2022 ASID IMPACT REVIEW:
BUILDING DESIGN, SYSTEMS & TECHNOLOGY INSIGHTS BRIEF

Interior Design:
Evidence-Based Design In Practice

RESEARCH STUDIES ON COVID-19
Moving Strategies To Post Pandemic Action

AMERICAN SOCIETY OF INTERIOR DESIGNERS
RESEARCH

OVERVIEW

Building design, systems & technology represents the most interdisciplinary part of understanding COVID-19 and the work of interior designers.

Solutions that have been identified and recommended to mitigate COVID-19 in the interior environment require a holistic approach to building design. As new systems emerge and technology advances, this integrative design approach positions interior designers at the intersection of building design and project management. Collaboration comes to light as an important part of the discussion.

"BOMA International helped lead the charge on shaping the commercial real estate industry response to the outbreak of COVID-19. Throughout the pandemic, BOMA has created numerous resources for our members to use when navigating CDC guidance and federal, state and local legislation and mandates. The work being done by ASID on behalf of the interior design profession is another important and necessary tool in making sure the commercial building spaces remain vibrant, useful and safe as we move into this new collaborative era."

– DON DAVIS, ESQ. BOMA

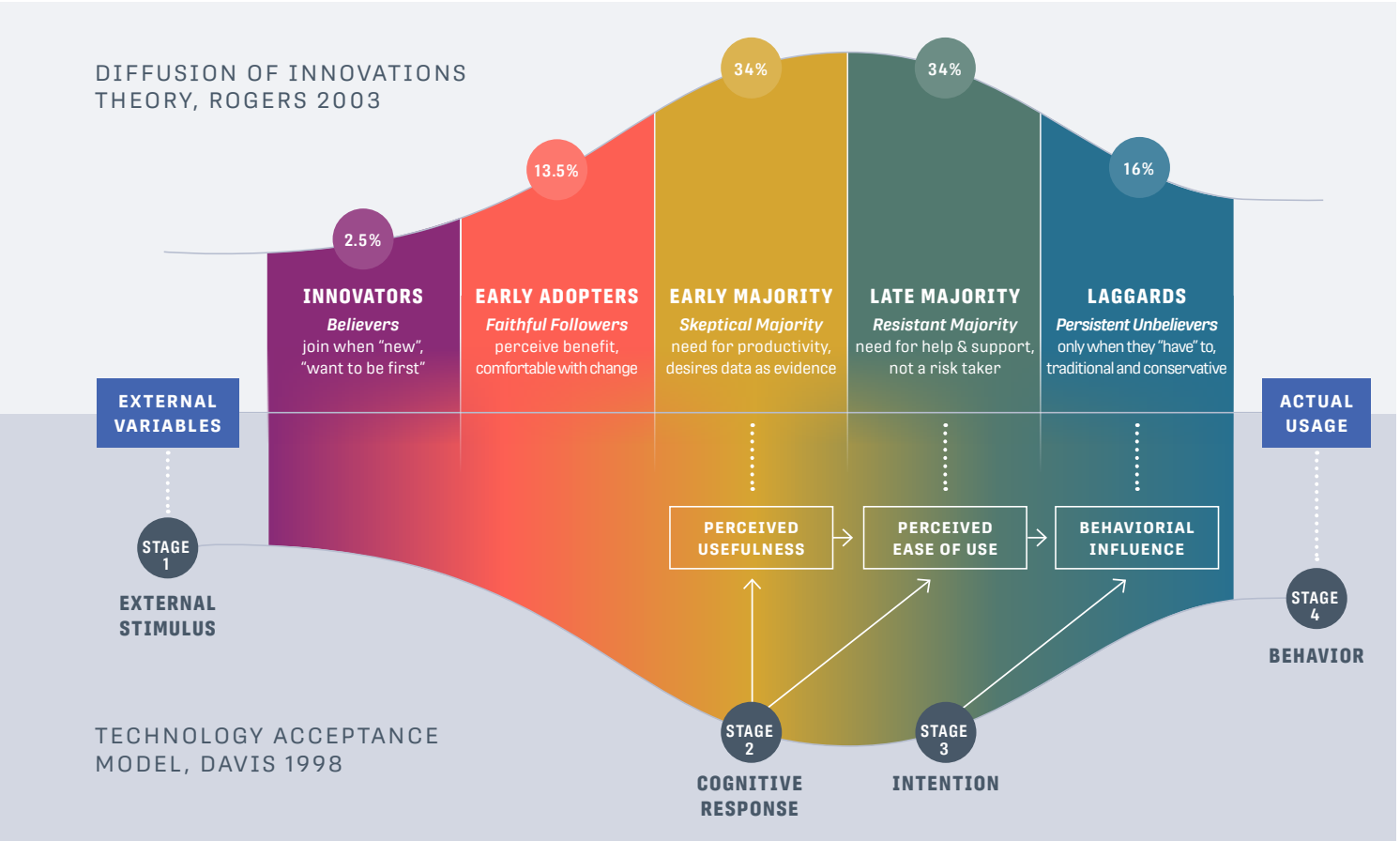
INTERIOR DESIGN AND BUILDING DESIGN, SYSTEMS & TECHNOLOGY

The effect of a global pandemic on the built environment presents an opportunity to understand the complexities of design from multiple viewpoints. Important in the conversation is the realization that technology drives change in all aspects of life and in particular the design of spaces, buildings, and communities. Recognizing the interface of technology in the context of innovation is relevant to the built environment, in that recent disruptions have required new solutions to building systems and design protocols. These challenges result in the need for a systematic and interdisciplinary approach to complicated scenarios that holistically impact buildings and human health. Technology plays a critical role in this discussion as the pandemic has accelerated the rate at which adoption occurs in order to solve issues related to buildings and interior spaces.[13] [16]

The *Technology Adoption Model (TAM)* is a framework for understanding how new technology and innovative solutions are accepted based on perceived usefulness, ease of use, and degree to which the intended technology may change behavior or have an impact.[5] [13] Coupled with the TAM, is the rate at which innovations are adopted, which is reflected in Rogers' Diffusion of Innovations Theory (2003). The Diffusion of Innovation suggests that technology is accepted quickly by risk taking innovators, early on in the process by adopters, and late (or not at all) by laggards.[18] Variables such as compatibility, trialability, and demonstrability play into decisions to adopt the innovations.[13] The Technology Adoption Model and Diffusion of Innovations follow a similar path of acceptance in that both are influenced by external variables, dependent on users, and result in the adoption or usage of technology. Because technologically based innovations are intrinsic to solving key building design issues, understanding acceptance and rate of adoption is significant. This parallel is reflected in the Integrated Model of Diffusion of Innovations and Technology Adoption below.

INTEGRATED MODEL OF

DIFFUSION OF INNOVATIONS & TECHNOLOGY ADOPTION



TOWARDS A MODEL FOR BUILDING DESIGN & SYSTEMS INNOVATION

The design of buildings has been affected not only by the pandemic, but technology that has pervaded society and the world in all aspects of life. Ubiquitous and diverse technologies that evolved from cloud computing, data analytics, communications, and devices are now integrated in the built environment for the comfort and well-being of humans and to improve functionality.[15] This technology interface, the Internet of Things, is an inherent part of building systems and design.

The Internet of Things (IoT) simply put, is the means through which devices sense, collect, communicate, and exchange information (data) through predictive and interactive means to create smarter environments. The application is scalable and varies from (smart) homes and workplaces, to buildings, energy, transportation, cities, and industries. These dynamic technologies can be defined in three categories of (1) people to people (2) people to machines/things and (3) things/machine to things/machines that interact through the internet.[9]

THIS DYNAMIC TECHNOLOGY CAN BE DEFINED IN THREE CATEGORIES

1 **PEOPLE** *to* **PEOPLE**

2 **PEOPLE** *to* **MACHINES/THINGS**

3 **THINGS/MACHINES** *to* **THINGS/MACHINES**

The fundamental principles of **flexibility**, **agility (diversity)**, and **adaptability** are components of the IoT and evidenced in evolving building systems that are intuitive and responsive.

As these technologies are infused more deeply into buildings and personal monitoring devices, they provide the impetus for design strategies.[11] The fundamental principles of flexibility, adaptability, and agility are components of the IoT and evidenced in evolving building systems that are intuitive and responsive. Design solutions interfaced with technology create opportunities towards a more resilient and healthy built environment for the future.[9] [15] [19]

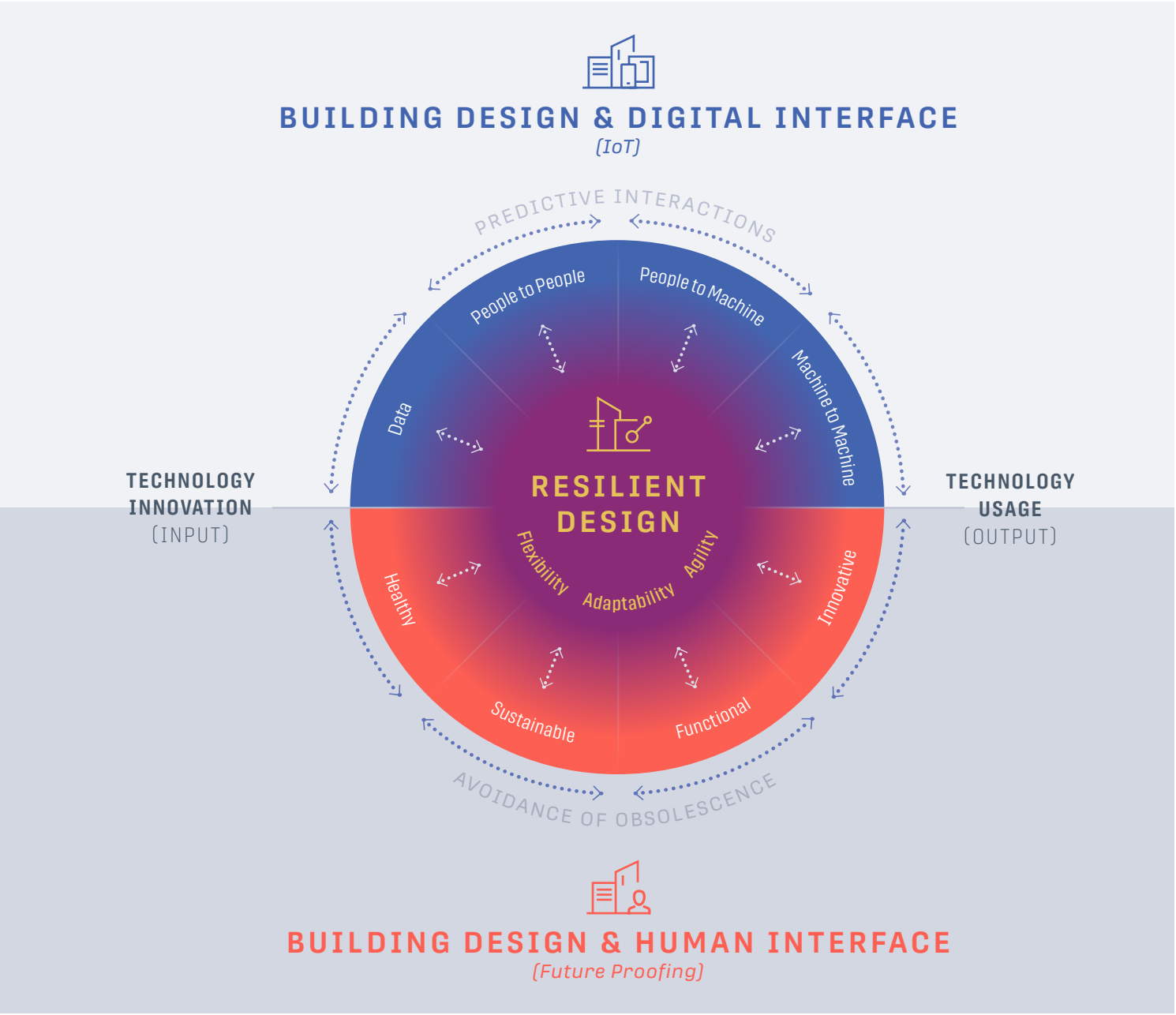
Similarly, designing for the future ("future-proofing") centers on resiliency with the goal of avoiding obsolescence. The process of future proofing (anticipating the future) is to design in the context of resiliency to lessen the effects of unintended events with minimal consequences. Avoiding obsolescence can be viewed through physical (materials and property), functional (operational), aesthetic (appeal), and sustainable (environmental) characteristics. These components start to frame a human interface with building design that leverages technology, functionality, human health, and sustainability.[16] [17]

Resilient environments are human centered and designed with **sustainability**, **durability**, **diversity** and **social equity** in mind.

Future proofing and the IoT are interrelated in that each requires a flexible, adaptable, and agile approach.[16] Both focus on technology as a fundamental input to the building system, requiring human adoption and interface in the process. The culmination of these constructs begins to provide a model for innovation that links technology with building systems and design, with resiliency as the connection. Resilient environments are human centered and designed with sustainability, durability, diversity and social equity in mind.[17] They can and must be able to leverage new technologies and developments.[16]

MODEL OF RESILIENCY

BUILDING DESIGN, SYSTEMS & INNOVATION



BUILDING DESIGN, SYSTEMS & TECHNOLOGY

A GLOBAL PERSPECTIVE

As the effect of the pandemic continues to be a global issue, internationally shared research has identified strategies and provided insight into solutions that link building design, systems and technology. These concerns are significantly related to indoor air quality *(source control, ventilation, and air cleaning)*, design of interior spaces *(flexibility, occupancy, finish materials, exposure to nature, and maintenance)*, and technological advances to enhance the built environment *(digital strategies for mitigation and control, sustainable practices, energy supply and conservation, touchless and sensory devices)*.[2] [6] [12] [14] [20] These are global issues influenced by population density, access to technology, natural resources, socioeconomics, and governance policies that impact the ability to mitigate crisis situations. Collaboration becomes an essential component in solving human health issues in a technology driven, global economy.

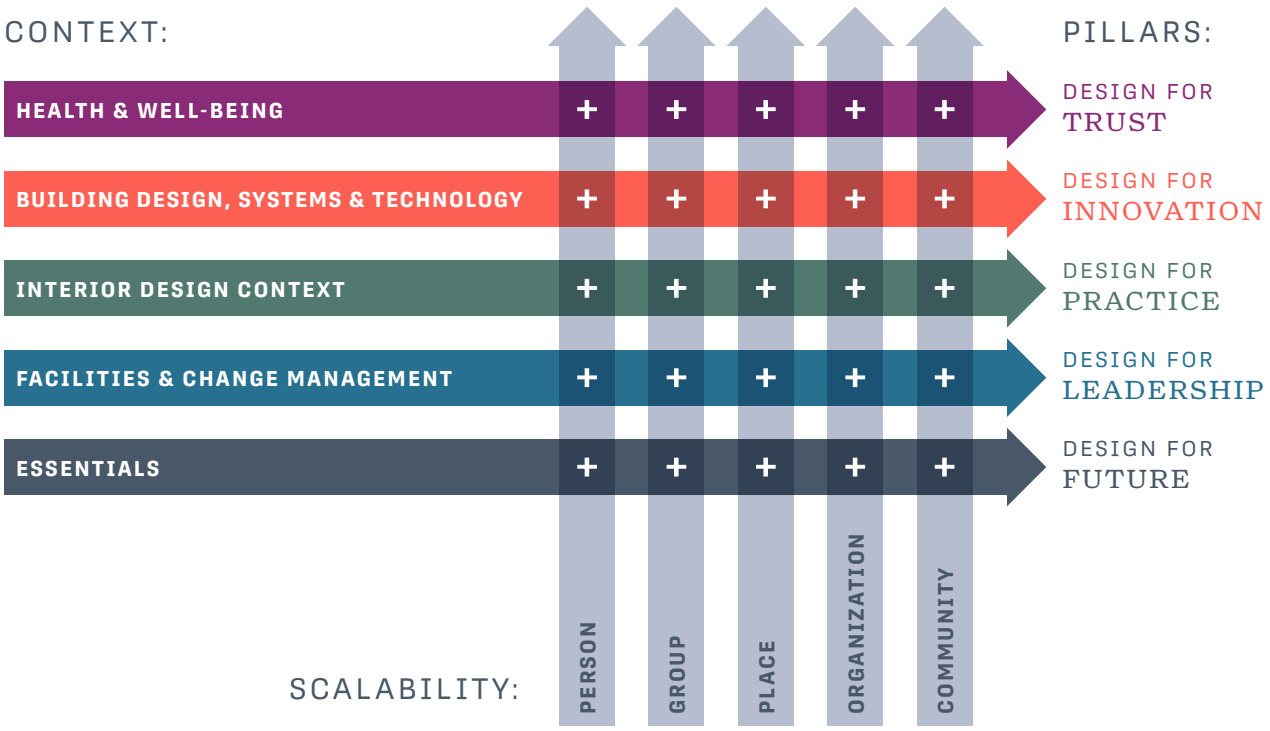
DESIGN FOR INNOVATION

The design process is creative, in and of itself, but does not necessarily lead to innovation. While both are framed around the concept of idea generation, innovation is built on "divergent" thinking, in that ideas are flexible, fluent, and original with the intent of implementing new procedures, practices, or products.[18] Contextual to innovation are mediators such as an environment that promotes innovation, leaders that encourage innovation, and individuals' or organizations' propensity for innovation.[7] Innovation drives technological advances and reflects mindset or need for change which may be the result of social, organizational, or environmental disruption. Innovation is at the core of transformative new strategies for the design of building systems and is deeply embedded in the technologies that affect human health and well-being.[12] In times of crises, as evidenced in the pandemic, the adoption of innovation is critical to mitigating environmental viruses. Innovation will continue to influence design for the future and is associated intrinsically with technology and the IoT.

INSIGHTS BRIEF: CONTEXT

FRAMEWORK

THE FIVE PILLARS OF DESIGN CONSCIOUSNESS©



"Five Pillars of Design Consciousness" define a framework that **informs the future practice of interior design**.

Key relationships in the critical areas frame new conversations linking to people and strategic design initiatives identified as "pillars." The result is a multi-disciplinary approach that connects interior design practice with research, technology, building systems, and innovation. Interior design is at the intersection of these issues as an intrinsically human-centered profession; collaboration among groups is an imperative in driving changes that impact health and well-being.

A HOLISTIC VIEW

CONTEXTUAL RELATIONSHIPS

Influencing Factors:

HUMAN-CENTERED | RESILIENT | HOLISTIC

The pandemic has impacted all aspects of life and consequently the health and well-being of people across the globe. Well-being is influenced by many variables, not the least of which are emotional stress, anxiety, trauma, and loss that affect wellness on multiple levels. Physical concerns related to the Corona Virus itself, coupled with the deeply rooted psychological and mental issues associated with months of isolation and loneliness have resulted in a new human-centered and holistic approach to design. As relationships between the built environment and health + well-being emerge, resiliency becomes a key variable.

Influencing Factors:

INNOVATION | FUTURE PROOFING | IOT

Transmission of the virus has required a new focus on air ventilation systems, filtration systems, fresh air capacity and disinfection, humidity and comfort controls are among other considerations. Lighting design has emerged as an important part of the building system and key to mitigation strategies. Integrative solutions in terms of metrics that monitor and measure key variables, space utilization, thermal sensors, and touch free technology positively impact human health & well-being. Interdisciplinary collaboration drives this conversation.

Influencing Factors:

SPATIAL CONFIGURATION | EVIDENCED BASED SOLUTIONS
INTERDISCIPLINARY COLLABORATION

Interior design has been identified at the core of solutions with direct impact on health & well-being, as confirmed by protocols established by the CDC. From minimalist design solutions (cleanable materials and surfaces) to flexible and adaptable spaces, social distancing, furnishings and product selections, and - materials, interior design decisions are key in reducing viral transmission and contribute to health & well-being. Spatial configurations that include natural views, daylight, and exposure to green space further promote sustainability initiatives and well-being.

Influencing Factors:

ECONOMICS | INFRASTRUCTURE | HUMAN BEHAVIORS

The pandemic has forced an unprecedented change not only in the approach to facilities but human behavior as well. Key factors including cleaning protocols, building usage and maintenance, and energy consumption affect design decisions. Outdated buildings and lack of investment in infrastructures have resulted in buildings that are not often capable of supporting recommended protocols to mitigate viral transmission. Utilizing space appropriately requires behavioral changes that are often difficult to manage. Social distancing, hand sanitizing, room capacities, and other protocols require cohesive strategies that communicate how design solutions impact health & well-being.

Influencing Factors:

SOCIAL JUSTICE | SUSTAINABLE COMMUNITIES
SYSTEMS THINKING

As has been seen throughout history, the result of this pandemic is a major shift in the way in which private, public and community environments are designed and maintained. The need for increased resilience, improved air quality, sustainable buildings, and a systems thinking approach to design and urban development is critical. The health & well-being of people, groups, and communities is at stake and transcends sectors and disciplines. Socio-economic issues, urbanism, and social inclusivity emerge as barriers to health & well-being, with clear implications for design solutions and broad scale collaboration. Increased green areas, renewable energy, closed-loop water supplies, and sustainable buildings are variables in mitigating future viruses. Emerging typologies have the potential to change the landscape of design and impact health & well-being for all people.

BUILDING DESIGN, SYSTEMS & TECHNOLOGY

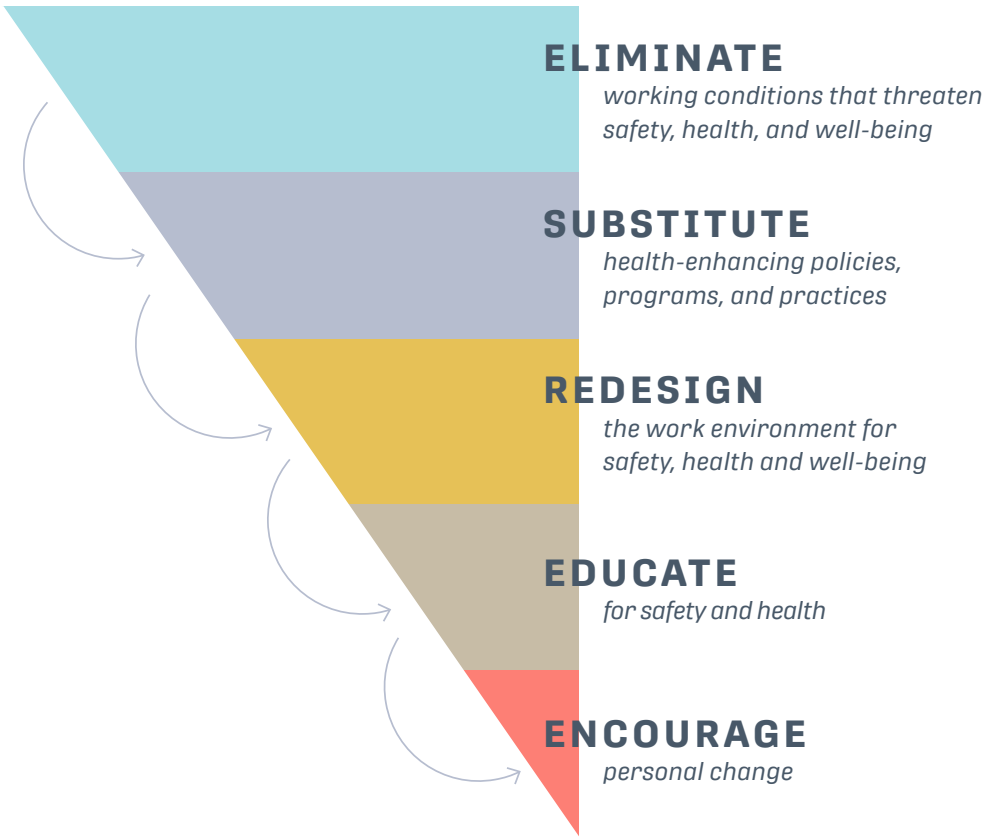
WORKER-CENTERED STRATEGIES & APPLICATION

Organizationally, it is important to consider the specifics of implementing building controls at multiple levels to create safe and healthy environments. Focus on workers is imperative and links "people" with "place." Strategies that associate building design to worker safety, identify a "Hierarchy of Controls" in which five levels of environmental controls, place the most effective solutions at the top of the model.[3] These solutions are often the most difficult and costly to implement as major change may be required, but have long term effectiveness. Conversely, strategies at the lowest level are less effective and inexpensive to implement but may be costly to maintain over time .

The Total Worker Health (TWH) approach, expands on the previous model and considers the environment holistically in the context of health, safety, and well-being of workers. This updated model incorporates design (or "re-design") as a central component and is part of a "Prevention by Design" PtD concept.[3] The model has application across typologies, and scales, with design solutions critically positioned in the center of conversations related to the built environment and worker health the model is highly relevant.[3]

HUMAN-CENTERED

HIERARCHY OF CONTROLS APPLIED TO NIOSH TOTAL WORKER HEALTH



NIOSH [2016]. Total Worker Health. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2017-112

HIERARCHY OF CONTROLS APPLICATION

ELIMINATE *working conditions that threaten safety, health, and well-being*

- Identify threats of transmission through critical exploratory assessment.[14]
- Integrate technology to mitigate viral transmission and improve environmental comfort and well-being.[1]
- Invest in building modifications to eliminate risks.[3]

SUBSTITUTE *health-enhancing policies, programs and practices*

- Implement sustainable practices from design through operations.[12]
- Establish energy-savings settings for mechanical & building systems.[24]
- Conduct regular risk-assessments.[24]
- Incorporate incentive programs that contribute to health and well-being.[12]

REDESIGN *the work environment for safety, health and well-being*

- Holistically integrate building systems with spatial requirements for balance, function, and control.[1]
- Design interior spaces for maximum flexibility and agility.[10]
- Integrate elements of nature to improve well-being.[12]
- Select materials that positively impact users and the environment.[12]

EDUCATE *for safety and health*

- Establish training, assessment, and monitoring programs for cleaning protocols, building occupancy, and space utilization.[14]
- Focus on "people" vs. the "place" to implement effective change.[12]
- Communicate policies and practices openly to inform occupants.[6]

ENCOURAGE *personal change*

- Establish occupant philosophies of change with users as "stakeholders" in the environment.[1]
- Provide training and interventions for stress reduction and management.[12]
- Advocate for personal control in terms of well-being and the use of effective protocols.[2]

BUILDING DESIGN, SYSTEMS & TECHNOLOGY

Influencing Factors:
INNOVATION | FUTURE PROOFING | IOT

INNOVATION

FLEXIBLE | AGILE | DIVERSE | ADAPTABLE

Integrate ubiquitous technology to improve efficacy:

- Increase use of tools to continuously monitor and diagnose air quality issues[12]
- Integrate flexible electronics and nanoscale materials for "smart" applications [10]
- Leverage touchless "sensing" technology for safer environments[12]
- Design flexible and responsive spaces and ventilation systems[8]

FUTURE PROOFING

FUNCTIONAL | PHYSICAL | HEALTHY | TECHNOLOGY

Apply principles of integrated design to prevent obsolescence:

- Engage a multidisciplinary approach to expedite design solutions for rapid response[2]
- Supplement ventilation systems with air cleaning, disinfection, HEPA filtration, and safe application of germicidal ultraviolet (UVG) or ultraviolet germicidal irradiation (UVGI)[14]
- Increase airflow exchanges (indoor and outdoor) to reduce viral transmission[1]
- Effectively design and monitor spaces to increase flexibility and minimize occupancy[10]

IoT

INTERFACE | UX | DATA | TECHNOLOGY

Engagement with technology to impact life:

- Integrate digital commissioning platforms to identify systems anomalies[10]
- Reduce occupancy through source control monitoring devices[20]
- Implement layers of protections for safer environments; administrative, environmental, individual[2]

LOOKING FORWARD

OBSERVATIONS FOR THE FUTURE

RESILIENCY is an imperative in the planning of healthy, safe and sustainable communities. Energy efficiency, sound control, reduction in carbon footprint, and smart technology usage are among principles that can be applied to "future-proof" spaces, buildings, and cities.

COLLABORATION between disciplines emerges as a shift in thinking about the design process. As building owners, managers, clients, and the design profession engage in shared conversations, the theme of "human-centered" design provides impetus for decision making.

The continuing digital explosion and IoT will drive advances in building systems technology into the future, as the need for data to measure effectiveness of innovations is needed. The IoB ("Internet of Bodies") is emerging as a concept related to privacy and **INNOVATION**, raising ethical issues and concerns.

The planning of flexible, functional, and sustainable spaces places **INTERIOR DESIGN** at the intersection of the design process. Providing critical input into spatial configurations and arrangement, materials specifications and maintenance, lighting, acoustics and other aspects of the built environment is needed. Interior design connects stakeholders at multiple levels.

As the merging of technologies overlap into personal domains questions of privacy will impact **GOVERNANCE & POLICIES** at an increasing rate. Devices that are intended to protect and monitor behaviors share information that cross the boundaries of "personal rights."

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ABOUT ASID IMPACT REVIEW: TASK FORCE

ASID established the ASID IMPACT Review: Task Force with the goal of examining interior design's role in the pandemic. Specific goals of the Task Force included the research, identification, and analysis of reliable and relevant content for interior design professionals, including but not limited to principles, guidelines, and /or tools. Through creative and strategic processes, subject matter experts, and a triangulated process, ASID will demonstrate DESIGN IMPACTS LIVES and advance its leadership in response to COVID-19 and beyond. Additionally the work will inform best practices and identify other critical initiatives, improving environments for all and advancing the profession. The approved content will address critical gaps in the research, identify future initiatives, and examine ways to demonstrate the impact of interior design for the benefit of enhancing people's lives.

IMPERATIVE:

To create healthy, equitable, and beautiful places that inspire and promote human well-being from personal spaces to the community.

GUIDANCE:

- We believe we have a responsibility to the planet and future inhabitants to create healthy, sustainable, and livable spaces
- that design has the ability to positively impact people's lives
- that interior design is at the core of the built environment and an integral part of the design process
- that interdisciplinarity, collaboration, and integrative design are critical to our future
- that evidence based design and research informs best practices, influences public policy, and has demonstrative effect on the design of spaces

A SPECIAL THANK YOU TO THE ASID IMPACT REVIEW: TASK FORCE

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ABOUT ASID

The American Society of Interior Designers believes that design transforms lives. ASID serves the full range of the interior design profession and practice through the Society's programs, networks, and advocacy. We thrive on the strength of cross-functional and interdisciplinary relationships among designers of all specialties, including workplace, healthcare, retail and hospitality, education, institutional, and residential. We lead interior designers in shared conversations around topics that matter: from evidence-based and human-centered design to social responsibility, well-being, and sustainability. We showcase the impact of design on the human experience and the value interior designers provide.

ASID was founded over 40 years ago when two organizations became one, but its legacy dates back to the early 1930s. As we celebrate nearly 85 years of industry leadership, we are leading the future of interior design, continuing to integrate the advantages of local connections with national reach, of small firms with big, and of the places we live with the places we work, play, and heal. Learn more at asid.org.

BUILDING DESIGN, SYSTEMS & TECHNOLOGY INSIGHTS BRIEF PARTNER ORGANIZATION

BOMA International

Founded in 1907, the Building Owners and Managers Association (BOMA) International is a federation of U.S. local associations and global affiliates. The leading trade association for commercial real estate professionals for more than 100 years, it represents the owners, managers, service providers and other property professionals of all commercial building types, including office, industrial, medical, corporate and mixed-use. BOMA International is the partner individuals in the commercial real estate industry choose to maximize value for their careers, organizations and assets. Its mission is to advance a vibrant commercial real estate industry through advocacy, influence and knowledge. More information on BOMA can be found here.

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Superior Essex lives up to its company wide commitment of industry-leading sustainable innovation and product transparency by sustainable manufacturing – *the industry's first and only Zero Waste to Landfill facility* – innovative, high-performing, sustainable communications cables. Moreover, 55 families of these products feature Environmental and Health Product Declarations (EPDs and HPDs). All of our copper products also have Life Cycle Assessment Optimization certification that help to support the LEED EPD Option 2 credit. Over 8 product families have achieved Red List Free certification, all of which contribute points to green-building certifications such as LEED, WELL and the Living Building Challenge.

Seeking to achieve Zero Carbon certification within your buildings? We also offer some of the industry's first Carbon Negative products through our Zero Carbon program. We manufacture the most sustainable communications cable products available in the marketplace – remaining sustainable both in product and process by remaining mindful of our raw materials, manufacturing, transportation, installation and end of life practices. Our communication cables support IoT through Power-Over-Ethernet technology that allow power and data to flow through a communication cable to an end device up to 90 watts.

We're here to support a more sustainable and smart built environment into the future because we firmly believe that the technology that interconnects the world should also respect it. We invite you to learn more at www.superioressexcommunications.com

Trane® - by Trane Technologies (NYSE: TT), a global climate innovator - is a world leader in air conditioning systems, services and solutions. Trane helps customers succeed by providing innovative solutions that optimize indoor environments through a broad portfolio of energy-efficient heating, ventilating and air conditioning systems, building, contracting and energy services, parts support and advanced controls for homes and commercial buildings.

Trane's Wellsphere, launched in 2020, is a holistic approach to building wellness. It's a multi-disciplinary collective of experts using world class technologies and services to help improve the viability of your building.

As part of Trane's Wellsphere™ approach, we're relying on science to establish best practices for indoor air quality and setting standards that put people first. Trane Technologies' Center for Healthy & Efficient Spaces (CHES) provides a critical roadmap for idea exchange, research, partnership development and advocacy within indoor environmental quality. CHES convenes leading experts to advance indoor environmental quality (IEQ) policy, strategies and solutions; establishing a roadmap for more resilient and sustainable communities and spaces.

For more on Wellsphere, CHES and Trane's holistic approach to building wellness, visit www.trane.com/wellsphere.