

The Material Passport: A Wild Idea that Became the Future

by Antonella Ilaria Totaro

Interview with Sabine Oberhuber and Thomas Rau



Thomas Rau is an architect and entrepreneur. His studio, RAU Architects, is a leader in the field of carbon-neutral and circular buildings. In 2013, Rau won the ARC13 Oeuvre Award for his contributions to the promotion of sustainable architecture through conferences, documentaries, and publications.

RAU Architects,
www.rau.eu

They were among the first to perceive the need for a material passport and to see buildings as material banks. They created Madaster, the cadastre for materials, to protect the material, circular, and financial value of built structures. In 2018, they presented the Universal Declaration of Material Rights to the UN. Through their book *Material Matters*, published in Italy by Edizioni Ambiente, they presented an alternative to the overexploitation created by the linear economy. Sabine Oberhuber and Thomas Rau, with their organisations Turntoo, RAU Architects and Madaster, are demonstrating that a new balance between humans and nature is not only necessary but also possible. Through new forms of architecture, innovative concepts, and circular products and services, these two visionaries seek to find this balance and remind us that, as they often repeat, “we are guests on the Earth.”

In 2017, they told us that closing the circle is just one option, and now *Renewable Matter* has interviewed the duo once again to learn how the material passport has evolved in recent years and how they envision the future of the construction sector (and more).

Sabine Rau-Oberhuber is the director of Turntoo, the company founded in 2010 to help organisations in the transition to a circular economy by developing circular strategies and business models for their clients. Alongside Rau, she is the co-writer of *Material Matters* (Bertram + de Leeuw Uitgevers, 2016) a book which does not only offer rigorous critique of the current linear production and consumption system but provides a vision and practical examples of how a new circular economy could be achieved.

Turntoo,
turntoo.com/en



It has been almost five years since you launched the material passport and Madaster. How has the concept that materials need an identity evolved over this period of time?

“We have seen this whole topic of material passports expanding and becoming generally accepted. Back in 2011, when we showed people a passport and told them that materials also have rights and, therefore, also need an identity, we got really puzzled looks. The concept itself was not really understood at the time. When we launched Madaster in 2017, the material passport still sounded like a wild idea to many. Since then, we built an online platform which automatically generates material passports and is operating in five European countries. At the same time,

the wider discussion around material passports became very serious. For example, the Dutch government initiated a whole working group with the aim to standardise material passports, e.g. how they should be structured, what the content should be, etc. The same holds true for the EU, where there are also ongoing discussions on how to standardise the information to be stored in material passports. The Madaster platform is now active and operational in the Netherlands, Switzerland, Germany, Norway, Belgium and Denmark, and it is being finalised in several other countries.”

Is the creation of different material passports a limitation? For example, does it cause communication problems between each other?

“At the moment the discussion in the EU is focused on how to standardise information to be stored in material passports. This is a vital step. The Madaster online platform is providing the digital infrastructure to generate material passports. It is very good that there is political backing to expand the spread of the passport. For example, this backing is crucial for making the material passport mandatory, something we think will happen in the coming years. The Dutch government was discussing the possibility of making the material passport mandatory for every new building starting in 2022. All sectors, not just construction, are realising that there is a need for material passports, so as to start something we call ‘material asset management’ for our economies. This is becoming more and more widely understood!”

What did not go as you expected in these years?

“In 2017, we would have expected our proposals to spread much faster and much further. Then



again, we realise it is a huge mentality shift that we are trying together to accomplish as a society. We believe that with the circular economy and material passports, a phase of slow acceptance will be followed by a time of exponential growth, in which everything changes very quickly, as happened with the internet.”

Antonella Ilaria Totaro is an expert in circular economy and sustainability, which she has been working with for years between the Netherlands and Italy.

Do you think that the Covid-19 crisis changed the perception of the material passport?

“In a way, Covid-19 made companies aware of their vulnerability. They understood the risks that threaten supply chains at a time of material

Madaster

Madaster Foundation,
madaster.com

Madaster, the cadastre for materials, is the first platform which facilitates the central standardised, web-based generation and registration of material passports. Madaster was founded in 2017 with the intent to eliminate waste by giving each material in the built environment a documented and registered identity, departing from the principle that “waste is material without identity.” The Madaster platform generates and registers material passports, providing a detailed inventory with information about quantities, qualities, dimensions, and locations of all materials, components and products used in a specific building. In addition, the platform calculates a financial

valuation (current and future expected residual value of materials) and a circularity index. The Madaster material passport can be adapted and enriched over time providing a dynamic repository of building data. The data set can also be “archived”, resulting in an authenticated, timestamped set of data that cannot be changed anymore. Registration of objects takes place via an upload (MS Excel) or preferably a BIM model, from which the platform automatically structures and sorts the data. Madaster enables smart decisions on reuse of materials after maintenance, replacement, reconstruction or demolishing, eliminating waste and reducing CO₂.

scarcity much more clearly. Covid-19 contributed to a mentality shift that has influenced the whole discussion on sustainability and the circular economy, issues to which the material passport is directly related to.”

What are the next steps for the material passport and Madaster?

“We are still optimising the platform building new functionalities and using algorithms and technology to automate the analysis of the constituent elements of a building starting from its drawings. At the moment there is a lot of labour but automation will make it easier, for example, to understand how materials are connecting together in a building. All relevant data can be registered and documented automatically from Building Information Models (BIM). The use of smart connections will make it possible to access various data sources on products and materials (e.g. lifecycle assessment and CO₂ data), financial information (about the value of materials), and other data on the health-related aspects of materials, such as toxicity.”

How do you envision the buildings of the future?

“Buildings will be a mobile estate, structures that can be completely disassembled at the end of their lifetime. They will also be flexible, so much

so that it will be possible to alter and reconfigure them during their lifetime. We will start to generate construction materials in a much more industrialised way, with standardised elements that will be the basis for a construction that will not require specific structures for every single building.”

Do these developments in the construction sector also include the finance sector?

How do investors see the transition of the construction sector toward more circular practices?

“Investors want their building portfolio to be as sustainable and circular as possible. They are afraid of being left with a lot of stranded assets, meaning buildings that are not energy efficient. Circular buildings, especially if equipped with a material passport, always retain material value, which equates to financial value. Consequently, all the drivers to accelerate in the direction of circularity are present. Still, it is very important that governments define strong guidelines, otherwise the development we need will still be far too slow. Both the push from investors and the push from governments should incentivise building owners to really invest in circularity and sustainability.”

What would you do if you were put in charge of a 1-billion-euro investment portfolio tomorrow morning?

“We would definitely promote and invest in enablers for the circular economy. They are the crucial engine in the transition. We need to build a new ‘infrastructure’ for the circular economy. During the gold rush in the United States, the ones that got really wealthy were not the gold diggers but the people who were selling the shovels. It is vital to invest in technology companies because the system will work thanks to the platforms and technological solutions that are facilitating and enabling the circular flow of materials.”

If you had a magic wand, what would you change in the construction sector or, more generally, in our society?

“We would eliminate the need for economic growth, which is one of the biggest poison pills we have put into our system and is also poisoning the construction industry. If you look at what is being built because of financial incentives in a big city like Berlin, for example, you will find shopping centre after shopping centre being constructed and then left empty. At the same time, however, people who make the city liveable and interesting, like artists, journalists, etc., can no longer afford to rent in a city like Berlin. The phenomenon of gentrification is driven by large financial interests and is definitely something that we have to get rid of. Gentrification and investments in real estate that nobody really needs have to disappear. Looking at the future of the

Universal Declaration of Material Rights, theuniversaldeclarationofmaterialrights.org

Sabine Oberhuber, Thomas Rau, *Material Matters*, Bertram + de Leeuw Uitgevers BV 2016; www.bertramdeleeuw.nl/boek/material-matters



The Wooden Cathedral for Triodos Bank

The winner of numerous prizes, including the Post Construction Award at the 2021 BREEAM Awards, the “wooden cathedral” that RAU Architects has created for Triodos Bank is the first office building in the world that can be completely disassembled, with a structure made entirely of wood. Every element can be reused, is documented in the material passport, and is registered in Madaster, an online database for materials used in the built environment. This means that a digital record of the building has been created that lists every material, component, and product used, alongside its specific characteristics and financial value. This makes it possible to easily recover and reuse the different parts, thereby transforming the Triodos Bank building into a material bank.

While the project focused on maximising the reuse of materials in the future, recycled materials or existing construction materials collected from demolition projects were used during construction. Thanks to a special partnership with the Dutch Urban Mining Collective, 10,000 square metres of plasterboard were collected from existing buildings and then reincorporated into the flexible structure of the walls. The wooden beams, which were previously located in a building in Rotterdam, were used for Triodos after the nails were removed by people taking part in a social work initiative. Furthermore, the solar screens for the canteen were partially manufactured using recycled plastic from the oceans. Finally, the two bungalows that were located at the site where the new building has been constructed were dismantled and donated to an eco-village in the north of the Netherlands.

The entire building, from the ground floor up, is entirely made from wood: 132 standardised wooden elements,

wooden floors, wooden shafts and columns are held together using 165,312 screws, forming three five-storey towers. If the company wishes to relocate, or if the office were to close, all the components can be easily disassembled and reused. Only the basement has a concrete structure, which is required for water management.

The five-storey building, with a total floor space of 12,994 square metres, engages with circularity at different levels. Not only does it include the various aspects of the classic XR model (reduce, reuse, recycle, etc.), it also extends the notion of circularity from the purely material dimension to other relevant aspects such as energy, water, biodiversity, and social impact.

The building was prefabricated and assembled on-site, transforming construction into a logistical process. This not only reduced the failure rate, and thus material waste, but also construction time and transportation costs.

The building stores 1,612,000 kg of CO₂ and blends into the surrounding natural environment. Thanks to the choice of wood as a construction material, the building captured more CO₂ than it emitted during fabrication and construction, thus becoming one of the first carbon-negative office buildings in the world.

The application of a material passport (and its registration in a database together with a financial assessment) also aims to send a strong signal to the construction industry to design the maximum residual circular value. Collaborating with banks and accountants, RAU Architects is assessing the ways in which design and circular construction can reduce financial risks.

“Closing the Circle Is Just One Option. Interview with Sabine Oberhuber and Thomas Rau”, *Renewable Matter*, n. 16/2017; www.madaster.ch/application/files/4515/0530/8238/Thomas_Rau_and_Sabine_Oberhuber_-_Renewable_Matter.pdf

construction industry, a team at MIT in Boston developed an algorithm to find ghost clusters in Chinese megacities. These clusters consist of tall residential buildings that were built purely for investment purposes. Nobody ever bought them to live there. The algorithm can discover these clusters because there is no supporting infrastructure around which normally grows when people live somewhere, like shops, schools or restaurants, there is no infrastructure that would facilitate a community. Real-estate development is often completely detached from the need the society has for buildings.”

Are there many companies that are pursuing your circular approach?

“The topic is everywhere and we are glad that the discussion has reached a stage where every company feels that they have to engage in one way or another. Unfortunately, there is also a lot of circular greenwashing at the moment: many companies adding a little bit of recycled content to their products so that, on the surface, they

seem circular. Fortunately, we also see companies who are thoroughly reconsidering their business processes and activities. One of them is Swiss Federal Railways, who we worked with to develop a strategy. They are pursuing a circular approach on all levels, from infrastructure to stations, from buildings to ways of engaging their passengers and prompting them to make sustainable decisions.”

Do consumers also have a role to play?

“Consumers have a lot of power, but companies have more power. They can influence people through marketing. To help the whole system work more smoothly, companies should take responsibility for their actions and the consequences of their decisions, and we should have a very strong government to set the right boundaries. But, at the moment, we do not see politicians doing this. It is very sad, but in politics we lack leadership toward circularity and bold action, we need to address the climate crisis. Some cities are moving, but we cannot wait for cities to activate one by one.” ●