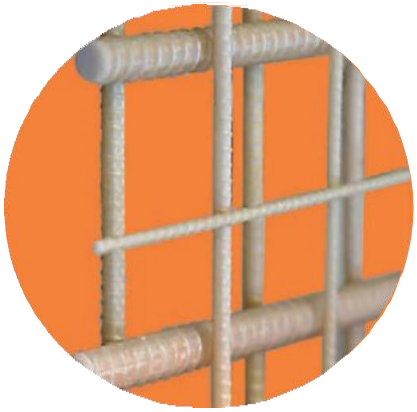

ARMAKOMPOZIT

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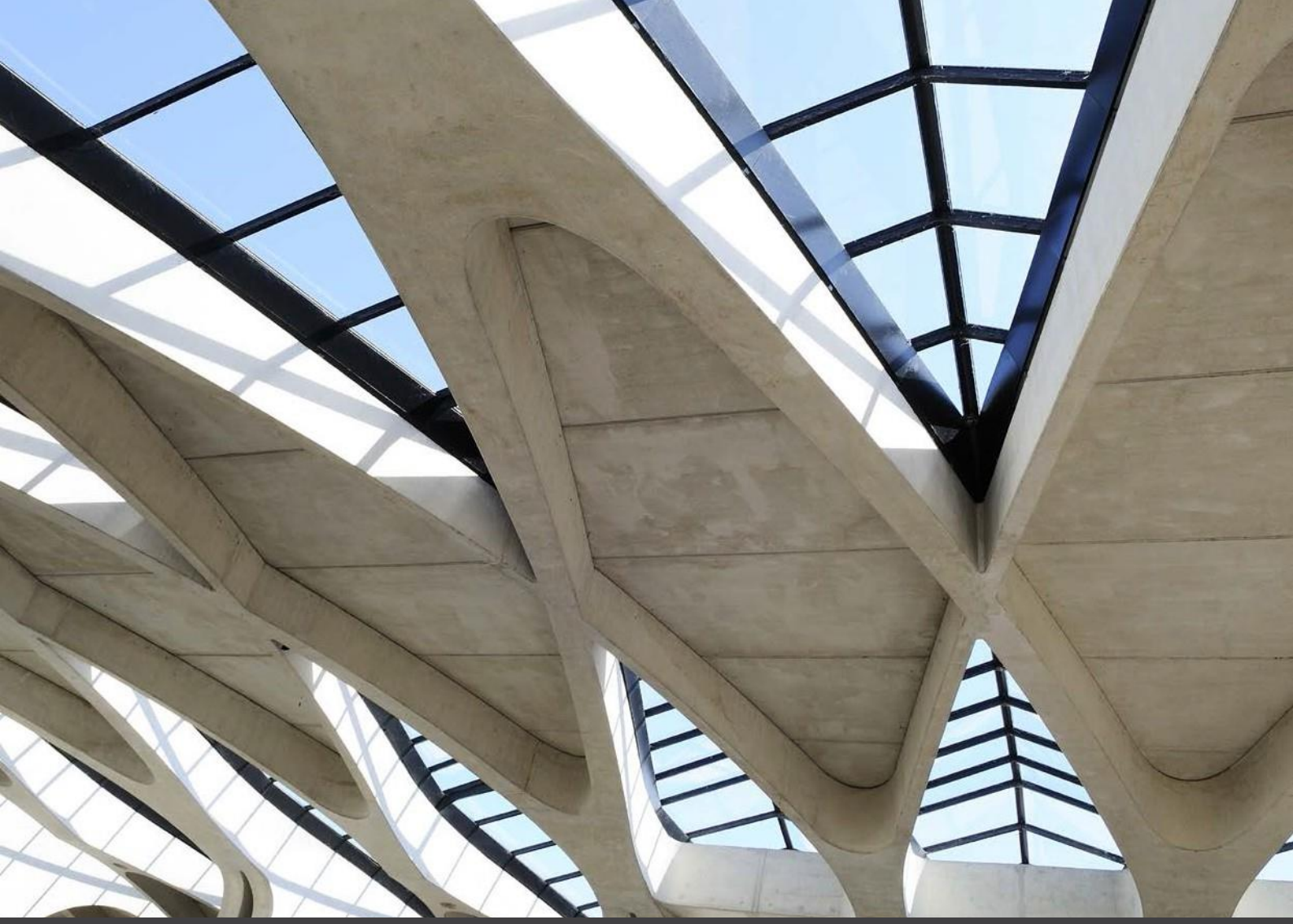
COMPOSITE BARS FOR CONCRETE REINFORCEMENT



Composite bars ArmaKompozit

perfect alternative to traditional steel concrete reinforcing bars

REINFORCED CONCRETE – steel reinforced concrete

- Major defect of reinforced concrete is its susceptibility to corrosion
- The effects of corrosion cause damage to concrete, which decreases life span of material
- Constructions made of reinforced concrete require expensive servicing and maintenance

ArmaKompozit composite bars

+ ArmaKompozit composite bars are highly resistant to corrosion
+ Concrete constructions reinforced with ArmaKompozit barsdo not have the defects present in constructions made of reinforced concrete
+ Composite bars ArmaKompozit are fully consistent with the sustainable development of building industry

According to the strategy of sustainable development "buildings have to be projected from materials that require low-cost maintenance and servicing and facilitate easy separation of various materials during servicing and disassembly."

One of the basic materials used in building industry is concrete. This material transfers compressive stress and exhibits low degree of tensile strength. Increase in tensile strength is achieved through reinforcing concrete and has been used int the building industry since the nineteenth century. Unfortunately, this solution bears a fundamental defect associated with corrosion of steel used for concrete reinforcement. Reinforced concrete constructions are frequently exposed to damaging effects of humidity, salts (used for defrosting soil), frost, frequent changes in temperature and loadings. Long-term effects of these factors on reinforced concrete lead to the corrosion of bars. The effects of bar corrosion destroy concrete and result in the origination of cracks and gaps in concrete. Reinforced concrete is not a long-lasting material and therefore requires frequent maintenance and carries high repair costs.
Also, reinforced concrete poses a major challenges during disassembly. The challenges are associated with the need to extract steel bars from concrete before crushing concrete**. Servicing and repair costs of European infrastructure due to steel bar corrosion amount to 30 billion EUR per year. These costs can be almost two times higher than construction costs themselves.**
These problems led to seeking new, better materials for concrete reinforcement with high tensile strength and resistance to corrosion.

ArmaKompozit composite bars provide the ideal solution to address all above mentioned problems.

Composites made of all known materials have the most appropriate resistance to weight ratio and are overall resistant to corrosion in alkaline environments as well. Besides that, composite materials are solid, do not require maintenance and servicing, do not pose a problem during dis-assembly, because concrete and composite bars do not need to be crushed separately. Composite bars conform perfectly to the strategy of sustainable development of building industry.
Until recently, composite bars (as opposed to steel bars) have not been widely used due to high prices.

The development of manufacturing technology and innovation have enabled the manufacture of composite bars that meet strict requirements related to strength, and corrosion resistance ata competitive price.

PROPERTIES OF COMPOSITE BARS ArmaKompozit

tensile strength

Composite bars **ArmaKompozit** are 2.5 times stronger than the tensile strength of AIII carbon steel.

resistant to corrosion

Composite bars are made of a solid and long-lasting material resistant to both fresh and sea water.

light

9 times lighter in weight than steel, easy to manipulate during the manufacturing process, storage and use at construction sites.

resistant to chemicals

Composite bars **ArmaKompozit** are resistant to chlorides, acids and chemicals in both acidic and alkaline environments.

non-magnetic

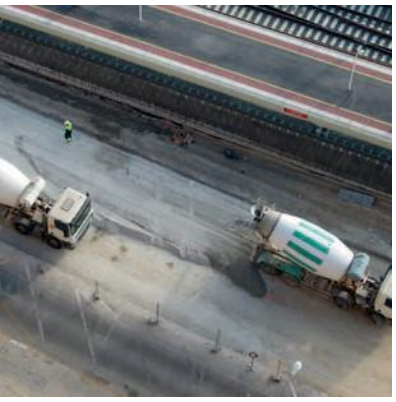
Composite bars conduct electromagnetic waves.

dielectric

Electrically insulating and nonconducting.

thermally nonconducting

Thermally nonconducting – heat insulating and unlike steel manifesting thermally insulating properties at low temperatures. The coeffi cient of thermal expansion is similar to that of steel, which prevents damage caused by temperature changes. Composite bars ArmaKompozit are 100 times less heat conductive than steel bars.



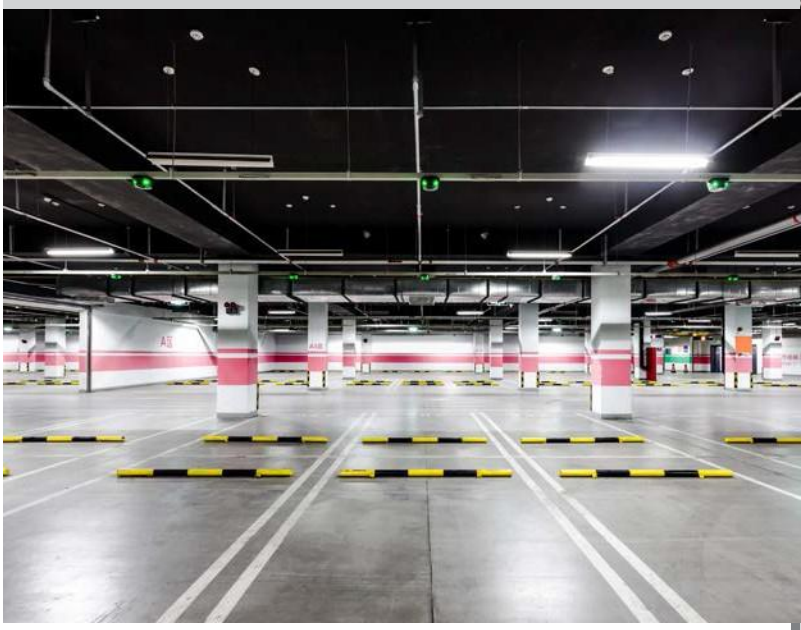







USE

- road and railroad infrastructure
- civic and industrial construction
- constructions and infrastructure exposed to water, waste water and aggressive chemicals
- prefabricated reinforced concrete components
- special constructions



COMPOSITE BARS ArmaKompozit – REPLACING STEEL

Properties of composite bars ArmaKompozit are ideal for use in constructions exposed to effects of water and temperature.

Bridge and road infrastructure:
- **protective road barriers**
- **carparksandhandlingareas**
- **bridges**

Prefabricated reinforced concrete components:
- **road panels**
- **rail beams**
- **sewage elements**
- **fencings**

Sea and port infrastructure:
- **constructions exposed to sea water such as constructions located in ports, platforms, embankment**

Family houses and industrial building:
- **foundations reinforcement,**
- **floorings,**
- **carparksandhandlingareas**

Agricultural buildings and constructions:
- **cattle-breeding constructions, wastewater collectigon tanks and sewage tanks, sewage and melioration,etc.**

composite bars ArmaKompozit

ADVANTAGES

- Thinner concrete covering
- Lighter components
- Corrosion resistant
- No maintenance, servicing and replacement costs
- **Implementation of new products**
  - longer service life
  - lower weight
  - resistant to the effects of aggressive environments
- **Cost Efficient**

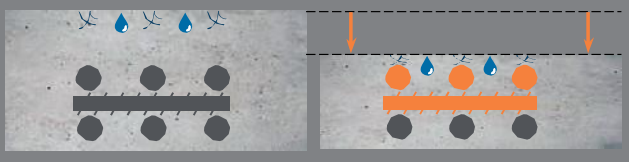
Properties of composite bars ArmaKompozit – significantly thinner concrete

Lower bar diameter

Wider gaps between bars – saving material

Overall resistance to corrosion allows for thinner heat insulation

Very low coefficient of thermal expansion – use of composite bars ArmaKompozit prevents damage to concrete caused by thermal effects



REPLACING STAINLESS STEEL – SPECIAL USES

Properties of composite bars ArmaKompozit allow themto be used in buildings, where constructions made of regular reinforced concrete fail to meet the expected requirements.

Frequently, there is a need to use an alternative to steel bars such as stainless bars, or the need to use special additional technical elements which increase overall cost.

The use of composite bars ArmaKompozit takes away the need for such elements and significantly lowers the costs for concrete reinforcement compared to the use of stainless steel bars.

Devices generating power operated in industry set-tings, for example transformers exposed to contact with reinforced concrete may cause induction of electrical current in steel bars. This accelerates the corrosive process and loss of resistance of the entire construction. Composite bars ArmaKompozit are electrically nonconductive and do not affect the operation of electrical devices operated in their proximity.

In complexes where steel may have negative effects on the operation of electronic devices or disable their operation the use of non-metal and non-magnetic reinforcement bars is required.

In addition to being good electric insulators, com-posite bars ArmaKompozit are also fully electromagnetically neutral. The bars, therefore, address the above mentioned callenge and are significantly more cost effective than stainless steel.

This especially applies to the following sites:

Power and heating stations:

- **power units**
- **transformer stations in large factories**

Airports:

- **buildings for flight control**
- **radar stations**
- **air traffic control towers**

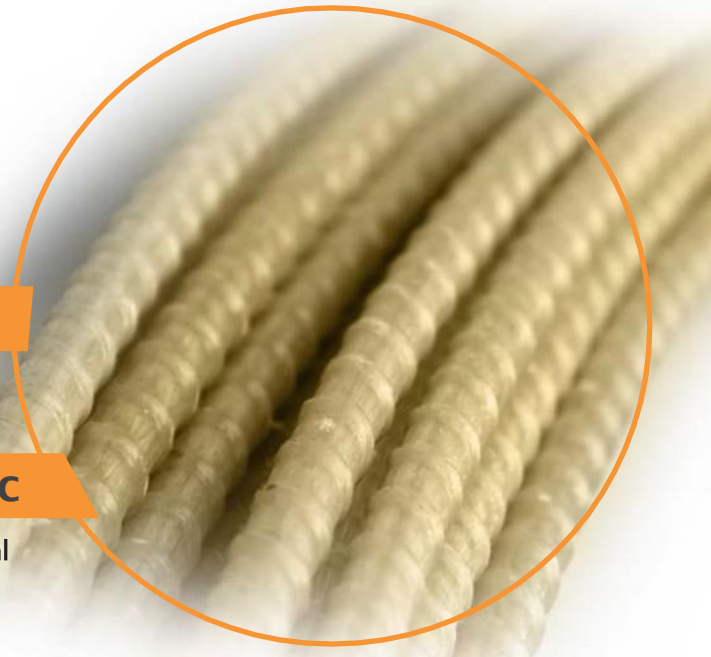
Testing facilities and laboratories

Hospitals

Military buildings

Composite bars **ArmaKompozit**

– perfect reinforcement material for special purpose buildings. Properties:

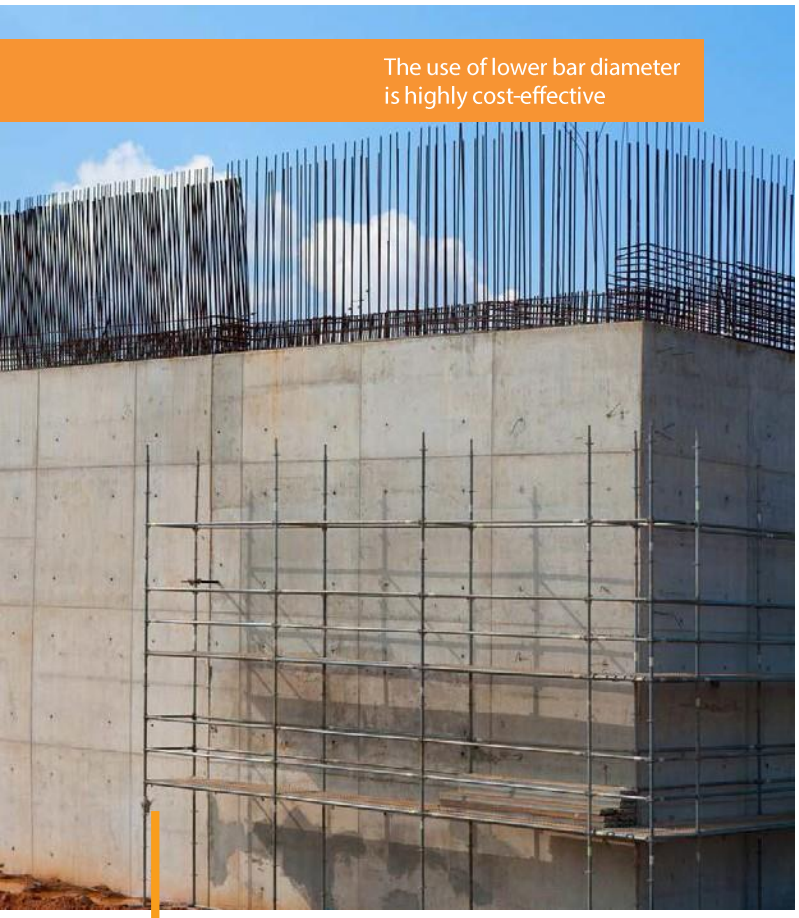


dielectric

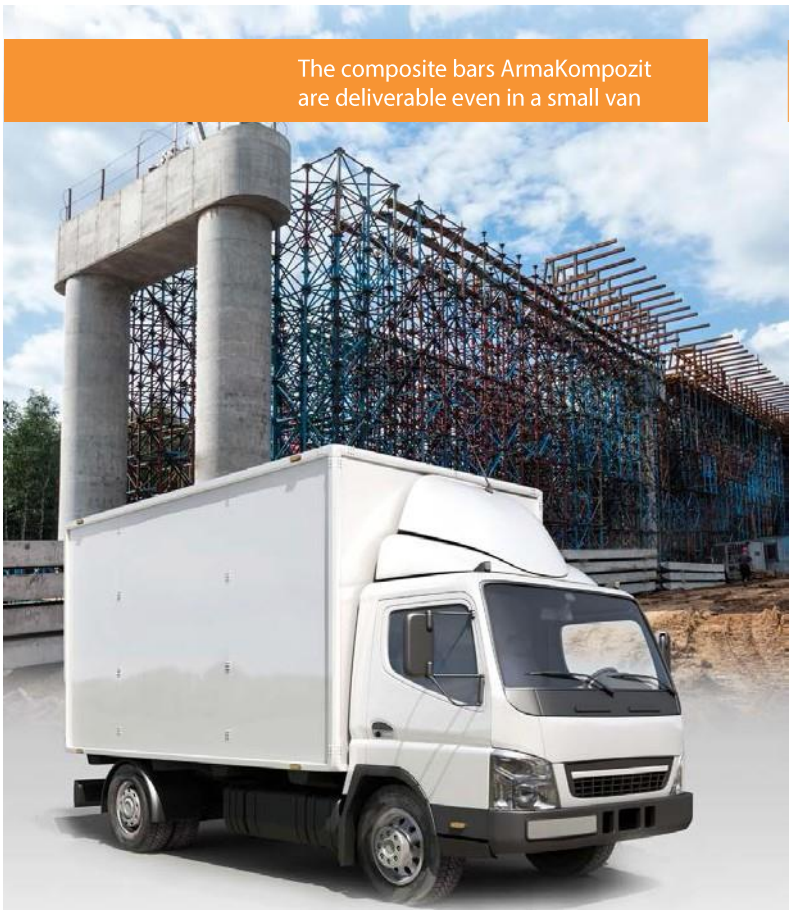
electrically nonconductive without electrical induction

non-magnetic

electromagnetically neutral



The use of lower bar diameter is highly cost-effective



The composite bars ArmaKompozit are deliverable even in a small van

Composite bars ArmaKompozit – ECONOMICAL

KEY ADVANTAGES – DURING CONSTRUCTION

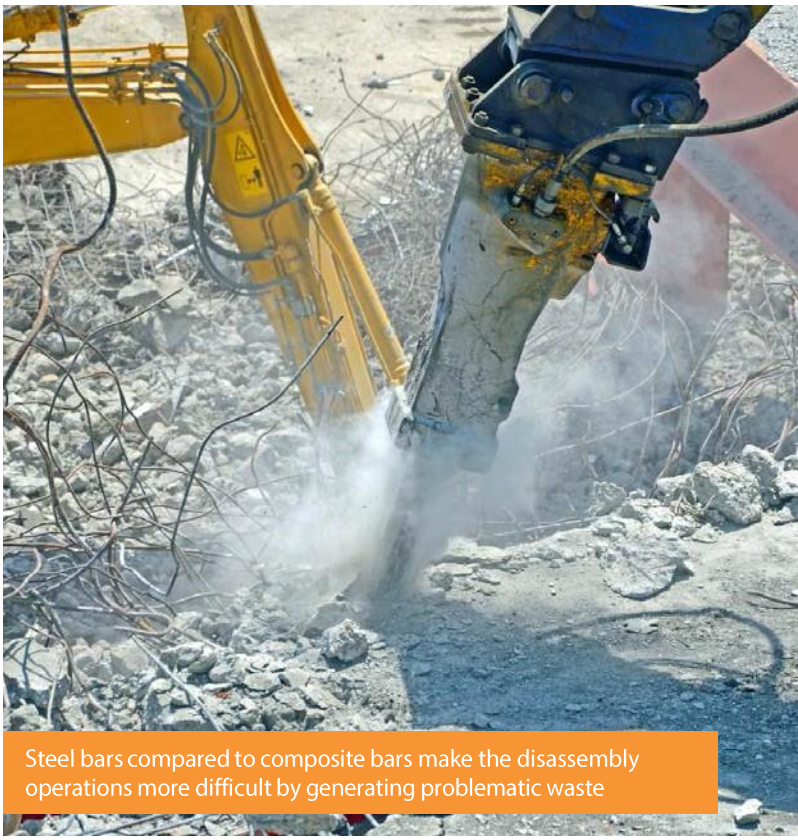
Thinner concrete covering
Lower logistics costs
Faster and easier disassembly
Waste and loss minimization

Composite bars ArmaKompozit are 2.5 times stronger than the tensile strength of AIII carbon steel.
This means that to achieve an identical degree of reinforcement composite bars with lower diameter can be used instead of steel bars. The use of a low-er volume of reinforcement bars allows for saving costs resulting from thinner concrete.
The lightness of composite bars saves costs associated with loading, unloading and storing bars at the construction site. These operations may be performed manually without any special equip-ment.

Furthermore, composite reinforcement bars ArmaKompozit are manufactured in coils (up to 50 meters long), which guarantees optimal use of entire reinforcement without material losses (unused ends). The bars are not connected to achieve greater length. The coils may be delivered in a small van - using a large truck is unnecessary.

Composite bars are manufactured in form of coils, which guarantees optimal use of material and reduces waste.

Corrosion is the most frequent cause of damage to buildings made of reinforced concrete



Steel bars compared to composite bars make the disassembly operations more difficult by generating problematic waste

ADVANTAGES DURING BUILDING USAGE

Composite bars ArmaKompozit are made of solid material resistant to the effects of damaging environmental factors. After building completion, composite bars do not require any maintenance or servicing.

The protection of concrete strength in aggressive environments require a costly surface treatment based on adding several protective layers.
To prevent the damage caused by humidity, frost, carbon dioxide, salt and other aggressive factors and to protect the life span building usage, increasing the thickness of thermal insulation is often required.

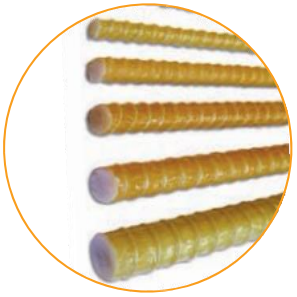
The use of composite bars ArmaKompozit poses no problems specified above.

ADVANTAGES AFTER THE PERIOD OF PROJECTED USAGE

Low liquidation costs

The advantage of using composite bars lies in not only immediate but also long-term economic benefits.

During disassembly, composite bars ArmaKompozit do not require extraction prior to crushing concrete and generate low amount of additional waste to be liquidated.



COMPARATIVE TABLE

Reinforcement bars	Steel grade AIII	Glass fiber composite bars
material	steel	Glass fibers with polymeric binder of resin
tensile strength [MPa]	440 – 550	min. 1000
modulus of elasticity [MPa]	200000	55000
elongation [%]	10-25	2,2
corrosion resistance	corrosive	non-corrosive
thermal conductivity	yes	no
electrical conductivity	yes	no
produced profiles [mm]	6-80	4-16
length [m]	bars 6, or 12 meters	bars 6-12 meters
eco-friendly	Not eco-friendly	Eco-friendly, easy liquidation
longevity	According to standards	Minimum of 80 years
Equivalent replacement of steel bars for composite bars (regarding mechanical properties)	6 mm / 0.22 kg	4 mm / 0.026 kg
	8 mm / 0.40 kg	6 mm / 0.045 kg
	10 mm / 0.62 kg	8 mm / 0.089 kg
	12 mm / 0.89 kg	8 mm / 0.089 kg
	14 mm / 1.21 kg	10 mm / 0.133 kg
	16 mm / 1.58 kg	12 mm / 0.155 kg
	18 mm / 2.00 kg	14 mm / 0.198 kg
	20 mm / 2.47 kg	16 mm / 0.300 kg

OFFER

REINFORCEMENT BAR	Ø [mm]	standard length [m]
	4	50
	6	50
	7	50
	8	50
	10	50
	12	12
	14	12
	16	12

ACCESSORIES Spacers for horizontal and vertical reinforcement	Ø [mm]	Space [mm]
	4 – 20	10;15;20;25
	4 – 20	25
	4 – 20	30
	4 – 20	35
	4 – 20	35;40;45;50

Composite bars ArmaKompozit – ECOLOGICAL

Composite bars ArmaKompozit do not require maintenance and servicing and are easy to liquidate

The manufacturing process of composite bars requires much less energy

The use of composite bars ArmaKompozit limits the carbon dioxide emissions

Composite bars ArmaKompozit meet all requirements related to both environmental projecting and the concept of sustainable development

Recommendations for projecting of concrete constructions regarding their effects on the inviroment:

- designing constructions
- designing based on the construction's resistance to environmental eff ects
- environmental projecting containing evaluation and minimization of construction eff ects on envi-ronment during the entire construction lifespan.

Environmentally friendly projecting principally overlaps with the concept of sustainable development of building industry according to which it is needed to:

- project objects with long service life and to use solid materials not requiring maintenance and servicing;
- secure a simple and easy separation of various materials during repair operations and disassembly;
- use materials with high degree of recycling;
- avoid materials that generate problematic waste;
- minimize the use of materials with high energy requirements

Composite bars ArmaKompozit are solid, do not require maintenance and servicing, are easy to liquidate and do not generate problematic waste.

The manufacture of composite bars requires much less energy compared to traditional reinforcement bars. The manufacturing of composite bars uses only 20-30 percent of energy needed to produce an equivalent number of steel reinforcement bars. Besides that, concrete reduction resulting from the possibility of decreasing the thickness of thermal insulation with the use of composite bars, leads to lower energy consumption and carbon dioxide emissions. For instance, the produstion of every tonne of cement emits approximately one tonne of carbon dioxine.

Composite bars ArmaKompozit meet all requirements related to projecting, represent a new approach and support the concept of sustainable development as an environmentally friendly material.

ARMAKOMPOZIT

Scientific and production company ArmaKompozit is a leading manufacturer of composite reinforcement bars.

ARMAKOMPOZIT

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