

AMAC

Road Infrastructure Mobile Survey Technologies



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Bringing Technology to Highways Asset Management

Ex Local Authority Highway Engineer – 38 years

On the IHE Highways Inspectors Training Board

What is AMAC Europa?

- It is joint venture by the Cidaut Foundation and DBi Services.
- **What Technologies are available?**
- Road Markings and Road Stud Retroreflectivity Survey to BS EN 1436 and TD 26/17 (Design Manual for Roads and Bridges)
- Road Sign Retroreflectivity Survey to TD 25/15 (Design Manual for Roads and Bridges)
- Street Light Illumination Survey to BS EN 13201-4 and TD 34/07
- 360 degree Asset Inventory Video Survey
- **LiDAR**
- **Data Capture**
- Is performed from a vehicle travelling at road speed.
- There is no requirement for Traffic Management.



CIDAUT, is a private non-profit Foundation, registered and recognized as Technology Center, whose activities are developed in the field of the transport and energy sectors

400 Industrial clients

72 Millions Euros
 R&D facilities and equipments

222 Research staff
 (70% bachelors degree)

23,304 m²
 total surface

3 Headquarters
 Spain, Germany and México

14 New Technology Based Firms

36 Patents



Our main goal is to **increase competitiveness** and **industrial development** of companies operating in the **Transport and Energy Sectors**

Research, Development and Innovation
Technology Transfer
Training

automotive



energy



railway



environment



aeronautic





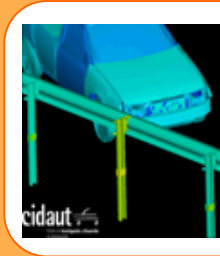
Safety on Transport

- Vehicle
 - Active safety
 - Passive safety
- Road infrastructure
- Accidentology

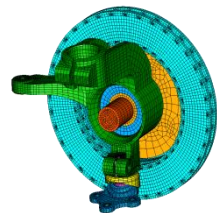
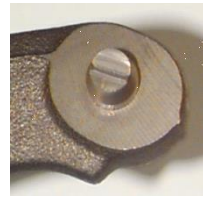
- Automotive
- Aeronautic
- Railway



ACCIDENTOLOGY



ROAD INFRASTRUCTURE



Support Systems to Avoid Accidents

ACTIVE SAFETY



○ frontal safety



○ side safety



○ head impact



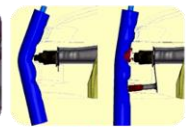
○ whiplash



○ structure subsystems



○ out of position

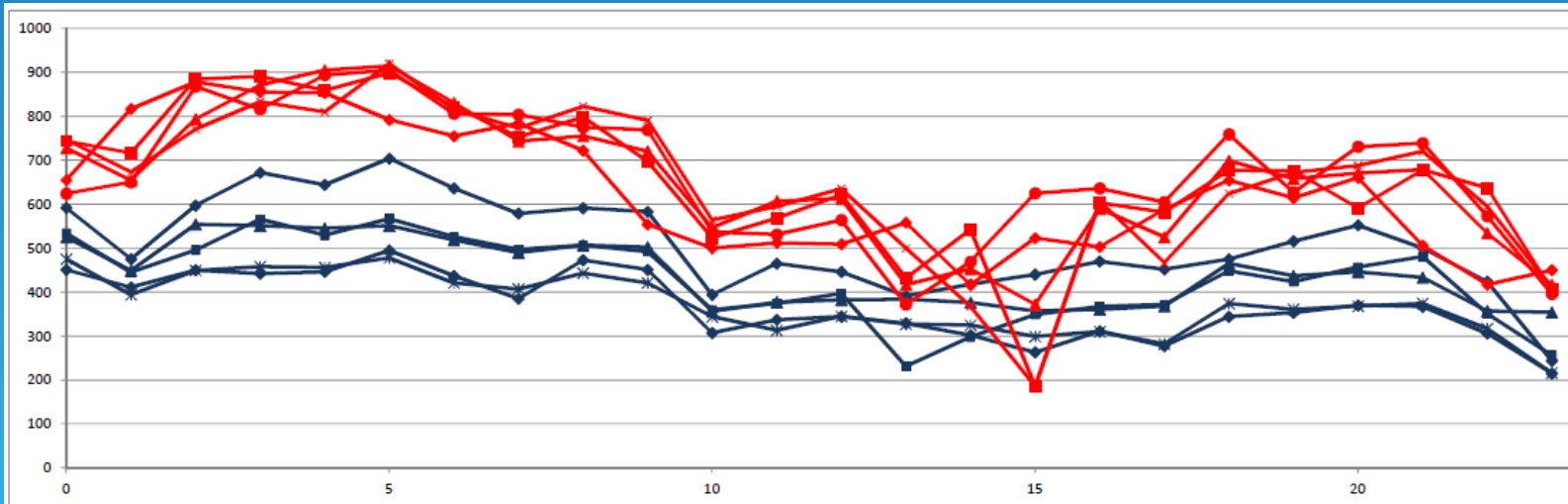


○ pedestrian

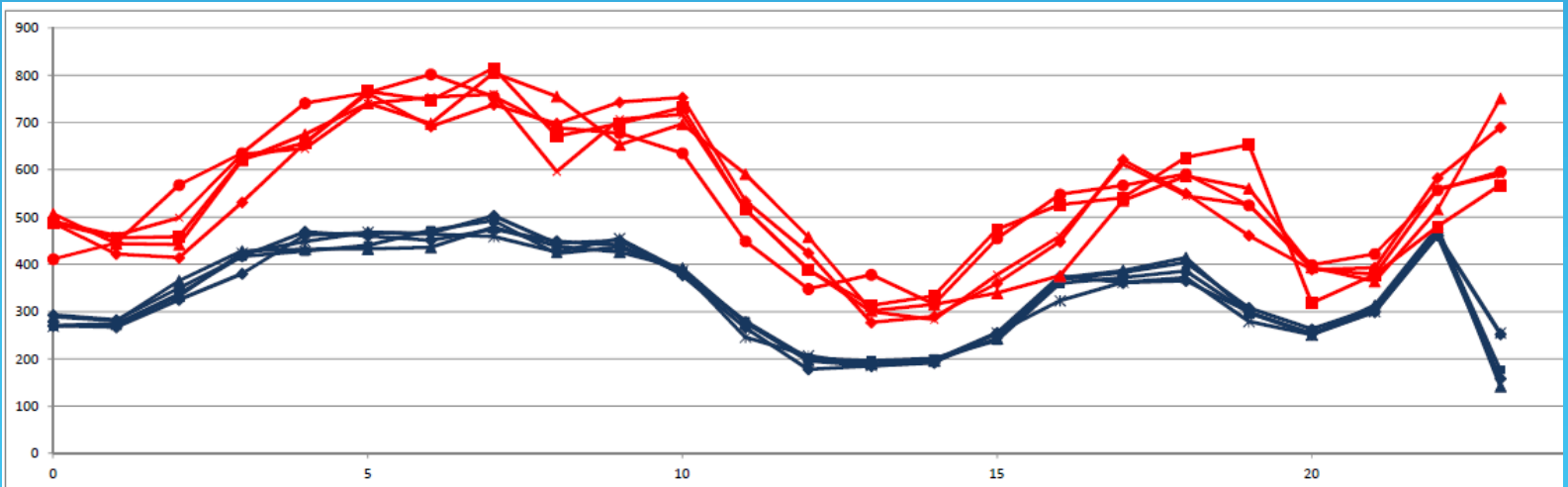
Support Systems for reducing the consequences beyond accidents

PASSIVE SAFETY

AMAC – Pavement Marking Dynamic Survey

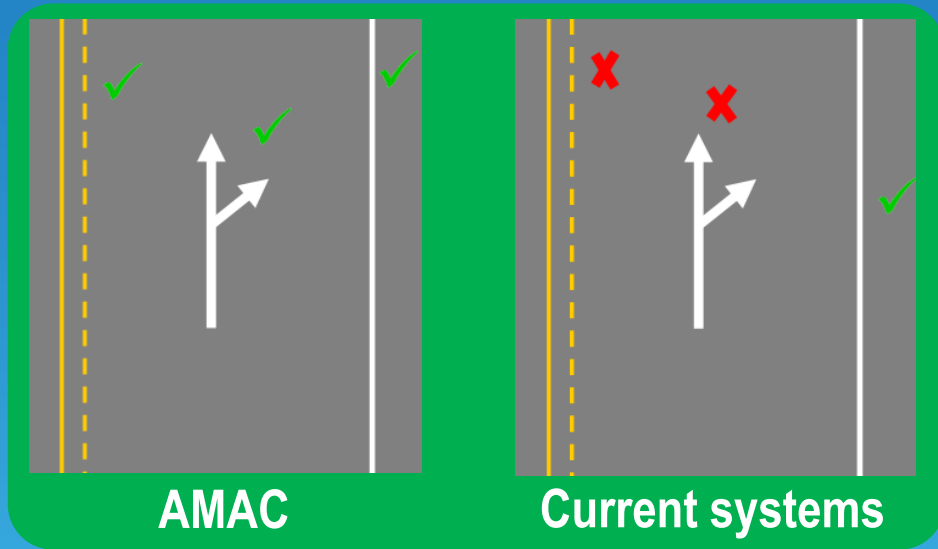


No accuracy
No repeatability



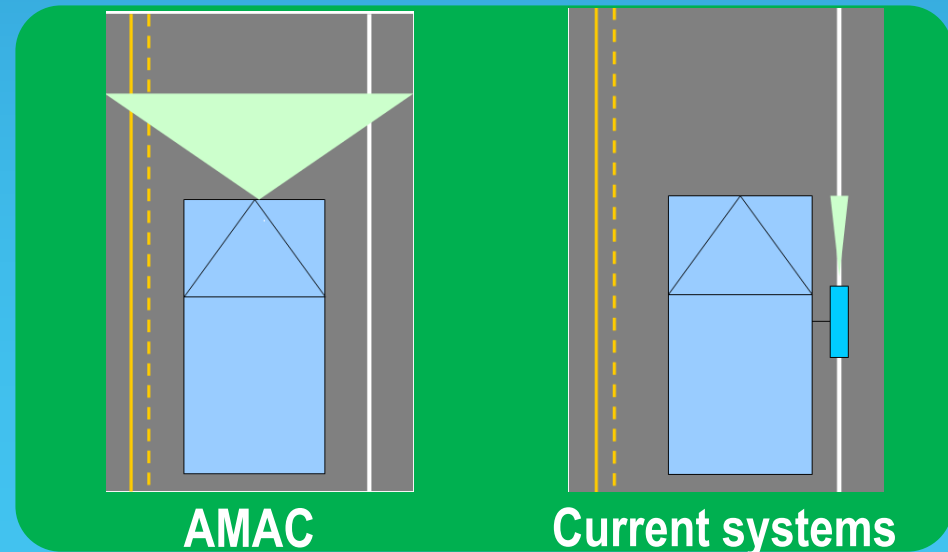
Repeatable
Accurate?

AMAC – Pavement Marking Dynamic Survey



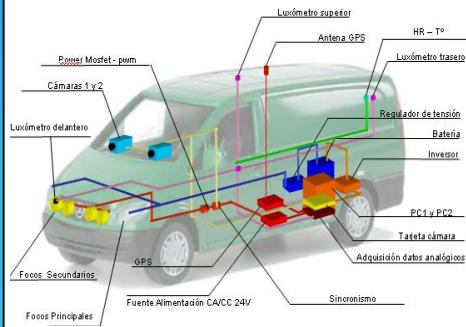
**Simultaneous measurement
of adjacent lines to lane**

**Independent of operator
(Transversal range = 5 m)**

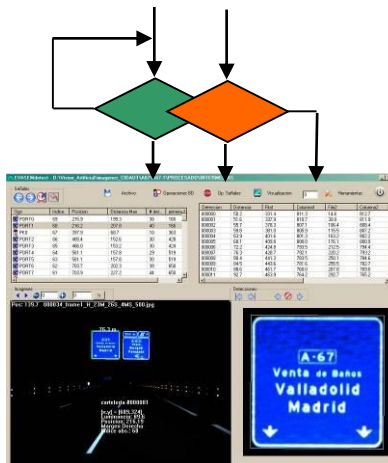


COMPONENTS

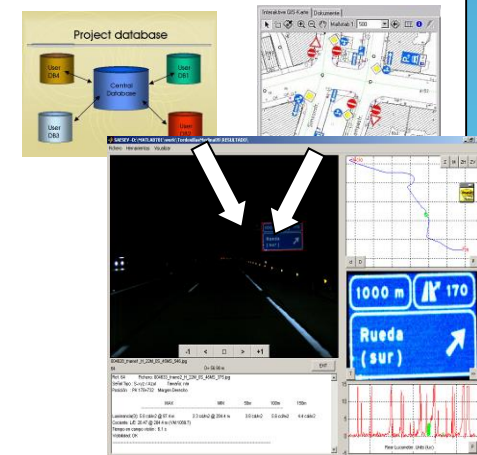
Mobile Survey vehicle



Post-processing software



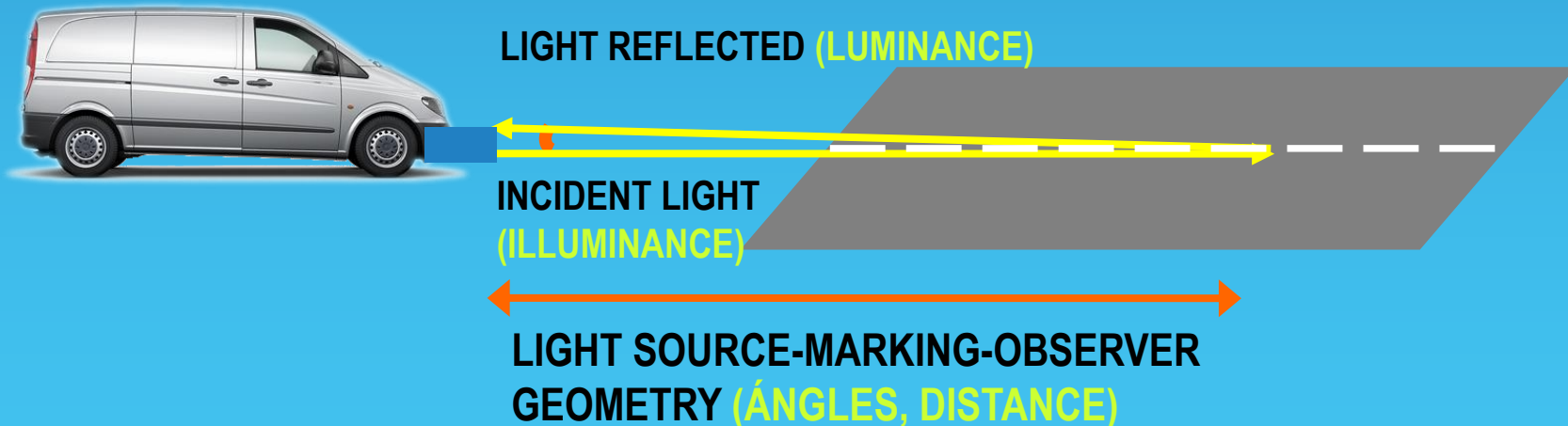
Deliverables (display software, shapefile, excel...)



Retroreflectivity measurement according to EN 1436 (30 m geometry)

Observation angle = 2,29°; Entrance angle = 1,24°

$$R' = L / E \text{ mcd}/(\text{lx}\cdot\text{m}^2)$$

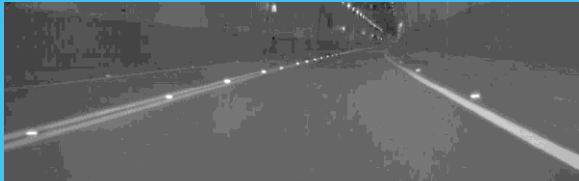


• Pavement marking costs optimization

- Warranty check
- Acceptance of installed materials
- Remaining useful life estimation
- Forecast of future investments
- Measurement of performance based maintenance contracts

• Pavement marking complete inventory:

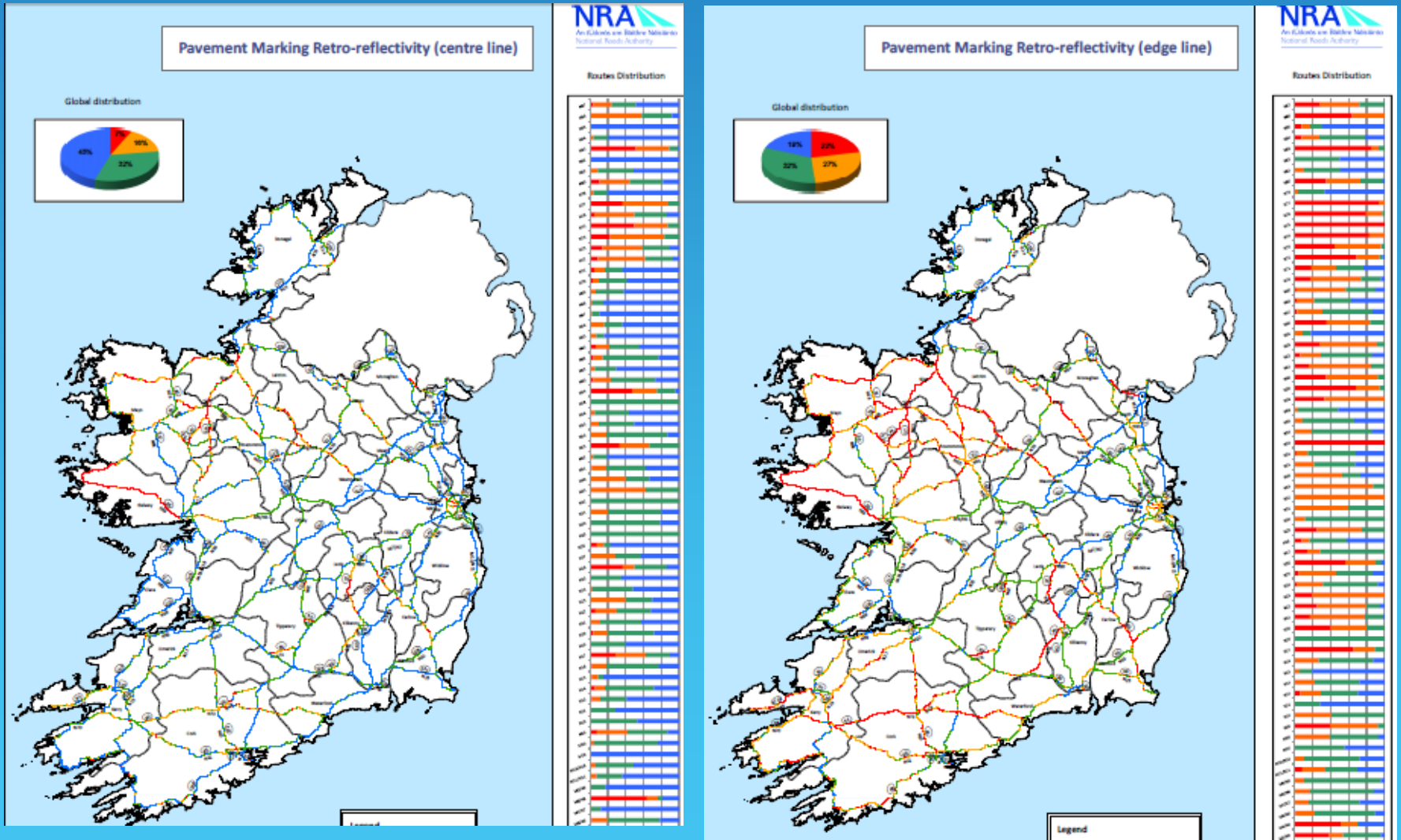
- Retroreflectivity of all lines according to EN 1436.
- Pavement marking symbols retroreflectivity (also EN 1436)
- Measurements every meter (average ranges customizable).
- Road Studs assessment
- GPS position (beginning/end) of every type of line (solid, broken, single, double)
- HAPMS & GIS data integration



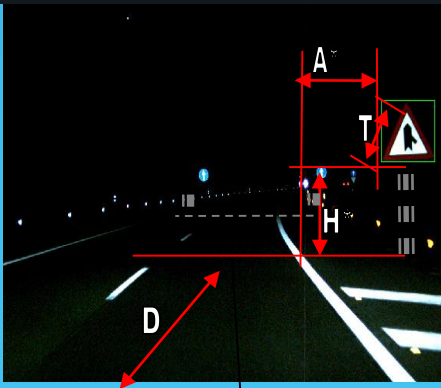
AMAC – Pavement Marking Dynamic survey

Network level decision tools

- Investment planning at short, medium and long term



- **Traffic signs maintenance costs optimization**
 - Warranty check
 - Acceptance of installed materials
 - Remaining useful life estimation
 - Forecast of future investments
 - Measurement of performance based maintenance contracts
- **Traffic signs complete inventory:**
 - Retroreflectivity of all colours for post-mounted and overhead signs.
 - Sign GPS position.
 - Sign size
 - Height and offset to carriageway edge
 - HAPMS & GIS data integration
 - Sign code



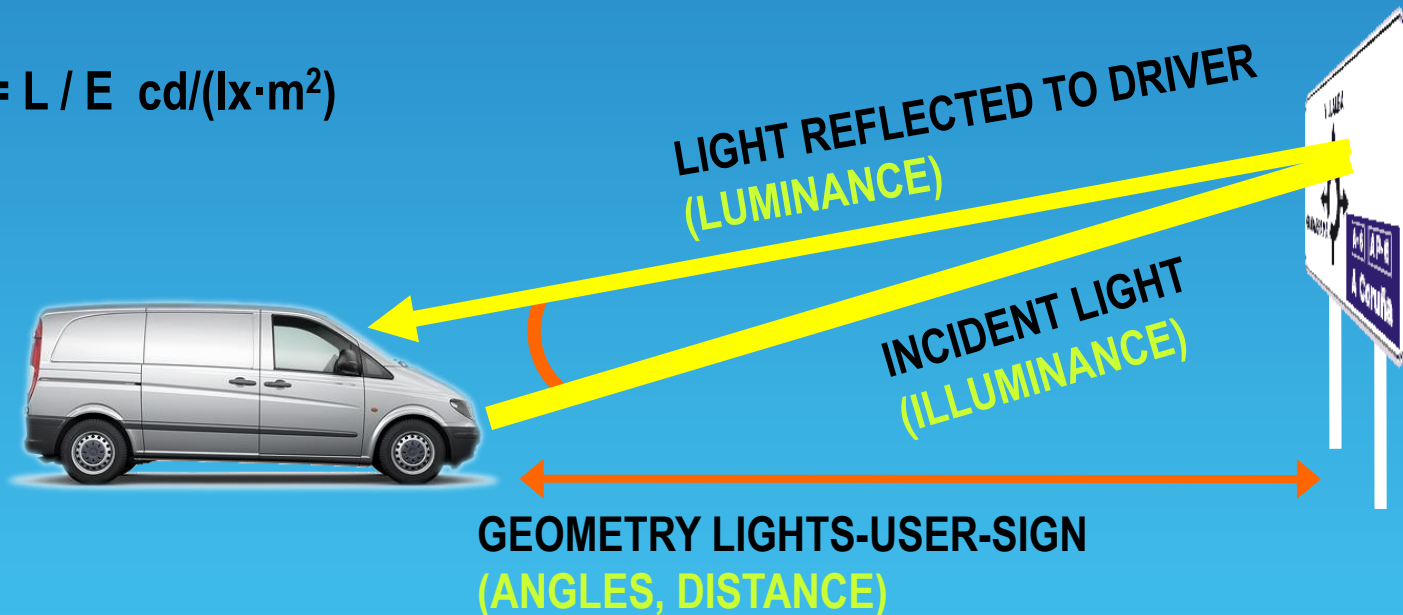
RETROREFLECTIVITY = NIGHTTIME VISIBILITY



RETROREFLECTIVITY

Retroreflectivity measures the capacity to **reflect** the light from vehicle lamps to the driver making the sign **visible**

$$R' = L / E \text{ cd}/(\text{lx}\cdot\text{m}^2)$$



To get its value, is necessary to measure the **luminance**, **illuminance** and the **geometry**.

ACCURACY



	Background retro	Legend retro
Handheld	20,3	173,5
AMAC	18,5	163,7



	Background retro	Legend retro
Handheld	166,3	
AMAC	173,7	

AMAC 360° (Inventory and Condition Assessment)



AMAC 360° (Inventory and Condition Assessment)



- 6 images captured simultaneously
- 360 degree field of view
- All imagery rectified and GPS referenced
- Point feature mapping
- Linear mapping and measurements
- Attribution
- Provides quantitative and qualitative analysis of highway structure and furniture.
- Exports into GIS or Maintenance Management Systems
- Integrates with sign and pavement retroreflectivity data

AMAC 360° (Inventory and Condition Assessment)

Project icc-000000

- Clip Manager
- List of clips (1)
- icc-000000

Layer Form

Sign

Field	Value
GPS Date	23/07/2014
X	-74.681265
Y	40.295579
Z	10.678691
Heading	42.56
Extraction Date	08/12/2014
Frame Number	2367
Roadway	Route 1
Height	8.27
Width	14.11
Placment	Overhead
Category	Guide
Condition	Good
Reflective Strip	No
Position on Post	Top
Post Structure	Non-breakaway
Post Condition	Good
Sign Damage	nil

Item ID 11

Copy Paste

Close All Close Ok Apply



Configuration 2D Analysis GIS

Message Log

AMAC 360° (Inventory and Condition Assessment)



Configuration 2D Analysis GIS

Layers:

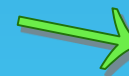
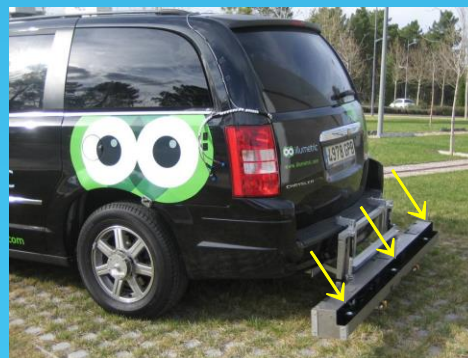
- Defensas
- Obras de Fabrica
- Postes



Lon	-100.00660	Lat	26.513960	Alt	217.990007
dXY	3.70	dZ	0.11	dXYZ	3.70

Illuminance measurement

- Illuminance is directly measured according to the EN 13201-4 standard by means of a proprietary method developed at CIDAUT (Patent pending)
- Two sets of lux-meters are placed on the frontal and rear ends of the vehicle. The effective illuminance at a point is calculated from the contributions on both sides of the vehicle.
- Three pairs of lux-meters (left, central and right positions) are used in order to obtain complementary measurements according to the grids specified by the current standards.



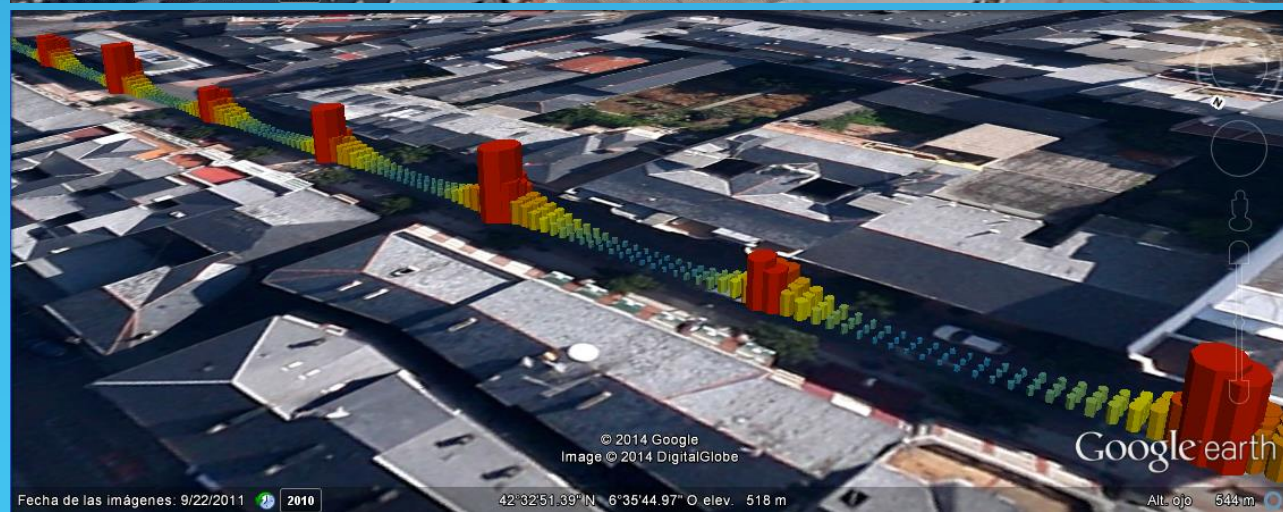
Position and light source identification

- High precision GPS receiver
- Additional Inertial Navigation System for positioning in places with low or null GPS signal (e.g. tunnels)
- Light sources identified and positioned by means of stereoscopic image analysis. Latitude, longitude, height from the floor and inter-distance of the light sources are calculated.
- Applications:
 - Geotagging of light measurements
 - Light sources geo-tagged inventory



Illuminance Measurement

Resultant illuminance values (as well as other measured magnitudes) can be stored as “Illuminance maps” in KML format and easily represented in geographical software such as Google Earth



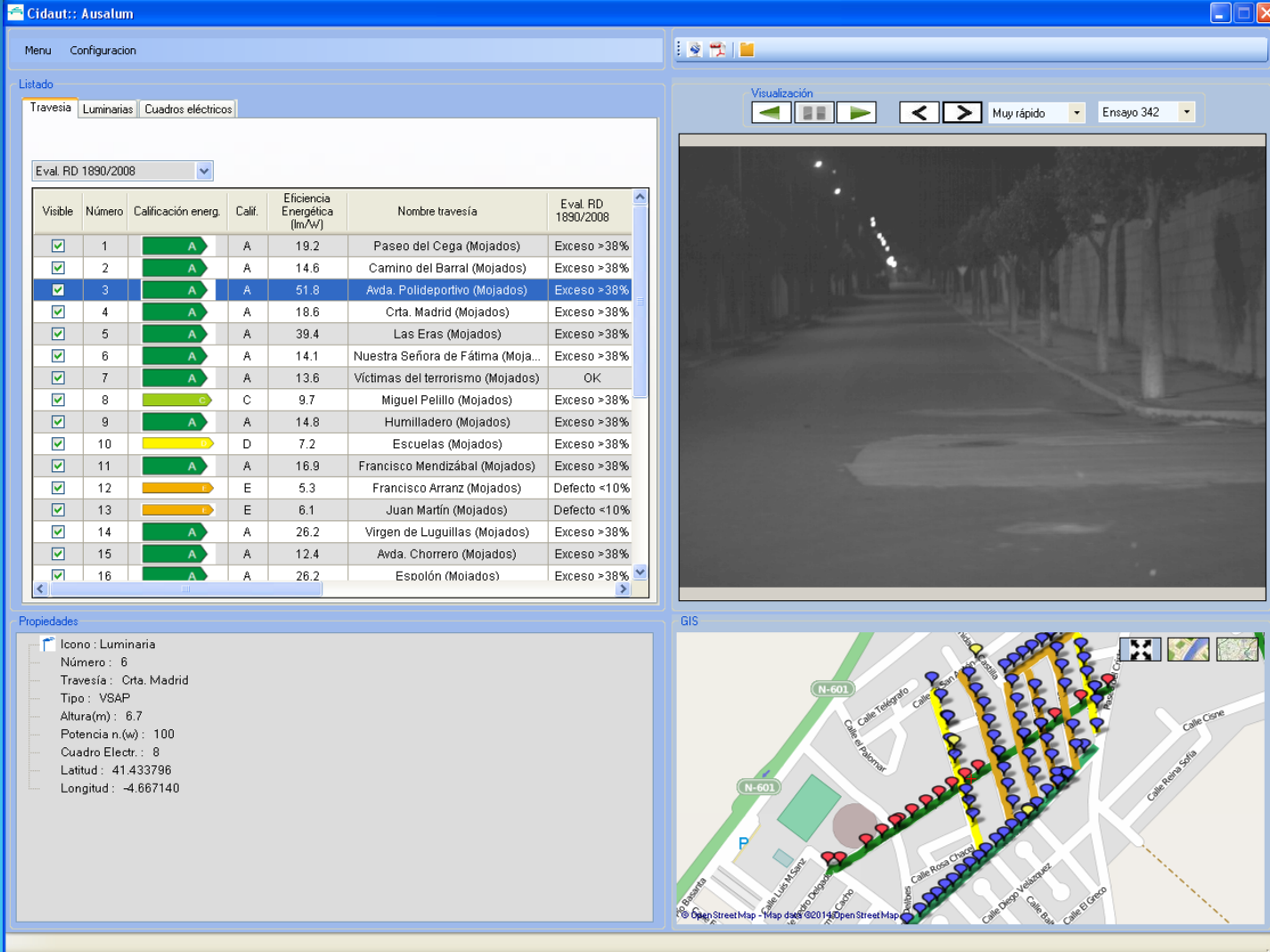
Typical Outputs



- Luminance and illuminance values
 - Geo-tagged measurements (light maps)
 - Related parameters: Averaged values, uniformities,...
- Light points Inventory
 - Positioning latitude, longitude and height)
 - Interdistance
 - Light type (LED, HPS, MH,...) and spectrum
- Energy efficiency and consumptions
 - Additional measurements or data required
 - Control boxes inventory and characterization
 - Energy efficiency per street or group of luminaries
 - Energy efficiency audits
- Consultancy services
 - Definition of actions
 - Investment prioritization
 - Maintenance plans

Typical outputs

Viewer software provided as a part of the results



Cidaut:: Ausalum

Menu Configuración

Listado

Travesía Luminarias Cuadros eléctricos

Eval. RD 1890/2008

Visible	Número	Calificación energ.	Calif.	Eficiencia Energética (lm/W)	Nombre travesía	Eval. RD 1890/2008
<input checked="" type="checkbox"/>	1	A	A	19.2	Paseo del Cega (Mojados)	Exceso >38%
<input checked="" type="checkbox"/>	2	A	A	14.6	Camino del Barral (Mojados)	Exceso >38%
<input checked="" type="checkbox"/>	3	A	A	51.8	Avda. Polideportivo (Mojados)	Exceso >38%
<input checked="" type="checkbox"/>	4	A	A	18.6	Crta. Madrid (Mojados)	Exceso >38%
<input checked="" type="checkbox"/>	5	A	A	39.4	Las Eras (Mojados)	Exceso >38%
<input checked="" type="checkbox"/>	6	A	A	14.1	Nuestra Señora de Fátima (Moja...	Exceso >38%
<input checked="" type="checkbox"/>	7	A	A	13.6	Victimas del terrorismo (Mojados)	OK
<input checked="" type="checkbox"/>	8	C	C	9.7	Miguel Pelillo (Mojados)	Exceso >38%
<input checked="" type="checkbox"/>	9	A	A	14.8	Humilladero (Mojados)	Exceso >38%
<input checked="" type="checkbox"/>	10	D	D	7.2	Escuelas (Mojados)	Exceso >38%
<input checked="" type="checkbox"/>	11	A	A	16.9	Francisco Mendizábal (Mojados)	Exceso >38%
<input checked="" type="checkbox"/>	12	E	E	5.3	Francisco Arranz (Mojados)	Defecto <10%
<input checked="" type="checkbox"/>	13	E	E	6.1	Juan Martín (Mojados)	Defecto <10%
<input checked="" type="checkbox"/>	14	A	A	26.2	Virgen de Luguillas (Mojados)	Exceso >38%
<input checked="" type="checkbox"/>	15	A	A	12.4	Avda. Chorrero (Mojados)	Exceso >38%
<input checked="" type="checkbox"/>	16	A	A	26.2	Espolón (Mojados)	Exceso >38%

Propiedades

Icono: Luminaria

Número: 6

Travesía: Crta. Madrid

Tipo: VSAP

Altura(m): 6.7

Potencia n.(w): 100

Cuadro Electr.: 8

Latitud: 41.433796

Longitud: -4.667140

Visualización

Muy rápido Ensayo 342

GIS

Map showing street layout with luminaires (represented by colored dots) overlaid on a GIS map. Streets include Calle Telegrafal, Calle Palmeras, Calle Rosa Chanco, Calle Diego Velázquez, Calle Isaac, Calle El Greco, Calle Reina Sofia, Calle Cine, and N-601.

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<http://www.cidaut.es/en/>

