Engineered Transparency
Glass in Architecture and Structural Engineering

Wood Auditorium, Avery Hall
GSAPP, Columbia University

September 26, 27 + 28, 2007

Convened by
Graduate School of Architecture, Planning and Preservation (GSAPP), Columbia University
Mark Wigley, Dean

Michael Bell, Professor, Conference Chair

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

Institute of Building Construction, Technische Universität Dresden
Bernhard Weller, Director and Professor

The conference will be accompanied by the exhibition Through Glass
Curated by Rosana Rubio-Hernandez
On display in Avery Hall, 200 level September 24 — October 12
After its role in the last century’s call to a radical new architecture and urban life, glass architecture is today more ubiquitous than ever. A highly engineered product, glass has emerged in a new light as an apparently culturally accepted material in design and construction. Its new incarnation, however, reveals a virtually new product replacing the glass used even twenty years ago. The innovations are observable and have direct use. Offering new modes of visual pleasure and spatial experience to building occupants—glass has also been the beneficiary of major advances in engineering that are decidedly less visible—structural innovations, new control and design engineering at the level of optics, thermal properties, and expanded fabrication limits as well as installation methods have quietly reconfigured the extent and reach of glass applications. We are so continually surrounded by such discretely functioning glass that we do not even see it. This interdisciplinary conference aims to bring an ordinarily extraordinary material back before our eyes.
6:30–8:00 PM

Welcoming Remarks and Introduction
Mark Wigley
Dean, GSAPP, Columbia University

Welcoming Remarks from
Oldcastle Glass

Keynote Lecture
Kazuyo Sejima
Architect, SANAA, Tokyo
Is Glass Still Glass? 
Moderator: Michael Bell
Professor of Architecture, GSAPP, Columbia University

In its early 20th-century appearances, glass architecture—i.e., designs by Walter Gropius or Mies van der Rohe, or writings by Paul Scherber—was both fact and metaphor. A signal of cultural and material production in major upheaval, it promised a new if not radically altered interior world and a new relation to production. Does glass architecture still signify cultural transition? Does the depth of engineering and the control of risk in new work reduce or enlarge the cultural project of glass today? Is glass still glass?

Typically associated with either the architectural innovations of the 1920s or the recent technical and decidedly global innovations tied to energy issues, new coatings, and new adhesion systems, gaskets, adhesives, sealants, as well as assembly procedures and potentials—have rewritten the curtain wall and its application in building. In the course of doing so, there has been a steady revision of openness and the control of the cultural aspects of the transparent building. What are the new connections in glass architecture—both visual and mechanical—that have allowed this new reach for architecture and how do they affect your work?

James Carpenter
Architect, James Carpenter Design Associates, New York City
Guy Nordenson
Professor of Structural Engineering, School of Architecture, Princeton University
François Roche
Professor of Architecture, GSAPP, Columbia University
Architect, R&Sie(n), Paris
Hans Scholer
Engineer, Struβbergemann and Partner, Stuttgart

Connections: Visual and Mechanical 
Moderator: Kenneth Frampton
Ware Professor of Architecture, GSAPP, Columbia University

Evolution in the fabrication of glass and its mechanical components—framing systems, gaskets, adhesive, sealants, as well as assembly procedures and potentials—has brought the curtain wall and its application in building. In the course of doing so, there has been a steady revision of openness and the control of the cultural aspects of the transparent building. What are the new connections in glass architecture—both visual and mechanical—that have allowed this new reach for architecture and how do they affect your work?

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Glass at the Limits 
Moderator: Antoine Picon
Professor of the History of Architecture and Technology, Graduate School of Design, Harvard University

In an era of ubiquitous and inexpensive global communications and increasingly expensive energy costs, what are the critical implications for glass in building over the next decade? Will energy issues force a major change in transparent architecture? Have concepts of transparency, so fully embedded in architectural theory and history, been dislocated to new modes of transparency? Have newly mobilized forms of mathematics unlocked programs of information transparency, self-generated and navigated forms of media, new forms of community made architectural transparency? Does architecture have a chance to affect these conditions?

What are the new limits of glass—as technical instrument or social and political metaphor?

Beatriz Colomina
Professor, School of Architecture, Princeton University
Elisabeth Diller
Architect, Diller Scofidio + Renfro, New York
Matthias Schuler
Engineer, TRANISSOLAR, Stuttgart
Bernhard Weiler
Director and Professor, Institute of Building Construction, Technische Universität Dresden

The technical limits of glass seem to have reached a new plateau: is it still possible to consider glass architecture a frontier project for the new generation of architects and engineers? Or do its ultimate material limits, in bending, stress and strain, cost, energy, loss, modularity, and seeming standardization require a new mode of seeing glass architecture as inevitably embedded in a new stratum of capital-intensive and ubiquitous building materials? Is glass now a fully conventional material?

How have the roles material plays in design changed and to what extent can we consider any material extraordinary today, when we extended the capability to engineer material performance and to reduce risk?

Steven Holl
Professor of Architecture, GSAPP, Columbia University
Werner Sobek
Engineer, Werner Sobek Engineering and Design, Stuttgart
Professor of Architecture, University of Stuttgart

Reception
FRIDAY  
SEPTEMBER 28

9:30-11:00 AM
Structural Glass, Structure and Glass
Moderator: Richard L. Tomasetti
Engineer, Thornton Tomasetti, Inc., New York

Conventional goals for installation of glass have isolated and maintained the brittle material in conditions that assure minimal intrusion of stress and strain. Today, new means of testing and modeling loading, and of verifying the effects of the behavior of integral systems on each other have allowed more dynamic interaction of comprehensive ensembles of structure, glass, and framing systems. This panel examines the role of structural engineering in glass architecture and in particular new means of testing and projecting the behavior of systems.

Ulrich Knaak
Professor of Architecture, Technical University, Delft
Nina Rappaport
Publications Director, School of Architecture, Yale University
Jens Schneider
Professor of Engineering, University of Applied Sciences, Frankfurt

11:15 AM-12:30 PM
Optics and Climate Engineering
Moderator: Joan Ockman
Director, Temple Hoyne Buell Center for the Study of American Architecture at GSAPP, Columbia University

The economic impact of recent environmental energy savings laws has usually been understood for overt if not linear decreases in energy consumption. Yet the emergence of a new standard of climate engineering also has produced architectures that are efficient but not decidedly driven to reducing consumption so much as allowing for a new type of architectural experience.

Glass architecture has been the recipient of many of these engineering advances and its visual qualities register against and sustain a history of glass projects. But the visual aspects of glass have also been transferred from the experience of the user to a wider examination of material performance. The optic project is one of discrete examination and calculation of a finer gradient of affects. A finer visualization of the properties of glass as material and what these properties can allow architecturally raises the expectations for climate engineering, building design, and ultimately for energy studies in architectural design.

Michelle Addington
Associate Professor, School of Architecture, Yale University
Robert Heintges
Professor of Architecture, GSAPP, Columbia University
Toshihiro Oki
Engineer, SANAA, Tokyo

12:30 PM-2:00 PM
Break

2:00-3:15 PM
New Materials/Conversion of Light
Moderator: Scott Marble
Professor of Architecture, GSAPP, Columbia University

During the early 1990s a shift in direction occurred in architectural design that began to place greater emphasis on the performance capabilities of building materials—in effect the performance capabilities of architecture in its widest sense. Decades of academic work that relied on theories of meaning often taken from linguistic criticism have been increasingly displaced as the dominant method in both architectural education and building design. As an overall catchphrase, “new materials” has indicated a wide range of meanings, but in general it has indicated materials that will by their very nature change what we design—and possibly for whom we design.

What are potentials that lie within the term “new materials” for glass application today? How are new glass materials re-writing what we do with glass and for whom we work?

Graham Dodd
Engineer, ARUP, London
Susanne Rexroth
Researcher, Institute of Building Construction, Technische Universität Dresden
Thomas Richardson
Material scientist, Lawrence Berkeley National Laboratory,
University of California, Berkeley
Stefan Röschert
Architect, Diller Scofidio + Renfro

3:30-5:00 PM
Security, Safety, and Blast Loading
Moderator: Michael Bell
Professor of Architecture, GSAPP, Columbia University

Impact loadings have been a concern of the engineering community for decades, in particular in those places that regularly experience hurricanes and tornadoes. Blast loadings were added to the set of loads on a large scale with the first attacks on U.S. embassies abroad, without really entering the public consciousness, because those attacks happened at a distance. Today, all landmark and important structures need to be re-engineered under a new set of design criteria. How do these new demands affect the glass installations as defined in earlier sessions of this conference? How does the engineering community respond to this challenge?

No realm of technical research outside of blast loading and security in glass applications seems as at odds with what we have historically expected of glass architecture. A construction possessed of a delicacy supplied by transparency—essentially fragile even as it has often been presented as anything but, in terms of social or political effect—glass architecture has routinely been understood as causing a re-evaluation of social or political hegemony. This tenacious quality has been a metaphor for the breaking of social relations within which the work situates itself.

Yet blast loading and security issues suggest that the limits we have placed on glass to sustain impact have been expanded—and indeed glass architecture’s continued presence, even acceleration in contested sites in an era of security risks would have us re-write glass as an act of securing stability rather than up-ending it. What are the new means of increasing—or sustaining—glass applications in security situations? How do we evaluate these in the context of the historical themes of glass as brittle and indeed fragile?

Albrecht Burmeister
Engineer, DELTAX, Stuttgart
H. Scott Noville
Professor and Chair, Department of Civil and Environmental Engineering, Texas Tech University
Robert Smelewitz
Engineer, Applied Sciences Division, Wadlington Associates, New York

Closing Remarks
ALBRECHT BURMEISTER

Since 1989, Albrecht Burmester has been a partner and Managing Director of DELTA-X GmbH, an engineering firm based in Karlsruhe, Germany. His firm specializes in lightweight, steel structures, structural glazing, structural glass facades, and facade engineering. He applies the finite element method (FEM) in the engineering design process. He previously worked on bridge projects at the Ed. Züblin AG headquarter and as a scientific assistant at the Institute of Structural Mechanics at the University of Stuttgart, from where he received a civil engineering degree. His dissertation was awarded the Professor Fritz Plan Prize. In 1987 he was awarded the Fritz Plan Prize of the University of Karlsruhe (TH) which recognized his contribution to structural dynamics. He is also on the engineering faculty of the University of Applied Sciences in Erbach. Burmester is a member of the standardization committee that oversees design and application regulations for the use of glass in buildings and civil engineering projects and directs the working group “Bomb-Blast-Resistant Design” (Fachverband Konstruktiver Glasbau).

JAMES CARPENTER

A leading architect in the development of new and emerging glass and material technologies, James Carpenter is a principal at James Carpenter Design Associates, which has advanced architectural design by focusing on the integration of natural light, into the structure and design of large buildings. The firm specializes in developing enclosures using glass, structural skies, and building skins for major projects, which have included World Trade Center Tower 7, Time Warner Jazz*(Lincoln Center, and the new MTA Transit Center at Fulton Street, all in New York City, as well as Gucci Tokyo.

BEATRIZ COLOMINA

Beatriz Colomina is a Professor at the School of Architecture and Founding Director of the Program in Media and Modernity at Princeton University. She is the author of Domesticity at War (ACTAR and MIT Press, 2007), Doble exposición: Arquitectura, tecnocultura, y el Estado en el México Bicentenario (Alai, 2006), and Privacy and Publicity. Modern Architecture ex Moss Medio (MIT Press, 1999). She is also co-founder and Managing Director of Bombast-Resistant Design (B-R-D). She is interested in the collaborative and interdisciplinary activity that has accompanied Modern Architecture since the late 1980s.

KENNETH FRAMPTON

Kenneth Frampton is the Ware Professor of Architecture at the Graduate School of Architecture, Planning and Preservation at Columbia University, where he has taught since 1979. He is the founder and director of the seminar and technical studio on the curtain wall.

ROBERT HEINTGES

Robert Heintges is principal of Heintges & Associates, an international consulting firm that provides a wide range of services to architects, owners and manufacturers, and product design processes. Heintges has worked in the field of facade systems and design since 1989.

STEVEN HOLL

Steven Holl has realized cultural, civic, and residential projects both in the United States and internationally. In 1976 he founded Steven Holl Architects, which has offices in New York City and Beijing. The firm has been recognized around the world with numerous awards and accolades, and its work has been widely published and exhibited. Holl’s work has been presented in numerous museums and exhibitions, and Steven Holl Architects opened the highly acclaimed Nelson-Atkins Museum of Art (Kansas City, Missouri) in 2018. Holl’s work on the design of architectural glass was inspired by the work of Le Corbusier, Peter Zumthor, and Rem Koolhaas. Holl’s work on the design of architectural glass was inspired by the work of Le Corbusier, Peter Zumthor, and Rem Koolhaas. Holl’s work on the design of architectural glass was inspired by the work of Le Corbusier, Peter Zumthor, and Rem Koolhaas.
ULRICH KNAACK
Ulrich Knaack completed his architecture studies at RWTH Aachen. He went on to lecture in structural design and subsequently founded the firm REInHOLD MARTIn...
Thomas Richardson earned a BS degree in Chemical Physics at Michigan State University and a PhD in Inorganic Chemistry at the University of California, Berkeley. He leads a materials research team for the Windows and Daylighting Systems Program of the Department of Environmental Energy Technologies Division at Lawrence Berkeley National Laboratory (LBNL) in Berkeley, California. He also heads a laboratory of chemistry developing lithium batteries for the U.S. Department of Energy’s Batteries for Advanced Transportation Technologies (BATT) program and another pursuing lightweight hydrogen storage solutions for fuel cell cars. His work in the field of electrochromic windows has concentrated on dynamic reflecting coatings that act as selectable mirrors in both the visible and near infrared regions of the solar spectrum. These windows have the potential to reduce energy consumption for heating, cooling, and lighting of commercial and residential buildings while at the same time improving user comfort and productivity. Richardson was awarded the Department of Energy’s R&D 100 Award in 2004 for this technology.

STEFAN RÖSCHERT

Born in Geneva, Stefan Röschert worked with Ateliers Jean Nouvel, in Paris, and Skidmore Owings & Merrill, in New York, before joining the architectural firm Diller Scofidio + Renfro, which he worked extensively in the area of branding as a strategist, consultant, and designer for several New York- and Paris-based companies, and in 1999 founded his own firm, Project Architecture. He was added to the New York and New Jersey, urbanites, conceived with a broad focus on private cultural and public projects, and developed and designed as well as on international competitions and theory. Röschert received an MA in Architecture with distinction from the Technische Universität Berlin. He earned his MS degree in Architecture at Columbia University in 2001. He has been the recipient of numerous prizes, including the Brand-Streemmann Scholarship and the Erwin Schenck Award, as well as the German Academic Exchange Service Alumni fellowship, and several International Foundation scholarships.

JENS SCHNEIDER

Jens Schneider is an engineering consultant at Goldschmidt Fischer and Partner, Heusenstamm, Germany, specializing in structural engineering. He was previously an engineering consultant at Goldschmidt Fischer and Partner in Stuttgart, specializing in glass structures, and a scientific assistant at Darmstadt University of Technology. He received a MSc in Structural Analysis, Department of Civil Engineering. Schneider holds a PhD in structural analysis at the Darmstadt University of Technology, and is the author of more than 30 publications on glass. He is a Professor of Engineering at the University of Applied Sciences, Frankfurt, and has been a lecturer on steel structures at the University of Applied Sciences, Structural and Engineering Mechanics at the university. He was also a lecturer on Steel Structures at the University of Applied Sciences, Structural Engineering at the Hochschule für Technik (HT) Stuttgart.

HANS SCHOBER

Hans Schober has been the President of Schlachter Bergmann and Partner (SBP) LP, since 2005. Schlachter Bergmann, a leader in glass construction, has realized various projects with architects such as Kazuyo Sejima, Frank O. Gehry, Steven Holl, Rem Koolhaas, and Helmut Jahn. Schober, a co-author of Gläser (Birkhäuser, 1999), is also curiously a visiting professor at Architecture at Harvard University’s Graduate School of Design.

KAZUYO SEJIMA

Kazuyo Sejima founded the architectural firm SANAA, with Ryue Nishizawa, in Tokyo in 1995, after establishing Kazuyo Sejima & Associates in 1987. Previously, Sejima, who holds an MA from Japan Women’s University, had worked for Toyo Ito & Associates. Among SANAA’s recently completed projects are the Theater for the Almara Cultural Arts Center in the Netherlands; Toledo Museum of Art in Ohio, USA; Zollverein School of Management and Design in Essen, Germany; Nobauer Campus Building in Basel, Switzerland; and Naoshima Ferry Terminal in Japan. Current projects include the New Museum of Contemporary Art, in New York, Louis E Lorenz in France, Learning Center EPFL in Lausanne, Switzerland, Vitra Factory Building, in Weil am Rhein, Germany, House for China International Exposition of Architecture in Nanjing, China, and the expansion of the Institut de l’Economie Méditerranéenne. The firm has realized many major works in Japan, such as S-House in Okayama, N-Museum in Washuwa, and the Kyoto National Museum and Koga Park Café in Okayama. O-Museum in Nagano, and the 21st Century Museum of Contemporary Art in Kanazawa, as well as storrs for Issey Miyake and Christian Dior both in Tokyo.

ROBERT SMILOWITZ

Robert Smilowitz is a Principal in the Applied Sciences Division of Weidlinger Associates, based in New York, and a member of the R&D 100 Award-winning Cooper Union. He earned a PhD from the University of Illinois at Chicago. Smilowitz has more than thirty years of experience participating in the protective design and vulnerability assessment of federal courthouses, federal office buildings, embassy structures, air terminal, and commercial properties. He analyzed the World Trade Center underground parking garage in response to the 1993 bombing and the World Trade Center, in Saudi Arabia, in response to a terrorist vehicle attack in 1996. Smilowitz is a member of the ASCE/SEMA World Trade Center Building Performance Study, and developed protective design retrofit of the Pentagon facade related to the aircraft impact of September 11, 2001. Smilowitz also has participated in the...
explosive testing of full-scale curtain-wall systems and is a principal developer of analytical software for simulating curtain-wall response to an explosive terrorist threat. He is GSA National Peer Professional, a National Associate of the National Academies, and a registered professional engineer in New York and California.

WERNER SOBEK

Trained as both an architect and as a structural engineer, Werner Sobek has been a Professor at the University of Stuttgart since 1995. He has headed the University’s Institute for Lightweight Structures and Conceptual Design since 2000, succeeding Frei Otto. He is also the founder of Werner Sobek Engineering and Design, one of the leading engineering consultancies worldwide. The firm, established in 1992, currently has offices in Stuttgart, Frankfurt, Moscow, and New York. Sobek holds a PhD in structural engineering from the University of Stuttgart and previously worked at Schlüch, Biermann and Partner in Stuttgart. In 2004 his work was the subject of an exhibition entitled Show Me the Future, held at the Pinakothek der Moderne Museum in Munich.

RICHARD L. TOMASSETTI

Richard Tomassetti is Chairman of Thornton Tomasetti, Inc., based in New York, an international engineering firm that has provided structural engineering for the world’s tallest buildings in the world—the Petronas Towers in Kuala Lumpur and Taipei 101 in Taiwan—as well as for the recently completed New York Times Building in New York City. Many of his firm’s projects include innovative uses of glass for aquariums, winter gardens, atriums, curtain walls, and protective design. Among his numerous honors and awards are election to the National Academy of Engineering, the 2006 AIA NY Chapter Award, and the New York Association of Consulting Engineers’ 2002 Engineer of the Year Award. Tomassetti is an Adjunct Professor in the Department of Civil Engineering and Engineering Mechanics at Columbia University and at New York University. He is also an active author, lecturer and recognized investigator of structures in distress.

BERNHARD WELLER

Bernhard Weller is a Professor of Civil Engineering and Director of the Institute of Building Construction at the Technische Universität Dresden. His areas of expertise include the design and testing of glass structures and building skins. A main focus of his research is the structural use of glass and glass bonding. After earning a degree in civil engineering at RWTH Aachen, Weller worked as an engineering consultant in structural design, after which he was appointed Professor of Building Construction at the Technische Universität Dresden. In 2005 he was a Visiting Professor at Columbia University in New York.

MARK WIGLEY

Since 2004, Mark Wigley has served as Dean of Columbia University’s Graduate School of Architecture, Planning and Preservation. Prior to joining Columbia in 2000 as Director of Advanced Studios, Wigley taught from 1987 to 1999 at Princeton University. He received both his BArch (1979) and PhD (1987) degrees from the University of Auckland, New Zealand. Wigley has also served as guest curator for exhibitions at The Museum of Modern Art, New York; The Drawing Center, New York; Canadian Centre for Architecture, Montreal; and Witte de With Center for Contemporary Art, Rotterdam. An accomplished scholar and design teacher, he has written extensively on the theory and practice of architecture, and is the author of The Architecture of Deconstruction: Derrida’s Haunt (Routledge Press, 2001) and is one of the founding editors of Volume magazine.

The Graduate School of Architecture, Planning and Preservation at Columbia University (GSAPP) offers six master’s degree programs: Master of Architecture, Master of Science Advanced Architectural Design, Architecture and Urban Design, Urban Planning, Historic Preservation, and Real Estate Development. With an enrollment of 650 students from some 55 countries, the School serves as a leading laboratory for testing new ideas about the environmental role of the architect in a global society. It cultivates an atmosphere in which all of the disciplines dedicated to the built environment are invited to think differently, to move beyond the highest level of professional training, opening a creative space within which the disciplines can re-think themselves in order to find new settings and new forms of professional, scholarly, technical, and ethical practice.

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The Department of Civil Engineering and Engineering Mechanics is one of nine departments in the Fu Foundation School of Engineering and Applied Science at Columbia University. Offering undergraduate programs in civil engineering and engineering mechanics, it provides students with a firm technical basis while nurturing decision-making and leadership potential. The civil engineering program, accredited by ABET, architecture, Montreal, and Witte de With Center for Contemporary Art, Rotterdam. An accomplished scholar and design teacher, he has written extensively on the theory and practice of architecture, and is an invited speaker at the highest level of professional training, opening a creative space within which the disciplines can re-think themselves in order to find new settings and new forms of professional, scholarly, technical, and ethical practice.

www.bauko.bau.tu-dresden.de

The Institute of Building Construction at Technische Universität Dresden is devoted to the built environment in all areas of building construction. Research and development activities are carried out in close collaboration with industrial and institutional partners and thus reflect and address the current and future demands of the building industry. The main fields of research at the Institute are the use of glass in construction and the energy-efficient performance of building envelopes. Important topics are the structural use of glass, the use of composite construction materials, and the structural bonding of glass elements, especially the use of adhesive bonding. In the field of energy efficiency in relation to building envelopes, the aesthetic and structural design of photovoltaic elements and the building physics of facades are subjects of current interest.

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