MIT’s Industrial Liaison Program (ILP) can bring the intellectual power of MIT to your organization by providing a direct connection to the knowledge, experience and resources at MIT in these areas – giving you the ideas to stay ahead. For more information about how the ILP can put the resources of MIT to work for you, call us at 1-617-253-2691, e-mail us at liaison@ilp.mit.edu, or visit http://ilp.mit.edu.

MIT and Building/Construction & Related Industries

The Massachusetts Institute of Technology (MIT) is a leading center of research and education on topics important to building, construction, and related areas and industries such as:

- Architecture, design
- Building, infrastructure
- Computation, digital tools, fabrication
- Materials, sustainability
- Real estate, housing
- Smart technologies, sensor systems
- Urbanism, urban development/planning

Below are brief descriptions of a selection of MIT centers, departments, groups, and labs conducting research and education in these areas. Please note that this is not a comprehensive summary of research being conducted at MIT in the topic areas listed above and the center or lab, etc., may fall into more than one category.

ARCHITECTURE, DESIGN

The Aga Khan Program for Islamic Architecture (AKPIA) at MIT is dedicated to the study of Islamic architecture, urbanism, environmental and landscape design, and conservation. It prepares students for careers in research, design, and teaching and aims to enhance the understanding of Islamic architecture and urbanism in light of contemporary issues and to increase the visibility of Islamic cultural heritage in the modern world.

The Changing Places group is investigating how new models for urban architecture and personal vehicles can be more responsive to the unique needs and values of individuals though the application of disentangled systems and smart customization. The group is developing technology to understand and respond to human activity, environmental conditions, and market dynamics.

The MIT Sustainable Design Lab is part of the Building Technology Program at MIT. The Lab’s mission is to produce high-quality fundamental and applied research that facilitates the design of resource-efficient and comfortable environments at the building and neighborhood scale. The goal is to change current architectural practice by developing, validating and testing design workflows and performance metrics that lead to improved design solutions as far as occupant comfort and building energy use are concerned.

The Department of Architecture is composed of five semi-autonomous discipline groups: Architectural Design; Art, Culture & Technology; Building Technology; Computation; History, Theory and Criticism. Each discipline group has the opportunity and responsibility to teach and conduct research in its own area at both the undergraduate and graduate levels, as well as to work within the professional program in architecture. Depth is provided in technical areas such as computation, new modes of design and production, materials, structure and energy, as well as in the arts, humanities and social studies.

BUILDING, INFRASTRUCTURE

The Building Technology Program includes teaching and applications of the fundamentals of technology as well as research in technology for the next generation of buildings. Areas of focus include building structures, materials, industrialized build-
The MIT Infrastructure Architecture Lab conducts research on the relationships between broad, macroeconomic factors driving built infrastructure and the specificities of architectural and urban form. Lab researchers combine the knowledge frameworks and techniques of economic and planning theory with the practices of architectural design to study the real-world complexities that go into the making of infrastructure and its effects on built form. MIT-IAL particularly focuses on situations in emerging economies and the developing world and is focused on the dynamics of land conversion as a supply-side feature in global investment trends, and the manner in which governments and policy paradigms on infrastructure respond to mobility.

The Laboratory for Infrastructure Science and Sustainability (LISS) aims to develop scientific knowledge and technology for the quantified sustainability of existing physical infrastructure and for innovative sustainable designs of new systems, contributing to societal and economic development. Areas addressed include Innovative Materials, Sensing, Condition Assessment, Energy Efficient Buildings & Materials, Earthquake Engineering, and Resilient Structures.

The Organization for Permanent Modernity investigates operational templates of public form that integrate architecture, infrastructure, and landscape into elements of a lasting territorial order. Its hypothesis entails the possibility of a public reading of the territory through forms of permanence, while accommodating uncertainty and change within and around these interventions.

The Prototypes of Prefabrication Research Laboratory (POPlab) investigates prefabrication in the design and construction of architecture and urban environments, applying a scientific vision that results in spaces that are better thought, better engineered, and better built. The lab works at multiple scales developing technologies and systems that aim to have an impact in our built reality. In this hands-on laboratory, ideas are tested in the physical world.

The Structural Design Lab at MIT is an interdisciplinary research group focused on conceptual structural design. The group includes undergraduate and graduate students pursuing degrees in Civil Engineering and Architecture. Research interests include form-finding, funicular structures, equilibrium methods, structural optimization, digital fabrication, and interactive design processes.

The Department of Civil & Environmental Engineering (CEE) seeks to understand natural systems, to foster the intelligent use of resources and to design sustainable infrastructures. CEE is focused on technological innovations, seeking advances in basic knowledge and taking a systems perspective. Efforts are concentrated on quantitative and analytical approaches, novel experiment-based modeling, and the development and/or use of appropriate tools and technology. CEE’s research and graduate education programs coalesce around three fields of inquiry: environmental science and engineering; mechanics, materials and structures; and transportation.

**COMPUTATION, DIGITAL TOOLS, FABRICATION**

The goal of the Computational Making Group is to articulate and circumscribe an emerging area of interdisciplinary research the group calls Computational Making. The group views making broadly to include the making of things—from drawing a picture on paper, to weaving a basket, to building an interface, to 3D printing a model, to machining engine parts, to constructing a building—as well as the making of spaces through movement and perception. The focus is not on the end results of making activities, but on the processes and practices of their formation. The relationship between abstract computation and active making is the group’s ultimate inquiry.

The Design Fabrication Group explores the application of digital fabrication for building delivery. The group aims to discover effective methods to apply computation to the design and production of buildings directly from 3D CAD models. The goal is to help people construct homes instantly using digital fabrication. The group’s systems make possible immediate manufacturing of structures as a kit of parts from a 3D model. A variety manufacturing methods, from additive to subtractive, are used. The theoretical framework is based on generative modeling techniques found in evolutionary design.

The Digital Structures research group aims to contribute new knowledge to empower the design and fabrication of innovative, creative, and performative architectural structures. The group is focused on the synthetic integration of creative and technical goals in the design and fabrication of buildings, bridges, and other large-scale structures. Research activities are based in three interconnected areas—collaboration, computation, and fabrication—which are united by a common focus on the synthesis of design and technology.

The MIT Mobile Experience Lab uses personal mobile devices to unlock potential in the physical world around us. The MIT
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Mobile Experience Lab’s international team of architects, designers, engineers and social scientists seek to radically reinvent and creatively design connections between people, information, and places.

The Self-Assembly Lab is a cross-disciplinary research lab at MIT inventing self-assembly and programmable material technologies aimed at reimagining construction, manufacturing, product assembly and performance. The Lab’s goals are to re-imagine processes of construction, manufacturing and infrastructure in the built environment.

MATERIALS, SUSTAINABILITY

The MIT Concrete Sustainability Hub (CSH) is an inter-disciplinary research group at MIT dedicated to improving the sustainability of concrete production and use. The mission of the CSHub is to develop breakthroughs that will achieve sustainable and durable homes, buildings, and infrastructure. Research at the CSHub is focused on three main platforms of concrete: Materials Science; Buildings & Pavements; Economics & Environment.

The MIT International Design Center (IDC) is a premier scholarly hub for technologically-intensive design science, research and practice. It is based both in Singapore and in Cambridge, MA, with academic and industrial partners from around the world. IDC faculty, researchers and students work together to design devices, products, systems, services and elements of the built environment that address strategic needs of the global community in the following areas: Design with the developing world; information and computer technology-based devices for better living; and the sustainable built environment.

The Materials Processing Center (MPC) researchers cover the full range of advanced materials, processes, and technologies including: electronic materials; batteries and fuel cells; polymers; advanced ceramics; materials joining; composites of all types; photonics; electrochemical processing; traditional metallurgy; environmental degradation; materials modeling; materials systems analysis; nanostructured materials; magnetic materials and processes; biomaterials; and materials economics. The center has added new research thrusts in materials for infrastructure and materials for energy applications.

The Urban Metabolism Group studies the material and energy flows arising from urban socioeconomic activities and regional and global biogeochemical processes. The characterization of these flows and the relationships between anthropogenic urban activities and natural processes and cycles defines the behavior of urban production and consumption. Urban metabolism is therefore a deeply multi-disciplinary research domain focused on providing important insights into the behavior of cities for the purpose of advancing effective proposals for a more humane and ecologically responsible future.

Civil and Environmental Engineering Dept.: Mechanics of Materials and Structures research centers on the development of new materials; the nondestructive evaluation of structures; the repair and retrofit of structures using advanced plastic composites; and the synthesis and evaluation of innovative designs. Projects dealing with the mechanics of materials focus on high-performance concrete (fiber-reinforced and silica fume composites), advanced plastic composites, intelligent construction materials, manipulation of materials at the nanoscale and the atomistic modeling of proteins and other natural materials. Structures research includes projects on computer-aided structural engineering, intelligent structural engineering system and innovative concepts in high performance structures. Research in nondestructive evaluation focuses on infrastructural systems, including concrete and steel structures and soils.

Mechanical Engineering Department Research in Energy Science and Engineering focuses on technologies for efficient energy conversion and utilization, which aim to meet the urgent challenge of a safe, sustainable energy supply. Energy research activities are focused on new and existing technologies at the systems and scientific levels. Research spans the following technical areas: automotive power plants and ocean propulsion systems; fossil fuel combustion; wind power; solar energy; electrochemical energy storage; thermoelectric technologies; fuel cells; hydrogen production and storage; refrigeration; thermodynamics of power systems; energy efficiency in a wide range of systems; ocean energy; certain aspects of nuclear energy; hybrid engines; thermal management of electronics; and energy efficient buildings.

REAL ESTATE, HOUSING

Center for Real Estate (CRE) research covers numerous areas of real estate including the economics of property markets, the impacts of regulation, and the sources of equity and debt financing. Additional research, in the form of faculty-supervised student thesis work, contributes to a growing inventory of new information. CRE offers the first-ever one-year Master of Science in Real Estate Development (MSRED) degree, as well as an integrated suite of professional development courses. CRE’s selective industry partnership program advances the art and science of international real estate, and bridges the gap between theory and practice.

The Samuel Tak Lee MIT Real Estate Entrepreneurship Lab (STL Lab) aims to educate future entrepreneurs and thought leaders in the real estate sector to undertake socially respon-
sible investment and development worldwide, with a particular focus on China. The lab will fund fellowships to attract both U.S. and international students; will support research on sustainable real estate development and global urbanization; and will make the lab’s curriculum available online to learners worldwide via MITx.

The Special Interest Group in Urban Settlement (SIGUS) links housing and community interests in the Department of Architecture and Department of Urban Studies, focusing on developing areas worldwide. SIGUS explores the new professionalism emerging for architects and planners, and concentrates on service, participation and non-traditional client groups. SIGUS offers workshops and short courses, and carries out research and outreach programs stressing participatory methods in promoting affordable and equitable housing. Research is focused in four areas: Design and planning; dissemination of information; sustainability; and the role of the professional.

The Urban Economics Lab at MIT focuses on studying economic activity and economic trends in cities. The Lab uses analytical models and big data to understand what makes cities thrive or decline, how housing values are formed and oscillate, and how local politics and social phenomena manifest in the context of increasing global urbanization.

SMART TECHNOLOGIES, SENSOR SYSTEMS

Research in the MIT AgeLab is conducted by a multidisciplinary and global team of researchers, business partners, universities, and the aging community working to design, develop, and deploy innovations to improve quality of life. The AgeLab’s work sits at the intersection of infrastructure, information, and institutions. The lab’s research themes cover Transportation & Community; Housing & Home Services; Health & Caregiving; Business Strategy & Innovation; Finance & Longevity Planning; and Livable Communities.

The Center for Environmental Sensing and Modeling (CENSAM) is a Singapore-MIT Alliance for Research and Technology (SMART) Interdisciplinary Research Group, is monitoring and modeling Singapore’s climate as well as air and water quality. The Center’s models can accurately predict climate change events (such as extreme rainfalls, increased air temperature, sea level rise, etc.) based on various realistic economic scenarios (business-as-usual energy usage, carbon mitigation, etc.). CENSAM’s goal is to provide constant monitoring and accurate modeling of the intricate climate, urban, and marine ecosystems of Singapore at local, regional, and global scales.

The City Science Initiative leverages advances in data analysis, sensor technologies, and urban experiments to provide new insights into creating a data-driven approach to urban design and planning. To build the cities that the world needs, a scientific understanding of cities that considers our built environments and the people who inhabit them is needed. Six research themes include: Urban analytics and modeling; incentives and governance; mobility networks; electronic and social networks; energy networks; and places of living and work.

The SENSEable City Lab focuses on studying and predicting how digital technology is changing the way we describe, design, and occupy cities. Interconnected computational elements are increasingly saturating the built environment (whether small-scale mobile devices, or larger-scale infrastructural microprocessors), which allows technology to be designed that could function as an interface between people and the city. Projects carried out at the lab are intended to help learn how cities are used and thus make better use of their resources and improve their design. The Lab’s researchers come from various disciplines such as physics, architecture, urban planning, the arts, electrical engineering, and computer science.

URBANISM, URBAN DEVELOPMENT / PLANNING

The Center for Advanced Urbanism (CAU) is committed to fostering a rigorous design culture for the large scale by focusing disciplinary conversations about architecture, urban planning, landscape architecture, and systems thinking. The CAU is motivated by the radical changes in the environment, and the role that design and research can play in addressing these. CAU embraces conversations with the world’s top experts at MIT, to feed and foster its innovations. The group takes pride in the fact that participants in the center create projects, build things, and actively change society out in the real world, and then come together to learn from each other’s experiences, publish, and debate about future directions.

The Civic Data Design Lab works with data to understand it for public good. The group seeks to develop alternative practices which can make the work done with data and images richer, smarter, more relevant, and more responsive to the needs and interests of citizens traditionally on the margins of policy development. In this practice the researchers experiment with and develop data visualization and collection tools that highlight urban phenomena. The group’s methods borrow from the traditions of science and design by using spatial analytics to expose patterns and communicating those results, through design, to new audiences.

The MIT Community Innovators Lab (CoLab) is a center for planning and development within the MIT Department of Urban Studies and Planning (DUSP). CoLab supports the
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development and use of knowledge from excluded communities to deepen civic engagement, improve community practice, inform policy, mobilize community assets, and generate shared wealth. CoLab facilitates the interchange of knowledge and resources between MIT and community organizations, and engages students to be practitioners of this approach to community change and sustainability.

The Project for Reclamation Excellence (P-REX) is a design research lab developing non-traditional design solutions to push the boundaries of conventional practice and incorporate resilient thinking into large-scale strategic planning & design. P-REX analyzes landscape systems to embed long-term sustainability and environmental intelligence in planning and design projects. The group seeks to find the largest possible ecological benefits for sites, across scales from local to regional.

The Special Program for Urban and Regional Studies (SPURS) is a one-year, non-degree program designed for mid-career professionals from developing and newly industrializing countries who are or will be shaping policy in developing countries to further develop their planning and problem-solving capacities. Each academic year, qualified individuals carry out a program of study and research focusing on the problems of urban and regional change within the broader context of development.

The MIT Tata Center for Technology + Design’s research and education mission is to develop solutions to challenges facing resource-constrained communities globally, with an initial focus on India. Center-affiliated Faculty and graduate student Tata Fellows engage in hands-on projects, with an approach that is rigorous and relevant to societal, economic, environmental, and political factors. The Tata Center brings together technical, pedagogical, and organizational expertise from across MIT to provide holistic support to more than 40 projects in the developing world within the broad focus areas of: Agriculture; energy; environment; health, water, and urbanization.

The Urban Risk Lab is a cross-disciplinary organization of researchers and designers addressing the most challenging aspects of contemporary urbanization, operating as designers at the intersection of disaster management and risk engineering, hurricanes and earthquakes, ecology and infrastructure, rural and urban, research and action. The group develops methods to embed risk reduction and preparedness into the design of the regions, cities and everyday urban spaces to increase the resilience of local communities.

The Department of Urban Studies and Planning (DUSP) education and research is broadly comprised of four specialization areas: City Design and Development; Environmental Policy and Planning; Housing, Community and Economic Development; and the International Development Group. There are also three cross-cutting areas of study: Transportation Systems Planning, Urban Information Systems (UIS), and Multi-Regional Systems Planning.

The mission of the Massachusetts Institute of Technology is to advance knowledge and educate students and others in science, technology, and additional areas of scholarship. MIT is committed to generating, disseminating and preserving knowledge and to working to bring this knowledge to bear on the world’s great challenges. As part of its mission, MIT maintains relationships with industrial organizations that enable the exchange of ideas in the context of real-world problems and demonstrate how principles studied at MIT are applied to generate practical benefits for industry and society. MIT’s Industrial Liaison Program helps develop these relationships by facilitating industry’s access to MIT and its vast resources.