As the construction, maintenance and operation of the built environment undergoes significant changes based on demands in lower energy consumption, low CO$_2$ emissions, and higher durability and long lasting quality, the building industry is delivering with innovative solutions in new construction methods and technologies. Consequently, the focus on sustainable design shifts increasingly towards the evaluation and thoughtful deployment of building materials and methods themselves. Instead of continuing local building traditions, more opportunities arise to make use of new and emerging products and construction methods. Many of these technologies are already developed, but little known or scarcely implemented by a wider audience of architects and contractors. This research seminar is a continuation of a series of initiatives to look closely at new and emerging advanced construction methods applicable for the North American market and to communicate their opportunities for the higher demands of responsible building construction. Furthermore, we will evaluate and research on the potential for advanced and integrated environmental systems, and how alternative construction methods can create new opportunities.

Each semester's course will concentrate on the vast opportunities and innovative applications of specific material categories or specific construction methods.

The structure of the course will consist of self-directed and team-based research, where literature, contact to the industry and research institutes as well as discussions and student presentations and work shops will play a major role.

The product each student is expected to deliver is communicational material in form of a compendium for architects, designers, engineers as well as for students. It is expected that students are motivated for team efforts and independent research with weekly deliverables. As an effort to compile this valuable material over time and to make it available for a broad audience, a publication is planned.

prerequisite: Arch 417, graduate standing, Location: Room TBD
Research

The structure of the course will consist of self-directed research based on literature, contact to the industry and research institutes as well as discussions and student presentations, field trips and workshops.

In order to fully understand the materials and systems one has to research on various comparative criteria. It is intended to create several groups, responsible for specific criteria across systems and construction methods, and specific individuals responsible for comprehensive documentation.

In discussions, individual research, and workshops students will have the opportunity to collaboratively develop suggestions for design opportunities, comparative studies of different construction methods.

This course is a research based course and not a lecture course.

Construction Compendium

The product, each student is expected to deliver is communicational material in form of a compendium for architects, designers, engineers as well as for students. It is expected that students are motivated for team efforts and independent research with weekly deliverables.

The goal of the course is not only to gain comprehensive knowledge of different construction methods, but to create documentation with a highly communicational value to practitioners and students alike.

The materials, eventually published in a format of a printed “Advanced Construction Compendium” and as web-based resource, requires the development of visual communication skills as well as an understanding of hierarchies and importance of specific information.

The Compendium will require basic introductions to materials and products, construction methods and assemblies, as well as in depth information about data, detailed drawings, photo documentation, and sourcing.

In a second step, suggestions on design opportunities, integration of systems and presentation of case studies add to the basic technical information in order to build a bridge between technical data and design.

For graduate students it provides an intensive introduction to the translation of technical information into design relevant aspects as well as the translation of research into communication.

At the broader level of professional education, the research will take you to a wide range of local and international cultures of building, their traditions and contemporary practices. On the other hand, through contact to the local and national industry and research institutions, this broad knowledge will then be able to be translated into relevant information for the North American market.

The overarching goal is to present critical information on the advancement of construction, in relationship to its environmental impact, durability and quality assurance with a focus on developing more sustainable building practices.

The "Compendium" will be a tool of communicating this information to a wider audience, in order to foster good practices and advancements in the built environment.

As an effort to compile this valuable material over time and to make it available for a broad audience, a publication is planned.

Cover Image:
LiTraCon™, light-transmitting concrete invented by Hungarian architect Áron Losonczi, Litracon Kft, and distributed by Byzance Design, France, is made using a combination of 96-percent concrete and 4-percent glass fiber. Exterior light is channeled by the glass fibers and filtered through concrete blocks into interior spaces. Photograph courtesy of LiTraCon, Source: http://www.textileworld.com/Issues/2013/March-April/Nonwovens-Technical_Textiles/French_Technical_Textiles_Industry-Futurotextiles_3-Nexus_Of_Technology_And_Art
Each of the construction methods and systems will be comprehensively described through various criteria: [not in a hierarchical order]

- General description of the construction method, definitions
- History, references, application examples
- General material properties
- Material availability, sourcing
- Manufacturing, manufacturers
- Erection
- Fasteners, connections
- Systems integration
- Thermal behavior
- Structural behavior
- Water tightness
- Vapor Permeability
- Air tightness
- Fire resistance
- Acoustic Behavior
- Penetrations, Thermal Separation solutions
- Openings
- Transportation
- Cost
- Esthetics
- Finishes, layers, attachments
- Limitations
- Design opportunities
- Environmental impact
- Health concerns, air quality
- Precision, tolerances, dimensional stability
- Durability
- Warranties, quality control
- Material strength, compression strength, structural dimensions
- Applicable code, regulations, testing
- Installation, sequencing, preparation, system integration
- Case Studies, application examples
- Craft, labor requirements
### Semester Schedule (subject to change)

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>Introduction to the Course and its Research Topics</td>
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<tr>
<td></td>
<td>Team building</td>
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<tr>
<td>Week 2</td>
<td>Presentation, Information gathering</td>
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<td>Week 3</td>
<td>Methods of Inquiry</td>
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<tr>
<td></td>
<td>Information gathering/Discussion</td>
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<tr>
<td>Week 4</td>
<td>Information gathering/Discussion</td>
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<tr>
<td>Week 5</td>
<td>Information gathering/Discussion</td>
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<tr>
<td>Week 6</td>
<td>Comparison Workshop</td>
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<td>Week 7</td>
<td>Presentation</td>
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<tr>
<td>Week 8</td>
<td>Introduction to Instruction and Reference Materials</td>
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<tr>
<td></td>
<td>Presentation, Comparison, Discussion</td>
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<tr>
<td>Week 9</td>
<td>Design opportunities and limitations</td>
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<td>Week 10</td>
<td>Design for Communication</td>
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<tr>
<td>Week 11</td>
<td>Development of graphics</td>
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<tr>
<td>Week 12</td>
<td>Final refinement of information</td>
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<tr>
<td>Week 13</td>
<td>No Classes: Thanksgiving</td>
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<tr>
<td>Week 14</td>
<td>Final Presentation and discussion</td>
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</tbody>
</table>

Field trips are offered when possible and might be outside regular class time.
GRADING
As the work in the seminar is both individual and collective, the criteria for evaluation include not only research excellence, but also the ability to make constructive contributions within the overall framework of the class, participating actively in group discussions and all collective undertakings. There will be one major research paper as the final deliverable. Grading is based on a comparison to other students currently in the course, with past students at the same level, with the instructors’ personal expectations relative to the objectives of the course and student improvement over the semester.

Relevant Criteria for this Seminar:
- develop research skills
- make connections between conceptual ideas and construction practices.
- reduce anxiety of how to make something and instead find excitement in the inquiry related to building construction.
- increase empowerment and agility in design decisions
- understand the relationships between new materials and methods as an extension of long held principles of conventional practices.
- investigate materials and methods as they are able to define and contribute to the making of buildings.
- understand limits and constraints of various systems either dimensionally or because of time-based or trade-based procedures.
- consider the performance of materials and methods as a means to make buildings more economical, efficient, and / or sustainable.
- understand the malleability of conventions without losing the logic of the initial system.
- advance the design thinking in studio because of their understanding of materials and assembly principles.
- advance the ability for research and its translation into relevant information
- advance the communication skills

The seminar will be directed in several parallel tracks: short research components, long-term investigations, translation of material into graphic communication, and individual and group work.

Class meetings concentrate on discussions on specific research components, which students are expected to prepare prior to class meetings.

Each student group will have to find case studies of recent buildings, which resemble a significant step in the advancement of a particular construction method. Describing its relevance for the North American market will enhance the documentation.

Evaluation
A [Excellent]: Work must reflect outstanding achievement in content and execution and far surpass given requirements.
B [Good]: Work must reflect high achievement in both content and execution and excel beyond given requirements.
C [Adequate]: Work simply meets the given requirements.
D [Poor]: Work is less than satisfactory and minimally fulfills requirements.
E [Inadequate]: Work fulfills few if any of the requirements and the studio must be retaken.
I [Incomplete]: This grade is ONLY available due to health reasons or other emergency circumstances.

In addition to the final grades, each student will be given a written evaluation near the middle of the semester. This evaluation will be based on work submitted to that date. Upon receiving these mid-semester
evaluations, each student must make an appointment to meet with the faculty to discuss the work, the student’s individual progress in the course, and general directions where the student should focus his or her attention for future growth and development. Students who feel the grade assigned to their work is in error should initiate a grade complaint with a 500 word e-mail to their studio faculty describing the reason why this might be the case. Grade complaints will be handled as a serious matter through the Program Chair. A grade complaint can result in raising or lowering a grade if the matter goes before an independent panel.

ONLINE COURSE EVALUATIONS
The final course evaluations are important to the quality of instruction. Please take the necessary time to critically and constructively evaluate the course as well as the teacher’s quality of instruction and guidance in relation to your own participation in the course, engagement in the subject matter as well as your interaction with your peers and your instructor.

STUDIO ETIQUETTE
- The studio meets every Friday from 9:00am to 12:00pm.
- The students are required to be in attendance during scheduled meeting times, and are expected to be working on their research and engaging in group discussions / workshops during studio time.
- Participation in all sessions and presentations is required for the successful completion of the course. Students must be in attendance for the entire session [not only for their personal review]. Two or more unexcused absences will result in a failing grade for this seminar.
- Due to the high aim to publish the material produced, it is expected that each student takes the responsibility for highest quality work, both, of your own work, as well as through supporting your colleagues’ work within the studio. Sharing information and ideas, as well as maintaining a steady culture of critical discourse within the studio is especially necessary.

PLAGIARISM
Plagiarism is knowingly presenting another person’s ideas, findings, images or written work as one’s own by copying or reproducing without acknowledgment of the source. It is intellectual theft that violates basic academic standards. In order to uphold an equal evaluation for all work submitted, cases of plagiarism will be reviewed by the individual faculty member, and/or the Program Chair. Punitive measures will range from failure of an assignment to expulsion from the University.

In this course, where your research and output is based to a large extent on outside sources such as literature, internet publications, dissertations and image material, you are held responsible to adequately quote the source and/or author. In most cases you are asked to translate your findings into original material.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES
If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way the course is usually taught may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Services for Students with Disabilities (SDD) office to help us determine appropriate academic accommodations. SDD (734-763-3000;http://ssd.umich.edu) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide is private and confidential and will be treated as such.
THE ACADEMIC POLICIES OF THE COLLEGE

You will be held responsible to all of the academic policies of the college. Please refer to: http://taubmancollege.umich.edu/students/academic_policies/general/

DEADLINES / ABSENCES

Students who miss deadlines due to valid extenuating circumstances may submit the required work at a later date, as agreed upon with the instructor. University regulations limit such circumstances to serious personal illness and death in the immediate family. Unexcused late projects will not be accepted, incomplete projects will be evaluated in relation to their degree of completion, and a student will be allowed to present such work only with instructor approval. In cases where students must miss a class, they are responsible for making up the missed material. Lectures and demonstrations cannot be repeated.

OFFICE HOURS

Fridays 12:15 - 1:00 by appointment only. Office 1223.
London Basketball Arena, Wilkinson Eyre Architects & KSS Design Group, 2011
Fabric Formwork, Miguel Fisac
Textile Facades
Convertible SEFAR® Architecture TENARA® Fabric
ETFE Pillow Facade, Roof
ETFE Pillow Roof
ETFE Pillow Roof with inserted thin film PV
Fiber fabric reinforced Concrete

Fiber fabric reinforcement in a EIFS application
INITIAL MATERIAL AND CONSTRUCTION METHOD SELECTION

Due: Friday 09-12, Presentation, Information gathering

TASK
In individual efforts, all students will gather possible research topics related to current construction methods and materials/ material applications and/or assemblies. The initial material and information selection should be limited to TEXTILES, FIBERS AND MEMBRANES, relevant in contemporary construction. In your material gathering effort, it is not required to limit your search to materials and methods applied in the United States, however the research topics should be promising in the availability to conduct a thorough analysis and comprehensive communication about history, material properties, and applications, including case studies and/or product information. There is no limit in this initial search of how many different alternatives you will present.

PRESENTATION
In form of a pdf presentation, you will strategically demonstrate the potential of each of your research topic as it relates to ADVANCED CONSTRUCTION METHODS. Describe what role the material/construction method plays in today’s advancements in construction and what potential you may see in the application. State clearly whether your resulting material refer to materials and products or to assemblies and construction methods

DISCUSSION
Following the presentation, we will group and categorize your searches and establish a matrix, how the materials and methods relate to one another, and how we can describe their role in today’s advanced construction industry.

TEAM FORMING
Based on common research interests, you will form teams of 2 or 3 to narrow down your focus on a specific Construction Method or material Application.

RESEARCH
Within the next three weeks, you and your team will corroboratively gather material from various sources, including publications, the internet, material and product/manufacturer information, dissertations, publications from research institutions, case studies and the like. It is important to gather a multitude of information for a comprehensive analysis of the material. It is a good idea to already start writing some product/method introductions, historic overview etc.

Please refer to Suggested Construction Methods and Criteria on Page 3.

A presentation and team discussions are planned for Friday 10-24.