ITRAFFIC

Keeping Our Roads Safe

Eco-Signs

PRODUCT PROFILE

SANRAL

BUILDING SOUTH AFRICA THROUGH BETTER ROADS

RUBBER-SIGN PILOT PROJECT PRODUCT REVIEW: ECO-SIGNS

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Introducing **Eco-Signs**

Eco-friendly & Biodegradable Tech

ITRAFFIC PTY LTD is a pioneering leader in the provision of road safety & technology advanced solutions based in SOUTH AFRICA.

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1. Introduction

Rubber-signs are road signs which are manufactured from recycled tyres.

2. Objectives

- Test the degradation/weatherability (UV resistance) of the road signs which is manufactured from recycled tyres.
- Test attraction for vandalism and theft of the rubber signs; and
- Test the fixing ability of the rubber-signs to signposts

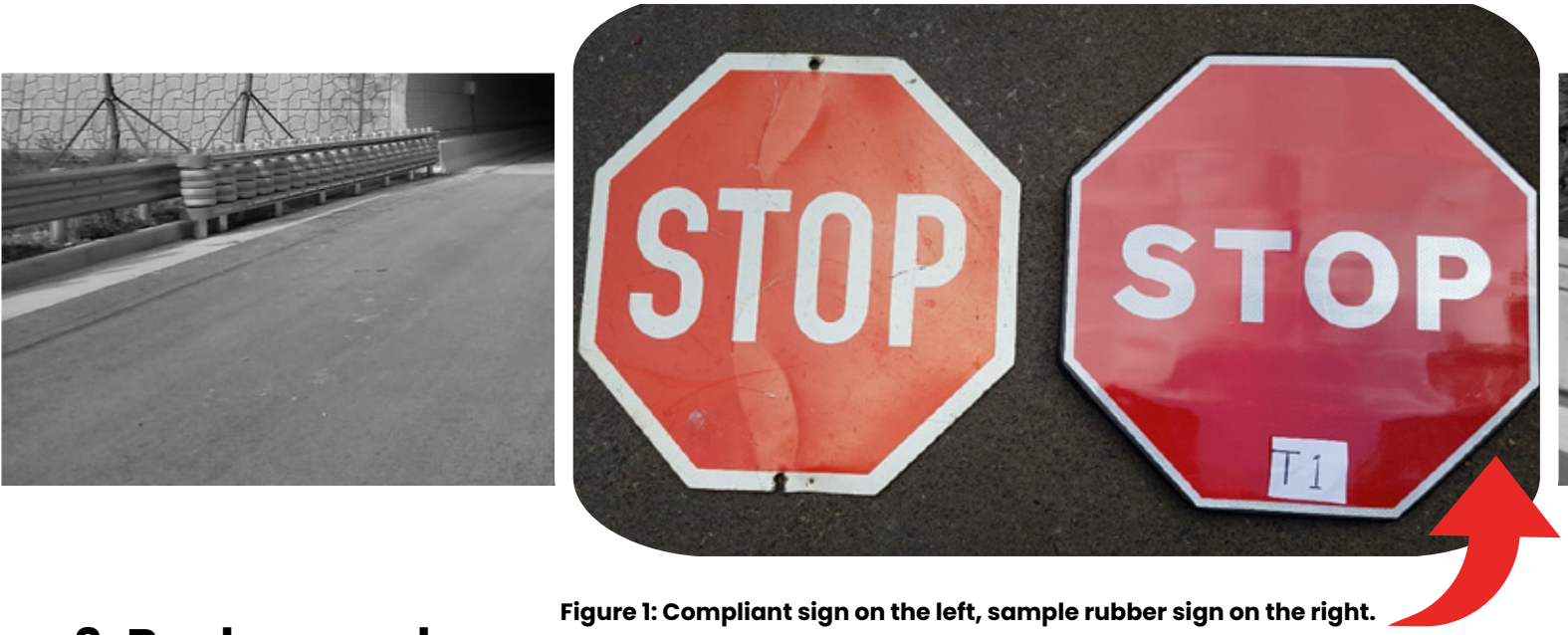

Figure 1: Compliant sign on the left, sample rubber sign on the right.

3. Background

At a meeting held on 4th October 2019, a sample of four (4) Eco-signs (3 regulatory stop signs and an information sign frame) were provided to the Technical Innovation Hub (TIH) for evaluation. An AENOR Certificate of the constancy of performance CE 0099/CPR/A72 /0116 was also provided. See Appendix A in Section 8.There were however no N Marks on the specific samples

The samples of the signs provided however did not comply with the South African Road Traffic Sign Manual (SARTSM), i.e. the regulatory stop sign lettering dimensions were only 115mm instead of 210mm for a 60 km/h restriction, but the other dimensions of the frame did comply. For comparison of the rubber sign letter dimensions with that of a compliant sign see Figure 1 below.

3. Background

In terms of the COLTO Standard Specifications for Roads and Bridge Work, steel plates for road signs shall be 1,4 mm thick prepainted galvanized steel plate treated on both sides with an epoxy primer followed by a silicon polyester top-coat (Z275 Chromadek or approved equivalent). It also states that the reverse side of a STOP sign R1 and its derivatives shall be painted white. The reverse side of all other signs shall be dark grey.

Before the sign could be erected, it had to be retrofitted to comply with the legal standards. One of the local sign manufactures did the retrofitting of the signs free of charge. A R1 Stop and Reserved parking for busses and taxis signs were retrofitted for the erection of the pilot project as shown in **Figure 2.**

Figure 2: Retrofitted Stop and Reserved parking rubber road signs.

Figure 3: Location of the pilot project in Grabouw.

It was challenging to find a suitable location to erect the signs due to the dimensions of the signs that were for 60km/h restrictions, while most of the national roads have 120 or 100 or 80 km/h speed restrictions i.e. larger dimensions. Therefore, we decided to erect the signs in the Grabouw informal settlement area along Ou Kaapse Way and its intersection with the N2. See the location shown in **Figure 3.**

4. Benefits of the Rubber - Signs

4.1. Environmental Impact

Tyres were originally manufactured with the rubber from rubber trees but were later manufactured from synthetic rubber consisting of 19% natural rubber and 24% polymer. The rest is made up of metal and other compounds. Rubber tyres decompose over periods of 50 to 80 years while plastic bags can take 500 to 100 years to decompose in landfills. As much as 28% of microplastic in the ocean comes from tyres shedding synthetic rubber as it wears down.

The other major issue is the leaking of old tyres which contain heavy metals and chemicals which leaks into the environment as it disintegrates on landfills. Between 1990 and 2017 there has been a dramatic reduction in stockpiled tyres due to a growing market for scrap tyres recycling (11% in 1990 and 81% in 2017).

The recycling of shredded tyres have many uses:

- As rubber mulch in gardens
- Shredded tyres can be used on roads instead of gravel
- Crumb rubber for ground flooring and into asphalt rubber layers
- Tyre derived fuels in steel mills as a carbon source to replace coal or coke during manufacturing
- Collision barriers and frames for erosion and rainwater control

The manufacturing of road signs from recycled tyres is an innovation which can reduce the environmental impact of used tyres.

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4. 2. Road Safety Impact

Traffic signs are utilized as a method of warning and guiding drivers, helping to regulate the flow of traffic on roads. These signs convey a simple but clear message and provide adequate time for proper response.

The traffic signs are not merely aesthetic but there to warn motorists of potential dangers and give important instructions that will keep the driver, passengers and other road users safe.

The illegal removal/vandalising of traffic signs is becoming a major problem in specific areas close to formal and informal settlements which are normally next to or close to roads and streets.

People do not realize the safety consequences when removing these signs. It is not clear for whatever reason traffic signs are removed. Is it for the scrap value or other usages?

The existing traffic signs are all manufactured from Chromadek sheets of different thicknesses which has little second-hand scrap value but used as building material for informal houses.

By manufacturing traffic signs from reused tyres is a test to see the attractiveness and theft value of the rubber signs. To test this, we had to erect a sign in such a high-risk area and see if or how soon it will be removed and also compare the lost value between the normal sign price and that of a rubber sign.

4. 3. Rubber cannot corrode

South Africa has a coastline of 2850km with many small towns and municipalities along the coastline. One aspect that impacts on infrastructure along the coastline is corrosion. The ocean air contains salt which causes steel to corrode 10 times faster than inland air with normal humidity. Saltwater does not cause the metal to rust but it accelerates the rusting process because electrons move more easily in saltwater compared to nonsaline water.

The road traffic signs used by the municipalities are mostly manufactured from Chromadek sheets which despite being galvanised corrode with time and does not last as long as the inland traffic signs and therefore require more frequent replacement. In contrast, rubber road traffic signs do not contain any metal as part of the sign except for the bracket which is used to mount the sign to a pole. If stainless steel brackets are used it will contain no elements/part that can erode.

Figure 4 below shows the effect of erosion of the road signs that were erected in 2013, the photos were taken in 2020, thus 7 years. The signs were exposed to coastal conditions for this period. Corrosions is visible on the signs despite being made from galvanized plates.

Figure 4: Condition of galvanized signs exposed to coastal conditions.

5. Testing of the Rubber – Signs

AENOR is responsible for the developing standards and carring out standardization and certification in Spain The AENOR certificate of constancy of performance CE 0099/CPR/A72/0116 tested the following aspects of vertical fixed sign plates:

- Substrate and surface protection of the sign plate
- Daylight chromacity and luminance factor
- Coefficient of retroreflection
- Wind load
- Temporary deflection of the sign plate bending
- Dynamic snow load
- Point loads
- Partial action factor

The objective of the pilot study was not to verify the above claims, but rather to investigate the practicality of using the signs in South African conditions that could not be established from the above-mentioned testing.

5.1. Ultraviolet (UV) Degradation

While most of the UV radiation from the sun is absorbed in the earth's atmosphere, about 33% still reaches objects on the surface of our planet. The harm/damage caused by UV rays is called degradation.

5.1. Ultraviolet (UV) Degradation

UV rays therefore affect many natural and synthetic polymers including some rubber products depending on the degree of exposure. With too much exposure, these materials can fade in colour and lose strength.

The degradation caused by the sun was seen as one of the crucial factors in evaluating the material performance of the rubber signs. The normal expected design life of a road sign is 8 years and depends on its reflectivity and fading of the sign face as a result of the sun. Our objective was not to monitor the reflectivity of the sign faces but more rather the performance of the rubber mould of the signs.

As the pilot project's duration was only for six (6) months, it was decided to place the rubber sign mould horizontally fully exposed to natural sunlight and ambient conditions for the pilot duration and monitor the following aspects:

- Fading of its colour
- Loss of strength
- Premature cracking
- Disintegration of rubber

In our findings, we will compare the difference of the above aspects with a similar rubber sign which was not exposed to sunlight.

The degradation of rubber signs can also be determined through infrared spectroscopy. The effect of UV degradation on materials that require a long service life can also be measured through accelerated exposure tests. With modern solar concentrator technology, it is possible to simulate 63 years of natural UV exposure on a test device in a single year. Due to practical constraints, these two test methods were not available for the pilot project.

5.1.1. Findings on the Ultraviolet (UV) degradation

We compared the degradation of the rubber signs (mould samples T2 and T3) placed in the sun for 6 months with a mould sample (T1) which was kept out of the sun and environment over the same period as shown in Figure 5.

Figure 5: Degradation of rubber signs with different class retroreflective material.

The difference in colour between T1 and T2 is related to the difference in classes of the retroreflective material and not to UV degradation.

We could not observe any fading of the rubber moulds, changes in colour, loss of strength, premature cracking or disintegration of the rubber moulds. See photos of rubber mould samples T1, T2 and T3 in **Figure 6** and **Figure 7** respectively.

Figure 6: Photos of the backside of the rubber sign moulds T1 and T2.

Figure 7: Photos of the front and backside of the rubber sign mould.

No clear evidence of delamination could be found after the pilot duration as shown in Figure 8.

Figure 8: Photo of the delamination inspection between the retroreflective material and the rubber mould. No delamination was observed after 6 months.

5.2. Temporary deflection of the sign plate/mould bending

Mould sample T3 was used to test the temporary bending properties of the rubber moulds. Pressure was applied to the mould until the two outer edges of the mould touched and then released to see how quickly it goes back to its original shape as shown in **Figure 9**. After releasing the pressure, the rubber mould retracted to its original shape shown in **Figure 10.**

Figure 9: Photos of the bending process.

Figure 10: Photos of retracted rubber sign after bending

5.3 Vandalism and Theft

5.3.1 Findings on Vandalism and Theft

We found that when road signs cannot be easily removed by vandals, they tend to be bent to such an extent that they cannot fulfil their function any longer.

What the bending test has shown is that the rubber signs will retract to their original shape after bending. We also found that it is very difficult to bend the rubber signs once they have been fixed to a signpost

Although the signs have been erected in a high-risk area for vandalism and theft they were not removed or vandalised during the pilot project. The fact that the rubber Stop R1 sign was fixed higher than the normal distance above ground level could also have contributed to it not being vandalised. See photos of the signs taken at end of May 2020 shown in **Figure 11.**

Figure 11: Photos of rubber signs at end of May 2020.

5.3 Vandalism and Theft

5.3.2 The fixing ability of the rubber sign to the signpost

The rubber signs are provided with two special brackets for the fixing of the signs to signposts. These brackets are fixed to the rubber mould through holes in the rubber mould ribs/stabilizers as shown in **Figure 12.** The holes for the brackets are close to the edge of the ribs and U shape fibreglass elements are used to strengthen the fixing of the rubber mould with the bracket as shown in **Figure 13**. The brackets fixed to the sign are shown in **Figure 14** and the fixing of the sign to a timber post using the brackets and sanky clamps is shown in **Figure 15**.

Figure 12: Holes in the rubber sign mould for the fixing of brackets.

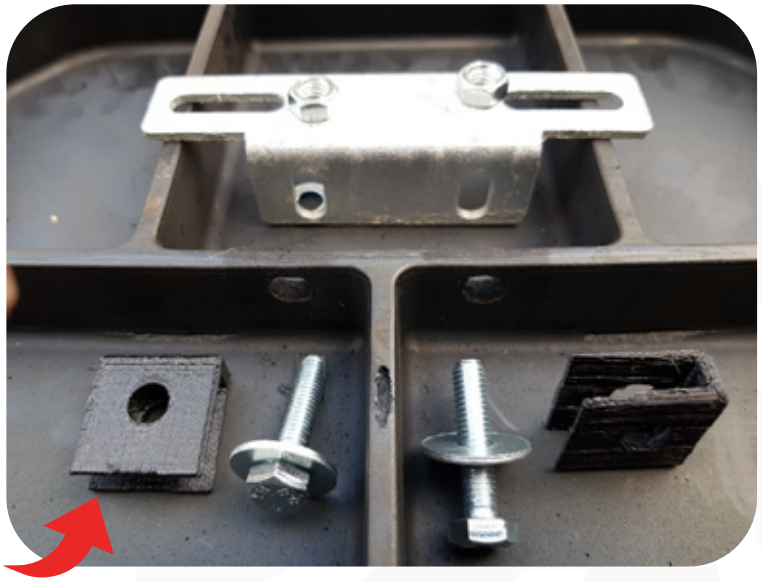

Figure 13: Photo of the bracket components.

Figure 14: Photo of the fixed bracket

Figure 15: Used sanky clamp system to fix rubber sign to timber post.

6. Conclusion

After monitoring the rubber sign mould for 6 months, in a horizontal position exposed to ambient sunlight, no ultraviolet (UV) degradation i.e. fading in colour, loss of strength, premature cracking or disintegration of the rubber could be observed. From the visual inspection, no delamination between the retroreflective material and the rubber mould could be observed after leaving it in the sun for 6 months either.

The signs erected in the road environment were unvandalised and still functioning as expected after the 6 months pilot period which indicates that they did not attract the attention of thieves or vandals for the duration of the pilot project. It is believed that this could be linked to the low scrap value of the signs and that the signs elasticity may be unappealing to vandals.

The manufacturing of recycled rubber roads signs has several benefits:
• Since rubber road signs are made of recycled tyres they do not corrode and can resolve the problem of the corrosion of road signs along South Africa's coastal areas.
• They can reduce the environmental impact of used tyres on landfill sites.

A cost comparison between chromadek and recycled rubber could not be made as the as Eco -signs did not provide the rates for the rubber road signs.

South Africa does not have SANS specification for recycled rubber road signs. To be cover for certification AENOR will have to investigate product certification to SANS for South African firms to be able to offer valid certification.

7. References

Appendix A: AENOR certificate of constancy of performance

AENOR

Certificate of
constancy of performance

CE
0099

0099/CPR/A72/0116

In compliance with Construction Products Regulation 305/2011/EU of the European Parliament and of the Council, of 9 March 2011, the notified body AENOR (n. 0099) has issued this certificate to

RUBBER RECOVERY INDUSTRY S.L.

registered office	PI Eitua, Pab. 70 48249 BERRIZ (Bizkaia - España)
Construction Product	Sign plates for fixed vertical road traffic signs
Harmonised Standard	EN 12899-1:2007
References	Specified in Annex to the Certificate
Production site	PI Eitua, Pab. 70 48249 BERRIZ (Bizkaia - España)
Certification scheme	This certificate attests that all provisions under system 1 concerning the assessment and verification of constancy of performance and the performances described in Annex ZA of the aforementioned harmonised standard are applied and that the product fulfils all the prescribed requirements set out above. This certificate will remain valid until its validity date, provided that the test methods and/or factory production control requirements included in the harmonised standard, used to assess the performance of the declared characteristics, do not change, and the product, and the manufacturing conditions in the plant are not modified significantly. This certificate supersedes A72/000116, dated 2018-07-26
First issued on	2017-07-26
Modified on	2018-09-24
Validity date	2019-07-26

Rafael GARCÍA MEIRO
Chief Executive Officer

Original Electronic Certificate

AENOR INTERNACIONAL S.A.U.
Génova, 6. 28004 Madrid. España
Tel. 91 432 60 00.- www.aenor.com

Control body accredited by ENAC. Accreditation number: 03/C-PR356

AENOR

Certificate of constancy of performance

0099/CPR/A72/0116

Annex to Certificate

Substrate and surface protection of the sign plate	Daylight chromacity & luminance factor	Coefficient of retroreflection	Wind load	Temporary deflection of the sign plate-bending	Dinamic snow load	Point loads	Partial action factor
SEÑAL TRAFICO Mezcla caucho PS10 Y PS25; SP2	CR2	RA1, RA 2 y RA 3	WL3	TDB0	DSL0	PL0	PAF2

First issued on 2017-07-26
Modified on 2018-09-24
Validity date 2019-07-26

Original Electronic Certificate

AENOR INTERNACIONAL S.A.U.
Génova, 6. 28004 Madrid. España
Tel. 91 432 60 00.- www.aenor.com

Control body accredited by ENAC. Accreditation number: 01/C-PR356

environment, forestry
& fisheries
Department:
Environment, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

Waste Bureau
SOUTH AFRICA

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http://www:environment.gov.za, Wastebureau@environment.gov.za

File Reference: WMB
EDMS Reference: Hard Copy
Enquiries: Ms Girly Kgoetego
Tel: (012) 399 9871 **Email:** GKgoetego@environment.gov.za

Dear Sir/Madam

TO WHOM THIS MAY CONCERN

The Waste Management Bureau supports Itraffic as an innovative company manufacturing road signs called Eco signs with recycled tyres.

The Bureau is willing to work with Itraffic with its Eco sign initiative as Waste Tyres in South Africa have been piling up with no use, which poses a huge problem for the environment. Being able to recycle waste tyres and make great use of it will surely play a huge role in solving one of our enviromental issues.

Eco signs are eco friendly. The Waste Management Bureau supports and promotes Eco Friendly products.

Yours sincerely

Ms Nosipho Ngcaba
Director-General
Department of Environmental Affairs
Letter Signed by: Dr V Msimang
Designation: Executive Manager: Business Development (Waste Management Bureau)
Date:09 July 2020

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