Scaling up healthcare capacity at speed

Helping clients globally to prepare, respond and recover
WSP is focused on supporting our clients to control the spread of COVID-19, maintain business continuity and ensure the health and safety of our communities, employees, colleagues, friends and families.

We were able to assist our clients by deploying our specialist healthcare expertise to build capacity in field hospitals, modular expansions, temporary quarantine facilities; adaption of existing healthcare facilities, expedite construction projects and convert industrial facilities.

Please contact us to discuss how we can help you.
Adapting Existing Facilities

We can adapt existing healthcare facilities, whether in construction or complete, to enable the care needed for our clients and the community. We also understand the requirements and challenges in demobilising temporary solutions to meet future demand.
Existing facility adaptation

Rapid conversion or augmentation:

From
— Operating theatres
— Non-critical wards
— Outpatient facilities
— Ambulatory surgical care
— In-construction projects
— Parking structures or garages

To
— Additional ICUs
— Isolation units
— Lower acuity beds
— Entire wards
— Temporary quarantine facilities
— Drive-through assessment and testing

Advantages:
— Existing clinical environment
— Established; infrastructure, workforce, logistics, SOPs, Clinical standards

Challenges:
— Continuity of business whilst converting
— Finding suitable estate
— Limited available space
— Supply chain lead time

Critical paths

Acute focus on priorities

Take stock of every available asset and capability

Identify suitable space:

Review space utilisation
With elective surgeries being suspended which spaces can be quickly converted?
For example Pre-op, PACU, Exam rooms.

Assess locations
Can we exploit existing and adjacent infrastructure such as medical gases?

Identify the type of care required
Make the most of your existing negative pressure rooms. Do all patients need to be in an Airborne Infection Isolation (AII) environment?

Develop a robust clinical model
What patient pathways need review and what is the impact on space?

Ensure records of pre-Covid state
Have you audited and recorded any modifications? You will need to return the spaces to normal.

Create an emergency-prepared future
Could the temporary changes be adapted to enable a permanent switch of use with minimum effort?

Rapid response: Inception to operationalisation

<table>
<thead>
<tr>
<th>Day</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Assess need and type of space required</td>
</tr>
<tr>
<td>2</td>
<td>Identify suitable space and pre-existing infrastructure</td>
</tr>
<tr>
<td>3 – 4</td>
<td>Baseline buildings capability</td>
</tr>
<tr>
<td>5</td>
<td>Assess and overcome constraints</td>
</tr>
<tr>
<td>2 – 3 weeks</td>
<td>Fit-out core spaces</td>
</tr>
<tr>
<td>3 weeks to 3 months</td>
<td>Mobilisation</td>
</tr>
</tbody>
</table>

Assess equipment need and procurement early. We have the capability to help our clients engage suppliers, industry partners and ensure successful delivery.
Expediting hospital construction projects

OU Medical Center
Oklahoma City
Our team is working towards a temporary fit-out of two patient floors with ICU beds currently in mid construction. We are converting these floors into full negative pressure wings with HEPA filters and monitored pressurisation. The owner has targeted a 60-day completion. We are the general contractor and are providing building inspection services.

Henri-Mondor University Hospital
Créteil, France
As part of the project team we are proud to have contributed to the partial, early opening of the “resuscitation - blocks - interventional RBi” building creating 85 ICU bed capacity.

Kings College Critical Care Unit, UK
As part of an ongoing project our team have been working on the provision of two new floors of Critical Care Units (CCU). As the new CCU sits directly over the theatre block, the project also involves replacing all the theatre plant while the theatres remain in operation. We employed the commissioning specialists directly and, working continuously with a variety of the Trust’s regular subcontractors we completed the fire stopping, commissioned the fire alarm cause & effect and established the pressure cascade. The CCU is now in operation in emergency mode, doubling capacity through the provision of 60 much needed CCU beds.

Unity Health, St Michael’s Hospital
Toronto, Canada
Our teams have been involved in the early partial opening of Peter Gilgan Patient Tower. This will provide critical single patient rooms, designed with infection control measures to meet the current need for critical care units.

Dell Seton Medical Center at The University of Texas, Austin, US
The two towers at this facility operate at 100% outside air and are fully exhausted to improve patient well-being and the healing experience. WSP have advised on the isolation contingency plan for the operating rooms when needing to treat an infectious patient during this time.

Shattuck Re-occupancy
(BMC Newton Pavilion), US
To address a potentially large number of homeless COVID-19 patients, the city of Boston, in conjunction with the State of Massachusetts, decided to convert the unoccupied building, currently being renovated, into COVID-19 treatment space for approximately 300 patients. We provided mechanical and electrical engineering support to reactivating the building systems controls and balancing of the existing systems to ensure the intent of the M/E narrative is met. Working with architects SLAM and general contractor Gilbane this project was completed in 21 days.

Mask Production Facility
Hong Kong
We are appointed as MEP and clean room design consultant to retrofit, within two months, an existing warehouse in Tsuen Wan into a mask production facility. The 540 sq.m space will house three production lines and packing areas within a clean room environment built to Class 100K.

Adapting existing facilities

Municipal Hospital Munich Harlaching, Germany
We have supported our client in a fast track two day programme to fix and install equipment to create additional ICU capacity.

Kings College Hospital NHS Trust, UK
Through our long-term involvement with this site and its Estates team we are engaged to provide design and consultancy support for the extension of the piped oxygen service into two wards that have now been adapted to cater for critical care patients. The temporary installation was designed and installed in two weeks to increase the number of critical care beds by 54.

OU Medical Center
Oklahoma City
Our team is working towards a temporary fit-out of two patient floors with ICU beds currently in mid construction. We are converting these floors into full negative pressure wings with HEPA filters and monitored pressurisation. The owner has targeted a 60-day completion. We are the general contractor and are providing building inspection services.
Rapid Modular Construction

Our teams can design precision engineered modular buildings that enable rapid additional healthcare and quarantine space wherever required.
Types of facilities

- Additional ICUs
- Isolation units
- Lower acuity beds
- Entire wards
- Temporary quarantine facilities

Advantages
- Overcomes space limitations in existing infrastructure
- Adjacent to existing services
- Speed of delivery
- Ability to ensure quality control
- Easily repurposed
- 24/7 buildability
- Temporary solution to accommodate demand

Challenges
- Manufacturer needs to be able to change design quickly
- Establish local procurement and supply chain
- Manufacturers adapting to clinical best practice
- Mothballing
- Asset ownership
- Logistics
- Prohibitive contractual and bidding processes

Key considerations

Project set up and governance
- Establish your stakeholders early

Design phase
- Use BIM for seamless design
- Plan all spaces to reflect clinical best practice
- Prepare site advance works whilst modular in production
- Detailed design needs to be done before factory fabrication
- Compliance with building regulations

Pre-construction phase and preparation
- Maximise existing infrastructure and overcome constraints
- Customise installation method based on intended location
- Identify which components can be factory installed and which need to be done on site.
- Prepare foundations to support utility requirements, especially the drainage connection

Rapid response: Inception to operationalisation in under 3 months

<table>
<thead>
<tr>
<th>Month 1</th>
<th>Month 2</th>
<th>Month 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish brief and identify timeline</td>
<td>Develop and agree concept design</td>
<td>Detailed design</td>
</tr>
<tr>
<td>Form a strong team – integrated design development</td>
<td>Enabling works</td>
<td>Construction</td>
</tr>
<tr>
<td>Identify and assess local manufacturers</td>
<td>Expedite planning and approval</td>
<td>Assess and procure materials and equipment</td>
</tr>
</tbody>
</table>

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Modular healthcare facilities

Modular Isolation Container Design
Hong Kong
We are proud of two of our experts in Hong Kong for donating their time to design a fully-compliant negative pressure isolation room in a 20ft container. Using this technology, it is estimated it would be possible to build a fully-functional isolation hospital in Hong Kong in approximately one and a half months.

Norfolk and Norwich University Hospital (NNUH), UK
ModuleCo are delivering a modular healthcare building consisting of eight isolation rooms, two ICU rooms and associated support rooms. The fast-track project is due for completion at the end of May 2020. Our team are designing the MEP leadup services including medical gases, mains cold water, power, data, fire, security, and BMS; undertaking a peer review of ModuleCo’s MEP design proposals for the internal installations; designing the required services diversions; and the re-provision of existing services including, power, external lighting and a dry riser.

Temporary quarantine facilities (TQF)

Sai Kung Recreation Camp
Hong Kong
Number of blocks: 3
Number of units: 99
Size of units: 3m x 6m includes wash room facilities.
Purpose: Quarantine (14 days)
Future use: Disassembled to use for other purposes
Our services: Civil, structural and building services design consultant for the contractor including the utilities connection.
Duration: Mid-Feb to end of April 2020

Junior Police Pat Heung Centre
Hong Kong
Number of storeys: 2
Number of units: 126
Size of units: 3m x 6m includes wash room facilities.
Purpose: Quarantine (14 days)
Future use: Interim Housing.
Our services: Civil, structural and building services design consultant for the contractor including the utilities connection.
Duration: Mid-Feb to end of April 2020

Lei Yue Mun Park
Hong Kong
Number of storeys: 1-2
Number of units: 234
Purpose: Quarantine
Future use: Interim Housing with 4-storey tall capability.
Our services: Structural design consultant
Duration: Mid-Feb to mid-April 2020
Large Venue Conversions

We can repurpose large open-space venues to manage the surge. We will help you maximise the advantages and overcome the challenges of using these types of venues and enable rapid mobilisation of new healthcare space.
Suitable venues for consideration

**Conventional centres**
- Arenas
- Stadiums

**Advantages**
- Large floor space
- Established logistics teams
- Short lead time
- Overnight transformation capability
- Skilled in complex wayfindings

**Challenges**
- Navigation of local planning
- Provision of adequate utilities to supply clinical areas
- Project governance and leadership
- Fire compartmentalisation
- Clinical planning, governance and staffing requirements

Critical paths for successful deployment

**Optimise project team skills and delivery:**
- Establish your stakeholders early
- Confirm project structure and organisational demarcation lines
- Manage, record and audit the programme development from inception

**Understand infrastructure, equipment and constraints:**
- Obtain site drawings
- Plan procurement early – there will be lead time

**Deliver purposefully:**
- Plan utility spaces to reflect clinical best practice

Experience

**Birmingham NEC, UK**

As the clinical planners on this major convention centre transformation we are focused on delivering clinical best practice for a 4,500-bed field hospital which could be developed in phases as demand requires. The hospital was mobilised in nine days from inception to completion.

**Rapid response: Inception to operationalisation in 9 days**

<table>
<thead>
<tr>
<th>Day</th>
<th>1-2</th>
<th>1-3</th>
<th>3-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish the brief</td>
<td>Develop a responsibilities matrix</td>
<td>Develop the project scope, environment, infrastructure and needs</td>
<td>Develop programme and phasing</td>
</tr>
</tbody>
</table>

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Hotel Conversions

Our teams can repurpose hotels into robust temporary healthcare facilities, with safe, comfortable patient environments, quickly and efficiently.
Key considerations

We have already performed the design, testing and prototyping that will enable us to speedily convert hotel facilities into normal or isolated patient facilities.

**Advantages**  
- Designed for single occupancy  
- Existing back of house / front of house systems  
- Housekeeping and logistics in place  
- Robust electrical systems and back up  
- HVAC system and air circulation  
- Resilient plumbing for heavy use  
- Existing IT infrastructure  
- Windows enable easy individual space conversion  
- Access to daylight and outside views  
- Existing workforce can be utilised  
- Currently vacant

**Challenges**  
- Demarcation of clean and dirty areas  
- Control of infection  
- Soft furnishings harbour infection  
- Development of robust inclusion and exclusion criteria  
- Ensure electrical infrastructure meets requirements of additional loading  
- Ensuring clinical supply chain  
- Legal contractual requirements around ownership

**Hotel conversions**

**US**

Reviewing US Army Corps Engineers Site Adapts for Hotels and Arenas template. Working on design build teams and as prime for contracts. We have teams prepped and ready across the US and we are working on hotel conversion efforts in Richmond, Virginia and Boston, Massachusetts.

**Rapid response: a 6 step plan**

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3 – 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain existing drawings</td>
<td>Review spaces and pre-existing infrastructure</td>
<td>Baseline buildings capability</td>
</tr>
<tr>
<td>Assess equipment need and procurement early. We have the capability to help our clients engage suppliers, industry partners and ensure successful delivery.</td>
<td>Assess and overcome constraints</td>
<td>Fit-out core spaces</td>
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Hotel conversions: typical room layouts

### Layout option 1: moveable furniture

- **Option 1 Inner zone**
  - R1. Hotel bed
  - R2. Hotel bed with medical lines
  - R3. Hotel/reclining chair
  - R4. Hotel wardrobe
  - R5. Hotel desk
  - R6. Hotel plumbing fixtures

- **Option 2 Ventilation for source containment capture at bed**
  - Increase exhaust – likely bigger fan required
  - Potential OA transfer

### Layout option 2: fixed furniture

- **Option 1 Inner zone**
  - R1. Hotel bed
  - R2. Hotel bed with medical lines
  - R3. Hotel/reclining chair
  - R4. Hotel wardrobe
  - R5. Hotel desk
  - R6. Hotel plumbing fixtures

- **Option 2 Ventilation for source containment capture at bed**
  - Increase exhaust – likely bigger fan required
  - Potential OA transfer

### Special medical equipment

- E1. Ventilator capable; storage cabinet
- E2. Telemetry/pump on iv stand
- E3. Stool
- E4. Over bed table
- E5. Mobile work station
- E6. Linen hamper
- E7. Sharps/gloves
- E8. Hand sanitizer station
- E9. Infectious waste
- E10. Cubicle curtain

### Engineering changes

1. Remove carpet
2. Install vinyl flooring or epoxy
3. *Revise hvac ducting and hepa filtering*
4. Add emergency back-up power & ups
5. Add electrical outlets
6. Add privacy curtain

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Adapted using USACE’s H2HC
Our Expertise

We offer rapid response project management, advisory and engineering services and are able to mobilise and deliver within days.

Our professionals provide facility assessments, site adaptation design, commissioning, quality assurance and project management.

— experts provide rapid prototyping design solutions that ensure facilities protect workers and patients in a healthcare environment.

— research has enabled us to develop options for ventilated headboards and our experience includes Respiratory Intensive Care Units (RICUs).

We are
— Clinical planners
— Decontamination advisors
— Healthcare advisors
— Mechanical and electrical engineers
— Occupational Health and Hygienists
— Project and programme managers
— Retired military officers experienced in contingency operations
— Security consultants
— Structural engineers
— Sustainability consultants
— Technology consultants

We build collaboration into everything we do:
— We optimise the use of tools such as Microsoft Teams, Skype and SharePoint.
— We can conduct virtual site inspections to ensure connectivity between all stakeholders and speedy project delivery.
— Through our long-established global healthcare network we offer a wealth of experience to apply to your local challenges.

Our Healthcare Clients

Our priority, like yours, is to keep everyone safe. We appreciate that you are facing significant challenges and we are committed to combining our high-quality technical capabilities with our deep sector expertise to help you prepare, respond and recover.

Healthcare providers
— Australia, Department of Health
— Germany, Landesanstalt für Gesundheit (LGL)
— Health Canada
— Hong Kong Hospital Authority (HKHA)
— New Zealand Ministry of Health
— Singapore, Ministry of Health
— South Africa, National Department of Health
— Sweden: Vastra Gotalands Regionen, Region Skane, Region Uppsala
— UK, Department of Health
— UK, National Health Service (NHS)

Private providers
— Ascension
— HCA
— Shattuck
— UHS

Architects
— BDP
— HKS
— HOK
— Perkins and Will
— Earl Swensson Associates

Emergency response teams
— U.S. Army Corps of Engineers (USACE)
— Federal Emergency Management Agency (FEMA)
Scaling up healthcare capacity at speed
Helping clients prepare, respond and recover

ABOUT WSP
Dedicated to serving communities locally, nationally and internationally, WSP provides a full spectrum of engineering consultancy services, leveraging a global network of professionals to respond to challenges and crises wherever our clients need us to.

wsp.com/healthcare

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