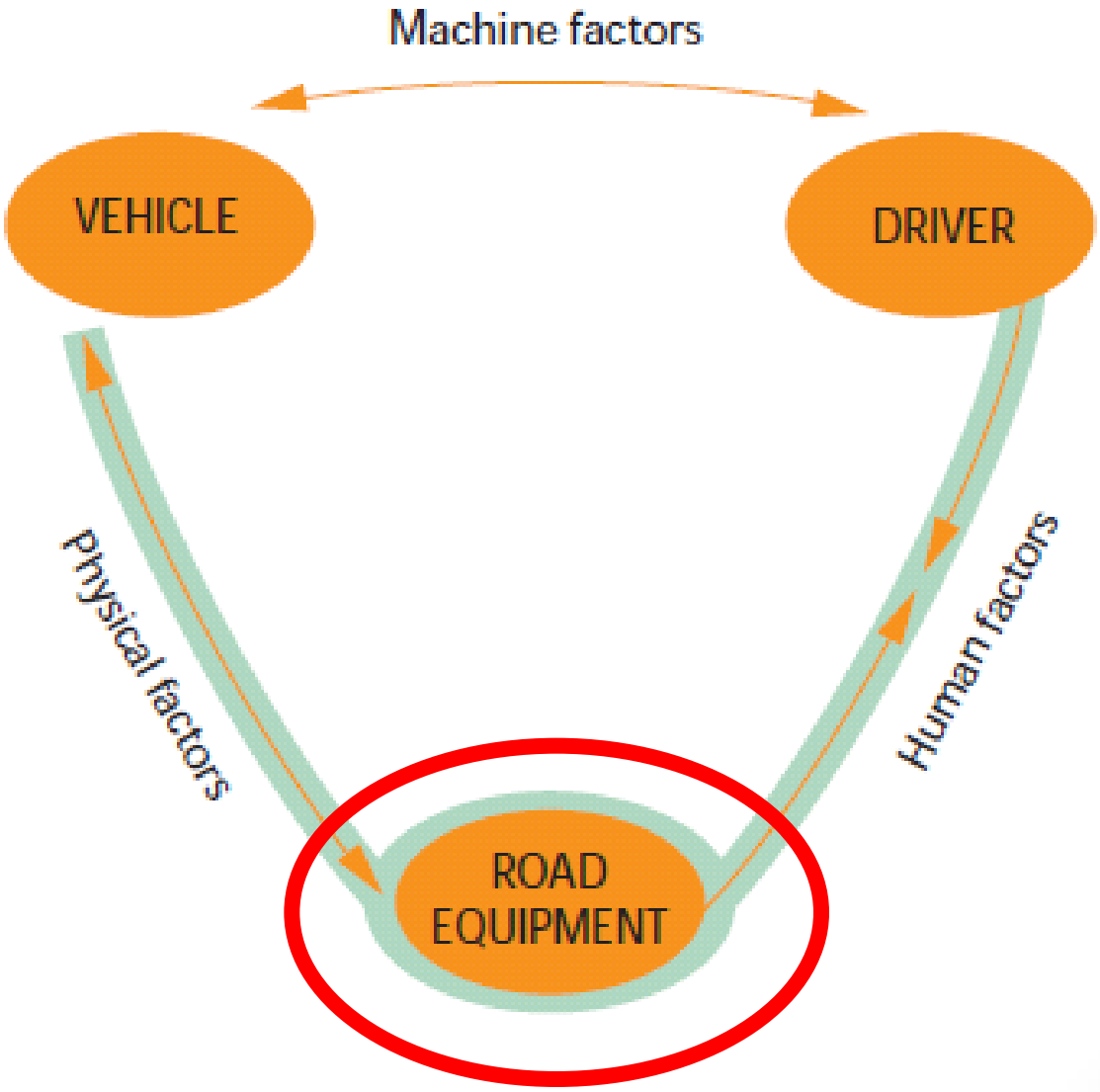
Creating “forgiving” roadsides by using passive safe road equipment EN12767

Carolien Willems
Member WG10, TC226 of EN12767
Developer of the ZIPpole
Director and co owner Safety Product

SAFETY-PRODUCT

www.safety-product.eu
www.zippole.com

Road safety =


Machine factors
VEHICLE
DRIVER
Physical factors
Human factors
ROAD
EQUIPMENT

In road design, allowances need to be made that can help compensate for human error, and roads and roadsides are built in such a way that their physical characteristics minimize potential harmful consequences to all.

World Health Organization

DECADE OF ACTION FOR ROAD SAFETY 2011-2020

VISION ZERO INITIATIVE
TRAFFIC SAFETY BY SWEDEN

Vision zero: "in every situation, a person might fail, the roadsystem should not"


Andere
richtingen

Road equipment

- to improve traffic safety and social safety

- close to the road to be “seen”
  - can they be an obstacle in an accident ?

  - how to design safe roadsides?
  - how to handle obstacles close to the road?
    - why taking care of obstacles close to the road?






Creating “forgiving” roadsides by using passive safe road equipment (EN12767)

- Explanation on the standard
- When using passive safe poles?
- What type of safe poles?
- Choosing the right product

Road equipment

- to improve traffic safety and social safety

- close to the road to be “seen”
  - can they be an obstacle in an accident ?

  - how to design safe roadsides?
  - how to handle obstacles close to the road?
    - why taking care of obstacles close to the road?

Creating “forgiving” roadsides by using passive safe road equipment (EN12767)

- Explanation on the standard
- When using passive safe poles?
- What type of safe poles?
- Choosing the right product






Accidents do happen but do the consequences have to be so bad ?


90

Road equipment

- to improve traffic safety and social safety

- close to the road to be “seen”
  - can they be an obstacle in an accident ?

  - how to design safe roadsides?
  - how to handle obstacles close to the road?
    - why taking care of obstacles close to the road?

Creating “forgiving” roadsides by using passive safe road equipment (EN12767)

- Explanation on the standard
- When using passive safe poles?
- What type of safe poles?
- Choosing the right product






How to design safe roadsides?

This philosophy of a "forgiving road" is the mere recognition that road users sometimes leave the running carriageway for explainable or unexplainable reasons.

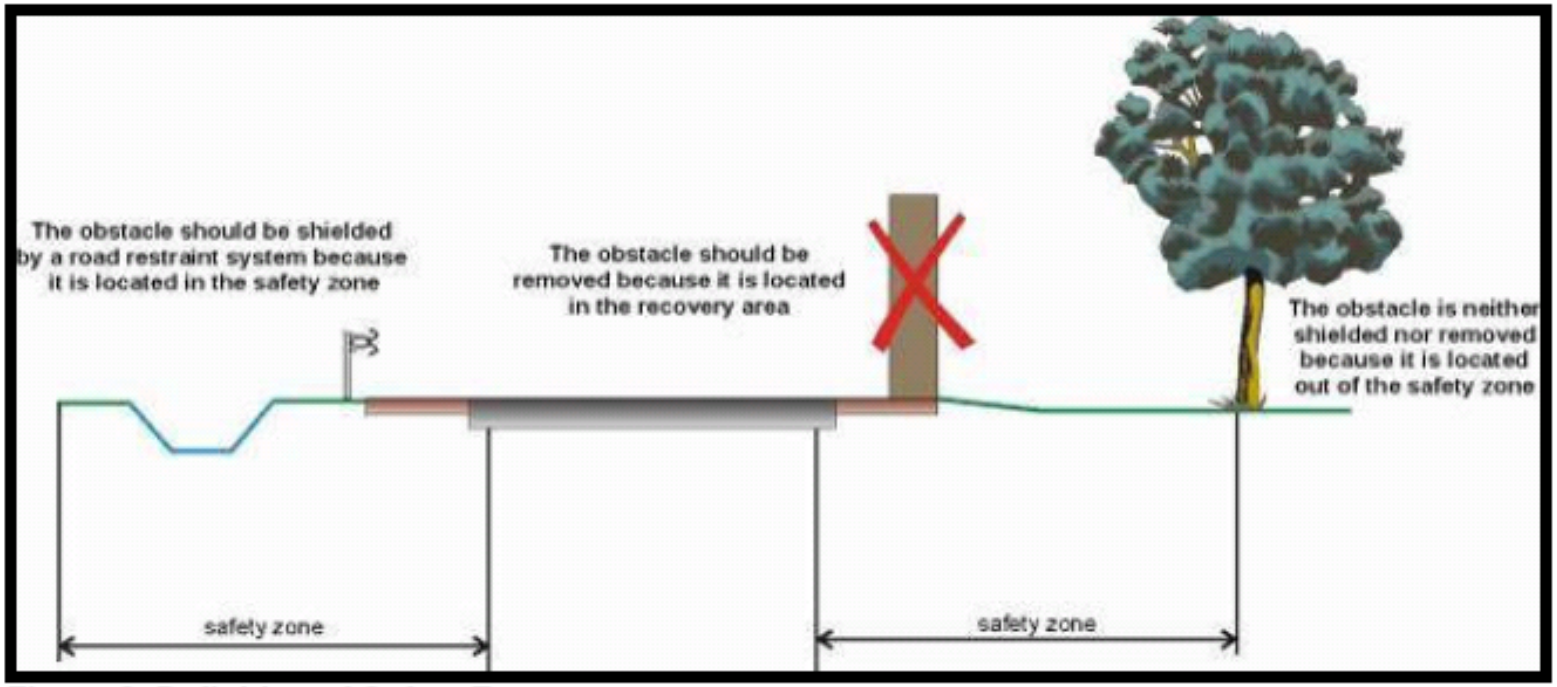


Figure 3. Definition of Safety Zone

Safety zone = recoveryzone + stop zone

Recovery zone: small hardened zone to recover to get back on the road
Stop zone: zone to stop carefully, flat to avoid risk to roll over, without obstacles

Safety zone = recoveryzone + stop zone

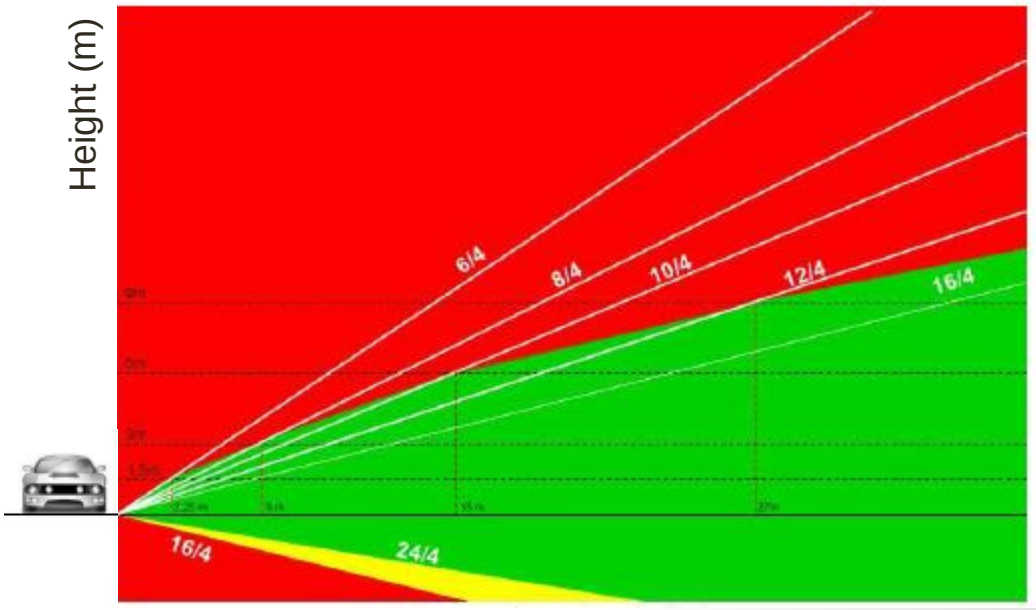
Example, AWV Belgium

http://www.vsv.be/sites/default/files/2._lichtvisie_en_vergevingsgezindheid_van_wegen_-_video.pdf

design speed	middle of the road	slope < 24/4					design speed	middle of the road	24/4 < slope < 16/4				
		straight on	curve						straight on	curve			
			standard		special for motorcycles					standard		special for motorcycles	
km/h			100<R<1000	R<100	100<R<1000	R<100	km/h			100<R<1000	R<100	100<R<1000	R<100
50	5m	1,5m	2,08m	2,67m	3,54m	3,83m	50	5m	3m	4,17m	5,33m	7,08m	7,67m
70	10m	3m	4,17m		7,08m		70	10m	6m	8,33m		14,17m	
90	16m	4,9m	6,75m		11,38m		90	16m	9,8m	13,5m		22,75m	
120	29m	8,6m					120	29m	17,2m				

Safety zone:
size depending on:

- Speed limit
- Curves
- Slopes
- Amount of roadusers
- Type of roadusers



Road equipment

- to improve traffic safety and social safety

- close to the road to be “seen”
  - can they be an obstacle in an accident ?

  - how to design safe roadsides?
  - how to handle obstacles close to the road?
    - why taking care of obstacles close to the road?

Creating “forgiving” roadsides by using passive safe road equipment (EN12767)

- Explanation on the standard
- When using passive safe poles?
- What type of safe poles?
- Choosing the right product






How to handle obstacles close to the road?

1. REMOVE — trees to the woods

2. MAKE THEM FORGIVING — no trees but bushes
roadinfrastructure: lights, signs, …

3. ISOLATE — isolate bridgepilars with guardrails

Why taking care of obstacles close to the road?

What happens in an accident while hitting an obstacle?

- Damaging the car, the passanger space
- Slowing down too abruptly






3 impacts in an accident:

when the car hits the obstacle:

deformation by the car to absorb partly the impact

when the passanger hits the interior of the car

well attached seatbelt to avoid hitting the steering wheel or the window and activation of the airbag

when the organs bump into each other and human tissue threats to implode

creating a longer distance to slow down in a controlled way






Road equipment

- to improve traffic safety and social safety

- close to the road to be “seen”
  - in “the safety zone” ?
  - obstacles ?

  - how to design safe roadsides?
  - how to handle obstacles “in the safety zone”?
    - why taking care of obstacles close to the road?

Creating “forgiving” roadsides by using passive safe road equipment (EN12767)

- Explanation on the standard
- When using passive safe poles?
- What type of safe poles?
- Choosing the right product






EN 12767, passive safety for road infrastructure = product standard to qualify products

The severities of accidents for vehicle occupants are affected by the performance of support structures for items of road equipment under impact. Based on safety considerations, these can be made in such a way that they detach or yield under vehicle impact.

This European Standard provides a common basis for testing of vehicle impacts with items of road equipment support.

This European standard considers three categories of passive safety support structures:

— high energy absorbing (HE);

— low energy absorbing (LE);

— non-energy absorbing (NE).

Energy absorbing support structures slow the vehicle considerably and thus the risk of secondary accidents with structures, trees, pedestrians and other road users can be reduced.

Non-energy absorbing support structures permit the vehicle to continue after the impact with a limited reduction in speed. Non-energy absorbing support structures may provide a lower primary injury risk than energy absorbing support structures.

EN 12767, passive safety of road infrastructure

NE

The pole breaks or comes out of the ground. The speed of the car is not really reduced so no energy is absorbed. There might be the risk of having a second accident.

LE

The pole bends slightly and then breaks or comes out of the ground, there is some energy absorbed so the speed is slightly reduced.

HE

The speed of the car is slowed down, the energy of the impact is highly absorbed.

EN 12767, passive safety for road infrastructure

Table 1 — Impact speeds

Speed class km/h	Impact speeds km/h
50	35 and 50
70	35 and 70
100	35 and 100

Table 2 — Energy absorption categories

Impact speed, v_I km/h	50	70	100
Energy absorption category	Exit speed, v_e km/h		
HE	$v_e = 0$	$0 \leq v_e \leq 5$	$0 \leq v_e \leq 50$
LE	$0 < v_e \leq 5$	$5 < v_e \leq 30$	$50 < v_e \leq 70$
NE	$5 < v_e \leq 50$	$30 < v_e \leq 70$	$70 < v_e \leq 100$

E (J)= m/2 * v² :

$(50^2 - 0^2) < (70^2-5^2) < (100^2-50^2)$

$2500 < 4875 < 7500$

EN 12767, passive safety for road infrastructure

Table 5 — Occupant safety

Energy absorption categories	Occupant safety level	Speeds			
		Mandatory low speed impact test 35 km/h		Speed class impact tests 50 km/h, 70 km/h and 100 km/h	
		Maximum values		Maximum values	
		ASI	THIV km/h	ASI	THIV km/h
HE	1	1,0	27	1,4	44
HE	2	1,0	27	1,2	33
HE	3	1,0	27	1,0	27
LE	1	1,0	27	1,4	44
LE	2	1,0	27	1,2	33
LE	3	1,0	27	1,0	27
NE	1	1,0	27	1,2	33
NE	2	1,0	27	1,0	27
NE	3	0,6	11	0,6	11
NE	4	No requirement	No requirement	See 5.6	

crash test 100 km/h

view with more detail

Road equipment

- to improve traffic safety and social safety

- close to the road to be “seen”
  - in “the safety zone” ?
  - obstacles ?

  - how to design safe roadsides?
  - how to handle obstacles “in the safety zone”?
    - why taking care of obstacles close to the road?

Creating “forgiving” roadsides by using passive safe road equipment (EN12767)

- Explanation on the standard
- When using passive safe poles?
- What type of safe poles?
- Choosing the right product






When using passive safe poles?

= country guidelines

Finland: on roads where speed is ≥ 60km/h and 1000 vehicles/day

Belgium: roads where speed is ≥ 50 km/h and within the safety zone, without guardrails

Holland: NE poles if clear zone of 40m by 50m

…

What type of safe poles to use?

100HE3: in case of other obstacles, other roadusers or no flat roadside

100NE3: in case of a clear, flat roadside, no other obstacles or no other roadusers

Example

Slovenia

Dangerous obstacles are:

- tree-lined alley with trees which diameter is bigger than 15 cm
- columns of street lighting or other

instalations except when columns for street lighting by crash testing reach the corresponding results according to Slovenian standard SIT EN40 in SIST EN12767

- and similar

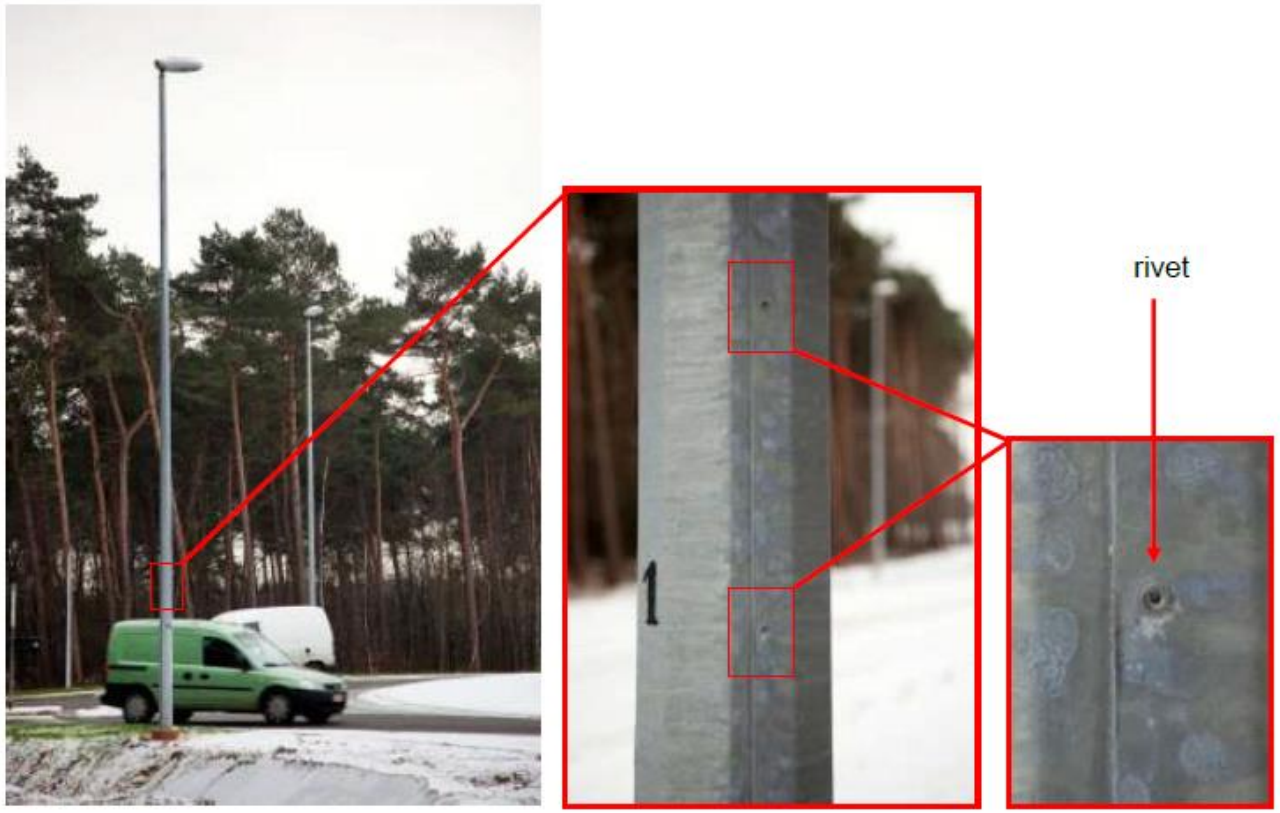
Source: Republika Slovenija, Tehnicna Specifikacija za javne ceste, TSC 02,210:2010 Varnostne ograje pogoji in nacin postavitve

Ljubljana ring road in 2012

How does the ZIPpole work?

- Bended plate(s) in elastic steel, riveted together
  - strong in vertical direction,
  - weak in horizontal direction when hit in an impact

The rivets collapse one by one like a ZIP, the strong shape looses it strength and the plate bends. The energy will be absorbed by the steel resisting in bending. The car will be slowed down.



ZIPpole

CE

Choosing the right product:

Risk of installation
The installation guidelines of the manufacturer should be followed to guarantuee the right functioning of the product.

Size of the safety zone
If the product has a specific zone to hit in a car crash, the installation should be done accordingly.

Multidirectional
If the product can be hit from different directions, the product should be safe in all directions.

Risk for secondary accidents
If there are other obstacles, it is best to slow down the colliding vehicle.

Guidance

1 Challenge designers to remove obstacles from the safety zone

2 If not possible to remove them, make them forgiving

Create “forgiving” roadsides by demanding for the highest safety level for road infrastructure:

> prescription of products being CE marked according EN12767, 100HE3 and 100NE3

Thank you for your attention.
Questions or remarks?

Thank you
More information?

Offices:
Boudewijnlaan 5
2243 Pulle
Belgium

Offices and production:
Industrie E17/ 3, N°3320
9160 Lokeren
Belgium

Crash site:
Hoogbuul
2250 Olen
Belgium

www.zippole.com
www.safety-product.eu

Carolien Willems
Carolien.willems@safety-product.eu
Member TC226, WG10 for EN12767
Tel: +32 473 71 20 24

SAFETY-PRODUCT

ZIPpole

Accidents don’t cause only emotional damage… What is the cost for society of injured people in traffic accidents?

People getting injured or killed in traffic gives a big emotional pressure but also a big cost for society.

Our suggestion is to make authorities face facts by showing them the financial calculation of investing in safe poles compared to the money to spend on road accidents.

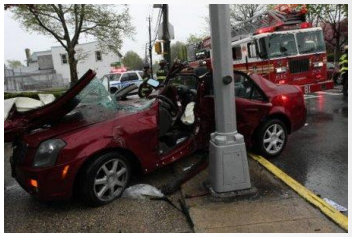
Off course, people have to drive safe and young people have to be educated but accidents will always happen. The thing is: doing something wrong in traffic is most of the times not done on purpose. So does the driver have to be punished so badly by driving onto obstacles? Can we not consider following innovative designs like passive safe infrastructure ZIPpoles and improve the infrastructure?

CALCULATION

What is the cost for someone being badly injured or being death in traffic?

Belgium: Assuralia, the organisation of insurances says: the cost for someone being badly injured or death is by the average 383.000 euro.

How many people get badly injured or killed by driving onto a lighting pole or an obstacle?
Belgium: In 2007 there were 217 persons badly injured or death by driving onto a lighting pole. If you don't have the exact figures by driving onto a lighting pole, make the comparison with obstacle and take a certain % of this amount.



Total: 217 x 383.000 euro = 83 million euro / year for medical care for accidents againts lighting poles

Calculate the cost for delivery and installation of the ZIPpole
Belgium: 800 euro

What is the amount of lighting poles installed?
Belgium: 250.000 on regional roads and 1.500.000 on local roads so that makes 1.750.000 poles

83 mio euro / 1.750.000 poles makes 47 euro/year/ pole
800 euro / 47 euro = 17 years

After 17 years all lighting poles in Belgium can be replaced by not spending the cost for medical care.

Our suggestion: make this calculation for your country and show it to decision makers. Who can doubt these results?

ZIPpole CE

Project with our without ZIPpoles?

Offer with	rigid poles	ZIPpoles
Removing low voltage net, up in the air	6 810,08 EUR	6 810,08 EUR
Installing low vlotage net below groundlevel, 1560m	62 443,96 EUR	62 443,96 EUR
Couplings low voltage net	7 334,60 EUR	7 334,60 EUR
Renewing and couplings low voltage net	38 802,40 EUR	38 802,40 EUR
Cabling below groundlevel for public lighting	32 885,71 EUR	32 885,71 EUR
Total netadjustments:	148 276,75 EUR	148 276,75 EUR
Public lighting: poles and luminars		
- 45 poles, powdercoated, 8m height	27 262,80 EUR	29 239,65 EUR
- 45 luminars, SON-T 100 watt	13 495,50 EUR	13 817,70 EUR
Recycling:	14,90 EUR	14,90 EUR
Poles and luminars:	40 773,20 EUR	43 072,25 EUR
Connection costs:	6 390,00 EUR	6 390,00 EUR
Total, excl VAT:	47 163,20 EUR	49 462,25 EUR
Total	195.439,95 EUR	197.739,00 EUR

Calculation: price difference in this public lighting project with or without ZIPpoles:
2299.05 euro or 51 euro/ pole
Having a project with passive safe poles instead of rigid poles makes the project in this case 1,2% more expensive. Other projects have proven, the ZIPpole can be cheaper aswell !

How to evaluate the expenses of ZIPpoles: All other goods and all works in a public lighting project will remain the same no matter if chosen for passive safety or not !! If the ZIPpole is more expensive, the total project cost will only be influenced by a small bit.

What is the profit for society? Imagine this project is there for 25-30 years and imagine there is only 1 light injury avoided, the pay back cost of 2299.05 euro, by avoiding medical care, is paid back in no time !!

ZIPpole CE