SGS INTRON BULLETIN BULLETIN SEPTEMBER 2020

Centre

Range of techniques used for survey of iconic museum building in Belgium

Opportunities for reuse in Circular Building

High-tech monitoring of first structural element made from reinforced geopolymer concrete





IN UNCERTAIN TIMES, YOU CAN RELY ON EXPERTISE

We find ourselves in turbulent times, in a situation which is very much out of our control. So which certainties can we count on right now?

As human beings, it is in our nature to seek out security and control when faced with change. We are creatures of habit and change doesn't come easily to us, so we take solace from people telling us what we should do. Perhaps we feel they know better than we do. At the moment, our television screens are filled with so-called experts, zealously and enthusiastically sharing their knowledge on Coronavirus measures and society. As we sit, glued to our devices, this feeds our need for greater certainty and control. But is that what we get?

At SGS INTRON, we are all too familiar with building incidents and the great uncertainty they bring with them. We have examined fallen balconies, walkways, parking lots and stadium roofs; all high-stress situations with a lot at stake, from which we have gained valuable experience. All the while we have our finger on the pulse of construction quality across the Netherlands. Unfortunately, the results aren't always positive.

The building process is a complex one, with multiple stakeholders with different interests, so it's no wonder that the occasional problem arises. A Building Act has been introduced with a view to improving construction quality. As far as I'm concerned, this is by no means a guarantee. What we must avoid is a new scheme from paper tigers and an incentive for market players to produce an As-Built File at little expense, so that they can wash their hands of any issues. What we really need is expertise, something that seems to be more and more lacking. Perhaps the term is somewhat old-fashioned. But we like using it nonetheless. Any professional working on part of the building process - no matter what their role - should know what they are doing, and if they don't, they should have the sense to seek help. Quality is founded on the desire to achieve the best outcome for your customers and for yourself.

We don't often brag about our expertise. And we definitely don't appear on television. That isn't who we are; nor what most of our customers are looking for. We simply are there for them – without fail. To offer security in uncertain times. Or whenever it's needed. We rely on our expertise. That, at least, is certain.

Technical Director, Marnix Derks of Soprema:

"THE KURHAUS ROOF IS TESTAMENT TO WHAT WE AND OUR CUSTOMERS CAN ACHIEVE TOGETHER"

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With a history spanning over a century, family firm Soprema has manufacturing plants and trade organizations all over the world. Internationally, it represents one of the largest suppliers of construction materials for the outer shells of buildings. "We produce and supply building materials that protect against external factors", explains Technical Director for Northern Europe, Marnix Derks. "The bulk of our products target waterproofing: liquid products, but also synthetic and bituminous membranes, plus spray foam insulation. Certifications are hugely important to us. They represent the best means of backing up the quality and sustainability credentials of our products in the applications they are intended for. Not only that, they are also very important for interpreting all of the tests and trials carried out by external labs and our own team at Soprema labs. For the certification of roofing materials, we've been working successfully with SGS INTRON Certification for many years now."

"SGS INTRON Certification is critical for us; but in a positive way. They are approachable. While we may not always agree with one another, we are in constant dialog. Good audits - like SGS INTRON Certification's - keep us on our toes, and we gain from that. It teaches us where we can improve even more. This is why, among other reasons, we have brought certification of our PVC, TPO, ECB and bitumen roofing sheets to SGS INTRON Certification. In all, there are around twenty KOMO certifications, one CE certification and four separate NL-BSB certifications for products we market under private label."

PVC WITH A REAL COPPER LOOK

Ninety percent of those roofing products are not visible to passers-by after installation. The product on the Kurhaus in Scheveningen is an exception to the rule and is a real eye-catcher. "The roof uses our unique PVC product, Flagon SRF Copper Art", states Derks with enthusiasm. "Our customer chose this product for the roof during the recent renovation of the Kurhaus. The coppercolored roof is a distinctive feature on this special building. It's a great opportunity to showcase what we can offer." The results speak for themselves, as the Kurhaus roof won Roof of the Year in 2018. "Without a good working relationship with the customer, we wouldn't have had the same success," Derks continues. "As a supplier and manufacturer, we stayed in constant communication. Together, we invested a lot of time in finding the right methods for flawlessly installing our sustainable product. This was tricky, given the shape of the roof and the many details we had to take into account. But we did it: the new roof has a real copper look, and will last a good twenty to thirty years. During that period, it will even oxidize in the same way real copper does."



PUTTING HEADS TOGETHER OVER STANDARDS AND REQUIREMENTS

Like most other Soprema roofing materials, Flagon SRF Copper Art received its KOMO certification through SGS INTRON. "Our Dutch customers mainly professional roofers - request it," explains Derks. "They take the KOMO certification as proof that the product satisfies the minimum criteria set for sound, safe and sustainable buildings. All market players are involved in setting those minimum requirements. We manufacturers and users sit around the table together to determine the certification standard. I myself sit on a number of NEN committees as well as the technical committee concerned with drawing up BRL 1511, the standard for sheet roofing systems. As a leading company, you need to take responsibility in that sense. As such, together, we maintain and protect the desired quality standard, which is good. Going forward, in terms of certification, I think we'll need to look more at product performance and less at composition.

That will also open up more possibilities for the reuse of materials – something that isn't happening all that much yet. But as a manufacturer, you need to be getting on with it ahead of time. In a number of countries, we are building factories designed around reusing roofing sheets, spray foams and polyester. We recycle bituminous products at various plants. Circularity is the keyword for the future."

GEOTEXTILE AND DOME SKYLIGHTS

Soprema plans on expanding its range in the Netherlands over the coming years. "We are the market leader in roofing materials", states Derks. "But other leading products that we manufacture within the group haven't yet been introduced on any large scale: our products for civil engineering, for instance, such as waterproofing for bridges, tunnels and foundations; and structures that let in light, such as skylight strips and domed skylights. We will also be marketing those products in the Netherlands. But we supply more than just the products themselves: we also supply the information and knowledge needed to install them properly."

RANGE OF TECHNIQUES USED FOR SURVEY OF ICONIC MUSEUM BUILDING

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The KANAL-Centre Pompidou in Brussels was built as a Citroën garage in 1934. The industrial building is architecturally unique. Most striking are the high, semi-circular facade of the former showroom, and the characteristic skylights and steel roof structure of the former workshop. Since 2018, the building has been temporarily used as a museum for modern and contemporary art. It is currently closed for a major renovation. The exhibition space will be extended significantly, while three blocks with multiple floors will be constructed in addition to the existing building. The idea behind the modifications is to transform the KANAL-Centre Pompidou into a suitable home for a museum of modern art and architecture. In advance of the major renovation works, a thorough structural survey was required to determine what would - and wouldn't - be possible.

THE CHALLENGE OF IN SITU ARTWORKS

SGS INTRON was appointed by the KANAL Foundation to carry out the survey together with SGS EHS Geotechniek. The builder, Bureau Greisch of Liège, led the technical side of the project. "We were one of the few parties able to offer all of the required disciplines", says consultant and project manager, Michel Boutz of SGS INTRON. "The survey was extensive and challenging, not least because it took place almost entirely inside of the building while it was still functioning as a museum. To prevent damage to the artworks and disturbance to visitors, we put a lot of effort into limiting noise, dust, water and fumes. We used nondestructive techniques and electrical equipment wherever possible. However, in certain places within the building, we did need to carry out materials testing in order to clearly ascertain the condition

the building was in. This included excavation work and exposing specific reinforcements. For the geotechnical tests, we even had to drive a large CPT truck and drilling rig into the building. Through the use of tents, tarpaulin wrapped around a frame above our cherry picker and a special fume extraction system, we managed to keep disruption and risks to a minimum."

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A TECHNICAL FEAT

The unique thing about this survey was the variety of techniques deployed. As Boutz explains, "On site, geotechnical investigations established the composition and bearing capacity of the ground, as well as the groundwater level. For the concrete flooring, we used non-destructive techniques such as radar and Ferroscan to get a good picture of the reinforcements in place. The coating on the steel structure was examined using a hand-held XRF machine on site to detect any heavy metals and hexavalent chromium. A special geotechnical method called seismic cone penetration testing even made it possible to determine the length of the concrete pile foundations. We also took and tested numerous samples: soil and concrete cores, samples from all parts of the steel structure and paint samples. These were tested thoroughly at our lab to determine the composition and strength of the material, among other things."

UNDERGROUND MEASUREMENTS WITH SEISMIC WAVES

A key aspect of the project was the survey of the building's foundations. This was crucial not only because these would be coming under additional load, but also because the basement levels of the new blocks were planned right beside the existing pile foundations. "We carried out this special test in collaboration with the Belgian firm, Denys," says Boutz. "The foundations were exposed at six different locations within the building. The building's main supporting structure was made up partly of steel columns mounted underground on a foundation block of up to a meter thick. The block in turn sat on concrete piles. At each of the test sites, we excavated the top 50cm of a pile. This involved making a pit of approximately 2 meters from the level of the building's floor. Denys took care of expertly stabilizing the pit at each stage. The reason behind the excavating was that we needed to know how the foundation was assembled, how strong the concrete was and how long the pile foundations were. To determine the strength, we tested cores taken from the pile head at our lab. The final test

isn't something we get asked to do often. For this challenging geotechnical investigation, we enlisted the help of Fugro. As the piles were likely only partially reinforced, we used seismic cone penetration. This involves driving a cone fitted with geophones deeper and deeper into the ground. That told us the resistance as a function of depth, and therefore the level of the bearing layer under the ground. The geophones on the cone registered the vibrations we applied to the pile by striking an anchor with a hammer. By measuring the velocity of the sound waves, we were able to determine the depth of the pile tip. This corresponded with the level of the bearing layer. We were thereby able to determine the length of the piles relatively accurately through the use of nondestructive techniques, and ultimately meet this very unique request."



OPPORTUNITIES FOR REUSE IN CIRCULAR BUILDING

MEER INFORMATIE: AGNES SCHUURMANS

The reuse of products and elements is considered the best way of using materials longer. In most cases, the environmental impact of reusing a material is lower than recycling it back to a raw material. However, reuse remains relatively rare within the construction industry. Possible reasons for this are that products cannot usually be extracted from a building undamaged; because it is unknown whether or not a product will still be technically sound in a new application or simply because doing so is too expensive as it requires additional resources or transportation.

A thorough inventory of materials and subsequent circular-conscious demolition are critical steps on the road to higher-value reuse. But greater certainty concerning the level of performance we can expect from reused products is also called for. In some instances, this is straightforward. For example: pavement stones can quite easily be reused on a large scale. But what about more complex products – particularly if they have a structural function or play a part in ensuring fire safety?

RISK CATEGORIES FOR ASSESSING MATERIALS REUSE

At SGS INTRON, we know an awful lot about the properties of products. One of the ways we apply this knowledge is in assessing whether a product – or an entire structure – is fit for reuse, and what its expected remaining lifespan is. Unfortunately, this still often occurs on an hoc and individual project basis. As an example, we contributed to the CUR Recommendation 121 'Determining lower threshold expected lifespan in existing reinforced concrete structures'. For Stichting Bouwkwaliteit, Foundation for Building Quality, we examined how the environmental performance of elements for reuse could be assessed in relation to the Building Act. We proposed introducing the use of risk categories: the greater the risk, the more evidence required; this would allow smart choices to be made about the most important tests, for example. For low risks, it should be possible to substantiate the properties. This avoids high outlays.

We are keen to make our knowledge more widely accessible, which is why we have created an assessment framework. The assessment is split into two stages:

- First, the complexity and risk are assessed, and the product is assigned a 'risk category';
- 2. Per product group, the characteristics that the product satisfies are ascertained or substantiated.

SAFETY & FUNCTIONALITY				
RISK	CATEGORY	BUILDING DECREE PERFORMANCE	REMAINING LIFESPAN	ACTION
Low	4	Substantiate	Defaults	
	3			
High	2	Prove	Test	
	1			
STAGE 1		STAGE 2		





DEVELOPING GUIDELINES

We advocate the development of pointers for each product group through the introduction of a set of guidelines, for example. This would eliminate a lot of uncertainty in the market when it comes to making choices about reuse. Manufacturers play a key part in this, as they know best which properties matter. The steel industry in the UK has compiled a document on the reuse of steel, for instance¹. However, research projects such as those currently being conducted around national targets for circular building must also help determine these guidelines.

DETERMINING MATERIAL PROPERTIES

Material passports in construction also play a role in this. Properties that we know will need assessing in the future must now start being included in the documentation that will remain available throughout the entire chain. Asset management offers a means of recording interventions during the use phase, as well as any incidents that could impact performance. But we shouldn't set everything in stone: we should look discerningly at what is really necessary, and commit to that throughout the chain.

SGS INTRON is seeking parties who are keen to develop this philosophy with us. If you are interested, please contact agnes.schuurmans@sgs.com.

10R-MODEL CIRCULARITY



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¹STRUCTURAL STEEL REUSE ASSESSMENT, TESTING AND DESIGN PRINCIPLES, SCI publication P427, 2019. ISBN 13: 978-1-85942-243-4. Published by: SCI, Silwood Park, Ascot, Berkshire. SL5 7QN UK, www.steel-sci.com

DANISH FIRM AFATEK ON TRACK FOR IBA PRODUCT CERTIFICATE

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In Denmark, Incinerator Bottom Ash (IBA) – residue from waste incineration - has been fully accepted as a building material for road construction for the past twenty years. The authorities consider it an excellent alternative to primary raw materials. Danish company Afatek processes around 250,000 tons of bottom ash a year from waste processing plants across Eastern Denmark. "We have made substantial investments", explains Director, Jens Kallesøe, "so as to be able to extract as many valuable metals from the bottom ash as possible, but also to upgrade the mineral components. This makes the product 100% fit for use under roads, parking lots and/or industrial sites." Afatek is leading the way in Europe when it comes to quality and certification of bottom ash. The firm is preparing for its next pioneering project: product certification. "Thanks to our expert partners, such as SGS INTRON, we are making great progress."

QUALITY LEADERS

Afatek has been performing regular quality checks for many years. These begin with an exit check at the plant, but go on to include much more: "For the past seven years, we've tested all our products against specifications from the Danish Road Directorate", explains Kallesøe. "Every 5,000 tons of material is checked for leached hazardous substances and for the strength, i.e. quality, of the building material. No one else in Europe was doing that. Seven years ago, material standards didn't even exist."

SAME LEVEL OF ASSURANCE WITH LESS TESTING

Using a comprehensive statistical survey that comprises leaching data from the past five years, SGS INTRON has demonstrated that Afatek can dramatically reduce the number of environmental tests from nearly 50 to a maximum of five tests a year, and without compromising quality. The separate treatment and testing of batches from different plants is no longer necessary either, as their quality is comparable. Consultant Huub Creuwels met Afatek Quality Manager Jenssen at a conference in Vienna in 2019: "I explained that we used a recognized European system that tells us whether the testing frequency can be reduced based on average values and dispersal. He immediately showed an interest. Two weeks later, I went to Copenhagen to explain things in more detail."

OVERSEAS PARTNERS

Jens Kallesøe is very happy with the SGS INTRON partnership. "We've always worked alongside specialist partners based outside of Denmark. We like doing things that haven't been done before and discovering new ways of improving quality and efficiency further through discussion. On the road to certification, we thought it would also be a good idea to have a Dutch party on board. We're familiar with Green Deals and other such projects. Having a partner with the scope and quality SGS INTRON enjoys is very valuable for us. Their advice on how



to go about testing our products was very important, and the fact that we need to test less produces significant cost savings right away. We are still in regular contact. For example, SGS INTRON is helping us devise ways to test the ecotoxicological properties of our material. That represents one of the final hurdles on the road to certification."

A PROVEN HIGH-QUALITY ALTERNATIVE

Afatek is aiming for a Danish product certification. "That certification is very important to us. The goal is to have the quality of our product described and documented properly so we can prove that our products represent a construction material of the same standard as the highest quality granulate. This will strengthen our position in the Danish market and allow us to demand a higher price for our products. In short: this project is a great investment for us – not least thanks to our collaboration with SGS INTRON."

"It's good to have a partner like SGS INTRON on board"

HIGH-TECH MONITORING OF FIRST STRUCTURAL ELEMENT MADE FROM REINFORCED GEOPOLYMER CONCRETE

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Mobilis is the first civil works contractor in the Netherlands to build a structural element using reinforced geopolymer concrete. The structure in question is a wall between a carriageway and an elevated cycle path at a new railway underpass in Heiloo. Public sector bodies Rijkswaterstaat (Executive agency of the Ministry of Infrastructure and Water Management) and ProRail allocated a budget for the project from the government Klimaatenvelop initiative, which is aimed at promoting the circular economy. The reason behind this is that geopolymer concrete has a notably smaller CO, footprint than conventional cement concrete. The new dividing wall is fitted with a high-tech monitoring system consisting of two sets of sensors. The system will feed the stakeholders real-time information on the behavior and characteristics of the sustainable concrete over time.

REMOTE MONITORING OF STRUCTURAL BEHAVIOR

"On behalf of Mobilis, we initiated a program that will monitor the dividing wall and a test wall constructed outside of the project over a period of ten years", explains Michel Boutz, Senior Consultant at SGS INTRON. SGS INTRON teamed up with Zensor, a spin-off of the Vrije Universiteit Brussel, for the development of a suitable monitoring system for the dividing wall and the choice of sensors. "We've been working with this company for years," says Boutz. "In consultation with Mobilis, we chose two sets of sensors. The first set records how the wall deforms in two directions. Should deformation prove to be greater than normal, the sensors will signal this early on. The second set of sensors gives us insight into the risk of reinforcement corrosion. Sensors with various functions have been built in for this purpose: one monitors the temperature of the concrete, another monitors moisture entering the concrete cover, another the steel potential and, lastly, there is a sensor that directly records the degree of corrosion."

HIGH-TECH WITHOUT DISRUPTION TO TRAFFIC

This ideal combination of sensors allows SGS INTRON to remotely monitor precisely how the structure is behaving, as well as any risk of corrosion to the reinforcement or inadmissible deformation. This, says Michel Boutz, is unique: "Such advanced means of nondestructive monitoring of geopolymer concrete are a first in the Netherlands, and probably the world." From behind a computer screen, we can see what signals the various sensors are sending and, where necessary, set action limits, so that the stakeholders receive a notification when a sensor registers values that call for action."

SAMPLES FROM TEST WALL

A reinforced test wall was also constructed shortly after the dividing wall. This is being kept, in sections, at an outdoor location and will be strewn with road salt in the winter so as to emulate the conditions of the dividing wall as closely as possible. SGS INTRON will also monitor the characteristics of this wall for a period of ten years; not using sensors, however, but by performing inspections, taking samples and performing lab tests on cores taken from the wall. "We will be looking at properties such as compression strength, chloride penetration and carbonation", explains Boutz. "For the assessment of reinforcement corrosion, we want to use non-destructive methods. This will give us a complete picture of how the geopolymer concrete evolves over ten years. The monitoring system for the dividing wall is already fully operational, and we plan to begin sampling on the test wall at the one-year mark."



COLUMNS AND CUPOLA OF 19TH CENTURY STILL IN GOOD CONDITION

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SGS EXPERTISE POOLED FOR QUALITY SURVEY

SGS regularly reviews the condition of existing buildings throughout Belgium. One of those was the historic Wintercircus building in Ghent, which we visited early this year. Built in 1885, dozens of companies have performed at this former circus. Upon completion of a full renovation scheduled to take until 2022, the building will accommodate offices around a large internal gallery, a rock music venue, café, restaurant and shop. In advance of the renovation, VK Architects & Engineers asked SGS INTRON to ascertain the condition and stability of the cupola and columns around what was the central ring and the floors. SGS I&C, SGS NDT and SGS INTRON successfully collaborated on and completed the job.

BASELINE MEASUREMENT

"It was important to the client for us to take a baseline measurement", says project manager John Speerstra of SGS INTRON. "Over the years, the building has endured fires, renovations and neglect, among other things. The purpose of our survey was to determine whether the quality of the steel trusses in the cupola and the steel columns below it were still up to today's standards, and to identify any visible or invisible damage or corrosion. We also checked whether the dimensions of the structural elements still corresponded to those on the original drawings."

INSPECTION AT THIRTY METERS ELEVATION

The comprehensive survey that was conducted over two weeks concluded that the steel structure was still in good condition. The team from SGS INTRON and SGS I&C (Infra and Construction) began with a detailed visual inspection. "The main challenge was the access", continues Speerstra. "The cupola is over thirty meters high." A platform was built underneath the cupola providing access for checking the trusses as well as the columns. Scaffolding erected above the platform made it possible to inspect the steel elements in detail.

NON-DESTRUCTIVE TESTING AND LAB TESTS

"This also enabled our NDT (nondestructive testing) colleagues to safely check the dimensions and measure cracks. They performed ultrasonic tests to establish whether corrosion had reduced the thickness of the steel. The lab tests for strength, weldability and hardness were primarily carried out on samples taken from those structural elements identified by the client as critical. The results of the on-



site survey and the results from the SGS INTRON metal testing lab were recorded in a clear report, along with photos, drawings and exact locations."

CLEAR OVERVIEW

John Speerstra reflects on a successful project. "Without a doubt, our strength for this project lay in the combination of our expertise. Across three departments, we were able to give the client a very tangible result. As a result of that – plus our commitment, flexible attitude and practical, solutions-led approach – we have a very happy client."

"We delivered a result that really benefits the customer"

CSC CERTIFICATION IN BELGIUM SUSTAINABLE IMAGE INCREASINGLY IMPORTANT

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CSC certification provides manufacturers of concrete, cement, aggregates and, as of recently, dry mortar across the world with proof of their environmentally friendly, sustainable and responsible working methods. The origins of raw materials are one thing that is taken into account, but production methods, environmental, economic and societal factors are also considered. In the Netherlands, nearly all concrete processing plants are already certified; however, the CSC label is also slowly gaining ground in Belgium. The Belgian government recognizes it under the heading of 'green construction'. Trade association FEDBETON promotes CSC certification with the help of SGS. "SGS is a member of the Concrete Sustainability Council (CSC) and has been involved in its development since the start", explains Jeroen Pos of SGS INTRON Certification. "We want to be leaders in this field; to be the best Certifying Body. Following a pilot project FEDBETON conducted in 2019 with three CSC certifications for ready-mix concrete plants, there are already more new requests for CSC."

THREE LEVELS OF CERTIFICATION

Belgian cement manufacturers are starting to take up CSC. "A readymix concrete plant can achieve a high level of certification by procuring CSCcertified cement", explains Jeroen Pos. "This makes CSC certification very interesting to producers of cement and granulate too. The associated costs aren't that high: manufacturers upload all of the evidence themselves to the CSC toolbox. If they opt for SGS, then I and the auditor, Matthias Merkx of SGS Belgium, take care of assessing the supporting documents. Matthias then also performs random spotcheck audits on-site. The product gets awarded points for each area, and can achieve either bronze, silver or goldlevel certification. The highest level also earns more BREEAM points, which is of direct benefit to the contractor when tendering for projects."

PLASTICS RECYCLING IN THE CIRCULAR ECONOMY

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Plastic recycling is on the rise, a fact well known by residents in the Netherlands, who see plastic packaging being collected and processed separately. Waste streams from industry, businesses and recycling points are also now making their way to waste plastic processors, with specific streams including waste plastic from metal and car recycling. Previously, these streams were incinerated at waste processing plants to partially supply energy, but there is now a growing demand for materials reuse. Government policy to encourage a circular economy is a strong catalyst behind plastics processing, and the closure of the Chinese market to waste plastic has also contributed hugely to the growth of the Dutch plastics processing industry.

The sector is still in its infancy: various initiatives are cropping up and technical advancements in processing techniques are steadily increasing. The chemical treatment of waste plastic is being encouraged by the primary plastics industry. This produces the base products for plastics by chemically treating plastic waste through the likes of pyrolysis processes. Direct recycling of the various polymer streams is mainly used for thermoplastics, which can be remelted. Besides the stream of soft plastics - such as packaging foils hard thermoplastics are also collected, sorted and processed into streams of secondary waste plastics that are then remelted into granulate and incorporated into many types of plastic.

SGS INTRON has vast experience serving industries concerned with converting waste into secondary raw materials, and is applying this experience to the field of plastics recycling. Among other activities, they can carry out composition analysis, analysis of environmental contaminants and substances of very high concern (SVHC), testing of products from secondary raw materials, life-cycle analysis (LCA) and quality systems.





COMPOSITION ANALYSIS

The composition of the plastic to be recycled is extremely relevant in dictating how it is treated and the quality of the end product. Some treatment methods, for instance, exclude oxygenated plastics as these can damage the end product. Consistent quality of the raw material is always very important for the treatment process. Various methods can be used to analyze composition, such as FT-IR (infrared spectroscopy) for the identification of polymers. It has been shown that good visual sorting can be reproduced and is highly valuable when assessing incoming plastics waste. SGS INTRON has adopted this analysis, based on the wealth of experience it has amassed through composition analysis for construction and demolition waste.

ENVIRONMENTAL CONTAMINANTS

There are detailed regulations for stony materials, as detailed by the Dutch Decree on Soil Quality (BBK). This gives recycling firms clear standards that secondary products must meet. For plastics, however, no such regulations exist. In practice, the assessment of secondary plastic products often begins with the Decree on Soil Quality standards for composition and leaching, as these are familiar among stakeholders. Use of the European leaching tests (TS 16637 series) makes it possible to also look at organic substances for leaching, not only inorganic ones, as stated in the BBK.

SVHC (SUBSTANCES OF VERY HIGH CONCERN)

Awareness of substances of very high concern is growing significantly in the interest of avoiding human exposure



to substances that could be harmful to health. The emphasis here is on substances believed to be carcinogenic. SVHCs that have featured fairly frequently in the news of late are so-called PFAS (polyfluoroalkyl substances). A number of substances in this family are thought to be carcinogenic and have been included in the REACH regulations for some time now. The list was recently expanded with a number of new PFAS. At the request of Rijkswaterstaat (executive agency of the Ministry of Infrastructure and Water Management), SGS INTRON produced an inventory of SVHCs that could be listed in waste streams of the sectoral plans in the Dutch National Waste Management Plan (LAP). The purpose of this overview is to offer waste processing companies and regulators a frame of reference for assessing relevant SVHCs in their waste streams. Where concentrations exceed the permitted values, the processor must advise how they will treat the relevant SVHC.

The absence of SVHCs is also relevant for the designation of end-of-waste status of secondary products.

For this research, SGS INTRON is utilizing the vast analysis facilities available through the worldwide SGS organization. This ranges from broad screening at 0.1% level to far more sensitive analyses for specific substances at ppb (parts per billion) level.

PRODUCT TESTING

One of the products plastics recycling produces is plastic granulate. From this, new plastic products can be made. These products naturally have to meet technical requirements in terms of strength and lifespan, as do products made from primary materials. SGS INTRON deploys a wide range of mechanical analyses and aging methods, and is experienced in testing and assessing product lifespans.



LIFE-CYCLE ANALYSIS (LCA)

The environmentally-focused life-cycle analysis (LCA) method is a quantitative method for assessing the sustainability of products and processes. Comparison of various treatment options or various products in a functional setting is what makes LCA the tool of choice. LCA is becoming more and more commonplace in the Netherlands, particularly thanks to the Environmental Cost Indicator.

CE MARKING AND CERTIFICATION

Where a harmonized European standard exists for a product, a product with secondary plastics must also adhere to that standard. The product can thus only be launched on the market with CE marking and a declaration of performance. SGS INTRON supports manufacturers with this.

Many semi-manufactured products derived from plastics recycling still go directly on specification to customers, who will then make an end product from them. Individual customers will agree their own specifications with the processor. The processor relies on experience to provide their customers with a good mix of semi-manufactured products. As things stand, the semimanufactured products market is still, to some extent, open to a wide range of customers. As and when this evolves, a need will of course arise for secondary raw materials of reliable quality, and for independent testing and guarantees from certifying bodies, such as SGS INTRON Certification.

CONCRETE WITH HIGH PERCENTAGES OF FINE AND COARSE RECYCLING GRANULATE

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In the Netherlands, concrete rubble has already been fully recycled for twenty years, although primarily as base course material in the civil engineering sector and only to a limited extent as aggregate in concrete. Thanks to innovative recycling techniques, it is now possible to considerably reduce the hardened cement paste content in both fine and coarse concrete granulate, significantly improving the structural and sustainability properties of the concrete made from it. This development will help promote the application of these modern fine and coarse recycling granulates as aggregates in concrete, particularly if endorsed by a CROW CUR recommendation.

CURRENT REGULATIONS

The Dutch concrete standard NEN 8005 states that in typical environmental classes, up to 30% of the coarse aggregate can be replaced by traditional concrete granulate with a granule density of at least 2,200kg/m3. CUR Recommendation 112 permits a higher replacement percentage of the coarse aggregate, but if the replacement percentage exceeds 50%, correction factors for the structural properties must be applied, and limitations apply for certain environmental classes.

CROW RESEARCH

CROW working group N1482 'New recycling methods for aggregates' is researching the effects of concrete granulate quality on the structural properties as well as the sustainability and lifespan of concrete. Of particular interest here is the content of residual cement block in the produced granulate. The research involves two innovative recycling processes: the SmartCrusher (Smart Liberator) from Smart Circular Products (SCP) and the combined process of Advanced Dry Recovery (ADR) plus Heated Air-classification System (HAS) from C2CA Technology (a joint venture between GBN and TU Delft). The diagram shows a brief description of the Smart Liberator and the ADR + HAS.

Both processes produce a fine (<4mm) and a coarse (4-22mm) granulate from regular concrete rubble which, after characterization, are subjected to a comprehensive concrete test performed by SGS INTRON and TNO to ascertain their relevant structural and sustainability characteristics.

CROW CUR RECOMMENDATION FOR INNOVATIVE RECYCLING GRANULATE

Because concrete granulate produced through innovative recycling techniques contains considerably less hardened cement paste, both the fine and coarse fractions can be applied in higher ratios in new concrete, without any need for adjustment to the structural calculation rules (correction factors).

The research results will be used to formulate a CROW CUR recommendation, which is expected at the end of 2020. This will include a quality classification for the granulate produced, based on the maximum replacement percentage of the sand and/or gravel with these fine and/or coarse recycling granulates, whereby the structural calculation rules apply in full.



Example of granules in a 4-22mm fraction: gravel (left), SmartCrusher/SCP (center) and ADR/GBN (right)

N.B.: some granules contain remnants of adhered hardened cement paste or are agglomerations of sand grit bound by hardened cement paste



Example of 0-4mm fraction: SmartCrusher/SCP (left) and ADR+HAS/GBN (right)

SMARTCRUSHER PRINCIPLE

In traditional jaw crushers, one of the jaws moves more or less in a horizontal direction, breaking the concrete rubble under high force. This not only crushes the weaker hardened cement paste, but also causes a lot of breakage to the aggregate. On the SmartCrusher, both jaws move also in a vertical direction, crushing the concrete rubble with shearing forces (see image on right). Because the shear strength of concrete is much lower than its compressive strength, this requires much less energy while also causing less breakage to the aggregate. Furthermore, clever use is made of the fact that breaks tend to occur at the porous boundary layer between the aggregate and cement block - also known as the interfacial



Laboratory prototype Slimbreker and SmartCrusher principle, whereby the lower roller serves as a means of regulating the retention time between the jaws

transition zone – leaving only a minor amount of hardened cement paste adhering to the aggregate. The movement of the material within the SmartCrusher also results in autogenous milling, which removes and pulverizes cement block alongside the crushing process.

Pre-crushed concrete rubble is processed into a coarse fraction of 4-32mm (depending on the original dimensions of the gravel) and a fine fraction of 0-4mm (separated by sieving). The finer fraction is then separated in a cyclone into a fraction of 0.2-4mm and two configurable powder fractions between 0mm and 0.2mm.

ADVANCED DRY RECOVERY (ADR)

Advanced Dry Recovery (ADR) technology enables granules to be sorted based on differences in dimension and density (specific gravity), even if the input material has a high moisture content. The principle behind this sorting method is shown in the figure below.

Granules in the concrete rubble that have been pre-crushed to around 16mm are ejected at high speed using a rotor. This additional kinetic energy separates the parts, despite the elevated moisture content. The finer and lighter parts (0-1mm) are ejected but do not travel as far. Assisted by the internal air circulation, these are then separated from the coarser parts into a different fraction. The remaining fraction is then separated by a wind sifter into a fine fraction (1-4mm), which will also include coarser yet lighter parts such as wood and plastic, and a coarse fraction (4-16mm).



Schematic representation of ADR

HEATED AIR-CLASSIFICATION SYSTEM (HAS)

The ADR rotor product and the ADR airknife fine fraction are processed further in the HAS. The principle behind the HAS is a combination of drying and air classification, whereby the material is briefly exposed to heat before subsequently being sorted by granule size using an air jet. The heat is reused to dry and separate materials for an efficient use of energy.

The thermal treatment induces thermal stress in the granulate, which weakens or breaks the bond between the cement block and aggregate. In addition, partial dehydration of the cement block occurs, which also serves to weaken or degrade the hardened cement paste.

LATEST PROGRESS AND DEVELOPMENTS IN HEXAVALENT CHROMIUM TESTING FOR COATINGS ON THE MARKET

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Appropriate testing methods are essential if we are to get the hexavalent chromium dossier for coatings on objects under control. There is some good news, though: recent years have seen significant progress in this area. Wil Klarenaar, a materials scientist at SGS, explains: "We are gaining lots of new insights that are leading to reliable and practicable test methods. Pioneering labs are also working on accreditations from the RvA (Dutch Council for Accreditation). All of this signals that we are now beyond the initial stages of development."

It goes without saying that we want to know exactly where hexavalent chromium is present in our society. In order to identify this, we need reliable methodologies. "Much greater clarity has emerged within the field in recent years", says Klarenaar. "Multiple tests have indeed confirmed that our surroundings are full of hexavalent chromium. Not only is the substance present in public spaces, but also in all kinds of buildings and structures, such as floors and window frames, for instance."

FOCUS ON HIGH CONCENTRATIONS

If hexavalent chromium is all around us, then we need to concentrate on where it matters most. "Do we focus on very low concentrations of chromium, or on the higher concentrations that pose the greatest risk? This is the milliondollar question. To know for certain whether concentrations are low or high, developing test methods is essential. Real progress has been made in recent years as far as this is concerned."

A MOMENT OF REFLECTION

Specialists gained a lot of experience between 2018 and 2019. The hexavalent chromium dossier is still relatively new, so clients need research. "As experts, we've seen many applications," says Klarenaar. "As we delved deeper and



deeper into the subject and the research methods, things were developing quickly. We were honing, learning and gaining new insights week after week. When it's all evolving so quickly, there comes a time for reflection at a certain point. This is essentially where we translate our experiences into structural improvements to a methodology that we will be able to use for many years to come."

INTERESTING DEVELOPMENTS

We are seeing some interesting developments in terms of testing methods. For instance, SGS has a useful instrument for detecting chromium onsite. As Klarenaar describes, "The handheld XRF, which became RvA-accredited in May 2019, also enables us to instantly test for other heavy metals such as zinc, lead, cobalt, nickel and cadmium. It's a unique piece of kit, because SGS is the only accredited company in the Netherlands able to detect chromium on-site." In addition, SGS's lab analysis is also accredited, and a 4-stage plan has been developed: the more stages clients go through, the more accurate the detection of hexavalent chromium.

CONSTRUCTIVE PROGRESS

So, why is third-party validation so important? According to Wil Klarenaar, "It underscores the fact that we are making vital progress in testing techniques. For a society-wide issue such as hexavalent chromium, clients need to be able to rely on proven methodologies. We are making some real constructive progress with this now. A year ago I never would have imagined getting to the stage we are at now in terms of development."

COLLABORATION BETWEEN LABS

What is unique in this situation is that labs are joining forces in their efforts to supply the market with the necessary means for testing. "There's a good reason why," says Klarenaar. "Labs are all coming up against the same issues at this stage of the hexavalent chromium dossier: very complex paint layers that often make proper inventorization and analysis difficult. The fact is that with hexavalent chromium, there are all kinds of external influences that can lead to unpredictable chemical reactions. This makes analysis far from straightforward. It is something that we as investigating bodies want to address, so we are looking to collaborate and share our experiences."

A REMARKABLE SITUATION

Klarenaar believes this can only be a good thing. "Hexavalent chromium is a societywide issue. Finding like-minded partners in a challenging area of work is wonderful. This year, a number of labs even agreed on a harmonized methodology, which will enable us to produce comparable results. As far as I'm concerned, it's a remarkably progressive situation."

MORE STAGES MEANS GREATER RELIABILITY

Klarenaar goes on to explain the 4-stage plan: "These are the four stages we go through to detect hexavalent chromium. You need at least one stage in order to determine whether you're dealing with hexavalent chromium or not. The more steps you go through, the more definitive the outcomes. However, each stage has its shortcomings. Consider complex paint layers, for instance: those can produce deviating results in the lab. Going through all four stages offers the highest test result reliability. But a standalone test or a combination of testing methods is also an option."





* Optical microscopy and Scanning Electron Microscopy/Energy-Dispersive X-ray Spectroscopy



"SGS has a handy Accreditation Council accredited instrument for detecting chromium on site, making SGS the only accredited company in the Netherlands able to detect chromium on site. Our lab analysis is also accredited."



CONCRETE TESTING FOR THE NUCLEAR INDUSTRY

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SGS INTRON has been approved as a supplier of concrete testing for the construction of nuclear power plant Hanhikivi NPP1 in Finland on the Hanhikivi peninsular on the Gulf of Bothnia, south of the city of Oulu. The concrete tests to be performed are so-called 'special tests', specific to the concrete being used on the nuclear island.

SAMPLES AND SAMPLING ON-SITE

While we have prior experience with similar projects, this one is quite unique. Raw materials would usually be sent to our lab, where we would prepare the concrete. However, we were not allowed to do that for this project. The concrete for the samples has to be prepared at the plant itself, which means that a number of SGS INTRON staff will travel to Finland to take and make up the test samples. The samples will be cured underwater during transport. This solution put us on a level playing field with the local competition.

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LAB ACCREDITATION EXPANDED

The necessary tests will be performed on the concrete at our lab in the Netherlands. To facilitate this, the list of accredited operations for our lab needed to be expanded. This was done successfully within the deadline. Construction of the nuclear island will commence once the Finnish government has issued the permit, and we can get started.

GEOPOLYMER CONCRETE A SUSTAINABLE ALTERNATIVE TO TRADITIONAL BUILDING MATERIALS IN SPECIFIC APPLICATIONS

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Geopolymers in construction are nothing new. Indeed, the Egyptians used them to build the pyramids. Yet in recent years, this inorganic binder has received a lot of attention as a cement substitute, mainly because it offers significant reductions in CO₂. But is the material as easy to work with and durable? "In certain applications, we know that our binder, made from secondary raw materials, is even more durable than traditional building materials", says Patrick Ammerlaan of consultancy firm SQAPE, a joint venture between Cementbouw and Mineralz. "Our RAMAC brand - a ready-mix geopolymer concrete - has proven high performance, particularly in applications that require the unique properties of this material, such as shrinkage, acid resistance, wear resistance or waterproofing."

ROBUST PROCESS

"For years, just like Cementbouw, we had been looking for sustainable alternatives to traditional raw materials into which we could incorporate waste materials", says Rob Bleijerveld of Mineralz, co-founder of SQAPE. "The SQAPE technology is patented. It contains additives that enable us to control the process. This means that we can match the properties of the building material we are producing to the customer's chosen application."

PROVEN QUALITY

Naturally, there can be no compromise on quality. "We rely on a reputable institution such as SGS INTRON to demonstrate that our material performs well," explains Bleijerveld. "Both the raw materials we supply and the licensed products that concrete manufacturers make with them – bricks, flags and curb stones – have a quality mark. SGS INTRON regularly performs quality audits on the raw materials that we supply to our licensees.



What's more, the concrete products manufactured are BRL 5070 certified (Dutch standard for pre-manufactured concrete products). That way, we can assure that the quality of our process is always high, and that the mixes we make using SQAPE technology meet the requirements of the Decree on Soil Quality, and our customers' expectations."

COMPLETE CONCEPT

Quality assurance is also the motivation behind SQAPE's complete concept offering to customers. "We help concrete manufacturers wanting to utilize our technology to do so successfully", says Patrick Ammerlaan. "We supply the raw materials - the binder (a powder) and the alkaline activator - plus the knowledge necessary to use the material in an application with the desired specifications."

NEW GENERATION READY-MIX CONCRETE

"We're also in the process of launching our own brand: RAMAC, an alkaliactivated ready-mix concrete. With this, we are hoping to promote the commercial development of SQAPE technology. We began with surfaces for cycle paths. RAMAC gives the surface a hard-wearing top layer, with fewer expansion joints. We then went on to make a roundabout. Geopolymer concrete has a different microstructure to cement concrete, which makes RAMAC more flexible, better for imprinting and less likely to shrink and crack. Which is what makes it suitable for the construction of a roundabout, as it will need to endure high stress and lots of rotational movements. Our most recent development is a durable warehouse floor. RAMAC is ideal for that, too: not only thanks to its high flexural tensile strength, enhanced hardness and density, but also because the material is water - and acidresistant."

EXCELLENT ENVIRONMENTAL CREDENTIALS

"Confidence in the market is growing", observes Rob Bleijerveld. "SGS INTRON plays a key part in that. We test all our developments ourselves and we then like to have our results confirmed.

As an independent party, SGS INTRON continually verifies our findings. The SGS INTRON test reports on our website are also significant. One report by Gert van der Wegen confirms that the concrete technological properties of SQAPE geopolymers potentially make the binder suitable for a large number of concrete products. These range from paving stones, curb stones and slabs to agricultural concrete products, sewage pipes and hard surfaces. Research by SGS INTRON consultant Ulbert Hofstra

removes any concerns regarding environmental health (leaching) and the health & safety aspects of processing geopolymer concrete. RAMAC boasts excellent environmental credentials: reductions in CO₂ of 40-80 percent and an extremely low Environmental Cost Indicator score. Plus, the product is fully circular. Once broken up, concrete products made with SQAPE Technology can simply be incorporated into new concrete. We've tested this too, both from an environmental and civil engineering perspective."





PATRICK AMMERLAAN



ROB BLEIJERVELD

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