TECHNION RESEARCH AND DEVELOPMENT FOUNDATION LTD.
BUILDING AND INFRASTRUCTURE TESTING LABORATORY
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מוסד הטכניון למחקר ופתוח בע"מ
ה מ ב ד ק ה ל ב נ י ן ו ת ש ת י ת
מעבדה מרכזית

PROJECT No: 52/1810/2001/1.(Ofirbiancoleteng.)

CERTIFICATE OF TESTS and MEASUREMENTS

of SOLAR POWERED RETROREFLECTIVE ROAD STUDS .

EXPERTISE on

ACTIVE (intelligent) CAT EYES

Product design and development—MIRACLE IND. CO. LTD. KOREA

Specimen 1 : SOLAR MIRACLE—Model M.S. 162F(M)

Specimen 2 : SOLAR MIRACLE—Model M.S. 200 SERIES

- The original test report is in Hebrew.
- This certificate is not an exact translation of the reports number 52/1810/2001 dated April 2001 and report number 52/1810/2001/1 dated June 2001 nevertheless includes all paragraphs of the above mentioned documents.
- This document includes full details of testing requirements.
- This report refers only to the specimens tested.

This certificate is authorized by Georgee Birnbaum C.E. M.Sc.

The expertise was requested by B. O. L Inter Trade.

P.O. B. 6152 Haifa 31061 Israel

November 2001

סניפים: חיפה 04-8225181 פקס. 04-8220208 נצרת עלית 06-6556741 פקס. 06-6564296 ק.ביאליק טלפקס. 04-8761039 כרמ'אל טלפקס 04-9884295
קרית שמונה טלפקס. 06-6951202 חדרה טלפקס. 06-6346497 נתניה 09-8619046 פקס. 09-8820942 רחובות: 08-9362474, פקס. 08-9362475 ירושלים: טלפקס. 02-6521837

1. GENERAL

1.1. SOLAR MIRACLE—Model M.S. 162F(M)- specimen 1- yellow panel

SOLAR MIRACLE—Model M.S. 200 SERIES specimen 2 - white and yellow panel

The above specimens (1 and 2) were tested.

1.2 The tests were made according to the following standards and specifications. At this time there is no available Israel standard. The specimens were tested according to the following standards:

- EN 1463-1 European Standard 1997- Road Marking Materials- Retroreflecting Road Studs. Part 1. Initial Performance Requirements.
- C.I.E. Commission Internationale de l' eclairage- Recommendation for Surface Colours for Visual Signalling Publication C.I.E. No 39-2 1983 (2^{nd} ed.)
- Hewlett Packard GmbH Publication No ECO 02 03/98 – High Brightness Selection Guide.
- EN 60529 1991 . Degrees of Protection Provided by Enclosures (IP code) .
- C.I .E. Publication No 54 1982 Retroreflection Definition and Measurement.
- C.I.E. Technical Com. Report No 72 . Guide to the Properties and Uses of Retroreflectors at Night.
- CEN/TC 226 Road Equipment pr EN 12352
- Israeli Standard 2247 Vertical Traffic Signs : Retroreflective Traffic Signs Part 1.1 and 2.same as the C.E.N 12899-1

The test certificates were submitted by the Korean authorized producer FITI TESTING & RESEARCH INSTITUTE . The tests were conducted according to the Specification of TRAFFIC SAFETY & FACILITIES INSTALLATION . The products were accepted by the TUV TEST REPORT E2010718E01 From German lab.

1.3. Specification of the solar road stud – specimen1 and specimen 2

1.3.1.Model M.S. 162F(M)- specimen 1 double side FLASHING

1.3.2. Model M.S. 200 SERIES specimen 2 double side FLASHING

1.3.3.Flashing Times 120/minute specimen1

1.3.4.Flashing Times 180/minute specimen2

1.3.5.Dimensions:

- 150 x 120 millimeter – head of the road stud -- specimen 1
- 132 x 122 millimeter- head of the road stud -- specimen 2
- Height of the road stud head specimen 1: 30 millimeter- specimen 1
- Height of the road stud head specimen 2: 20 millimeter- specimen 2

The following values are related to specimen 1 and specimen 2.

1.3.6.Weight 700 g.

1.3 .7 .Solar output 0.35 W of each specimen

1.3.8. High intensity emitting diode—LEDs No technical specification was available .

1.3.9.Colour –yellow- specimen1, white and yellow- specimen 2.

1.3.10. Quantity on each panel –2pcs.

1.3.11. Output/led (luminous intensity) 5000 mcd.

1.3.12..Power current 12-16 mA/hour.

1.3.11.Material of Upper Parts : Clear Polycarbonate.

1.3.13. Material of Lower parts: Aluminum Alloy.

1.3.14. Charge Ability 110- 120 mA/hour with Nickel cadmium batteries.

2. TESTS and MEASUREMENTS PERFORMED

2.1.Photometric Performance: Retroreflective Sheet

2.1.1.Color of lenses: yellow – colorimetric system in accordance with C.I.E. publication 15.2-

- Specimen 1

Chromaticity coordinates : x = 0.5193, y = 0.4686: luminance factor 0.222. The limits of the chromaticity coordinates specified in C.E.N Standard12899-1 –

- Specimen 2 (white and yellow panel)

Chromaticity coordinates : x = 0.350, y = 0.360: luminance factor 0.765. The limits of the chromaticity coordinates specified in C.E.N Standard12899-1 –

Chromaticity coordinates : x = 0.520, y = 0.4700: luminance factor 0.201. The limits of the chromaticity coordinates specified in C.E.N Standard12899-1 –

The test were performed with Hunter spectrometer , geometry of measurements 0/45.

SATISFACTORY TO STANDARD

2.1.2 .Coefficient of retroreflection :mcd/lux/m2 (after CEN 12899-1) yellow –specimen 1

Observation angle→ Incident angle↓	02°	0.33°	2.0°
5°	**340**	**240**	**6**
30°	**200**	**140**	**3**
40°	**140**	**120**	**2**

The retroreflection values in the table are not applicable for road studs embedded in asphalt.

The test were performed with L.M.T. goniometer 2000 ,

2.1.3 .Coefficient of retroreflection :mcd/lux/m2 (after CEN 12899-1) white – specimen 2

Observation angle→ Incident angle↓	03°	0.33°	2.0°
5°	**220**		
10°		**28**	
15°			**5**

2.1.4 .Coefficient of retroreflection:mcd/lux/m2 (after CEN 12899-1)yellow- specimen 2

Observation angle→ Incident angle↓	03°	0.33°	2.0°
5°	**110**		
10°		**17**	
15°			**2**

SATISFACTORY TO STANDARD

2.2 Photometric performance of the flashing panels.

2.2.1. Luminance of the flashing panel at peak of flash:yellow **11 cd/m2 and white 15 cd /m2**

2.2.2. Luminance of the flashing panels at peak flash after immersion in water during

1 hour: yellow **10 cd/m2 and white 13 cd/m2**

2.2.3. Luminance of the flashing panels at peak flash after 4 days immersion in salt water:

yellow **9.8 cd/m2 and white 12 cd/m2**

The test were performed with Minolta luminance meter .

SATISFACTORY TO STANDARD

No corrosion was observed . High degree of protection. Good resistance to weathering.

2.2.4. Colors of the light signals: yellow and white

The tests were performed with Minolta chromameter.

SATISFACTORY TO STANDARD

2.3 . Impact test with solid steel ball mounted on pendulum:

SATISFACTORY TO STANDARD

2.4. Impact test: free fall of flashing road stud (actively flashing) from a height of 1.0 m to concrete floor--- good structural performance- unbreakable.

SATISFACTORY for the visual and mechanical function of active road studs

(Cat eyes.)

2.4. The external surface of the solar road studs was completely weatherproof .

2.5. Universal mounting system

2.6. Viewing distance: on straight road : 900 m

2.7 Ambient illumination level for start of flashing: 100 lux.

3. SUMMARY

THE TESTED ROAD STUDS of all the specimens ARE FULLY COMPLIANT WITH STANDARDS.

Georgee Birnbaum C.E. M.Sc