SOLID STATES
Changing Time for Concrete

The Second Columbia Conference on Architecture, Engineering and Materials

October 1–3, 2008
SOLID STATES
CHANGING TIME FOR CONCRETE

WOOD AUDITORIUM, AVERY HALL
GSAPP, COLUMBIA UNIVERSITY

OCTOBER 1—3, 2008

Convened by
Graduate School of Architecture, Planning and Preservation, Columbia University
Mark Wigley, Dean
Michael Bell, Professor, Conference Chair

in collaboration with
Fu Foundation School of Engineering and Applied Science, Department of Civil Engineering and Engineering Mechanics, Columbia University
Christian Meyer, Chair and Professor

Exclusive sponsor: Lafarge

The conference will be accompanied by the exhibition Concrete Trajectories Curator: Rosana Rubio Hernandez
Associate Curator: Jesús Donaire García de la Mora
On display in Avery Hall 200 level September 29—October 3, 2008
CONCRETE IS ENTERING A RENEWED ERA OF DEVELOPMENT WITH WORLDWIDE IMPLICATIONS AND UNDER RADICALLY NEW ECONOMIC CIRCUMSTANCES. WHAT ARE THE FUTURES OF CONCRETE IN ARCHITECTURE AND ENGINEERING IN TERMS OF TECHNOLOGIES OF REINFORCEMENT, MATERIALS SCIENCE, EMERGING MARKETS AND CAPITALIZATION, GEOGRAPHIC PRODUCTION, INSTALLATION, AND ENVIRONMENTAL IMPACT? WHERE WILL INNOVATION HAPPEN AND WHAT WILL INSTIGATE POTENTIALS IN DESIGN AND ENGINEERING?

THE GOAL OF THIS CONFERENCE IS TO OPEN NEW UNDERSTANDINGS OF THIS PERVASIVE, YET EVER-EVOLVING MATERIAL. BRINGING TOGETHER A WIDE RANGE OF LEADING ARCHITECTS, ENGINEERS, AND SCHOLARS, THE COLUMBIA CONFERENCE ON ARCHITECTURE, ENGINEERING, AND MATERIALS IS A MULTI-YEAR PROJECT TO EXPLORE THE DRAMATICALLY CHANGING LIMITS OF KNOWN AND NEW MATERIALS IN AN ERA OF RAPID URBANIZATION AND WITHIN UNPRECEDENTED FORMS OF TECHNICAL MEASUREMENT, COORDINATION, AND PRODUCTION THAT INCREASINGLY BLUR THE BOUNDARIES OF PROFESSIONS AND OF MATERIALS. DO CONTEMPORARY MEANS OF STRUCTURAL AND MATERIAL ANALYSIS SUGGEST A WAY OF MODELING MATERIAL ATTRIBUTES SUCH THAT ANALYSIS ITSELF MIGHT PRODUCE A NEW MATERIAL? WILL ALTERNATE TECHNIQUES CREATE A VIRTUAL STRAIN OR QUASI-ALLOY, LEADING TO A POTENTIAL REALM OF COORDINATED MATERIAL ACTION?

THE COLUMBIA CONFERENCE ON ARCHITECTURE, ENGINEERING, AND MATERIALS EXPLORES THE BOUNDARIES BETWEEN MATERIALS SCIENCE, ENGINEERING AND DESIGN BY MOBILIZING SYMPOSIA, STUDIOS, EXHIBITIONS, BOOKS, AND FILMS IN AN INTENSELY FOCUSED INVESTIGATION. HOW IS A NEW GENERATION OF PROFESSIONALS AND MANUFACTURERS FUSING ENGINEERING AND ARCHITECTURAL PRACTICES INTO RADICAL PLATFORMS FOR DECISIVE URBAN ACTION?
CONCRETE: MEASUREMENT AND COORDINATED ACTION
Concrete is understood to be the building material that virtually assured and verified the rise of modern engineered cities. Reinforced concrete, the composite of concrete and steel, instigated more than one hundred years of invention in building form and structure and still is the predominant system in use today. The fusion relies on both concrete and steel, but it is arguably concrete that gains the accolades for the plastic shaping of building and space—both today and historically—even as this shaping would not be possible without reinforcement. What, then, is concrete, and what are the futures of concrete not only in terms of its reinforcement but also in terms of its chemical engineering, its utilization, its geophysical production and installation, and its roles in energy and environmental impact? Is it still fruitful today to examine a material in isolation?

In the matrix of reinforced concrete it is concrete that seems to be the focal point—the role of steel, even as reinforcement, is essential and integral yet it has less value in the popular discussion of building. The confidence to imagine new forms of plastic work, however, was sourced and manifest in this hybrid of steel and concrete. The rationalization of structure lies with the future of two materials—the synergism between the properties of the two materials. Today the techniques of both reinforcement and concrete are dramatically changing ever so rapidly as urbanization and economic development do not allow. Why is it that the potential of concrete has less value in the popular discussion of building? Is it still fruitful today to examine a material in isolation?

PARALLEL ACTION
In the past decade the concept of a composite or what would constitute concerted but segregate behavior between materials has come under a new lens of evaluation and opportunity. Can we still talk about reinforced concrete with the operative word reinforced—or is a more complex interaction now the key to our thinking about material coordination? Is concrete still reinforced or can we supplant that term with new more accurate terms? What constitutes coordinated materials today and how are we reiterating the control of coordinated structural assemblies both before and after construction? What are the limits of the modeling of complex or coordinated behavior of structural form?

Aspects of time and duration—the nature of material in time and its application, but also under effects such as thermal action or long-term deterioration—are central to our work and are more carefully examined today. Engineers, architects, and materials scientists are more able to predict and anticipate the interaction and dynamic relationships between materials with a level of accuracy that was not possible even ten years ago. These examinations of material behavior arguably more fully constitute the cutting edge in architecture and engineering than the material itself—that is, the techniques of measurement and prediction might be seen as equal to and in part constitute a mode of material. In this regard do we begin to see materials as approaching or differentiating themselves from each other as forms of behavior rather than as intrinsic differences? Are species of material modeling attributes of material do they form a circumstance that is by nature material and intrinsic?

NEW LOCATIONS, SAME MATERIAL
Material persists in isolation even as it cannot be as easily segregated as it once might have been. Material offers innovation at its own inherent levels and within its own chemical engineering. Industries are still segregate as well, and their locations, means of capitalization, and relation to labor and economies are key to how something is built and in the case of contemporary global trade it also affects aspects of sustainability. With this in mind, what then, can we say about concrete engineering that we don’t already know—that is, after a discussion of its historical role, of its role in developmental design, and of its role in energy and environmental impact? Is it still fruitful today to examine a material in isolation?

URBANISM AND INFRASTRUCTURE: CONCRETE PLUS
In its known roles concrete has never been far from urbanism or from being vested as a form of civil life itself. From its essential chemical engineering to its place in architectural form and the plastic shaping and graph of its components, concrete is yielded as the source of a kind of pragmatic brilliance: as basic and essential, yet also loftying the indices of social life and public progress and carrying the weight of perceived urban success and urban failure. Concrete has also been expected to provide aspects of the inefable. Its properties provide a sense of permanence, but it also has been the very material to provide everything but permanence; concrete is intrinsically based in concepts of time and of movement—of how the formalization of flow, and here it can perhaps be renewed as a temporal medium—as something that is both actual and a model. It is both fixed and in transition—solid, but only as a stage that indicates attributes of solidity. Recall the use of concrete in the banked test tracks at the Fiat factory in Turin completed in 1923; concrete as the substratum upon which acceleration and centrifugal force were played out above a factory where column span was a component of production, labor, and efficiency. Compare this to the still deeded and expanded square of the Centre Notre Dame du Rancy completed almost simultaneously or the concave modeling of the surfaces of Le Corbusier’s Ronchamp. Concrete as we have historically received it has always been concrete plus form—but also concrete plus speed plus aesthetics plus abstraction.

What don’t we know about concrete going forward—to the day after tomorrow? To next year? Ten years from now?

These histories can be projected into future states: to uses of concrete in infrastructure, in waterworks, in airports, in military installations, and, predominantly, within the rapid development of cities today. This conference brings leading architects, scholars, and engineers to Columbia University to discuss the implications of new technologies in concrete architecture and engineering, at the scale of building and at the scale of infrastructure—within new forms of natural, mechanical, and digital production. 

—Michael Bell, Conference Chair
WEDNESDAY
OCTOBER
1

6:30—8:00 PM

WELCOMING REMARKS AND INTRODUCTION TO CONFERENCE
Mark Wigley
Dean, GSAPP, Columbia University
Bruno Lafont
Chairman and CEO, Lafarge

KEYNOTE LECTURE
Steven Holl
Professor, GSAPP, Columbia University
PLASTIC MATERIAL = PLASTIC SPACE

If concrete has virtually constituted a material history of the antique city and its infrastructure it is also understood and referenced by an often narrowly received history that presents its links to modern urbanization and metropolitan life as inevitable, robust, and vigorous. Concrete in this regard is fundamentally central to modern architecture and to the modern city. Based in the work of Auguste Perret, reinforced concrete is, however, situated as a rational, pragmatic material that is also given tenuous balance and tremendously delicate installation: it is pushed to limits of structure, formwork, and execution and it weaves between the rationalized aspects of a modern society and the traces and signifiers of historical programs and building types such as the basilica. Perret showed a deeply restrained relation to the plastic aspects of concrete that are commonly known in the work of Le Corbusier. Plasticity of form and the rationalization of construction dominate architectural thought in the 20th century and Le Corbusier’s architecture made both cases emphatically, but there were hybrid directions that were more often tenuous and they bear renewed examination in light of new advances in concrete today that show it to be a material of more technical refinement. Giuseppe Terragni’s work in concrete replaced an expected robustness with a severe and thinned surface planarity easily associated with Mies van der Rohe’s work in glass, marble, and/or travertine. Richard Neutra’s Lovell Health House (indeed his entire career) fused light steel framing technologies with similarly planar readings that made concrete seem as planar and as liquid as glass in his work. His Lovell Health House was a hybrid structure of steel stiffened by the diaphragm action of concrete. Terragni and Le Corbusier both used ferroconcrete for thinner, more planar installations—in stair balustrades and other details—narrowing the wall from the normal robust installation in structure or building volume. Today can these be seen as precursors to new problems in concrete: are the histories of concrete too narrowly understood and can they be reopened to provide new tributaries? How, for example, do concrete and construction materials integrate with other systems today and those from the outset of the 20th century? How are concrete works dismantled—is there innovation in the expected life span of materials that affect design? Do we still expect material properties to affect space in architecture and engineering, how is material understood as plastic and expressive? What constitutes a material’s limits?

Le Corbusier worked in concrete for an entire career. Mies approached a quasi-nihilism in his and a plastic spaces realized in steel, glass, and quarried stone—he did not pursue concrete after his early works, but his work represents an instrumental role of measure, calculation, and precision of tectonic expression that seems more central today than ever. For all its weight, concrete has almost always been simultaneously an indicator of empty space—by way of surface and volume, and at times of lightness (as in the work of Perret). These ideas are renewed as we reexamine concrete not only as surface and form but also as integral to and coordinated with other materials; as composites that are not so much assemblies but alloys—new materials in total with new potentials.
FORMWORK: BUILDING A BUILDING TWICE

Advanced work in the chemical makeup of concrete allows new methods of formwork and newly extensive pours. Yet to build in concrete is still to build twice: one builds the formwork prior to the pour. What aspects of formwork change in light of new concrete mixtures? What evolutions in formwork such as precasting or lost formwork have greatest implications for our work? At the small scale, formwork is often literally rented and relocated from site to site. Does the formwork constitute an absent origin—the trace of a once immense outward force—or is its significance less critical than in previous generations? What aspects of formwork can be seen as essential and/or intrinsic to the work—how is it designed and understood as a temporal medium versus an unacknowledged pre-structure?

What role will cementitious structural insulated panels play in future work—in relation to sustainability but also to labor, organization of construction, and architectural space?

CONCRETE TECHNOLOGIES: NEW FORMS OF FLOW AND OF TIME

Still recent advances in the workability and flow properties of concrete dramatically alter what we can achieve in concrete construction and design. Self-consolidating concrete has revolutionized the field in recent years and these changes coincide with concepts of flow in a wide range of disciplines. Woven into existing circumstances, concrete requires focus, precision, and an ultimate willingness to see the work last—it is not a temporary material and its execution requires a view to what will likely be the next century. How do we measure doubt and apprehension in light of a long-lasting material? What concepts of flow present in the formation of concrete can be applied to themes of use, space, or the other aspects of the life of the concrete building?

What role do new technologies—be they of or aside from concrete—offer the concrete work produced today? How was concrete understood in the early part of the 20th century as an attribute of technical achievement and/or a political device and what do these trajectories mean in contemporary work?

What aspects of major work readied for emerging economies can be related to the rise of the mid-century state-sponsored infrastructural and/or industrial projects by international contractors such as Bechtel or Brown and Root; to concrete as an apparatus of the state or of states—the World Bank and/or global corporations? How has your work fused concepts of material to concepts of flow, of time, and increasingly, to new forms of economic flow?
FRIDAY
OCTOBER 3

9:30—11:00 AM

Moderator: Kenneth Frampton
Ware Professor of Architecture, GSAPP, Columbia University

Pascal Casanova
Group Director, Research and Development, Lafarge

Benjamin A. Graybeal
Engineer, Federal Highway Administration, Washington, DC

Antoine Naaman
Professor Emeritus of Civil Engineering, University of Michigan, Ann Arbor

Surendra Shah
Walter P. Murphy Professor of Civil Engineering and Director of the Center for Advanced Cement-Based Materials, Northwestern University

STRUCTURAL CONCRETE: AFTER STEEL REINFORCEMENT

Reinforced concrete is being reengineered; both the means and techniques of reinforcement are changing, as are the plasticity and nature of admixtures. New innovations allow more contiguous pours and thus newly continuous surfaces, newly elastic forms. What are the futures of reinforcement in concrete and what applications do we imagine they will as a catalyst for change in design and engineering?

Potential new work includes:
- Micro-thin concrete, fiber-reinforced concretes are examples of the migration of reinforcement technologies.
- Quality: Concrete is unique, compared with other materials, especially steel and glass, as it requires an elaborate quality-assurance program to assure that both off- and on-site work meets specifications.
- Ductility/Brittleness: Concrete is a very brittle material. But by properly reinforcing it, it can be made ductile. This is of particular importance in seismic regions. In a transition to fiber-reinforced concrete, engineers are elevating this "art of reinforcing" to a new level, in which the material is now basically ductile.
- Serviceability/Durability/High Performance: Not long ago, a "good" concrete meant simply concrete with high compressive strength. In recent years, the concept of durability has taken hold, because we want to assure that the concrete maintains its properties throughout its design life. "High-performance concrete" is now understood as a material that assures superior performance throughout its design life. This concept allows a new mean to address problems associated with the life span of infrastructure.

11:15 AM—12:30 PM

Moderator: Laurie Hawkinson
Professor, GSAPP, Columbia University

Jacques Ferrier
Architect, Jacques Ferrier Architectures, Paris

Jacques Lukasz
Group Senior Vice President, Scientific Affairs, Lafarge

Christian Meyer
Professor and Chair of the Department of Civil Engineering and Engineering Mechanics, Columbia University

Paulo Monteiro
Professor, Department of Civil and Environmental Engineering, University of California at Berkeley

12:30—2:00 PM

BREAK

CONCRETE: SUSTAINABILITY, DEVELOPMENT, AND NEW INITIATIVES

The concrete industry is addressing sustainability issues on several fronts. Advances are necessarily measured against the global production of concrete in addition to smaller regional and local dimensions. As with all building materials, questions of embedded energy, eventual use, and local advantages, such as proximity to building materials, are all both global in nature and local and contingent on immediate detail: the degree of modernization at plants worldwide affects greenhouse gas emissions, the nature of agglomerates as recycled and/or newly mined minerals couples with building life-span issues of use, such as the expected value of thermal mass, or the rapidity of urbanization and the sourcing of materials. Sustainability in this regard is far from a direct equation even as direct action is possible—increasingly it will be embedded in issues such as carbon trading and global markets but the question is, what role can we add to this equation today that lies within both technical and political or social dimensions.

An immediate issue is the successful development of Portland cement substitutes, typically by-products of other industrial processes, such as fly ash and slag. Aggregate can be partially replaced by recycled materials such as construction debris, including recycled concrete aggregate and also glass, paper mill residues, and tires. These efforts not only result in the value-added secondary uses of what otherwise would become waste materials (often land filled at high cost), but they often improve the properties of the end product. What is possible to further reduce the environmental footprint of the concrete industry?

How is sustainability a unique project for concrete and what are the goals beyond sustainability? What are the key social and political dimensions of concrete and sustainability issues?

- Water: Approximately one billion cubic meters of water are used each year in producing concrete. Regions that lack a ready water supply can be inordinately affected by the amount of water needed to produce concrete.

- Reuse and Recycling: Post-production is also a central issue: the demolition and disposal of concrete structures, pavements, and like constitutes an environmental question that has unique parameters when compared to other building materials. Construction debris contributes a large fraction of our solid waste disposal problem, with concrete being its largest single component.

- Plant Modernization: It has been estimated that more than ten billion tons of concrete are produced each year worldwide. In the United States this translates to a ratio of approximately two tons of concrete per person a year. This requires an unequaled amount of natural resources to provide the aggregate and the raw materials for cement production. Of equal concern is the fact that the production of Portland cement has historically released large quantities of CO2 into the atmosphere, making not only advancements in the design of plants critical but also the use of recycled aggregates. The cement industry is believed to account for five to seven percent of all carbon dioxide released worldwide, but as major...
Advances are made in how cement production is accomplished, these advances are measured against both the location and region of production. Are there advantages in the regional aspects of production, such as the levels of modernization and investment at plants, production demands, and levels/speeds of urbanization?

New forms of urbanization create as much as 80 percent of the worldwide market for concrete today. The persistence of concrete as both a renewed material and as new application is more urgent than ever if we gauge its current implementation. How do we gauge the fact that the speed of urbanization means that concrete will effectively become the primary material of new cities in the next decade? Will design and technical innovation be more likely to occur in certain locations where there is a confluence of key factors such as accessibility of materials and investment? What does an architect or engineer offer in light of the global aspects of building materials today—in terms of construction and contracting, and also in light of the speed, liquidity, and processes of urban change? Where do we place our concerns and establish a stake in the situation—how do these development scenarios affect forms of architecture in terms of region or even aspects of architecture and urban design that often have addressed disinvestment rather than rapid change?

Are the goals of practice in relation to macro-scale or smaller-scale work outpaced by urbanization, or do we have new capabilities that arise from this rapid urbanization?

What distribution or outlines of production describe relations between material manufacturing, installation, and use in work today—where a material originates and where it meets design and installation goals?

How does work on infrastructure change in light of what we know of evolving economies or evolving demand? Has the arena of infrastructure expanded to included a wider range of technologies, a more prevalent awareness of new means and methods from leveraging economic potentials, off-site work, embedded digital technologies, and smart materials?

Does concrete still portend plastic architectural space: is it still an architectural project or has concrete migrated to being a question of infrastructure even at the level of building design in which virtual city-scale works are realized as near singular events; indeed as forms of evolved infrastructure?
THE SCALE OF PRACTICE: GLOBAL PRACTICE/GLOBAL CLIENT

Bound to material and its spatial organization, architecture and engineering practices are also tied to intricate layers of commodity practices and investment that today have almost inevitably become global in nature. The nature of practice is more tightly woven and responsive to investment than it ever has been; yet it is also frequently less weighted by overt characteristics of place and instead tied to trans-locations and interconnected matrices of development as well as consultants and partner practices. During the past 20 years, practice often seemed to have been indexed by way of a constellation of world cities and their particular relations—the city in this sense superseded the nation as the nexus of interchange.

Yet today trade and barriers between emerging economies are changing dramatically and at times reinforcing the role of national relations in development and design. In this realm, the anticipated roles of architectural and engineering practice, in terms of both cities and wider themes of urban life, are often fused. That is, they form unified practices that take on characteristics of one another, as architecture, engineering, and, increasingly, economics. These practices at times produce work that is more quasi-infrastructure than architecture.

What forms of practice have emerged today in this arena—how have concepts of architectural space and technique been reorganized within practices of engineering and architecture to allow us to operate at levels that may have been previously the domain of international contractors or state organizations? What is the role of the architectural concept in an era of deeply engineered materials and equally instrumental economic demands on design?

Generations of architects since the 1930s have helped write a story of international and then global practice, yet the global practice, as a socially critical instrument, is still relatively young. If the practices of Archigram or Superstudio and others depicted infrastructural worlds that borrowed industrial metaphors as well as outright techniques from history while promoting radical forms of social life, what can we say of today’s critical practices? What is the role of the image of infrastructure and its material techniques—what is the role of space, of event, or of nonmaterial design in an era of deeply coordinated material value?

Have practitioners of the generation that began work in the 1970s and 80s on what were often disinvested and neglected urban sites now emerged as global participants in the rise of a new city? How do building materials and their new means of capitalization and distribution affect design practice: within the global exchange of real estate, high-tech forms of construction and materials management are relatively new—so, too, is the need to again examine cities as a central frontier of social life. Is material a significant attribute of this condition or can we examine it still as an attribute of design rather than a determining factor?

3:30—5:00 PM

Moderator: Jean-Louis Cohen
Sheldon H. Solow Professor in the History of Architecture, Institute of Fine Arts, New York University

Juan Herreros
Professor, Escuela Técnica Superior de Arquitectura de Madrid

Matthias Schuler
Engineer, TRANSOLAR, Energietechnik, Stuttgart

Werner Sobek
Professor and Director, Institute for Lightweight Structures and Conceptual Design, University of Stuttgart

Bernard Tschumi
Professor, GSAPP, Columbia University

5:00—6:00 PM

CONCLUDING DISCUSSION: THE ARCHITECT AND ENGINEER

How has practice in engineering and architecture changed, and going forward, what does a university need to address about industry and what does industry need to know about the university?

What are the most advanced new relationships between academia and industry, and how are they organized?
PARTICIPANTS

MICHAEL BELL
Michael Bell is a Professor of Architecture at Columbia University’s Graduate School of Architecture, Planning and Preservation, where he is Director of the Core Design Studies and Chair of the Program on Architecture, Engineering, and Oil. He is the founder of Michael Bell Architecture, a design studio in New York City. His design work has been recognized with awards from the New York, the Venice Biennale, Yale University’s School of Architecture, the Art Institute of Chicago, the University of California, Berkeley, and ArchLab, France. Bell has received four Progressive Architecture Awards, and his work is included in the collection of the San Francisco Museum of Modern Art. Books by Bell include: 16 Houses: Designing the Public’s Private House (2000), Michael Bell: Space Replaces Us: Essays and Projects (2008), and pub

ANGELO BUCCI
ANGELU BUCCI is the President of the Hotel Association of America. He was educated in architecture at the University of Wisconsin, Urbana-Champaign, and is the author of four books: BIT: Business Intelligence and Technology (2004), L2R: Leadership in the 21st Century (2002), Cohen has a degree in Architectural Design from the University of California, Berkeley, and as an architect in New York, New York, the Venice Biennale, Yale University’s School of Architecture, the Art Institute of Chicago, the University of California, Berkeley, and ArchLab, France. Bell has received four Progressive Architecture Awards, and his work is included in the collection of the San Francisco Museum of Modern Art. Books by Bell include: 16 Houses: Designing the Public’s Private House (2000), Michael Bell: Space Replaces Us: Essays and Projects (2008), and pub

Pascal Casanova
Pascal Casanova is the Group Director of Research at Lafarge. He is a graduate of the École Polytechnique and the École Nationale des Ponts et Chaussées. Casanova started his career with a public works company specializing in civil engineering, where he was in charge of supervising French bridge projects. He joined Lafarge in 1999 as Technical Director, where he worked on Ductal®, the high-performance concrete, handling its transition from the research stage to implementation in industry. In 2002 he was appointed Head of Lafarge’s Development and Design Office at Lafarge, overseeing several technological breakthrough projects. Since 2005 he has also served as Managing Director of Lafarge Roofing Components, headquartered in Germany.

Jean-Louis Cohen

PRESTON SCOTT COHEN
Preston Scott Cohen’s work is known for its敏度 to the interplay of architecturally sensitive environments, descriptive geometry, and the two-dimensional projection of three-dimensional models of his firm. Preston Scott Cohen, Inc., encompasses projects ranging from single-family dwellings to public educational and cultural institutions. Cohen received the first prize in the international competitions for the design of Robbins Elementary School in Trenton, New Jersey (2005), and for two museums: the Taiyuan Art Museum in Taiyuan, China (2007-11), and the Tel Aviv Museum of Art, Amir Building (2002-09). He is the recipient of numerous awards and honors, including the Academy Award in Architecture from the American Academy of Arts and Letters and the Progressive Architecture Awards. The author of The History of Architecture and the History of Architecture, he has written and lectured extensively on modern architecture and urbanism, emphasizing the role of reinforced-concrete frames and shells in the evolution of architectural forms. He has written a number of books, including The Poetry of Useful Things (2004).

KENNETH FRAMPTON
Kenneth Frampton is the Ware Professor of Architecture at the Harvard University Graduate School of Design. He is the author of the seminal book Modern Architecture: A Critical History (1980), Modern Architecture: A Critical History (1980), and of Serious Fashion: A Critical History (1999). He is the recipient of the 2014 Functional Design Award of the American Society of Landscape Architects. Frampton is a strong advocate for the role of architecture in society, and has been a key figure in the development of the field of architectural history and criticism.

Carlo Eduardo Comas
Carlo Eduardo Comas is a Professor at the Universidad de Los Andes in Bogotá, Colombia. He is the author of numerous articles on contemporary architecture and design, and has contributed to several books and exhibitions on the subject. He is a member of the Academy of Arts and Letters of Colombia and has received several awards for his work in architecture and design.

Benjamin A. Graybeal
Benjamin Graybeal is a research structural engineer with the U.S. Federal Highway Administration (FHWA) at its Turner-Fairbank Highway Research Center. He manages the structural component research program for FHWA, with a distinct emphasis toward application of advanced computational methods to structural engineering. Since 2001 he has been the principal investigator of the High Performance Concrete (HPHC) research program. Results of this work have been applied in full-scale structural testing of HPNC components, and field deployment of HPNC technology.

LAURIE HAWKINSON
Laurie Hawkins is a partner at Smith-Miller + Hawkinson Architects—a New York-based architecture and urban design firm. Laurie has worked on a wide range of projects in the United States, Europe, and Asia, and has received numerous awards for her work. She is a frequent speaker and writer on the subject of sustainable and innovative design, and has contributed to several books and articles on the subject.

JACQUES FERRIER
Jacques Ferrier is a French architect and urban planner who has worked on projects throughout Europe and the United States. He is known for his innovative approach to urban design and planning, and for his emphasis on the role of reinforced-concrete structures in modern architecture. He has received numerous awards for his work, including the Academy Award in Architecture from the American Academy of Arts and Letters.

NEIL DENARI
Neil Denari is an architect and principal of Neil Denari Architects (ND+A), located in Claremont, California. He is also a professor at the University of Houston and Harvard University, and is a Professor-in-Residence at the Department of Architecture and Urban Design at the University of California, Los Angeles. He is currently working on projects of various scales throughout the United States, Europe, and Asia. His work has been published in a number of books and journals, including Modern Architecture: A Critical History (1980), Modern Architecture: A Critical History (1980), and Serious Fashion: A Critical History (1999).

JACOB RÖNNING
Jacob Rønning is a Norwegian architect and urban planner who has worked on projects throughout the United States, Europe, and Asia. He is known for his innovative approach to urban design and planning, and for his emphasis on the role of reinforced-concrete structures in modern architecture. He has received numerous awards for his work, including the Academy Award in Architecture from the American Academy of Arts and Letters.

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Juan Herreros has also taught at the University of Buenos Aires, the Architectural Association in London, and the School of Architecture at the University of Kansas City. He has conducted numerous lectures, courses, and interna-
tional studio and workshop experiences. In 1984, with Iñaki Abalos, he founded the Madrid-based practice Abalos & Herreros. In 1992 he established the Multimedia International League (MIL) and in 2006 founded the influential practice Juan Herreros Arquitectos, which encompass-
sest the diverse fields of architecture and ped-
didactic activity. The firm's projects underw-
ay in Spain, Portugal, the United States, and Uruguay. His work has been widely published and exhibited, among his books are Zona Bajas, editor, and Iñaki Abalos, in Tower & Office (2003).

STEVEN HOLL
Steven Holl has realized cultural, civic, university, and residential projects both in the United States and interna-
tionally. In 1976 he founded Steven Holl Architects, which currently oper-
ates offices in New York, New York and Beijing with a staff of 65. The firm has been instrumental in the development of numerous awards and accolades, and its work has been widely published and exhibited. Holl's emphasis on construction with the Linked Hybrid mixed-use complex (Beijing, China), Nanjing Museum of Art and Architecture (Nanjing, China), Vanku Center (Shenzhen, China), Knut Hamsun Center (Hamaroy, Norway), the Art Terry Wainfield (Amsterdam, for MM House (1989). In 1999, he was awarded an award for a Paul Rudolph Project Honor Award from the New York City chapter of the AIA. She is also principal of her firm, Toshiko Mori Architect, in New York City. In 2002 she received the Academy Award in Architecture from the American Academy of Arts and Letters, and the Medal of Honor for the New York City chapter of the AIA. Her book, Toshiko Mori: The Language of Excellence was awarded a 2008 Project Honor Award from the New York State Chapter of the AIA. Mori is the editor of an annual competition with the late Roy Carlson, a pion-
eer in the field of mass concrete technology. The competition is composed of three parts: design, workshop, and technical paper. The first part requires the sub-
mission of design concepts and an application for participation. The second part involves the workshop, which is held in conjunction with the conference. The third part consists of the technical paper, which is submitted by the participants. The papers are reviewed by a panel of experts who determine the winners. The winners are awarded a cash prize and a certificate of recognition. In addition, the winners are invited to participate in a post-conference tour of the site where the workshop was held. The conference is sponsored by the American Concrete Institute and is supported by various organizations, including the American Society of Civil Engineers, the American Association of Engineering Societies, and the American Society of Mechanical Engineers. The conference is held annually and attracts participants from around the world. The conference is a showcase for the latest research and developments in the field of concrete technology. It is an opportunity for practitioners, researchers, and students to exchange ideas and learn about the latest advancements in the field. The conference is also an excellent opportunity for networking and building relationships with other professionals in the field. The conference is an important event for anyone interested in the field of concrete technology, and it is highly recommended for anyone planning to attend. It is a great opportunity to learn about the latest advancements in the field and to network with other professionals in the field. It is also a great opportunity to share ideas and learn about new technologies and methods.
INSTITUTE OF TECHNOLOGY IN 1972.  He worked on the Concrete Institute, the Prestressed Concrete Institute, the American Concrete Institute, the American Conference on International Ferrocement Society. Naaman’s research has led to more than 50 publications, including two textbooks, and twelve co-edited books. His research interests include prestressed concrete, high-performance fiber-reinforced cement composites, fiber-reinforced cement composites, ferrocement, high-performance fiber-reinforced cement composites, and the optimization of advanced construction materials to improve structural performance.

GYOR NORDENSON
Guy Nordenson is a structural engineer and Professor of Structural Engineering at Princeton University’s School of Architecture. He is also a Faculty Associate at the Princeton University Center for Human Values. After studying at MIT and the University of California, Berkeley, he began his career as a draftsman in the joint studio of R. Buckminster Fuller and Isamu Noguchi in Long Island City. Nordenson co-founded the Structural Engineers Association of New York in 1997, when he began his own practice, Guy Nordenson and Associates. Nordenson is the New York office of Ove Arup & Partners. In 1998 he was a Loeb Fellow at Harvard Graduate School of Design. His drawings and models for several He initiated and led the development of the New York City Seismic Code from 1984 to its enactment in 1987. He is a registered engineer in 20 states and a licensed civil engineer in the United Kingdom, Israel, and Cuba. He began his private practice in Cuba in 1958 with the design of the 700-room Monte Carlo Hotel. In 1982 he settled in New York City.

ANTOINE PICION
Antoine Picion is a Professor of the History of Architecture and Technology at Harvard University’s Graduate School of Design. He is also the Director of the Harvard Graduate School of Design’s Center for the History of Science and Technology. He is also a member of the American Academy of Arts and Letters. He is a recipient of the 2008 ASLA Award for his work on digital culture and architecture.

NANAKO UMEMOTO
Nanako Umemoto is a partner in the New York-based firm Reiser + Umemoto. The firm has practiced together in New York City since 1986. Their international practice has included projects in Asia, South America, Europe, and the Middle East. The firm’s projects include residences, commercial and residential buildings, and institutional projects throughout the United States. The firm has received national and international awards for its work, including the Libeskind Prize, the Henry Bacon Medal, and the American Institute of Architects National Gold Medal.

MATTHEW SCHULER
Matthew Schuler is a Managing Director of the New York-based architectural firm Transsolar. He has been involved in the design of a number of major solar and energy-saving projects in the United States and Europe. He is a member of the American Institute of Architects and the American Society of Heating, Refrigerating and Air-Conditioning Engineers. He is a registered engineer in 20 states and a licensed civil engineer in the United Kingdom, Israel, and Cuba.

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mathematicians. He also received the 2006 Holcim Award for Lifetime Achievements in Structural Engineering from the American Society of Civil Engineers. In 2005, he received the 2005 Urban Visionaries Award for engineering from The Cooper Union School of Architecture. He was also elected to the Academy of engineering of the Year from the Association of Cuban Engineers, and the Leader of Industry Award from The Concrete Industry Board in 1999. His firm, Yaral A. Sterk, P.C., has an extensive portfolio of projects, including such iconic structures as the Carnival Freighter, the Performing Arts, Miami, which received three engineering awards. Bronze Award, American Society of Civil Engineers, Circle World Tower, which received multiple awards, including the highest award from the American Institute for the year 2000, the revitalization of Grand Central Terminal; 42nd Street Redevelopment; and the Gatehouse for the Philip Johnson Estate.

PIERLUIGI SERRAINO

Pierluigi Serraino is a practicing architect in the San Francisco Bay Area. He holds degrees from the Università degli Studi di Roma “La Sapienza,” SO-Arc, and the University of California, Los Angeles. He is Ph.D. candidate in the College of Environmental Design at the University of California, Berkeley. His projects and articles have appeared in Architectural Record, Architectural Design, Hunch, ACADIA, Casa d’Oriente, and Modernism, among other journals and magazines. He is the author of several books, including Modernism Rediscovered (2000) and NorCalMod (2006). Serraino has been a member of the editorial board of Architecture California and is a former Chair of the Architectural Design Forum at the San Francisco Museum of Modern Art.

SURENDA P. SHAH

Surenda P. Shah is the Walter P. Murphy Professor of Civil Engineering and Director of the Center for Advanced Cement-Based Materials at Northwestern University. His current research interests include fracture, fiber-reinforced composites, nonde- structive evaluation, transport phenomena, and structural systems. He is a co-author of the books Fiber Reinforced Cement Based Composites (1992) and Fracture Mechanics of Concrete (1994). He has published more than 400 journal articles and edited more than 20 books. He is past editor of the RILEM Journal. Materials and Structures. Shah is a member of the National Academy of Engineering, has received many awards, including the Swedish Concrete Award, American Institute of Steel Construction’s Anderson Award, RILEM Gold Medal, ASTM Thompson Medal, American Society of Civil Engineers’ Charles Pankey Award, and Engineering News-Record Magazine’s Top Designer. He was named one of the ten most influential people in concrete by Concrete Construction. Recently, he spent time at the Indian Institute of Technology, Mumbai, as an Honorary Professor under the auspices of a Fulbright Grant. In addition to teaching at Northwestern, Shah has taught at the University of Illinois, Chicago, and served as a visiting professor at Massachusetts Institute of Technology, University of Sydney, Denmark Technical University, University of Singapore, Darmstadt University, and Laboratory Central des Ponts et Chaussées, Paris. He currently serves as Honorary Professor at Hong Kong Polytechnic University.

WERNER SOBEK

Werner Sobek studied architecture and structural engineering at the University of Stuttgart in Germany. In 1991 he became Professor of the Architectural Design Forum at the San Francisco Museum of Modern Art.

BERNARD TSCHUMI

Bernard Tschumi is Professor at Columbia University’s Graduate School of Architecture, Planning and Preservation. He served as Dean from 1988 to 2003. First known as a theorist, he exhibited and published essays (1981) and wrote Architecture and Disjunction, a series of theoretical essays (1994). In 1983 he won the prestigious competition for the design of the Parc de la Villette, a 125-acre public park on the east edge of Paris containing dramatic buildings, walkways, bridges, and gardens. Projects include the New Acropolis Museum in Athens, as well as an archaeological museum and a cultural center, both in France. He recently completed a 5,000-seat concert hall, the Philharmonie, as a residential tower in New York City. His most recent books are Tschumi on Architecture, Conversations with Enrique Walker (2000) and a biography and monograph by Gilles De Bains, Bernard Tschumi (2008).

MARK WIGLEY

Since 2004, Mark Wigley has served as the Columbia University School of Architecture, Planning and Preservation. Prior to joining Columbia, Mr. Wigley was in the Center of Advanced Studies, he taught from 1987 to 1999 at Princeton University, where he was Director of Graduate Studies in Architecture in 1997. He received both his B. Arch. (1979) and his Ph.D. (1987) degrees from the University of Auckland, New Zealand. Wigley has served as guest curator for widely attended exhibitions at The Museum of Modern Art, New York, The Drawing Center, New York, National Gallery of Canada, and the Venice Biennale. He has works in the collections of the San Francisco Museum of Modern Art. Architecture + Design Forum at the California Academy of the Arts in San Francisco, and a cultural center, both in France. He recently completed a 6,000-seat concert hall, the Philharmonie, as a residential tower in New York City. His most recent books are Tschumi on Architecture, Conversations with Enrique Walker (2000) and a biography and monograph by Gilles De Bains, Bernard Tschumi (2008).

MARK WIGLEY

Women Wilson is Associate Professor at Columbia University’s Graduate School of Architecture, Planning and Preservation where she directs the Program for Advanced Architectural Research. In 1991, she received a Ph.D. in American Studies from the University of Kentucky, Parsons/ The New School for Design, Princeton University, and an O. Ph. D. in American Studies from New York University.

MABEL WILSON

Mabel Wilson is Associate Professor at Columbia University’s Graduate School of Architecture, Planning and Preservation. She received a B.S. in Architecture from Virginia, an M.A. from Columbia University, and a Ph.D. in American Studies from New York University. She has been featured in the book Block History Made Visible, which examines the social and material production of the displays, exhibitions, museums, and cities where black Americans remembered their past and envisioned their future. Out of this research she is developing a database and interface. The Visible History Project, which presents this scholarship to a wider audience.

Women Wilson has taught at the Cooper Union School of Architecture in the arts where she chaired the Graduate Visual and Critical Studies Program, the University of Kentucky, Parsons/ The New School for Design, Princeton University, and an O. Ph. D. in American Studies from New York University.
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Solid States is the second in a series of conferences on architecture, engineering and materials. The series originated as a plan to collaborate, Mark Wigley, Dean, GSAPP, and Christian Meyer, Chair, Civil Engineering and Engineering Mechanics, began discussions to host a joint conference as a new model of exchange between architecture and engineering. The first conference in the series, Engineered Transparency, on glass, was held at GSAPP in September 2007. The third conference, on metals, will be held at GSAPP in autumn 2009.

For information about this and future GSAPP events, please contact Benjamin Prosky, Director of Special Events, at 212 854-9248; bp2171@columbia.edu

Solid States: Changing Time for Concrete would not have been possible without the energy, goodwill and intellectual rigor of the conference chair, Michael Bell, who has been supported by a group of dedicated advisors and collaborators, including Christian Meyer, Mark Wigley, Jean-Louis Cohen, Steven Holl, Laurie Hawkins, Juan Herreros, Jacques Lukasik, Antoine Picón, Jesse Reiser, Werner Sobek, Stephanie Teissier, and Philippe Hardouin, Diana Daring and William Merking, and Benjamin Prosky, Davon Ercolano-Fraovan, Phillip Anzalone, Mark Bearak, Adam Mercier, Dora Kelle, Victoria Bentz, Luke Bulman, Stephanie Salomon, Gabriell Bach, John Ramahlo, Lou Fernandez, Kevin Allen and the GSAPP AV crew, Rossana Rubio-Hernández, Jesús Donaire García de la Mora, Mark Wasiuta and the GSAPP exhibitions team, and Jieun Yang.

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