



# Brisa Road Safety Observatory

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**ASECAP DAYS**



**COSTA NAVARINO 2019**

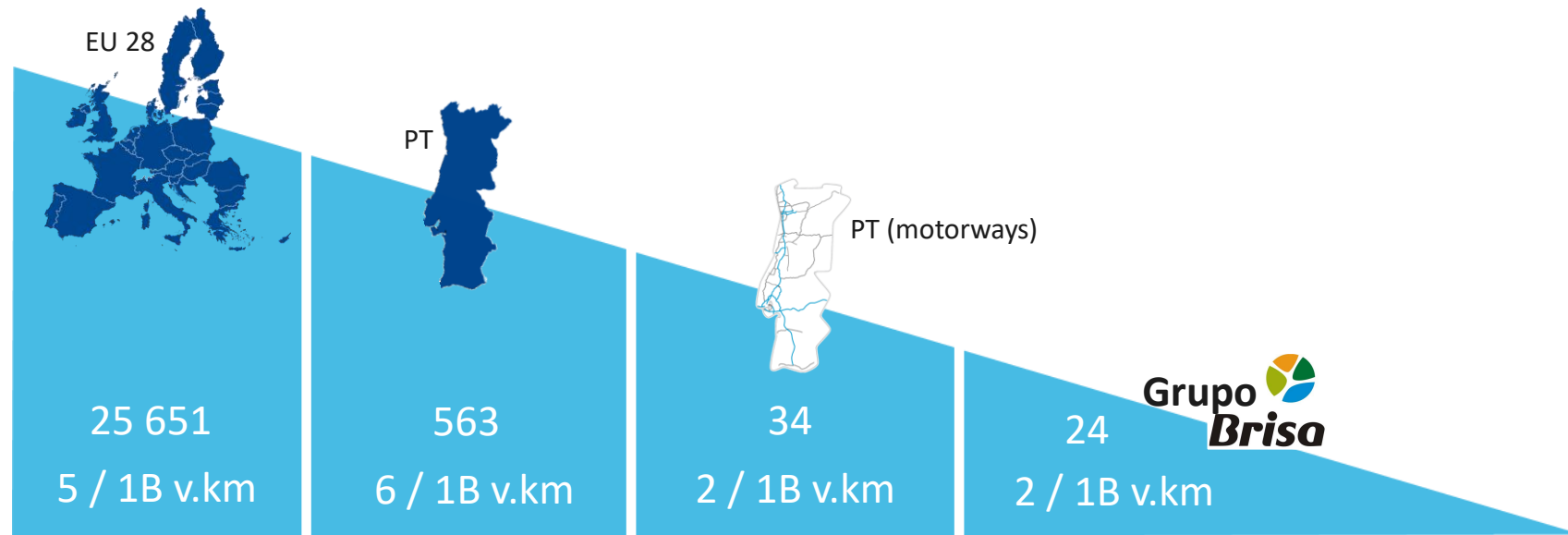


**Brisa**

The priceless value of human life has increased the relevance given to **Road Safety**

## Road fatalities per year

(Statistical pocketbook 2018, APCAP, Brisa)



## European Union Objective

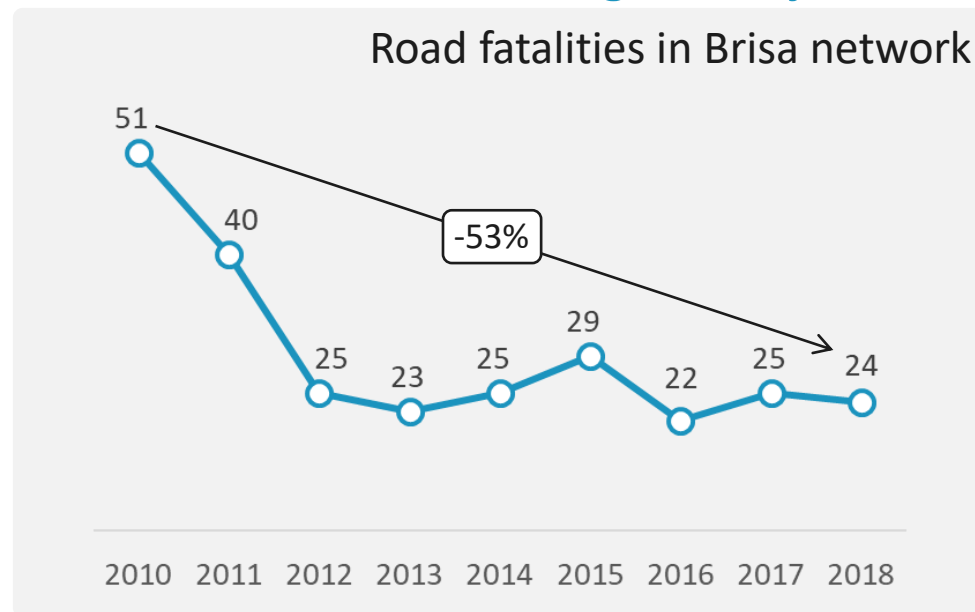
Reduce road fatalities by 50% between 2010-2020

### In 2017

EU – reduced 20%

Portugal – reduced 31%

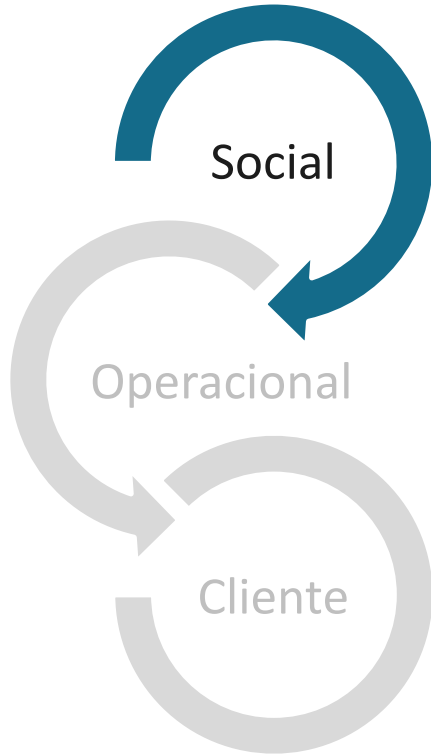
### Brisa is focused in achieving this objective





Road Safety on  
motorways





- Priceless value of human life
- Social responsibility in promoting ethically responsible behaviors
- Contribution to the establishment of higher safety patterns





Social

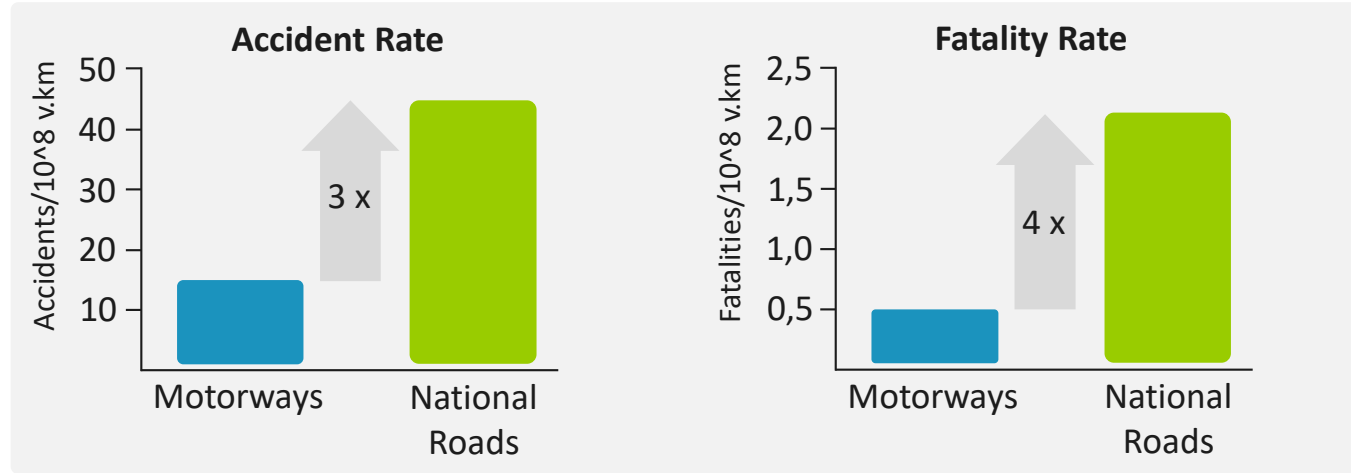
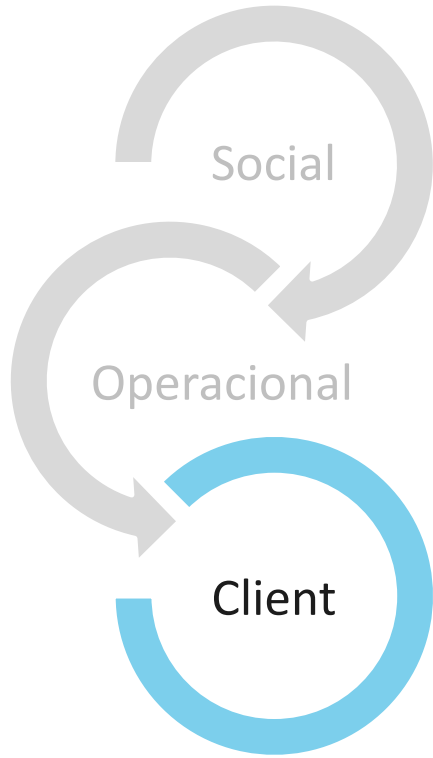
Operational

Cliente

- 24/7 road assistance
- Active traffic management

- Better assistance, safety and comfort provided to the clients
- Ensure the fastest reposition of the normal driving conditions

Pressure and impact on the company costs



- Safety and travel time are the key success factors for choosing the motorways
- Fatalities reduction and effective road assistance increase motorway competitiveness towards the alternative routes

European Union medium/long term objective

Zero European road fatalities in 2050



Because road safety is a key issue in the relation between Brisa and its clients...

- Brisa assumed also **“Vision 0”** objective
- Created the **Brisa Road Safety Observatory**





Workforce dedicated to study and debate road safety on Brisa motorways and define strategies and initiatives in this scope

## Team

Participation and integrated vision of all the business units related with road safety:

- Strategic Planning
- Concessionaires
- Engineering
- Operations
- Marketing & Client Management

Goal

**Analyze** events and gather statistics to help making better **strategic decisions** promoting road safety

## Detailed analysis of the events

### A4

Pk 29+275 (Baltar / Paredes)  
1 ferido grave  
Piso molhado  
Colisão guardas de segurança  
Distração

### A1

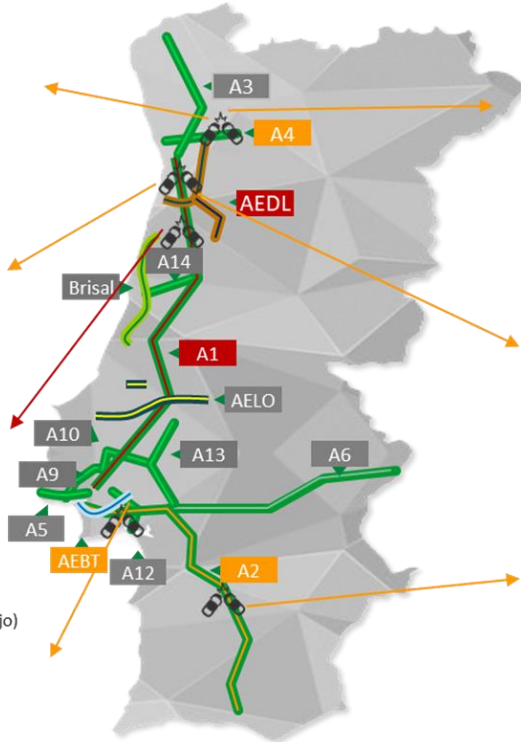
Pk 290+160 (Feiteira/ Carvalhos)  
1 ferido grave  
Piso seco e limpo  
Colisão frontal  
Circulação em contramão

### A1

Pk 273+000 (Estarreja/ Feira)  
1 vítima mortal e 1 ferido ligeiro  
Piso seco e limpo  
Colisão perfil de betão  
Velocidade excessiva

### A33

Pk 34+600 (Sarilhos Grandes/ Montijo)  
1 ferido grave  
Piso seco e limpo  
Colisão guardas de segurança  
Desconhecido



### A4

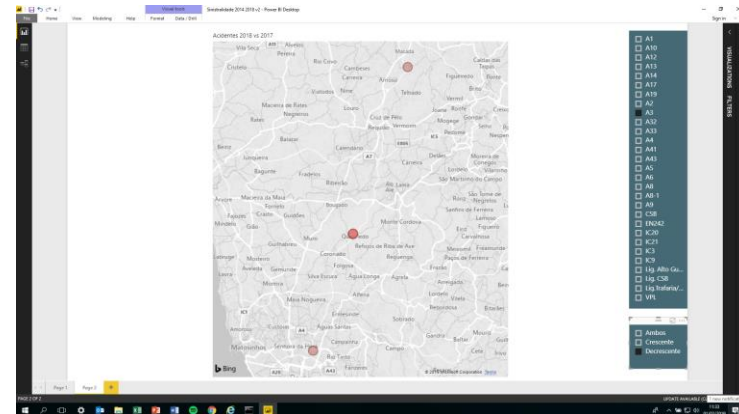
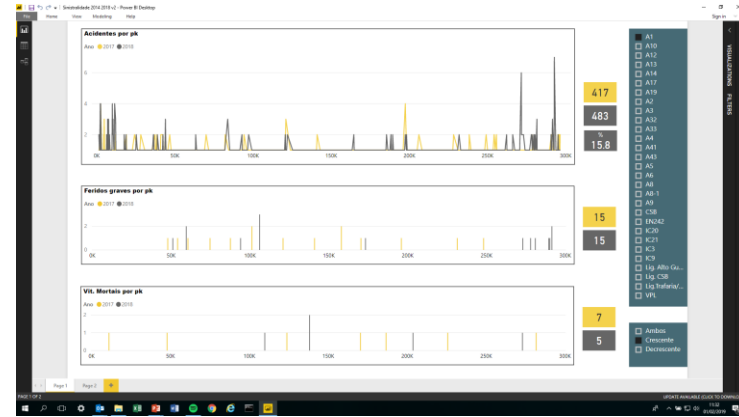
Pk 26+760 (Paredes/ Baltar)  
1 ferido grave  
Piso seco e limpo  
Colisão traseira  
Manobra incorreta

### A1

Pk 291+520 (Feiteira/ Carvalhos)  
2 feridos graves  
Piso seco e limpo  
Choque com sinalização  
Desconhecido

### A2

Pk 9+200 ( Almada/Fogueiteiro)  
1 ferido grave e 1 ferido ligeiro  
Piso seco e limpo  
Colisão guardas de segurança  
Desconhecido



**Advanced Analytics** applied to  
Brisa network accident pattern  
analysis



## Analyzed variables

Events (>7000/year)



Events (fatalities)



## Infrastructure

- Friction
- Roughness
- Texture
- Curve radius
- Slope

## Traffic

- Speed
- Volume

## Weather

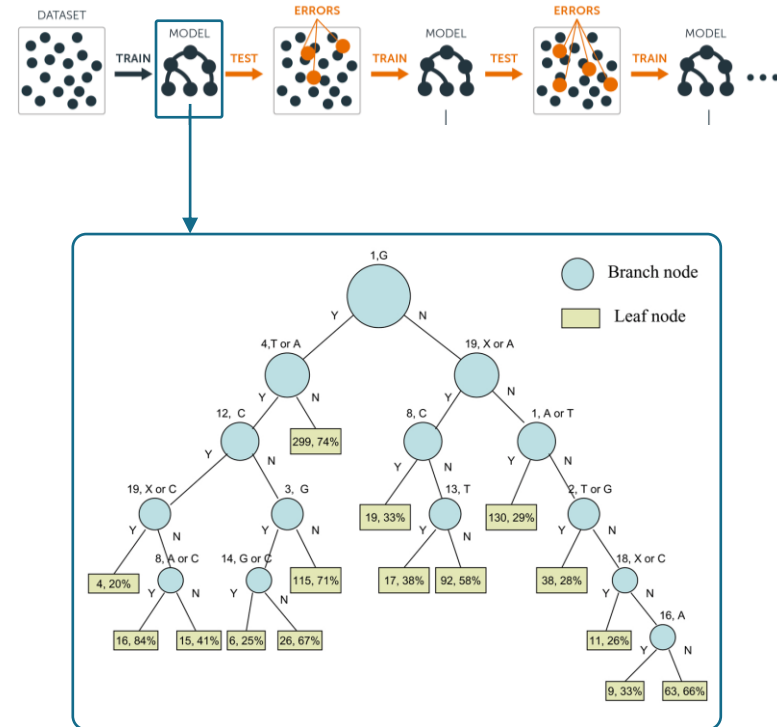
- Precipitation
- Temperature

## Analytic process

### 1 variable relevance

## Gradient Boosting Algorithms

To identify and understand the relevant variables



## Analytic process

### 1 variable relevance

## Market Basket Analysis

To identify simultaneous occurrences

### Example

When event “A” and “B” occur, event “C” also occur in 90% of the cases

$$\begin{aligned} \text{Rule: } X \Rightarrow Y & \begin{cases} \text{Support} = \frac{\text{freq}(X,Y)}{N} \\ \text{Confidence} = \frac{\text{freq}(X,Y)}{\text{freq}(X)} \\ \text{Lift} = \frac{\text{Support}}{\text{Supp}(X) \times \text{Supp}(Y)} \end{cases} \end{aligned}$$



Rule	Support	Confidence	Lift
$A \Rightarrow D$	2/5	2/3	10/9
$C \Rightarrow A$	2/5	2/4	5/6
$A \Rightarrow C$	2/5	2/3	5/6
$B \& C \Rightarrow D$	1/5	1/3	5/9

## Analytic process

2

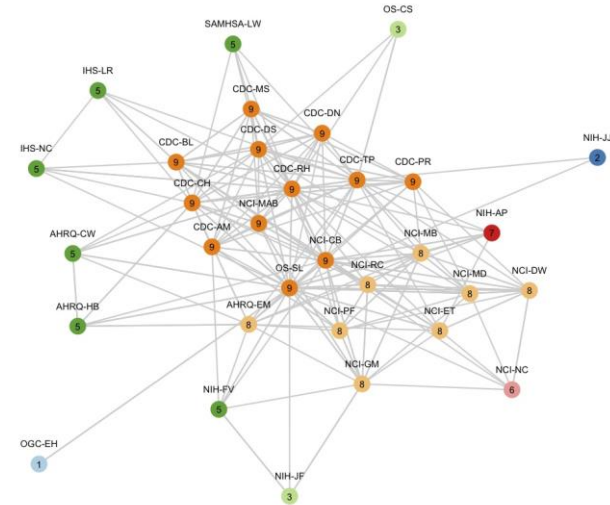
relation between variables

### Bayesian Networks

to understand occurrence probabilities and crossed variable influence

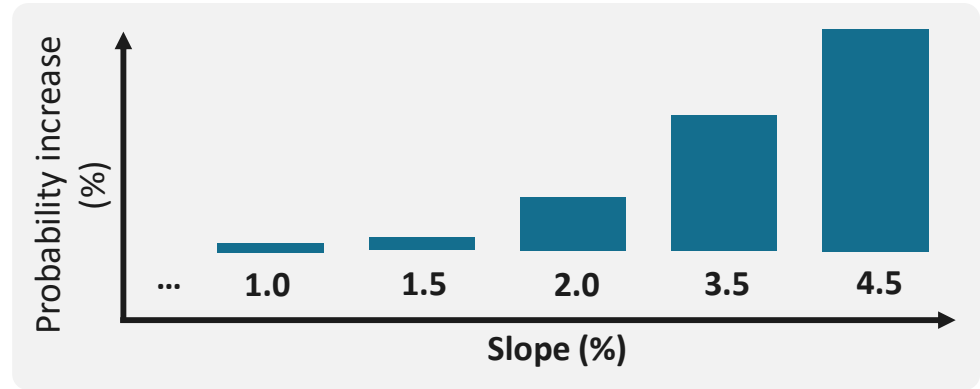
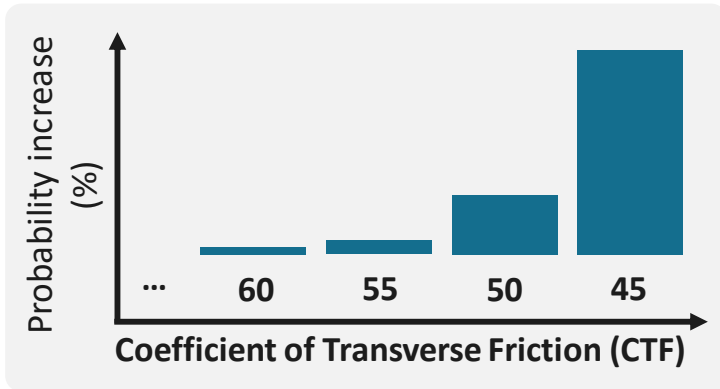
### Example

Rain and traffic influence accidents, but rain also influence traffic



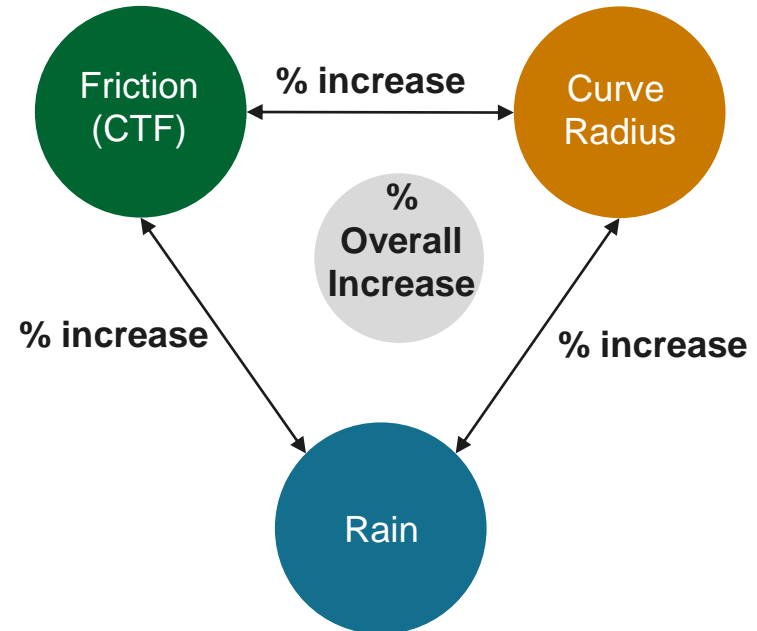
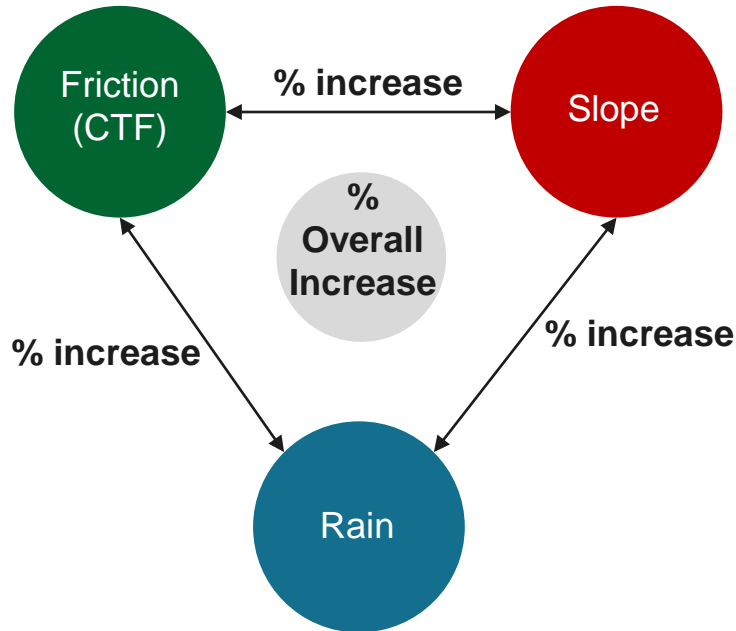
## We tried to understand

- 1 The increase in accident probability caused by each variable





2 The increase in accident probability caused by the combination of variables



## 3 Detect problematic locations on the network



South → North  
Pk 38+600 to 39+000

- >> High accident concentration in 400 meters
- >> Low Coefficient of Transverse Friction
- >> Significant slope of 5%
- >> Curve radius of 500 meters

## 4 Propose mitigation measures

### Pavement interventions



Protection



### Speed regulation and enforcement



# Advanced Analytics in accident pattern analysis

In the end of the day we want to:

1 Identify accident patterns

2 Identify and understand its causes

3 Understand if we can act over these causes

4 Define and implement measures to reduce or even end those accident causes



Customer  
Service



Thank you



**Safety  
First**