What we were set-up to do:

The key is in the how:

In April 2020 it became clear that greatly increased testing was needed to evaluate and control the spread of the Coronavirus. Under this reality, which brought to the surface strong racial and income healthcare disparities, our incubator focused on answering the following question:

How can we develop a testing solution that is quick and cost-effective to implement, and bring it directly to underserved, high-risk communities?

An agile response:

At the onset of the project our team identified five key parameters to define the success of the testing process: mobility, accessibility, speed, flexibility, ease of implementation, and scalability. Under this framework, we explored the refitting of vehicles that could be quickly converted into mobile testing centers.

To address the ease of implementation, connection to the communities and universality of the response, our starting point was the re-purposing of underutilized school buses.

Our concept is equitable and responsive. As outbreaks occur in different locations, deployable healthcare units respond in real-time and can be quickly assembled by under-served communities. The system gathers essential geolocation and test-result data, allowing real-time data feedback-loop to help authorities with strategic decision-making.

What a great idea! Now what?

When we submitted to the innovation incubator our team was sure about one thing: we wanted to quickly prototype our idea and get the mobile bus up and running. With this in mind our scope focused on developing a roadmap to implementation which would further explore the technical components of our "off-the-shelf" system.

However when reaching out to experts such as medical staff and health authorities as part of our technical research, we came across barriers that we were not expecting. People loved the idea but until a prototype was built as proof of concept it was going to be hard to move the concept further. We found ourselves in a "chicken and the egg" situation: how much more can we design without a client? versus, will we ever get a client if we don't have a full design?

In the process of making connections we were introduced to New York City Relief, an organization that serves those who struggle with homelessness. This partnership became fundamental for our project not only because their operation is based out of a bus that serves the community at public parks, but because we learned from them that a solution to such a complex challenge, in this case public health, requires small and steady steps. It was through them that we learned that we could still make a difference and move one step further by focusing on a small part of our solution: the mobile pop-up booth.

This report summarizes our journey, what we learned and the final outcome. What comes next is still unknown.

Here's what we learned about the process:

Aim high and know when to scale down:

Our BIG idea (the bus) became an extraordinarily strong PR piece that grabbed people's attention, the story was relatable and humane. Besides from the challenges we found along the way people were listening. It made clear that our solution got to the root of equity and that more than ever we needed to challenge the status quo and redesign the way under-served communities are served.

On the other hand, our big idea required many resources, especially connections that were outside of our network.
This situation brought us to the need to "scale down" and focus on some of the elements from the original idea which could still be implemented and built as proof of concept.

Learn more about our Minimal Viable Product

Partnerships matter (Internal and External)

Behind this project there is a team of passionate and multi-disciplinary Perkins & Will members which for the past 6 months shared their expertise and diverse points of view. Architects, interior designers, strategists, video producers and product designers with experience in workplace, healthcare, science and technology and data analytics came together to come up with a holistic and human centric solution.

The importance of partnerships doesn't stop at the internal level. By sharing our idea with the public and inviting Arup and New York City Relief to participate, we learned about service and digital design and got to pilot our project with the people that matter the most: our end users.

Reaching out and making connections matters, especially in a time like this.

Meet our amazing team!

We stand behind our BIG idea:

After 6 months of diving into our research question we stand behind the idea that healthcare MUST be accessible to EVERYONE, In the process we found that although there are challenges outside the scope of design, as architects, we play a huge role in re-imagining the way space can hinder or facilitate equitable interactions.

Through the design of the mobile booth we found that design can strengthen or remove unequal relationships of power. Design decisions like perceived height, direct eye contact, color, amongst others play a huge role in the way person experiences space and relationships.

The mobile bus also brought to the surface that public space can play a more significant role in providing these services by creating mobile solutions that reach the communities that need support and that we can design outside of the traditional boundaries of "private" institutions.

AIA Video: Creating positive impact

Next Our Journey: Timeline

New York Mobile Response
Roadmap to implementation

Meet the team

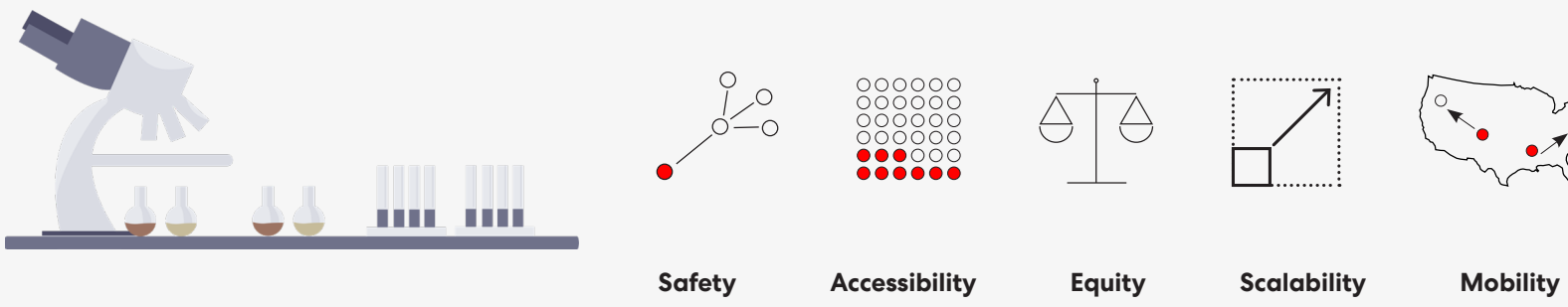
This is an interactive PDF. Click on the menu to learn more about each chapter

Click and learn about our

Key milestones:

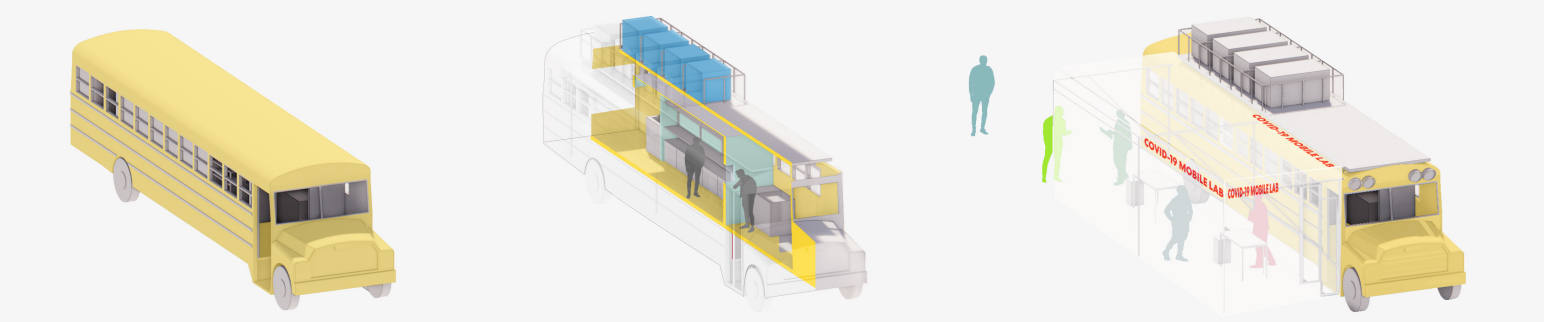
Preliminary Research and Design Framework

April 2020



Conceptual Design: Mobile Testing Lab

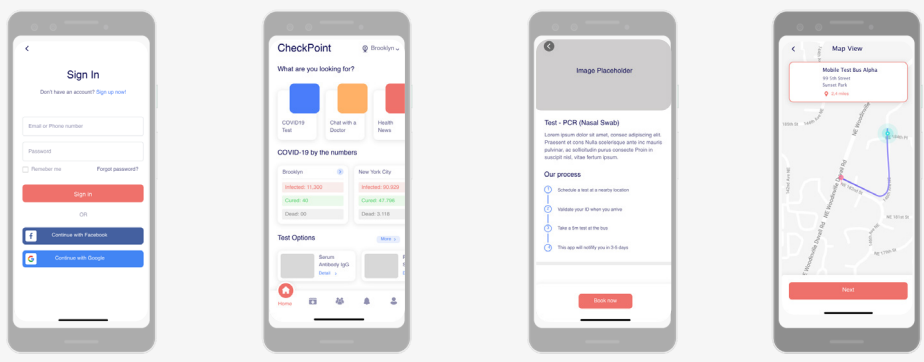
April 2020



Underutilized School Buses → Outfitted with testing technology → Deployed to communities at high-risk

Service Design: Mobile App in collaboration with ARUP

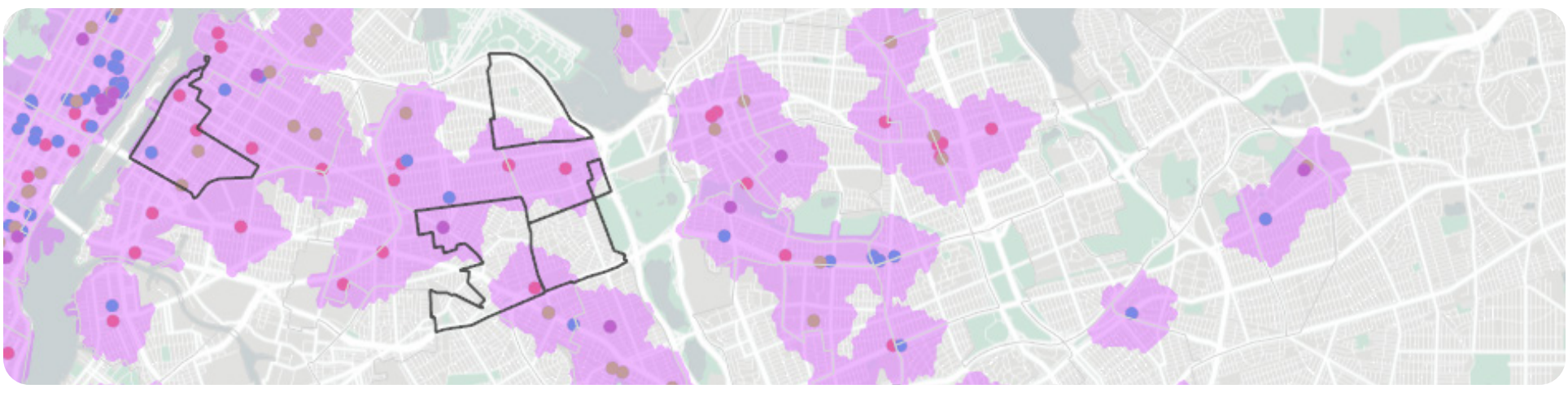
April - June 2020



Sign-up | Data Dashboard | Testing Process | Map

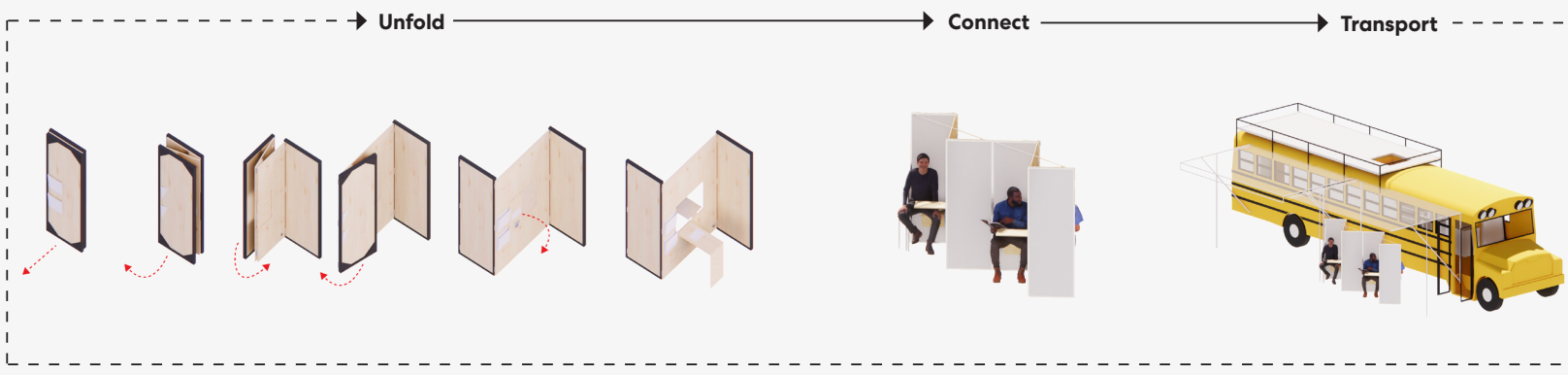
New York Test and Tracing Initiative: Mapping

May 2020



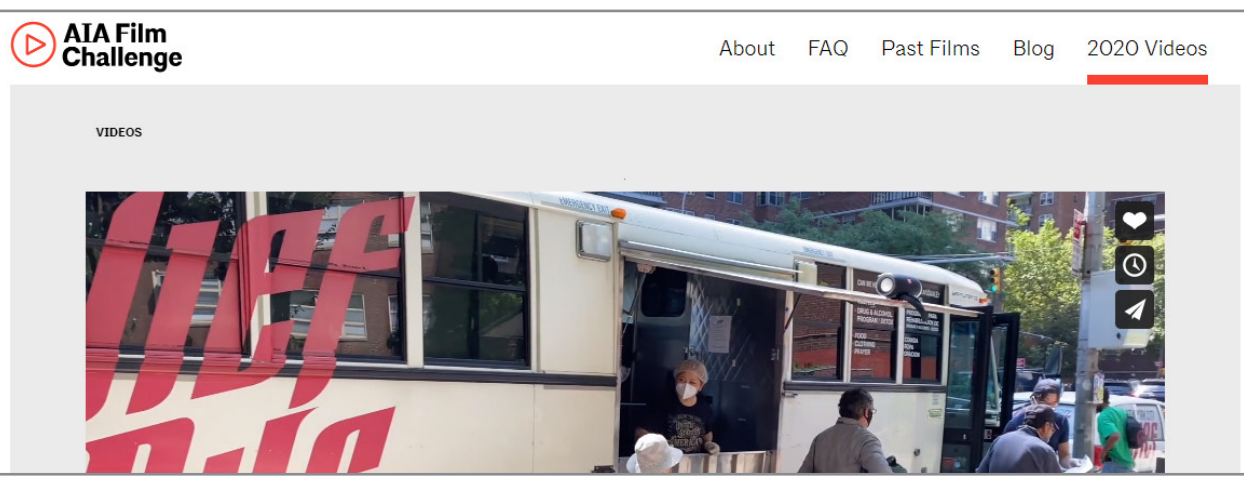
Pop-up care booth: Prototype in collaboration with NYCR

May - Sept 2020



AIA Short Film Challenge

Aug 2020



The Situation:

412K is total number of confirmed cases of coronavirus around the globe - a number that as we speak, continues to grow. According to the CDC, most of the U.S population will be exposed to the virus in the coming months, and there will be increased instances of community spread. The rapid spread of the virus and its subsequent effects has put an immediate strain on an already overloaded healthcare system, that is now dealing with elevated rates of hospitalization and millions of people waiting in line to be tested.

Under this scenario, experts agree that coordination of a public response will strongly rely on how quickly countries implement testing as the key measure by which to understand and control the spread of the virus. Even more, the economic health of countries might depend on the testing processes that give people a green light to get back to work without the risk of infecting others.

— A WORD FROM THE EXPERTS:

"Although mobile clinics are usually seen as something ephemeral", Dr. Cohen said, "I think we're in this for the long haul."

Coronavirus testing goes mobile in Seattle, New York Times

Testing Approaches:

After analyzing the current response to emergency testing, the team found that centralized hospitals are not the ideal environment to deal with highly transmissible viruses, mainly because social distancing is hard to control and resources are scarce and scattered. Because of this, cities like Seattle and New York quickly identified the need to implement drive-through testing facilities that ensure secure social distances are maintained. Through our research we found that while this method has been successful in controlling the risk, in high-density areas the system could create social inequalities due to a large percentage of the population depending on public transportation. Other solutions such as Israel's use of ambulances for home testing have increased the strain on the emergency response system, while other DIY methods have not succeeded.

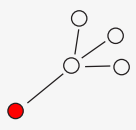
Existing approaches analysis:




	Hospital testing	Drive thru testing	Home testing	DIY
+	• Lab testing on site • Equipment,Staff, Materials easily exchanged • High volume testing	• High volume processing possible • Scalable solution	• Low chance of transmission • Equitable	• Immediately scalable • no deployment issues
−	• Increased risk of transmission in journey and triage • Many hospitals' swell zones - unsuitable HVAC • Out of geographical range for many ppl • Limited scalability	• Those without private cars either cannot access or expose drivers to risk	• Comparatively labor intensive and time consuming • If using medical service vehicles it creates a system strain	• Fraudulent tests • Inexperienced testing technique • Relies on postal service • Differences in financial resource
?	• How might hospitals service other forms of testing (e.g. pharmacy, drive thru, home and mobile) more effectively?	• Interstate deployment possible but not completely mobile • Limits spread of virus but can expose drivers to risk	• Difficult to scale • Low volume and high cost can lead to difficulties of scalability	• How to balance equability • Quality of sample

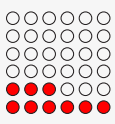
Our Project:

In the past weeks, our team has identified seven key parameters that define the success of the testing process: **mobility, accessibility, speed, flexibility, ease of implementation and scalability**. Under this framework we are exploring the refitting of vehicles that can be quickly converted into mobile testing centers. To address the ease of implementation, connection to the communities and universality of the response, our starting point is the re-purposing of underutilized school buses.



Limit risk of transmission due to testing need

Minimize transit for the person to be tested



High volume testing with long operation periods

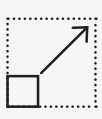
Efficient and comfortable methods for practitioners

Equitable testing

Solution that does not rely on proximity to a facility or a car

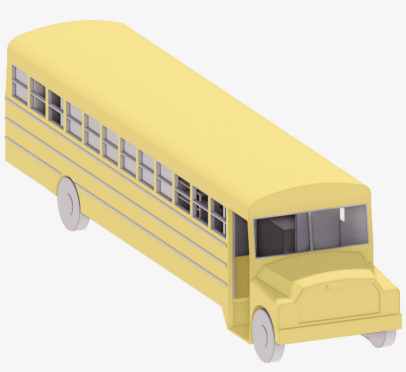
Responsive capacity

As the virus moves, so should testing capacity

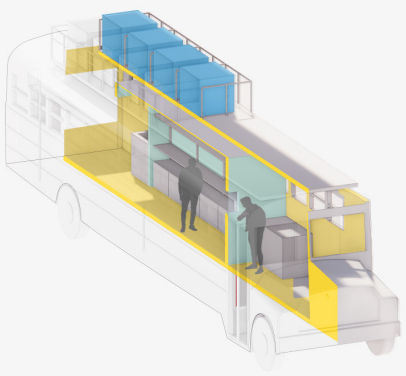


Scalability Implementation- speed

Ability to ramp-up quickly according to need



Underutilized School Buses →

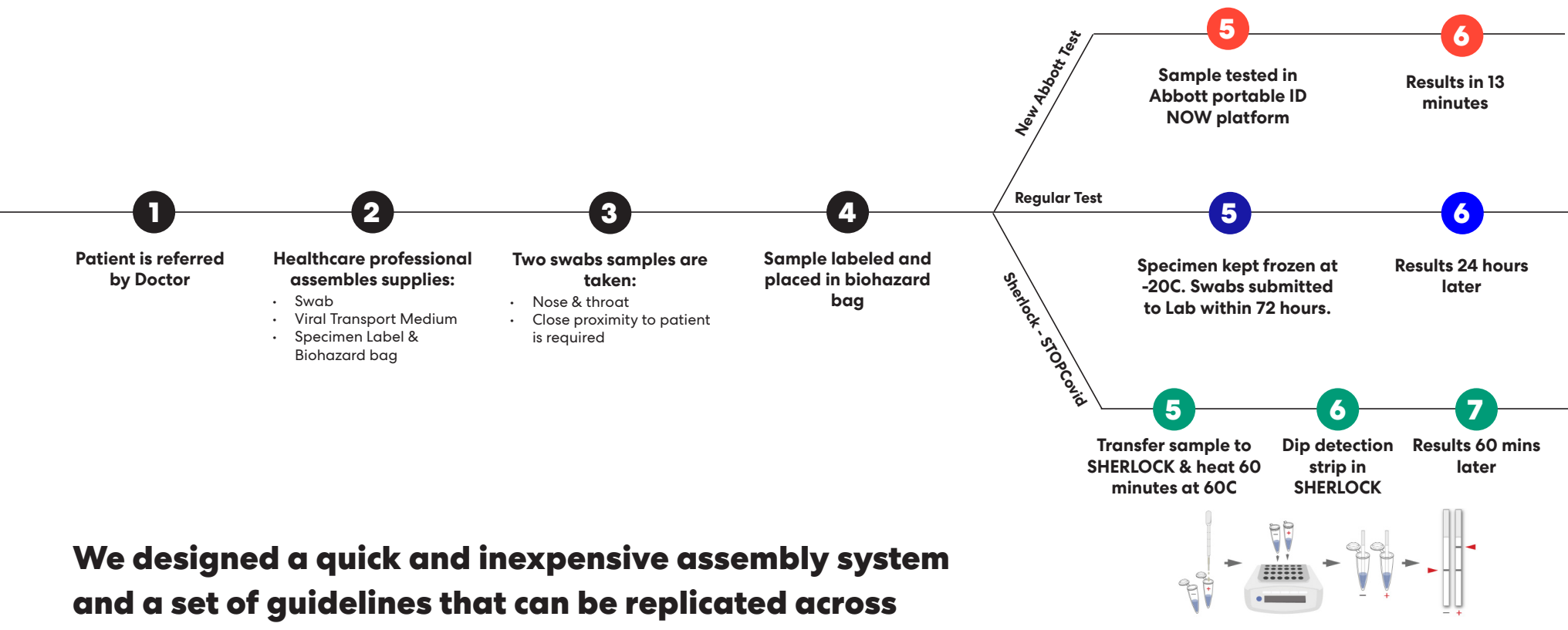


Outfitted with testing technology →

Deployed to communities at high-risk

COVID -19 Testing Technology

The team did some extensive research around the testing technology available at the time, and came across the recently FDA-approved Abbott ID NOW COVID-19 test. The layout of the mobile testing lab concept was based on this new technology which also supported the need for speed, flexibility and mobility in testing, by enabling vulnerable populations and isolated groups to be tested and receive their results within minutes



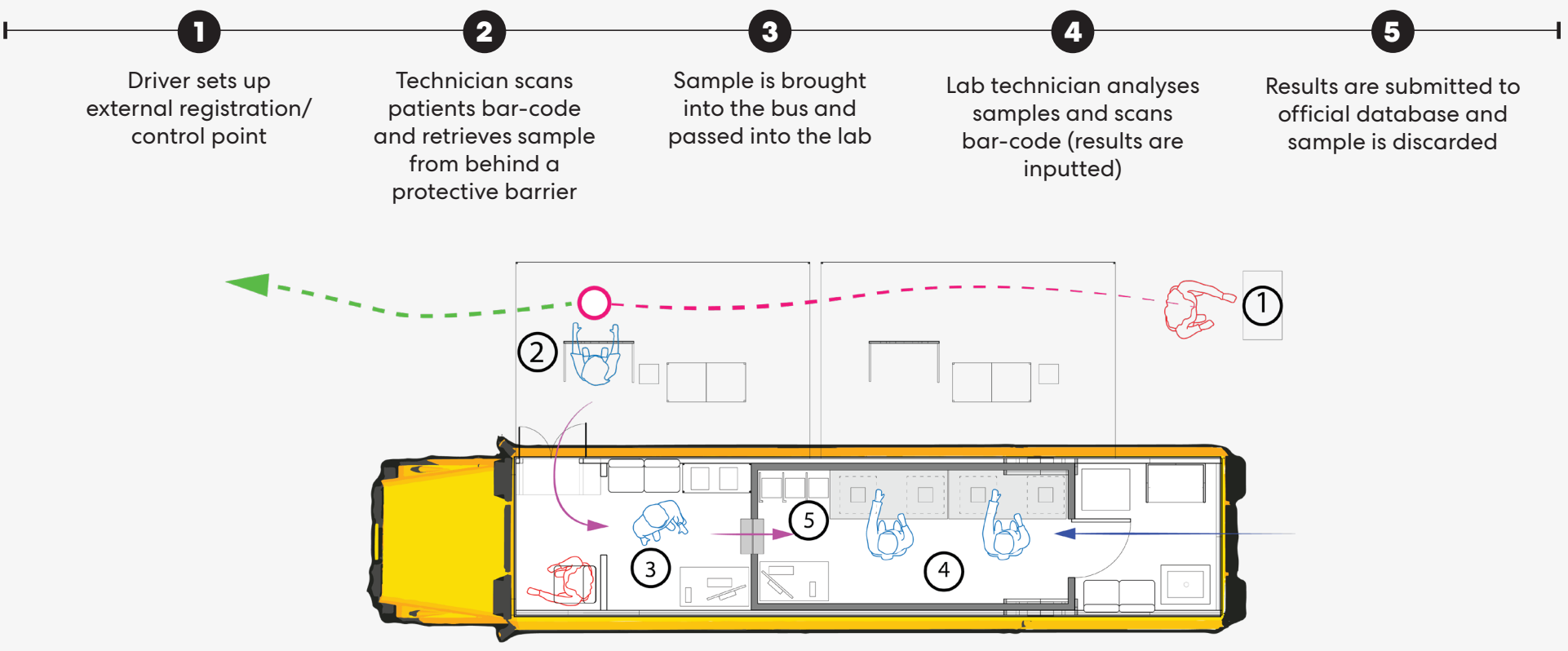
We designed a quick and inexpensive assembly system and a set of guidelines that can be replicated across the world—a low-tech, DIY system that can be quickly adopted by under-served communities.

How it works:

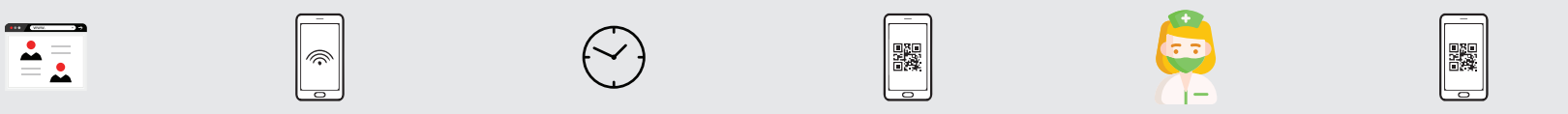
Individuals are referred to the mobile testing lab through doctors and appointments would be made through a **mobile app**, so that crowds could be controlled and social distancing rules adhered to. Of course, given the testing solution's emphasis on equitability, smartphone access or a referral from a doctor is not a pre-requisite and everyone is welcome to sign-up.

Upon arrival, individuals are greeted by technicians behind a plexiglass shield underneath a canopy. Following a brief check-in process, the technician would take a sample using a swab from the individual's nose and/or throat. Their samples would then be labeled or barcoded and brought into a lab environment on the bus via a pass-through box.

The labs would host two technicians who would run the samples collected through the ID NOW rapid testing instrument. Once results are received, they would be recorded and uploaded to the federal government's official database. Tested samples and the expended test materials would then be placed in biohazard waste bags and discarded safely. For tested individuals with mobile app access, results would be sent through a phone notification. For those without, results could be relayed verbally.



How to get tested?



Off-the-shelf construction

Every element of the mobile testing lab, including the generators, HVAC systems, and the awnings, is designed to be sourced from off-the-shelf from vendors, ensuring easy replicability across communities.

To support lab technicians, the rear of the bus could include a respite area, a gravity-based hand washing sink, a refrigerator for water and lunches, seating, and storage options for personal protective equipment. In addition, a clean flow process could be implemented, and a negative air pressure system created, to minimize the risk of environmental contamination within the lab space. Generators could be placed on top of the bus to provide electricity.

— A MULTIDISCIPLINARY APPROACH

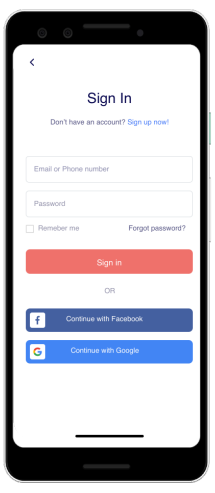
"We aim to bring together intuitive technology and service design into a unique mobile care space,"

Paul McConnell, Arup Design Director of Digital Experience

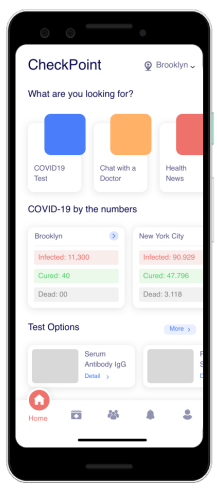
Another piece of the puzzle:

Once we developed the concept design for the lab, we invited our industry colleagues at Arup to co-design the project's companion app.

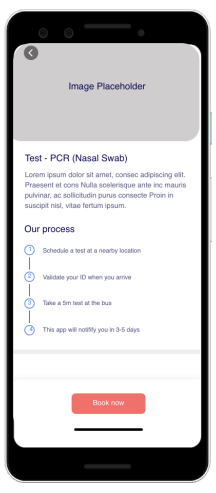
Through rapid prototyping we explored and refined a process that would give communities the confidence to return to normal. The first iteration of the design included elements such as a data dashboard, scheduling, mapping and arrival and test result notifications.



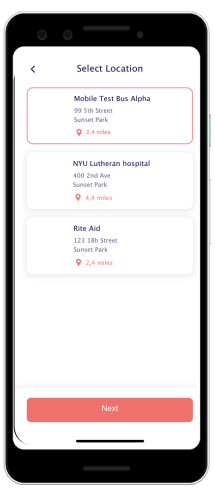
Sign-up



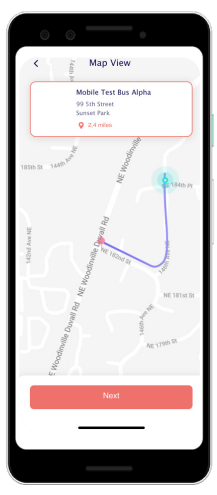
Data Dashboard



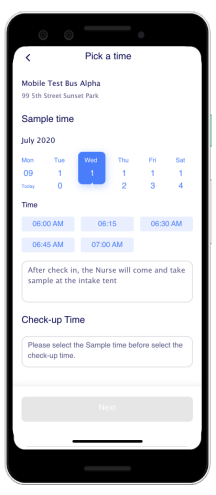
Testing Process



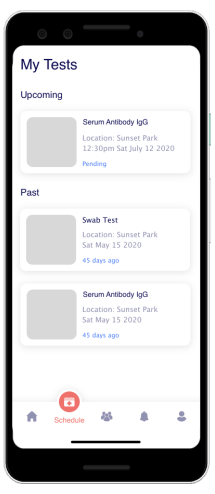
Location



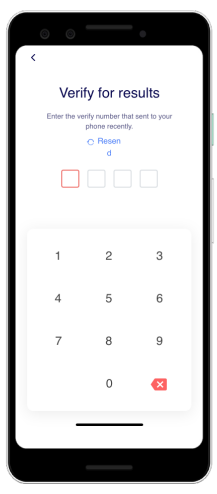
Map



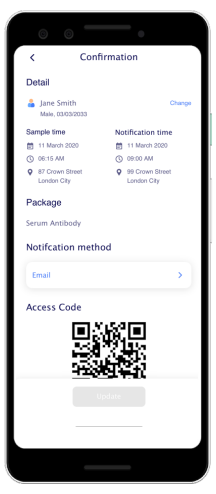
Appointment



Appointment



Results



QR Access Code

ARUP

Design Principles:

To ensure that the integrated care values and the practice ethos are reflected in every aspect of the user experience, we devised five key UX principles that drive the UX vision and serve as human-impact measure for the proposed mobile and technology solutions. These are generic enough to be considered for the overall experience.

Usable:

Users understand the service defining how the testing process works, with a clear sense of their own role and actions.

Interactions are simple, intuitive and help users get what they need quickly and effortlessly. It provides staff with the effective and convenient tools and interactions at hand that support staff in their everyday task and broader strategic goals.

Accessible:

Experiences are accessible by people with all range of physical and mental abilities.

Adaptive:

Services are designed to elegantly accommodate layers of change, enabling systems to effectively adapt over time.

Humble:

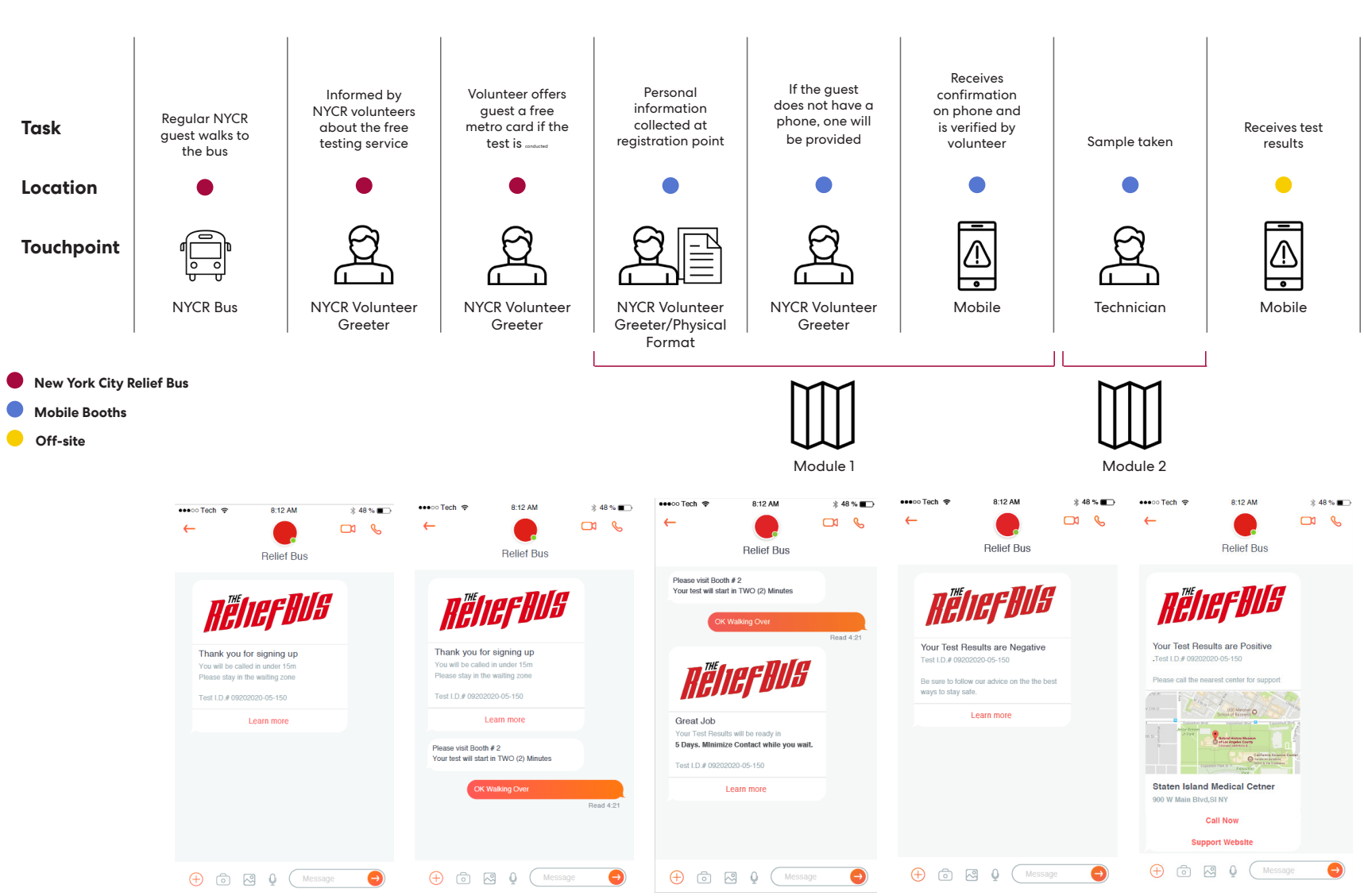
Services do not overreach and have just enough functionality. They respect privacy and anonymity and are resilient and secure.

Well-being

Experiences are designed to serve the ultimate goal - to make people feel better. an empowering and motivating experiences promotes health via every possible medium.

The MVP Mobile App

A "minimum viable" product was also designed for New York City relief. With low-technology we collaborated with ARUP to design the simplest process that would allow an individual to get tested by approaching the mobile booth.



How do we fit?

We quickly understood that to turn the project into a reality we needed to fit into the city's larger testing system and reach out to those in charge of the initiative. In May 8th, a month after we having developed our concept design, New York's Test and Tracing initiative was announced.

We mapped out healthcare services provided in the neighborhoods the initiative was focusing on and based on this data we identified the ways in which our solution would be a great complement and support for the larger city efforts. A lot of effort was spent trying to find the right channel to get us into the Test & Tracing system.

Test & Trace Corps

In recent weeks, Mayor de Blasio announced the City's comprehensive plan to test, trace, and treat every case of COVID-19 by partnering with the city's public hospital system.

The purpose of this initiative is to expand the testing capacity and investigate, trace and isolate cases of Covid-19.

The plan:

By partnering with community clinics across the five boroughs, Test & Trace Corps' goal is to test 20,000 people per day by May 25th and scale up to 50,000 people per day by August 1st.

Testing sites will operate outside of traditional clinic and hospital settings to minimize the burden on the healthcare system.

Opposition to the plan:

Many view the plan as a distraction to the real mission for community clinics as it could represent an increased burden on the healthcare system. Many have stressed that the hospital system's primary responsibility must be patient care.

"This plan raises a lot of alarm bells. Contact tracing is a core function of the Department of Health and Mental Hygiene, and has been for years," Council Speaker Corey Johnson said. "This is a distraction when we need to be focused on battling this virus." [2]

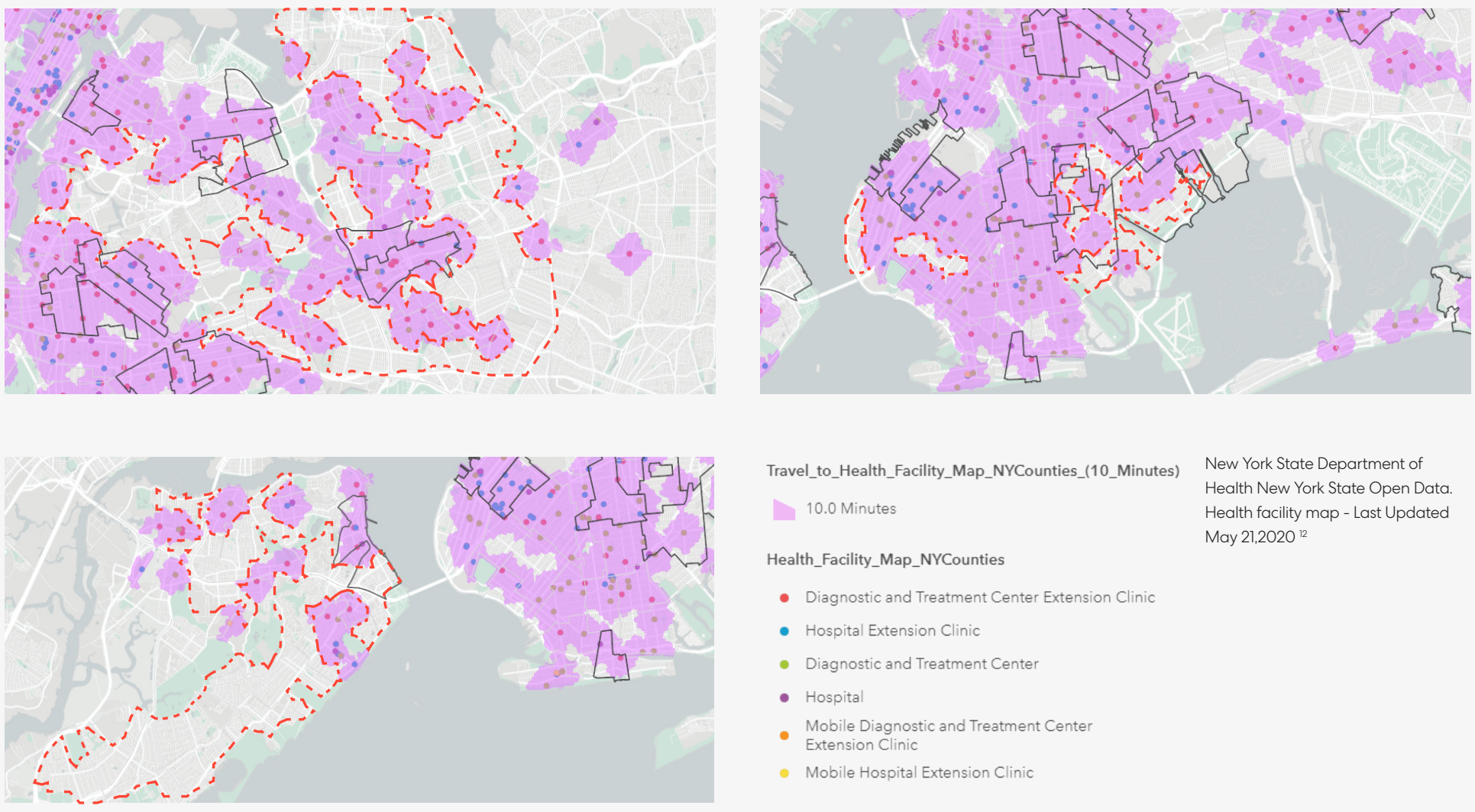
It's all about context (& politics):

Mayor Bill de Blasio today announced the City's comprehensive plan to test, trace, and treat every case of COVID-19.Their work will allow the City to immediately isolate and care for those who test positive for the virus, and then rapidly track, assess, and quarantine anyone they came into contact with who they may have infected." [1]

NYC Office of the Mayor, May 8th 2020

Neighborhoods the plan is focusing on:

Mayor de Blasio announced the Test and Tracing Corps will look to strengthen the involvement of community health providers in the neighborhoods outlined in the map below. Areas in purple show a walking distance of 10 minutes to a clinic or healthcare facility. Areas surrounded by a dashed red line require longer travel time and therefore might depend on public transportation. Purple areas do not address the maximum capacity of the healthcare facilities.



New York State Department of Health New York State Open Data. Health facility map - Last Updated May 21,2020 [12]

Neighborhoods identified by Test and Trace Corps **Target areas for support mobile solution**

1

Additional Support Spaces

With **maximum flexibility and minimal cost,** our bus could support the community clinics operations **without the need to look for additional space available.**

2

Limited Capacity and Geographical Distance

There are some **areas in the city** (some identified by Test & Trace Corps, or adjacent) **that don't have a strong healthcare network** and in which support from the local clinics might not be enough to fulfill the testing need. **The bus can support the operation in a flexible way.**

3

Localized tracing & monitoring

Our mobile solution makes tracing and monitoring easier to achieve. The bus can serve neighborhoods that need to be closely monitored. By bringing the testing to the community there is **less risk of spreading the virus outside the community.**

4

Scheduling & Social Distancing

The design of the mobile application facilitates social distancing. There is traffic control of the people waiting to be tested.

5

A Solution for Everyone

The mobile nature of the solution ensures **people with mobility challenges such as the elderly and the homeless are served.**

Getting down to work:

Building our Minimal Viable Product

New York City Relief is a mobile front-line responder that serves those struggling with homelessness in the NYC Metro area.

The NYCR outreach bus provides vulnerable communities with low-barrier access to essential items and services that lead to life transformation.

Soon after the design for the **mobile testing solution** design was publicly shared, New York City Relief (NYCR) reached out to find ways in which our solution could be adapted to their needs. Although they were interested in the larger mobile testing solution, they were encountering similar challenges in terms of staffing and testing supplies.

Through their regular outreach the organization had developed strong connections to the communities they serve by removing physical and emotional barriers. Compassion, relationship building, and equity are at the core of NYCR's mission -– pillars that were challenged during the pandemic because of the need to limit face-to-face interactions. **With this in mind, our solution allowed NYCR to continue its advocacy efforts during the pandemic by ensuring safety for both its staff and guests while maintaining a sense of equity and approachability.**

The "pop-up care" unit is a modular, portable huddle room that creates a safe place for Life Care Visits. Adjacent to the NYCR outreach bus, this outdoor meeting space facilitates conversations and communication about access to resources such as IRS stimulus checks and health services. **The unit includes a seating area, integrated shared technology, ensures direct eye contact and open conversation with minimum use of PPE and can be quickly adapted as a testing booth, compatible with the mobile testing integrated solution.**

The system can be qui**ckly assembled and transported inside the NYCR bus and set up in multiple configurations.** This allows the organization to adapt to various outreach locations. As new public health challenges arise, resilient outreach solutions that flexibly meet the needs of under-served and low-income communities will be critical to these programs. We are currently working with NYCR to pilot this solution.

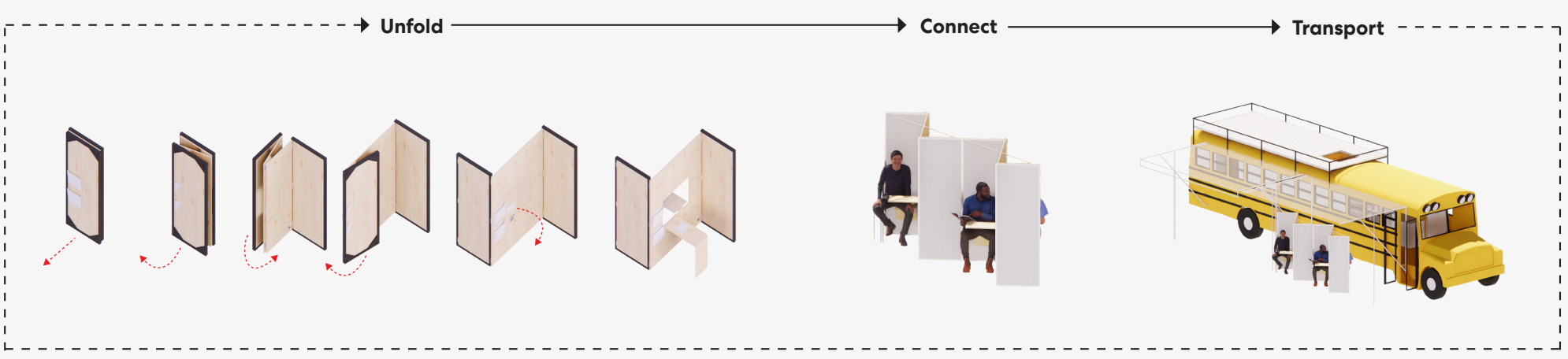
What we heard:

- **New York City Relief** was looking for a design solution that allowed them to **continue their advocacy efforts with the homeless population while ensuring safety** for both their staff and the communities they serve.
- The "mobile booth" would serve as a place where **meetings of up to 30 minutes can take place.** These type of meetings involve conversations, exchange of documents and information/ direction about diverse processes.
- The components of the booth needed to be **quickly set up** (15 minute assembly process) carried, and stored inside NYC Relief's mobile outreach bus
- **New York Relief's mission** of "compassionately serving those struggling with homelessness by providing hope and resources" **had to be clearly represented in the aesthetics and functionality of our solution. Creating a sense of equality and approachability were core design drivers.**

Specific Program:

- Comfortable seating in a "meeting" configuration
- Work surface to fill out documents
- Shared technology. Information on screens needs to be projected
- Document pass-through
- Acoustics must be considered especially since booths will be set up in the outdoors.
- Ideally no PPE (or minimal) should be used during these meetings.
- Design solution should work under all weather conditions.

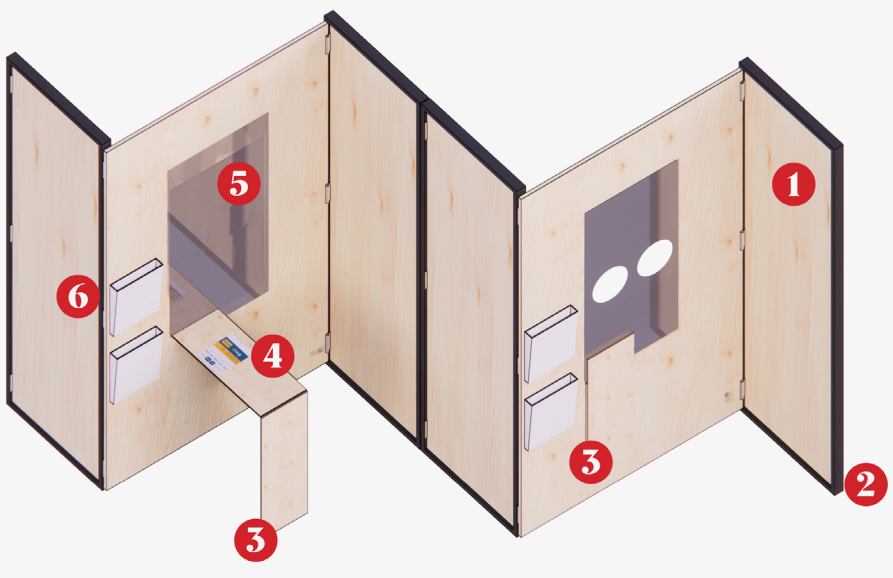
The pop-up booth has the flexibility of being used as a sampling station that is part of the larger mobile testing bus initiative.



Getting down to work:

The prototyping process

1 Design



1. Structural framing for support
2. Framing depth allows panels to fold away
3. Fold out desk
4. Integrated desk monitor
5. Sliding acrylic screen reveals openings for medical procedures
6. Pockets for handouts and drop-offs

Design Drivers

Vision:

Clearly articulate New York City Relief's core values of compassion, oneness, revolution, and excellence by ensuring each person is treated with respect and dignity. The z-shaped module provides equal protection and privacy for both the staff member and the guest.

Operations:

Relatively low-tech solution that staff members can easily set up and transport during the mobile outreach. The materials and construction ensure the module can withstand the wear and tear of multiple outreaches per week and that it can have a long-term use beyond the current crisis. The module's z-shape provides structure and makes it self-supporting

Flexibility:

Not only can the module be used for meetings after the pandemic, but it can also be adapted as a sampling booth for COVID-19 testing, which NYCR is looking to provide to their guests.

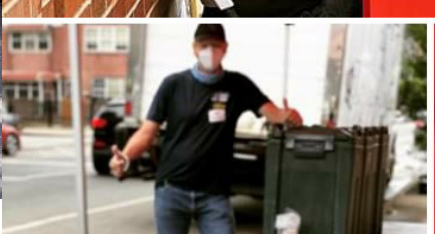
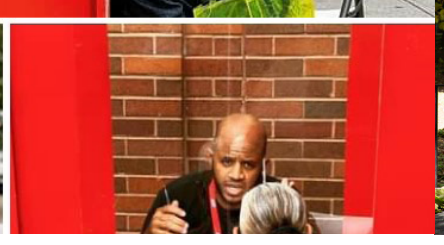
2 Build

For three consecutive weekends our team got together to build our first prototype of the pop-up booth




3 Test

New York City relief tested out the module at their Chelsea and Bronx outreach.

4 Refine

V1: Our first iteration was a foldable box/shelter for the NYC Volunteer. After some review we identified it focused primarily on the volunteer creating a hierarchical relationship

V2: Revise the booth to ensure an unbiased design which makes everyone feel equally welcomed no matter which direction they approached the booth. 4 panels (2'x8' each) unfolded into a Z shape to create an open booth that still defines a area of privacy on both sides. In the center a table folded out revealed a window that allowed for visual connection between occupants.

V3: Built as the first prototype. The height was lowered to 7' and the foldable table removed to allow for a more stable connection of a bolted in place shelf/table that could be removed/installed during setup/take-down.

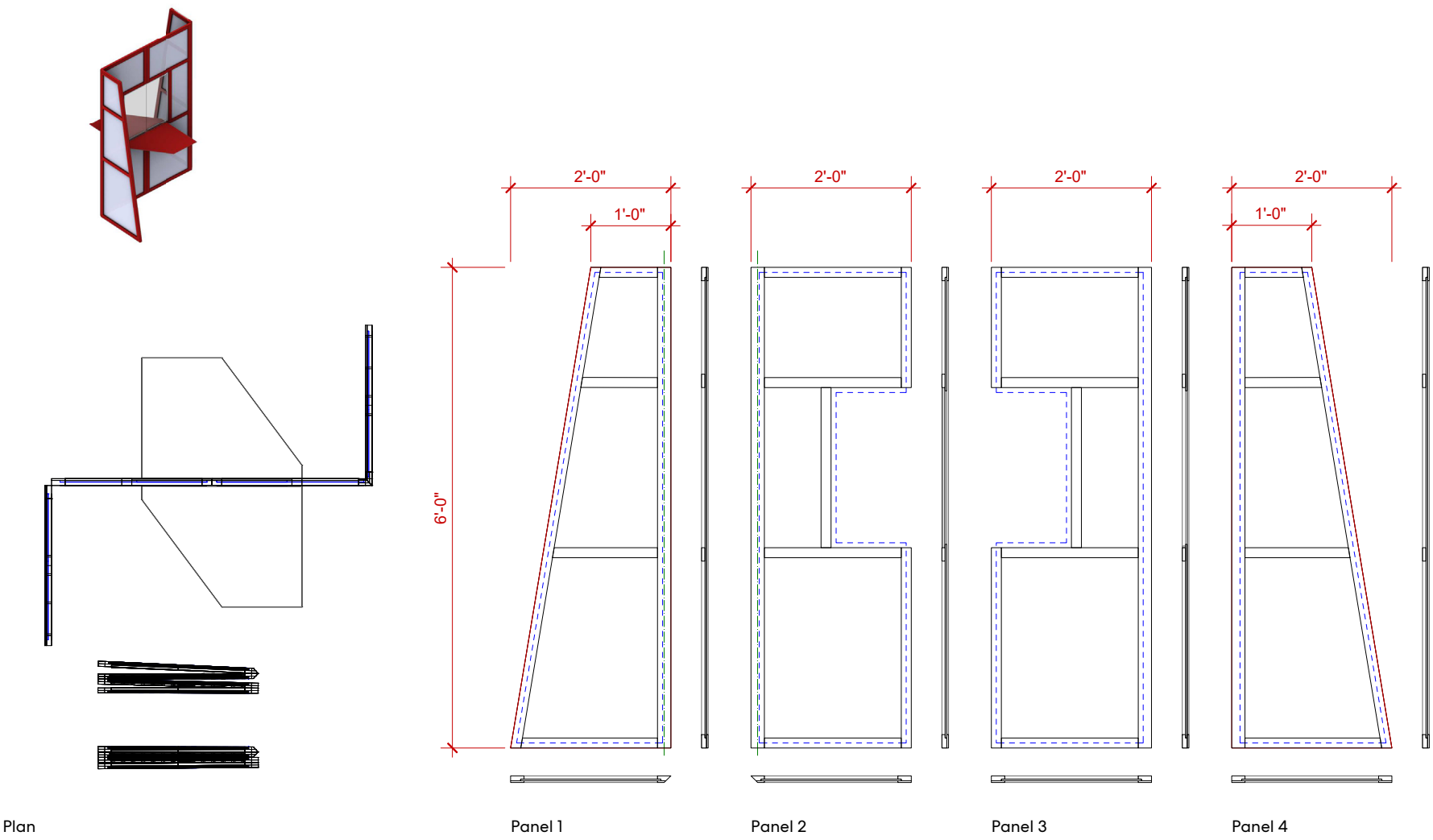
V4: Currently documented (See next page). In this iteration we are looking to reduce weight and create a better work surface. To do this we are proposing a reduction of the overall height and an angle for the boards to create a more dynamic intervention. The desk is getting deeper and getting an angle that will still direct the occupants to look at each other while having ample work surface.

5 Document

New York City Relief
295 WALNUT ST. ELIZABETH, NJ 07201
(800) 736-2773

Pop-Up Care: Layout

Perkins and Will
1250 Broadway, New York, NY



Plan | Panel 1 | Panel 2 | Panel 3 | Panel 4

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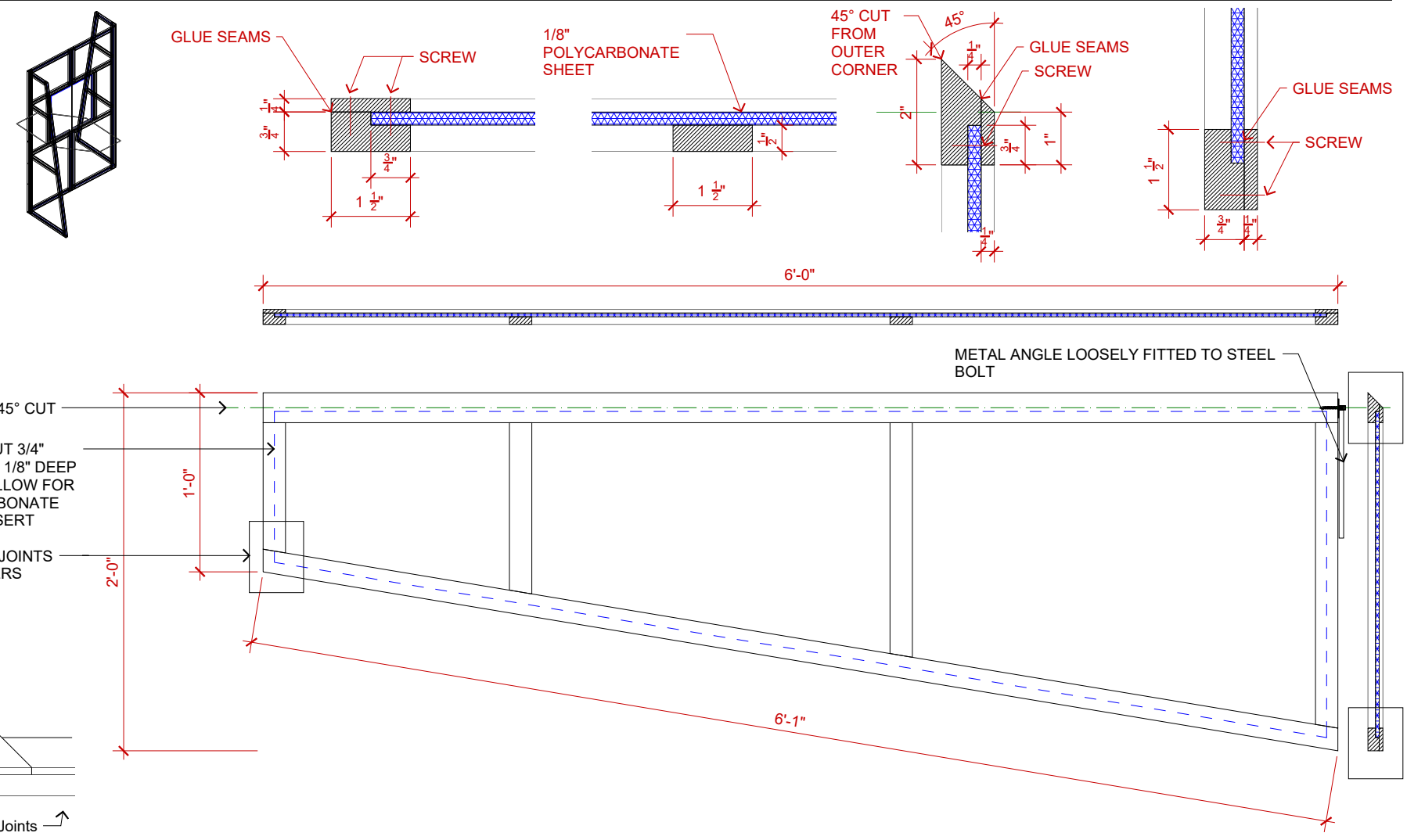
Pop-Up Care: Panel 1

Perkins and Will
1250 Broadway, New York, NY



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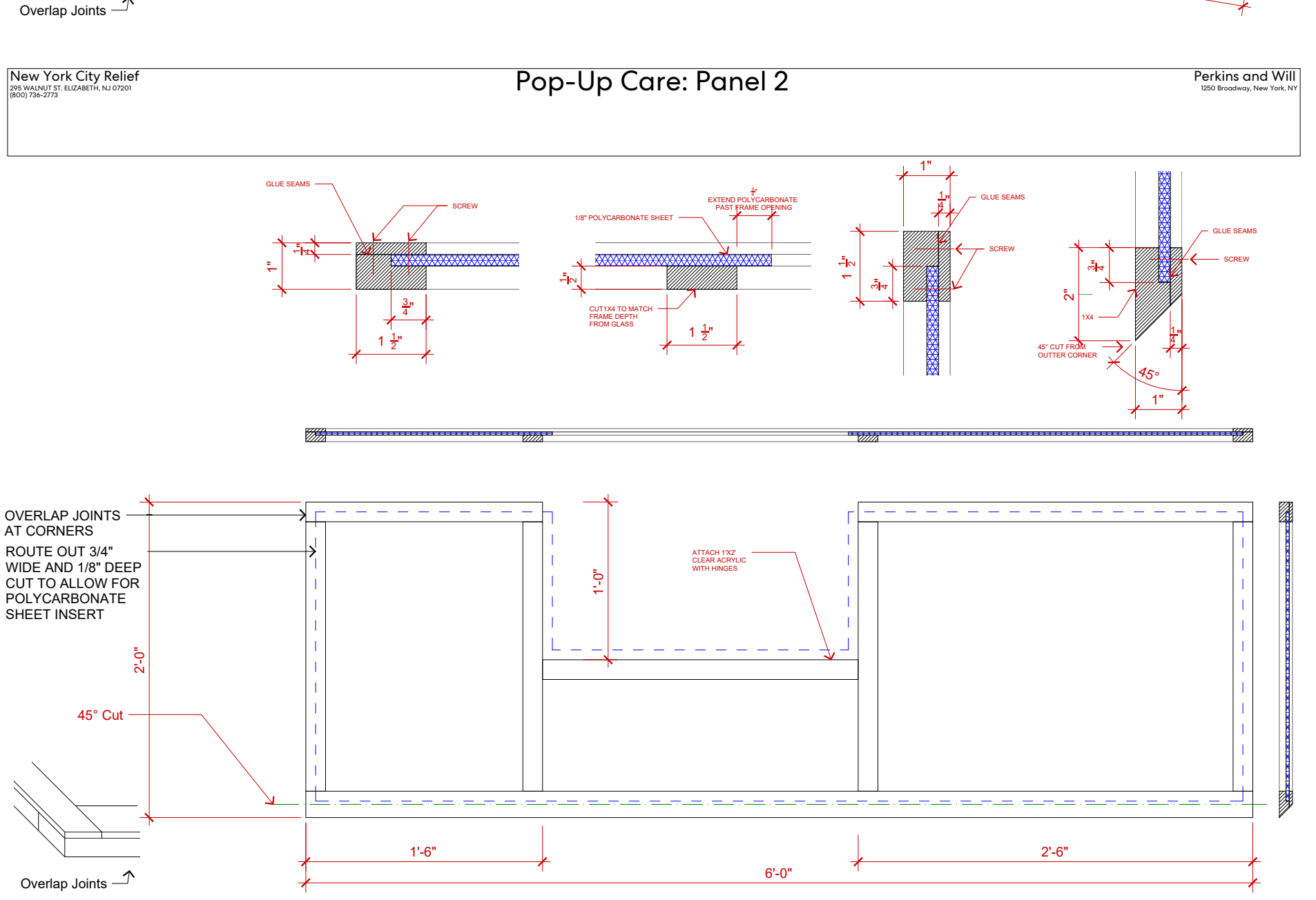
Pop-Up Care: Panel 2

Perkins and Will
1250 Broadway, New York, NY



A multi-disciplinary approach

Our Larger Team

We strongly believe that the success of our project can be attributed to the individual passion and the multi-disciplinary approach or each of our team members. There has been an immense team effort put into this project and learnings that we want to share as part of our research.

Jordan Hanson

"One of the most satisfying things about this project was its scale and timeline. As designers we always have dreams of contributing to society via design. However, our typical projects stretch over months/years with the same amount of time post construction to hear user feed back with no sureness that we can act on that feed-back. The pop-up-care unit allowed us to get to the root of a single problem with equity/health safety and design something to break down those barriers in away that we could act over weeks instead of months. With user feedback happening immediately."

Katie Johnson

"I was grateful to be part of this innovation incubator team. NYCR is an organization that is near and dear to my heart, and they have an very important mission to serve the needy in our city. It was such a valuable and rewarding experience to leverage our design expertise to make a positive, real-world impact during COVID. I am hoping we can continue this type of work with NYCR and other community organizations"

Mariana Giraldo

" If I had to choose my top three lessons learned from this project I would say:
a) There are risks that are definitely worth taking, especially when you believe you have a strong and well structured idea voice it out and people will listen, **b)** having a good idea is never enough, it takes a village of passionate people who believe in the outcome **c)** Even if your idea benefits society you will encounter challenges outside of your control and navigating those barriers can be exhausting, but it is also important to keep pushing."

Iv Shquevi

"Initiative: doing something without being told you have to. Sometimes the strongest and most worthy projects are the ones in which you are part of a team that is out there combating one of the deadliest diseases of our generation. A team that will do the research and come up with a design that can become an opensource example of how to bring equitable healthcare to all populations around the world and in our community. I am glad to have had a part in this initiative."

Matt Malone

"This project offered us an opportunity to cross collaborate in ways that we had not been taking full advantage of to now by having an S&T view on a concept that helped enrich it as an idea, but perhaps more importantly this incubator allowed us to do that for an initiative that was public facing and for the public good, or the betterment of our community and world. The idea materialized easily into a project because the team shared a passion for what we were doing and what each member brought to the team."

Rob Goodwin

Enlai Hooi

The interesting thing for me was looking into the root causes of COVID-19 infection and prevention and taking it from a first principles approach as opposed from an architectural approach.
Having the opportunity to face the client with a distributed team was also interesting. Distance can challenge your ability to sympathize and get to the root of the problem. A lot of came down to empathy and successful communication.

Michael Woods

"It was so good to see that we could respond quickly and effectively to NYCR's needs. No project is too small or too temporary to have a significant impact. As architects, we don't always see that. Our film can share the message with a much wider audience that can support NYCR. People in other places can see how similar ideas can work for them."

The Mobile Testing Lab in the News:

We could turn out-of-use school buses into low-cost mobile COVID test labs. Fast Company, April 2020

Firms turn to school buses, shipping containers for speculative COVID-19 testing hubs. Arch Paper, June 2020

How School Buses Could Become COVID Testing Labs, Commercial Observer, June 2020

Perkins and Will Designs COVID-19 Mobile Testing Solution Using Retrofitted School Buses. Interiors+Sources, June 2020

Estúdio projeta estação de testes móvel para coronavírus. Casa Vogue Brasil. April 2020

Perkins and Will-led team develops COVID-19 mobile testing labs for under-served populations. Archinect, May 2020

Global design firms collaborate on new COVID-19 mobile testing lab to bring testing to vulnerable communities worldwide. Building Design & Construction. May 2020

Perkins and will & schmidt hammer lassen retrofit school bus into COVID-19 mobile lab. Design Boom, May 2020

Architects design COVID-19 mobile testing labs for underserved communities. Inhabitat, May 2020

Design Firms Collaborate on New COVID-19 Mobile Testing Lab. Canadian Interiors, May 2020

On the Ground: How a Grassroots Network of Architects Produced Critical Pandemic Responses. Oculus Magazine. 2020

Temporary Architecture Podcast. Monocle on Design, July 2020

Action in the Age of Crisis. Contract Magazine. July 2020

Bibliography:

References:

1. Coronavirus Testing Goes Mobile in Seattle.
Retrieved from: https://www.nytimes.com/2020/03/13/us/coronavirus-testing-drive-through-seattle.html

2. Laboratory testing strategy recommendations for COVID-19, World Health Organization.
Retrieved from: https://apps.who.int/iris/bitstream/handle/10665/331509/WHO-COVID-19-lab_testing-2020.1-eng.pdf

3. The Doctor Who Helped Defeat Smallpox Explains What's Coming.
Retrieved from: https://apps.who.int/iris/bitstream/handle/10665/331509/WHO-COVID-19-lab_testing-2020.1-eng.pdf

4. Coronavirus News: First use of rapid test for COVID-19 happening on Long Island,
Retrived from: https://abc7ny.com/rapid-test-for-coronavirus-long-island-nassau-county-suffolk/6068435/

5. Bus, van to offer preventive care for under-served: Cambridge,
Retrieved from: https://www.nwaonline.com/news/2019/apr/01/two-mobile-health-centers-will-roll-out/

6. Mobile Health Map,
Retrieved from: https://www.mobilehealthmap.org/tools-and-resources and https://www.youtube.com/watch?time_continue=489&v=PcGBGOymLd8&

7. ID NOW™ COVID-19 MOLECULAR. IN MINUTES. ON THE FRONT LINE,
Retrieved from: https://www.alere.com/en/home/product-details/id-now-covid-19.html

8. Interview with Kathy Saber MD, conducted by Iv Shqevi

9. Test and Trace: Mayor de Blasio Announces New York City Test and Trace Corps, May 8th 2020.
Retrieved from: https://www1.nyc.gov/office-of-the-mayor/news/333-20/test-trace-mayor-de-blasio-new-york-city-test-trace-corps

10. De Blasio creates 'Test and Trace Corps' for NYC's battle to eradicate coronavirus. May 8th 2020.
Retrieved from: https://www.nydailynews.com/coronavirus/ny-coronavirus-test-and-trace-corps-nyc-de-blasio-20200508-keejptcqorczvgphdc4cmy4gpm-story.html

11. Department of City Planning (DCP) Open Source Data New York City Population By Neighborhood Tabulation Areas.
Retrieved from: https://data.cityofnewyork.us/City-Government/New-York-City-Population-By-Neighborhood-Tabulatio/swpk-hqdpa

12. New York State Department of Health New York State Open Data. Health facility map - Last Updated May 21,2020. Retrieved from: https://health.data.ny.gov/Health/Health-Facility-Map/875v-tpc8

Images from:
https://www.pexels.com/photo/man-wearing-a-face-mask-driving-a-vehicle-4391481/
https://unsplash.com/photos/9b4QLnWR3Sk
https://unsplash.com/photos/Yww5F0Vqh0I
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