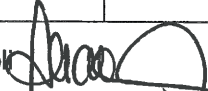



CORECOM S.r.l.



Customer:	CORECOM S.r.l.				
Research:	Spermental – technological project				
Title:	Contract's technical specifications for transparent conglomerate ECOPAV with EVizero binder				
Document:	Doc.n°R543/16	Review: 01	04/07/2016	Order:	1521/15
Document edited by:	Engineer Alessandra Niccoli 				
Lab. Executive Manager:	Engineer Stefano Tattolo 				

Summary

1	TRANSPARENT CONGLOMERATE ECOPAV	3
1.1	<i>MATERIALS AND THEIR QUALIFICATION</i>	3
1.1.1	<i>The binder</i>	3
1.1.2	<i>The Aggregates</i>	3
1.1.3	<i>The Mixture</i>	6
1.2	<i>MIXTURE PRODUCTION</i>	8
1.3	<i>PREPARATION OF THE LAYING SURFACE</i>	8
1.4	<i>MIXTURE LAYING</i>	9

1 TRANSPARENT CONGLOMERATE ECOPAV

The following article is referred to the preparation of the wearing surface of the conglomerate 'ECOPAV' made with EVIzero binder, characterized by a neutral color, a low visual impact, and based on polyolefin.

The technical specifications of the transparent conglomerate are needful indications for the right use of the product. It's necessary to make a specific mixture study depending on the aggregate petrographic nature, the color and the granulometric range of the available materials.

1.1 MATERIALS AND THEIR QUALIFICATION

1.1.1 The binder

EVIzero is a neutral colored binder with a low visual impact, based on polyolefin, used for the realization of different roads in urban and natural contexts. It's a mixture made with polymers and by-products coming from the industrial process. The main characteristics are mentioned in the following chart 1:

Require	Method	u.m.	Range
Penetration at 25°C	UNI EN1426	dmm	25/55
Softening point	UNI EN1427	°C	>75
Dynamic viscosity	UNI EN1427	mPa*s	>700
<i>Properties' variation after short – term Ageing (UNI EN 12607-1)</i>			
Residual penetration	UNI EN 1426	%	>60
Increase of softening point	UNI EN 1427	°C	<3
Variation mass	UNI AN 12607-1	%	<4

Chart 1. Binder characteristics

1.1.2 The Aggregates

They must be exclusively not recycled aggregates and they must be the result of the mixture of coarse aggregates, fine aggregates and filler that might come from the fine aggregate or additive fraction.

The coarse aggregate (granulometric fraction withheld by 2 mm sieve and passing through 45 mm sieve) should come from the crushed stones or different petrographic nature as long as the following parameters (mentioned in Chart 2), for each granulometric class used in the mix design, has to be satisfied:

Requirements	Method	u.m.	Class
Aggregate size	UNI EN 933-1	mm	d/D declared*
Grading	UNI EN 933-1	%	G _c declared*
Particle density and water absorption	UNI EN 1097-6	Mg/m ³	ρ _{ssd} ρ _a ρ _{rd} declared*
Percentage of crushed surfaces in coarse aggregates	UNI EN 933-5	%	C _{100/0}
Coarse aggregate's shape – Shape index	UNI EN 933-4	-	SI ₁₅
Coarse aggregate's shape – Flakiness index	UNI EN 933-3	-	FI ₁₀
Resistance to fragmentation of the coarse aggregate	UNI EN 1097-2	-	LA ₂₅
Determination of polished stone value	UNI EN 1097-8	-	PSV ₄₂
Resistance to wear of the coarse aggregate	UNI EN 1097-1		M _{DE} 15
Resistance to thermal shock	UNI EN 1367-5	-	V _{LA} declared*
Resistance to freezing and thawing	UNI EN 1367-1	%	F ₁
Chemical composition	UNI EN 932-3	-	declared*
Affinities of coarse aggregates with bituminous binders*	UNI EN 12697-11	%	≥ 90

* The test must be done on transparent inerts-binder blend.

Chart 2. Coarse aggregates characteristics

The fine aggregate (granulometric fraction withheld by 0.063 sieve and passed through 2 mm sieve) should come from natural and crushed elements with the characteristics summarized in the following chart:

Requirements	Method	u.m.	Class
Aggregate size	UNI EN 933-1	mm	d/D declared*
Grain size	UNI EN 933-1	%	G _f declared*
Particle density and water absorption	UNI EN 1097-6	Mg/m ³	ρ _{ssd} ρ _a ρ _{rd} declared*
Assessment of fines: Methylene blue test	UNI EN 933-9	g/kg	MB _F declared*
Assessment of fines: Sand equivalent value	UNI EN 933-8	%	≥ 70
Chemical Composition	UNI EN 932-3	-	declared*

Chart 3. Fine aggregate characteristics

The filler (granulometric fraction passed through a 0,063 mm sieve) may come from the fine fraction of aggregates or may be made of stone dust, better if calcareous origin, or from cement, or hydrated lime, hydraulic lime, asphalt dust, fly ash.

Requirements	Method	u.m.	Class
Grading of filler aggregates	UNI EN 933-10	%	declared*
Fineness of filler – Blaine method	UNI EN 196-6	cm ² /g	declared*
Particle density and water absorption	UNI EN 1097-7	Mg/m ³	declared*
Voids of dry compacted filler	UNI EN 1097-4	%	V _{28/45}
Delta ring and ball test	UNI EN 13179-1	°C	Δ _{R&B} 8/16
Bitumen number	UNI EN 13179-2	%	declared*
Water solubility	UNI EN 1744-1	%	WS ₁₀
Water susceptibility of fillers	UNI EN 1744-4	%	declared*
Harmful Fines – Methylene blue test	UNI EN 933-9	g/kg	MB _F declared*

Chart 4. Filler's characteristics

* The reported symbol in the charts shows the requirements categories for whom it's not necessary to follow a specific value, in so doing redirecting to the acceptance declared by the producer. The declaration of the producer could be, although not object of project prescription, verified by the Works Management in order to underline possible discrepancies between what has been seen during the qualification phase and has been checked during the executive phase and what has been declared in quality.

1.1.3 The Mixture

The ECOPAV conglomerate with EVizero binder (NEUTRAL color with low visual impact and with polyolefin base), must have the granulometric compositions according to grading envelopes written below (UNI EN 12697-2), and they must be defined using the sieves belonging to the base group + 2.

In particular, the wearing surface 'type A' should be considered suitable for roads with a light volume of traffic, the wearing surface 'type B' should be considered suitable for pavements and/or cycle / footpaths but NOT for vehicle:

Sieve (mm)	wearing surface type A (%)	wearing surface Type B (%)
16	100	-
12.5	90-100	100
8	70-88	90-100
4	40-58	44-64
2	25-38	28-42
0.5	10-20	9-20
0.25	8-16	5-15
0.063	6-10	3-8

Chart 2. Grading envelopes of ECOPAV transparent conglomerate

Requirements	Method	u.m.	light volume of traffic	pavements and/or cycle / footpaths but NOT for vehicle
			Class	Class
Mixture Temperature	UNI EN 12697-13	°C	min 140 max 160	min 140 max 160
Content of soluble binder	UNI EN 12697-1	%	B _{min} 5,6	B _{min} 5,4
Content of residual voids ¹	UNI EN 12697-8 UNI EN 12697-6 procedimento C	%	V _{min} 3,0 V _{max} 6,0	V _{min} 3,0 V _{max} 6,0
Content of residual voids ²	UNI EN 12697-8 UNI EN 12697-6 procedimento C	%	V _{min} 2,0	V _{min} 2,0
Water sensitivity ³	UNI EN 12697-12	%	ITSR ₈₀	ITSR ₈₀

Marshall test ⁴	UNI EN 12697-34	kN mm kN/mm	S _{min10} F declared* Q _{min} declared*	S _{min7.5} F declared* Q _{min} declared*
Stiffness (IT-CY at 20°C) ¹	UNI EN 12697-26	MPa	S _{min2800}	S _{min2200}
Indirect tensile strenght ¹	UNI EN 12697-23	GPa* 10 ⁻³	ITS _{min} 0,80 ITS _{max} 1,95	ITS _{min} 0,80 ITS _{max} 1,95
Resistance to permanent deformation ⁵	UNI EN 12697-22	%	PR _{DAIR9,0}	PR _{DAIR9,0}

Chart 6. Transparent conglomerate ECOPAV's characteristics

- 1- The result will have to be determined on transparent conglomerate samples compacted in lab according to UNI EN 12697-31 (120 gyrations with specimen diameter ϕ 150);
- 2- The result will have to be determined on transparent conglomerate samples compacted in lab according to UNI EN 12697-31 (210 gyrations with specimen diameter ϕ 150);
- 3- The result will have to be determined over/on transparent conglomerate samples compacted in lab according to UNI EN 12697-31 (40 gyrations with specimen diameter ϕ 150);
- 4- The result will be determined on transparent conglomerate samples compacted in lab according to UNI EN 12697-30 (2x75 blows);
- 5- The result will have to be determined over/on transparent conglomerate samples compacted in lab according to UNI EN 12697-33 in order to restore the same density level obtained on compacted samples with 120 gyrations and specimen diameter ϕ 150.

The compacted layer of ECOPAV transparent conglomerate should satisfy the following requirements:

Requirement	Method	u.m.	Soft vehicle accessible	NOT vehicle accessible
			Value	Value
Content of residual voids ⁶	UNI EN 12697-8 UNI EN 12697-6 Procedure C	%	max 6%	max 8%
Thickness ⁷	UNI EN 12697-36	mm	4cm	3cm

Chart 3. Mechanical and physical requirements for ECOPAV transparent conglomerate layer

- 6- The result has to be determined on transparent conglomerate samples taken during the procedure, using drilling operations according to UNI EN 12697-27;
- 7- The result has to be determined in case of areas limited by extension.

1.2 MIXTURE PRODUCTION

The ECOPAV transparent conglomerate used for wearing surface has to be produced in asphalt mixing plants , with suitable characteristics, always kept perfectly working and running in every single part.

The production capacity of every plant will not have to go further its own potential, in order to ensure the perfect drying, the uniform warming of the mixture and a perfect screening that ensures a suitable re-classification of the aggregate single classes. The aggregate storage area should be previously and conveniently prepared in order to avoid the presence of clayish materials and water stagnations that could compromise aggregate cleanliness.

Furthermore the heaps of the different granulometric classes must be clearly separated among them and the restocking operation must be made with the highest attention.

The plant will have to guarantee production's uniformity and suitable mixtures according to the attached ZA – UNI EN 13108.

Mixing time will has to be established according to plant's characteristics, in order to allow the complete and uniform coating of the aggregates with the binder.

1.3 PREPARATION OF THE LAYING SURFACE

Before the realization of ECOPAV conglomerate layer with EVIzero binder (NEUTRAL color with low visual impact, polyolefin base) it will be necessary to prepare the laying surface with suitable interlayer bending, siting it with automatic systems. Interlayer bending means an interconnection layer in cationic bituminous emulsion with the purpose to avoid possible flows related to the layers' interface in overlapped conglomerates. The bituminous emulsion's dose will be such that the residual bitumen is 0,5Kg/m².

The cationic bituminous emulsion's characteristics are the following written in the chart number 8 and they are classified according to UNI EN 13808

(Bitumens and bituminous connectors – Specifics for cationic bituminous emulsions):

Requirement	Method	u.m.	Class
Particle polarity	UNI EN 1430	-	Positive
Breaking value	UNI EN 13075-1	-	(Class 4) 70-130
Binder content (by water content)	UNI EN 1428	%	(Class 7) 65-69
Residual binder	UNI EN 1431	%	(Class 7) ≥ 65
Oil distillate content	UNI EN 1431	%	(Class 2) ≤ 2
Efflux time (40°C – 2mm)	UNI EN 12846	s	(Class 5) 70-130
Residue on sieving - 0,5 mm	UNI EN 1429	%	(Class 3) ≤ 0.2
Residue on sieving - 0,16 mm	UNI EN 1429	%	(Class 3) ≤ 0.5
Settling tenency (7 days storage)	UNI EN 12847	%	(Class 3) ≤ 10
Residue on sieving - 0,5 mm (7 days storage stability)	UNI EN 1429	%	(Class 4) ≤ 0.5
Adhesivity	UNI EN 13614	%	(Class 2) ≥ 75
Characteristics of the residual binder			
Penetration at 25 °C	UNI EN 1426	dmm	(Class 3) ≤ 100
Softening point	UNI EN 1427	°C	(Class 2) ≥ 55
Cohesion energy (Pendulum Test)	UNI EN 13588	J/cm ²	(Class 4) ≥ 1
Elastic recovery at 25°C	UNI EN 13398	%	(Class 4) ≥ 50

Chart 4. Characteristics of the emulsion for hand attack

1.4 MIXTURE LAYING

The ECOPAV transparent conglomerate's laying for the realization of the wearing layer for urban pavements and/or for cycle paths will have to be done using asphalt paver machines in a perfect state of efficiency having self – leveling automatism.

Asphalt paver machines should leave a finished layer perfectly shaped, without shelling, cracking and without flaws for segregation of bigger lithoid

elements.

All the match joints will have to be subjected to vertical cut and removal of zeroing terminal part or lateral laying (this last one only when approaching sideswipes are realized in different timing) in order to proceed with the surfaces' approaching of new realization.

The transport of the transparent conglomerate from the plant to the laying construction site will have to be done through means of transport with suitable capacity, efficient and speedy/fast and always with cover tarpaulin in order to avoid excessive superficial cooling and crusts formation.

Transparent conglomerate's temperature during the laying act immediately checked behind the paver should be kept always not inferior to 140 °C.

The laying of the conglomerates will be interrupted when the general weather conditions may affect the work's success.

The compromised layers will immediately be removed and then build again at contractor charge.

The transparent conglomerate ECOPAV's compaction will start when it will be laid using the paver and the compaction will be led at the end without interruptions. It will be necessary the use of tandem rollers with metallic wheels with a weight not inferior to 8 tonnes.

It will also be necessary that the compaction will be led with the most suitable methodology in order to have a uniform densification in every single point and in order to avoid cracking and sideswipes in the layer just laid.