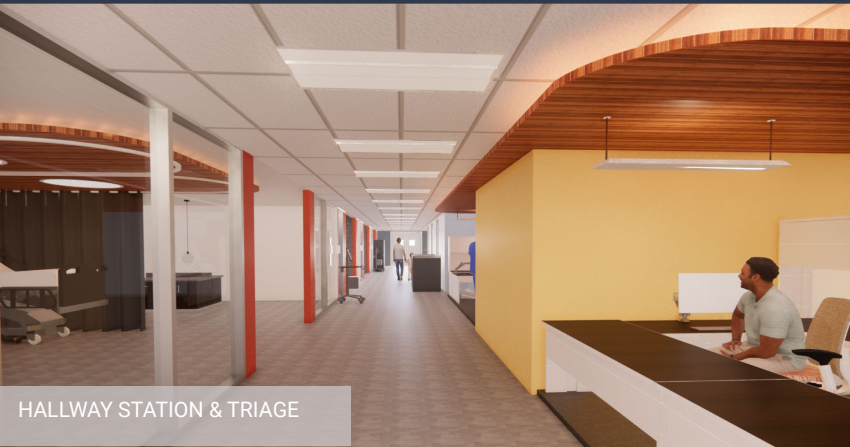


STAFF LOCKERS



RESPITE ROOM

Nurses Stations & Storage

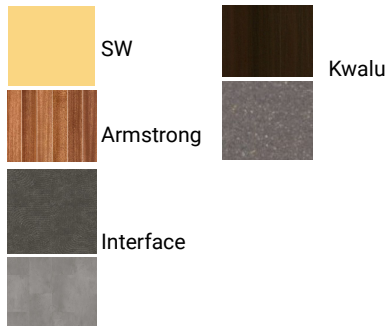


HALLWAY STATION & TRIAGE



NURSE STATION

Materials



Furniture

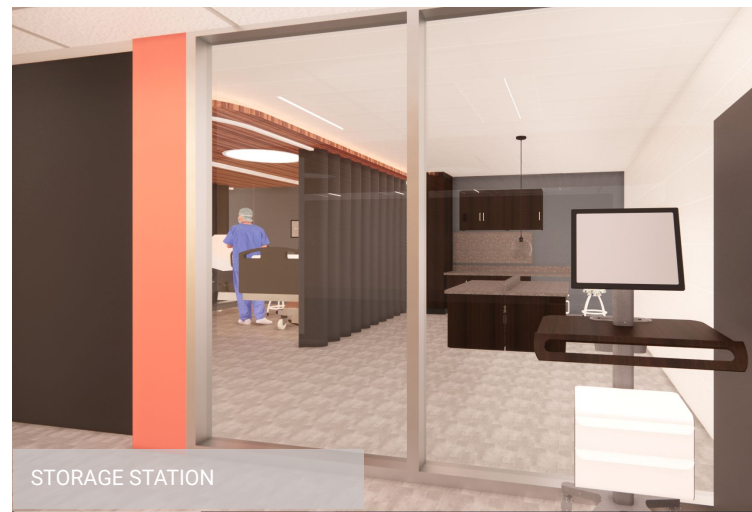


Steelcase

Lighting



Cooper



STORAGE STATION

Patient Spaces



Lighting



Cooper

Materials



Armstrong



Stinson



Interface

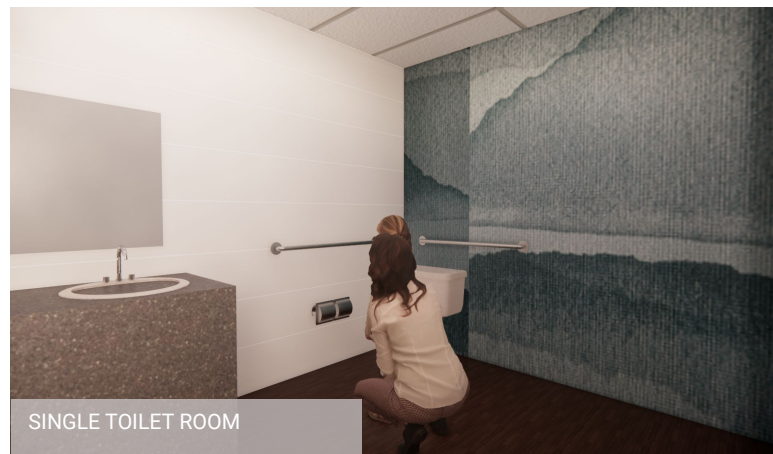


Wolfgordon

Furniture



Stance & Steelcase



Trauma Aspects

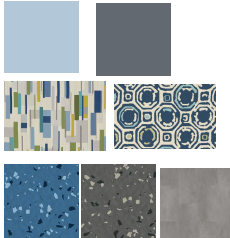


Lighting



Cooper

Materials



SW

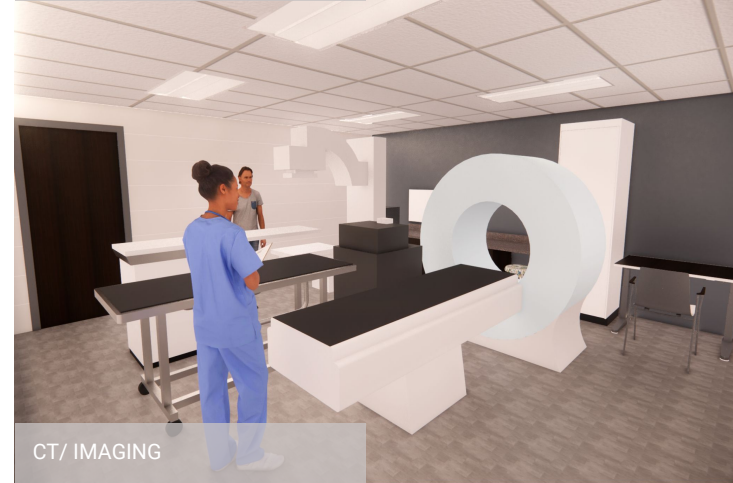
Stinson

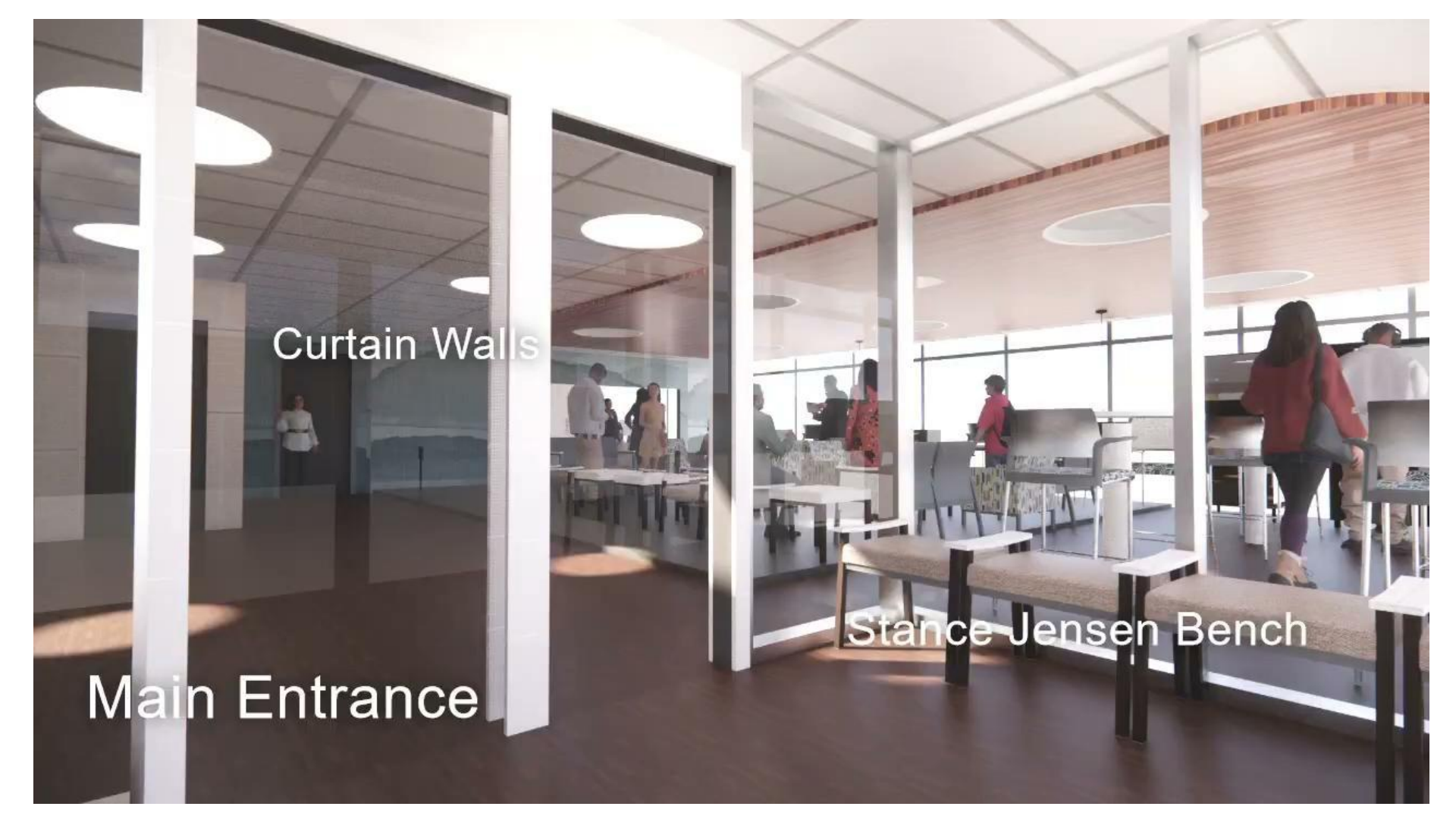
Interface

Furniture



Stance & Steelcase



An architectural rendering of a modern interior space. The scene is viewed through a series of glass walls supported by white vertical frames. The ceiling is a curved, light-colored structure with horizontal wooden slats and several circular recessed lights. The floor is a dark, polished material. In the foreground, there are several modern, light-colored chairs with dark legs. In the background, people are seen sitting at tables, and a woman in a red jacket is walking. The overall atmosphere is bright and contemporary.

Curtain Walls

Stance Jensen Bench

Main Entrance

THANK YOU

