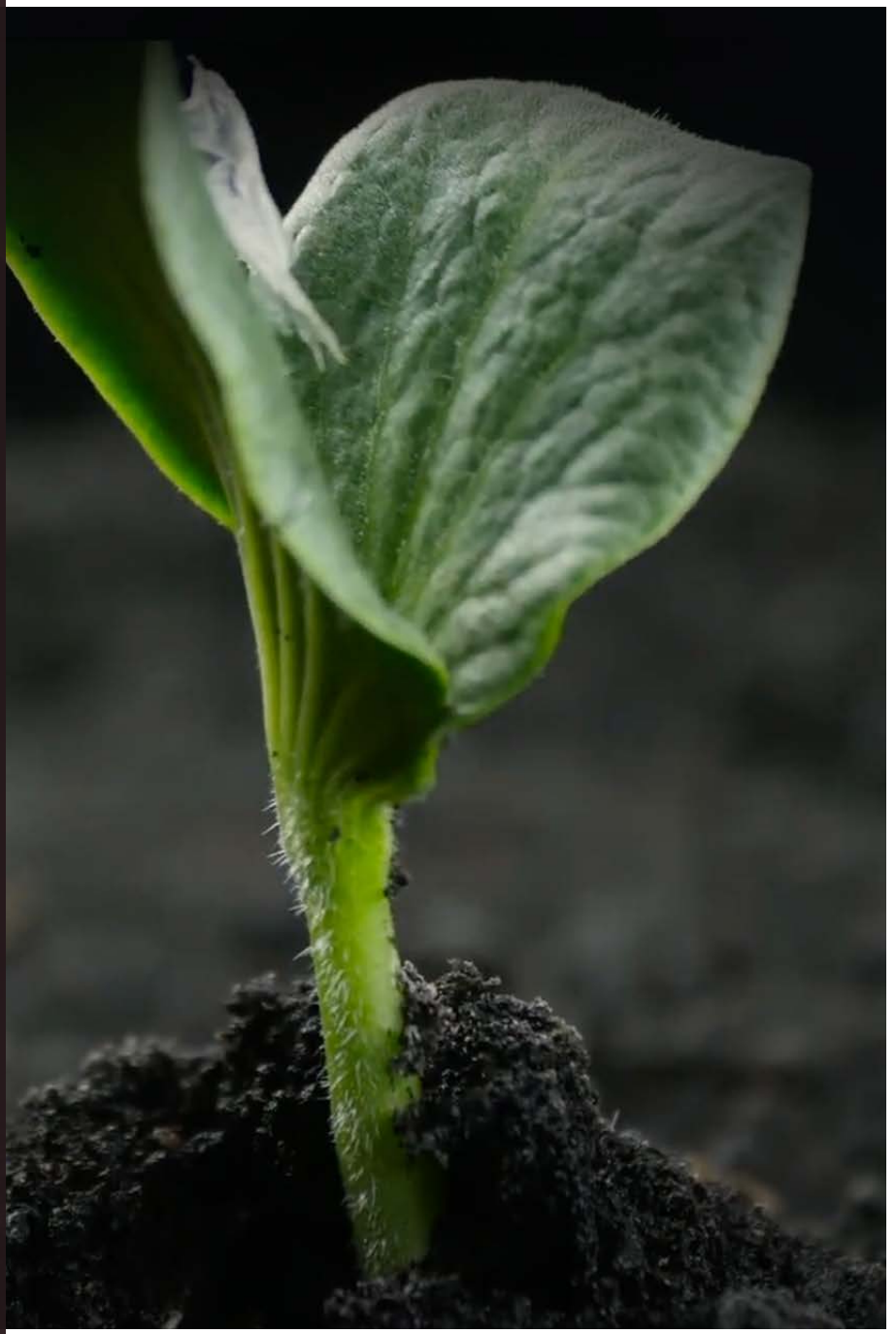
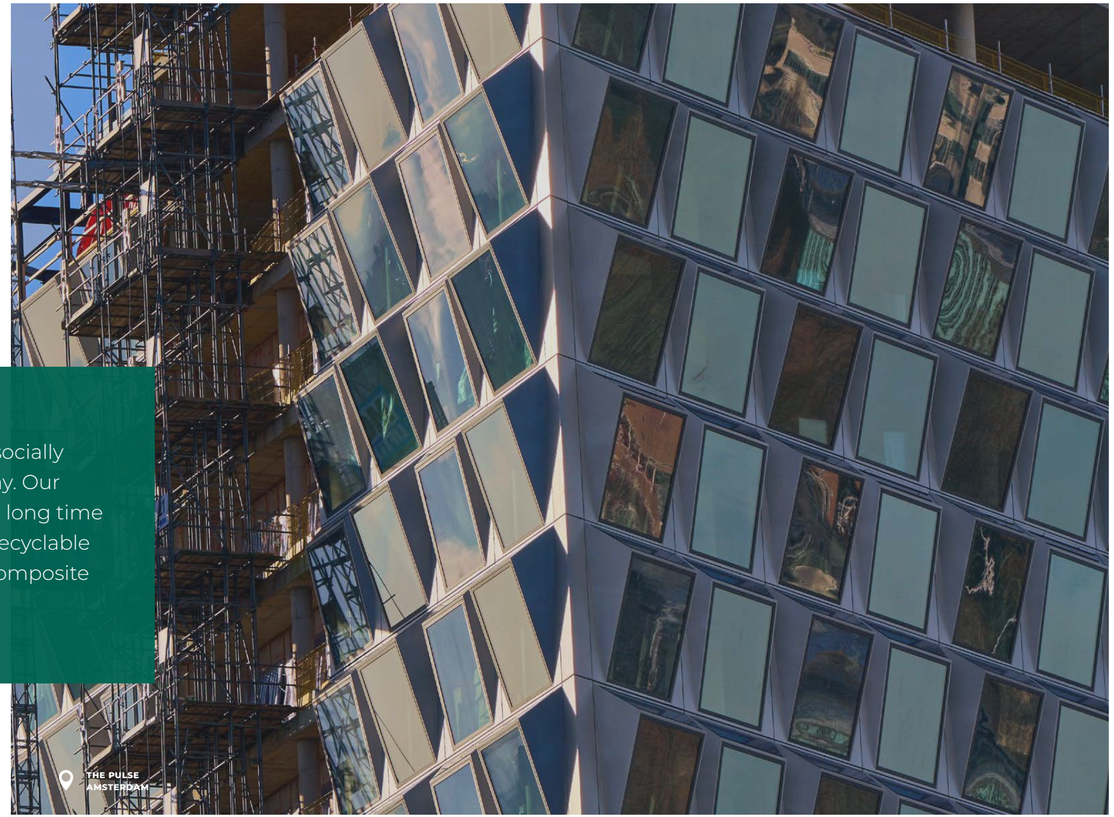
Bio-based fire resistant composite.



DUPLICOR®
bio-based fire resistant composite



‘We work in a socially responsible way. Our products last a long time and are 100% recyclable by using bio-composite materials.’

Lightweight, affordable, environmentally aware and fire-safe

Every composite processing company dreams of a bio-based composite material that contains all the advantages of composite without any of the disadvantages. Cost, environmental impact and flammability have been a stumbling block to using composite on a really large scale for years. After years of thinking, testing and experimenting, we succeeded in developing a biocomposite material that scores better on all points than we ever dared to dream. In this brochure, we would like to introduce you to Duplicor®, the biocomposite that no one thought was possible.

Sven Erik Janssen
Commercial Director

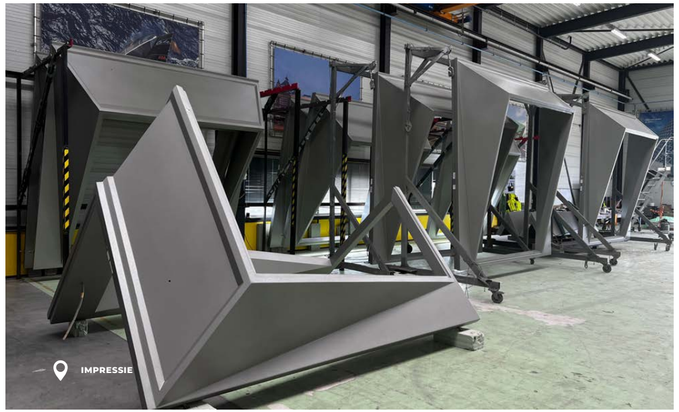
Pieterjan Dwarshuis
Technical Director

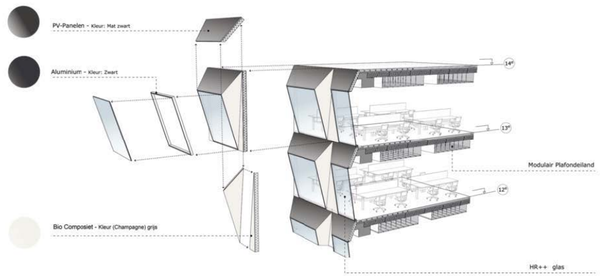
Jeroen Troost
CEO

The Pulse
of Amsterdam

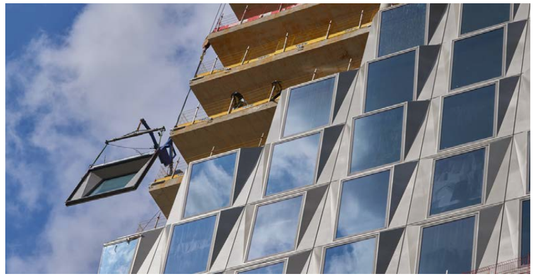
Duplicor® new building facade for high-rise Approx. 1,100 pieces of facade elements measuring 3.6x 3.8 metres. Distributed in 17 moulds that create the increasingly outward cantilevering window sections. The biocomposite facade elements for this project are strong and rigid enough to hold the wind suction forces and the windows' own weight. With a B S1 D0 fire spread certificate from Efectis, this Duplicor® facade meets the highest fire requirements.

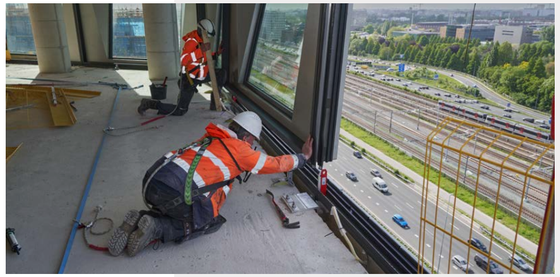


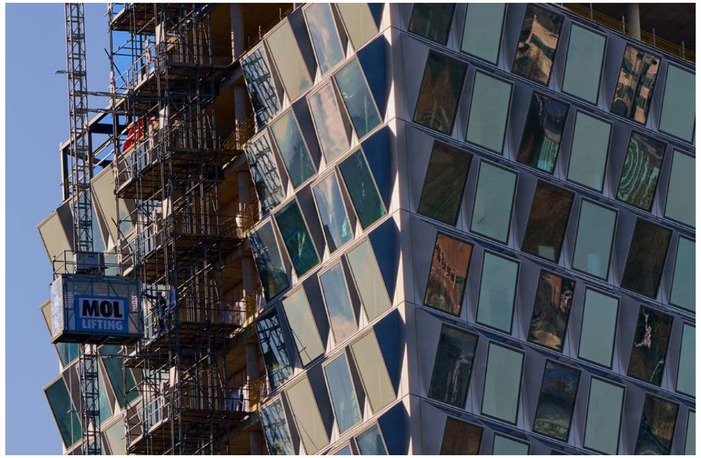




IMPRESSION







Architect
MVSA

Developers
VORM EDGE Technologies

The Amsterdam development combines an urban forest with a state-of-the-art office tower, high-end residential building and public facilities such as cafés and restaurants, a cinema and a supermarket.

The building is designed to incorporate innovative circular elements and operate as sustainably as possible. In doing so, both developers are aiming for WELL Platinum certification. With over 7,000 m² of solar panels and numerous innovations, the development will achieve a BREEAM Outstanding certification. Reducing energy consumption, biodiversity and water are three main themes within the development.



Make the difference

Together, we are capable of a great deal. We send people to the moon, build a residential community in space and fly nonstop from Europe to Australia. The common ground between all these fantastic innovations is low weight. We should apply that much more often. No, we should apply it all the time!

Save weight. Always!
Mankind puts a lot of effort into moving material every day, including ourselves. The heavier all that material is, the more energy we have to put into moving it. Weight saving can therefore be very beneficial to us as humanity. Probably because we have the technical knowledge and know-how to construct and build heavy objects, we leave it that way. Especially when it is not really necessary in our eyes to save weight. If it is really necessary, think of the space, aerospace and, to a lesser extent, automotive industries, we can build much lighter. But when the need is not directly in front of our feet, we leave it as it is. And that's quite a shame.

Lighter is better, in all respects
In our daily lives, the aircraft industry performs best when it comes to lightweight structures. An average passenger plane, an Airbus A220-300, holds an average of 164 people. Fully loaded, including fuel, the aircraft weighs 55 tonnes before take-off. Or about 340 kg per passenger. With that weight, we move one person at over 800 km/h at 10 km height at around -50°C.
Transporting two people over ground, in an average mid-range car, that car with occupants quickly weighs 1,200 kg. That's an average of 600 kg to get one person from A to B by road. But we get really crazy when we want 5,000 people to work in a 50-storey office building. Such a building quickly weighs 250,000 tonnes, or 50,000 kg per person, merely as a workplace. If we want to keep the earth and its resources intact for the next generation, we need to use materials smarter and more efficiently.

The revolution in construction
The unique properties of our material create unprecedented opportunities compared to traditional construction methods.

We provide innovation in the field of:
- Material
- Process
- System
- Product

Discover the combination of Duplicor® (materials) and Qbix (construction method).

Source: Designing Lightness Adriaan Beukers, Ed van Hinte (rewritten into article in this brochure).

Save weight, build circularly and recycle

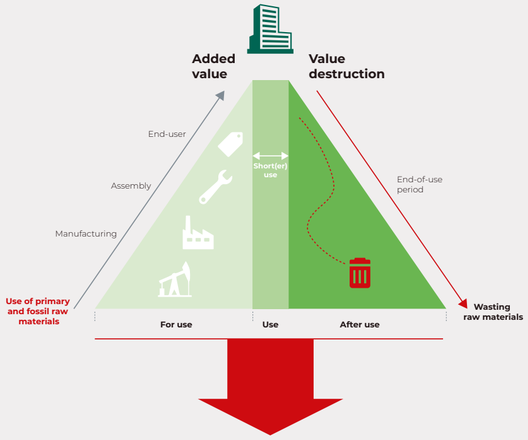
Weight-saving is hardly used in construction, as well as in adjacent industries. Desks, office chairs and cabinets are usually not constructed with weight in mind. Except when we want to take them with us to the campsite. We move all that weight from A to B, without thinking about the deeper consequences, even though we want to build and recycle bio-based. We combined all three and with good reason.

Weight costs energy

To build a building, we need to bring steel, glass and concrete to the site. To do so, we use heavy trucks, immense cranes and heavy tools. When we build circularly, we tackle all these heavy raw materials with heavy machinery, immense cranes and dispose of them with big trucks. So we are quite busy moving weight around. For construction, it doesn't matter, but transporting, building, dismantling and transporting consume unnecessary energy. Circular construction is good, but moving (too) much weight can be done much smarter.

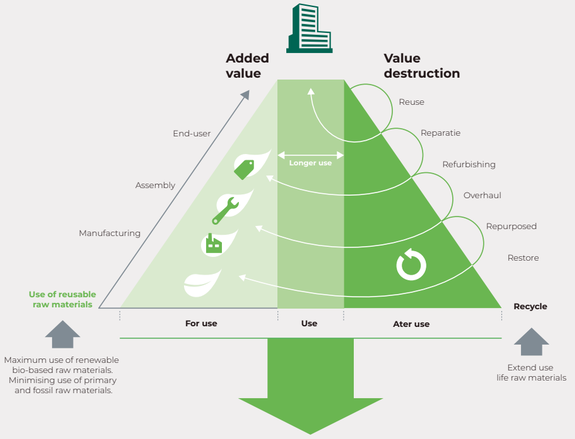
Source: Designing Lightness Adriaan Beukers, Ed van Hinte (rewritten into article in this brochure).

Old-fashioned linear economy



Results in polluting and harmful waste and plastic soup

Sustainable circular economy



Low carbon footprint, 100% bio-based and recyclable



Build with waste

It takes 100,000 kg of CO2 to produce 100,000 kg of concrete. That can not only be done smarter, it has to be done smarter. Duplicor® biocomposite is made from biowaste and old PET bottles. So we make new building material from a vegetable residue and used plastics. On top of that, Duplicor® is superlight and therefore costs a minimum to transport and lift. Also, all finishing work can be done in advance by plumber, electrician, air-conditioning specialist and carpenter. This ensures that much less travel is required from specialists to the building site and less lifting is needed to realise the building. Duplicor® lasts a long time and is reusable or recyclable. After the building's lifetime, much less weight needs to be dismantled and disposed of.

Break the cycle

Constantly using raw materials to make new products is out of date. We need to use materials that are available more intelligently and save on our fossil fuels. Wind energy, driving on electricity: these are all developments that can no longer be stopped. Low weight plays a very important role in all these processes. A 50-storey office building may weigh 2,500 tonnes in the future. When do you break the cycle.

Ecological Footprint

Insulating capacity

Duplicor® is a highly insulating material. As a result, no additional insulation materials are required in the facade construction (insulation value of pet-foam: λ value 0.028). The result is a lightweight facade that is extremely thin. This provides a much larger usable floor area per floor, which greatly benefits the construction price per m². A Duplicor® facade or balcony therefore also does not act as a cold bridge (thermal bridge). The installation of thermal insulation anchors is therefore unnecessary. In addition, Duplicor® is sound-absorbing by nature. The sandwich construction also provides additional damping, preventing a sound box effect.

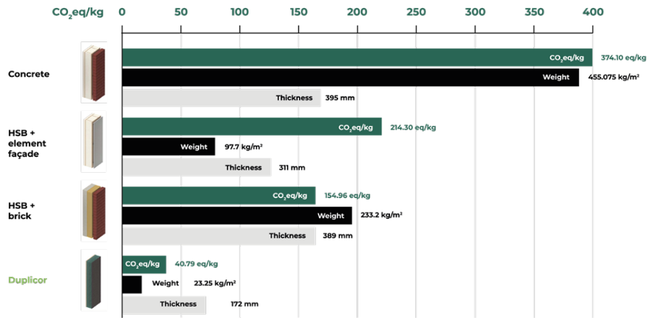
Fewer seasonal influences

Due to the low weight, we can include a lot of features in the building components we produce. We do this in the factory. The ready-made parts are assembled on site. This means you are much less dependent on weather influences during construction. Everything is produced indoors and applied on site.



‘Duplicor® biocomposite has a significantly lower ecological footprint compared to normally used polyester, epoxy or phenolic resin plastic composites’

Lowest possible CO2 impact



Duplicor® is included in the National Environmental Database (NMD)

Ask us for the EQI scores to set up your MPG calculation with cost reduction by using Duplicor®

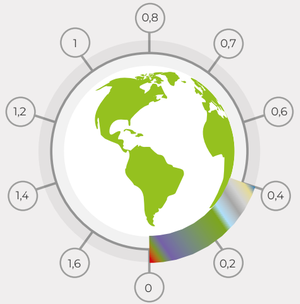
Here you will find a comparison of environmental impact of 1 kg Duplicor® compared to common resins such as phenol and polyester resins in composite applications. In this diagram, calculations were made using the CML2 shadow price method.

(Source: Biobuild EC program)

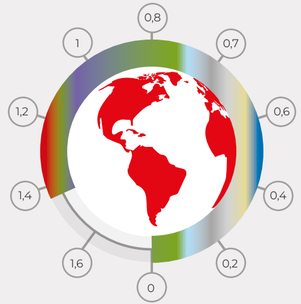
Environmental impact, inshadowprices (€/kg)

- Land competition
- Photochemical oxidation
- Terresttrial ecotoxicity
- Marine aquatic ecotoxicity]
- Fresh water aquatic ecotox
- Human toxicity
- Ozone layer depletion (ODP)
- Global warming (GWP100)
- Eutrophication
- Acidification
- Abiotic depletion

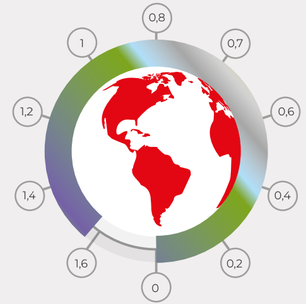
DUPLICOR®



Polyester resin



Phenolic resin



Duplicor® basis for efficient building

With a virtually non-combustible composite material (B S1 D0 Fire standard according to NEN-EN 13501 SBI) made from biowaste and 100% recycled PET bottles, the full potential of composite can finally be exploited in the construction world. Just think what you can achieve with this fantastic building material.

Low maintenance costs
Duplicor® elements can be provided with a UV-resistant coating with a lifespan of more than twenty-five years. The lifespan of the composite itself is more than 50 years. Duplicor® is highly dimensionally stable. Its coefficient of expansion is about 22*10-6 m/m/K (~ equal to aluminium). The maintenance costs of Duplicor® are extremely low partly due to these specific properties.

Cost-efficient
Duplicor® is up to 60% more economical than current plastic composite materials. But in addition, Duplicor® provides numerous benefits in construction, each of which in turn has a positive effect on the construction price.

We have gained a lot of experience and knowledge in recent years, which allows us to offer a world of solutions.



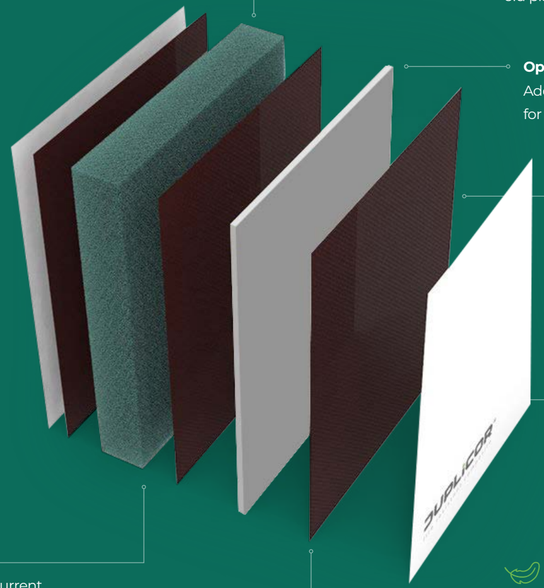
Fewer lifting movements.
Due to the very low weight of Duplicor®, much larger parts can be prefabricated in the factory, in which various features have already been fitted. For example, a balcony can already be attached to a facade panel at the factory. This greatly reduces the number of lifting movements on the building site. In addition, scaffolding-free construction is possible due to the low weight with integrated ready-to-use frames and windows.

Integrated facilities
When constructing facade elements, the many facilities that are normally added later (during construction) can already be taken into account. Thus, we can produce elements where all provisions for insulation, electricity, drainage, PV panels and safety are already included. These parts are placed ready-to-use and are immediately ready for use.



Fully bio-based compsite (construction) material

With Duplicor®, we set the new tone within the construction world. The first 100% bio-based composite that is right on all sides.



Core of recycled foam
100% produced from recycled PET bottles and old plastic packaging.

Optional
Additional reinforcement for acoustics.

Bio-based resin
Duplicor® resin is made from 100% agro-waste

Fire-retardant
Meets B S1 D0 fire standard according to NEN-EN 13501 SBI.

Affordable
Up to 60% cheaper than current composite materials.

Lightweight
Up to 15 times lighter than concrete.

Duplicor® is a fully bio-based composite (building) material. Made from a 100% natural resin, it is virtually incombustible, lightweight, CO 2-saving and affordable. With Duplicor®, the full potential of composite can finally be exploited in the building industry. In short: innovative in all its facets. With Duplicor®, we can finally exploit the full potential of composite.

Composite for all kinds of (building) applications
Duplicor® is a lightweight CO 2-saving bio-composite with excellent temperature resistance and fire resistance. Structured from a bio-resin - extracted from agro-waste - and combined with fibre laminates, Duplicor® can form products for all kinds of building applications. Virtually all shapes and applications are possible.

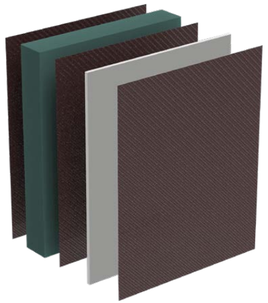
Countless possibilities
Duplicor® is a composite with unique mechanical and thermal properties. It offers enormous potential for creative freedom in the use of building materials. The possibilities are endless. From facades and facade elements to full-scale roof structures. From floors and interior (parts) to offshore solutions ... and much more.

With Duplicor®, we can finally exploit the full potential of composite.



Duplicor® technical data

Convince yourself.
The technical specifications of Duplicor® bio-composite are unique in the composite market. At a price that is very competitive with current building materials, especially when fire rating and lightweight with a high insulation value come into play.



Duplicor® Solid		
Characteristics	**Test method**	**Outcome**
Thickness		0.2 - 20 mm
Specific weight		1800 kg/m³
Stiffness (E-modulus)	ISO 527-4	36000 N/mm² (unidirectional fibres) 19000 N/mm² (0/90 fibres)
Tearstrength	ISO 527-4	800 N/mm² (unidirectional fibres) 460 N/mm² (0/90 fibres)
Interlaminar Shear strength	ISO 14130	24 N/mm² (300 grs #7781 test)
Temperature stability	Tg DSC test	176°C
Basic colour	Brown	
Fire rating plain	NEN EN 13501	B S1 D0
Fire rating coated	NEN EN 13501	B S1 D0
Chemical resistance		High

Duplicor® Sandwich		
Characteristics	**Test method**	**Outcome**
Thickness		10-500 mm
Specific weight recycled pet-foam core		48 ±10 kg/m³
Strength and stiffness		High strength and stiffness depending on laminate and core thickness
Temperature stability	Tg DSC test	150 °C
Basic colour	Brown	
Fire rating coated	NEN EN 13501 NEN EN 13501	B S1 D0 B S1 D0
Thermal insulation	EN 12667	0,028 W/(m.K)







Composite that virtually does not burn

The flammability of composite material has always been a challenge. Other fire retardants are often added to meet building code requirements. Until now. Duplicor® virtually does not burn, making it the first bio-composite without a fire retardant in Euro fire class B.





Testing for Efectis | Fire Breakthrough: WBDBO 70 minutes

Unique fireproof bio-composite
Duplicor® sandwich laminates and solid laminates meet the B S1 D0 Fire Standard according to NEN-EN 13501 SBI. This means that Duplicor® has no flame spread, makes a very limited contribution in case of fire and is very difficult to burn. And that is absolutely unique.

Fire-safe without fire retardants
No fire retardants have been added to Duplicor®. This greatly benefits the mechanical properties of the resin. It is no coincidence that Duplicor® complies with the B S1 D0 fire standard: the material (almost) does not burn, emits little smoke and does not release any loose particles.

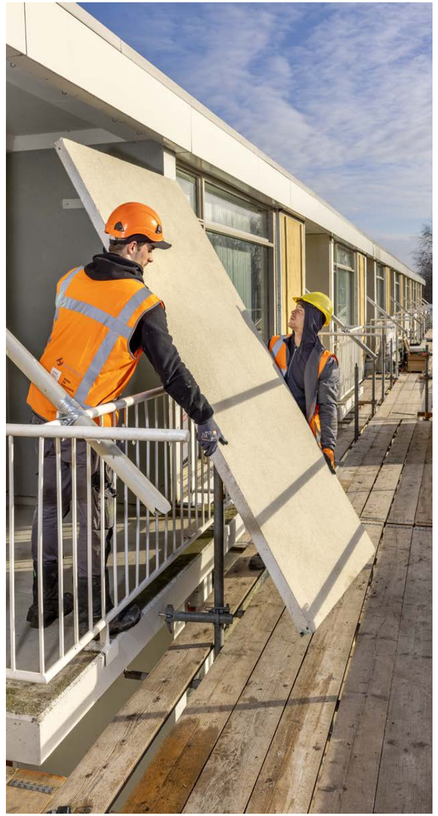
Excellent mechanical and insulating qualities
Duplicor® has excellent mechanical and insulating qualities. But our bio-composite also scores high on fire penetration. WBDBO requirements of 40, 60 or 90 minutes are easily achievable.

Duplicor® meets the most strict fire safety requirements, which is absolutely unique.



Duplicor®: fireproof and bio-based

Fire behaviour: B S1 D0 NEN-EN 13501 SBI



All the facts at a glance

Bio-based resin
A building material that hardly burns and is lighter, stiffer, more insulating, more corrosion-resistant, more economical and has more design possibilities than, for example, aluminium. On top of all these unique product features, we were able to add another advantage. Duplicor®'s resin is made from agrowaste. This is a residual product from the food industry which, until recently, was thrown away or partially recycled. This material is the basis for our resin, making Duplicor® resin 100% bio-based. A feature we can no longer ignore in the modern construction world.

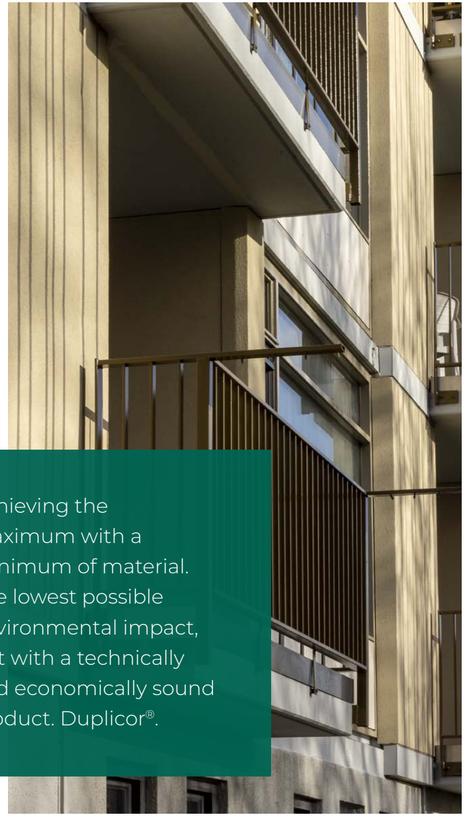
Core of recycled foam
One of the applications of Duplicor® is composite sandwich panels and shapes, such as facade panels, balcony solutions, ornaments, etc. To produce these parts, we use a foam core. This foam core is produced 100% from recycled PET bottles and old plastic packaging. This also makes the core sustainable and helps reduce climate and environmental impact. Cores are also available from 100% bio-based materials such as cork, recycled cardboard, etc...

Lightweight
One of the most obvious advantages of composite is the weight of the material, set against its rigidity and strength. Duplicor® with all its advantages as mentioned, is a composite and therefore lightweight and extremely rigid. Constructions of Duplicor® are often up to 4 times lighter than the same construction made of aluminium and up to 15 times lighter than concrete! The advantages for construction are therefore numerous.

Affordable
Composite material suitable for construction, in Euro fire class B, was unthinkable until recently. It was an immense challenge to make this happen, all the more so because it also had to fit the budget in the sector. Because Duplicor® is largely manufactured from biowaste, combined with a unique production process, it is up to 60% cheaper than the current composite materials available for construction. This makes Duplicor® in many cases much more economical than conventional solutions.

Fire safety
The flammability of composite materials has always been a challenge. Especially in combination with other requirements, such as size (thickness) of the material. Until now, other fire retardants were added to meet the requirements of the Building Regulations.

Duplicor® is naturally fire-retardant. No fire retardants are added to the material. This greatly benefits the mechanical properties of the resin. Duplicor® is therefore the first composite without a fire retardant to be classified in Euro fire class B. The Duplicor® sandwich laminates and solid laminates meet B S1 D0 Fire Standard according to NEN-EN 13501 SBI. This can definitely be called unique. In practice, this means that Duplicor® has no flame spread, makes a very limited contribution in case of fire and is very difficult to burn. Duplicor® also has excellent mechanical and insulating properties.



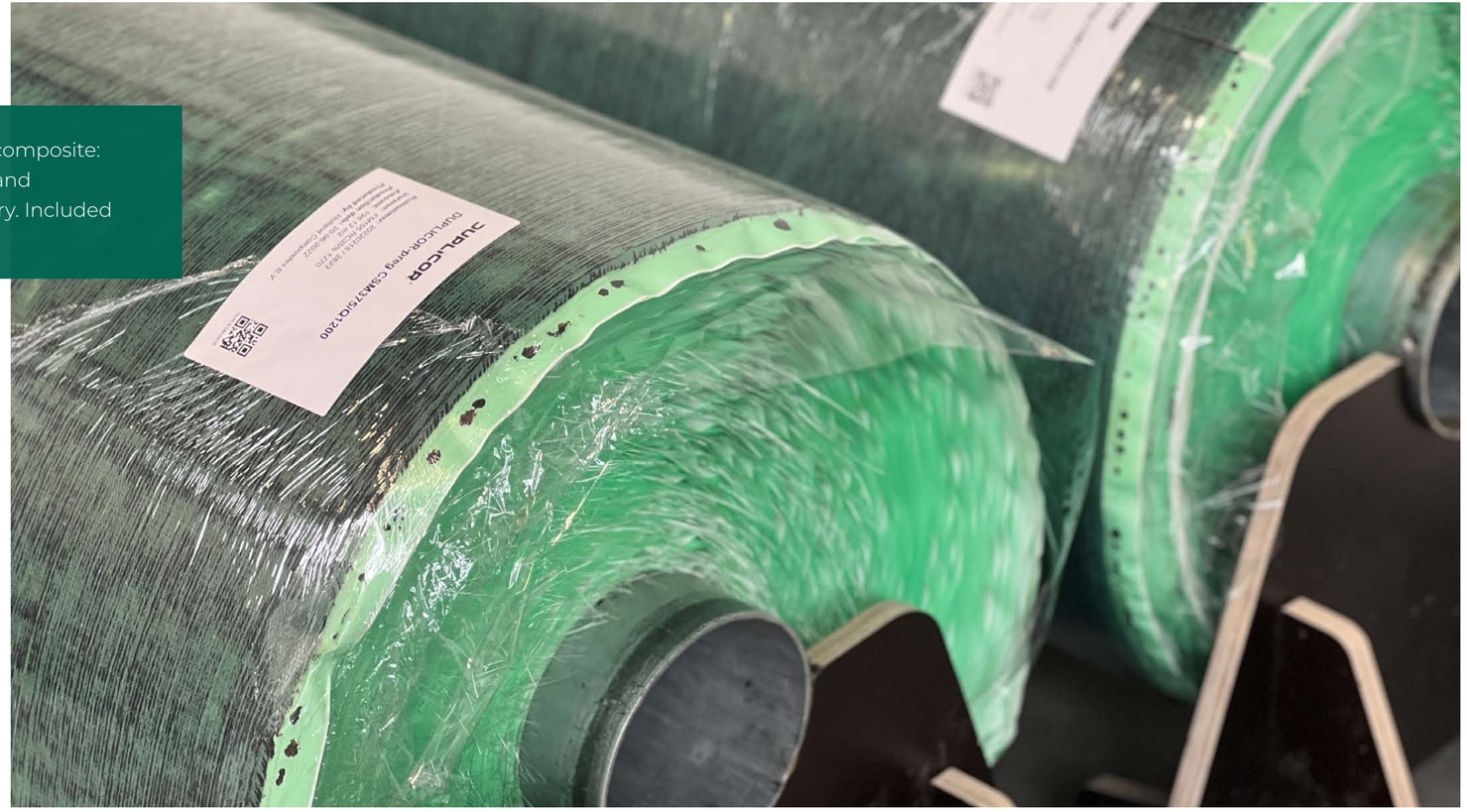
Achieving the maximum with a minimum of material. The lowest possible environmental impact, but with a technically and economically sound product. Duplicor®.

Duplicor® products

Duplicor® offers various bio-composite products that can be used for various purposes. All our products offer you a wide range of benefits: CO2-saving, bio-based, lightweight, fire-resistant, extremely strong, multi-applicable, recyclable, affordable and sustainable.

- **Simple sandwich panels (e.g. renovation panels)**
- **Moulded single roofs/facade edges**
- **More complex and thicker structural facade elements**
- **Total system (fully integrated facade element)**
- **Pre-preg rolls**
- **Sheets**
- **Profiles**

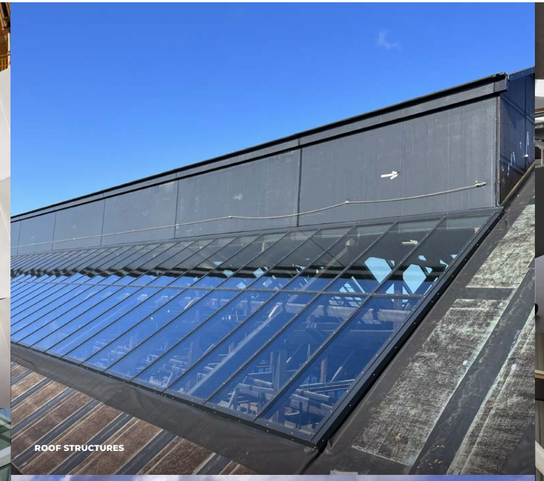
Bio-based composite: innovative and revolutionary. Included in NMD



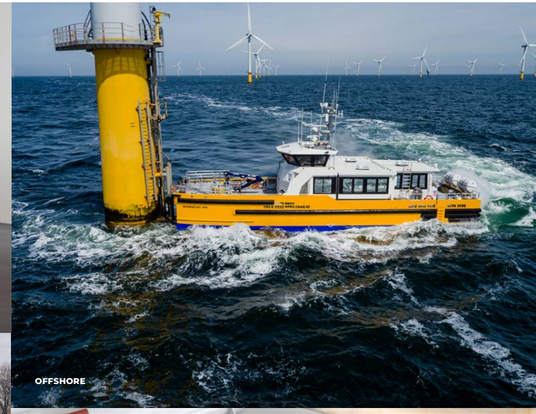
Countless Applications

Duplicor® is a unique material with unique mechanical and insulating properties. This has added enormous potential for creative freedom in the use of building materials. Virtually all shapes and applications are possible. Every day, we are surprised by new options, insights and requests. We challenge you to push the boundaries of Duplicor®. We have already listed a large number of applications for you.


FACADES

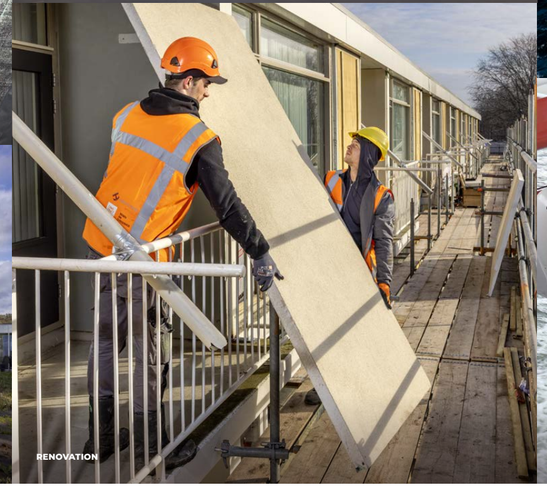

ROOF STRUCTURES


INTERIOR AND FURNITURE


OFFSHORE


FACADE FRAMES

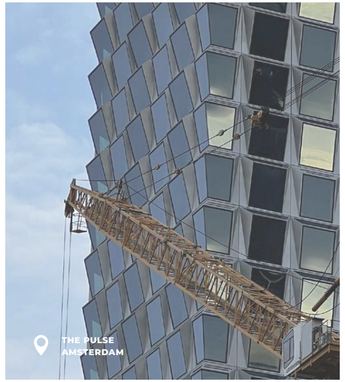

QBIX BUILDING SYSTEM


RENOVATION


INDUSTRIAL COMPONENTS

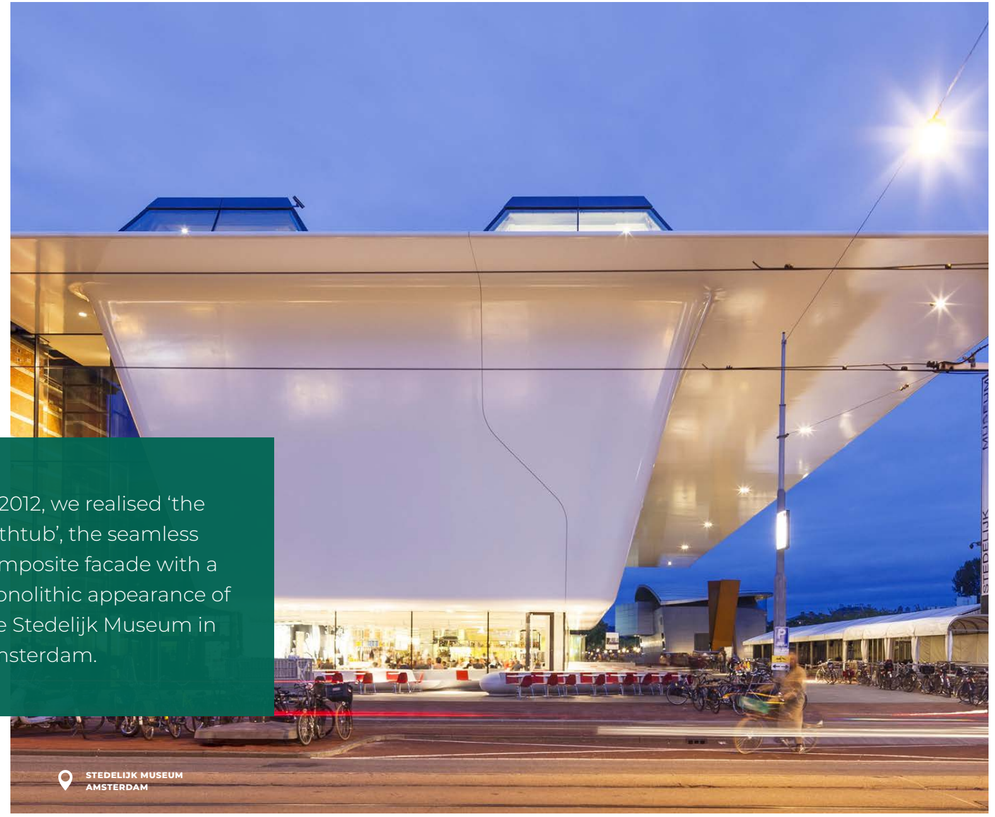
Facades

Composite is extremely suitable for creating special facades. In 2010/2011, we realised the facades for Hogeschool Windesheim Zwolle, better known as Building X. In 2011, this building was voted BNA building of the year. In 2012, we realised ‘the bathtub’, the seamless composite facade with a monolithic appearance of the Stedelijk Museum in Amsterdam. Which facade do you realise with Duplicor®?



THE PULSE
AMSTERDAM

In 2012, we realised ‘the bathtub’, the seamless composite facade with a monolithic appearance of the Stedelijk Museum in Amsterdam.



STEDELIJK MUSEUM
AMSTERDAM



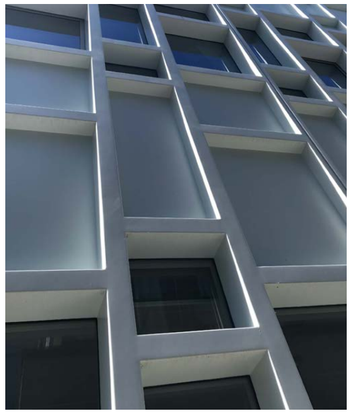
WINDESHEIM
ZWOLLE

Facade edges

Slender, excellent facade edges on buildings create insulation problems because they act as a thermal bridge with all the building engineering challenges that entail. You can avoid this by using Duplicor®. Its thermal insulation is excellent, so it can be applied directly to the building without any further insulating measures. The acoustic properties of Duplicor® facade edges are also favourable. Due to the character of the material, the sound box effect is limited. The very low weight of Duplicor® results in cheaper, easier and faster anchoring.



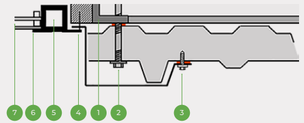




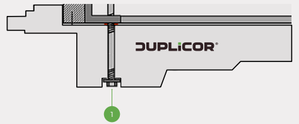


Facade frames

Current facade frames are often made of aluminium or (lightweight) concrete, which in turn is not always possible with timber frame construction. With Duplicor®, you can apply a facade frame that is 75% lighter than an aluminium variant at almost the same cost as aluminium.



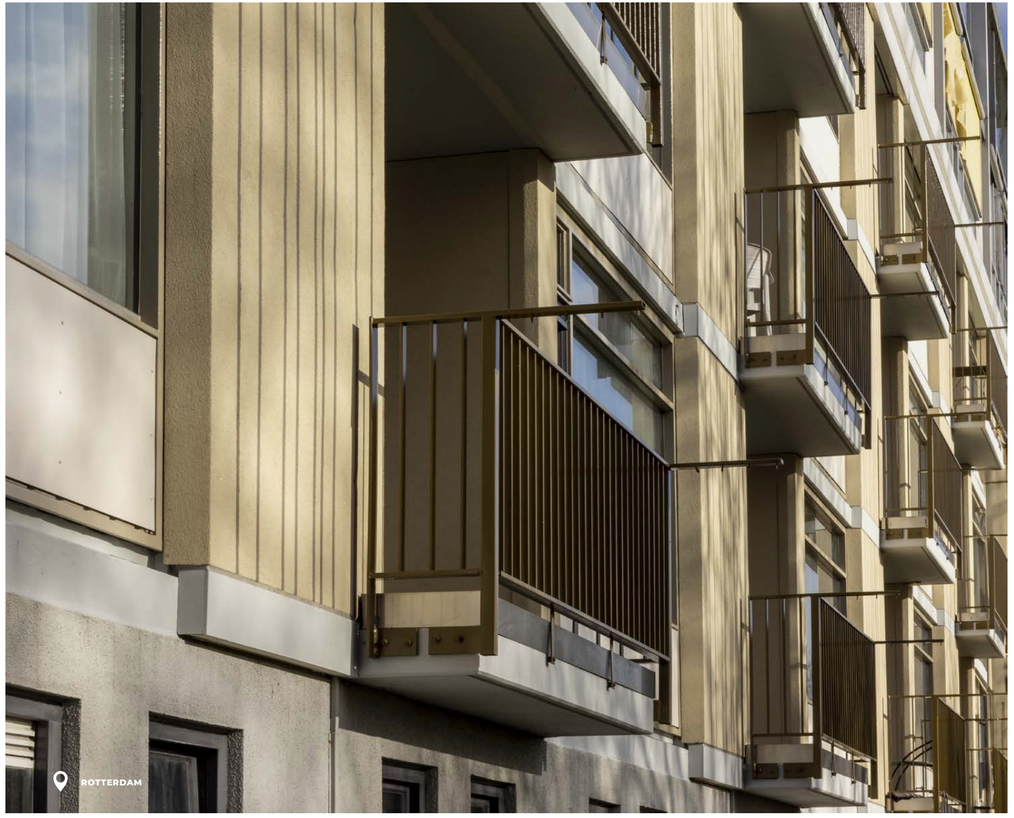
Conventional facade frame
Many parts, many operations. Labour-intensive and heavy end product.

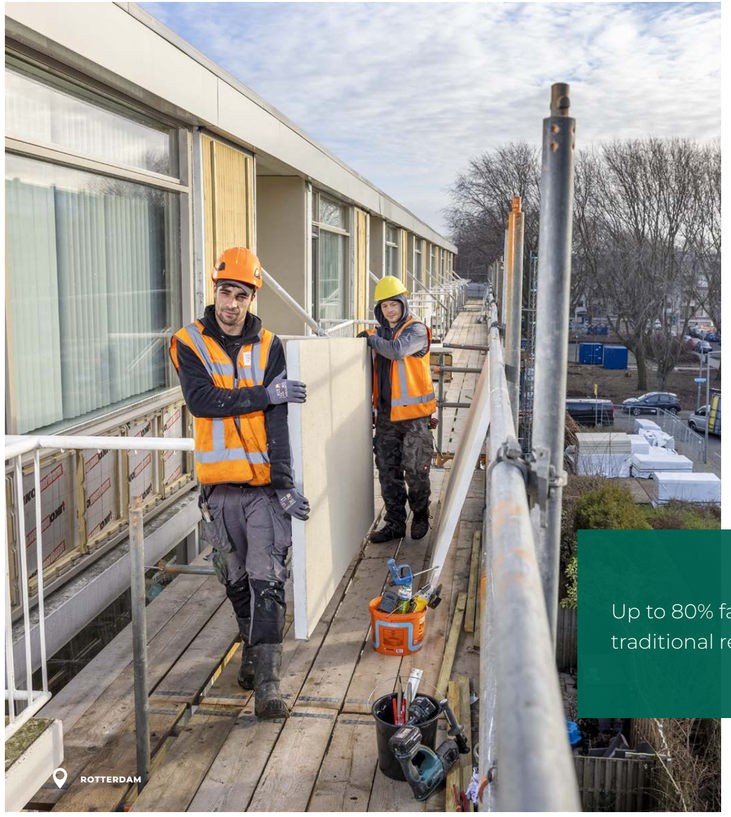


Duplicor® facade frame
One prefabricated part, fast assembly. Light and durable end product

Facade renovation

Duplicor® facade and roof renovation elements are bio-based, lightweight, fire-safe and have a high thermal insulation value. The elements are delivered prefabricated to size with the desired end finish and are suitable for dry assembly. You have a wide choice of finishes. Mineral stone strip designs, decorative plaster finishes, almost anything is possible. In a single operation, your building is insulated and immediately looks modern and up-to-date again





Up to 80% faster than traditional renovation.

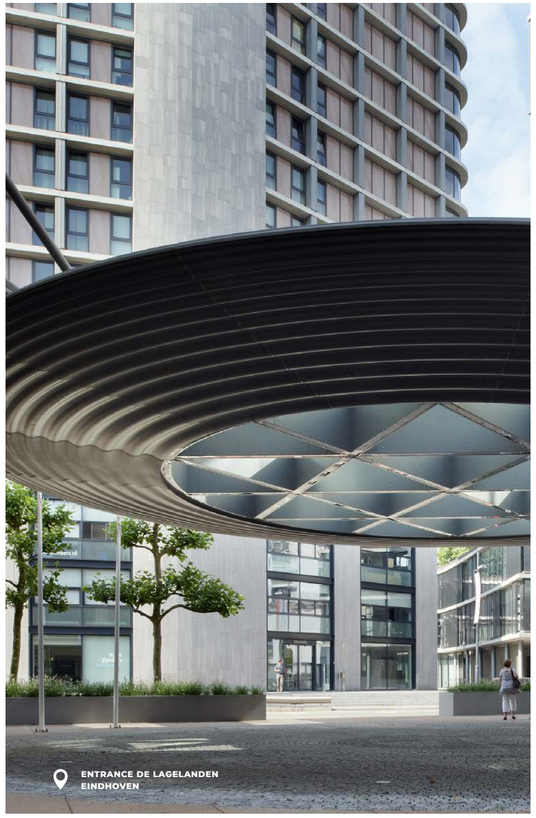
Roof structures

For many buildings, the lack of design freedom of the roof and roof structure is the biggest obstacle to creating a unique landmark within applicable budgets. Due to the high rigidity and low weight of Duplicor®, combined with its attractive cost, this is no longer the case. Every building can have its own crown.

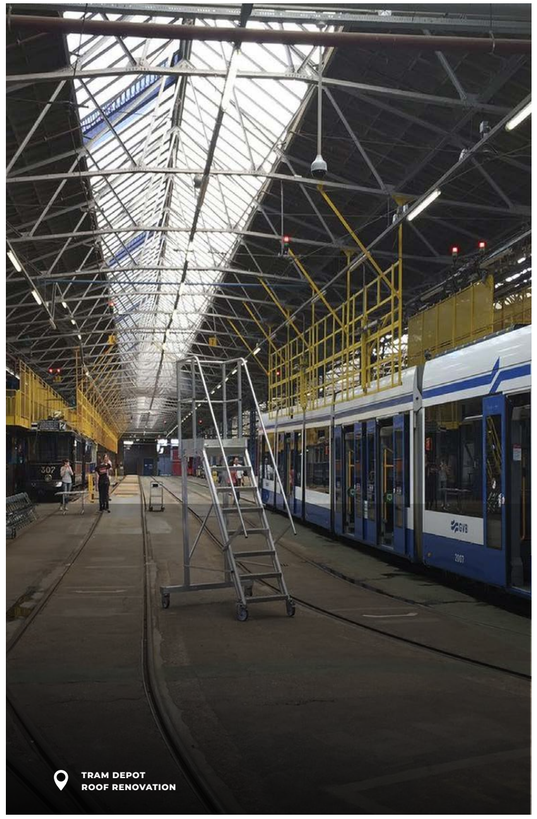
Bio-based solution for fire-safe lightweight roof elements.



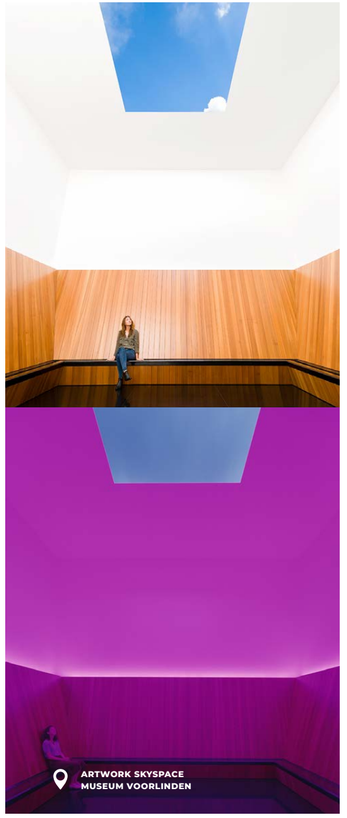
YITZHAK RABIN CENTER
TEL AVIV



ENTRANCE DE LAGELANDEN
EINDHOVEN



TRAM DEPOT
ROOF RENOVATION



ARTWORK SKYSPACE
MUSEUM VOORLINDEN

Topping Up

Topping Up is seen as one of 'the' solutions for reducing the housing shortage in dense urban areas. Densification and sustainability at the same time? This can be done by adding homes quickly, smartly and affordably to existing buildings in the inner city.

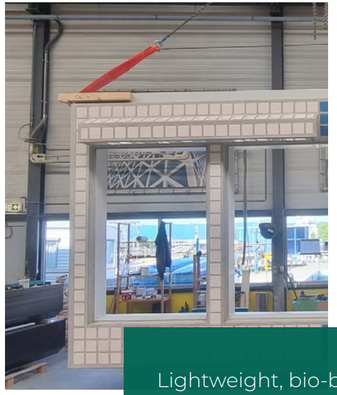
Many post-war apartment buildings lend themselves (structurally) to an extra storey. Sometimes even two. This allows us to add many homes in existing neighbourhoods in a relatively short time. In the municipality of Rotterdam alone, it has been calculated that topping up can yield around 4,000 extra homes. In the province of South Holland, we can even add around 30,000 homes by applying topping up.

Duplicor® integral sandwich facade and roof elements offer a lightweight and highly thermally insulating solution for bio-based 'topping up-building' while preserving as much useful floor space as possible



2-STOREY 'OPTOPPING' FOR ABN AMRO BANK AMSTERDAM WITH DUPLICOR® FAÇADE ELEMENTS





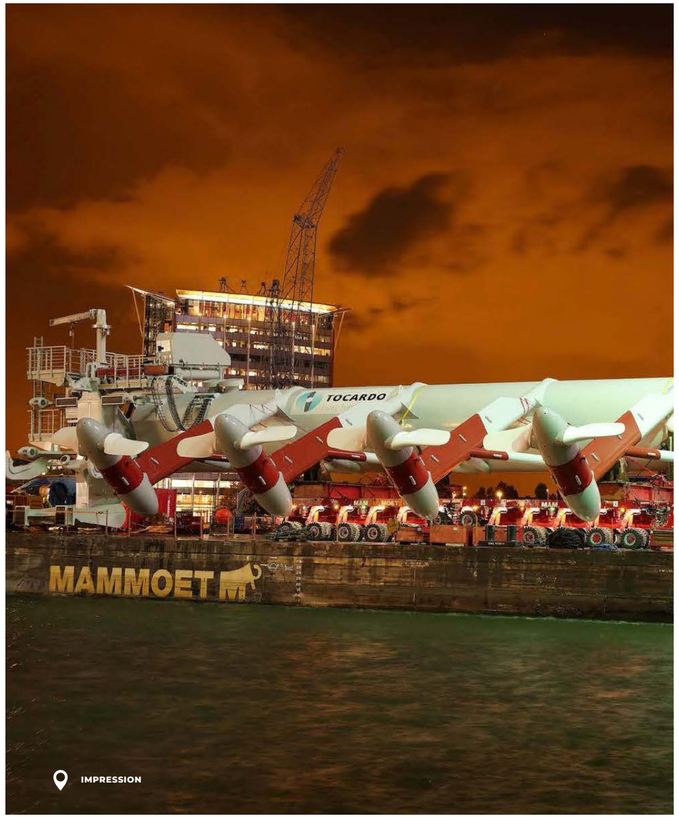


Lightweight, bio-based topping up with structural Duplicor® elements. Sustainable, compacted, and affordable.

Offshore

On the water, weight and surface area are important factors to consider. With Duplicor® deckhouses, we kill two birds with one stone. The weight is up to 4 times lower than an aluminium equivalent and the high insulation factor allows the walls to remain thin, leaving more interior space. It is also a great solution for living and working spaces on drilling platforms.

Duplicor® is not subject to environmental factors, whereas other materials are subject to erosion. Even maintenance of the material in the offshore environment is done without sparking and/or flammable processes. This keeps productivity optimal and results in less downtime during inspections and/or repairs.







Public transport

In passenger rail transport, Duplicor® offers high freedom of form when designing interior parts for train, tram and metro carriages. The B S1 D0 fire standard according to NEN-EN 13501 SBI offers maximum safety for passengers in case of calamities. The low price of Duplicor® allows composite to be successfully used in the mobility industry for the first time.

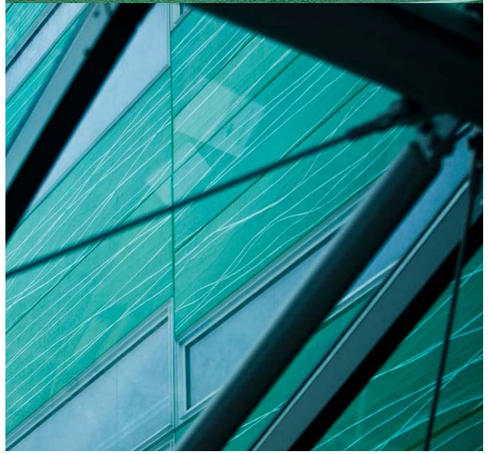
The bio-composite material nobody thought was possible.

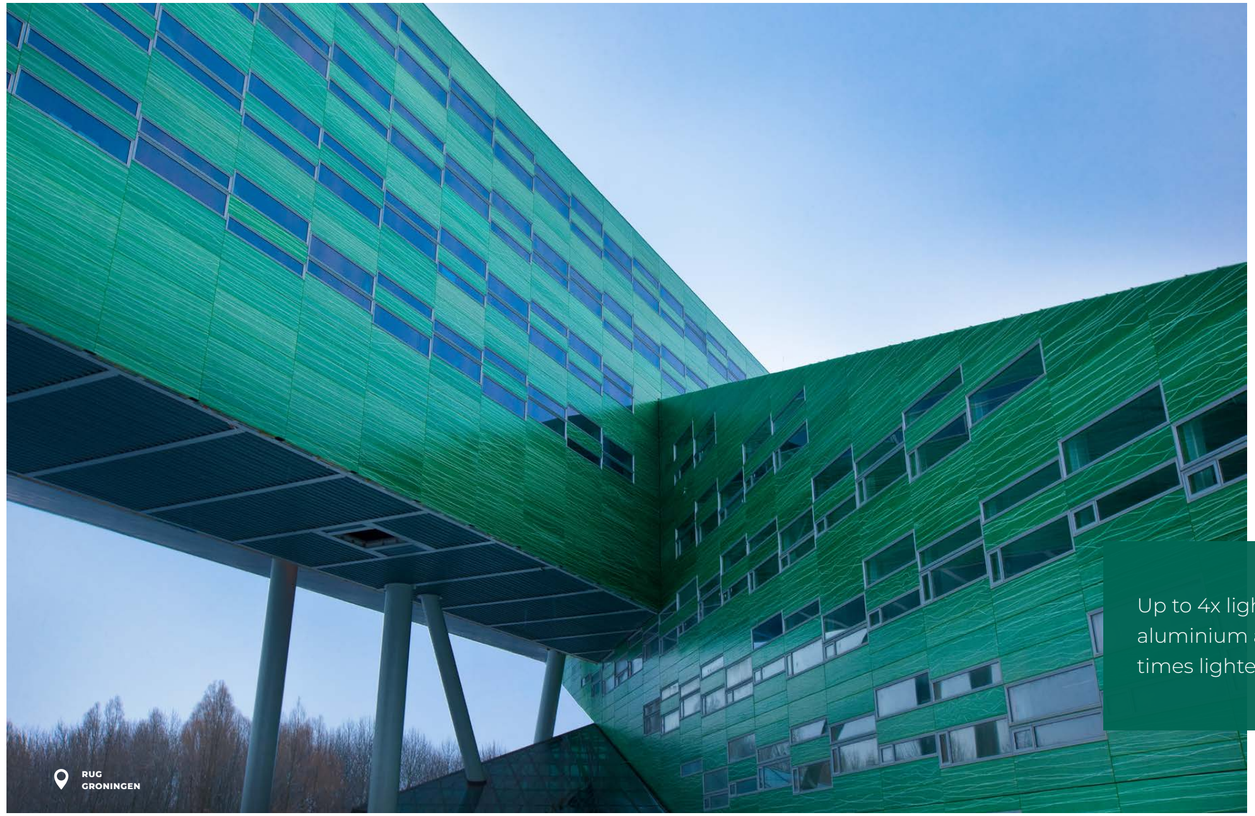
Customisation

We live in a world that is rapidly changing. It is becoming increasingly clear that we need to handle our raw materials differently to ensure that future generations also have a future.

Many companies are adapting their methods, products and offerings because they cannot do otherwise. Some companies are adapting because they believe in a better future by thinking smarter







RUG
GRONINGEN

Up to 4x lighter than aluminium and up to 15 times lighter than concrete.

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DUPLICOR®