

Infrastructure Space

5th International
LafargeHolcim Forum
Detroit 2016

Foundations

19

Magazine of the LafargeHolcim Foundation for Sustainable Construction



Infrastructure Space

5th International
LafargeHolcim Forum
Detroit 2016

How does Infrastructure Space affect the building materials industry?

"We have to invest at least twice as much money in infrastructure during the next 15 years as has been invested during all of human history. Is the industry ready for this?"

Rolf Soiron, Member of the International Committee of the Red Cross; Chairman of the Board of the LafargeHolcim Foundation



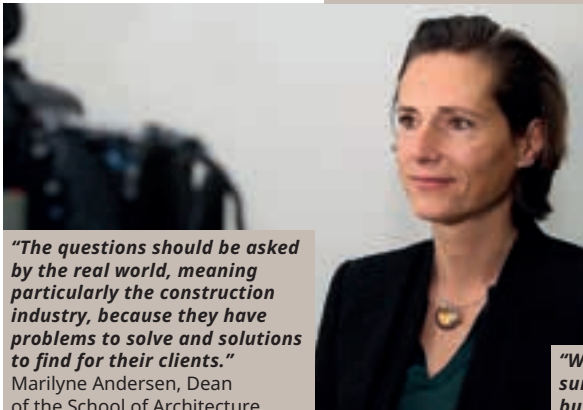
"We underestimate the network and the knowledge of the construction industry."

Maria Atkinson AM, Founding CEO of the Green Building Council of Australia; member of the Board of the LafargeHolcim Foundation



"The questions should be asked by the real world, meaning particularly the construction industry, because they have problems to solve and solutions to find for their clients."

Marilyne Andersen, Dean of the School of Architecture and Environmental Engineering at the EPFL Lausanne; member of the Board of the LafargeHolcim Foundation



"We all know that we're surrounded by infrastructure: but do we? Does industry make the intellectual, economic, or political space for infrastructure to continue to provide a positive impact in our lives?"

Reed Kroloff, Immediate Past Director of the Cranbrook Academy of Art; Conference Chair of the LafargeHolcim Forum 2016



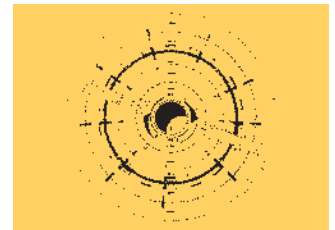
The LafargeHolcim Forum brings together specialists and experts from around the world: a good opportunity to ask the professionals a question with the cameras running: “How does Infrastructure Space affect the building materials industry?” Find wide-ranging answers in the statements throughout this magazine.



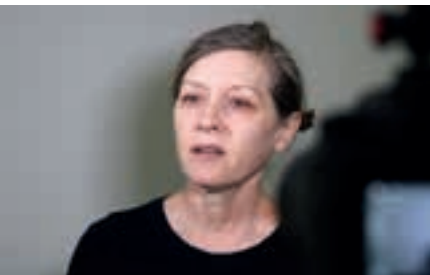
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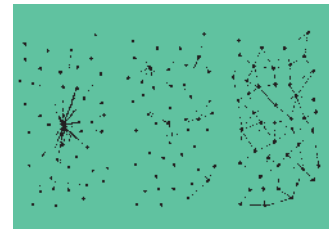
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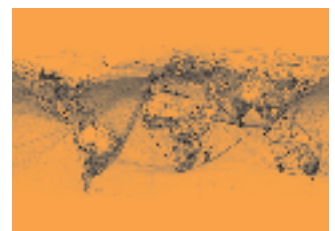
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Infrastructure?

Hearing this word, one instantly thinks of roads, pipe systems, cable networks, bridges, public places. But infrastructure also appears in less tangible forms: in systems for traffic management or capital flow, as a part of public security, as information technology, and in countless other forms. Taken as a whole, infrastructure is nothing other than a lubricant for societies and economies. The way it is designed fundamentally affects our lives and the space in which we conduct our activities. And because infrastructure is often laid out for the long term, it also affects future generations and the way society develops. It is thus a crucial issue in any analysis of how to shape the built environment in a sustainable way.

Space!

At the 5th International LafargeHolcim Forum, which took place from April 7 to 9, 2016 at Wayne State University in Detroit, USA, professionals from the fields of architecture, civil engineering, urban planning, social sciences, business, and industry examined the question of how infrastructure must be designed for the long term in order to meet the needs of present and future generations. The roughly 300 Forum participants came from 40 countries on all continents. Equally diverse were the points of view they injected into the eminently important discussion. The exchanges among the experts took place as part of keynote speeches, stationary and mobile workshops, and panel discussions – and of course also at the various informal gatherings during the three days.

Left: The LafargeHolcim Forum 2016 took place at Wayne State University's Community Arts Auditorium & McGregor Memorial Conference Center. The latter was designed by Minoru Yamasaki and completed in 1958.



The participants were greeted at the conference hotel by the team of the LafargeHolcim Foundation.



Robert Fishman, Acting Dean of the Taubmann College of Architecture & Urban Planning at the University of Michigan, welcomed the participants.



300 experts from all continents attended the plenary sessions of the Forum.



The participants visited the Diego Rivera Court at the Detroit Institute of Arts: gigantic frescoes depict life and industry at the Ford Motor Company in the 1930s.



Detroit has seen an unprecedented decline. It is therefore the ideal host city for a Forum on “Infrastructure Space” – because it impressively illustrates the importance of effective infrastructure for society.



Urbanization is a global trend. Over half the world's population now lives in urban environments; cities are growing increasingly gigantic. But Detroit, the largest city in the US state of Michigan, has seen the opposite development: The former world center of the automobile industry is one of the few large cities on the planet that has been hit by massive shrinkage. In 1950 nearly two million people lived here; today the population is less than 700,000. Of the 300,000 buildings in the city, about 70,000 are vacant; entire streets have been deserted.



The city is being gradually steered toward a brighter future.



Many buildings and entire districts have seen much better days. About 70,000 buildings in Detroit have been abandoned.

In his keynote speech at the Forum, Stephen Henderson presented what this negative development means in day-to-day life. The journalist, who received the prestigious Pulitzer Prize in 2014, grew up in Detroit. After years of successfully pursuing his career in Chicago, Washington, D.C. and elsewhere, he returned to his native city in 2007 to live there with his family. "In my childhood, Detroit was packed with people," he says. "This has fundamentally changed. When only 700,000 people are living in a city that was built for two million people, you have a lot of unused space. There was a time when we wanted more space, but now everything is empty and we have to ask ourselves: How should we use the space?"

The collapse of the city involved not only the car industry, which once made Detroit a flourishing industrial center, but also mismanagement. After all, people didn't evacuate to other states or regions – they relocated to the Detroit suburbs because the city itself failed to offer the desired environment. The people who remained in Detroit were mainly those who could not afford to move away. This led to a vicious circle: The city had less and less money and could no longer maintain its infrastructure – which prompted even more people to turn their backs on it. Detroit became the poorest and most violent large city in the USA: Public services and infrastruc-



ture crumbled, whole neighborhoods imploded. Stephen Henderson: "The first mile of paved road in the United States was on Woodward Avenue in Detroit. Today there is no city in this country with roads in such poor condition as in Detroit. There is simply no money for maintenance. Half of the 88,000 street lights are out. It has become dark in the city. A metaphoric darkness! Now the question is: How can we make the future brighter?"

The city was declared bankrupt in 2013 and placed under state management. Many small steps have been taken since then to reinstate normalcy; investments are now being made everywhere. Detroit is considered a worldwide textbook example of how a city can be rehabilitated. The key is not only the state's emergency rescue measures but especially the personal commitment of the residents of Detroit, people like Stephen Henderson. He bought the dilapidated house he had grown up in and turned it into a writer's residence and literary center. The people who have suffered through the decline show resiliency and are now taking part in the reconstruction of the city's infrastructure.

Infrastructure serves the people. But sometimes it's the other way around.



Stephen Henderson is Editorial Page Editor for the Detroit Free Press. He won a Pulitzer Prize in 2014 for his unflinching examination of Detroit's financial collapse that gave readers a sobering overview of the past and a hopeful road map for recovery. He is also winner of the 2014 National Association of Black Journalists Journalist of the Year Award. A Detroit native, he is a graduate of the University of Michigan. He has been a reporter, editorial writer, and editor for the Free Press, the Lexington Herald-Leader, the Chicago Tribune, and the Baltimore Sun. Before returning to Detroit in 2007, he spent four years covering the US Supreme Court for the Knight Ridder (now McClatchy) Washington bureau.

Going beyond the fence line



The construction industry can contribute much to sustainable development – also in the creation of infrastructure. Eric Olsen, CEO of the host company LafargeHolcim, showed how the world’s leading building materials Group is taking action to meet the complex challenges.



Lord Norman Foster's prototype *Droneport* shell at the 15th Architecture Biennale in Venice is made of 18,000 *Durabric* tiles from LafargeHolcim that form a self-supporting vaulted structure. The product was optimized to meet the specific requirements of the project (see also page 33).

The CEO of LafargeHolcim is involved every day with the materialization of construction projects. But Eric Olsen knows that infrastructure includes much more than just what is built. "The word infrastructure has a broad definition," he says. "Infrastructure systems facilitate flows of people, goods, resources, and information. These days, that can apply as much to technology as it does to construction."

« *LafargeHolcim was founded on some of the world's biggest infrastructure projects.* »

Nevertheless, the building materials industry still deals with infrastructure mainly in the traditional sense. With good reason, because after all, the history of many companies in the sector – including LafargeHolcim – is closely linked with large-scale infrastructure projects. As an example, Eric Olsen cited the 200,000 tonnes of hydraulic lime the company delivered to Egypt 150 years ago to build the Suez Canal. "The canal has certainly stood the test of time," says Olsen. "But a good deal has changed since our business forefathers fulfilled that contract in 1864."

Today the construction industry is aware that construction lifecycles can influence individuals, communities, the environment, and even the entire planet. Nowadays, no global company can ignore the often very long-term interrelationships. Eric Olsen confirms: "At LafargeHolcim, sustainability is a core value and central to how our business is run."

« *The worlds of construction and infrastructure are embracing sustainability.* »

The Group has defined its future sustainability strategy in its "2030 Plan." Olsen: "Focusing on those areas where we can make a significant impact, the 2030 Plan sets out a series of hard-edged commitments across four categories: climate, circular economy, water & nature, and people & communities." An example target in the area of climate is to reduce net CO₂ emissions per tonne of cement produced to 40 percent below 1990 levels.



Top: Classic infrastructure projects such as the Suez Canal form the basis of success for LafargeHolcim.

Right: Collaborating for sustainability: A prime example is the Olympic Park for the 2012 Summer Games in London.

Various measures being implemented by LafargeHolcim relate to resource consumption: “We have committed to use significantly more waste-derived resources in our own operations – 80 million tonnes a year by 2030.” Other targets are to consume a third less fresh water in cement production and to have up to 75 million people around the world benefit from socially sustainable initiatives in the areas of affordable housing and sanitation. And above all stands a sustainability-centered business goal. Olsen: “What I believe distinguishes us from the rest of our sector is an overarching business target to generate one third of company turnover by 2030 from solutions with enhanced sustainability performance.”

« *Sustainability is a core value and central to how our business is run.* »

Eric Olsen pointed out that even a company like LafargeHolcim – or even an entire industry – has only limited influence on its own. “International policy can be a dry subject. But it can have far reaching effects for all of us,” he notes, and on behalf of the Group he advocates putting a price on the worldwide production of CO₂. “This would act as an incentive for innovation, supporting investment in technologies and solutions that drive down CO₂ emissions.”

« *We believe that putting a price on carbon will spur efforts to tackle climate change across the construction sector.* »

Because complex and global challenges cannot be solved by tackling them alone, Eric Olsen considers it especially important that LafargeHolcim strives for greater sustainability in collaboration with other companies and other stakeholders. Thanks to such



collaboration, projects like the Olympic Park for the 2012 Summer Games in London – a classic infrastructure project – could be designed sustainably from the outset. LafargeHolcim supplied 90 percent of the ready-mix concrete and aggregates for the entire 200-hectare construction site by rail and waterway.

Another example of a fruitful look beyond the company's own backyard is the Green Building Centres partnership in India: "The Green Building Centres provide local masons with access to training and sustainable construction technology that minimizes the use of fuel and precious materials such as topsoil." In this way, explains Eric Olsen, the skills of local workers can be improved, the housing stock expanded, the local economy stimulated, and CO₂ emissions reduced.

« *LafargeHolcim is ready and willing to play its part in driving infrastructure on all levels.* »

Interdisciplinary collaboration and exchange of ideas – that's precisely what the LafargeHolcim Forum is all about. "Is there a better qualified and better equipped gathering to take on the challenges than the one assembled here in Detroit?" asked Eric Olsen – and answered himself: "I can't think of one. So, I would urge you to seize the opportunity. Speaking for LafargeHolcim, you'll find us ready and willing to play our part."



Eric Olsen is CEO of LafargeHolcim. He is also Member of the Board of the LafargeHolcim Foundation for Sustainable Construction and Chairman of its Steering Committee. He joined the Lafarge Group in 1999 and was a member of its Executive Committee from 2007 until its merger with Holcim. He is a business graduate from the University of Colorado, Certified Public Accountant, and holds a Master of Business Administration from HEC International Business School in Paris. He is a Board Member of Cimpress NV, chairing its compensation committee, and is a member of its audit committee. He is also Chairman of the Board of the American School of Paris.

Not too big to fail



In all our studies and discussions on infrastructure, might we be forgetting that the earth also has its own natural infrastructure? And that it is heavily burdened, even to the point of overload? In the future we will have to bring these two mega-systems into peaceful coexistence – a fact about which Simon Upton, Director of the Environment Directorate at the OECD, is certain.

In general, our choices are probably more limited than we think: “Rather than ask how we would like to live, maybe we should focus on how we will be forced to live by the physical constraints of the planet we’re living on.” On the planetary scale, our infrastructure is a sort of artificial superstructure that we overlay upon the natural systems. These natural systems, however, are the actual infrastructure of the planet, “an intricately interconnected web of living processes that cycle finite elements within an enclosed space drawing on incoming solar energy.”

« *The problem will be who carries what burdens in the transition. That is a fundamentally political problem.* »

Regrettably, we realize now that the infrastructure and our superstructure are not particularly well coordinated. Upton: “That superstructure – based on human intelligence – is starting to cause some massive perturbations in the earth system.” The extraction of resources continues incessantly while the capacity of the reservoirs we are filling with our waste products is rapidly coming to an end. Unfortunately, we humans are having difficulty in correctly assessing the potential consequences of these perturbations. And just as we had been persuaded in the financial crisis that certain companies are simply too big to fail, we still believe that the infrastructure of the planet is too big to fail. But even institutions like Lehman Brothers did fail...





“In light of this, I think it’s not so much a question of debating how we might want to live as coming to terms with some ways we definitely won’t be able to live,” says Upton. This means a radical departure from certain physical claims we make. Nevertheless, many choices remain open – and here, says the former politician, politics comes into play, because: “The realm of politics is all about choices!” Governments are gradually starting to recognize that the infrastructure and the superstructure of the planet might not be too big to fail after all. This can be seen, for example, in the fact that the two-degree limit was set as a hard, physical goal in the Paris Agreement.

« *We need to align our demand for resources with the tolerances and margins of natural systems which deliver most of our essential services.* »

In the future we must reconcile the mismatch between space and built infrastructure. Upton: “To do that, we have to have regard for the soft-wiring that lies behind hard infrastructure – and here I’m thinking of policies and regulations.” The problem is, however, that we already have countless policies in place in countless areas. They are all based on the assumption that fossil fuels will



Simon Upton

How does Infrastructure Space affect the building materials industry?

"We've built a huge stock of infrastructure that simply doesn't match the planet's needs. The industry must support creating spaces people can live in, and technology and infrastructure have to support that."

keep everything running. And even if we now add environmental policies – like green splashes on top of the existing policies – that doesn't change the fact that the underlying policies support the consumption of fossil fuels. That's one reason even really good policies like an ambitious carbon tax can fizzle out: "New technologies and business models can't penetrate because the rules weren't designed with them in mind."

«*Our space is constrained and our time limited.*»

All in all, Upton is convinced that in the future we won't be able to get around scaling down our demand for resources to a level that is tolerable for the planet. And we must realize that the reservoirs in which we are dumping our waste have very little remaining capacity. "Policymakers need advice on how to address that unavoidable reality. That advice must be grounded in the practical solutions you are working on."

«*The realm of politics is all about choices.*»

Rt Hon Simon Upton is Director of the Environment Directorate at the Organisation for Economic Co-operation & Development (OECD). He is a Rhodes Scholar with degrees in English literature, music, and law from the University of Auckland and a Master of Letters (MLitt) in political philosophy from the University of Oxford. At the age of 23, he was elected to Parliament in New Zealand, and became one of the country's youngest Cabinet Ministers in 1990. He has been a member the Board of the LafargeHolcim Foundation since the inception of the then Advisory Board of the Holcim Foundation for Sustainable Construction in 2004.

Codes and linkages



Skyscrapers, malls, resorts, franchises, parking lots, airports, golf courses, greenhouses, and ports often look the same no matter where they are.

The architect and urbanist Keller Easterling is convinced: Great untapped potential slumbers in infrastructure space. She says one reason this resource remains under-exploited is the cultural conditioning of architects, engineers, and designers.

A notable aspect of the LafargeHolcim Forums is certainly the phrasing of the topics. The carefully chosen wording gives ample leeway for interpretation, associations, and debating fundamental issues. This was seen with the very first Forum on “Basic Needs,” and the phenomenon was even more pronounced with the most recent event: “Infrastructure Space” – a fascinatingly amorphous term! How much can be read into it and deduced from it!

In fact, the participants of the 5th International LafargeHolcim Forum developed their hypotheses on this subject with academic passion, among them keynote speaker Keller Easterling. Through her presentation, the American architect made the Forum participants acutely aware of how big the gap is between the importance and the perception of infrastructure space. Although infrastructure shapes our everyday lives, we often do not see what belongs to it and how it works. This is probably a chief reason why infrastructure space is “currently an underexploited medium of innovation,” as Keller Easterling assesses the situation.

« *Infrastructure space is not just pipes and wires but a spatial operating system for shaping the city that's like a rule set.* »

The architect says the potential is not being exhausted mainly because of our cultural conditioning: “Culture is well-rehearsed at pointing to things but under-rehearsed at describing the interactivity or chemistry between things.” Designers, engineers, and architects are good at designing buildings and sites, but now they must also become good at recognizing relationships and creating dispositions in infrastructure space. The prerequisite is that they



Infrastructure space is considered by many a by-product of laws, econometrics, informatics, logistics, or global standards.



It's time to see more than buildings, to look behind the scenes and recognize infrastructure space.

must not see infrastructure space as another thing. "It's a large sociotechnical system, too large to be in any one place," says Keller Easterling, "and it cannot be assessed by its name, shape, or outline, but rather by its disposition." Even when buildings may look more or less similar regardless of their location, the underlying infrastructure space can be totally different. Recognizing it is the first step to bringing about real change.

« *Infrastructure space is currently an underexploited medium of innovation.* »

In infrastructure space one must know how to establish linkages, networks, and interplay.

But these changes are not easy to achieve – because infrastructure space is not always governed by logic. "The stories in infrastructure space are usually stories where reasonable things don't happen, where innovation comes up against those political superbugs and bulletproof forms of power." Because the powers in this world – political, economic, or cultural entities – know very well how to manipulate and control infrastructure space. "Infrastructure space constitutes a kind of extra-statecraft," says the architect, "a realm of governance outside and in addition to and often in league with the state."



*Infrastructure space is often not filled by
« cast-iron economic logics but by very powerful »
habits and fictions.*

If architects and designers want to play a role in infrastructure space in the future, they need to learn which controls and buttons to use in which situations. The trick is to see the difference between what is being said and what is being done – but also to adopt a different way of thinking: “It’s not about always knowing the right answer; it’s about knowing how to navigate a river,” explains Keller Easterling: “It’s not so much about knowing what, but more about knowing how.” She cited Savannah, Georgia as an example. In the 18th century the city planners drew up a growth protocol rather than a master plan for the city. Nobody knew how the city would look over time – but it was predetermined how the individual elements of the protocol should interact. A prototypical ideal case that has led to a highly-attractive city today.

To illustrate how important it is to acquire a toolset that allows one to act within infrastructure space and respond to new challenges, Keller Easterling named the current refugee crisis. Although infrastructure space has streamlined the movement of tens of millions of tourists, laborers and products around the world, when five or six million people must be moved away from global atrocities, an unsolvable problem arises. The countries have merely a dumb on-off button to grant or deny citizenship or asylum, and the human aid organizations in many cases seem to lack a spirit of innovation. The architect concluded with a provocative and intriguing possibility: “What if, in addition to our buildings, we left behind a kind of code or shorthand in infrastructure space – by designing linkages that can be established like software and updated over time?”

*Everybody in this room works hard to
« make responsible, reasonable decisions, »
but reasonable innovations can easily be
outmaneuvered by unreasonable politics.*



Keller Easterling is Associate Professor of Architecture at Yale University in Connecticut, USA and an architect, urbanist, and writer. She studied architecture at Princeton University and has taught architectural design and history at Parsons The New School for Design, Pratt Institute, and Columbia University. She was a co-author of “Poreform: Water absorptive surface and subterranean basin, Las Vegas, NV, USA” – a water absorptive surface and subterranean basin that captures rain runoff and adds over 75,000 megaliters (20 billion gallons) to the city’s water supply capacity. The project won the LafargeHolcim Award Gold 2014 for North America. Her books include “Extrastatecraft: The Power of Infrastructure Space,” in which she examines global infrastructure networks as a medium of polity.



The trans-Saharan pipeline will carry natural gas from Nigeria to Algeria and onward to Europe. (Wikimedia Commons)

More money for more infrastructure

Development of the African continent is being hampered by an acute deficit in infrastructure, among other things. Carlos Lopes is convinced that large projects will soon improve the situation. The UN Executive Secretary of the Economic Commission for Africa also sees potential for more self-financing.

In Africa almost all infrastructural indicators lag behind those of other regions of the world. Carlos Lopes knows this from personal experience, because the Executive Secretary of the Economic Commission for Africa (ECA) is from Guinea-Bissau, one of the world's most underdeveloped countries. According to Lopes, the deficiencies in Africa are evidenced mainly in roads, railways, ports & airports, information & communication technology, and in the energy sector. And these shortcomings have serious consequences, as he stated in his keynote speech: "It is estimated that these deficits hamper national economic growth by two percentage points every year and cut business productivity by as much as 40 percent."

« *Lack of proper infrastructure is a serious bottleneck for private business.* »

The example of transportation illustrates how deficient infrastructure hinders the private sector. "It is more expensive to get a container from the port of Mombasa in Kenya to Kigali in Rwanda than it is to get the same container from China all the way to Mombasa."

« *Africa has the potential to generate significantly more domestic financial resources.* »

So it's not surprising that the African leaders, often in alliance with the African Union, focus on large investments in this sector. "A number of mega-initiatives are making the business case for connecting African countries," explains Lopes. These include projects such as an 8,715-kilometer-long transportation corridor from Dakar to Djibouti for USD 18 billion, a natural gas pipeline from Nigeria via Algeria to Spain for USD 23.7 billion, or the LAPSET Corridor, which will connect Kenya's Lamu port to South Sudan and Ethiopia.

Much is also happening in Africa in the field of energy production. The Ethiopian project "Grand Ethiopian Renaissance Dam" is currently being implemented in the Blue Nile basin. Producing 5,250 megawatts, it will be the largest hydroelectric power plant in Africa. The reservoir will hold 74 billion cubic meters of water.



A transportation corridor for road and rail will traverse the continent from Dakar to Djibouti. (www.africa-eu-partnership.org)



A rail link between Cape Town and Cairo is an old dream yet to be realized – here a train of the "Cape to Cairo Railway" in Belgian Congo between 1900 and 1915. (www.digitallibrary.usc.edu)



Left: The new administrative building in Kenya's port Lamu is the starting point for the LAPSET Corridor to South Sudan and Ethiopia. (www.lapsset.go.ke)

Center: Ethiopia's "Adama Wind Farm" with a capacity of 153 megawatts is the largest wind project in Africa. (www.top-energy-news.de)

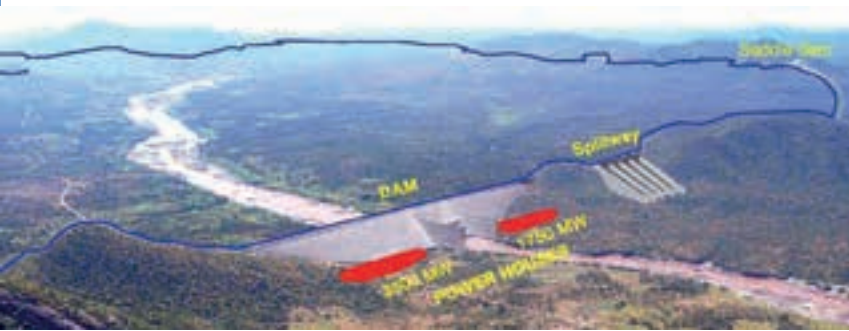
Right: Ethiopia is building the "Grand Ethiopian Renaissance Dam," creating one of the largest hydroelectric power dams in the world. (www.internationalrivers.org)

In addition, a renewable energy initiative has been launched to attract an investment sum of USD 70 billion in order to gain an additional 10 gigawatts of capacity by 2020 and at least 300 gigawatts by 2030. In 2014 Kenya became the world's third-largest producer of geothermal energy – with 600 megawatts. Ethiopia's "Adama Wind Farm" with a capacity of 153 megawatts is currently the largest wind project in Africa.

These projects underscore what Carlos Lopes tersely summarizes: "There have been more investments in infrastructure in the last five years than in the previous 30 years." But this also raises the question of how Africa can finance these and future projects. Lopes confirms that the funding gap is large and that additional resources are needed. "Between now and 2020 about USD 93 billion is needed to overhaul Africa's infrastructure." But Africa is not only a receiver in this scenario: "Contrary to popular belief, domestic financing remains the single main source of infrastructure financing. Recent estimates suggest that Africa finances about 65 percent of its infrastructure expenditure." This is possible thanks to increased tax revenues, gains in commodities prices, and a boom in demand that has persisted already for a decade. The general macroeconomic and institutional situation has also improved.

« *Perceptions of a continent completely linked to conflict persist, despite facts calling for a more nuanced view.* »

Lopes sees great opportunity in seeking alternative investment sources, and he emphasizes fast-growing pension funds in addition to private equity and state funds. He also expects that the



strengthening of regional integration and the recently established continental free-trade zone will significantly enhance the domestic resource base.

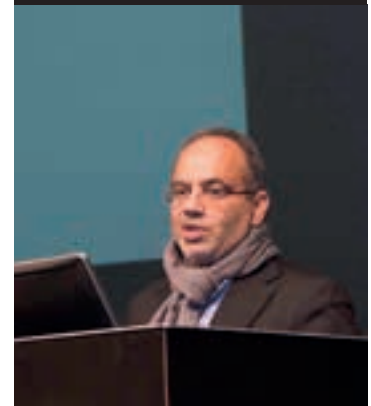
Current megatrends are in Africa's favor:

« *demographic boom, rising middle class, and* »
rapid urbanization.

But Africa still needs foreign investment to develop its infrastructure – and this is not easy to get because it's a long-term proposition based on complex ROI calculations. "For these types of investments stability is a must. The perception is that Africa is a risky place to invest and a continent in constant conflict and crisis." Carlos Lopes wants to counter this negative perception of Africa. Africa's total foreign debt rose to 37.1 percent of GDP by the end of 2015, but this level of debt is on par with that of other developing countries and is significantly below that of developed economies. "The total debt for OECD countries was nearly 80 percent of the GDP in 2008 and was expected to grow to 111.2 percent in 2015."

The general political violence in Africa diminished in 2015. In addition, civil war, armed uprisings, and violence against civilians was concentrated in only a few countries. Negative headlines have created a discrepancy between perception and reality in relation to the investment climate. "Over half of the world's ten fastest-growing economies are in Africa, and the continent ranks as the second most attractive investment destination in the world, according to Ernst & Young."

Carlos Lopes



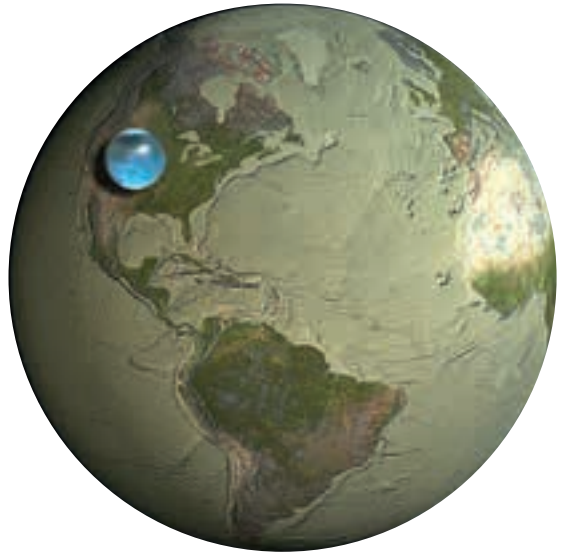
How does Infrastructure Space affect the building materials industry?

"Construction companies already have an important role to play on the economic side. In addition, they have to be involved in design, in looking for alternatives – and the fact that they embrace more and more sustainability dimensions helps."

Carlos Lopes was appointed by UN Secretary-General Ban Ki-moon as Executive Secretary of the Economic Commission for Africa (ECA), at the level of UN Under Secretary-General, in 2012. Carlos Lopes holds a PhD in history from the University of Paris 1 Panthéon-Sorbonne and a research master from the Geneva Graduate Institute of International and Development Studies. Following his service in the public sector of his native Guinea-Bissau in areas of research, diplomacy, and planning, Lopes joined the United Nations Development Programme (UNDP) as a development economist in 1988. He managed UNDP's global programme, with a portfolio of USD 1 billion. He says he tries his best to focus his professional life on important principles: "Never take it easy; every reality deserves to be understood in its complexity. Not simplifying what Africa is and what African challenges are is one example of that."



The impression is misleading – Water covers the earth's surface only with a very thin layer.



All the water in the world could be contained in a ball the size of the western USA.

Crisis management by design

Water is an essential resource – but it usually receives too little attention. The consequences are water shortages and many other disasters. Henk Ovink, The Netherlands' Special Envoy for International Water Affairs, advocates design solutions based on intensive collaboration.



“Water is the principle of all things. Everything is made of water, and everything returns to water.” This statement was made by the Greek philosopher Thales of Miletus over 2,500 years ago and it still holds true today. Water is a crucial resource. It shapes the global community in myriad ways. In his keynote speech Henk Ovink gave a current example of the influence of water: “The mismanagement of water is at the core of the Syrian conflict. It became a weapon of mass destruction.”

One reason Henk Ovink deals intensively with water is his background: He is Dutch, and where he comes from – between the Ems River, the North Sea, and the delta arms of the Scheldt – the people have cultivated a unique relationship with the water. A quarter of the Netherlands lies below sea level; the Dutch have used massive infrastructure to wrest space from the water.

« *People will feel the impact of climate change mostly through water.* »

Although the Netherlands lives under constant threat of water, Henk Ovink also knows that water is precious. “Scientists and astronauts tell you that our planet is blue,” he notes. “That’s a lie.” Water coats the planet like a thin layer of paint, and only some of it is usable. According to Ovink, humankind will feel the effects of climate change mainly through water. Water is already responsible for about 90 percent of all global disasters. It is expected that by 2050 more than two billion people will be affected by catastrophic flooding and by 2080 1.8 billion will be affected by water shortages. Too much water can be as disastrous as too little.

Left: Water is part of the culture in the Netherlands – it can become so elsewhere too.



An increasing part of the world will be affected by water shortages.



The threat of water must be met with regionally appropriate solutions.



Low-lying areas of New York suffered the devastating impact of Hurricane Sandy.



Sandy flooded New York and caused a blackout.



The sub-project “The Big U” of the competition “Rebuild by Design” won the global LafargeHolcim Award Bronze in 2015.



The so-called “Dry Line” will be built in phases. It will protect New York City from catastrophic flooding and create new spaces for the citizens to use.



“Rebuild by Design” aims to make water a part of the local culture.

A World Bank study shows that the consequences of the rising sea level alone will cost hundreds of billions. Billions of people live in delta regions and along coastlines. “Those deltas become more and more vulnerable – especially because of the way we urbanize, occupy, and develop these spaces,” observes Henk Ovink. The World Bank says that the rising sea level will cost the most in the United States. Africa will probably get away cheaper – but not because the problems will be less. “The economic and financial perspective on water risks in Africa is low because we value it low,” explains Ovink. Poor and vulnerable nations tend to be forsaken in times of crisis.

« *The World Economic Forum named water crises as the greatest risk for the next ten years.* »

Henk Ovink expects that humanitarian, environmental, economic, and political crises will increase both in number and intensity during the forthcoming decades. Unfortunately, the political will to find sustainable solutions is very small. Politicians like US President Barack Obama, who recognize the threat of climate change, face difficulties in enacting their agenda and establishing good working relationships. Many politicians have ignored climate change or even denied its existence. “Climate change is too slow for politicians,” believes Henk Ovink. “Over the last hundred years the sea level rose 24 centimeters – that is nothing for a politician.”

« *A storm like Sandy causes more problems than only water.* »

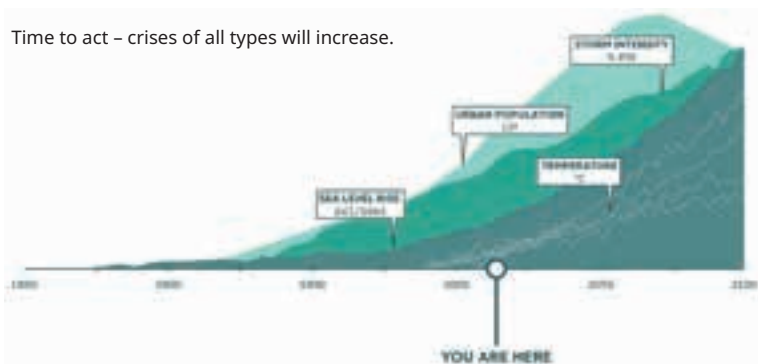
Water crises act like a magnifying glass for the problems of a region. They test physical resilience as well as social strength. “If we want to get to solutions, it’s all about collaboration,” stresses Henk Ovink. “That collaboration has to go across all: not only across politicians, scientists, and policymakers – but also across community leaders, activists.” And there’s no sense in investing money just for cleanups. One must also plan for prevention.

As an effective example of a sound approach, Ovink cited the recovery after Hurricane Sandy in New York, in which he served as a senior advisor. The project “Rebuild by Design” incorporates ideas from all segments of the New York population. “We did research in buses, trains, and on the streets – we talked to thousands of people,” tells Ovink. A competition was held in which everyone was invited to present their ideas for resilient infrastructure. Experts, politicians, interest groups, activists, and neighborhoods jointly sought regionally appropriate solutions for the overall public. For this approach, the sub-project “The Big U” by BIG – Bjarke Ingels Group was awarded the global LafargeHolcim Award Bronze in 2015.

« Climate change is a matter of national security. »

Projects like “Rebuild by Design” can be found around the world. Many government, business, and social groups are working together to find solutions for water crises. The United Nations has formed a high-level group to deal with the issue. “It’s not about making plans and producing blueprints; it’s about a change of culture,” explains Henk Ovink. “We need a global transformative approach.”

Time to act – crises of all types will increase.



How does Infrastructure Space affect the building materials industry?

“Collaboration is key – and collaboration starts with the willingness to understand the issues before jumping to conclusions.”

Henk Ovink is Special Envoy for International Water Affairs appointed by the Kingdom of the Netherlands. He studied at the Minerva Art Academy in Groningen and the Royal Academy of Art in The Hague, Netherlands. He also studied mathematics at Groningen University and architecture at Delft Technical University, Netherlands. Henk Ovink is Principal for “Rebuild by Design,” the resilience innovation competition he developed and led for the US Presidential Hurricane Sandy Rebuilding Task Force where he was senior advisor to the chair. “Rebuild by Design” was developed to spark innovation for a new standard of regional resilience in design & development, building, and rebuilding in the light of climate change, rising sea level, and future economic, ecological, and cultural demands. “Rebuild by Design” was named number one on CNN’s 2013 list of the top ten most innovative ideas.

Hong Kong

Shanghai

Mumbai

Indicator for social conditions

Infrastructure can reveal much about aspects like education level or social inequity. It therefore deserves close examination. The English urbanist Ricky Burdett conducts such analyses and draws important conclusions for future-oriented projects.



New York's Central Park shows that things can actually be improved through well-planned investments in infrastructure.

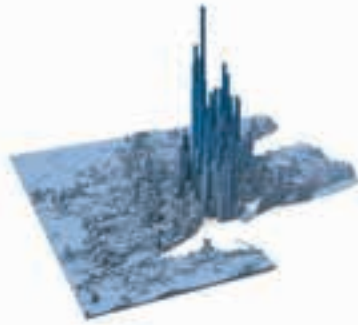
Urbanist Ricky Burdett did not miss the opportunity to begin with a compliment for the LafargeHolcim Foundation: "It's the first time I've been to your Forum, and immediately I'm jealous. The interdisciplinary nature of the discussions, especially here in Detroit, is really of great significance!" This led directly into the topic of his keynote address: the social impact of infrastructure on urban development and the importance of a holistic approach.

« *Education levels and the quality of education are totally correlated to how close you are to the city center and also to distance to public transport.* »

São Paulo

New York

London



“You can actually invest in infrastructure to do things better,” argues the British professor of urban studies. As an example he cited the 1858 design for Central Park in New York City. The park was planned and executed with great care – and gave the city a green lung. To achieve such success, it is necessary for everyone to come out of their little boxes not only to discuss sewage, schools, or airports but to consider the various interrelationships.

Urban density statistics show surprising results – London, for example, is an extremely low-density metropolis.

«*There’s a tendency to be pretty negative when we talk about infrastructure.*»

In the forthcoming years and decades, we will see enormous development in the form of urbanization, particularly in Africa and Asia. In such hotspots the question will sooner or later arise: “What model do we follow?” About a third of people will then live in some form of slum – in a place without the infrastructure that exists in highly developed areas. “One has to understand how to deal with this problem on a localized level, not only how to deal with problems on a global level.”

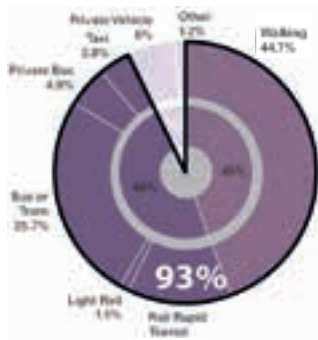


In Bogotá investments in public transportation directly influenced the literacy rate of the city.

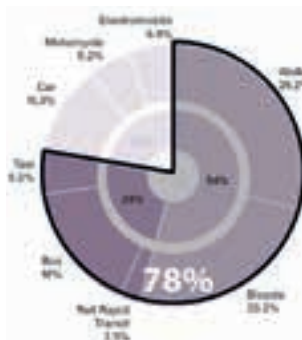
Ricky Burdett quantified one of today’s biggest problems. Nations that live at the current standard of the western world create a huge carbon footprint. The discussion should therefore be: How can we raise the standard of living for everyone while reducing the environmental footprint? His contribution to the discussion, says Ricky Burdett, is to elucidate the relationships between physical form, public transport, infrastructure, and sustainability.



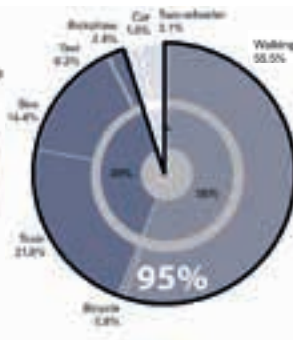
Highways in the sky are planned for Rwanda, to be used by drones distributing urgently needed medicine throughout the country.



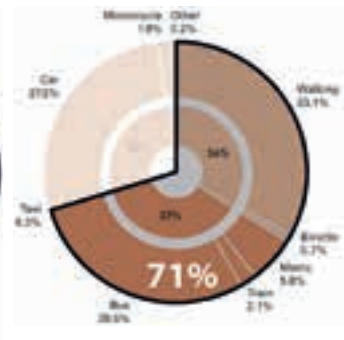
Hong Kong



Shanghai



Mumbai



São Paulo

How many people use public transportation and how long are the commuting times? Again, the figures give some surprising answers.

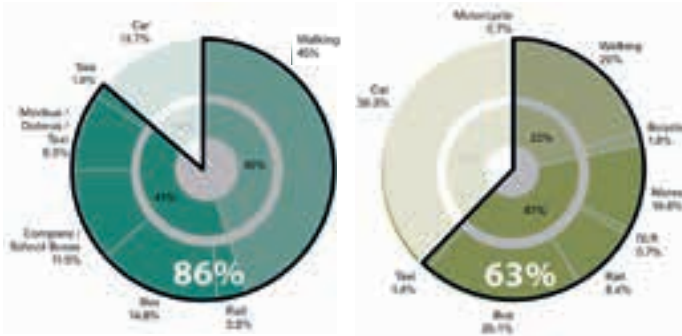
Large cities must be densified. An example requiring such intervention is London, where the density is dangerously low. Ultimately, it's a policy choice in determining how dense a city should be and how it should be developed. "70 years ago we had a tram in Detroit. It was taken away by the car industry because it would compete with their cause. And now the city is about to spend I don't know how much money to bring it back." Public transportation and the physical form of a city are closely related. In Hong Kong, a very dense city, 93 percent of the inhabitants use mass transit because it's the quickest means of getting around.

« Take a very simple formal structure, use a technology which is happening as we speak, create places where at the moment there is nothing, make them as simple as you can – and other things will grow around them. »

In cities like Istanbul, Mumbai, and São Paulo, the poorer segments of society are being displaced from the city center to the outskirts. "This is a symptom of what happened in the dynamics of urban growth in the 20th century." Burdett's studies show that "education levels and the quality of education are totally correlated to how close you are to the city center and also to the distance to public transport." This means that every decision about whether or how to invest in public transport has a direct influence on the education of the next generation. Some mayors understand this, as the example of Bogotá shows: Through smart investment in public transport, the Colombian capital ensures that young people have reasonably fast access to educational institutions – with the result that the city now boasts the highest literacy rate in Latin America.



London's new crossrail promises to reduce social inequality in the metropolis.



Istanbul

London

Transport infrastructure is also at the heart of a project by Lord Norman Foster and his foundation, on whose board Ricky Burdett sits. The project aims to fight disease in Africa by allowing medicine to be brought as quickly as possible to wherever it is needed. "The idea is to take drones and create highways in the sky that are useable all year round." As a pilot project for this, a network of droneports is being created in Rwanda. These are to serve not only as distribution hubs but also as nodes for further urbanization.

Norman Foster designed the shell for the droneports, which will be built by local workers using locally available materials in cooperation with Block Research Group at the ETH Zurich (engineering) and the LafargeHolcim Research Center in Lyon (*Durabric* compressed earth building material). A prototype droneport was built in May 2016 and contributed as an exhibit at the Venice Architecture Biennale with the support of the LafargeHolcim Foundation for Sustainable Construction (see also page 10).

In conclusion, Ricky Burdett returned his attention to London. The city is divided, expensive, and has fundamental social problems. East London is more deprived in comparison with the rest of the city. Riding the underground from West London to East, the local life expectancy at each stop along the way drops by about one year – city planners must accept this statistical fact. The crossrail, currently under construction, should help resolve such inequities. "And we can already see that this plan could work."



Ricky Burdett is Professor of Urban Studies at the London School of Economics & Political Science (LSE) and Director of LSE Cities and the Urban Age Programme. He is also a member of the board of the Norman Foster Foundation, a member of the UK Government's Independent Airports Commission, and a member of Council of the Royal College of Art in London. Ricky Burdett has been involved in regeneration projects across Europe and was Chief Advisor on Architecture and Urbanism for the London 2012 Olympics and architectural advisor to the Mayor of London from 2001 to 2006. He was also a member of the Urban Task Force that produced a major report for the UK government on the future of British cities.





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Space

5th International LafargeHolcim Forum

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Infrastructure
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Abdellaoui Najib,
Morocco



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United States



Adeyemi Kunlé,
Netherlands



Aguilar Carolyn,
Mexico



Al-Harithy Howayda,
Lebanon



Amer Mariam,
Egypt



Amezcua Julio,
Mexico



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Switzerland



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United States



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United States



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Graham-Douglas Viola,
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United Kingdom



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Moffett-Bateau Courtney,
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Pitera Dan,
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Woebken Christopher,
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Wong Tammy Kit Ping,
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Yu Yunlong,
China



Zaky Hana,
Egypt



Zeindler Carmen,
Switzerland



Zollinger Alfred,
United States

How does Infrastructure Space affect the building materials industry?
"We are moving into an entirely new realm that brings together theory and practice of various disciplines that ultimately collaborate."
Marc Angéilil, Professor of Architecture at the ETH Zurich; member of the Board of the LafargeHolcim Foundation

At the heart of every LafargeHolcim Forum are the four workshops simultaneously held on specific aspects of the Forum theme. These topics of focus are determined and prepared by the members of the Academic Committee of the Foundation: Marc Angéilil, Philippe Block, Harry Gugger, and Guillaume Habert, all professors at ETH Zurich/EPFL Lausanne. In each workshop, experts present case studies or theses to be discussed in plenum. The moderators are free to design each workshop as they see fit – some rely on group work; others hold panel discussions or conduct experimental games. Each workshop has a stationary part, comprising two half days, and a mobile part, comprising a full day. The participants are free to choose which workshop they would like to attend and they may also move from one stationary event to another. In "Infrastructure Space," they could choose between workshops dealing with interventions at a range of scales: from individual buildings to the planet.

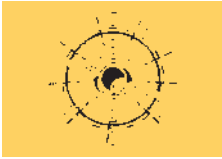
How does Infrastructure Space affect the building materials industry?
"The modern idea of infrastructure includes very intangible things - information technology, even social issues. But construction is still a hugely important contribution to infrastructure."
Harry Gugger, Professor of Architectural & Urban Design at the EPFL Lausanne; member of the Board of the LafargeHolcim Foundation



Above: Sarah Nichols, Scientific Coordinator of the Academic Committee of the LafargeHolcim Foundation, introduced the full day mobile workshops in the vicinity of her home town Detroit.

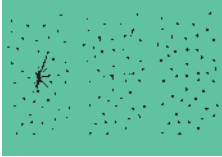
Right: Discussing the workshop findings (from left): Kathy Velikov, Jason Young, Georges Teyssot, Christian Schmid, and Reed Kroloff.





Yellow workshop

Architectural scale – Absorbing contemporary technologies



Green workshop

Metropolitan scale – Expanding toolsets for urban infrastructure



Blue workshop

Territorial scale – Recognizing politico-environmental ecologies



Orange workshop

Planetary scale – Exploring patterns of worldwide urbanization



Forming a new unit

In earlier times, buildings served mainly to protect people from the elements and manifold dangers. But buildings were never cocoons; they always allowed interaction with the outside world, because light, people, and objects had to be permitted to come inside.

Over the past 150 years, the permeability of buildings has steadily increased. This has been due in particular to new technologies such as electrification, air conditioning, the telephone, the internet, elevators, and so forth. Today buildings are linked with the outside world through numerous pipes and cables and often with wireless connections as well. But the infrastructure within buildings is still usually separate from the design; architects leave these systems up to specialized engineers.

How can this division be overcome? What would it mean to design architecture not chiefly to protect users but to support their activities? This workshop, headed by Georges Teyssot and Laurent Stalder, dealt with infrastructure space at the architectural scale.



The participants investigated the traditional relationship between design and technology, and they considered new ways to link the two. What is a smart city? And how would it interact with its environment? How can the aesthetics of technology be used?

In his summary, Georges Teyssot stated that current developments in technology are becoming increasingly important in buildings and in time will probably become as important as the architecture itself. The workshop participants also dealt intensively with the mistakes of the past. "Sometimes we deny our failures; society would rather look the other way," Teyssot stated. "But we have to face our failures." And the fear of disaster is important because it can spur change.

Georges Teyssot also referred to some particularly interesting presentations on elements of infrastructure, for instance windows or climate control systems that use completely new approaches. Many new technologies are extremely well suited to the needs of users. But therein lie new challenges, because "comfort can be very boring." Thus there remains much to discuss at the interface between infrastructure and design. But what does interface mean? "Our conclusion could be: Infrastructure and architecture will soon be one and the same," said Georges Teyssot. "They will form a new unit. The future will therefore be very interesting."



How does Infrastructure Space affect the building materials industry?

"Buildings have always been for humans. So the complexity of life has to be reflected in the way architects build and also in the way industry develops."

Laurent Stalder, Professor of Theory of Architecture at the ETH Zurich





The two leaders of this mobile workshop, Reed Kroloff and Gregory Wittkopp, took the participants to three building complexes that are exemplary for social development and manufacturing in the greater Detroit area. The infrastructural logic of each complex was assessed and discussed by the group.

Lafayette Park is located on a site where racial tension had once repeatedly flared. In the 1950s the city decided to completely redesign the site by creating a housing project, which was designed by Mies van der Rohe, Ludwig Hilberseimer, and Alfred Caldwell. Unusual at that time was the intention to house people of different ethnicities and income levels within the same neighborhood. Many aspects of the program have proven successful over the long term.

The second destination of the group is above all technologically impressive: the “Dymaxion House” – a prototype lightweight house. This aluminum building was designed by Richard Buckminster Fuller between 1944 and 1946 and intended for mass production.

The final stop of the mobile workshop was the Cranbrook Academy of Art and the Cranbrook Art Museum. Newspaper publisher George Booth founded the school, which was designed by the Finnish architect Eliel Saarinen and opened one department at a time starting in 1920. Rafael Moneo augmented the impressive buildings with his museum in 2002.





Urban infrastructure is much more

How does Infrastructure Space affect the building materials industry?

“One of the challenges is to understand the things that are beyond immediate comprehension. They are becoming much more meaningful.”

Jesse LeCavalier, Assistant Professor at the New Jersey Institute of Technology



Although infrastructure shapes every urban space, there remain large gaps in theoretical terms. The open issues include interfaces, form, and our understanding. And digitalization raises additional issues related to urban infrastructure – infrastructure today extends beyond what we see; it encompasses so much more than bridges and traffic lights. And it also entails things that hardly come to mind – in a sense, even global warming is now a part of our infrastructure.

The workshop led by Jesse LeCavalier and Jason Young explored through intense discussions the diversity of urban infrastructure, its meaning, and the available options for providing the “right infrastructure.” “During the sessions we moved from issues of visibility and invisibility to issues of mobility and the temporary and on to the subject of collectivity,” reported Jason Young.



How does Infrastructure Space affect the building materials industry?

“One thing that industries and companies could look at is the changing expectations that the various publics have of the built environment.”

Jason Young, Director of the School of Architecture at the University of Tennessee

To kick off the workshop, some highly provocative and useful examples of intangible types of infrastructure were presented. The participants found that behavioral patterns can also be seen as a sort of infrastructure. “You usually don’t think about these things as infrastructure,” says Young, “but when this soft infrastructure occurs in conjunction with the physical and material world, the combination can have very definite effects. And sometimes you also have to pay attention to the seemingly unimportant parts of a system if you want to understand the enormous potential of that system.”



Today we are seeing a broad shift toward the intangible. “Maybe time has replaced space in the logistical sense,” says Young. “If you consider the city and urbanism as micro-processes, that changes your notions of space and the physical environment.”

The topic of collectivity raised a great many questions. What about society, people’s daily lives? What forms of involvement and participation are there? One must see infrastructure as a form of collective intelligence, says Young. “As architects and designers, we tend to offer permanent solutions for non-permanent problems,” he quoted a speaker from the metropolitan scale workshop. “Maybe we need to be more aware of the limits of this approach. Conditions like these here in Detroit change – and it would be wrong to think that a solution that makes sense today will automatically make sense in the future, which is so difficult to foresee.”



This mobile workshop, led by Dan Kinkhead and Tom Sherry, investigated the adaptation, reuse, and repositioning of infrastructure.

The first stop was Michigan Central Station. This gigantic edifice, built between 1910 and 1913, is a registered historic landmark – and has been vacant since the mid-1980s. It’s still unclear how it will be used in the future. The group moved on to the “Ponyride.” Here, artists, entrepreneurs, and organizations that support social development of the city have moved into the disused industrial building where they find plenty of space for development. These engaged people exchange their knowledge, their resources, and particularly their ideas among one another – and in doing so help Detroit overcome its crisis.

The group then embarked on a boat tour. This gave them entirely new perspectives on the fallen and gradually recovering city. The ferry departed from the Port of Detroit, which is growing increasingly important, passed West Riverfront Park – a lively area of West Riverfront, which is slated for renewal in the next few years – and historic Fort Wayne, and finally reached Belle Isle, Detroit’s most majestic example of urban civic space.

The workshop finished with a tour of the East Side. Here the group saw numerous examples of efforts being taken to make Detroit fit for the future once again: infrastructures being adapted and neighborhoods stabilized by means of multiple small interventions.



The full complexity of the apparatus

Infrastructure plays an important role in the organization of society. It is therefore also a political and economic instrument that influences physical and cultural development. This is especially true for infrastructure at the regional and national scales, where the systems cross borders. In our increasingly networked world, such “territorial infrastructure” requires a new basic framework in terms of design, implementation, and usage.

The workshop, moderated by Geoffrey Thün and Kathy Velikov, focused on three categories of territorial infrastructure: infrastructure that protects society against environmental dangers and disasters, infrastructure for handling and distributing resources such as water or energy, and the infrastructure of connectivity. The workshop participants investigated questions such as: What ideological, cultural, economic, social, and political aspects are crucial in the development of these infrastructures? How can the



various publics be included in the development process? How is physical infrastructure linked to information technologies?

In her summary report, Kathy Velikov explained that we must not see territorial infrastructure as an isolated element because man-made, biological, geological, and temporal factors are in constant interplay with each other. The question is how we can talk about these systems: "How can we draw them? How do we model them?" This is not a marginal issue – because models are not simply representations but also have political consequences, as shown by the example of Galileo Galilei.

The notion of "apparatus" received great attention in the discussion. "There is a wiring between discourse, institutions, laws, administrative measures, scientific statements, and philosophical, moral, and philanthropic proposals – and we have to deal with this wiring," stated Kathy Velikov. Architectural form stands at the center of it all. The task is to design and redesign the elements of the apparatus in order to shape an infrastructure that's suitable for the future.

One thing is clear: There is no simple guide on how to design territorial infrastructure sustainably for the future – and the associated processes take a lot of time. "And it's not just about technologies and strategies, but also about issues such as the language of visual display that we must deal with," reminds Kathy Velikov.



How does Infrastructure Space affect the building materials industry?

"There's a tendency to overlook the extended impacts of the full value chain of the industry – beyond the material. A new kind of thinking is emerging."

Geoffrey Thün, Associate Professor of Architecture at the University of Michigan





This mobile workshop also dealt with the interaction between infrastructure and community. The leaders Dan Pitera and Diane van Buren walked with the participants along more than 10 km of the Beltline Greenway, a green corridor along a former railway line, which links various businesses.

One of these is the Earthworks Urban Farm. It is run by a soup kitchen; volunteers participate in the urban agriculture program. Seven large and well-maintained gardens are located around the soup kitchen. This infrastructural facility significantly shapes life in the neighborhood.

Further to the north is the Downtown Boxing Gym. Joe Louis, one of the best and most famous boxers in history, grew up in Detroit, but this gym is not about fame and glory. Established in 2007, the institution has proven highly successful in providing children and young people a safe and interesting place to spend their free time.

A particularly “hands-on” symbol of Detroit rising like a phoenix from its ashes is the Architectural Salvage Warehouse (ASWD), which was the final destination of the mobile workshop. Thousands of buildings have been torn down in and around Detroit. The ASWD prepares salvaged building materials for reuse – and has developed innovative systematic processes for recovering as much material as possible during demolition.



Urbanization of the hinterland

Our planet has become heavily urbanized over the past decades. This development has been enabled and driven by new infrastructure, agricultural technology, well-developed logistics systems, increased circulation of capital, and so forth. One visible effect of this development is the territorial expansion of urban agglomerations: Borders between cities and their environs are gradually dissolving.

The workshop moderated by Neil Brenner and Christian Schmid dealt intensively with the issue of how the global trend of urbanization is changing non-urban areas. “Nearly half the world’s population now lives in urban areas,” Christian Schmid stated at the beginning of his summary. “But in our discussions we also included the other half, because every region of our planet is affected in one way or another by urbanization.”

How does Infrastructure Space affect the building materials industry?

“The construction industry really has to be aware of the massive effects many processes have.”

Christian Schmid, Professor of Sociology at the ETH Zurich

The workshop presented the concepts of concentrated and extended urbanization. Concentrated urbanization takes place in urban nodes. But these centers depend on people, food, raw materials,



etc. that come from the outside, and their significance massively influences non-urban areas. "This gives rise to something that we call extended urbanization," said Christian Schmid.

Several speakers dealt with concrete examples of extended urbanization such as the region around Singapore or the Pearl River Delta. How is countryside placed at the service of cities? How do the requirements of cities change social life in the urban hinterland? And what infrastructure does the hinterland receive or require? In sparsely populated regions the per capita cost of infrastructure is much higher than in the city – which has a great effect on the quality.

"We tend to focus on concentrated urbanization and not pay attention to what lies further beyond," said Christian Schmid. This was one of the key findings of the workshop: We must adopt a broader perspective. "But we are only at the beginning of an important discussion. We need more analysis, more dialog, and strong commitment to shed light on the subject of extended urbanization."

In summary, the participants of the of the planetary workshop called for professionals to pay less attention to spectacular megacities and world cities and more to the urban hinterland – because this plays a key role in the sustainable development of the planet.

How does Infrastructure Space affect the building materials industry?

"All engagements with the built environment have to be reflected in how our decisions today are affecting our common space."

Neil Brenner, Professor of Urban Theory at Harvard University



The automobile was not invented in Detroit, but it was first mass produced here. The success of the car industry is long since history – so Jerry Herron and Aaron Martin took the participants mainly on a journey through the past. The first stop was the Ford Rouge Assembly Plant. Designed by Albert Kahn and built in 1928, this factory became world famous for integrated production: Base materials were fed in one end and finished cars rolled out the other. At one time, 100,000 people worked in the 93 buildings, some of which are gigantic. They produced their own electricity and made their own steel. Today only a few automobiles are manufactured here.

The Ford Highland Park Plant, also designed by Kahn, makes an even drearier impression. Here Ford began building the legendary Model T in 1910. This plant, today entirely abandoned, changed the face of the world – in the 1920s half of the world’s cars were made here. The third stop of the mobile workshop was then more alluring: In the Ford Piquette Avenue Plant the young Henry Ford developed the Model T and its predecessor models. An impressive museum is located here today.

The final stop in the city center was particularly architecturally stimulating: The Michigan Building a former giant luxury cinema is being used as a banal parking garage. Deterioration is pervasive in Detroit – but here the extent is downright absurd.





HOME OF MODEL Y
This site is the home of the first Model Y, which was built in 1908. It was the first mass-produced automobile and was a major success for Ford Motor Company. The car was built in this building, which was designed by Ford's son, Edsel Ford. The building is now a museum and is open to the public.

A new political framework

The concluding panel is always the climax and the closing of the Forum: The experts sum up and discuss the insights of the keynote speeches and the findings of the workshops. In Detroit, under the leadership of Rolf Soiron, the debate was conducted by Maria Atkinson, Arab Hoballah, Rahul Mehrotra, and Edgar Mora Altamirano – along with the plenum.

“If we conducted an interview with everybody in this auditorium,” **Rolf Soiron** opened the discussion, “there would be three statements. Number one: Infrastructure, however you define it, is indispensable for the well-being of our civilization. Number two: Radical changes are needed in the way we look at infrastructure and in the way we handle it. Business as usual is no longer possible. And number three: There are areas of infrastructure where we are running out of time for finding good solutions.” He wanted to make sure that everyone understood the full import of these three statements, so he offered two figures to illustrate the proportions: The

From left: Moderator Rolf Soiron, panelists Maria Atkinson, Arab Hoballah, Edgar Mora Altamirano, and Rahul Mehrotra.



« *There are areas of infrastructure where we are running out of time for finding good solutions.* »

estimated monetary value of all the infrastructure on the planet amounts to 50 trillion dollars, and the investments needed in global infrastructure by 2030 are estimated at around 90 trillion dollars. With these staggering numbers Rolf Soiron directed the discussion to the economic opportunities and risks that the next 15 years could hold – “the years in which all of you will be in charge!”

Rahul Mehrotra stated that infrastructure is probably the most powerful tool the global community uses for interaction. “We have to fundamentally acknowledge this before we can think about making economically reasonable decisions about it,” said the architect. Time is an important factor in dealing with infrastructure. “The challenge for us as professionals is to bring in the dimension of time in productive ways into the deployment of infrastructure.” In this way one can handle the economics of infrastructure very productively. Presently, we are investing too often in redundant systems that lag far behind reality. One question that was rightly posed in one of the workshops documents this dilemma: “Why are the designers and professionals deploying infrastructure so obsessed with permanence as a condition, and why are we only looking at permanent solutions for problems that are not permanent?”

Rahul Mehrotra is Principal of the architecture firm Rahul Mehrotra Associates in Mumbai, India, and Professor of Urban Design & Planning and Chair of the Department of Urban Planning & Design at the Harvard University Graduate School of Design (GSD) in Cambridge, MA.



« *Why are we only looking at permanent solutions for problems that are not permanent?* »



Maria Atkinson AM is a Sustainability Business Advisor as well as Co-Founder and Founding CEO of the Green Building Council of Australia, of which she is now a Life Fellow. She is a member of the Board of the LafargeHolcim Foundation.

Maria Atkinson raised the question of why everyone during the Forum failed to consider money in a positive light. It's worth asking what is even meant by economic opportunity. "If we're not linking sustainable construction, sustainable infrastructure, sustainable lifestyle with the money, then we're not in sync with the great opportunity to bring on the new economy and the solutions we so desperately need and want to see." Today we are still standing with one foot in the old economy, and instead of finding and working out new ways from scratch, we have remained content to make the most of new challenges using tried and true tools – or by adapting tried and true solutions as well as possible.

« If we're not linking sustainable lifestyle with money, then we're not in sync with the great opportunity to bring on the new economy. »



Edgar Mora Altamirano is Mayor of Curridabat, Costa Rica and a Non-Resident Fellow at the Ash Center for Democratic Governance & Innovation at the John F. Kennedy School of Government, Harvard University, Cambridge, MA.

Edgar Mora Altamirano is in the position to permit concepts and plans to be implemented – because he is mayor of Curridabat in Costa Rica. He noted that the creation of new infrastructure often creates barriers instead of making things more permeable. "Unfortunately, today it is either the political establishment or the market forces that decide what kind of infrastructure is built," he said. He would prefer – and considers it necessary – that citizens have a certain say in things. This type of participation is an issue that was often raised and discussed during the Forum. "This is especially important when you don't have a lot of resources to invest," said the politician. That's why it was significant to hold this Forum in Detroit, because here it is clear that one can make much from little – an example for many other cities with similar problems!

« Today it is either the political establishment or the market forces that decide what kind of infrastructure is built. »

Arab Hoballah found Rolf Soiron's gigantic figures all the more important as a reality check. "Many people who are working on design and modeling hate to think about money – because it hinders their work," said the architect with disarming honesty. In his 30 years of experience he has established three principles: "Everybody is right, and everybody is wrong – which means that you have to consider all possible aspects before you do something. Get away from semantics or you lose yourself in definitions. And be as practical as possible in bringing society and economy together." In recent decades, we have basically learned nothing about sustainability. On the whole, we are still operating in the mode of business as usual. Every individual and society as a whole must place much more value on efficiency. "Because a lot of the 90 trillion dollars can come from being efficient rather than from additional funding," assured Arab Hoballah.



Arab Hoballah is Chief of Sustainable Lifestyles, Cities & Industry in the Division of Technology, Industry & Economics (DTIE) of the United Nations Environment Programme (UNEP).

« *Many people who are working on design and modeling hate to think about money – because it hinders their work.* »

The moderator invited the audience to direct questions to the panel. Maria Atkinson took up the question of who stands to benefit from future investments. At a small scale, the question can be resolved cooperatively and with ease. If the task is to provide Detroit with an adequate sewer system, then there are plenty of funding mechanisms available. And those who would benefit the most are in fact e.g. the individuals who would have to pay no additional sewage fees. Investment in infrastructure requires patient capital that doesn't demand immediate return. The investors are generally not the ones who decide on the parameters of the infrastructure being installed. "The important thing is that we at the planning level determine what infrastructure has what kinds of impacts, so the right decision can be made." Arab Hoballah raised the question of what kind of investments are being discussed. "If it's business as usual, we know who is going to profit." But at the Forum we

are dealing with alternatives. “Especially in developing countries we need more soft and hard infrastructure that makes sure that products and benefits stay in the country first before going out.” Not as it is now in many export countries, where it seems that all infrastructure is principally designed to get goods out of the country as fast as possible. Nevertheless, one must be careful to make new solutions in every context attractive for the business side too; otherwise it will be difficult to find investors willing to put them into practice.

“Our discussions are too much fixated on manmade infrastructure,” added Rahul Mehrotra. “Natural infrastructure is critical too.” We must consider and discuss natural and built infrastructure together, “so you can open up a whole new discussion about the economy of infrastructure.” Governments today are ill equipped to deal with both of these forms of infrastructure and to develop new visions and projects. Usually one concentrates on only one of the two, which not infrequently leads to inequities. To reorient oneself in this automatically implies political decentralization in decision-making – and this in turn would allow local solutions that cost less.

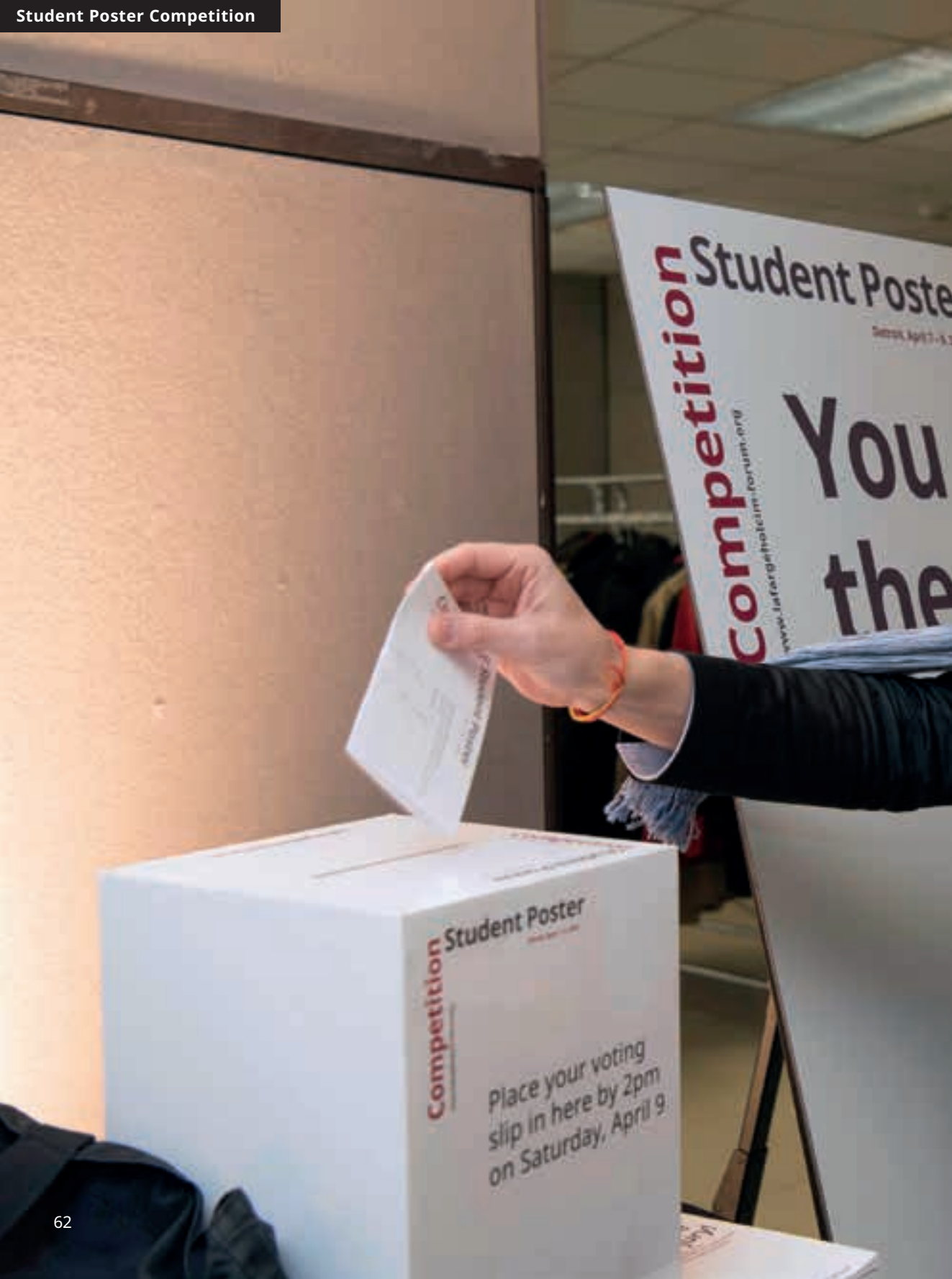
The politician Edgar Mora Altamirano agreed, as he is convinced that business as usual will only perpetuate the status quo in terms of profit-making and inequity. “And we don’t have the right incentives within the system to change the establishment at the moment.” It will probably take more pressure from the base to really change the way we use and develop infrastructure.

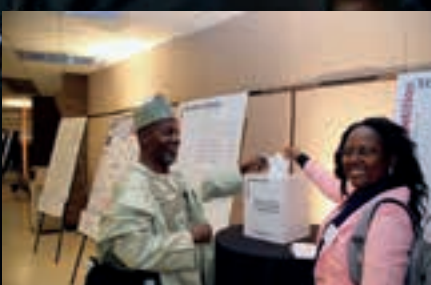
“At the end of the day, we are talking about new definitions of power and shifts in power,” summarized Rolf Soiron, “because the current elites seem either unwilling or incapable of distributing products, investments, and infrastructure.”

Unwillingness is in fact often encountered, confirmed Arab Hobbalah, but it's usually just hiding a shocking ignorance of the matter. "Governments send people to discuss so many different agreements on so many different issues - I don't blame them that they don't have a deep knowledge of every one of them." So it's up to the professionals to provide those responsible with this knowledge and thereby contribute to the shift of power. "But we have to be careful not to expect changes to happen overnight." Maria Atkinson advised against opting out of the decision-making process and advocated making use of the global network in order to gain new insights, exchange ideas, and make decision makers more accessible.

In summary, Rolf Soiron affirmed that we urgently need a new political framework, including rewards and sanctions, to steer the world in a sustainable and economically feasible direction. Money is not the biggest problem. "The real challenge is probably to get the whole population of this planet moving in a sustainable direction - in a decentralized way!" Detroit clearly shows one thing that mustn't be overlooked: It takes a long time before appropriate initiatives even start rolling.







New infrastructure, please!

Sustainable construction essentially has to do with our future. That is why the future generation of architects and engineers is given a dedicated platform at the LafargeHolcim Forum: the Student Poster Competition.



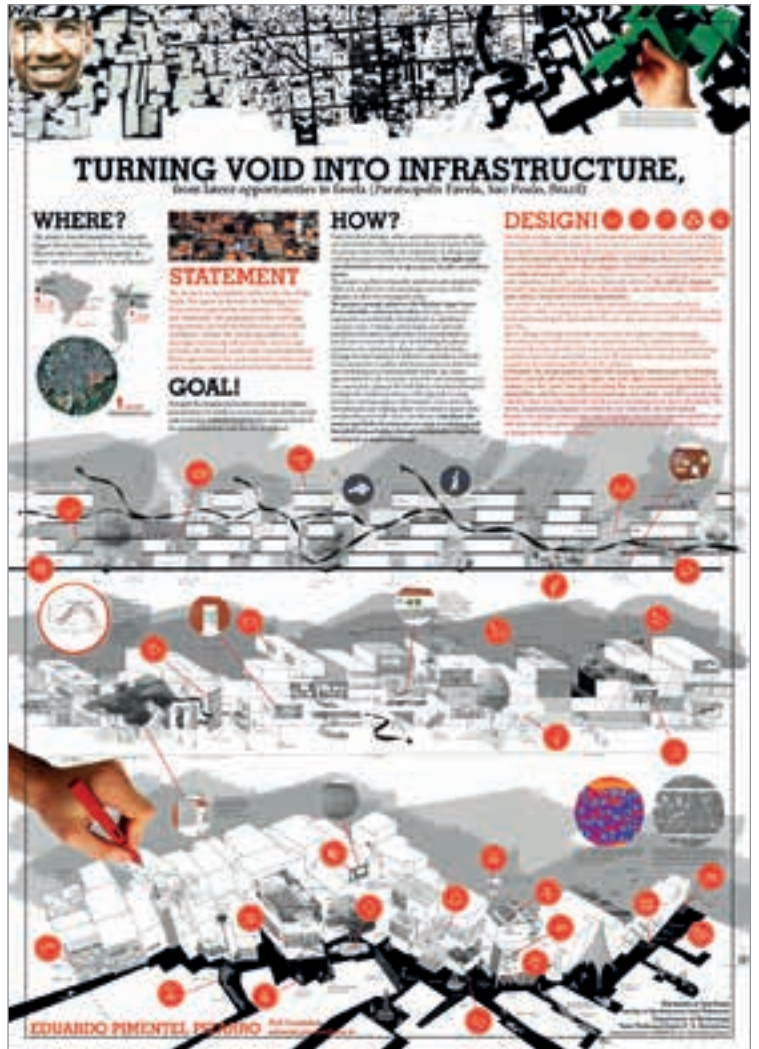
Following internal competitions at the partner universities of the LafargeHolcim Foundation in all regions of the world, 33 winning teams were invited to the Forum in Detroit to exhibit their projects and discuss them with the other participants of the event. The Student Poster Competition inspires new ideas among the Forum participants. The authors explained their projects to the interested viewers, answered questions, and persuasively supported their ideas. All Forum attendees were asked to cast their vote for the best of the projects presented by the students. Three winners were awarded and two honorable mentions cited.





Turning Void into Infrastructure, São Paulo, Brazil

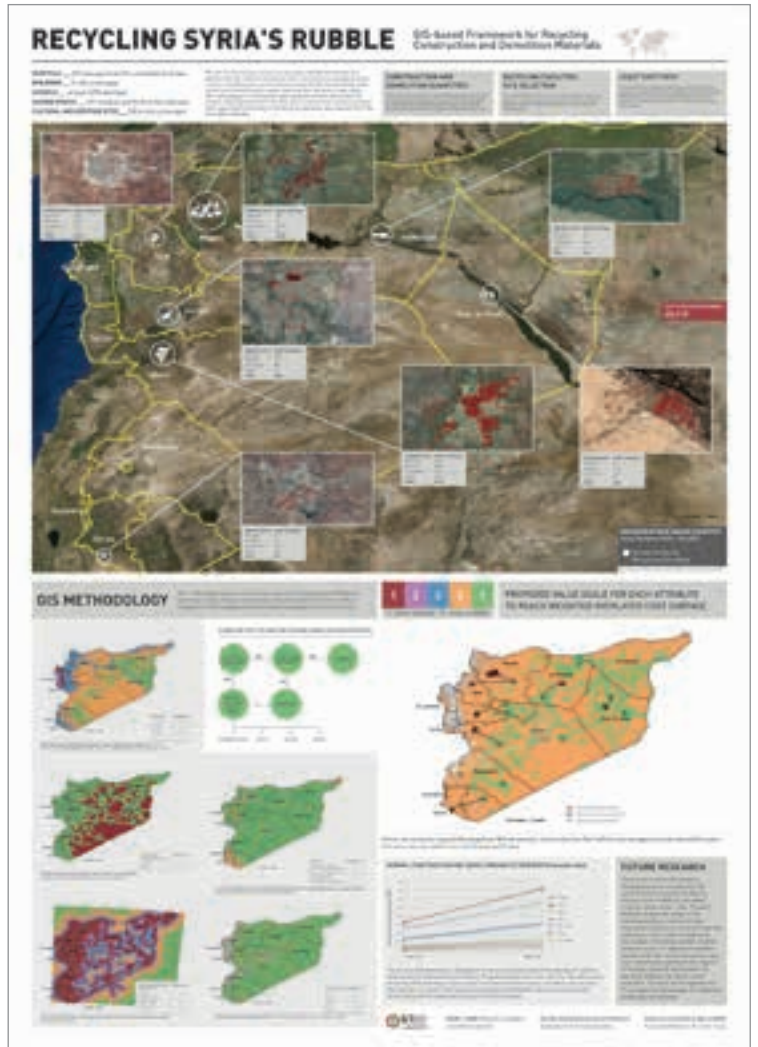
First prize in the Student Poster Competition went to **Eduardo Pizarro**, a student from the University of São Paulo (USP, Brazil). His project develops and activates open spaces and interstitial spaces between buildings in the second-largest favela of São Paulo, “Paraisópolis.” With small interventions adapted to the local conditions, the plan provides e.g. planted gardens and shaded places. The method behind the project is empirical and based on field investigations, analytical work, and design exercises – this approach was intended to lead to the most sustainable solutions possible.



Recycling Syria's Rubble



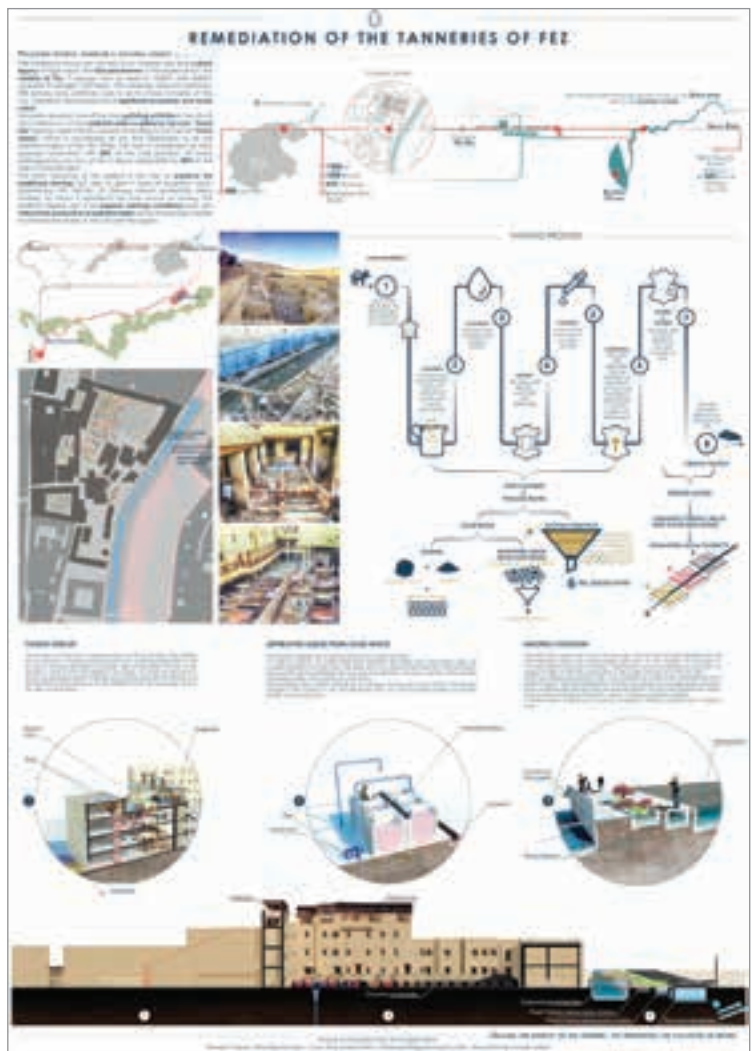
Nour Madi from the American University of Beirut (AUB, Lebanon) took second prize. Her project is a GIS-based framework for recycling construction materials in Syria. The scope includes both war rubble and ordinary construction waste of the nation's seven largest cities. The project optimizes the locations of recycling facilities as well as their capacity and size. Costs of the recycling processes and transport routes are also considered. Based on her analysis, Nour Madi proposes six locations for the recycling plants.



Remediation of the Tanneries of Fez

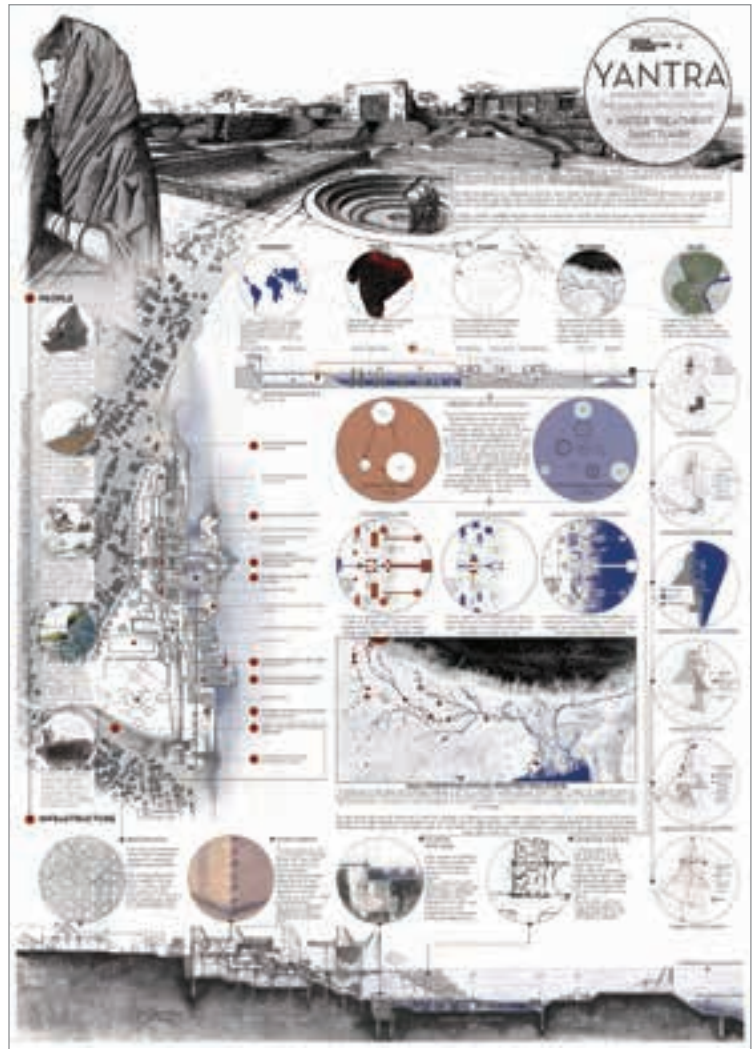


The third prize was won by the two students **Mohamed Mahmoud** and **Najib Abdellaoui** of the Ecole d'Architecture de Casablanca (EAC, Morocco). Their project deals with the renovation of the tanneries of Fez, which heavily pollute the environment. The traditional Moroccan tanneries are part of the cultural heritage of the country and form the basis for livelihood of many families. Proposing measures such as natural filtration systems, the project aims to improve working conditions and reduce water pollution.



YANTRA: Infrastructures of the Sacred and Profane, Varanasi, India

The project by **Vedhant Maharaj**, a student of the University of the Witwatersrand (Wits, South Africa), explores new methods for water-purification infrastructure along the Ganges River in India. A treatment plant on the Varanasi waterfront combines various water purification processes, from mechanical cleaning to natural filtration, to reduce pollution of the holy river. The buildings fit into the sociocultural, religious, and aesthetic context of the region and provide traditional washrooms and swimming pools – and they respond dynamically to the yearly monsoon flooding.



Biochar – A Smart Solution for Greener Construction, Beirut, Lebanon



Rayan Mourad from the American University of Beirut (AUB, Lebanon) studied the replacement of sand by biochar in concrete production. Biochar is a carbonic by-product of waste pyrolysis, a form of recycling. The project shows new forms of building with concrete as well as opportunities for environmental improvement and economic development. Using biochar in concrete is a way to optimize waste recycling in Lebanon; it can create new job markets and applications. The project also helps reduce the extraction, transport, and consumption of sand.

Biochar

A Smart Solution for Greener Construction

Problem Statement

- The Lebanese waste burning severely has caused the depletion of natural resources (sand).
- The sustainability of construction sand is especially a problem in Lebanon due to the regulatory system (government and private) on natural resources and the high expense of importing sand for construction (around \$4-6/m³).
- Lebanon is being a garbage waste as well due to the lack of waste management and treatment facilities. There are multiple waste treatment plants in Lebanon however only one of them collect the garbage of pyrolysis. Pyrolysis consists of burning municipal solid waste and separating it into energy (combustible), an ammonia liquid at around 100°C, the process (biochar) and solid carbon waste.
- This biochar has been investigated before as a potential partial replacement to sand in concrete, asphalt and other construction materials.

Objective

- Minimize the effect of global replacement of sand, to naturally, with biochar, depending on the amount of biochar used.
- Study the mechanical and physical properties of concrete made with biochar and compare them with conventional concrete.
- Provide a market for biochar in the construction industry and help the Lebanese community benefit from local resources and create job opportunities. It can also reduce a number of soil deficiencies by increasing and improving water-holding, nutrients and soil structure.
- Reduce the depletion of natural resources in the world and decrease CO₂ emissions and provide a green waste plant for the Lebanese community by creating job opportunities.

Geographic Location

Lebanon is part of the Middle East located at approximately 33°N, 35°E. Following along the coast of the Mediterranean Sea.

Action Plan

- Research of literature on biochar and concrete.
- Research of literature on biochar and concrete.
- Research of literature on biochar and concrete.
- Research of literature on biochar and concrete.

Methods & Preliminary Results

Using Scanning Electron Microscope (SEM) and Energy Dispersive X-ray Analysis (EDX) for image analysis, results show that biochar has a large surface area and porous structure. It is an effective adsorbent that can adsorb heavy metals and organic compounds. Biochar is a porous structure with a large surface area.

Conclusion

- Replacing sand with biochar in construction material is a green and sustainable solution that can help reduce the environmental and economic costs of construction. Biochar is a carbonic by-product of waste pyrolysis, a form of recycling. The project shows new forms of building with concrete as well as opportunities for environmental improvement and economic development. Using biochar in concrete is a way to optimize waste recycling in Lebanon; it can create new job markets and applications. The project also helps reduce the extraction, transport, and consumption of sand.

Prevention of natural Resources

Biochar
Less Cost
Fuel Sustainability
Sand replacement

Environmental Improvement
Less CO₂ Emission
Water Conservation
Less Energy Consumption
Less Fuel Consumption
Less Sand Consumption

Comparative Analysis & Tests of Material Properties


- Strength tests results show that biochar can be used as a partial replacement of sand in concrete. Biochar has a large surface area and porous structure. It is an effective adsorbent that can adsorb heavy metals and organic compounds. Biochar is a porous structure with a large surface area.

LafargeHolcim

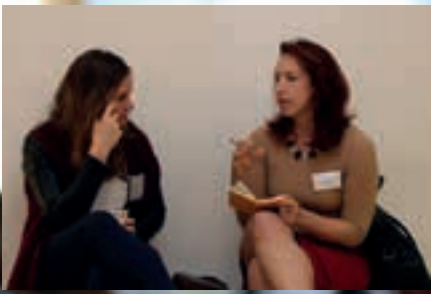




Infrastructure and space for exchange

A photograph of a man with white, wavy hair, wearing a dark blue suit jacket over a dark turtleneck. He is shown in profile, looking towards the right. In the foreground, a hand is visible, gesturing with fingers spread. The background is a plain, light-colored wall.

A main purpose of any conference is to promote informal exchange among the participants. At the LafargeHolcim Forum professionals in architecture, engineering, urban planning, construction, and social sciences used the breaks between the program events to share experience and make new contacts – beyond the boundaries of their own field, because Infrastructure Space is an interdisciplinary challenge.







Foundations 19

“Foundations” is the magazine of the LafargeHolcim Foundation for Sustainable Construction. This edition is fully dedicated to the 5th International LafargeHolcim Forum held in Detroit, USA, 2016.

This publication is available for free as a flip-book/PDF at www.lafargeholcim-foundation.org/foundations

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| Editor | Edward Schwarz, LafargeHolcim Foundation, Switzerland |
| Text | Textbüro Leutenegger, Zurich, Switzerland |
| Photos | Diego Brito, São Paulo, Brazil Erik Brühlmann, Zurich, Switzerland |
| Translation | Daniel Wentz, Magden, Switzerland |
| Layout | Schadegg Grafik, Gockhausen, Switzerland |
| Production | Carmen Zeindler, LafargeHolcim Foundation, Switzerland |
| Print | Karl Schwegler AG, Zurich, Switzerland |
| Publisher | LafargeHolcim Foundation for Sustainable Construction Hagenholzstrasse 85 CH-8050 Zurich, Switzerland Phone +41 58 858 82 92 info@lafargeholcim-foundation.org www.lafargeholcim-foundation.org |

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for Sustainable Construction, Switzerland
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Printed in Switzerland on FSC paper
ISBN 978-3-033-05718-0

Alejandro Aravena, Partner Architect at Elemental, Chile. Board member of the LafargeHolcim Foundation since 2013. Pritzker Prize laureate 2016.



“The LafargeHolcim Awards have not only brought awareness, but have also raised the standard for how we deal with sustainability.”

5th International LafargeHolcim Awards for sustainable construction projects. Prize money totals USD 2 million.

**COMPETITION
OPEN TILL
MARCH 21, 2017**

Renowned technical universities lead the independent juries in five regions of the world. The juries evaluate entries against the “target issues” for sustainable construction. The competition has categories for projects at an advanced stage of design, and also for visionary ideas of young professionals and students. Find out more at www.lafargeholcim-awards.org

The LafargeHolcim Awards is an initiative of the LafargeHolcim Foundation for Sustainable Construction and is supported by LafargeHolcim, the world leader in the building materials industry.

LafargeHolcim Awards

