2020 Project Delivery Course

Covid-19 Rapid Response Project Delivery

The American Institute of Architects

Project Delivery

an AIA Knowledge Community

November 17, 2020

Moderators

GRACE C. LIN, AIA, CSI-CDT

CBRE | Healthcare

2019-2020 Chair

Project Delivery Knowledge Community Advisory Group

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Hensel Phelps

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Project Delivery Knowledge Community Advisory Group

Project Delivery Case Study Webinar Series

Live Course - Are You Ready to Design & Build a Field Hospital in 10 Days?
When: Nov 10, 2020 from 2:00 PM to 3:30 PM (ET)
Community: Project Delivery

Course 1 = 1.5 LU/HSW

Live Course - Project Delivery in a Global Pandemic
When: Nov 12, 2020 from 4:00 PM to 5:30 PM (ET)
Community: Project Delivery

Course 2 = 1.5 LU/HSW

Live Course - COVID-19 Rapid Response Project Delivery
When: Nov 17, 2020 from 4:00 PM to 5:30 PM (ET)
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Course 3 = 1.5 LU/HSW

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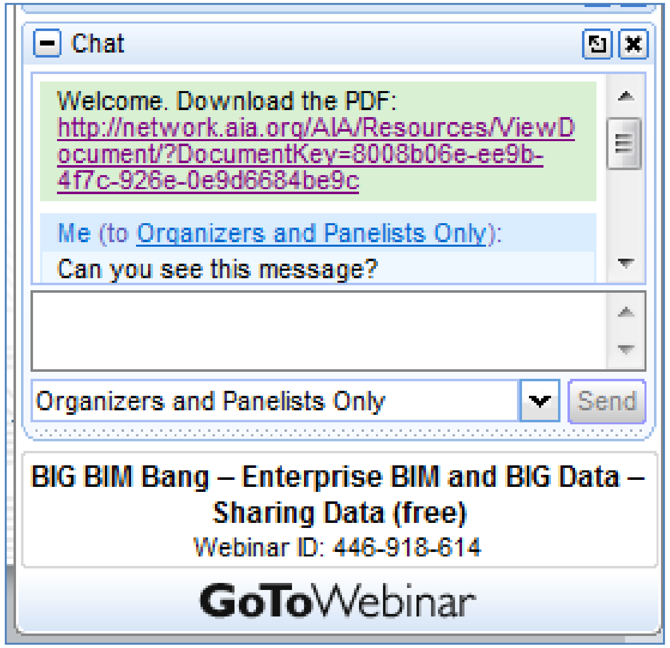

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Project Delivery in COVID-19 Era

"The COVID-19 pandemic is unprecedented. It has pressed on rapid design response and instant construction delivery to serve the community.

The AIA Project Delivery Knowledge Community (PDKC) gathered case studies from a number of architects who worked on the front lines during the public health emergency. These case studies share their stories, what they've experienced and learned in delivering essential projects during the moments of crisis. What worked, traps to avoid, how to win cooperation, and the course of actions taken to successfully deliver the projects.

These case studies highlight architects' work that will inspire and improve the visibility and awareness of project delivery in our profession. Such leadership role demonstrates the importance of project delivery and helps architects rise to the occasion."

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Project Delivery
an **AIA** Knowledge Community

Grace Lin, AIA
Chair of AIA PDKC

2020 Project Delivery Course

Covid-19 Infrastructure in Low Resource Settings

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Presenters

Gerard Georges
Director of Architecture

Build Health International

Thomas Darr
Project Architect & Site Supervisor

Build Health International

Sophie Hicks
Architectural Designer

Build Health International

Learning Objectives

1. Understand basic design principles for infection control in healthcare settings
2. Learn principles of material selection options for safe, rapid construction in low resource settings
3. Learn about international remote construction administration during a global health crisis
4. Understand the role sustainable systems play in areas with limited infrastructure; ie. water, energy

Course Description

This webinar will investigate the process of designing and implementing expanded hospital capacity in low resource settings throughout the world. While cities like Boston were able to construct massive, high quality medical facilities rapidly and with access to a variety of building materials and professionals, communities in Haiti and Uganda had to respond with the same urgency but far fewer resources. Build Health International used its experience working in these settings combined with medical expertise from Ebola and other outbreaks to design and construct Covid-19 treatment centers with all the constraints associated with building in developing nations.

Agenda

- Background
- Design Considerations
- Computational Fluid Dynamics (CFD) Analysis
- Construction Process
- Impact

Build Health International - Why we exist

BHI promotes health equity by developing high-quality health infrastructure to enable access to dignified and affordable healthcare in impoverished and resource-constrained regions of the world.

New England Baptist Hospital, Boston, MA

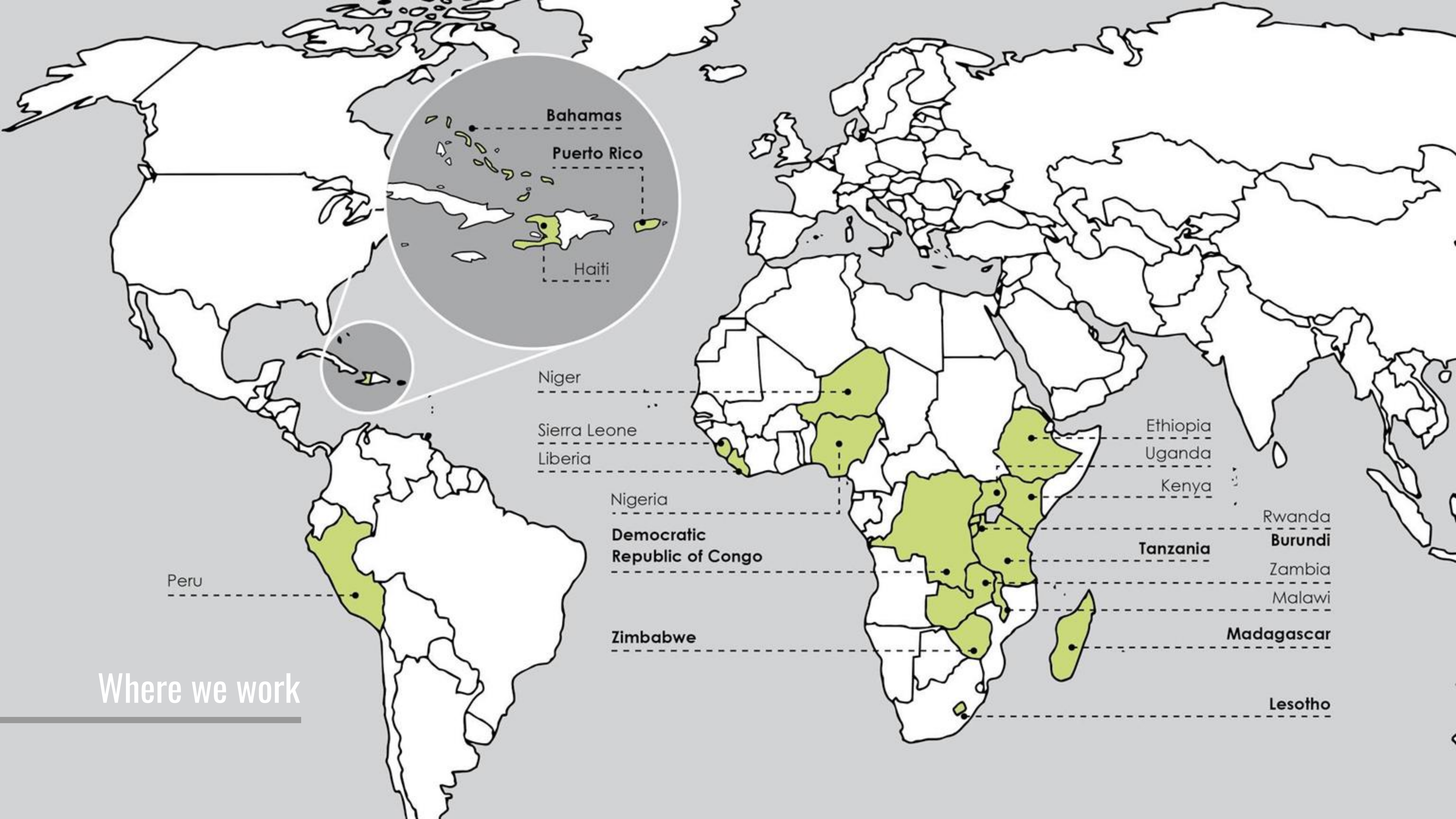
Brigham & Women's Hospital, Boston, MA

Port Loko Government Hospital, Labor & Delivery, Sierra Leone

Hospital Immaculate Conception, Haiti

The Ame
Institute
of Archit

Where we work



Building in Low Resource Settings

High Resource

- Widely available trained, licensed labor
- High quality materials readily available
- Well established medical supply chains

Low Resource

- Little access to trained labor but lots of untrained workers
- Limited access to high quality materials
- Poor or non-existent medical supply chains

Covid-19 Treatment Center Design

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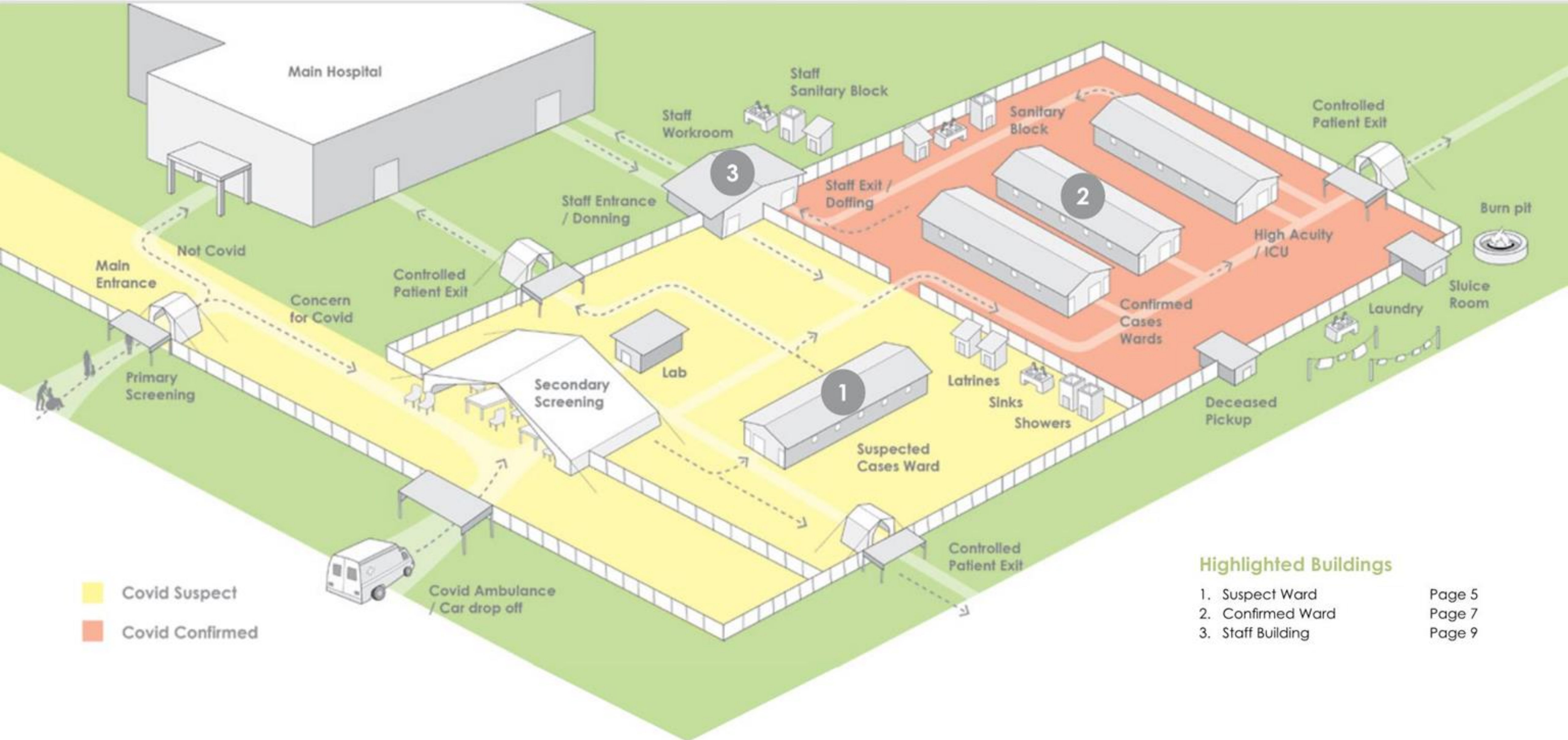
Covid-19 Treatment Center Design Considerations

- ◻ Patient & Staff Safety
- ◻ Separation of Covid-19 patients from hospital population
- ◻ Protection for doctors & staff
- ◻ Airflow & ventilation to remove contaminated air
- ◻ Flexibility of application

Treatment Center Prototype Campus Plan for Sites with Testing



Highlighted Buildings

1. Suspect Ward — Page 5
2. Confirmed Ward — Page 7
3. Staff Building — Page 9

Staff Building

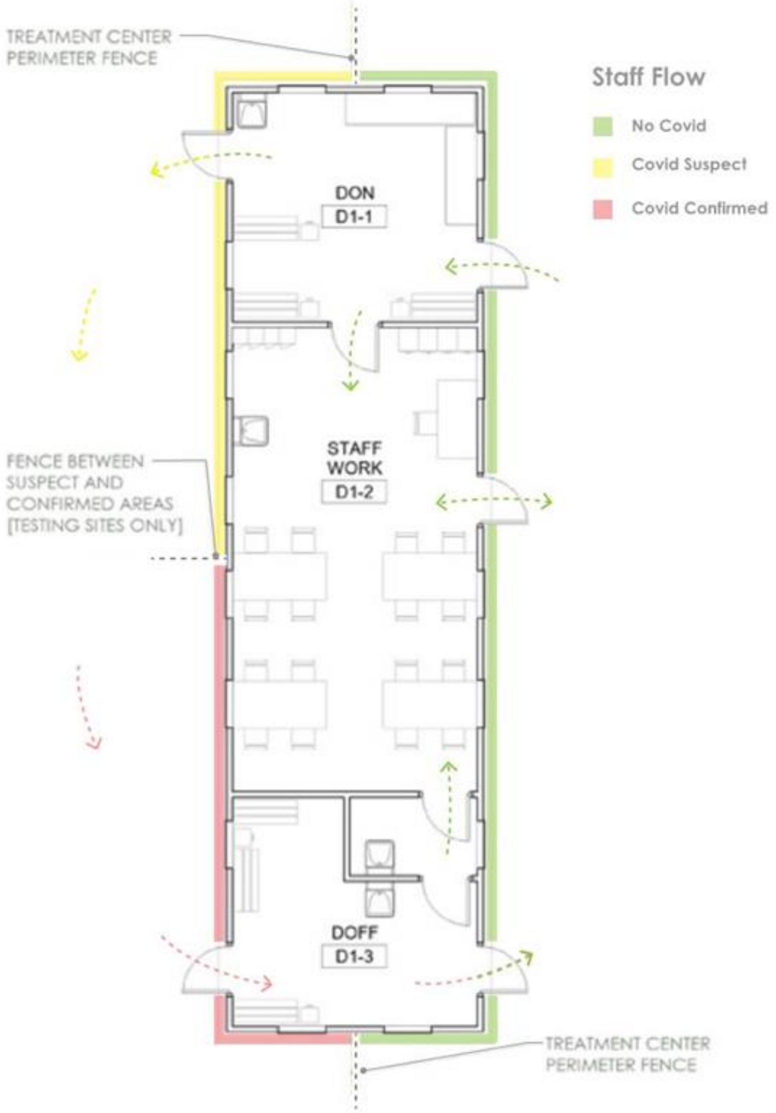
The staff building is designed as an integrated workroom, with don and doff spaces. This model should be used for sites with multiple COVID-19 wards within a Coronavirus Treatment Center. See full construction drawings an alternative ward design with in-ward donning and doffing areas.

In order to facilitate unidirectional flow of staff and materials, the staff building should be constructed on the outer fence line, such that the donning entrance and the doffing exit should face the outside of the treatment center site.

A staff sanitary block (including shower, toilet, and sink) should be constructed or made available near the staff building, but outside the treatment center.

D1 AXON

SCALE



D1 - LAYOUT

SCALE 1 : 100

Construction Document Set

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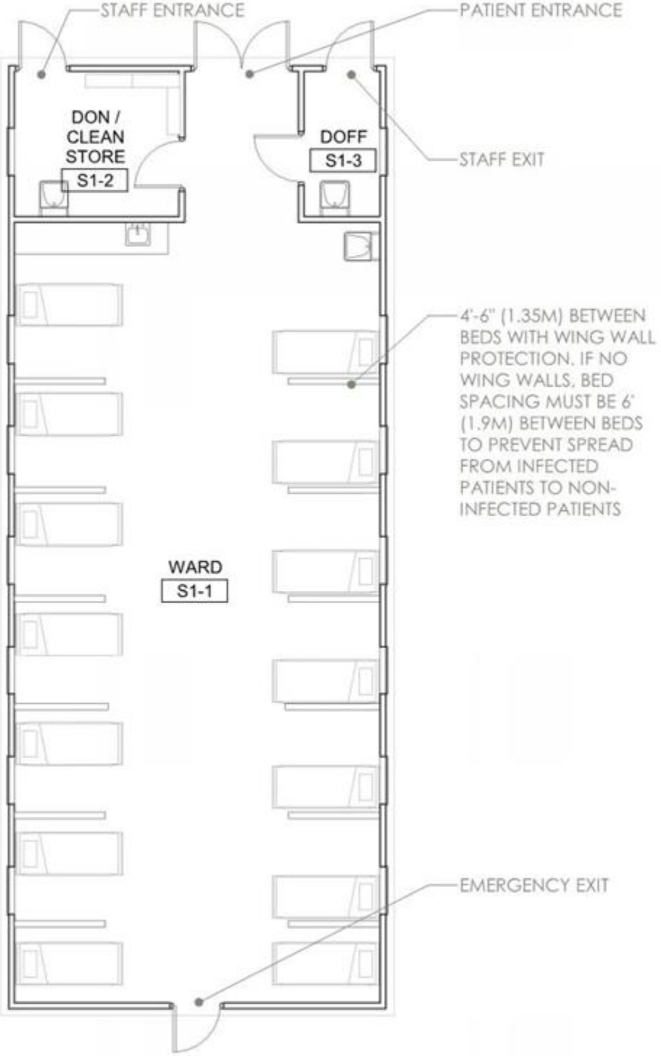


1 S1 - LAYOUT

SCALE 1 : 100

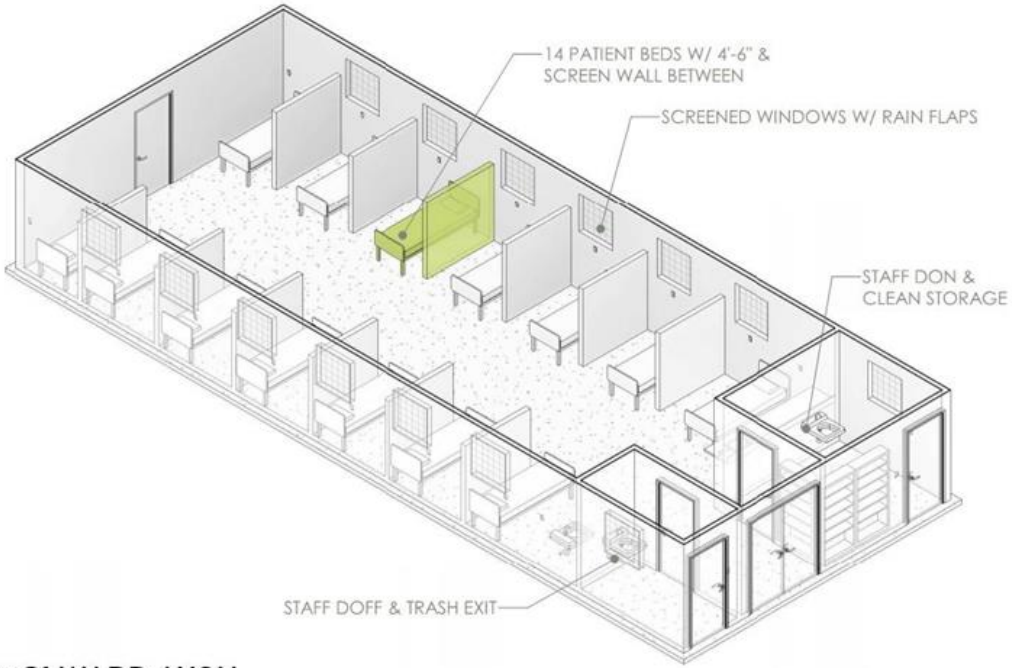
SUSPECT WARD 1 DESCRIPTION

SUSPECT WARDS SHOULD BE USED FOR THE FOLLOWING PATIENTS:

- PATIENTS WHO HAVE BEEN CLINICALLY DIAGNOSED AS COVID POSITIVE
- PATIENTS WHO HAVE BEEN TESTED AND ARE AWAITING RESULTS

SUSPECT WARDS ARE DISTINGUISHED BY WIDER BED SPACING AND DIVIDER PANELS BETWEEN BEDS TO PROTECT PATIENTS WHO MAY NOT HAVE COVID FROM NOSOCOMIAL SPREAD.

SUSPECT WARD 1 INCLUDES STAFF DON & DOFF ROOMS. THIS IS RECOMMENDED ONLY IN AREAS WHERE ONE OR TWO WARDS ARE CONSTRUCTED. FOR FACILITIES IN WHICH MORE THAN TWO WARDS ARE CONSTRUCTED, REFER TO SUSPECT WARD 2, WHICH IS DESIGNED TO BE ACCOMPANIED BY CENTRAL DON & DOFF SPACES.



2 S1 WARD AXON

SCALE

Build Health International

For additional information, please go to www.buildhealthinternational.org

S1-01

WARD S1 OVERVIEW

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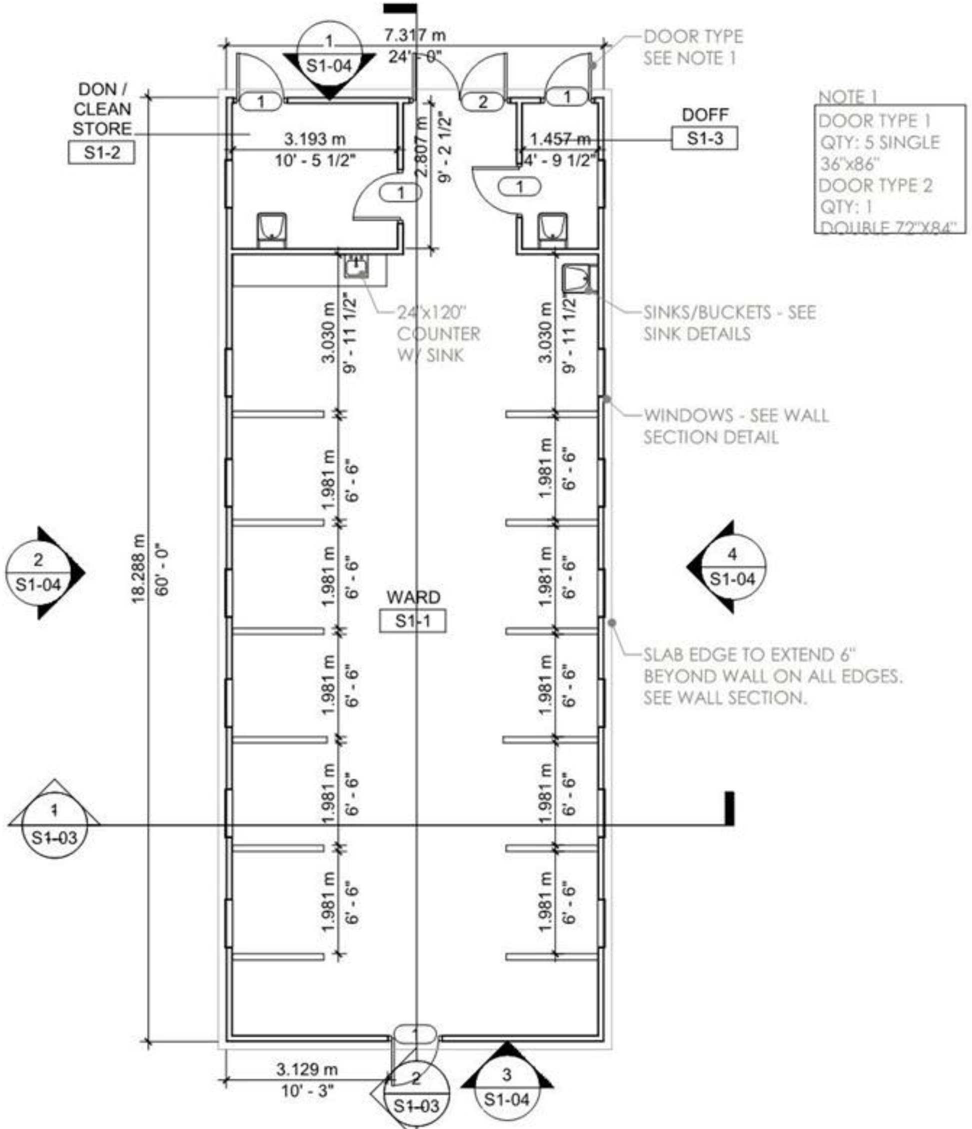
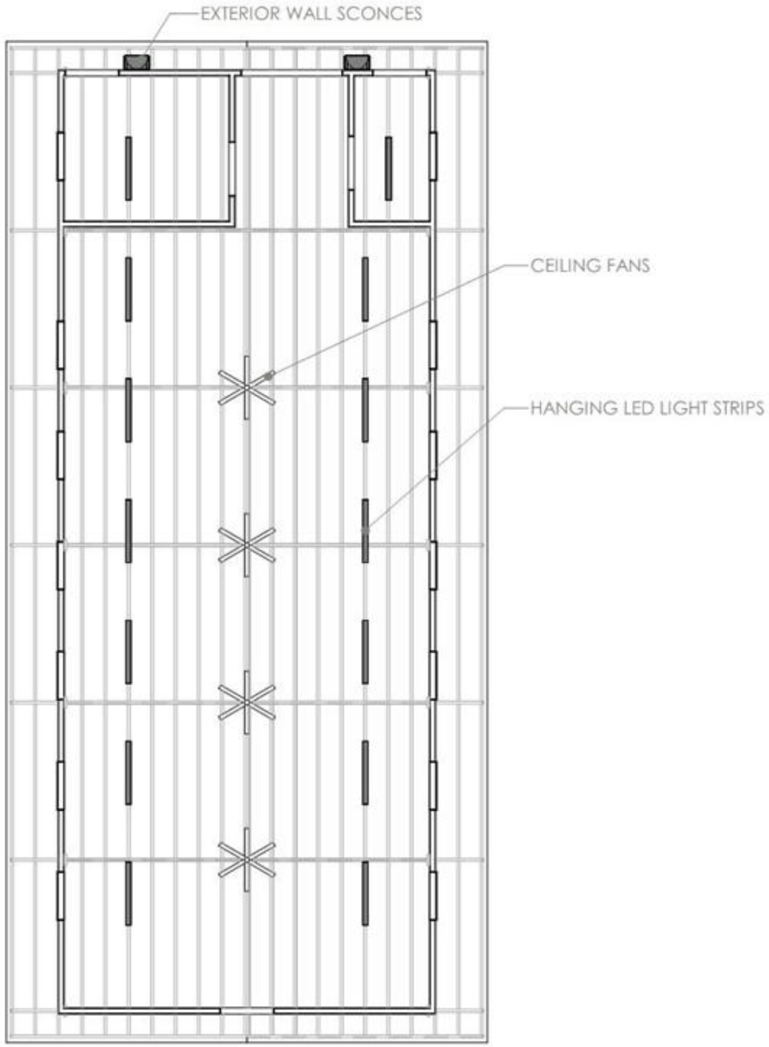


1 S1 - CONSTRUCTION PLAN

SCALE 1 : 100



2 S1 WARD CEILING PLAN

SCALE 1 : 100

Build Health International

For additional information, please go to www.buildhealthinternational.org

S1-02

WARD S1 CONSTRUCTION PLANS

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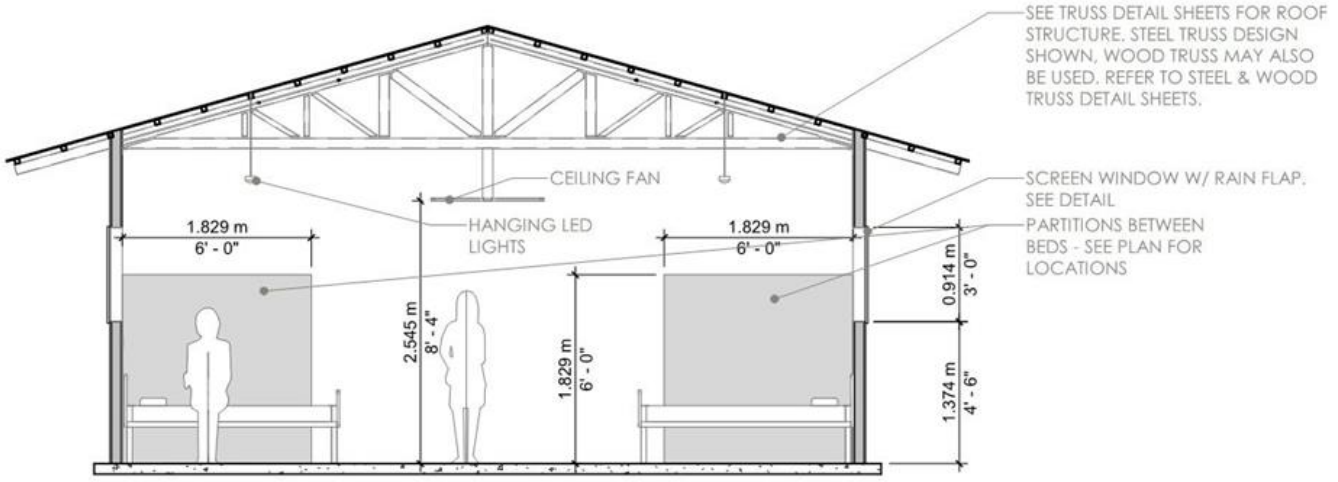
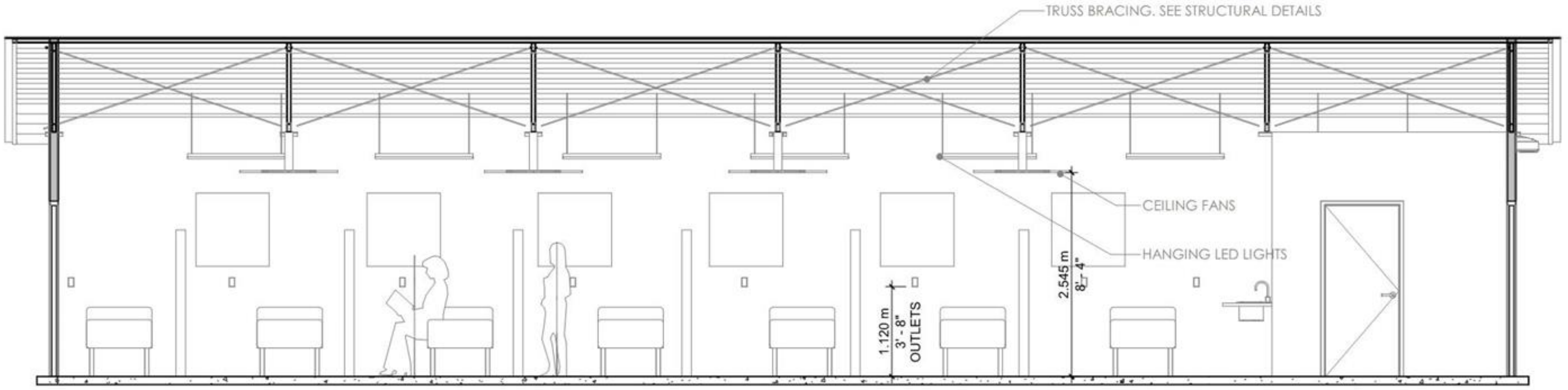


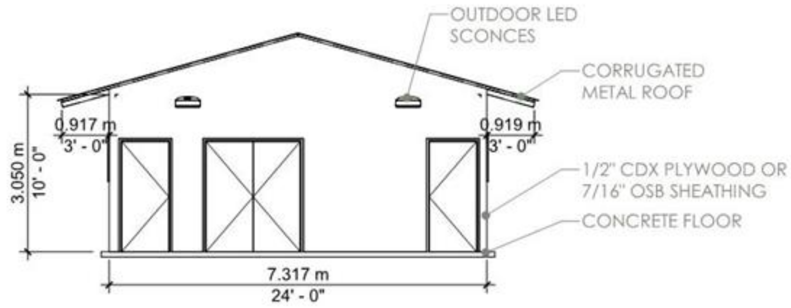
1 S1 SHORT SECTION

SCALE 1 : 50



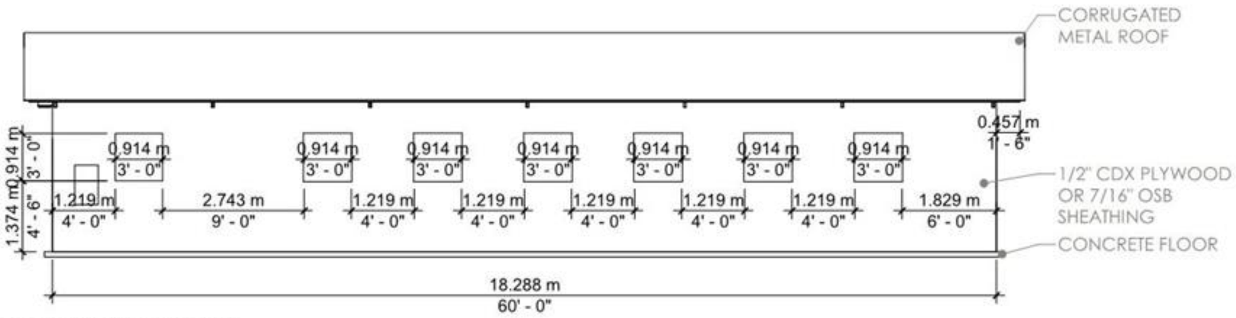
2 S1 LONG SECTION

SCALE 1 : 50



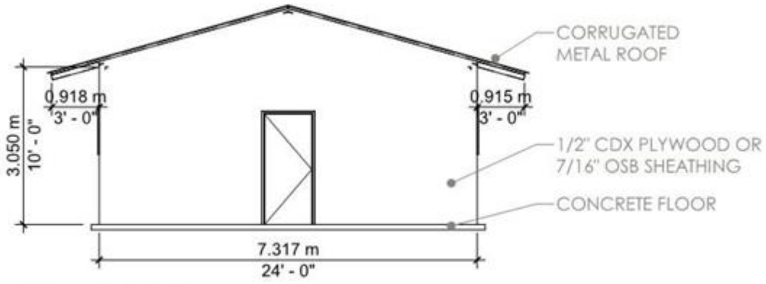
1 S1 WARD NORTH

SCALE 1 : 100



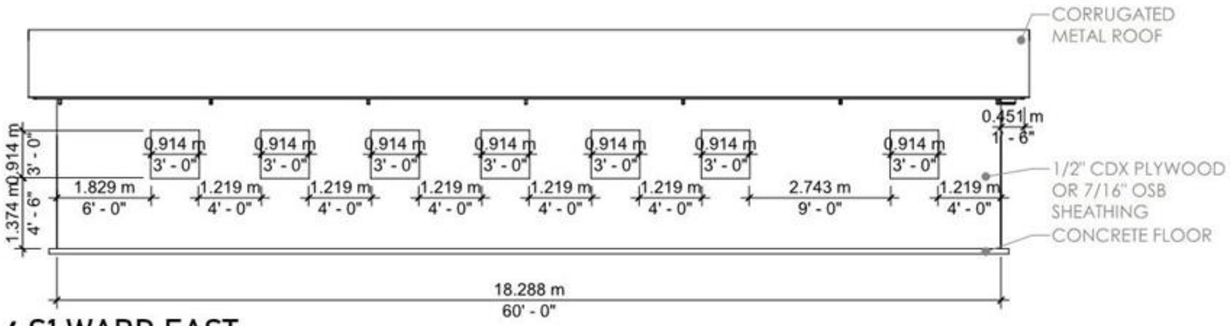
2 S1 WARD WEST

SCALE 1 : 100



3 S1 WARD SOUTH

SCALE 1 : 100



4 S1 WARD EAST

SCALE 1 : 100

Build Health International

For additional information, please go to www.buildhealthinternational.org

S1-04

WARD S1 ELEVATIONS

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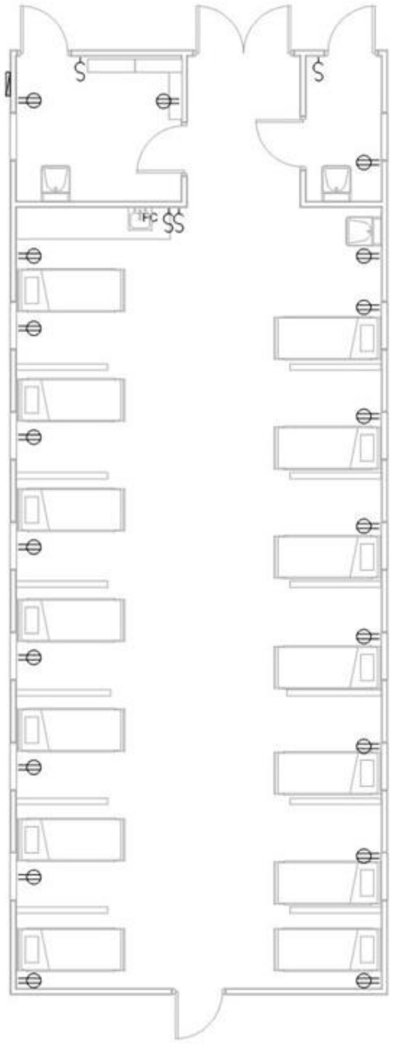
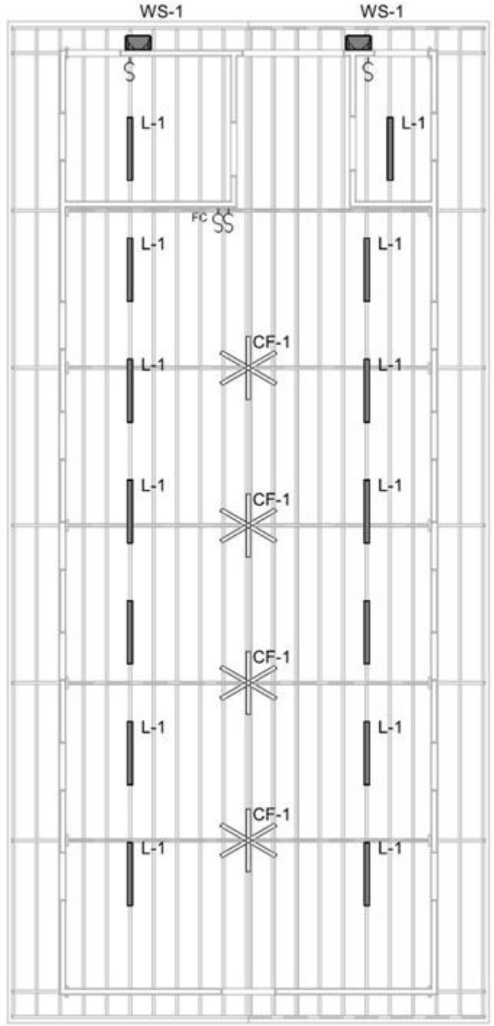


1 S1 - POWER PLAN

SCALE 1 : 100

	RECEPTACLE MOUNTED 1.12M AFF
$	LIGHT SWITCH MOUNTED 1.12M AFF
$ FC	FAN CONTROL MOUNTED 1.12M AFF
L-1	HANGING LED LIGHT
CF-1	VARIABLE SPEED CEILING FAN
WS-1	LED WEATHERPROOF WALL SCONCE

ELECTRICAL LEGEND



2 S1 LIGHTING PLAN

SCALE 1 : 100

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S1-05

WARD S1 ELECTRICAL DRAWINGS

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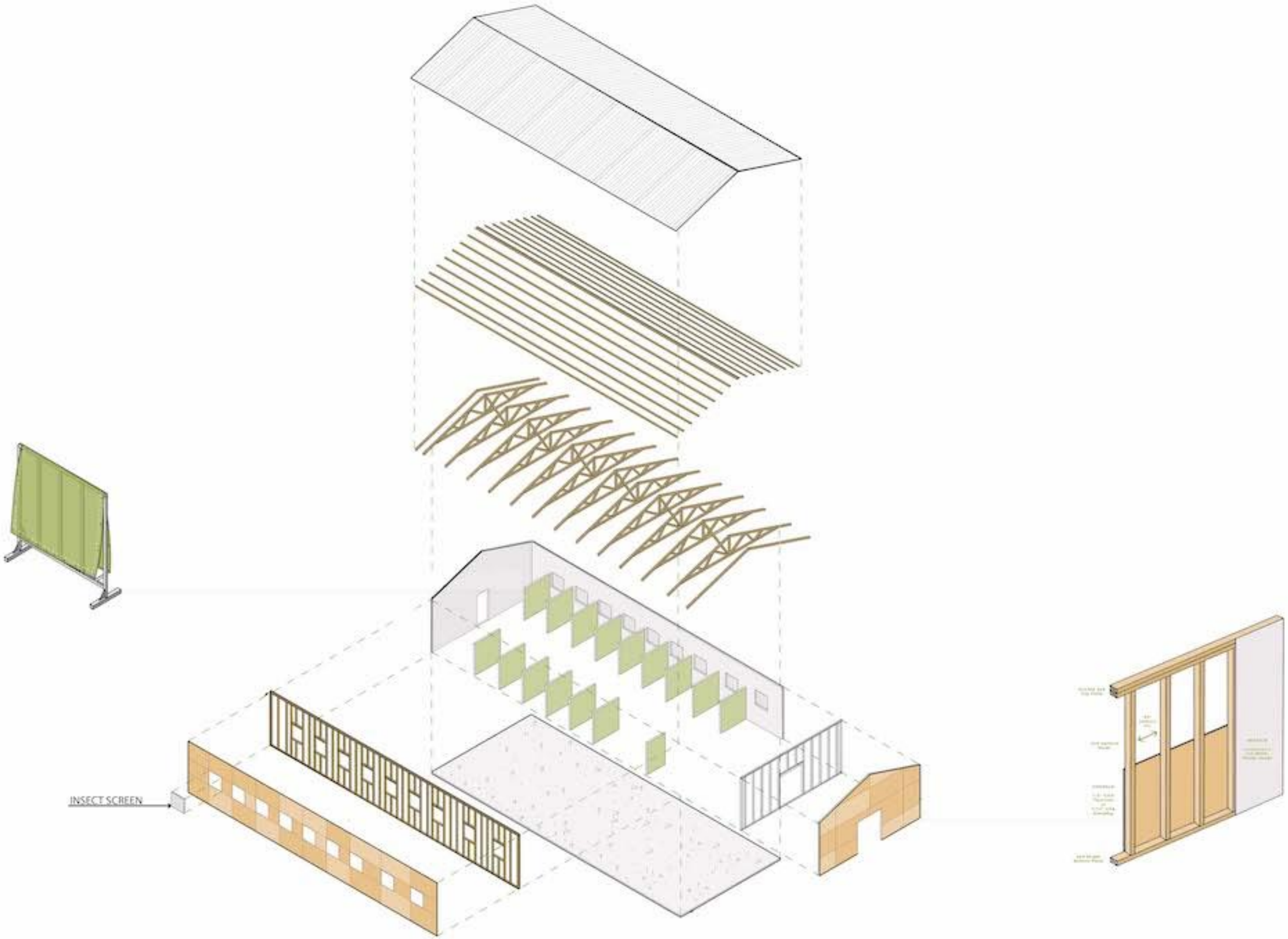

INSECT SCREEN

Ventilation & CFD Analysis

Natural Ventilation

Goal for 12 ACH but very little access to mechanical systems

Windows and interior fans provide natural ventilation

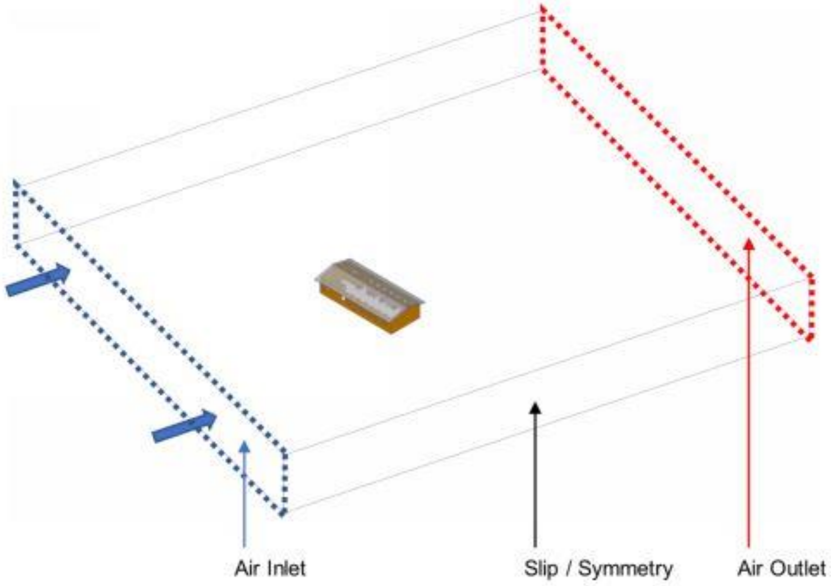
Dividers between beds help reduce airflow between patients

Computational Fluid Dynamics analysis was used to confirm airflow predictions

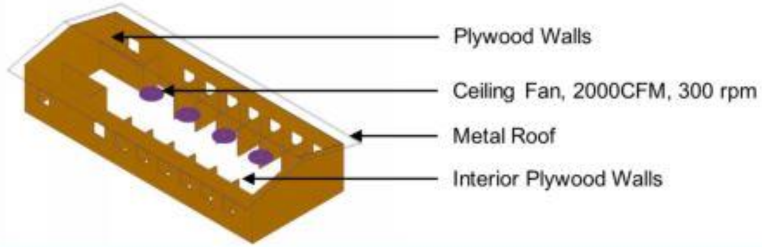
Natural Ventilation

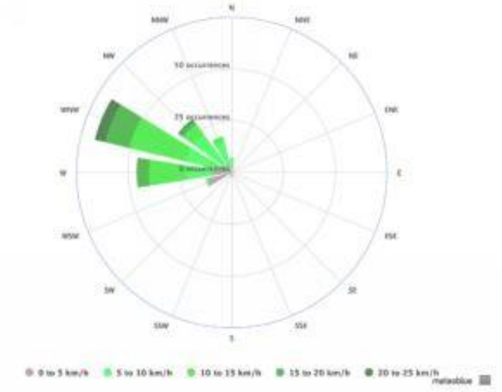
AIR CHANGES – CFD MODEL SETUP

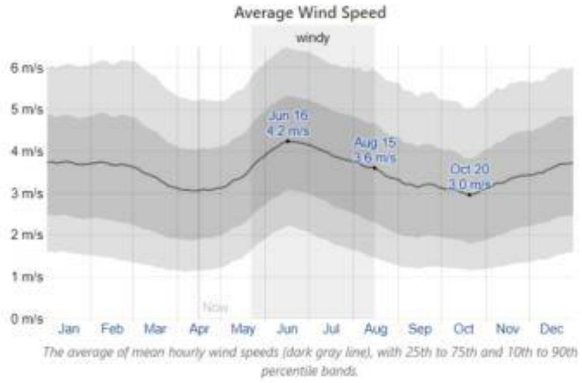
Setup of CFD model to study passive ventilation at St. Boniface test site in Fond des Blancs, Haiti.



Material Model







Local Wind Direction and Magnitude - Fond des Blancs, Haiti

Solver: Autodesk CFD

Turbulence Model: k-epsilon

Turbulent/Laminar: Turbulent

Turb/Lam Ratio: 100

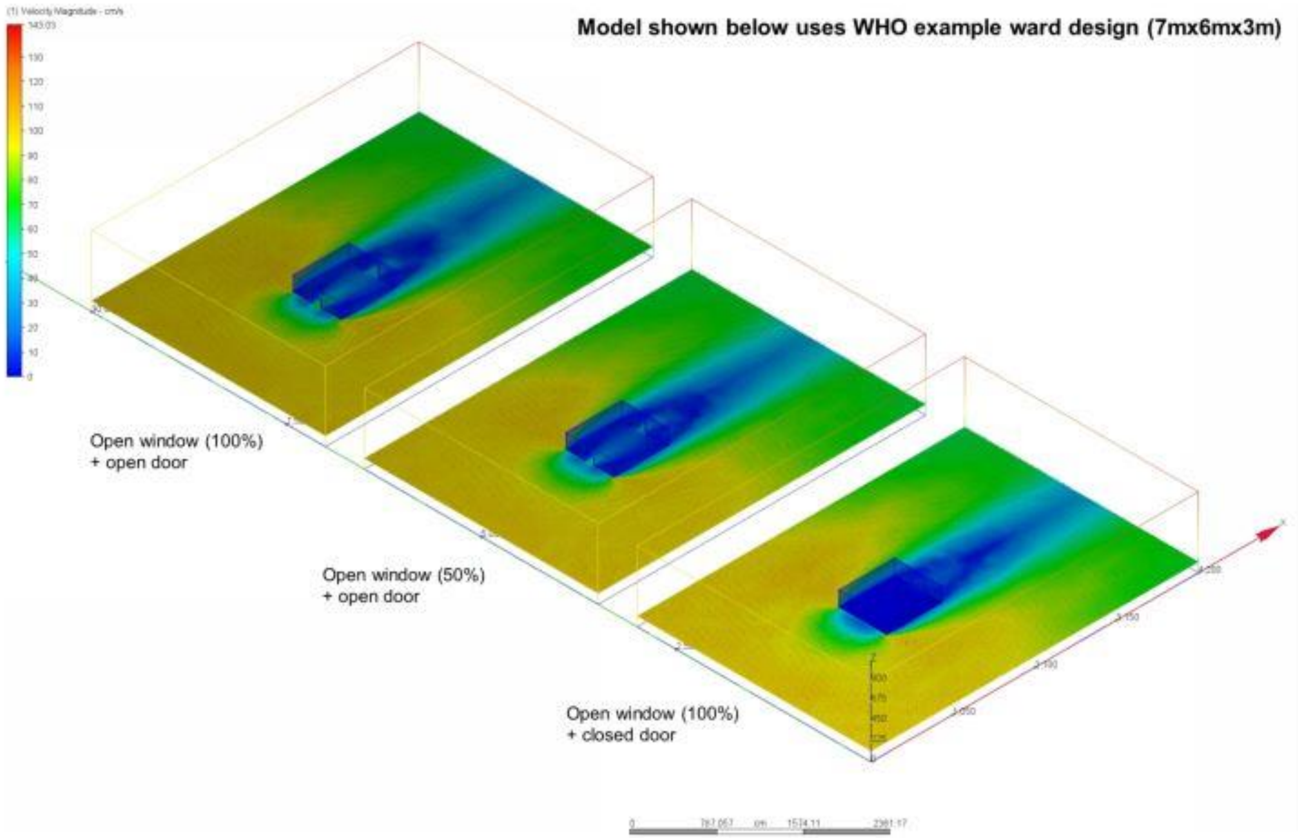
Compressibility: Incompressible

Gravity: 0,0,-1

Natural Ventilation

AIR CHANGES – VALIDATION

We validated our air changes per hour metric by comparing results from the Autodesk CFD simulation model to ACH figures found in the example ward design of the referenced WHO document.



Natural Ventilation for Infection Control in Health-Care Settings

Editors: James Atkinson, Yves Chartier, Carmen Lúcia Pessoa-Silva, Paul Jensen, Yuguo Li, and Wing-Hong Seto.

Geneva: World Health Organization; 2009.
ISBN-13: 978-92-4-154785-7

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Search this book

Overview

Adequate ventilation can reduce the transmission of infection in health-care settings. Natural ventilation can be one of the effective environmental measures to reduce the risk of spread of infections in health care.

This guideline first defines ventilation and then natural ventilation. It explores the design requirements for natural ventilation in the context of infection control, describing the basic principles of design, construction, operation and maintenance for an effective natural ventilation system to control infection in health-care settings.

Table 4.1 provides estimates of the ACH and ventilation rate due to wind alone, at a wind speed of 1 m/s, assuming a ward of size 7 m (length) × 6 m (width) × 3 m (height), with a window of 1.5 × 2 m^2 and a door of 1 m^2 × 2 m^2 (smallest opening).

$$\text{ACH} = \frac{0.65 \times \text{wind speed (m/s)} \times \text{smallest opening area } (\text{m}^2) \times 3600\text{s/h}}{\text{room volume } (\text{m}^3)}$$

https://www.ncbi.nlm.nih.gov/books/NBK143284/

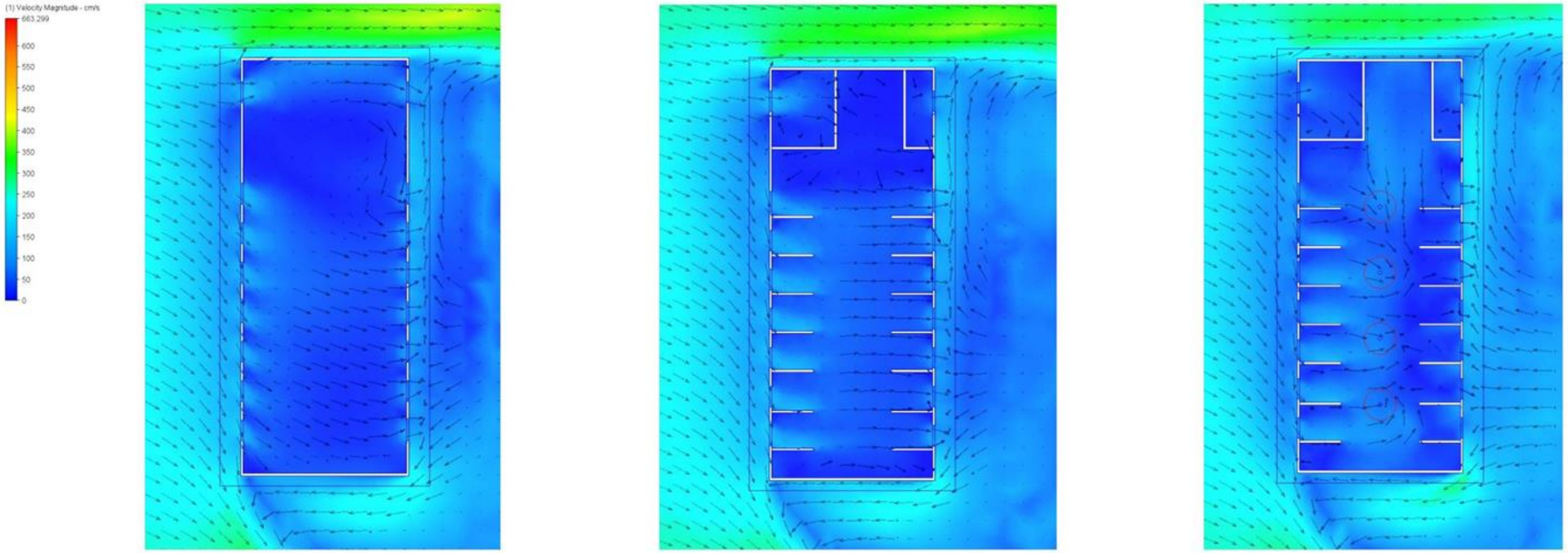
Air Changes per Hour		
	Adesk CFD	WHO Baseline
Open window (100%) + open door	36.82	37
Open window (50%) + open door	25.58	28
Open window (100%) + closed door	4.27	4.2

*CFD simulation matches results from WHO reference formula.

Natural Ventilation

AIR CHANGES – COVID WARDS DESIGN ANALYSIS

We then studied the air changes per hour in the three prototype COVID ward designs. Three typical wind velocities from Fond des Blancs climate data are simulated. The baseline of 12 ACH is met in these three cases given the simulation model conditions outlined in slide 3.



Ward A – No partitions

Ward B – Interior partitions

Ward C – Interior partitions + fans

	ACH Avg Wind (3.6 m/s)	ACH Max Wind (5.25 m/s)	ACH Min Wind (1.8 m/s)
Ward A	18.7	37.6	17.4
Ward B	19.3	37.7	16.6
Ward C	25.1	39.3	14.6

Natural Ventilation

Opportunities for further studies

Combine solar gain and air flow analysis

- Integrate with solar studies for specific weather systems

Air flow analysis for multiple wind directions

Air flow analysis for alternate interior configurations

- Exhaust alternatives

Airflow impact due to site obstructions

Covid-19 Treatment Center Construction

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Construction Process

No construction supervisors on site due to Covid-19

Remote construction administration from BHI home offices

On-the-ground crew in Haiti trained on previous projects

Photo-based guide for construction

1: Site Clearing

2: Concrete Forming

3: Concrete Pouring

4: Wall Framing

5: Stand Up Walls

6: Sheath Walls


7: Assemble Trusses


8: Paint Trusses


9: Paint Walls


10: Place Trusses


11: Bolt Truss Plates


12: Install Purlins

13: Insulate Roof

14: Install Roofing

15: Install Electricity

16: Plastic Interior

17: Sink & Workstation

18: Clean

Impact

50 beds in Fond des Blanc, Haiti

116 beds in Mbarara, Uganda

100 beds in Mirebalais, Haiti

COVID-19 Rapid Response Project Delivery Case Studies

Q & A

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2020 Project Delivery Course

From Surge to Solution: How Northwell Health Rapidly Built a COVID-19 Surge Unit

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Presenters

Thomas Morris
Partner

E4H Environments for Health Architecture

Alexandra Vigliarolo, RA
Project Manager

Northwell Health

Learning Objectives

1. Attendees will be able to identify strategies for designing an adaptable patient environment to address the unknowns of a pandemic disease.

2. Attendees will learn tactics for rapid project implementation with a multidisciplinary team, while working in a remote working environment.

3. Attendees will understand challenges and solutions for obtaining construction materials in periods of high demand.

4. Attendees will review regulatory and code applications, and best practices in the rapid deployment of pandemic project solutions.

From Surge to Solution

AGENDA

- Overview & Relationship
- The Need
- The Opportunity
- Project & Delivery
- Challenges
- Construction Process
- Lessons Learned & Solutions

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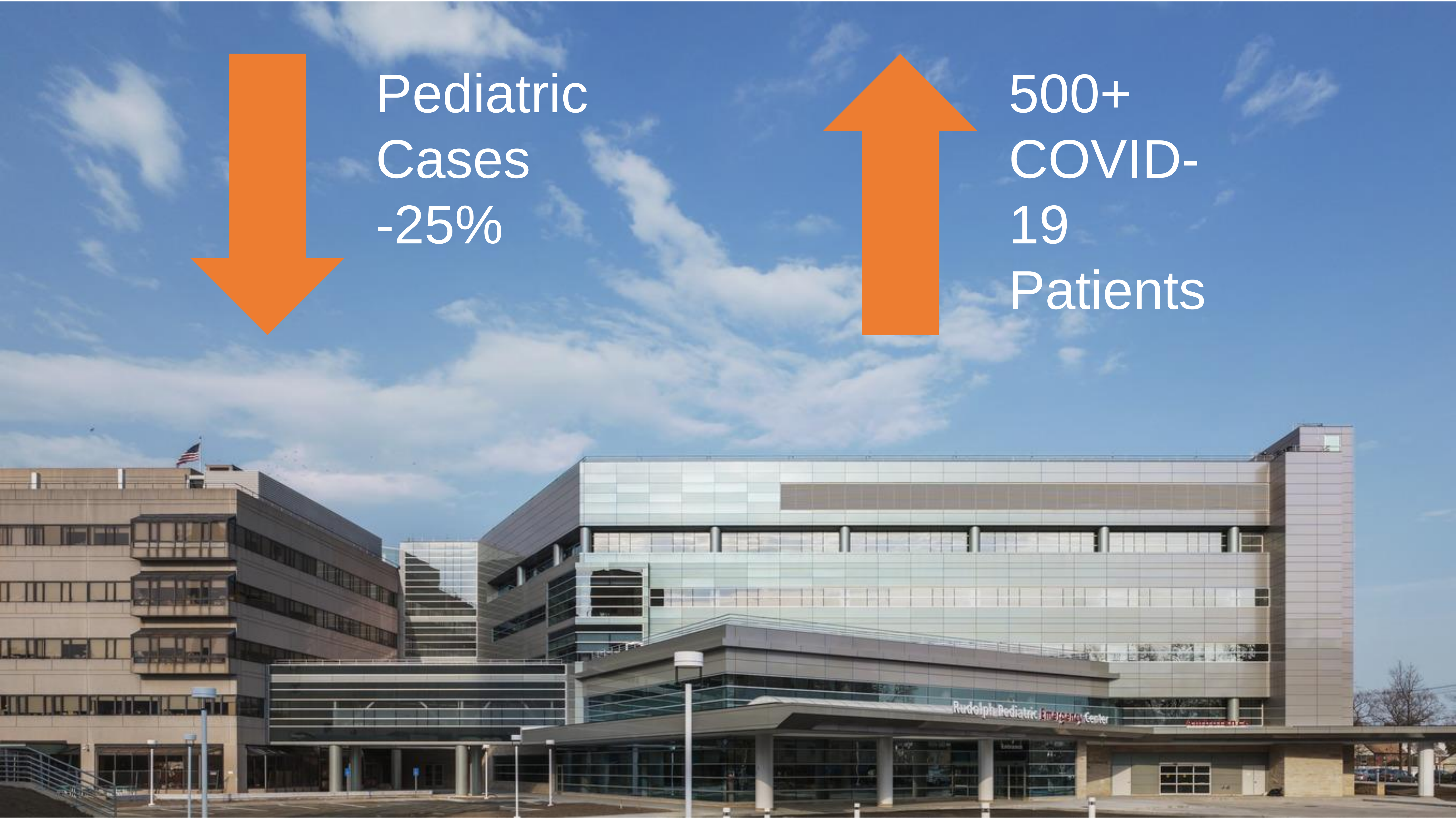
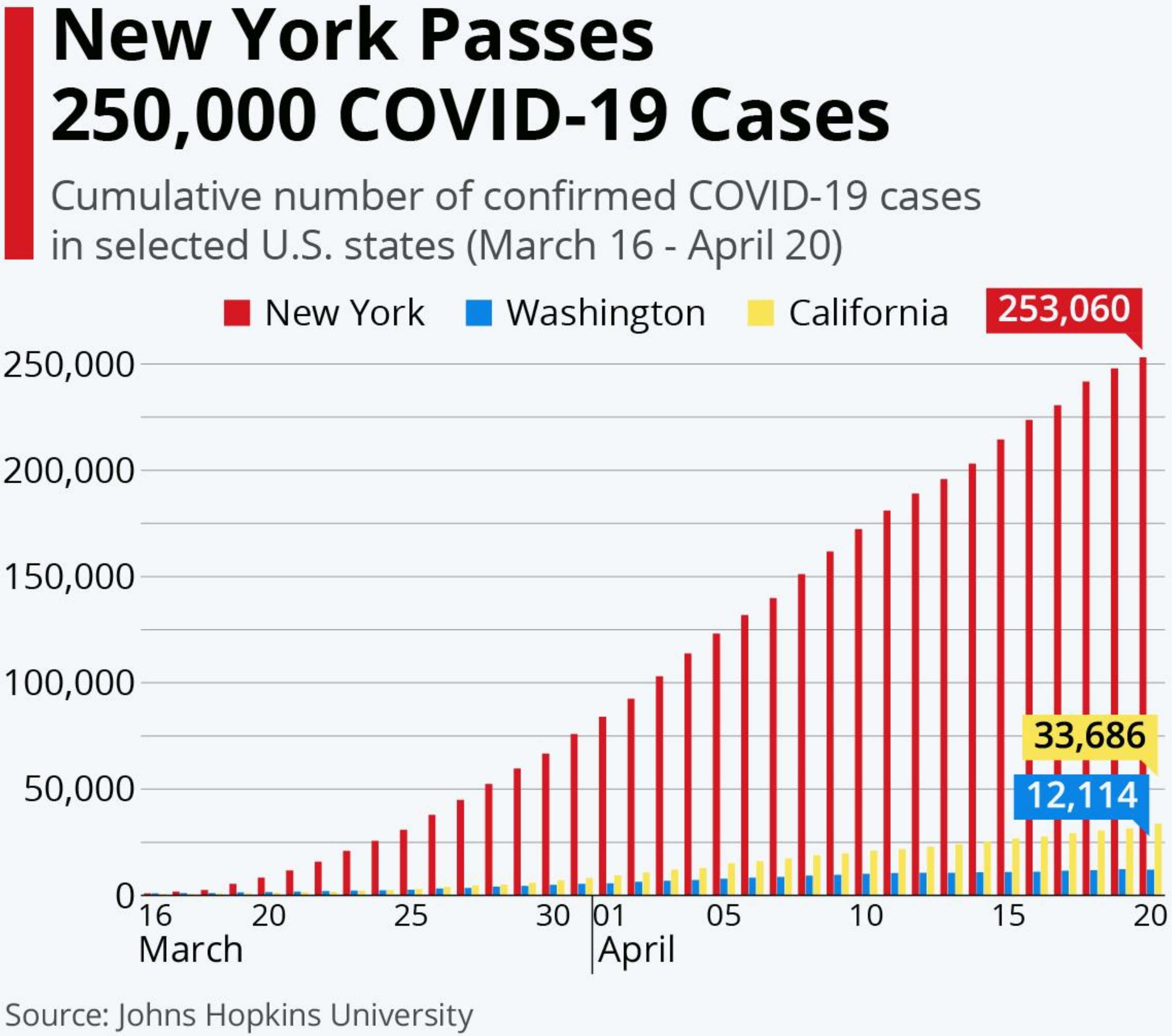
Long Island Jewish
Medical Center
Northwell Health


Pediatric
Cases
-25%
500+
COVID-
19
Patients
Rudolph Pediatric Emergency Center

NYC Faces a Patient Surge



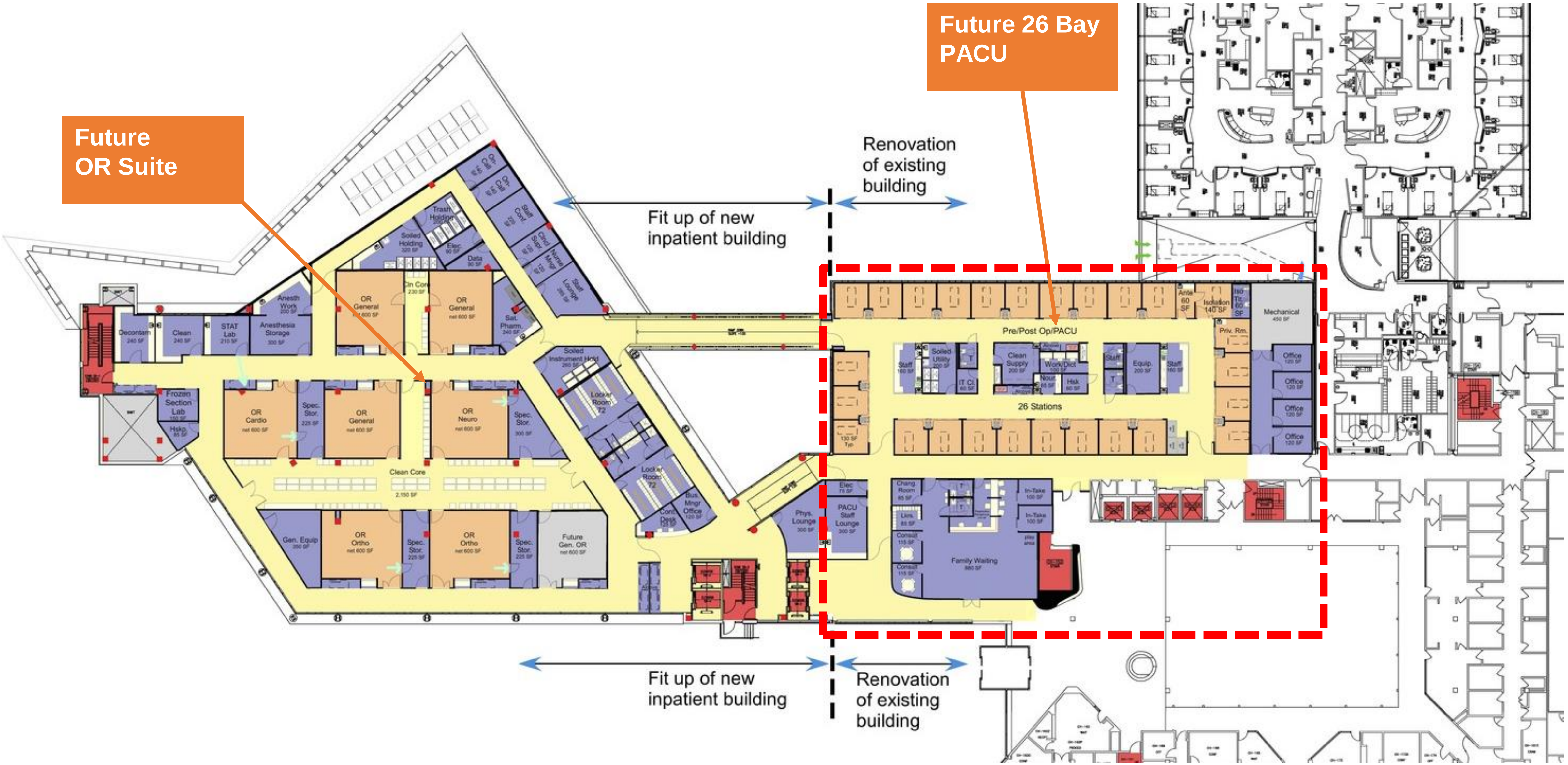

MARCH: 90 pediatric beds converted
It was not enough.
61
10.0
390
26
400
PEEP/CPAP

The Need

- Dedicated System-Wide COVID-19 Unit
- Aleve Emergency Department Surge
- Isolate Positive Patients
    - 60-65 Beds
    - Ward Configuration
    - 9,100SF Available
    - Negative Pressure
    - Emergency Power
    - Medical Gases – Oxygen, Vacuum, Medical Air
    - Handwashing Stations
    - Small Pharmacy/Clean Supply/Soiled Utility
    - Telemetry at Every Bed

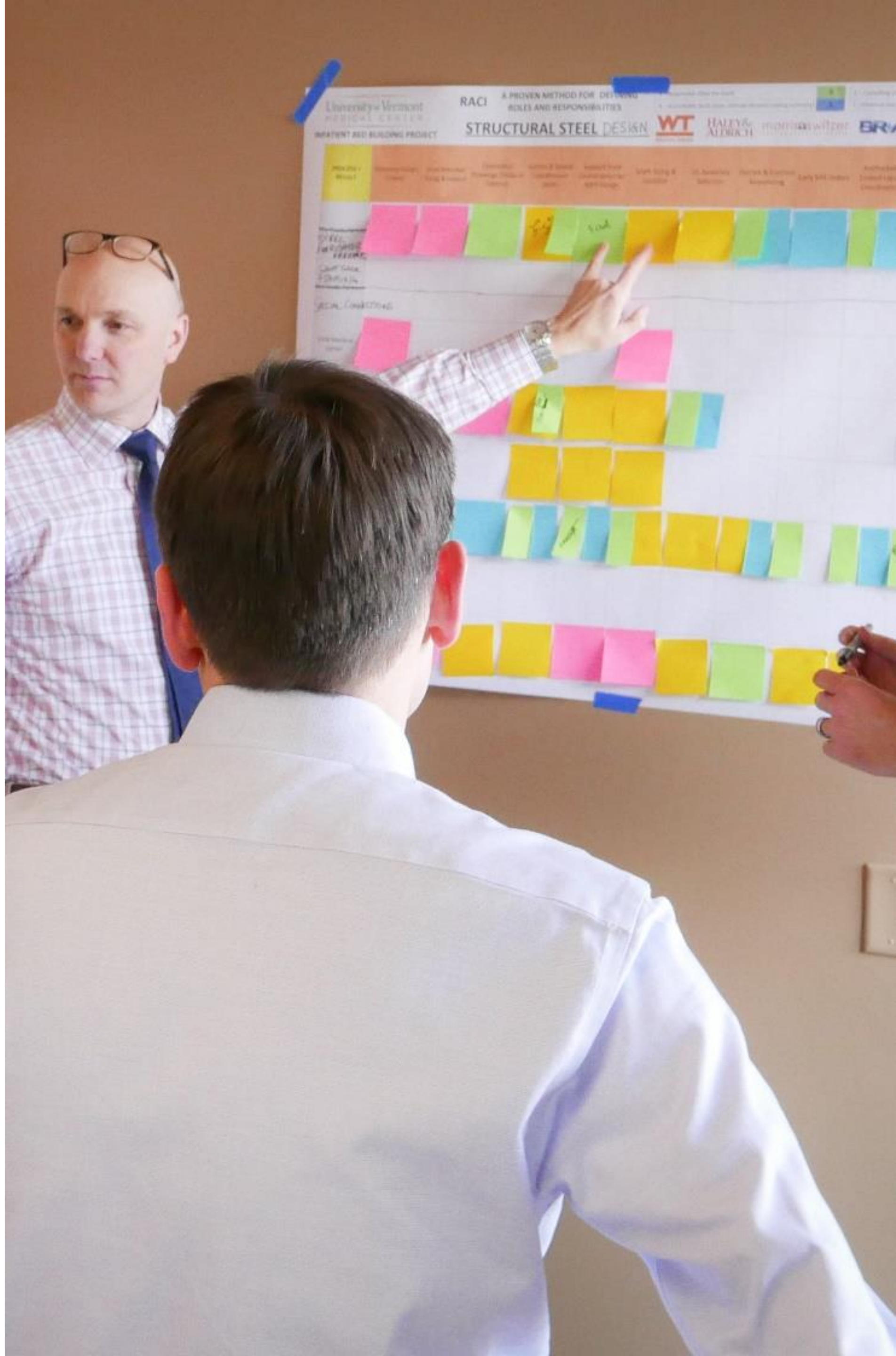
20+ Year Relationship with Northwell Health

The Opportunity

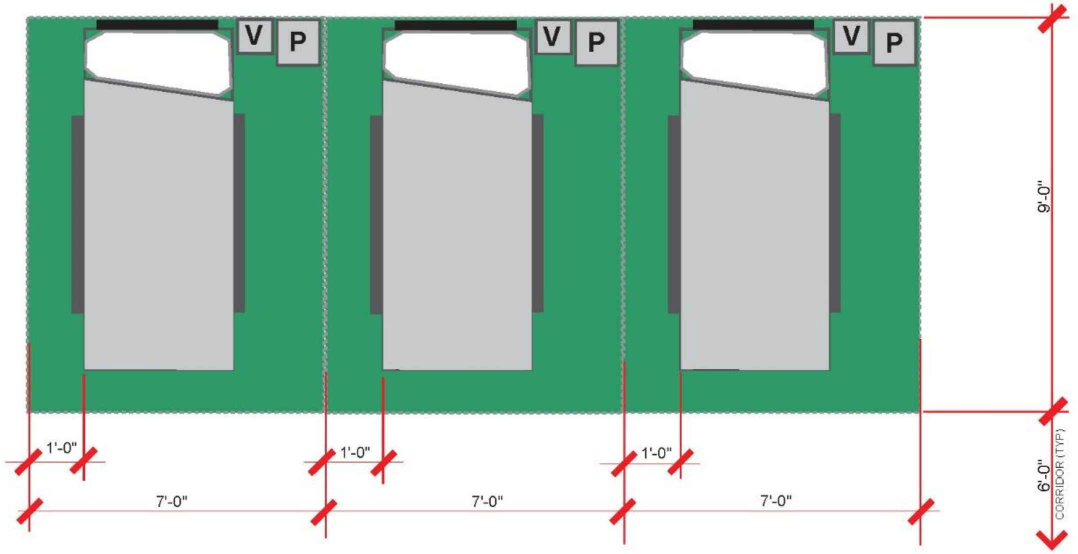


Design Process

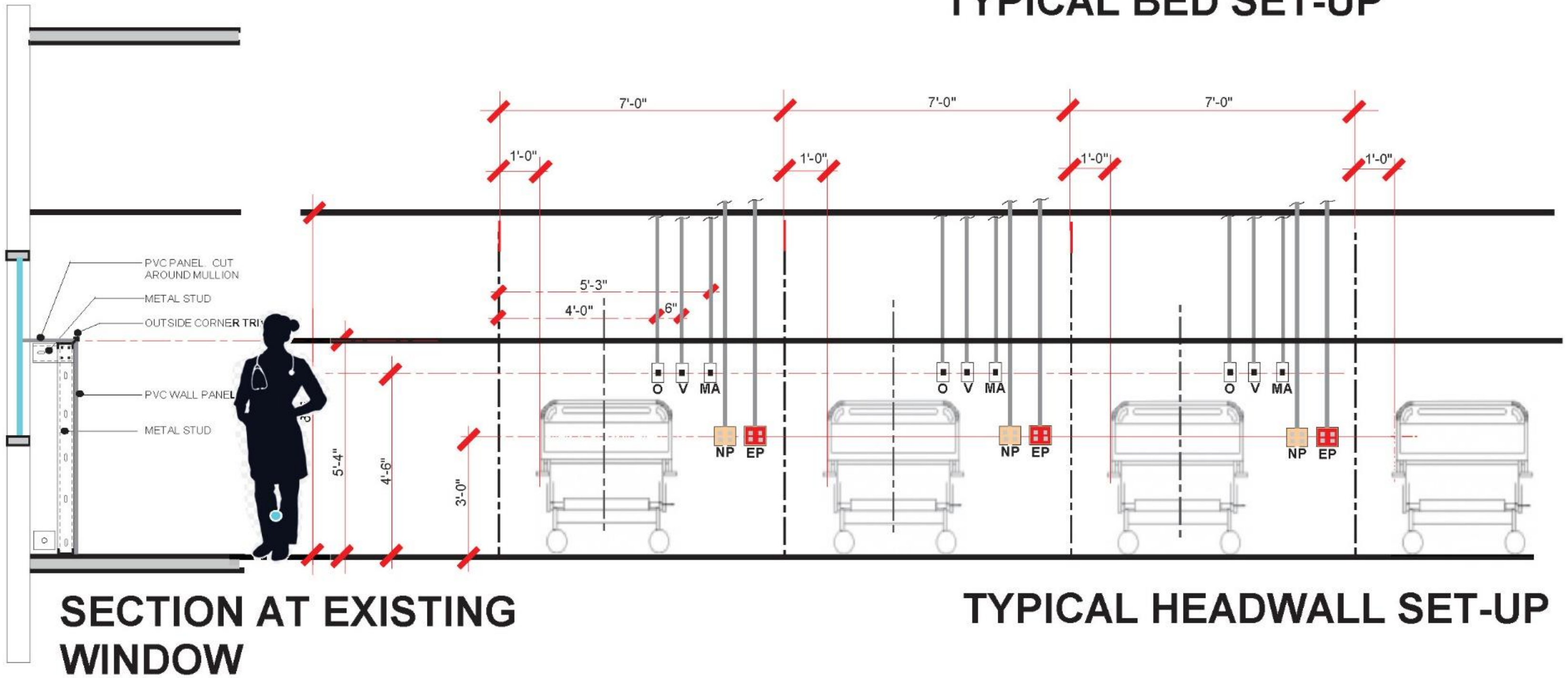
- 12,500SF total space
- Input from Nurse management
- Daily Zoom meetings
- Codes & Guidelines
- Concessions
- “Unofficial” moratorium
- “Eyes in the field”



PACU TEMP SURGE FLOOR PLAN



TYPICAL BED SET-UP

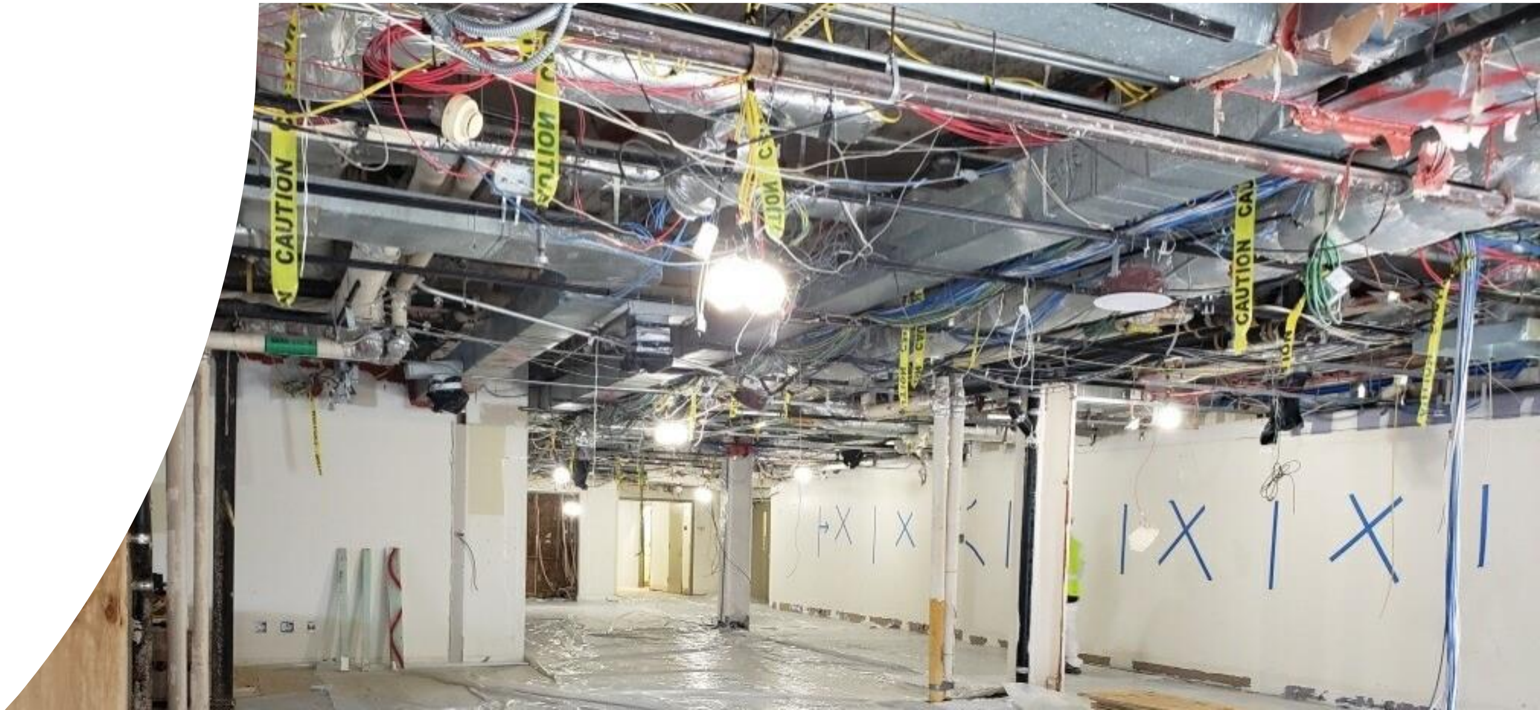


SECTION AT EXISTING WINDOW

TYPICAL HEADWALL SET-UP

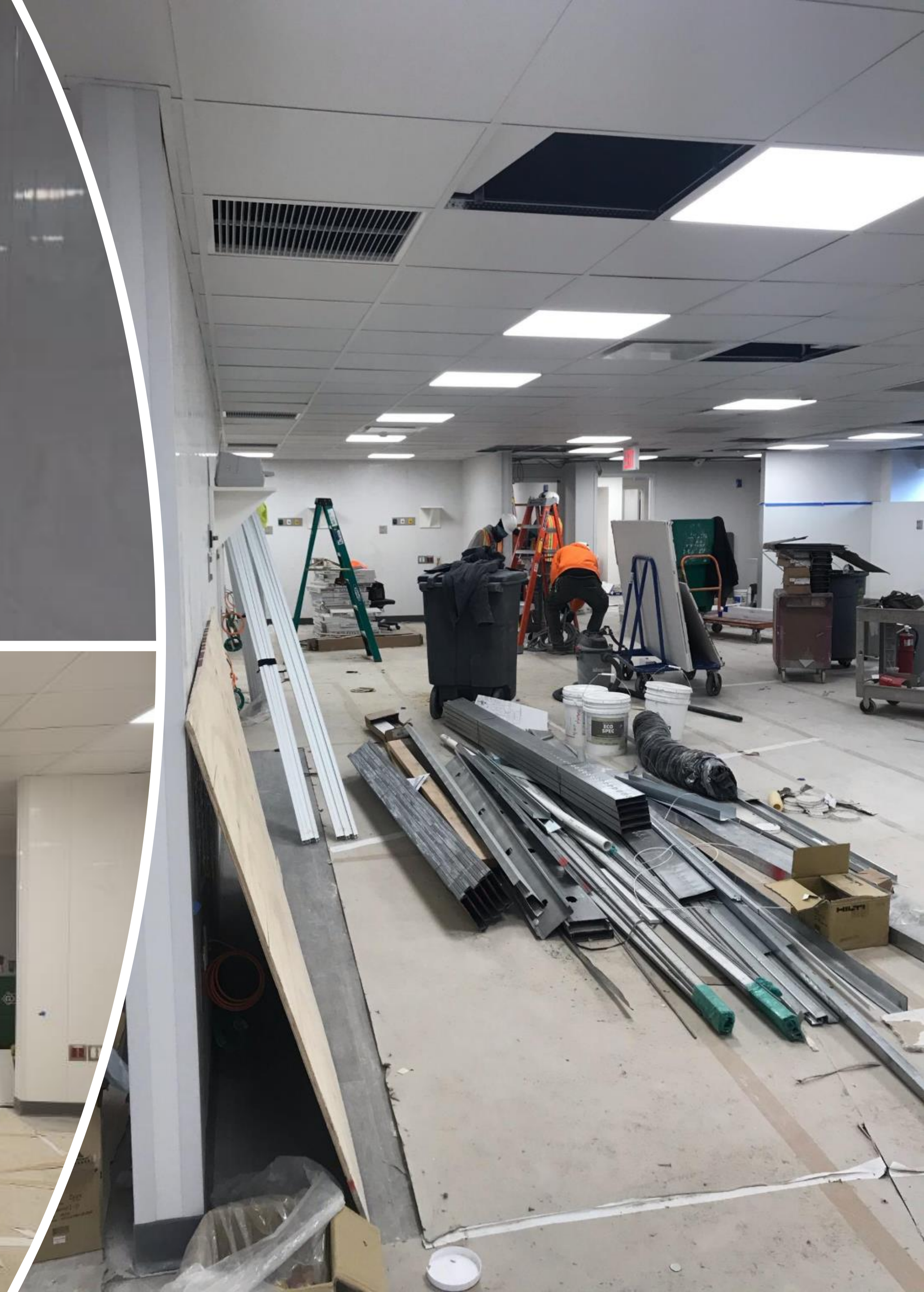
Challenges

- Emergency Power
- Oxygen
- Medical Gases
- HVAC/Exhaust
- No major building Shut-Downs



Construction Process

- 3 weeks to delivery
- Workforce Shortage
- Materials shortage
- COVID Construction Protocols



Lessons Learned & Solutions

- We needed dedicated circuits at each bay for a ventilator at each bed.
- As the numbers increased it became clear that dialysis patients were common among the infected COVID-19 patients so we had to install hookups for dialysis machines at 8 beds a few days before we opened.
- We added day 2 work including a break room and bathroom for staff so they didn’t have to leave the space to take a break and possibly infect other areas.
- In order to keep costs and amount of work down we put all lights on the same switches. Once the space was open for a week or two we became aware of the fact that during the night shifts, the patients couldn’t sleep well with all the lights while still allowing the nursing staff to do their jobs. We had electricians in full PPE working around patients to add switches to allow for less light at night.
- The space was originally designed for office space, not a heavily populated ICU with a lot of equipment so the cooling system was not equipped to handle the space. It was uncomfortably hot for staff inside the space so we added some spot coolers.


EXIT
LU SRGB (PACU) 06
LU SRGB (PACU) 05
(PACU) 04
Hill-Rom

COVID-19 Rapid Response Project Delivery Case Studies

Q & A

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AIA KnowledgeNet

https://network.aia.org/communities

The AIA **Project Delivery Knowledge Community** (PDKC) promotes the architect's leadership role in all project delivery methods by assembling and distributing knowledge and best practices for a variety of project delivery methods, e.g. design-build (DB), integrated project deliveries (IPD), and public-private partnerships (P3).

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Upcoming Course

December 2020

Live Course - Virtual Design + Construction: The Future of Project Delivery

When: Dec 8, 2020 from 2:00 PM to 3:00 PM (ET)

Community: Project Delivery

1.0 Hour Course = 1.0 LU

Visit https://network.aia.org/projectdelivery for more information

THANK YOU

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