ETH zürich

amàco
ATELIER MATIÈRES À CONSTRUIRE

GROUNDED MATERIALS

WORKSHOP **2015**
ACTIVITY REPORT

9th - 19th June 2015
Zürich - Switzerland

SUMMARY

Photographic credits (except specific mention) : Sasha Cisar/ETH and Aurélie Vissac/amàco

innovedum

Institute of
Construction and Infrastructure
Management

USYS TdLab
Department of Environmental Systems Science
Transdisciplinarity Lab · Science-Society Interface

ETH zürich

DUSYS DBAUG DARCH

ATELIER
MATIÈRES À
CONSTRUIRE
amàco

INVESTISSEMENTS D'AVENIR

les grands ateliers

ENSAG

INSA LYON

ESPCI ParisTech

CRAterre

Unité de Recherche
Architecture
Environnement
& Cultures Constructives

INTRODUCTION

Grounded Materials aims to develop sustainable building materials by disrupting current teaching in two fundamental ways. First, instead of studying each material separately we combine them in creative and unexpected ways - we call this **trans-material**.
Secondly, we work with selected stakeholders to ground construction materials in a societal context – we call this **trans-disciplinary**.

This ETH Zurich course aspires to develop grounded materials for the construction sector – materials that are sustainable and innovative whilst still responding to the constraints of those on the ground.

To do so it requires students to work with several materials at the same time (trans-material) and take into account societal constraints in the construction sector (trans-disciplinary). We believe this **approach fosters integrated and socially relevant solutions** in line with current ETH initiative for critical thinking.

In **interdisciplinary groups** students combine knowledge from material sciences, environmental sciences, engineering and architecture. Transversally, they explore the physical characteristics of various materials whilst taking into consideration production, design and application on the construction site.

The course is hosted by the **Chair of Sustainable Construction** from D-BAUG. This chair seeks to embed sustainability in all aspects of the built environment – whilst transferring integrated knowledge about the characteristics and applications of construction materials. The course is run in close collaboration with the **USYS TdLab** (Transdisciplinarity Lab) that develops new educational and research approaches to solve complex problems at the interface between academia and society. The course is also part of a new partnership with **amàco** (building matter workshop), an innovative teaching centre on construction materials science based in Villefontaine, France. The teaching method entails hands-on experiments, encounters and building. The learning contents also draws on aesthetic and affect to stimulate the participant’s curiosity.

ETH Zürich, Hönggerberg Campus

About the site

Grounded Materials Summer School took place at ETH Zürich on the Hönggerberg campus, which is located on the outskirts of the city of Zürich. This campus illustrates the links between science, industry and the general public, and won the European Cultural Award for Science in 2010.

In June, Students spent ten days in the HIR wooden pavilion, performing experiments, participating at lectures and other exercises. They also developed and presented their project for a grounded material in the pavilions.


ZÜRICH
GROUNDED MATERIALS SUMMER SCHOOL
ETH Höggenberg campus

Time schedule

Time	Part 1: Guided Experiments, Workshops, Lectures				
	Tuesday 1 9. June 2015	**Wednesday** 2 10. June 2015	**Thursday** 3 11. June 2015	**Friday** 4 12. June 2015	**Saturday** 5 13. June 2015
07:00				*Site visit 2 Lyss CreaBeton*	
07:30					
08:00	*Introduction*	*Sustainability*	*Discovering clays*		*Mix Design Strategies*
08:30	*Suprise Exercise*				
09:00	*Exercise Rich Picture*	*Stakeholder Analyis Site Visits Documentation*	*Physics of Clay*		
09:30			*Plasticisers & Cement*		
10:00					*Mix Design Strategies*
10:30					
11:00			*Lecture: Mineral binders*		
11:30		*Arch. of fibres*			
12:00				*Transfer*	
12:30					
13:00	*Earthen Arch.*	*Fibres Discovery Fibres Matrix Reinforce & Alleviate*	*Site visit 1 Winterthur Stroba Buildings*		*Mission Statement (problem identificatin, needs, staekholders)*
13:30	*Carzas Exercise Traditional Processing Techniques*			*Site visit 3 Zürich Mehr als Wohnen*	
14:00					
14:30					
15:00		*Lecture: Physics of fibres*			
15:30					
16:00		*Lecture: Physics of grains*		*Habitat Exercise*	
16:30					
17:00		*Input Dirk Hebel*		*Input Jasmin Packer*	
17:30					
18:00					
18:30					

Key:					
	TdLAB	*Site Visit*	*Exercise*		
	Amàco	*Exercise*	*Lecture*		
	All	*Input*	*Review*	*Synthesis*	*Apèro*
	Groups	*Project Work*			

Part 2: Design Project

Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
7	8	9	10	11
15. June 2015	16. June 2015	17. June 2015	18. June 2015	19. June 2015
				Review
Input Michael Stauffacher				*Apèro*

TRANS-MATERIAL TEACHING

As cities grow and resources become scarce, future engineers and architects have to think and implement sustainable solutions in an increasingly complex context. “Grounded Materials” seeks to suggest thinking materials outside the confines of individual materials like wood, steel and concrete by considering the constituting matter of all materials like fibres, grains and binders across different materials (trans-material). Materials thus can be differently reconstituted, e.g. through a locally specific or available assembly of matter.

Together with experts on material sciences, students experiment with materials and their physical properties to change the attitude towards existing construction materials. Concrete is made of grains and a binder. However, the physical properties that allows to improve strength properties through packing optimization in concrete can also be used to other contexts such as for instance desert sand, earth and all sort of urban waste. Similar attitudes considering fibres or binding agent allows a true trans-material approach.

magic

earth

emotion

wood

straw

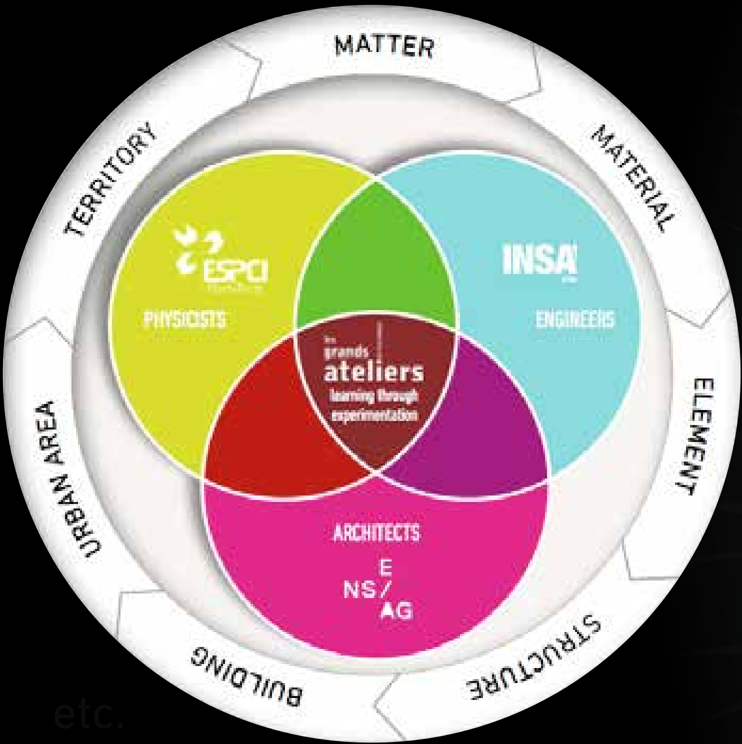
art

sand

etc.

water

creativity



amàco

ATELIER MATIÈRES À CONSTRUIRE

amàco project is an educational resource centre that aims to make visible, in sensory and poetic ways, the physic-chemical behaviour of the most common natural materials, such as sand, water, earth, wood, straw, etc. The project aims to disseminate knowledge regarding their application in construction, so as to promote the emergence of eco-friendly practices. amàco brings together physicists, engineers, artists and architects, under the same roof. Magic, emotion and creativity are the watchwords of the project.

amàco LECTURES & EXERCISES

amàco was in charge of most of the material science lectures and practical exercises at the beginning of grounded materials summer school.

The lectures were organized around two main subjects :

1.- *Building with Earth :* earthen architecture, traditionnal building techniques, physics of grains and phisics of clay muds ;
2.- *Building with Fibers :* architectures of fibres, physics of fibres.

The «experimental» lectures included some live experiments that were performed by the participants in order to increase the magic and emotion of the different scientific experiments.

Also, the participants were invited to get involved in hands-on experiments by doing planned exercises with earth and fibres :

1- Sensorial exercice
2- Traditionnal processing earthen techniques
3- Earth exercise (Carazas test) and fibres exercise

SENSORIAL EXERCISE

Sensorial discovery of earth

As an introduction to the experiments, the students were invited to discover how their senses allow them to get information on soils.

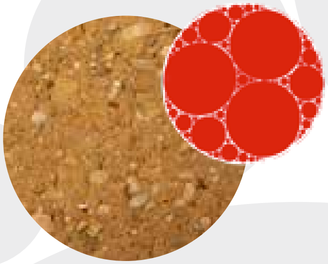
The view is the dominant sense, to the detriment of other senses. Amàco offers kinesthetic exercises where participants, blindfolded, focus on the sensations given by the touch, the smell, the hearing and the taste.

With this total sensorial experiment, it is possible to identify the mineral composition of a soil, the presence of organic matter, the salinity or the humidity but also and that is the most important it shows what is sensitive only with our own perception: cold, warm, appealing, etc. These exercises link the student with the materials in order to bring a familiarity with what they will work on during the summer school. It also abolish the barriers between the different field of expertise of the students as engineers, architects, environmental or material scientists are all confronted with a new sensations.

Aesthetics of matter

Some raw materials used in construction such as earth, straw or even wood, can be regarded as dirty, fragile and sometimes archaic. Through art, amàco proposes to modify the look on these raw materials highlighting their aesthetic potential.

«BUILDING WITH EARTH» EXPERIMENTAL LECTURE



The lecture «building with earth - from matter to architecture» was divided in two parts.

The first part focused on presenting an overview of earth architecture heritage and contemporary examples. It showed the functions earth material can have in relationship with a building technique (to carry, to insulate, to cover, to fill).
By trying to answer the question: How does it stand? Scientific experiments with grains were presented. They allow to understand the physics of earth as an assemblage of grains, air, water and a binder (clay).

In the second part, we went deeper in the matter and explained the physical-chemistry of interaction between earth components.

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Residence in Schlins – Roger Boltshauser & Martin Rauch, Schlins, Austria © rights reserved

«BUILDING WITH FIBRES» EXPERIMENTAL LECTURE

cane structure © Canya viva

Architectural installation in Alsace © Jordi Pimas

The lecture «Building with Fibres - from matter to architecture» was also divided in two parts.

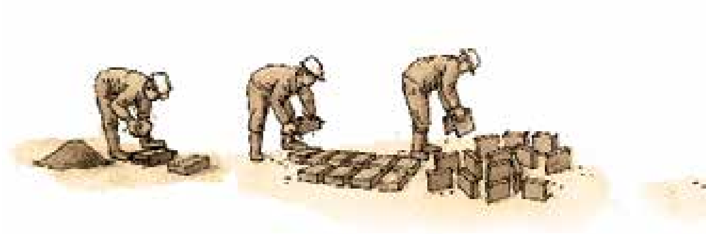
The main objective of the first part of the lecture was to show the use of natural fibres in architecture and explore all possibilities and qualities that can be inspiring for architects, engineers, artists, designers, etc. A short overview of the use of fibres in vernacular and contemporary architecture highlighted the different functions fibres can have (filter, insulate, dress, cover, reinforce).

In the second part, we deepen our understanding of fibres and explained their origins, their diversities and their inner physical and chemical properties, especially when there are interactions with other elements (water, grains, etc.).

TRADITIONNAL PROCESSING TECHNIQUE EXERCISE

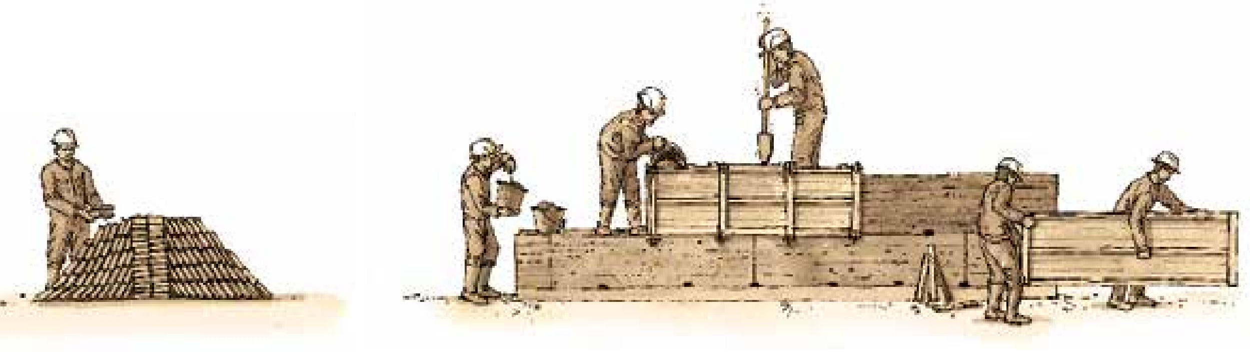
These exercises propose to discover some processing techniques used in traditional earth construction. By manipulating specific tools for each technique, participants collectively understand the differences between rammed earth (a monolithic technique), adobes (a masonry technique), compressed earth-straw or earth-hemp (insulation technique).

Furthermore, by changing various parameters, like the type of earth, the tools, the hydric state of the earth, the proportions of earth/fibres, the compaction forces, the accuracy of their practice, they can see the differences in the final building material they are producing. This «understanding by doing» gives them the appropriate know-how to use the matter around them.



ADOBE

Mud bricks or "adobe" is a very ancient and intuitive building technique used since the rise of human sedentary societies.
It consists of transforming a mix of earth and straw in a plastic matter by the addition of water so that the mix can be molded.
The fresh bricks are then sun dried.



RAMMED EARTH

Rammed earth is also vernacular technique requiring slightly more tools than adobe.
Wooden or steal tools are actually used to compact, layer by layer, earth into a formwork. The result is a monolithic bearing wall.

PRESSED EARTH-STRAW

Earth-straw is a quite recent technique mainly used to fill temporary or lost formworks. It consists of mixing straw or another fibre such as hemp, with a liquid clay mud in order to stick all fibres together when it dries. The mix is pressed into a mold or a formwork in order to make non-bearing walls. The high quantity of vegetal fibres provides a good thermal insulation.

EARTH EXERCISE TEST CARAZAS

As explained in the experimental lecture, earth is a material composed of three element: a liquid (water), a solid (sand/clay) and a gas (air). By modifying the hydric state of the earth, the interactions between these three elements can be drastically changed.

The aim of this exercise is to observe the variations in material aspect, by changing the hydric state of the earth (dry, humid, plastic, viscous or liquid) and the processing technique (poured, pressed or compacted). This exercise allows to teach by doing, the possible existing choices and variability in order to achieve a desired property.

During the exercise, four types of earth where tested and compared by the participants in order to show explicitly that different earth soil qualities provides very different results.

FIBRES EXERCISE

Inspired by the previous exercise with earth material, different kind of fibres were also tested with similar experimental set up. The fibres were used at different hydric state (dry, mixed with water or with liquid mud) and similarly as the earth exercise they were either poured, pressed or compacted.

The results were immediately compared.


TOSHIBA

TRANS-DISCIPLINARY TEACHING

In addition to the environmental considerations, future engineers and architects will have to take into account an increasingly complex societal context. “Grounded Materials” considers construction materials, and potential future materials in relation to their societal impact and in negotiation with selected stakeholders in this field (producers, users, developers, owners, etc.).

Together with experts, “Grounded Materials” provides a forum for students to adopt the perspective of various stakeholders from the construction sector in order to consider social and environmental constraints. This is because we believe that sustainable construction materials should be grounded in discussion between students, scientists, builders and producers in order to address emergent issues.

USYS TdLab

Department of Environmental Systems Science

Transdisciplinarity Lab · Science-Society Interface

The TdLab from the Department of Environmental System Science at ETH Zurich develops new educational and research approaches to solve complex problems at the interface between academia and society. Through its teaching programmes, the TdLab trains students to apply their scientific expertise to tackle complex societal problems that advance sustainable development.

USYS TdLAB EXERCISES & SITE VISITS

USYS TdLab led a series of activities that introduced students to design thinking and to identify the problem they wished to solve through their design of a grounded material. The TdLab proposed a series of interactive exercises that led them to adopt a stakeholder's perspective when designing their solution.

The main exercises were:
1- The Marshmallow challenge
2- Rich Picture Activity
3- Stakeholder Analysis

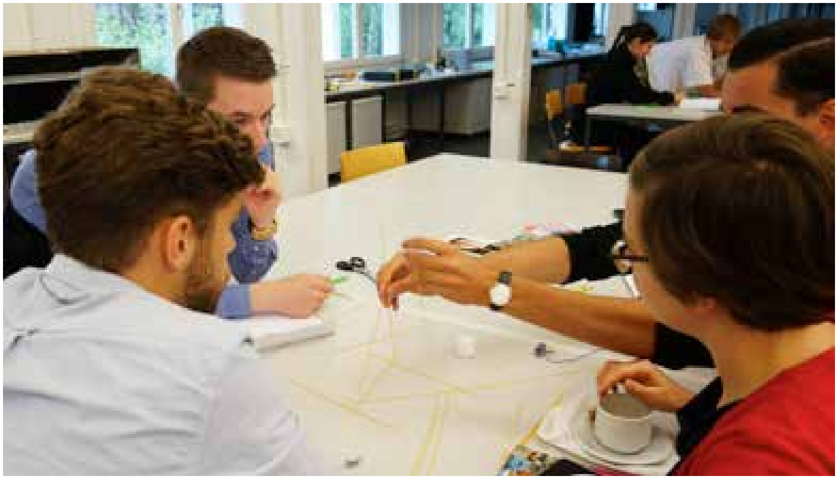
In addition to these exercises, the students visited four sites were they engaged with specific stakeholders. At the end of these visits a group debriefing allowed us to consolidate the information gathered from the field, and the new challenges this raised for the design of new sustainable materials.

1- An alternative material retailer (Stroba)
2- A construction site using earth material used (IG-Lehm)
3- A conventional prefabrication plant (Créabéton)
4- A completed multi-family building aiming toward a 2000W society (Mehr als Wohnen)

MARSHMALLOW CHALLENGE

This short and fun exercise is a perfect ice-breaker, and quickly builds a team spirit within interdisciplinary student group. Each group is given 20 sticks of spaghetti, a metre of tape and string and a marshmallow, and has to build the highest tower with the marshmallow at the very top.

This exercise leads the students to negotiate, exchange and decide on how to build the tower in a limited amount of time, most important here is not so much the preconceived knowledge of each person, but the groups ability to try and test solutions as they move forward. It is then not surprising that elementary school children regularly perform better at this challenge than senior executive managers.



RICH PICTURE ACTIVITY

This quick and fun exercise enables students to apprehend the complexity of a system, in this case, the value chain of construction materials. The learning objective of this activity was for students to realize how a building materials are grounded within a local context and that they are also a part of a value chain of people and organisation rather than abstract concepts. Given the interdisciplinary background of the course, the goal of this exercise was also to assess the baseline knowledge regarding sustainable materials that each individual already had. In order to do this, each student had to first explain in one sentence what they thought a sustainable material was.

In a second step, every student was asked to select one sustainable building material for the Zurich context. The students were then asked to draw the value chain for this material. Students were asked to use as many drawings as possible to visualize their ideas rather than text.

They were also asked to connect the elements that they included in their drawings. In groups students then discussed and reflected the definition and content of the value chains that each of them drew. Each group chose to develop one value chain further, refining it on the basis of group discussions.

On the basis of each group's rich picture, an open discussion was held with each group presenting their results. This enabled us to broaden our understanding of sustainable materials and to take a wider view of the life cycle of various materials.

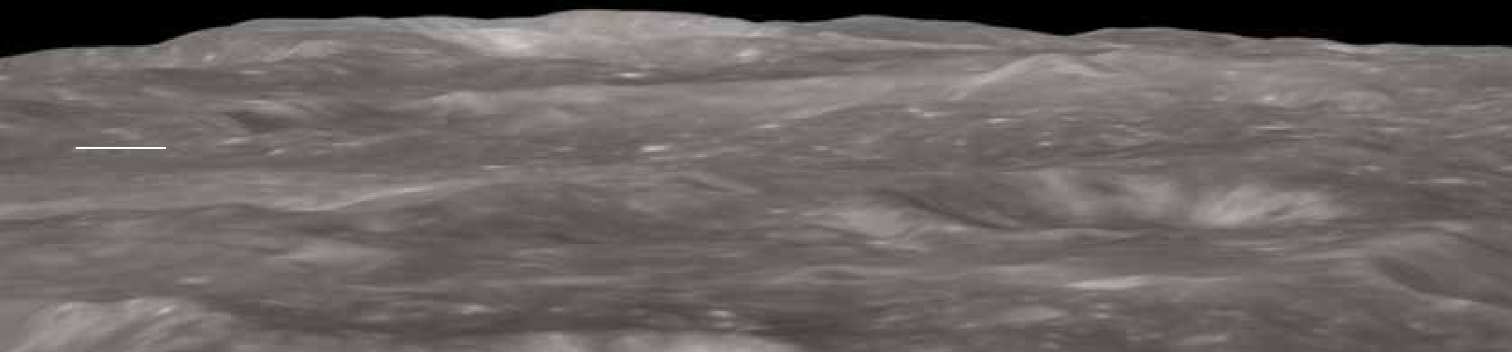
Throughout this process, the teaching team provided only guidance regarding instructions for what and for how long the activities were to be. All the knowledge and content specific to the topic of sustainable materials came from the students themselves. This is an important aspect of problem-based learning, upon which the design of this activity is based.

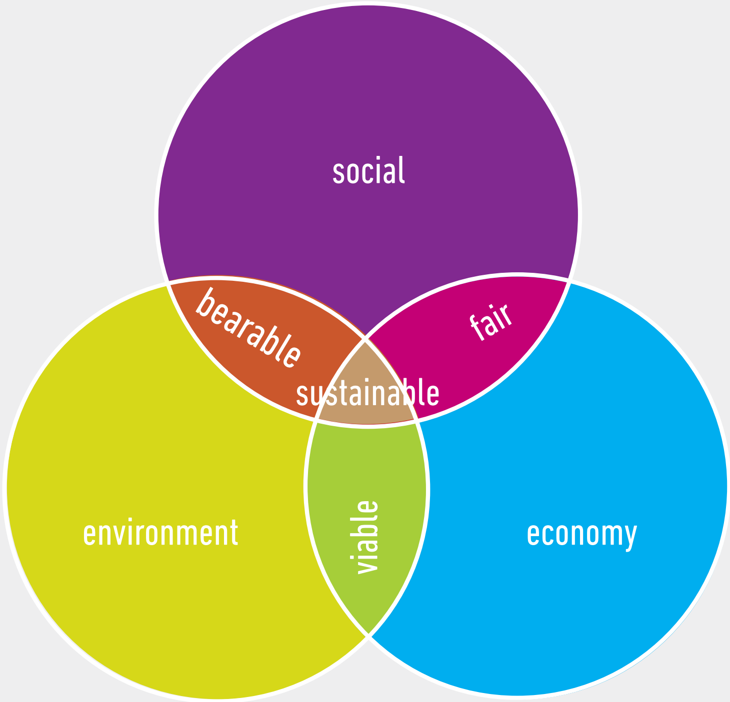
SUSTAINABILITY LECTURE

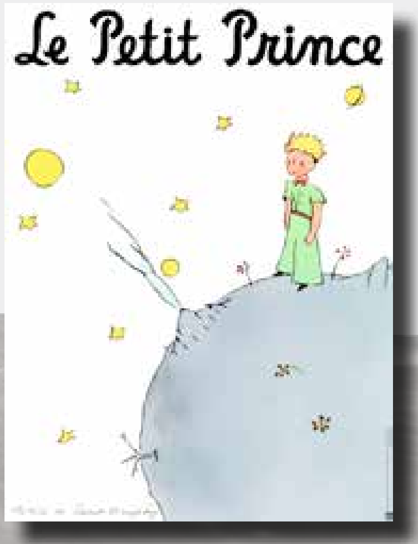
The day after the rich picture analysis, Prof. Guillaume Habert provided the students with a theoretical introduction to sustainability and how it is currently defined.

The history of sustainability was given from the Limits of growth (Meadows 1972) to the Brundtland-report (Brundtland 1987). The environmental impact of the building sector was also demonstrated, along with the importance of reducing energy use within this sector.

An initial definition of a Grounded Material was proposed. A grounded material is sustainable in terms of its ecological footprint, appropriate and socio-economically relevant and finally regenerative within its socio-technical system. As such, grounded materials promote a built environment that actively transforms both nature and society.







"One sees clearly only with the heart.
Anything essential is invisible to the eyes"
Antoine de Saint-Exupery

"What is important in building materials is not what they are,
but what you do with them"
John Turner

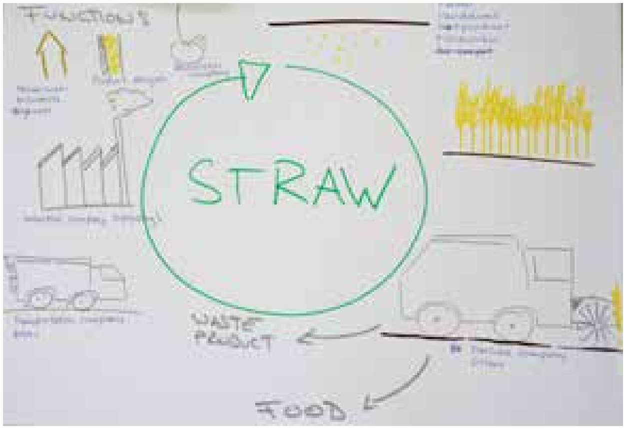
STAKEHOLDER ANALYSIS

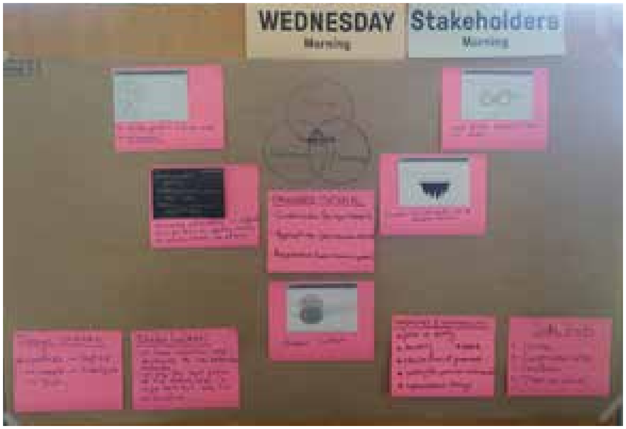
This exercise aimed at clarifying why it is important to understand the positions and needs of stakeholders in the construction sector in addition to the technical constraints that exist for the development of alternative building materials.

To do so, the groups went back to the value chains they had made during the rich picture activity. They were asked to identify the different persons or organisations involved in the development, the production, the implementation and the use of the building materials.

In a second step each group member assumed the role of a stakeholder and wrote down their personal incentives and constraints to use the selected sustainable construction material. These different positions were then presented in a plenary; where we identified and discussed the conflicting interests, learning that one man's incentive can be another man's constraint.

All the constraints and incentives were gathered on a blackboard and recurring themes were identified. At the end of the exercise, the position of the different stakeholders enabled the students to anticipate positions of stakeholder's in the upcoming visits, and help frame their questions.


FUNCTIONS
STRAW
WASTE PRODUCT
FOOD


WEDNESDAY
Morning
Stakeholders
Morning

SITE VISIT : Stroba

Stakeholder : Alternative material retailer

Near Winterthur the students met a small family-owned retailer of environmentally-friendly materials. The retailer showed mineral plasters that are ecologically friendly produced and insulation materials based on plants or animal hair and thus based mostly on renewable resources or products that have little environmental impact.

Students learned which materials would be useful in which part of the house materials and asked who are the clients. The owner of the company explained that these ecologically-friendly products are mainly used by small companies or individual builders. The question of cost competitiveness was raised and the importance of a holistic understanding of what a cost is was discussed. Finally, the students had the perception that a lack of knowledge for the potential users of these materials was a critical barriers for their further implementation.


THERMO
JUTE
DUO

SITE VISIT : Construction Site

Stakeholder : Builders

In Winterthur the students met with two builders of two nearby residential houses that were mostly renovated by using earthen materials. Walls were built with rammed earth, where wooden construction was necessary it was plastered with earth. One house was recently finished the other is still work in progress. Both were examples of in-situ construction process, where the builders built on site. This allowed much flexibility to tailor building elements to the very old building structure but it meant a slow building progress. The builders displayed different earths and applications of construction processes and shared their experience on building with earth. The projects were special because the builders were essentially their own clients and resident of the same houses.

SITE VISIT : CreaBeton

Stakeholder: Precast concrete element company, R&D representative

In Lyss students visited a factory that prefabricates concrete elements mostly for infrastructure. They learned about different constraints regarding prefabricating concrete elements like material composition and application. The production process of a large variety of products was shown, from sewage to train tracks or flooring outdoor areas. In all cases, the high level of automatization and the high speed of production was impressive to see. The discussion with the communication manager of the company as well as the R&D representative allowed the students to understand how sustainability issues was a clear topic for further development of their products and also how difficult it was for such a company to achieve a transition toward sustainability due to the existing high amount of capital invested in existing production infrastructure.

SITE VISIT : Mehr als Wohnen

Stakeholder : Client, architect, resident

In Zürich students visited a sustainable housing project entitled Mehr als Wohnen. The city of Zurich served as client for this project through an organization representing its subsidized housing cooperatives. It should be an experiment of sustainable materials and measures. The students engaged with the representatives of the client and an architect of two buildings. They also had the opportunity to meet a resident and visit her apartment. The collaborative planning process was discussed with the students and how different needs were negotiated between stakeholders. It also showed a broad variety of applications for sustainable materials and building elements.

ADDITIONAL INPUT

Dr. Jasmin Packer

The environmental scientist Dr. Jasmin Packer conducted a hands-on exercise with the students on material and habitats. Each group was provided with a set of materials (mud, wood, branches) and a habitat description. The students had to guess which animal habitat this corresponded to and make it in a short amount of time.
This was an entry for students to the topic of ecology, or the relations of organisms to one another and their physical surroundings. It also raised questions on how animals modify their surrounding by using local materials.She also discussed with students the meaning of resilience, and the importance of habitats that can absorb shocks and changes.

Prof. Dirk Hebel

Architecture professor, Dirk Hebel came one evening to present his conception of grounded materials to the students. He discussed the great challenges fast growing urbanisation creates in developing countries and the potential use of local materials such as bamboo. He also showed possibilities of reusing waste in construction. But his talk our discussion with him mainly focus on the difficulty of designing and implementing a product based on alternative materials (bamboo or waste) in the free-market. As an architect, he strongly highlighted the potential of an appropriate design that can render a product desirable for clients, not just because it is an alternative material, but also because it is pleasing.

SYNTHESIS

TRANS-MATERIAL SYNTHESIS : Mix design options

After focusing on individual material components students learned about ways to combine them. The students explored the consequences of optimising (or not) the ratio of different grain in an assemblage. First they quantified the grain optimization by comparing final height of column filled with always the same mass but different ratio of sand and gravel. They did the same exercise by mixing fibres and sand. In a second step they observed the effect of the ratio between the solid volume and the liquid volume in a suspension. To do so, they mixed different ratio of grain (either pure sand or sand and straw fibres) and a liquid paste (composed of clay and water). The mixes were examined through slump tests to define maniability of the final product. The last experiment combining different approach and entitled the Habert Test is a matrix with different water and clay ratio in the paste and different paste/grain ratio. The discussion after these experiments summarized the different key points to consider for the mix-design of materials and their relation with the final function of the material (insulation or structure) and its processing technique (pressed, poured).

TRANS-DISCIPLINARY SYNTHESIS : Mission Statement

To conclude the first part of the summer school students were asked to define a mission statement that would serve as a starting point for the design of a sustainable material. The learning objective was for the students to practice being specific about what problem for which they were designing a solution. The assumption behind this objective is that the materials designed should solve a specific problem for a specific group of people in order for it to be of use in the real world. We required that this mission statement or problem definition to answer three questions : 1) Who are affected by the problem or observation you have identified? 2) What is the unmet demand or need of these people? 3) What is/are the specific insight(s) upon which you have based the answers to questions 1 and 2?

In order to find the three elements of the problem statement, students first collected and summarized the insights of the first week. Second the students identified needs based on site visits and hands-on experiments. Third they associated the selected needs and discussed how different stakeholders could be affected. Finally they selected from the list of stakeholders and needs the most striking combination that should be solved by the group. In short presentations the groups presented then their mission statements and reasoning as to why they chose it. While the statements could be amended and improved during the second part based on an iterative process of designing a project, this problem definition provided the initial focus for their experimental efforts. This process of problem definition is adapted from the design methodology used at the design schools of Stanford University and Potsdam University. Different variations of this method are also used in corporate settings.

IBI

THE **CHAIR** OF **SUSTAINABLE CONSTRUCTION**

Led by Prof. Dr. Guillaume Habert,
The Chair of Sustainable Construction
from the Department of Civil, Environmental and Geomatic engineering at the ETH Zürich intends to ground sustainability in all disciplines involved in the built environment. More specifically, the chair seeks to develop research on the following points :

- The identification of the relevant parameters that influence the environmental impacts of buildings at the international, national and regional levels.

- The quantification of the improvement potential for each specific materials during the various stages of its life cycle.

- The implementation of these sustainable practices throughout the proposition of innovative constructive techniques based on a detailed analysis of the technical, economic and socio-cultural situations

GROUNDED MATERIAL PROJECTS

In the second part of course, the students worked collaboratively on the challenge of developing a grounded material in response to their mission statement. They were expected to adopt the perspective of the stakeholder they had decided to represent. Through out the second week students were tutored by the teaching team, and had the opportunity to go back to stakeholders to discuss their progress.

At the end of "Grounded Materials" the students presented their project to invited guests. The guests were made up of selected experts and stakeholders and enabled a rich dialogue and feedback on the quality of the material, and its applicability on site. Each group had the opportunity to present in character, representing the stakeholder they had selected. They defended their mission statement, and explained the particular needs their solution sought to address. During the final presentation, we had some rich discussions between students, and invited guests on the design process itself, the viability of their solution and the potential it unlocked. The variety of solutions among the groups highlighted that there are many different pathways to sustainability in the construction sector.

The following learning-evaluation criteria provided a framework to assess the student's performance :

- Relevance of the mission statement compared to socio-cultural and economic constraints discussed with the stakeholders.
- The proposed solution tackle the identified needs.
- The technical constraints are understood and relevant characterisation tests are used to optimise the product.
- The material optimisation process is clearly explained, and the analysis is based on scientific concepts and guided by a rational approach.
- The strong points are highlighted and potential sources of improvement have been identified.
- The oral expression and the information presented is clear and relevant.

PROJECT : Group 1

Mission Statement : as a construction company who wants to fulfil society's demand for sustainability, we need both cost competitive materials and processes because in the end, cost matters most.

The students in this group were representing a construction company called BlocKonstruction whose selling line was: "You want to build a sustainable house? You want the best quality for an attractive price? Our company will help you to realize your dream house with cheap and sustainable products. Our prefabricated earth elements are top of the line and allow for quick and easy building techniques." After having analysed the current pre-fabricated rammed earth walls they identified the joints between prefabricated elements as being the weak point of the process due to them being very intensive in time and labour. The students decided then to overcome this joint difficulty by embracing the joints and making them a feature, assuming the prefabricated character of them rather than hiding them. Their solution enabled the construction process to speed up radically, as they no longer had to hide the joints. Other more innovative construction processing technique such as 3d printing or porous formwork were tested in order to clearly position the company as a front runner in materials innovation.


Terrarc 2.0

PROJECT : Group 2

Mission Statement : as a production company for ceilings and floor elements, we need to expand our portfolio towards sustainable systems as there is a potential emerging market that we need to position ourselves in.

The students of Group 2 identified a production company to be their selected stakeholder. The difficulty of this group was to propose innovative and sustainable solutions without leaving its core expertise and whilst still show large innovation possibilities. The strategy identified by the students was a vaulted floor system that would be sustainable by design and that would additionally be able to be tailored with infinite possibilities of finishing elements depending on the client wishes. The Terrarc 2.0 is actually a pre-fabricated vaulted ceiling elements made with earth material and allowing glass floor or an insulation material to be added. Furthermore, in order not to increase the production costs, the group 2 studied how the ceiling elements could be quickly fabricated.

PROJECT : Group 3

Mission Statement : as an open-minded and environmentally conscious developer, we aim to specialize in sustainable constructions by recycling and reusing on-site materials from inner-city brown field. By doing so, we save transportation and landfill costs.

As a total contractor, the students were able to propose to their potential clients a full project solution from the planning stage to the execution. Throughout these different phases the developer sought to reuse on site materials, saving money in excavation, transport and landfill. The problem was to develop a suitable solution to easily all these excavation and demolition materials. The students focused on rammed earth construction based technique that they applied to recycled concrete rubble. This material was incorporated in a wooden frame, which would enable either onsite, or nearby prefabrication and an easy handling on the construction site. To validate their assumption, the students performed economic analysis including investment in equipment and the landfill taxes that would be avoided.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Tag der offenen Tür
12. September 2015
Lehmgrube Binz
Grubenstrasse 56, 8045 Zürich
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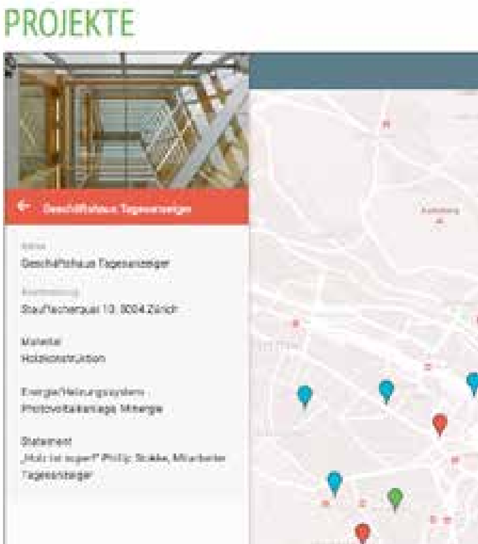
PROJEKTE
Geschäftshaus Tagesanzeiger
Geschäftshaus Tagesanzeiger
Stauffacherquai 10, 8004 Zürich
Material
Holzkonstruktion
Energie/Heizungssystem
Photovoltaikanlage, Minergie
Statement

PROJECT : Group 4

Mission Statement : as a private, small scale user, who wants to build his own house (not necessary himself), we need to have access to information in order to compare and decide between different materials.

After an analysis on how people can get access to information and the difficulties non-experts encounter, this group suggested two combined strategies. The first one would be a website that would provide access to information on sustainable building materials and exchange knowledge between interested people in the model of social networks. The second one would be an open house day where people could visit the houses of others and have a close look at the materials homeowners have used. To validate their hypothesis, the students did a survey, interviewing different stakeholders in Zurich and Switzerland about the idea of this open house day that they called ZueriWohnt. All of the feedback they received was very enthusiastic!
http://zueriwohnt.jimdo.com/


Designs

"GROUNDED MATERIALS"

was hosted by the Chair of Sustainable Construction
and developed in collaboration with the TdLab and amàco.

Chair of Sustainable Construction,
Institute of Construction and Infrastructure Management, ETH Zürich :
Prof. Dr. Guillaume Habert (development, teaching), Sasha Cisar (development, organization),
Dr. Coralie Brumaud (teaching), Gnanli Landrou, Giulia Celentano (support),
Annette Walzer (support), Dimitra Ioannidou (consultancy).

USYS TdLab (Transdisciplinarity Lab), ETH Zürich :
Dr. Michael Stauffacher (development, consultancy),
Alice Hertzog (development, teaching), Dr. Bin Bin Pearce (teaching).

amàco (atelier matières à construire),
ENSAG, INSA de Lyon, ESPCI, Les Grands Ateliers, Villefontaine :
Laetitia Fontaine, Mariette Moevus-Dorvaux (development), Aurélie Vissac (teaching).

Selected guests and stakeholders :
Ralph Kuenzler (IG Lehm), Sami Weisser, Nina Schlegel, Dieter Baltensberger (Stroba),
Andreas Hofer (Mehr als Wohnen), Claudia Thiesen (Mehr als Wohnen),
Dr. Aude Chabrelie (Creabeton Matériaux), Dr. Jasmin Packer (Adelaide University),
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Participants (students) :
Lucas Bauer (D-BAUG), Dimitri Bozovic (D-MTEC), Anouchka Kaczmarek (D-ARCH),
Julia Carpenter (D-MATL), Thomas Streule (D-BAUG), Valerio Frezza (D-BAUG),
Aike Steentoft (D-BAUG), Mirjam Minder (D-ARCH), Nadine Peneder (D-MATL),
Philippe Grönquist (D-BAUG), Petra Pfaff (D-ARCH), Stefan Caranovic (D-ARCH),
Mattia Seregni (D-MATL), Mike Heinrich (D-BAUG), Liviana Klein (D-USYS),
This Alder (architect), Vera Voney (D-MATL), Stefan Breit (D-USYS).