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HEALING
ON
DEMAND

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Prefabricated construction can be leveraged to effect healthcare growth after natural disasters
abstract

If you injured yourself at home you would not go to a store, buy supplies, and then create a bandage. In this situation most would simply reach for a first aid kit and immediately apply a pre-packaged bandage. Over many years this has become the standard for much of healthcare. Solutions are immediate and efficient.

Unfortunately for the larger physical elements of healthcare, like hospitals and smaller health clinics, this immediacy of service is currently less possible. When a healthcare crisis arises, like in the case of natural disasters where medical facilities are damaged, it can take years for permanent facilities to be re-established. As of now the immediate medical response to disasters is only temporary. In the U.S. needs are established, personnel are dispatched, and existing healthcare infrastructure is supplemented by temporary physical structures such as tents. In many situations globally, facilities are damaged beyond repair or there is simply no existing infrastructure to supplement. In these situations temporary solutions often become primary care. Monetary aid is initially overwhelming and temporary medical aid is immediate, but these solutions lack permanence and money too often runs out before lasting facilities can be constructed.

What if permanent healthcare facilities could be constructed with the same speed as they were destroyed? In a world where a hospital could be put in place like a band-aid from a kit, there might be potential for disasters to create growth in healthcare instead of destruction. If permanent facilities could be realized more quickly following disaster, their funding could be more adequate and their positive impact on communities would be expanded.
why healthcare

STATUS QUO
Architecture is not merely something humans have constructed; it is part of our identity. In times of disaster loss of home often defines refugees and destruction of large structures can indicate the fall of a city. The destruction of hospitals, however, represents the loss of life. In the wake of disaster homes may be rebuilt over time but the lives of hundreds and thousands depend on the amount of time it takes to reestablish healthcare infrastructure, if it ever existed prior to the disaster.

It is this ultimate necessity that has historically limited disaster relief to temporary structures capable of being installed sometimes within hours. The International Red Cross is currently capable of rapid deployment “within 48 hours of alert” with support for triage, first-aid, and medevac evacuation. This response is one of ten phases to their emergency response. The initial ERU, or “Emergency Response Unit” is then followed by more robust phases of healthcare services and additional logistics support like communications, water, and volunteer housing. There is very little argument with these services and their success. Thousands of lives have been saved by non-government relief agencies like the Red Cross all across the globe.

The issue, however, is that in the capacity of a relief organization for natural disasters, large NGO’s are primarily focused on assessment and mitigation of the most immediate threats to life and restoration of necessities like food and water. The subsequent recovery of homes, churches, and ways of life is usually handled by secondary volunteer organizations. Most importantly, the reconstruction of hospitals is often undertaken long after the initial response, if at all. The service offered by the Red Cross is effective but their units are only prepared to render services for up to four months with primary use confined to one month.
NEEDS
To put this timeframe of care in perspective it is important to relate it to the magnitude of services that are necessary in some situations. On January 12, 2010 Haiti was devastated by an earthquake and according to Doctors Without Borders, “60 percent of an already dysfunctional health system was destroyed in an instant.” In this case the “already dysfunctional” health system was one supplemented almost entirely by foreign aid for nearly two decades.

The quake was a catastrophe with over 200,000 Haitians killed and 300,000 injured, but in this case these 300,000 new patients were also a compounding factor with the entire underserved patient base already spread across the country. To expect auxiliary health services to handle just the new victims would be a tall order in itself. To overcome the sheer logistics of managing millions of patients during an immediate relief effort is simply impossible. Very quickly that four month time frame allocated for “relief” becomes an effort in managing the preexisting inadequacies of a devastated nation as new and existing patients become one in the same.

If only to expand the validity of Haiti as a study in compounding health needs, it is worth mention that in the same year of 2010 Haiti was ravaged by an outbreak of Cholera killing nearly 6,000 and infecting another 216,000. Between the quake and the infectious outbreak half a million patients were created in ten months. Just six months after the quake health services were straining to keep up, and 4 months later they would be struck with the outbreak of Cholera. This compounding of devastation is common in extremely poor countries as acute crises often exacerbate preexisting dangers.

The silver lining even after a few months was that the disaster relief effort had actually improved health service for many Haitians. With hundreds of international staff volunteering medical services the period of recovery was also an intense learning experience for many locals in healthcare practices.
At its peak two months into the effort there were 26 medical facilities, up from numbers that before could be measured on one hand, with only a single full hospital. Even six months in, though, issues started to arise with the sustainability of this bolstered healthcare. Within the year the temporary tents would be gone and efforts to build permanent structures were seemingly perpetually delayed. The daily tragedy for Haitians quickly became not a lack of healthcare volunteers and professionals, but simply a lack of permanent medical facilities.

The work done by hundreds under quickly assembled tents saved millions in Haiti, but tents can only last so long. Unfortunately their alternatives are simply inadequate in an emergency situation. Even the simplest permanent structures take too long to be effective in first response applications. In countries with already strained health systems there often seems to be this dilemma of both immediate and long-term healthcare infrastructure needs. This dangerous predicament is brought to light in times of disaster, but what if disaster could bring about a solution as well?
GROWTH POTENTIAL

Much can be learned from the status quo of light metal and fabric emergency medical facilities. They can be employed almost immediately and they are flexible enough for any environment. The major flaw is that after months they become inadequate for the standards of modern healthcare. In countries with robust health systems this is usually not a problem. In countries with healthcare deficiencies like Haiti, however, the impermanence of relief is an issue. According to the United Nations, funding for earthquake relief decreased from $1.1 Billion to $52.5 Million. \(^1\) After the initial relief effort an entirely new campaign must be undertaken to set up permanent facilities to transition to full recovery and potentially into a period of growth. This secondary phase of foreign aid is often fraught with issues of financing and commitment officials in country, and is even underserved by the private sector of investment.

By taking advantage of the funding in the initial “flash appeal” for aid after disasters, communities could grow through permanent institutions with medical and social functions. To achieve such immediate realization of facilities, however, new construction techniques must be employed. Projects which are completely site built require time to address issues of site, labor contracting, and material quality. Just as the Red Cross prepares emergency units for full service prior to deployment, permanent building elements can be outfitted prior to on site deployment for increased quality and efficiency. The benefits of prefabricating healthcare facilities has seen at a small scale in projects for nearly a decade. Most examples to date have been based off of the standard ISO container for the benefit of deployment logistics. Even at a small scale, these projects highlight the advantages in prefabrication, being outfitted with top of the line medical equipment and facilitating cutting edge medical care.

\(^1\) OCHA HAITI http://ochaonline.un.org
One approach to this is the use of shipping containers that have been repurposed to include a multitude of healthcare services within them. The organization Clinic in a Can has been able to offer this innovation across the globe with active clinics in Haiti, Sierra Leone, Nicaragua, Nigeria, Kenya, South Sudan, United States of America, United Arab Emirates, Saudi Arabia and the Philippines.

Similarly the organization Containers 2 Clinics has used this containerized strategy to create a multi-container health clinic in Haiti. Their women’s health clinic employs the same technology as clinic in a can but uses a modular connection strategy to create an expanded healthcare program.

Containers have also been employed to create clinics outside of disaster environments. In Java, Indonesia the structure of the ISO container has been combined with simple onsite additions to create a women’s clinic with a library space. While not under the time constraint of disaster relief, this project highlights the potential for a low cost facility to promote health as well as social growth in areas with minimal healthcare infrastructure. Just as Haitian’s were already experiencing need before the 2010 earthquake, many global communities deal with a serious lack of healthcare facilities as their status quo.
Clinic In A Can [2002]
Global [based in Wichita, KS]

With the support of suppliers like Midmark, Hill-Rom, and General Electric, the Clinic in a Can organization has been able to innovate a full service medical clinic with the mobility of a conventional tent based system. Their modular clinics are built within 20’ or 40’ standard shipping containers and can be outfitted with all equipment necessary for a variety of health services. These units are also completely self-contained with all necessary medical fluid and gas systems prefabricated inside.

Each module, with four potential units, may serve hundreds but with an aggregation of more modules it becomes possible to offer nearly full service healthcare relief to thousands, with almost zero onsite construction time. These units are currently online in Haiti, Sierra Leone, Nicaragua, Nigeria, Kenya, South Sudan, United States of America, United Arab Emirates, Saudi Arabia and the Philippines.

Containers 2 Clinics [2010]
Global (based in Miami, FL)

The work of Containers to Clinics is similar to that of other like ClinicinaCan but their focus is more on recovery of existing health systems than rural medicine. C2C attempts to partner with organizations on the ground to bolster their services and benefit the local health system. Their clinics not only offer care but also valuable data collection to help assess the needs of the local community. In their efforts to alleviate child mortality in Namibia, their units were used in direct partnership with the Ministry of Health.

Unlike CIAC’s stand alone containers, the clinics by C2C use two containers in an “L” configuration to allow for more flexibility and space. Their goal is to allow for adaptability and potential for expansion in a long term application. This approach allows communities to take ownership of their healthcare by giving them a facility that will last and grow with the needs of the patients.
Womens Health Clinic, Haiti [2010]

ARCHITECT: santec/stack design
ENGINEER: allied container systems
CLIENT: containers2clinics (c2c)
TYPE OF CARE: outpatient primary care
NUMBER OF BEDS: n/a
MATERIALS: ISO containers
METHOD OF ASSEMBLY: modular/onsite construction
SITE CONTEXT: rural
DEPLOYMENT (MIN/MAX): 3,000sf
PATIENTS SERVED: >10,000

program

surgical:
Pre/Post-Op [70sf]
Sterilization [50sf]
Surgery [115sf]
Mechanical [60sf]
Restroom [35sf]
Pharmacy [84sf]
Lab [84sf]
X-Ray [80sf]
Dark Room [40sf]
Exam Rooms [75sf x 2]

preventative care:
Mechanical
Bathrooms
Lab [50sf]
Pharmacy [60sf]
Radiology [80sf]
Dark Room [20sf]
Small Procedure [80sf]
Dental [450sf]
MEdical Exam Room [75sf x 2]
Reception [40sf]

Amin Clinic + Library [2010]
Batu, East Java, Indonesia

ARCHITECT: dpavilion architects, surabaya, indonesia
ENGINEER: junaeedi masil associates
CLIENT: east jawa ministry of public works
TYPE OF CARE: outpatient/public library
NUMBER OF BEDS: n/a
MATERIALS: ISO containers/glass/steel
METHOD OF ASSEMBLY: mondular/onsite constr
SITE CONTEXT: rural

While built primarily as a library, this community hub in Batu also houses a health clinic. This integration of services allows for better awareness of healthcare among villagers. This clinic is not focused on emergency medicine but instead fills the more globally pervasive healthcare gap created by poverty.

Projects like the clinic in Batu take the benefits of the container as a material and with minimal addition create an inspiring and hopeful environment. It can be important, when possible, to compromise efficiency to grow pride in a community.

process research

PREFABRICATION
While there have been advances in the use of prefabrication in healthcare for disaster relief, they have thus far been on a small scale. Projects using ISO containers are innovative but they are limited in their ability to support larger building programs. These smaller clinics help to prove the benefits of prefabrication for quality of care and speed of deployment but projects outside of healthcare may offer insight into opportunities for expanded care with the same efficiency of construction.

Prefabricated construction has made its most prominent strides in the housing sector. Homes have been constructed offsite and assembled onsite for decades. More recently, though, off-site construction has been advancing in the area of multi-family residential housing. Larger apartment projects have pushed the technologies of prefabrication as the growing housing markets demand faster and cheaper construction of units.

In the growing market of residential construction multiple methods of prefabrication have been employed. In projects such as Carmel Place and The Stack, both in New York City, units are built completely offsite with full interior outfitting done in the factory. Onsite work is limited to setting the units in place and application of the facade. This method has even been tested for disaster relief to alleviate immediate housing needs. Other projects use a more site intensive method in which elements of the building are designed as parts which are assembled onsite as a kit. While it began in residential projects this “flat pack” method has been employed in healthcare with the Puyo General Hospital in Ecuador.
Each of these methods provides unprecedented speed of completion by minimizing site work but each has different advantages. Complete prefabrication in which units are outfitted to simply be connected and finished offers quality control through factory tolerances but has its drawbacks in the flexibility of design. Because of their structural configuration, usually similar to a shipping container, they are limited in configuration but they benefit in their ability to expand almost infinitely as modules can be added. Their structural system is also well suited to projects in risky seismic zones due to the strength created uniform module connections. In studying the destruction created by Hurricane Andrew in Dade County Florida, FEMA concluded that modular homes fared best compared to other construction.¹

Compared to offsite construction of entire modules, “flat pack”² construction allows for more flexibility of design. With this method more complicated spatial connections can be achieved because the design is not constrained by standard geometries. Speed of construction is achieved by site work being limited to assembly of parts.

An understanding of the advantages of each method is essential to creating an ideal application of offsite construction for healthcare. In a post disaster application speed of delivery is most important, but a compromise may be necessary to achieve a design that could promote health awareness, community pride, and social growth.

Carmel Place [2013]
New York City, NY

ARCHITECT: narchitects
AREA: 35,000sf
PROGRAM: 55 apartments + retail
METHOD OF ASSEMBLY: offsite/modular [92 modules]
ONSITE TIME: 14 days
Built for a competition, the project at Carmel Place highlights the unprecedented speed of modular construction. This project employs lateral and vertical connections at corners to stack units. This method affords structural integrity with seismic resilience.
The Stack [2010]
New York City, NY

ARCHITECT: gluck+ architects
AREA: 28,000sf
PROGRAM: 22 apartments + retail
METHOD OF ASSEMBLY: offsite/modular [56 modules]
ONSITE TIME: 19 days

The Stack was the first modular project in New York City. This was an innovative proposal at the time and began the movement of prefabrication in NYC. Similar in scale and construction to the project at Carmel Place, The Stack employs techniques which could be applied to the connection of healthcare units in a multi-story configuration.

While construction of the 56 modules took four months, the 19 day site construction time represents the potential time of arrival for a design which was decided ahead of time and constructed prior to need. In the context of healthcare units could be designed ahead of time and theoretically be prefabricated on a similar timeline, prior to a natural disaster.
Emergency Housing Prototype [2014]
New York City, NY

ARCHITECT: garrison architects
AREA: 28,000sf
PROGRAM: 22 apartments + retail
METHOD OF ASSEMBLY: offsite/modular [56 modules]
ONSITE TIME: 19 days

Following Hurrican Sandy in 2012 the NYC Emergency Management Department with FEMA support developed a housing prototype for post disaster recovery.

The prototype consists of 5 prefabricated units that lock together to create 3 apartments, with two including 3 bedrooms. These units were constructed off site and thus were able to meet strict standards of quality and energy efficiency.

The intention of the exercise was to add to a disaster "playbook" from which solutions can be rapidly selected and implemented in disaster situations. These units can be constructed preemptively to allow for immediate deployment in the event of a natural catastrophe.

1-3. all images of garrison architects:
http://www.garrisonarchitects.com/projects/buildings/oem_housing_prototype
Puyo General Hospital, Ecuador [2012]
Puyo, Ecuador

ARCHITECT: PmMt Architectura, Ecuador
CLIENT: Makiber, SA/Salud Ecuador, Ministry of Health
TYPE OF CARE: Inpatient (PMI)
NUMBER OF BEDS: 125
MATERIALS: steel/plexiglass
METHOD OF ASSEMBLY: flat-pack/onsite construction
SITE CONTEXT: rural
DEPLOYMENT (MIN/MAX): 160,000sf

The hospital in Puyo is notable for its “flat pack” construction and its speed of completion relative to size of program. The project was completed in under a year. A project with double Puyo’s capacity was recently completed using the same method in Bengaluru, India. Again highlighting the advantages of prefabrication, this hospital in India was completed in only six months for $4 Million. The same traditionally constructed hospital would cost “nearly $30 Million”¹

program
1 main lobby
2 lobby
3 childrens space
4 administration
5 admissions
6 courtyard
7 nursing station
8 inpatient room
9 courtyard
10 post surgical unit
11 nicu
12 icu
13 emergency entrance
14 emergency dept
15 counseling
16 behavioral health
17 materials
18 outpatient surgery
19 psychiatric unit
20 pediatric unit
21 pharmacy
22 surgical suites
23 isolation unit
24 ccu nursing
25 physicians admin
26 shipping/morgue
27 ambulance staging

the test

The test of this thesis will be to design a hospital complex using a combination of the discussed prefabrication techniques. The goal of the proposal will be to create a construction system that will allow units of the hospital to be designed and fabricated prior to a natural disaster with deployment available immediately upon occurrence of a natural disaster. The design of the hospital will be one that can handle treatment and recovery of disaster victims in its immediate use, but also promote growth of health services in the community moving past the recovery period. With most disasters causing complete destruction, this proposal will serve a dual purpose as a growth catalyst in a broken community as well as a healthcare center.

While the Haitian Earthquake offers great insight into the potential application of an immediate healthcare solution, the needs of the Haitian community are so great that an initial proposal would not be able to expand quickly enough to be viable. To pragmatically test the proposal with more quantifiable data, it is more reasonable to provide a design for a smaller community with similar needs to many global communities affected by disaster.

In September of 2016 yet another earthquake shook the earth, this time devastating the people of Amatrice, Italy. This small town in central Italy was almost completely destroyed with its hospital sustaining great damage. Even without extreme poverty, this town of about 1,000 residents has experienced the same level of destruction as many Haitian villages. The destruction has been so complete that the town residents have said “the future is gone” \(^1\) and the mayor echoed saying “the town isn’t here anymore” \(^2\). It is this hopelessness that encourages a design that will not only provide aid to recovering victims, but hope to survivors of a future for their town.

\(^1\) http://www.cnn.com/2016/08/27/europe/italy-earthquake-amatrice-perugia/
PROGRAM
With ultimate scalability in mind this proposal will begin as a general service outpatient care facility offering limited scale of full hospital functions. Scalability is achieved by the ability of units to be aggregated into a larger site plan to include replications of the original mid-size layout. The focus will be on patient experience and the mitigation of patient stress due to isolation and trauma. The initial intervention will be about 7,000sf to include essential recovery health services.

Patient Intake [1000sf]
- clear identifiable entry
- potential integration with main waiting space
- privacy necessary for patient interviews

Triage [500sf]
- assessment of severity
- dispersal to other units
- decontamination showers
- examination and interview space

Circulation [2000sf]
- minimization of front/back of house
- few but wide circulation paths
- clear signage necessary to mitigate stress

Pre-Op [500sf]
- patient preparation space
- patient beds

Surgical [800sf]
- 12,000kg per unit for transport
- 300sf per unit
- airtight doors or electronic entry
- must be easily sanitized

Post-Op [1000sf]
- Patient beds

Pharmacy [200sf]
- security
- accessibility for medication distribution and nursing workflow
- close to operation modules

Exam Rooms [1000sf]
- privacy
- ease of sanitization
- 80-90sf each, larger rooms 100-110sf

Staff Housing [3000sf]
- quality housing necessary for staff commitment and comfort
- double units 300sf each

\[ \text{total sf} = 7,300sf \]

\[ \text{prototype \times 2} = 14,600sf \]

\[ \text{puyo general / proposed program} = 160,000 / 7,300 = 21 \text{ times larger} \]
SITE
Located 80 miles from Rome, the central Italian town of Amatrice was struck by a disastrous earthquake in September of 2016. The quake destroyed 80% of the village and highlighted the structural issues of an aging city. This comes as no surprise with Franco Barberi of Italy’s Civil Protection Agency saying “The case is not an uncommon one ... and according to statistics taken 2013 around 60 percent of Italian structures would also crumble if faced with earthquakes of a similar intensity to the recent one in Amatrice.”

With so much destruction the reconstruction of a modern hospital could be a catalyst for the rebirth of Amatrice all while supplementing the immediate aid efforts with modern healthcare facilities.

Unfortunately for Amatrice the Rieti region falls along the Appenine Mountain Fault line. The Topography essentially follows the historic pattern of earthquakes.

1. http://www.italianinsider.it/?q=node/4234
AMATRICE, ITALY
Located along an active fault line, the town of Amatrice has been at risk of an earthquake for centuries. The region is not only in danger from high seismic risk but also from an almost entirely crumbling building stock. With an earthquake occurring in nearby L'Aquila in 2009, it is apparent that the entire region could benefit from a modern hospital intervention. The town is so old that its original buildings fell in stark contrast to its modern additions. The maps and diagrams below highlight the disparity of damage between the older Western end of the town and the modern Eastern end. Additionally it was the Western end that felt the most extreme seismic activity as shown in the images diagraming three waves of the quake. To provide the most effective and lasting intervention, the proposal for a rapid deployment hospital will be sited within the Eastern section of Amatrice.
Focusing on vehicle access, convenience of pedestrian access, and construction site constraints, the site for the proposal has been set for a clear cut site along the Strada Statale N.577 behind the town's administrative buildings. This site is currently one of two which are hosting temporary housing and medical tents. With 145,000sf of space this site will conveniently join both temporary relief efforts and the permanent solution of the new hospital. The large site also offers the ability to expand the hospital in sections as the town recovers and grows. This expanded facility will also be able to support patients from throughout the region as modern hospitals are scarce. The flat site backs up to a deep slope offering views toward the valley below the town.
goals

The goal of this intervention will first and foremost be to aid the people of Amatrice by giving them access to high quality healthcare facilities. In doing this, however, the hope is that the town will begin to see growth and be encouraged to rebuild more sustainably for a long term future. If an immediately deployable hospital system can aid in initial recovery but then transition to a permanent health facility, the thesis will have been proven. Prefabrication will have brought a healthcare facility to a community in need and it will have lasting effects. In this case this will not be the only success. Proving the ability of prefabrication to shorten construction schedules and increase quality of health facilities provides the opportunity to propose similar solutions not only in towns like Amatrice but in places like Haiti. Further investigation, building off this proposal, could see more immediate healthcare solutions being implemented in many global communities affected by natural disaster.
design

In designing a prefabricated healthcare facility for Amatrice the scope of the town's needs became apparently more serious. It became obvious that the best way to serve this town would be not only to provide a rapid response solution, but also to create a center for healing in the continuing recovery, as this would be a long process. The program of the end design serves a larger initial number of victims, and has more adaptable space for to fulfill the less acute trauma needs of long term recovery. The hope is that this facility would be able to shift its function to primary care facility for the town and its surrounding region in the years to come.

In setting out to prove that prefabrication can be leveraged to effect healthcare growth after natural disasters, the design process clarified this goal. In the end what was proven was that, in areas where lack of construction infrastructure might delay reconstruction of a hospital, prefabrication can deliver high quality construction at a faster pace.

The facility that ultimately came out employs 110 main modules, accompanied by 110 systems modules, to create 16 recovery rooms, 12 exam rooms, 32 intensive care beds, and 4 operating theaters. As trauma needs decrease, intensive care space can be shifted toward rehabilitation. By employing an attachable system module with each main module, onsite systems connections are simplified to linking the lines of each module, as opposed to full on site HVAC, electrical, and plumbing installation.

The scheme of the facility is such that critical and non-critical functions are divided between the East and West sides of the site, with circulation running from the entry into both zones without conflict of foot traffic.

After four months of design, this system would take just over six months to fabricate and deploy, based on pricing of comparable modular systems created by established suppliers. While this type of system has not been fully tested in a healthcare setting, it is the goal of this proposal to further the discussion about how prefabrication can improve the lives of disaster victims.
HEALTHCARE RECOVERY DISASTER RESPONSES

- **TENTS**
  - Repair in 2-4 weeks, 50-250 beds

- **HYBRID MOBILE CLINIC**
  - Repair in 2-3 weeks, 50-250 beds

- **PREFABRICATED FULL RECONSTRUCTION**
  - Repair in 6-12 months, 300-500 beds

COURTYARDS

- **CRITICAL**
- **NON-CRITICAL**

CIRCULATION

- **RECOVERY**
- **EXAM**
- **ICU/SICU**
- **OR/OP**

CAPACITY

SITE 1
MODULAR COMPONENTS

REPURPOSING GRADE-LESS SPORTS FIELDS ALLOWS FOR USE OF PREFABRICATED FOUNDATION PANELS.

"MAIN" MODULES ARE DEPLOYED WITH MAIN STEEL FRAME, INTERNAL STRUCTURAL WALLS, AND INTERIOR FINISHES.

1/4 HEIGHT "SYSTEMS" FRAMES CONNECT ON-SITE ABOVE FINISHED "MAIN" MODULES AS SPACE FOR ON-SITE LINKAGE OF MECHANICAL LINES.

LASTLY THE FINISHED ROOF AND FACADE SCREENS ARE ATTACHED.
GROUND FLOOR PLAN

NON-CRITICAL AND RECOVERY FUNCTIONS FOCUSED ON THE WESTERN SIDE

CRITICAL SERVICES FOCUSED ON THE EAST SIDE

UNIVERSAL FUNCTIONS LOCATED CENTRALLY WITH SEPARATE PLANNING CORRIDORS FOR HIGH AND LOW TRAFFIC
MODULE ARRANGEMENT PLAN

SYSTEMS ROUTING VIGNETTE
RECOVERY ROOM

Separate HVAC frame
Allows flush ceiling.

RECOVERY COURTYARD VIEW
sources


