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ROADS

The road network plays a key role in the transport of freight and people as it offers easy and flexible use and provides access to the whole country. However, with the progressive increase in loads and traffic, road pavements are deteriorating faster and faster, with damage that is hard to control and brings with it complicated financial and management/operational issues, seriously compromising the safety and comfort of drivers.

We have had something of a wake-up call in recent years, coming to realize just how serious the transport safety issue is and seeing a resulting growing public awareness of the dramatic consequences. According to statistical studies, 20% of all reported accidents can be attributed to the quality of road pavements (source: www.infrastrutturetrasporti.it). In addition to concern for road user safety, there is the need for road providers to reduce road network maintenance costs and times and extend maintenance intervals. Consequently, investing time and effort into researching the development and implementation of innovative solutions for the construction and rehabilitation of road pavements is clearly a worthwhile strategy.



REDUCED CRACKING

The unique properties of the POLYSTRADA reinforcing membranes result in a drastic reduction in the onset of cracks due to issues of fatigue (repeated application of dynamic vehicle loads) and reflective cracking (existing cracks in the underlying structure reflecting to the surface following surface repairs).

APPLICATION FLEXIBILITY

POLYSTRADA membranes can also be used directly on top of milled surfaces without the need for newly constructed levelling courses.

POLYGLASS Q

ROADS

Correct use of suitable reinforcing systems, such as POLYSTRADA membranes, can result in the reduction of overall pavement construction and maintenance costs, extending the pavements' service life, overcoming the inevitable performance shortfalls of usual maintenance work (patch jobs to repair asphalt courses) in the case of more intense traffic and/or when dealing with more extensive cracking.

OPTIMIZED PHYSICAL AND MECHANICAL PROPERTIES

fibreglass carriers provide great tensile strength, enabling part of the tensile stresses to be absorbed, while the special elastomeric bitumen blend gives the membrane stress-relieving qualities and the ability to distribute concentrated loads

SELF-ADHESIVE

the special self-adhesive technology employed in POLYSTRADA membranes ensures good adhesion to the substrate, avoiding the need for tack coats to be applied when installing reinforcing products on either newly constructed or milled asphalt surfaces. (cost and time savings)

SAFETY AND COMFORT √
LESS MAINTENANCE √
LOWER ENERGY CONSUMPTION √
LOWER ENVIRONMENTAL COSTS √
GREATER EFFICIENCY √

LONG SERVICE LIFE

POLYSTRADA membranes are not affected by the mechanical and thermal stresses endured during the application of the hot mix asphalt overlay, such as the stress of very hot material being laid on top, road construction equipment being driven over the system, compacting of the asphalt mix, etc.

BARRIER TO THE HARMFUL EFFECTS OF WATER

POLYSTRADA membranes have waterproofing properties that stop water penetrating deep into the unbound underlying layers of the pavement and/or stop water and fine material creeping back to the surface as a result of the vehicle tyres' pumping action.

> COMPLIANCE WITH EUROPEAN STANDARD EN 15381

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POLYSTRADA, A MEMBRANE FOR "PAVING THE WAY"

Membranes from the POLYSTRADA line are innovative composite materials with improved performance and are specifically designed for reinforcing road pavements.

They comprise a rheologically superior polymer-modified bitumen membrane combined with a glass fibre reinforcing material. Particularly suitable for the maintenance and rehabilitation of the road's surface courses, POLYSTRADA membranes also prove highly effective in new constructions. POLYSTRADA products team the reinforcing contribution provided by glass fibre fabrics and grids with the stress-relieving/absorbing qualities that SAMIs (stress absorbing membrane interlayers) are known for, alleviating strain in the pavement structure. Moreover, their unique conformation ensures waterproofing inside the pavement structure.

Whatever the case, POLYSTRADA membranes optimize the bottom line in terms of costs/benefits and can be used to extend the service life of pavements considerably, whether newly constructed or due for rehabilitation, and/or reduce the thickness of the pavement in question, maintaining both the design life and existing road surface levels.

All this inevitably translates into a drastic increase in the safety and functionality of road infrastructure, with considerable beneficial fallout for the public.



WWW.POLYGLASS.COM

POLYSTRADA POLYGLASS SYSTEMS AND MATERIALS

Polyglass SpA, an undisputed leader in the field of residential and commercial waterproofing applications, has developed specific products for reinforcing road pavements, capable of meeting the various technical and financial requirements usually demanded in common practice. With their impressive flexibility, POLYSTRADA systems can be used in a variety of different applications: from strengthening road surfaces to handle heavy traffic to resurfacing sports fields as a crack-prevention membrane.









POLYSTRADA SYSTEM APPLICATIONS

- HIGHWAYS
- ROAD REPAIR AND STRENGTHENING
- RAIL AND ROAD EMBANKMENTS
- STRAIN ON BENDS
- VIADUCTS
- TUNNEL ENTRANCE EARTH REINFORCEMENT
- RAILWAY SUPPORT
- AIRPORT APRONS AND TAXIWAYS
- FREIGHT VILLAGES
- ROUNDABOUTS
- CONSTRUCTION OF FLYOVER ON RAMPS AND OFF RAMPS
- GARDENS AND STABILIZATION OF SLOPES PRONE TO LANSLIDES
- HEAVY LOAD PARKING LOTS

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POLYSTRADA SYSTEM PRODUCTS

POLYSTRADA

Polystrada membrane types

POLYSTRADA SA

POLYSTRADA SA is a cold-glued self-adhesive bitumen membrane comprising an elastomeric bituminous compound reinforced with a glass fibre composite. This carrier gives the product excellent dimensional stability, top mechanical performance and good on-site workability, ensuring quick and easy installation. POLYSTRADA SA features a top face finished with sand, which helps stop the wheels of road construction equipment sticking to it. In addition, the Adeso[®] self-adhesive technology featured on the underside of the product ensures excellent adhesion to all surfaces and also does away with the need for the traditional bitumen emulsion tack coat, without in any way affecting the required level of adhesion to the substrate. And as an added bonus, POLYSTRADA SA is 100% recyclable (millable material).

POLYSTRADA SA thus successfully marries the waterproofing properties of SAMIs (Stress Absorbing Membrane Interlayers) (designed to relieve parasitic stresses at the interface between different layers and at existing breaks in the structure) provided by the special bitumen membrane with the "structural" stress-absorbing and -distributing contribution provided by the glass fibre composite reinforcement. In that sense, it is worth pointing out that SAMIs are traditionally produced on site, with the hot application of large amounts of high-performance modified bitumen, which impregnate the polyester fabrics. Cold application means POLYSTRADA SA is perfect for reducing costs, time and the operational difficulties involved in installation, delivering even more controlled and reliable performance due to the industrial manufacturing process.

This product is therefore particularly suitable in the case of pavement resurfacing via the partial removal of bitumen courses affected by a moderate level of cracking and subjected to medium/high levels of traffic, effectively inhibiting reflective cracking. Alternatively, the product can be used effectively to protect longitudinal and transverse construction joints. When it comes to new road projects, this membrane has been designed for second-tier use (secondary roads of all kinds, both in and outside towns) and could allow asphalt to be laid to shallower depths without having negative effects on overall service life (longevity).

POLYSTRADA SA PLUS

When dealing with more "complicated" construction/maintenance work, where the "structural" contribution becomes a key factor (greater stress, poorer initial conditions, etc.), POLYSTRADA SA PLUS - the SA product taken to the next level - is a prime option and stands out both for the special rheological properties of the bitumen membrane and for the unique performance of the reinforcement embedded in it.

POLYSTRADA SA PLUS is a cold-glued self-adhesive membrane comprising a self-adhesive SBS bituminous compound reinforced with a glass fibre mesh carrier specially designed to give high tensile strength and dimensional stability. The technical and financial advantages already highlighted for the SA product clearly still apply, namely ease of installation courtesy of the optimized finish on both surfaces and 100% recyclability (millability).

POLYSTRADA SA PLUS is the optimal combination of the reinforcing contribution provided by the bitumen membranes and glass fibre grids, delivering excellent performance in any kind of situation calling for the structural capacities of the pavement to be restored/increased and, at the same time, requiring increased resistance to fatigue and reflective cracking. This quality translates into appreciable improvements in mechanical performance and durability, with reduced maintenance requirements.

Consequently, POLYSTRADA SA PLUS is recommended in the rehabilitation of pavements done by cutting out part of the severely cracked asphalt courses subjected to high levels of traffic. When it comes to new road projects, this membrane has been designed for first-tier use (highways and high-speed roads outside towns) and could allow asphalt to be laid to shallower depths without having negative effects on overall service life (longevity).



ROAD APPLICATIONS



POLYGLASS SYSTEMS AND MATERIALS

An integral and complementary part of the road pavement reinforcing systems is the adhesion-promoting primer, which serves to stop dusting and saturate open pores on the substrates when applying POLYSTRADA membranes on surfaces other than asphalt (concrete, cemented stabilized layer, hydraulic stabilized layer, etc.) in order to promote a stronger bond between the reinforcing products and underlying surfaces.

ADHESION-PROMOTING PRIMER

Bituminous primer: Polyprimer HP Strada

POLYPRIMER HP STRADA is an elastomer-based bituminous primer specifically designed and optimized for use in conjunction with POLYSTRADA membranes. It is used as to promote adhesion between the reinforcing membranes and underlying surfaces when the membranes are laid on surfaces other than asphalt.



APPEARANCE	Liquid
COLOUR	Black
SPECIFIC WEIGHT AT 20 °C - STANDARD EN ISO 2811	0,95 (±0,04) kg/l
SOLID CONTENT - STANDARD EN ISO 3251	51-57 %
DUST DRY (23 °C - 50% RH)	30-60 minutes
VISCOSITY DIN 53211 NOZZLE DIAMETER 4 AT 20 °C	19-25 seconds
FRAASS BREAKING POINT OF OXIDIZED BITUMEN	-12 °C
PENETRATION (DOW) OF BITUMEN AT 25 °C	15/20 dmn
FLASH POINT (CLOSED CUP)	<23 °C

DUST DRY	30-60 minutes
TOUCH DRY	100-140 minutes
PH A 20 °C	Neutral
BOILING RANGE	80-190 °C
SOFTENING POINT (R&B) OF BITUMEN	85-95 °C
AUTOFLAMMABILITY	245 °C
STABILITY IN ORIGINAL SEALED TINS	24 months
SURFACE TEMPERATURE FOR BEST USE	>5 °C

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INSTALLING POLYSTRADA SYSTEMS

The reinforcing systems' installation is a crucially important factor as incorrect installation is often responsible for the membranes failing to perform as expected and reach their potential, essentially undermining the systems' effectiveness.

The special self-adhesive technology employed in POLYSTRADA products means they can also be applied effectively on milled surfaces without requiring any tack coat between them and the substrate. However, said substrate must be even, clean, dry and free of all foreign matter, while any particularly extensive damaged areas (holes, depressions, wide cracks, etc.) must be repaired.

APPLICATION OF THE PRIMER

Only in the event POLYSTRADA membranes are to be applied on surfaces other than asphalt (whether newly constructed or existing asphalt remaining following milling), we recommend using POLYPRIMER HP STRADA bituminous primer to boost the bitumen membranes' bond strength. The primer should be applied by airless spray gun or roller. In either case, the surface to be treated must be even, clean, dry and free of all foreign matter. POLYSTRADA membranes should be applied only once the primer is completely dry.



INSTALLATION OF POLYSTRADA MEMBRANES

POLYSTRADA products are extremely quick and easy to install, providing a perfect base for the asphalt overlay to be evenly applied, without the need for mechanical fixing or torching. Rolls must be rolled out parallel to the direction of travel, with 100mm side and end laps. The adhesive side must face down, the silicone-coated film must then be removed and the membrane applied without allowing air pockets or wrinkles to form on the underside. Heat drawn from the hot mix asphalt overlay is key to ensuring the composite adheres properly to the asphalt surface, activating the heat-activated self-adhesive layer, while the sand surface finish stops the wheels of road construction equipment sticking. The temperature of the substrate must be at least 5 °C and is not to exceed 60 °C.

INSTALLATION OF ASPHALT OVERLAY

The asphalt overlay must be installed at a temperature of at least 150 °C to ensure a perfect bond between the product and substrate. The asphalt overlay must be at least 40 mm deep and this depth must be sufficiently increased in the event the interface is subjected to greater shear stresses (very heavy loads and/or strong tangential forces transmitted on the surface), so as to avoid de-bonding issues, which might compromise the effectiveness of the work carried out. It is advisable to make sure that road construction equipment does not turn on top of the membranes to avoid creasing.

The asphalt must be laid by pavers in perfect working order with automatic level control features. Pavers must proceed at a speed of no more than 5 m/min and must feature continuous asphalt feed.

The asphalt course must be laid to its full depth in a single pass, keeping breaks in laying to an absolute minimum and avoiding manual work to correct anomalies. To stop the asphalt cooling too quickly,

laying should not be performed in the rain or with ambient temperatures below 10 °C.



TECHNICAL AND SCIENTIFIC VALIDATION

The study is based on a laboratory mock-up of double-layered bituminous systems, with the application of POLYSTRADA reinforcing products at the interface. The unreinforced system was also examined for comparison purposes, thus allowing the study to highlight the contribution provided by the different products. The performance of the double-layered systems was analysed using innovative test protocols, aimed at determining interlayer bonding (prEN 12697-48) as well as stiffness (EN 12697-26) and resistance to fatigue (EN 12697-24), subjecting the samples to dynamic flexural loads.

More specifically, the advanced experimental approach was adopted in order to underline the unique aspects associated with the use of road pavement reinforcing systems: the interlayer shear bond tests confirmed the effectiveness of the bond between the bituminous layers where the reinforcing product was used, while dynamic testing in a "4-point flexural bending" configuration clearly demonstrated the considerable contribution that the bituminous composites made to the increased fatigue resistance in reinforced bituminous systems.

The double-layered samples were produced in lab by means of a specific Roller Compactor. An unreinforced interface, treated with a modified bitumen tack coat, was also included in the study for comparison purposes. The bituminous systems were produced with traditional dense-graded asphalt, used for both the lower layer and upper layer. In addition, different application methods were investigated using asphalt mixes prepared not just with traditional non-modified bitumen, but also

with binders modified with SBS elastomeric polymers.



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Products from the POLYSTRADA Line have undergone specific experimental validation/ characterization at the University of Padua's laboratory facilities in Italy (research headed by Prof. Marco Pasetto).





SCIENTIFIC APPROACH EXPERIMENTAL PLAN

Cylindrical specimens were taken from the double-layered slabs prepared with the Roller Compactor to be used in the interlayer bond shear strength tests, while prismatic specimens were taken for the purpose of dynamic 4-point flexural bending tests.





The interlayer bond shear strength test was conducted according to European standard prEN 12697-48 (known as the Leutner method), which entails forcing the layers of the double-layered sample to slide relative to each other along the interface being tested at a speed of 50 mm/min. During testing, applied force and relevant displacement are recorded and these data are then used to work out the essential interlayer bond strength parameters.





The flexural bending test instead involves using a suitable arrangement of fixtures to apply a sinusoidal dynamic load to a specifically sized prismatic sample that, as a result of the load applied, oscillates periodically around its horizontal axis while being held steady by the fixtures at either end. By applying engineer's beam theory and measuring the load and deflection along the centre line, it is possible to work out the stiffness of the double-layered system during testing, determining, by convention, the sample's fatigue failure as the point where stiffness equals half of the stiffness measured at the start of the test. Consequently, repeating the test with different levels of strain provides sufficient data to draw up fatigue curves.



SCIENTIFIC EVALUATION RESULTS



The shear bond strength tests clearly highlighted the different behaviour of the interfaces tested. Indeed, the unreinforced pavement showed high interlayer bond strength, though at the same time demonstrating brittle-type failure with physical separation between the layers.



Reinforced interfaces, on the other hand, showed ductile behaviour with high creep rates and reduced interlayer bond strength, without physical failure of the actual interface (results for POLYSTRADA SA PLUS, coded with the letter G, are illustrated in the graph). This result confirms the need to design the depth at which the reinforcing system is to be applied with great care based on actual traffic and product installation conditions.



These experimental results were corroborated by the stiffness values measured with dynamic flexural bend testing: these values proved directly proportional to the level of interface bond strength.

REINFORCED PG - Interface creep



This confirms the fact that greater interlayer bond strength translates into greater system stiffness.



However, this result is in no way related to the pavement's long-term strength, as shown by the fatigue testing carried out in a 4-point flexural bend configuration. Indeed, for all strain levels investigated, the reinforced systems - while featuring lower initial stiffness - gave a considerably longer fatigue life than the corresponding unreinforced system, showing how the contribution provided by the reinforcing system is mainly aimed at stopping damage inside the material (cracking) spreading, rather than at increasing the load-bearing capacity of the pavement in guestion.



More specifically, POLYSTRADA SA (code F) and POLYSTRADA SA PLUS (code G) products have demonstrated far superior performance thanks to the "reinforcing" contribution provided to the system by the reinforcing component (fabric or grid) embedded in the bitumen membrane (by way of example, the graph gives the results obtained with a strain of 400 microstrains).



Consequently, the fatigue curves obtained based on the results of the dynamic flexural bend tests clearly show the positive contribution provided by the POLYSTRADA reinforcing systems compared to a similar unreinforced system, confirming the application potential mentioned earlier.



To sum up, the experimental results obtained thus far as part of the research conducted at the University of Padua unequivocally attest to the considerable benefits in terms of performance that can be achieved with the suitable application of POLYSTRADA reinforcing systems.

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LIQUID AND PASTE WATERPROOFING MATERIALS AND ACCESSORIES

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