



safer roads for everyone

# **Low Cost Safety Measures and Road Safety Audit**

Steve Proctor, TMS Consultancy

# Topics to cover

- Safe Systems and Road Safety Targets
- Scale of the Problem
- Collision Causation
- Collision Investigation
- Cost Benefit Analysis
- Case Studies
- Road Safety Audit and Inspection
- European Directive on Road Safety Infrastructure Management



# Steve Proctor/ TMS Consultancy



- 35 years' international experience
- Written guidelines for national governments and local road authorities
- Director of national Road Safety Audit training programmes in UK and Ireland
- Undertaken collision studies, Road Safety Audits, Road Safety Inspections throughout Europe



safer roads for everyone



safer roads for everyone



024 7669 0900

About Us

Audits

Training

Safety Studies

Traffic & Transport

Contact Us

Search

GO

## About Us

- TMS Background
- Staff Profiles
- Careers at TMS
- Testimonials



## About Us

TMS provides practical expertise to improve road safety and traffic management by offering audit, consultancy and training services. Our driving principle is to deliver services and solutions that make roads safer and ultimately reduce casualties.





safer roads for everyone

# Safe Systems approach and Road Safety Targets



# A global catastrophe....

- 1.25 million people killed every year
- Half of these are pedestrians, cyclists or motor cyclists
- A further 50 million people are seriously injured, many of whom have life changing injuries



# Vision Zero Origins in Sweden

- In October 1997, the Road Traffic Safety Bill founded on Vision Zero was passed by a large majority in the Swedish parliament
- The Vision is an expression of the ethical imperative that:
  - *“It can never be ethically acceptable that people are killed or seriously injured when moving within the road transport system”<sup>1</sup>*

Prof Claes Tingvall, Swedish Road Administration



safer roads for everyone

# Safe Systems Approach

- Now implemented in Sweden, The Netherlands, Finland, Norway, South Africa and New Zealand
- Advocated by the World Health Organisation
- Focuses around Vision Zero:  
***“No loss of life is acceptable”***
- Based on the simple fact that we are human and make mistakes
- Therefore the road system must be designed to protect us at every turn





safer roads for everyone



# UN Fatal Road Casualty Reduction Target

**Global Plan**  
for the Decade of Action  
for Road Safety 2011-2020



 **DECADE OF ACTION FOR  
ROAD SAFETY 2011-2020**

- Official goal of “stabilising and then reducing” global road traffic fatalities by 2020 compared to 2010
- Plan is a tool to support the development of national and local plans of action



safer roads for everyone

# Road Safety Targets

- EU target to reduce road deaths by 50% by 2020 (compared to 2010)
- Scotland target (2020)
  - to reduce deaths by 40%
  - child deaths by 50%
  - serious injuries by 55%
  - child serious injuries by 65%

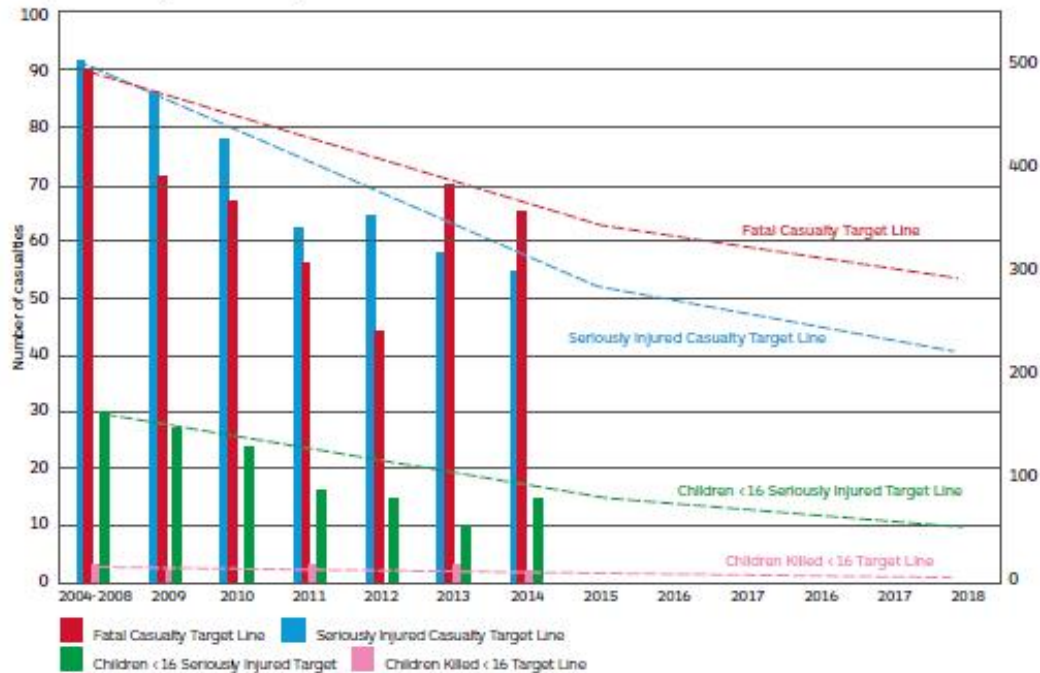


## 7. ANALYSIS OF ACCIDENTS AND CASUALTIES

Accident data is at the heart of understanding, delivering and improving road safety, and is central to the work of the Strategic Road Safety Team, as it provides a means to gauge not only those areas in need of safety improvement

measures but also allow monitoring of the effectiveness of such measures. This also allows decisions regarding investment to be evidence led and targeted.

### 2015/2020 Casualty Reduction Targets



### PERFORMANCE AGAINST TARGETS

The Scottish Government casualty reduction targets for 2020 are being met on the Scottish trunk road network, with reductions consistently below the current pro-rata target year on year in terms of 'Killed and Serious Casualties', 'Killed and Serious Child Casualties'.

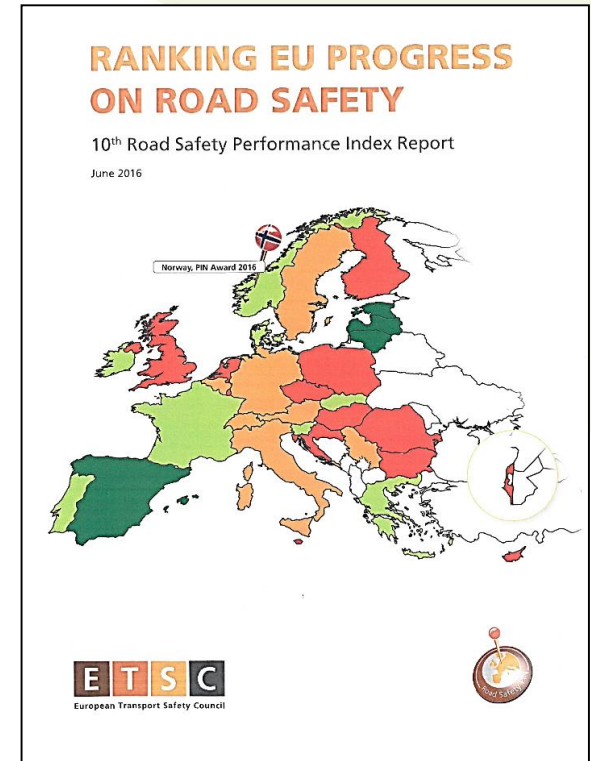
#### Summary

- We are on track to meet Framework targets
- Further action is needed
- The use of evidence-based decisions that are as possible



# EU Road fatalities in 2015

- ***“EU road safety progress has come to a standstill”***
- 26,313 reported road fatalities in 2015 (25,970 in 2014)
- 1% increase compared to 2014
- Target to reduce road deaths by 50% by 2020 requires an 9.7% reduction every year between 2016-2020
- Recommendation to provide funds to allow target oriented setting of measures

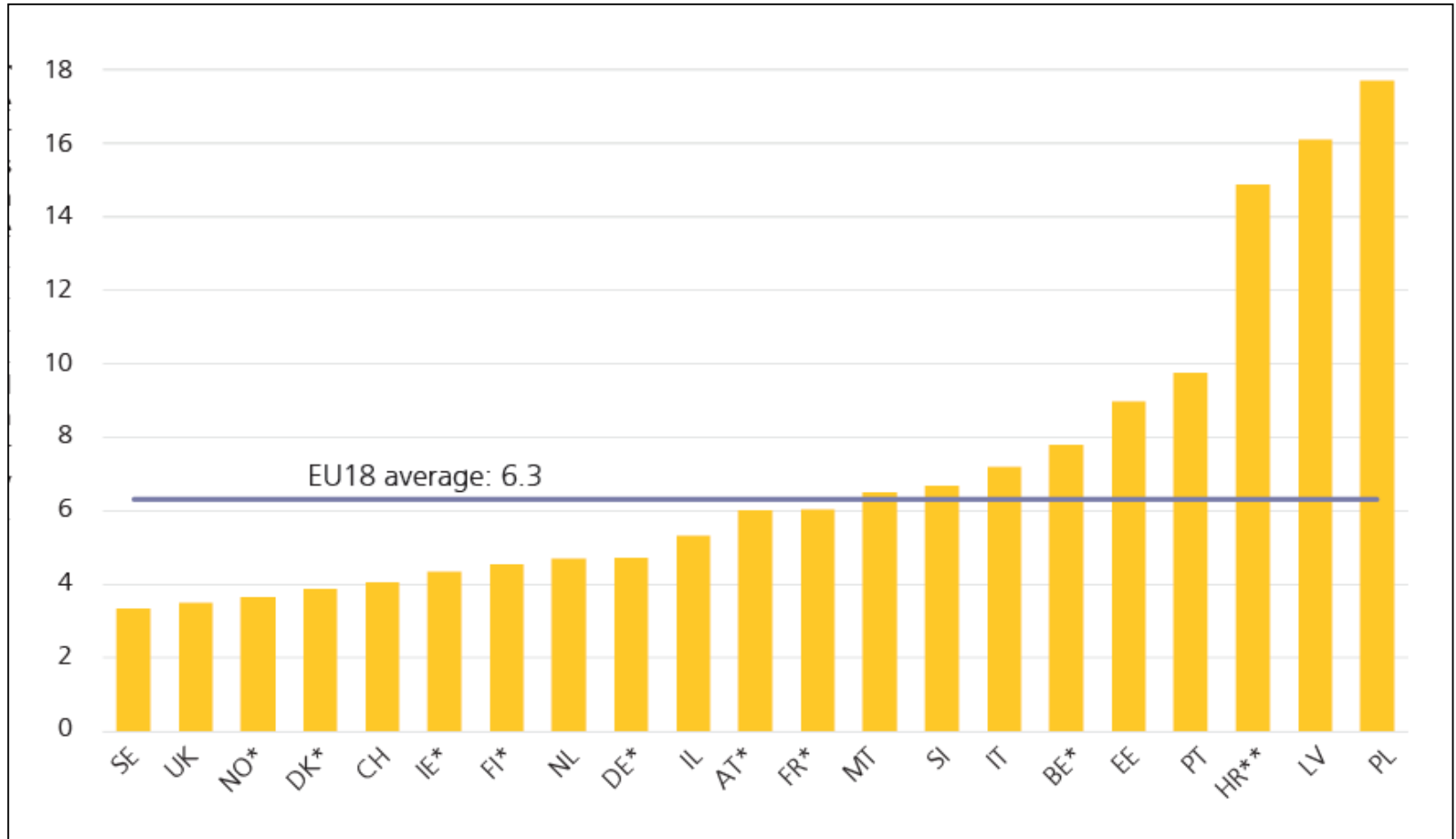


Source: 10th EU Road Safety Performance Index Report June 2016



safer roads for everyone

# EU Road fatalities in 2015



Road Deaths per billion vehicle kilometres in 2015



**safer roads for everyone**

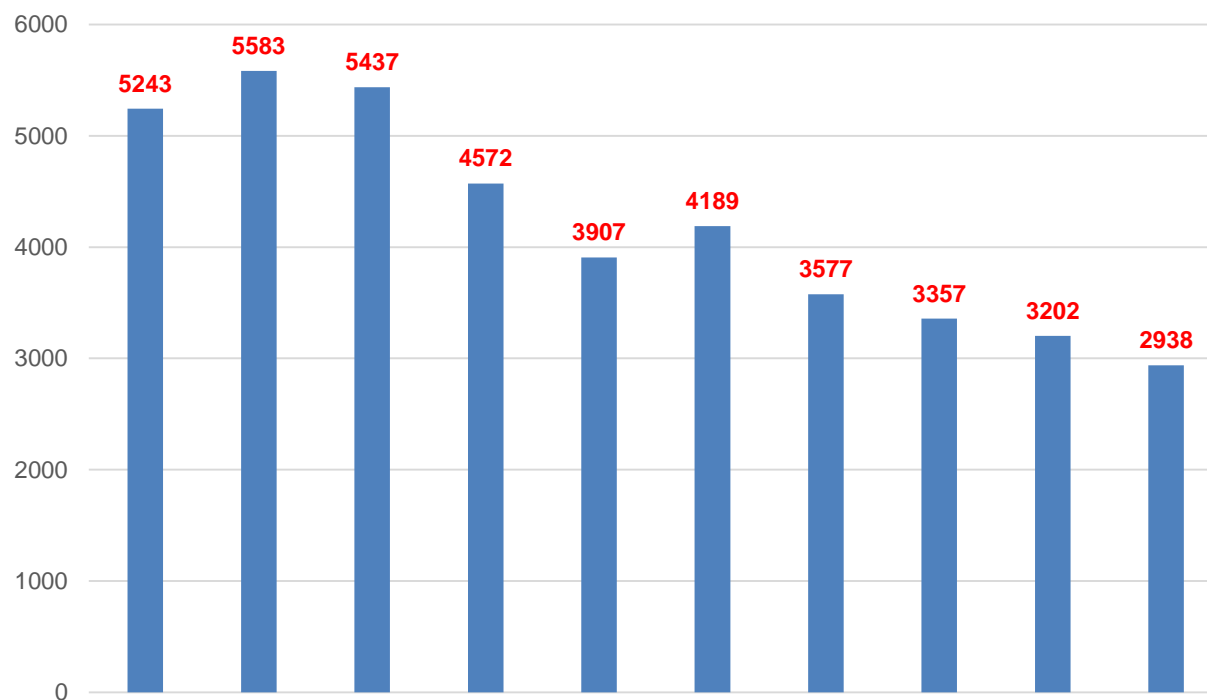
# Scale of the Problem



# Scale of the problem - Poland



Poland Fatalities 2006-15



safer roads for everyone



safer roads for everyone

# Collision Causation





# Road Collision Definition

An unintentional energy exchange, which occurs when energy of any type reaches a susceptible structure in amounts, and at rates, in excess of those that can be tolerated without damage



# Road Collision Definitions

- road collisions are :-
  - **rare** – 1 in 330 people in UK injured in 2014
  - **random** - impossible to predict where and when the next collision will happen
  - **multi-factor** - combination of behavioural, vehicle and highway factors
  - **“How did this road user fail to cope with the road environment?”**



# Multi-factor ...



Behavioural Factors



Vehicle Factors

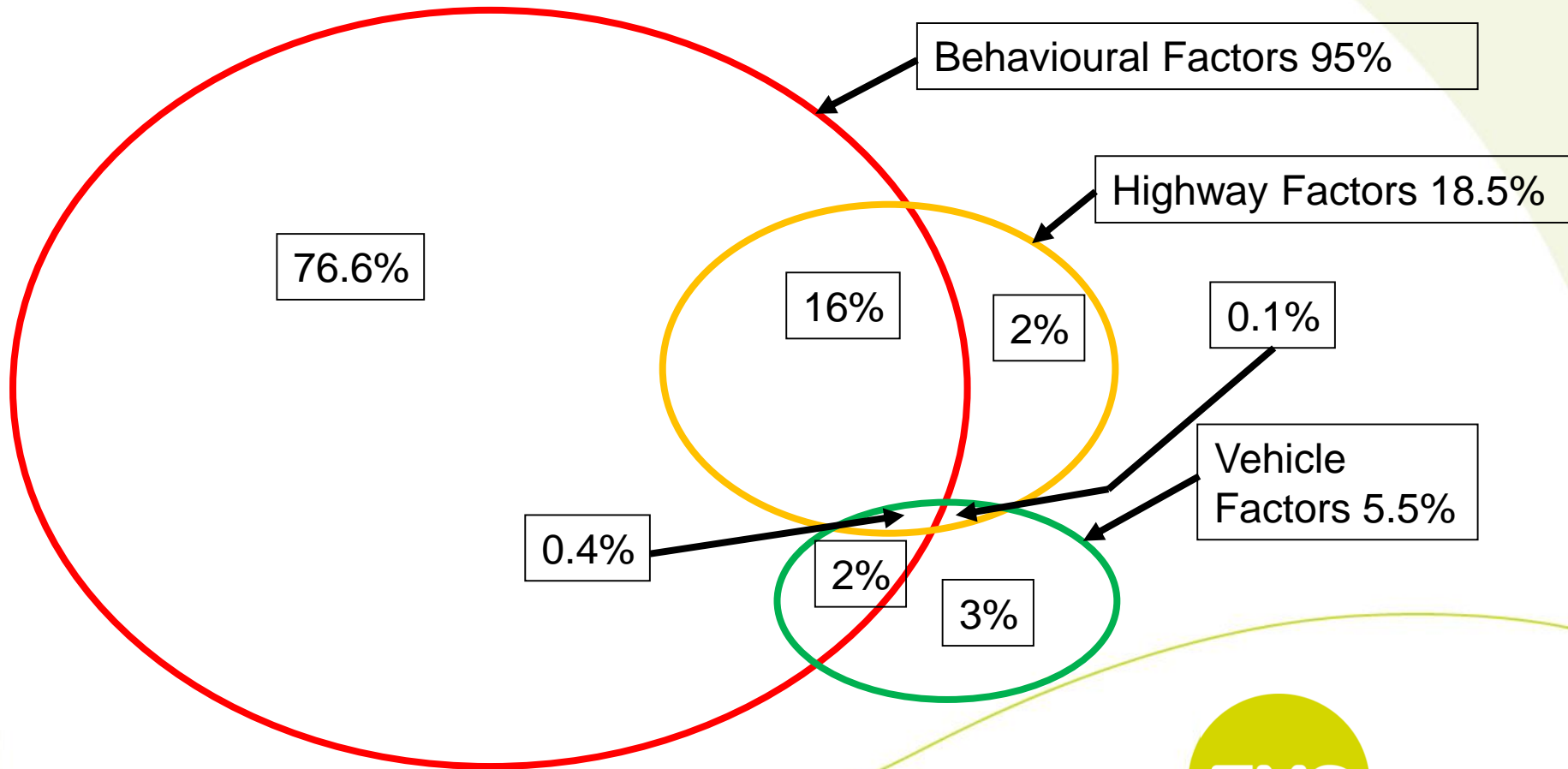


Highway Factors



safer roads for everyone

# Factors involved in a collision



# Collision causation workshop

- Work in groups of 4 to review the handout
- What were the main highway factors involved in the collision
- Why did this road user “fail to cope” with the road environment
- Which of the various parties involved in this incident would you consider to be liable, and by how much (%)

The logo for TMS (Transport Management Systems) is a yellow circle with the letters 'TMS' in white, bold, sans-serif font. It is positioned in the bottom right corner of the slide, partially overlapping the list item.

TMS

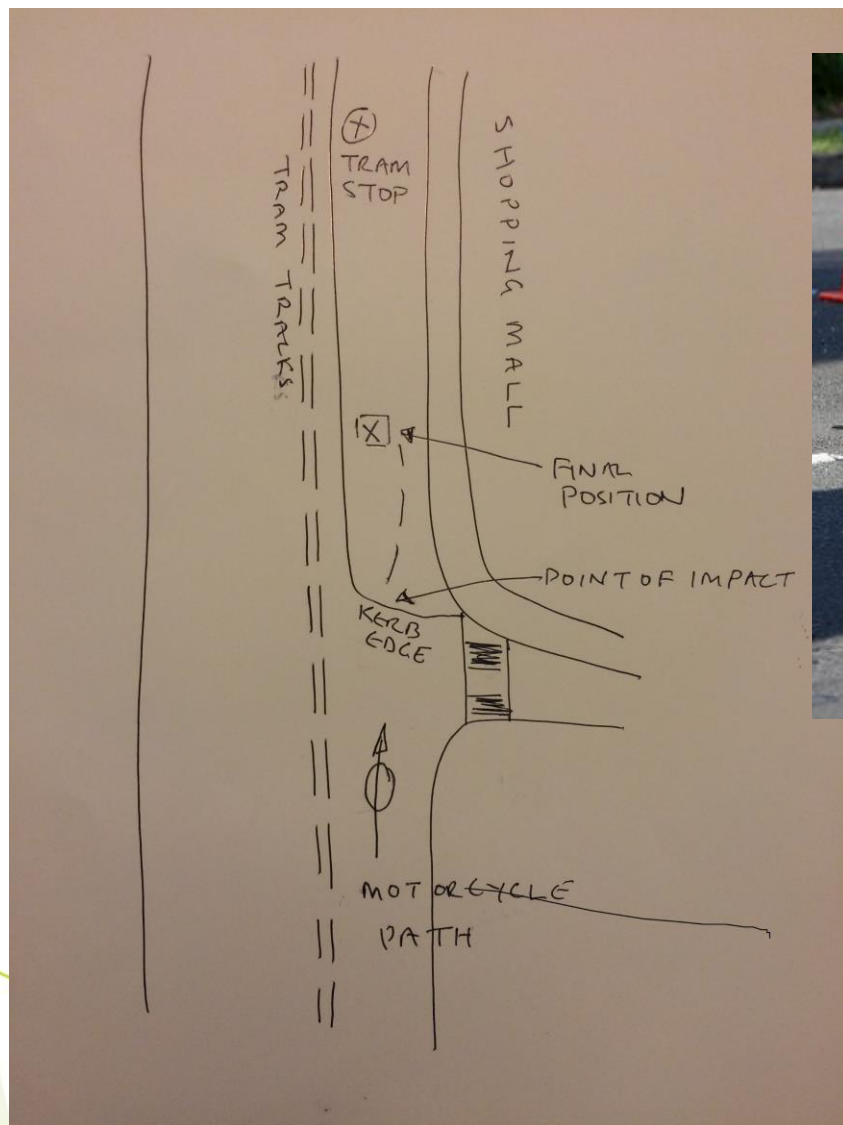








# Collision causation workshop



safer roads for everyone







**safer roads for everyone**

# **Collision Investigation**



# Collision Investigation – high risk sites

- Based on police collision data
- “A high number of collisions with a dominant crash pattern can indicate a problem related to the road
- collisions of this type will continue to occur unless the problem is treated
- making changes to the road environment can influence the way a driver behaves and reduce road collisions”


































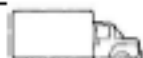











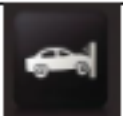


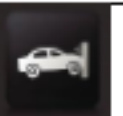

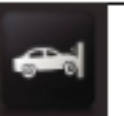

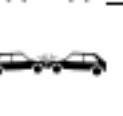
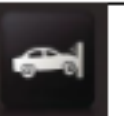
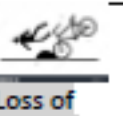






# Collision Investigation Workshop

- Work in pairs
- Examine the handout
- Analyse the collision grid and define the collision problem at this location



## FIVE YEAR COLLISION HISTORY 2011 – 2015: dangerous bend on rural road – speed limit 100kph

	1	2	3	4	5	6	7	8	9	10
	FRI Aug 2011	TUES Feb 2011	MON April 2012	SAT June 2013	SAT July 2014	THURS Jan 2014	SUN Oct 2015	WED Nov 2015	TUES March 2015	THURS Nov 2015
	2300	1000	0900	0100	2300	1100	2000	1300	2000	1800
										
										
										
Vehicle 1										
Vehicle 2										
	 Loss of control	 Head on	 Pedestrian hit by car	 Loss of control	 Head on	 Loss of control	 Loss of control	 Head on	 Loss of control	 Loss of control
Human factor										
















## Collision Analysis from Grid

### 1. Trends

	All collisions			
2011	2	1	1	1
2012	1	0	0	0
2013	1	0	1	1
2014	2	2	1	2
2015	4	3	3	4
	10	6	6	8
	85% confident of increase in 2015	88% confident of increase in 2015	88% confident of increase in 2015	92% confident of increase in 2015

### 2. Comparison with controls

				
Bend	60%	60%	60%	75%
Control	28%	33%	25%	25%
	95% confident of high site risk	95% confident of high site risk	99% confident of high site risk	99.9% confident of high site risk



# Collision Investigation - summary

- Indication of a recent increase in collisions
- Significant increase in wet road/ night time and loss of control/ head on crashes, also a site based risk compared to control data
- Site observations: poor road surface, getting worse, speeds approaching bend at 100kph, braking late

**TMS**



**safer roads for everyone**

# **Cost Benefit Analysis**



# Cost Benefit Analysis

- Average cost of an injury collision is derived from estimates based on:
  - Loss of earnings/ production
  - Personal loss
  - Cost to emergency services
  - Cost to health service
- Eg Ireland average cost of collision = 125,000 EUROS

**TMS**

# Collision Savings

- **Collision savings can be estimated by:-**

- looking at collision reduction achieved by similar schemes elsewhere (control data)

OR

- looking at the collision record and estimating how many collisions would have been saved if a safety scheme had been implemented at the start of the period being studied



# Collision Reduction Single Sites

## UK RoSPA Manual, 2007

Collision Reduction Schemes in Oxfordshire			
Treatment		Reduction	No of sites
URBAN	Pelican crossing	25%	39
	Traffic signals	50%	12
	Mini-roundabout	40%	34
	Road humps	50%	49
	Speed cameras	25%	46
RURAL	Right turn lane	60%	10
	<b>Signing</b>	<b>30%</b>	<b>103</b>
	Anti-skid at junction	30%	11
	Visibility improvement at junction	20%	18
	Visibility improvement on bend	40%	13
	<b>Bend signing</b>	<b>30%</b>	<b>140</b>
	Anti-skid on bend	50%	13
	30 mph village speed limits	25%	180
	Speed cameras	15%	16

# TAG – UK Collision Cost Values

**Table A 4.1.4: Average value of prevention per road accident by severity & road class  
£(2010 prices and 2010 values)**

Accident Severity	Road Class			
	Built-up	Non Built-up	Motorway	All
Fatal	1,766,781	1,897,359	1,962,139	1,841,455
Serious	201,721	227,468	240,389	210,089
Slight	20,965	25,303	30,426	22,174
All Injury	56,230	114,619	81,781	69,342
Damage only	1,858	2,718	2,611	1,964
Average cost per injury accident	89,118	135,816	101,626	99,300

TAG - Transport Analysis Guidelines  
Autumn 2015 release v1.4b



safer roads for everyone



# First Year Rate of Return (FYRR)

**FYRR (%) =**

$$\frac{\text{annual collisions saved} \times \text{collision cost} \times 100\%}{\text{scheme cost}}$$



safer roads for everyone

# Cost Benefit Analysis Workshop

- In pairs
- Consider options for treatment at the “dangerous” bend
- Estimate the cost of treatment
- Estimate collision savings to be made
- Calculate FYRR



### Low cost treatment mitigation:

Option 1: Chevron signs, Advance bend warning signs, rumble strips on the approach

Option 2: As above, plus high friction road surface around the bend

### Major scheme treatment mitigation:

Option 3: Re-align the bend

### Economic Assessment:

	Option 1	Option 2	Option 3
€ scheme cost	10,000	20,000	500,000
crash savings	50% dry loss of control/ head-on plus 30% wet loss of control / head-on	50% dry loss of control/ head-on plus 50% wet loss of control / head-on	75% loss of control plus 33% head-on
savings/year	0.56	0.8	1.03
€ crash cost	$0.56 \times 125,000 = 70,000$	$0.8 \times 125,000 = 100,000$	$1.03 \times 125,000 = 128,750$
FYRR	$70,000/10,000 \times 100\%$ = 700%	$100,000/20,000 \times 100\%$ = 500%	$128,750/500,000 \times 100\%$ = 26%

FYRR = First Year Rate of return = (crash savings/ year) / (scheme cost) x 100%

Cost of injury crash = 125,000 EUROS (Republic of Ireland figure)

# Scheme Prioritisation

<b>Scheme</b>	<b>AccSavings £</b>	<b>Scheme Cost £</b>	<b>FYRR %</b>	<b>Cumulative Cost £</b>
1	50,000	8,000	<b>625</b>	<b>8,000</b>
2	20,000	4,000	<b>500</b>	<b>12,000</b>
3	64,000	20,000	<b>320</b>	<b>32,000</b>
4	24,000	16,000	<b>150</b>	<b>48,000</b>
5	30,000	24,000	<b>125</b>	<b>72,000</b>
6	42,000	34,000	<b>124</b>	<b>106,000</b>
7	44,000	40,000	<b>110</b>	<b>146,000</b>
8	20,000	20,000	<b>100</b>	<b>166,000</b>
9	24,000	30,000	<b>80</b>	<b>196,000</b>
10	16,000	26,000	<b>62</b>	<b>222,000</b>



safer roads for everyone



**safer roads for everyone**

# Case Studies



# toolkit.irap.org

Select on treatment type

The screenshot shows a web browser window with the URL toolkit.irap.org. The page features a navigation menu with five items: Crash Types, Road Users, Treatments, Management, and About. The 'Treatments' menu is expanded, revealing three sub-sections: Safer Road Treatments, Safer Vehicle Treatments, and Safer People Treatments. A blue arrow points from the text 'Select on treatment type' to the 'Treatments' menu item.

**ROAD SAFETY TOOLKIT**

English

Home

**iRAP**

**The Road prevention**

Building on decadal safety plans for car occupants, motorcyclists, pedestrians, bicyclists, heavy vehicle occupants and public transport users.

collaboration between the International Road Assessment Programme (iRAP) and the World Bank Global Road Safety Facility.

Stay informed

07:42  
02/11/2016

Safer Road Treatments	Safer Vehicle Treatments	Safer People Treatments
Additional Lane	Motorcycle Lanes	Roadside Safety - Barriers
Bicycle Facilities	One Way Network	Roadside Safety - Hazard Removal
Central Hatching	Parking Improvements	Rumble Strips
Central Turning Lane Full Length	Pedestrian Crossing - Grade Separation	School Zones
Delineator	Pedestrian Crossing - Signalised	Service Road
Duplication	Pedestrian Crossing - Unsignalised	Shoulder Sealing
Intersection - Delineation	Pedestrian Fencing	Slopeslope Improvement
Intersection - Grade Separation	Pedestrian Footpath	Sight Distance (obstruction removal)
Intersection - Roundabout	Pedestrian Refuge Island	Skid Resistance
Intersection - Signalise	Railway Crossing	Speed Management
Intersection - Turn Lanes (Signalised)	Realignment - Horizontal	Street Lighting
Intersection - Turn Lanes (Unsignalised)	Realignment - Vertical	Traffic Calming
Lane Widening	Regulate Roadside Commercial Activity	
Median Barrier	Restrict/Combine Direct Access Points	
Median Crossing Upgrade	Road Surface Rehabilitation	

# toolkit.irap.org

Select on crash type

The screenshot shows a web browser window with the URL [toolkit.irap.org](http://toolkit.irap.org). The browser's address bar and tabs are visible at the top. The website's navigation menu includes 'Crash Types', 'Road Users', 'Treatments', 'Management', and 'About'. The 'Crash Types' dropdown menu is open, listing the following categories: Head On, Intersections, Lane Change, Manoeuvring, Rear End, Run Of Road, Vehicle - Cyclist, and Vehicle - Pedestrian. Below the dropdown, there is a section for 'Latest related case studies' with three entries: 'Bruce Highway (Cooroy to Cuna) Upgrade', 'Wurub Implements Model Junction Channelisation for Pedestrians', and 'High Friction Surfacing Treatment (HFST) Crash Reduction Program'. The main content area features a large image of a person's face and a search bar. The footer contains logos for iRAP and gTKP (Global Transport Knowledge Partnership), along with a description of the toolkit's purpose and a 'Quickfind' section with search filters like 'Central Matching', 'Seatbelts', 'Safe Speed', 'Publicity', and 'Licensing'. The Windows taskbar at the bottom shows the system clock as 07:43 on 02/11/2016.

# toolkit.irap.org

Treatment type -  
delineation

Clear delineation is required at intersections to inform road users that there is an intersection present and to provide information about the types of manoeuvres that may occur.

In the worst case situation, road users may not realise that an intersection is present, and collide with other vehicles or road users, often at high speeds. Poor delineation may also result in late braking behaviour by road users who are required to stop, or wish to make turns. Improvements to intersection delineation can be made by making adjustments to, or installing new traffic islands, street lighting, linemarking and signs.

Linemarking deficiencies (such as unclear approach lane lines, and faded or missing Stop or Give Way markings) are easily and cheaply treated. Warning signs can be used to give drivers advance notice of an upcoming intersection. They are also cheap to install and particularly useful where the intersection is sub-standard. Median islands (or splitter islands) can be used on the approaches to intersections to improve the provision of additional signs on median islands), and provide an additional level of pedestrian protection if designed well. Improving delineation issues

Improvements can be  
made....by markings and  
signs

- Reductions in speed.
- Awareness of the Intersection is increased.
- Vehicles are directed to a clearer path through the intersection.
- Median islands (if used) can create a refuge for pedestrians crossing the road, thus reducing the likelihood of pedestrian/vehicle crashes



## Related Images



## Treatment Summary

Costs	Low
Treatment life	1 year - 5 years
Effectiveness	10-25%

## Reference

- iRAP Road Quality
- iRAP Road Channelisation
- iRAP Road Attribute Risk Factors - Sight Distance
- Department of Main Roads, Intersections at Grade
- Department for Transport, Energy and Infrastructure (South Australia), Pavement Marking Manual
- Towards Safer Roads - (191-191) 24-25-173-173

Benefits – 10-  
25%crash  
reduction



# toolkit.irap.org

Crash type –  
loss of control

Crash Types

Road Users

Treatments

Management

About

English

Crash Types > **Run Off Road**

Like Share 0 Tweet G+ 0

Run-off-road crashes are common, especially in high speed areas. They occur at bends and on straight sections of road. In high speed environments they can have severe outcomes, particularly if an object is hit (for example trees, poles, pedestrians) or there is a steep embankment or cliff.

Research shows that the survival rate for hitting an object head-on reduces dramatically above 70 km/h, while a side impact into a pole or tree is greatly reduced at speeds above 40 km/h. Therefore, the consequences of running off the road above this speed will often be severe.

Print this page

IRAP gfkp

Related images

07:47  
02/11/2016

# toolkit.irap.org

## Treatment types – for loss of control

(e.g. rumblestrips), improve the chance of recovering control of the vehicle if it does leave the road (e.g. shoulder treatments), or reduce the severity of the outcome if a vehicle does leave the road (e.g. clear zones and crash barriers).

Safer Roads	Safer Vehicles	Safer People
Safer Roads	Estimated cost	Casualty Reduction
<a href="#">Delineation</a>	Low	10-25%
<a href="#">Rumble Strips</a>	Low	10-25%
<a href="#">Skid Resistance</a>	Low to medium	25-40%
<a href="#">Roadside Safety - Hazard Removal</a>	Low to medium	25-40%
<a href="#">Sidelops Improvement</a>	Medium	10-25%
<a href="#">Roadside Safety - Barriers</a>	Medium	40-60%
<a href="#">Shoulder Sealing</a>	Medium	25-40%
<a href="#">Speed Management</a>	Medium	25-40%
<a href="#">Traffic Calming</a>	Medium to high	25-40%
<a href="#">Lane Widening</a>	Medium to high	25-40%
<a href="#">Median Barrier</a>	Medium to high	60% or more
<a href="#">Realignment - Horizontal</a>	High	25-40%
<a href="#">Realignment - Vertical</a>	High	10-25%

### Related Case Study

**Bruce Highway (Cooroy to Curra) Upgrade**  
"Description" The AUD\$513 million Section B project formed part of the Bruce Highway (Cooroy ...

[Read more](#)

[6 more related case studies](#)

Did you know?

Latest Case Studies

07:48

02/11/2016

# toolkit.irap.org

Case studies of effective treatments

Case Studies > Improved Line Marking and Rumble Strips

Search...

Like Share 0 Tweet G+ 0

## State Highway 1, Waikato, New Zealand [Show map](#)

### Introduction

Between 2000 and 2004, a 200km section of State Highway 1 experienced 402 crashes, including 54 fatal crashes and 84 serious injury crashes.

A detailed analysis found that a high proportion of the crashes were loss of control and head on, and of these, two thirds occurred when it was raining and/or at night. Fatigue and inattention of both local and non-local drivers were identified as significant factors in the crashes.

### A 3-E's Approach

A 3-E's (Education, Engineering & Enforcement) approach was undertaken to address the problem. The overall study was titled South Waikato And Taupo Towards 2010 Targets (SWATT 2010). Education and enforcement efforts were applied to the entire 200km section of road. However, 37km of that section was also subject to engineering efforts. This involved upgrading signs and delineation and installing audio tactile pavement markings (or rumble strips). The focus of this case study is on the 37km stretch.

### Key Challenges

The focus was to keep drivers alert, on the road, and within their lane. Enhanced line delineation and audio-tactile devices were obvious mitigation measures. However this presented a number of challenges, including

- New Zealand's Manual of Traffic Signs and Markings (MOTSAM) allows for the installation of wide and profiled markings however edge-lines could only be widened to 200mm.
- MOTSAM requires a clear tracking width of 3.5m between profiled markings.
- Installing wide double yellow profile centrelines would require relocating the wider profile edge-lines a further 250mm outwards. This has cost implications of removing the existing edge-line and safety implications of reduced shoulder width and vehicle tracking closer to an often unforgiving roadside.
- Anecdotal evidence that traditional thermoplastic profiled markings were not proving to be durable under frequent over-tracking particularly by heavy vehicles and/or on the inside of curves.
- The high initial and maintenance costs.

Print this page

iRAP

GTKP

### Related Images



### Treatment Summary

Costs	\$425,000
Treatment life	5-10 years
Casualty Reduction	67% reduction in fatal and serious crashes versus a 38% reduction at the non-treated sites

### Related Crash Types

Head On  
Run Off Road

# toolkit.irap.org

**Delineation treatments described**

## Innovation

To address the challenges, a system was devised by a group comprising of New Zealand Transport Agency staff led by Colin Brodie (national safety engineer), consultants, Darrar Industries and NZ Road Markers Federation staff. The system involved

- Marking dual 150mm double yellow profiled centreline markings with a 100mm gap. This provides a 400mm wide painted barrier between opposing lanes.
- Widening the existing 100mm edgeline to 150mm.
- Installing 150mm wide ribs immediately outside of the painted edgeline. When looking along the edgeline from a driver's viewpoint, the line appears to be 300mm wide. The resultant clear trafficable width between edgelines is 3.25m and a slightly substandard 3.4m between profiled markings. The layout is illustrated in the 'Related Images' box to the right. The Related Images box also contains photos of the finished treatments.

## Evaluation

An comparison of the number of crashes on the 37km section of road before the treatment (April 2004 to November 2005) and after the treatment (April 2006 to November 2007) was undertaken. This showed that fatal and serious injury crashes dropped by 67%.

The evaluation also involved comparison of the crash reduction on the 37km section of road with the remainder of the 200km section of road, which had been subject to enforcement and education efforts, but not engineering efforts. This section of road experienced a reduction in fatal and serious injury crashes of 38% in the same period.

The evaluation also determined the reduction in crash costs as a result of the treatments. The 37km section of road experienced a 72% decrease in crash costs, while the remainder of the 200km section experienced a 29% decrease.

## Conclusion

The 3-E's road safety initiatives along State Highway 1 was successful in reducing the number of injury crashes and the cost of road trauma.

The most successful element was the audio tactile pavement markings (rumble strips), which reduced crashes substantially more than the un-treated sections.

Efforts are now underway to lay rumble strips along other sections of State Highway 1 throughout New Zealand. It is estimated that treating approximately 20% of the national highway (2000km) will result in the prevention of 13 fatal crashes and up to 200 injury crashes each year, with a benefit to cost ratio of more than 6:1.

**72% reduction in collisions compared to 29% elsewhere**

# Collision Reduction Single Sites

## UK RoSPA Manual, 2007

Collision Reduction Schemes in Oxfordshire			
Treatment		Reduction	No of sites
URBAN	Pelican crossing	25%	39
	Traffic signals	50%	12
	Mini-roundabout	40%	34
	Road humps	50%	49
	Speed cameras	25%	46
RURAL	Right turn lane	60%	10
	<b>Signing</b>	<b>30%</b>	<b>103</b>
	Anti-skid at junction	30%	11
	Visibility improvement at junction	20%	18
	Visibility improvement on bend	40%	13
	<b>Bend signing</b>	<b>30%</b>	<b>140</b>
	Anti-skid on bend	50%	13
	30 mph village speed limits	25%	180
	Speed cameras	15%	16

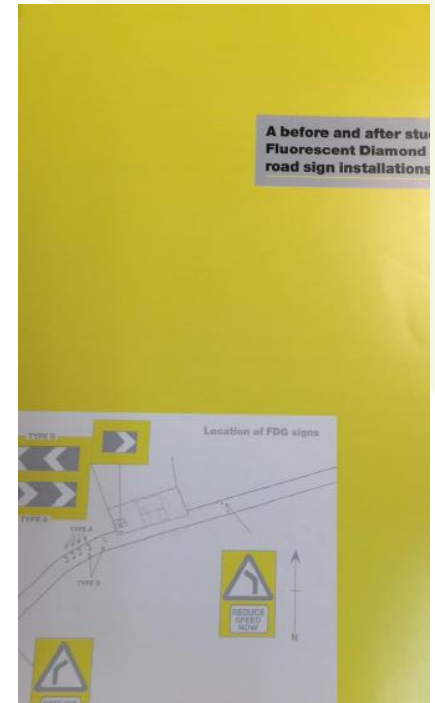
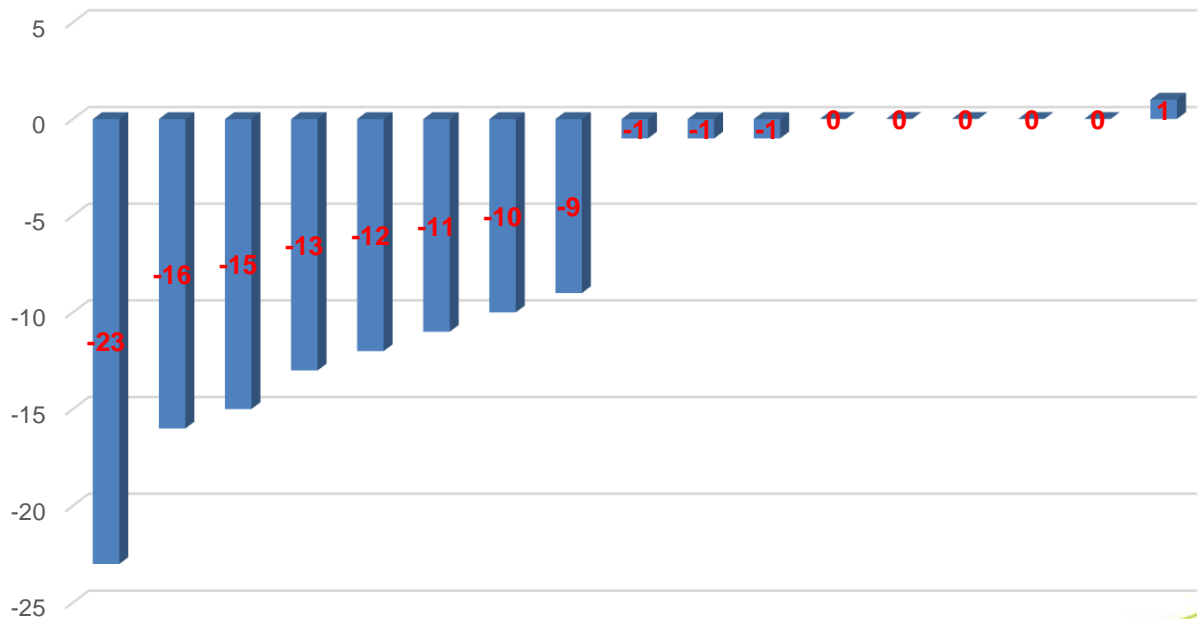
# Ireland Control Data

**Table H: Percentage Collision Reduction by Solution Type 1998-2004 with 5yr before and after data.**

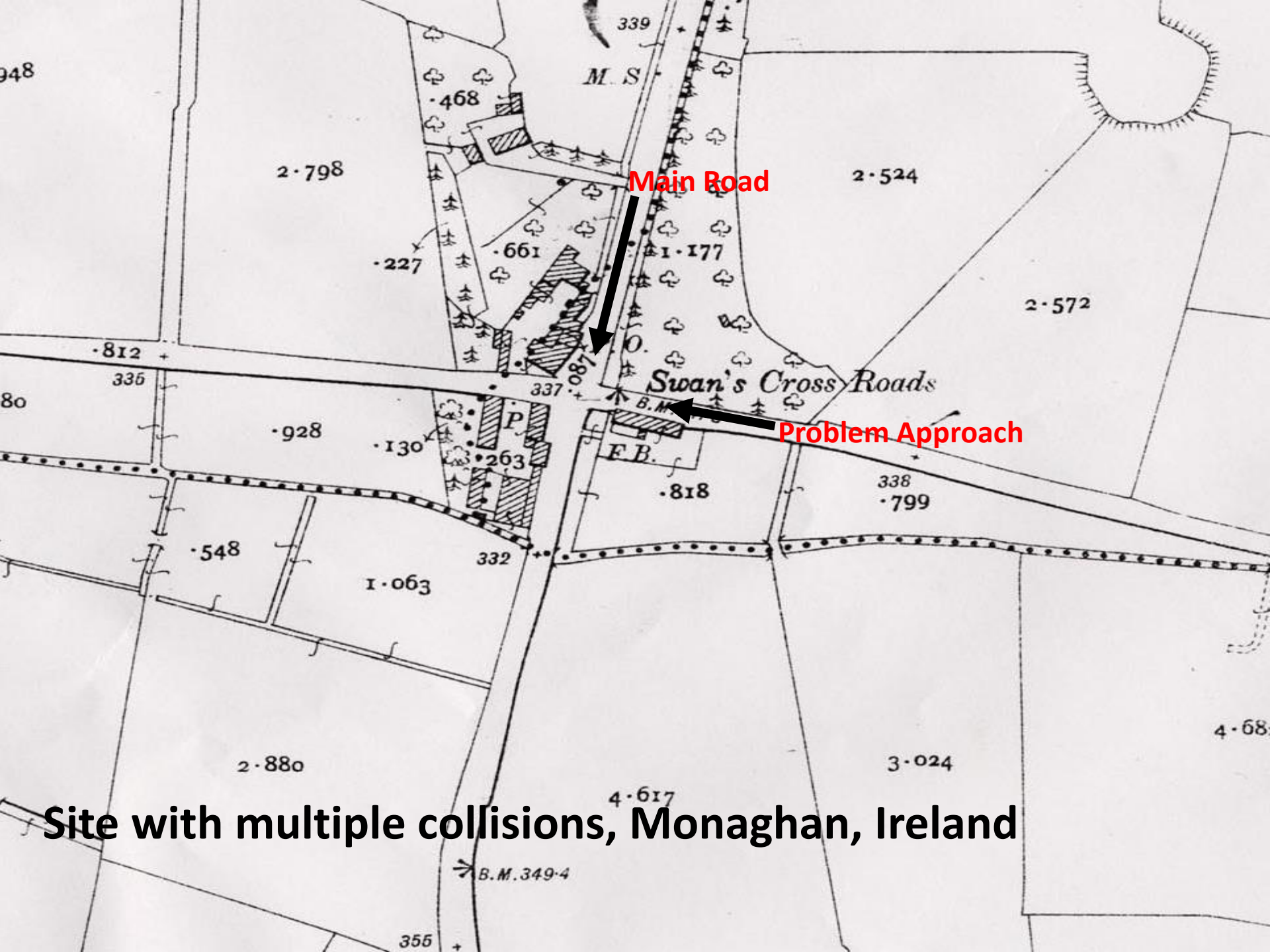
Urban/Rural Area	Short Solution Description	Number of schemes	Total Cost (yr 2002)	% Reduction on Collisions			
				All	Fatal	Serious	Minor
Urban	Antiskid plus other	15	€534,493	26%	100%	12%	26%
Urban	Pedestrian Facilities	29	€594,090	-17%	44%	18%	-34%
Urban	RTL	12	€480,818	-16%	86%	74%	-84%
Urban	Signing & Lining	47	€905,067	11%	51%	24%	6%
Rural	Crash Barrier plus other	11	€378,200	50%	69%	10%	61%
Rural	Lighting plus other	14	€688,841	67%	100%	69%	56%
Rural	Right Turn Lane plus other	57	€2,537,147	44%	37%	72%	32%
Rural	Sight Distance	30	€852,463	24%	63%	35%	13%
Rural	Sign & line	182	€3,005,985	15%	48%	22%	6%
Rural	Surfacing & Sign & line	24	€1,068,215	34%	39%	25%	36%
<b>Total</b>		<b>421</b>	<b>€11,045,319</b>	<b>20%</b>	<b>52%</b>	<b>32%</b>	<b>10%</b>

# TMS research mid-1990s

Percentage reduction in 85%ile speed at locations treated with FDG signs



safer roads for everyone



Main Road

Problem Approach

Swan's Cross Roads

Site with multiple collisions, Monaghan, Ireland





100m



40m



STOP

188

STOP

STOP

20m



**Low cost treatment**

# Low cost treatment





New Private Access of new bridge

41m From Archeological Site to Fenceline

Extent Of Works

New Bridge reusing existing masonry piers

Land Take Line

Extent Of Works

New Bridge

ch 200

ch 100

Major Scheme

83 *Lios Darach*  
NEWBLISS

*Muinchille*  
COOTEHILL

*neachan* →  
NAGHAN R188



100m



100m







# Signing as part of a package of measures





safer roads for everyone



safer roads for everyone

# Road Safety Audit (UK & Ireland HD 19) and Road Safety Inspection (Ireland HD 17)



# Road Safety Audit Definitions and Ethos

- “independent detailed systematic and technical safety check relating to design characteristics of a road infrastructure project covering all stages from planning to early operation”
- “who can be hurt here and why?”
- “Prevention is better than cure”
  
- to minimise collision numbers and severity
- to consider the safety of all road users - especially vulnerable road users



# Who should carry out Audits?

- independent of the design team
- at least two people with Road Safety Engineering “expertise”
- Certificate of Competency on TERN road schemes
- Competent team appointed by the employer



# Format of Safety Audit report

- list audit team members and others involved
- list safety issues - problem followed by recommendation stating the safety problem as clearly as possible
- list all plans and other information
- sign and date the report
- report requires a **response**



# Road Safety Audit and “enforcing” Regulations

- The Road Safety Auditor is NOT there to ensure conformity of signs and markings to regulatory requirements



Department  
for Transport

*DfT Circular 01/2016*

The Traffic Signs Regulations  
and General Directions 2016



**TMS**

safer roads for everyone

# Road Safety Audit and “enforcing” Regulations

- **However**, if road user safety is compromised in relation to
  - Size of sign and speed of road
  - Reflectivity of sign
  - Width of markings
  - Consistency of signage
  - Road user understanding of signs and markings
- **Then the Audit should comment**

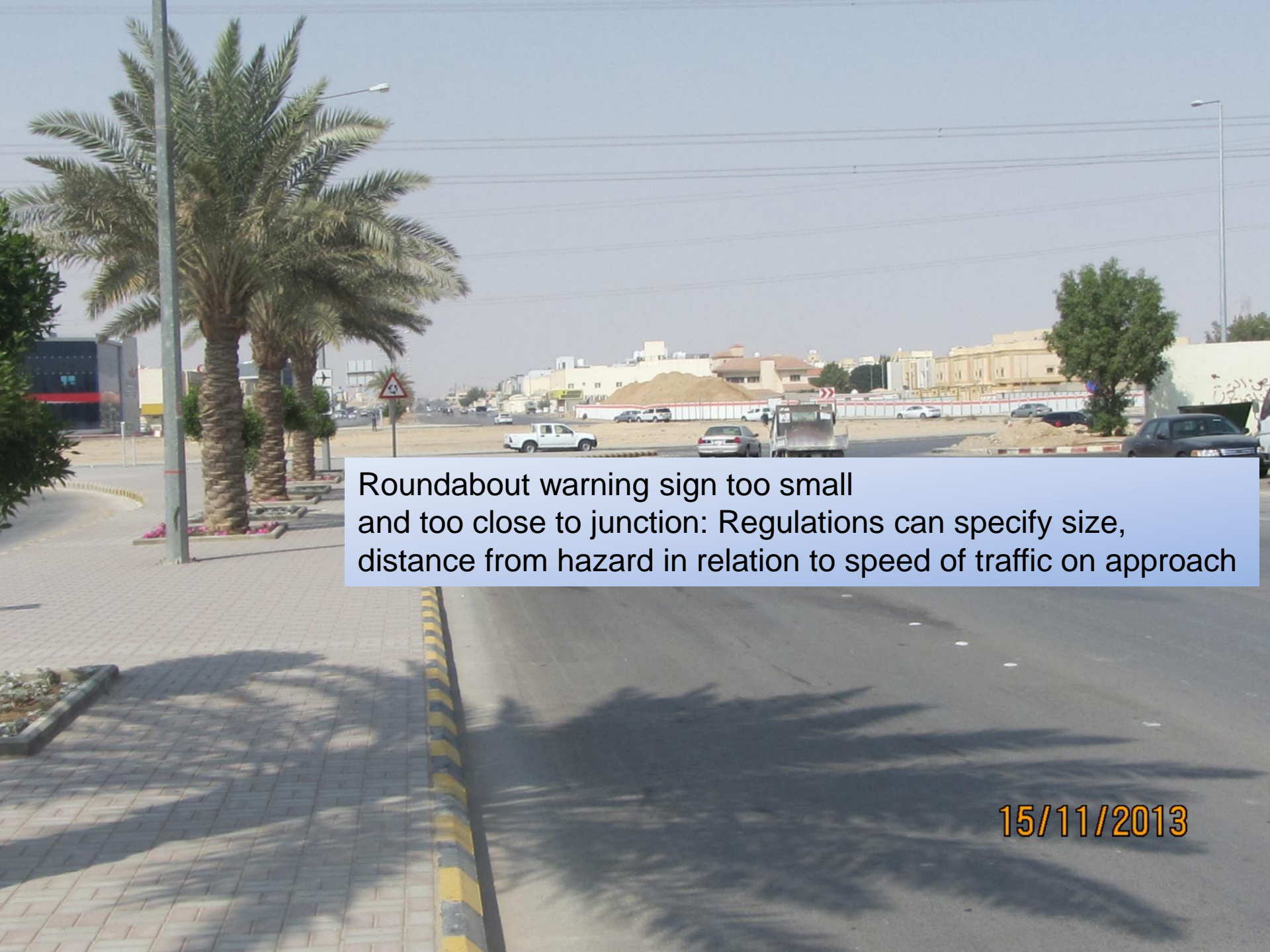






Inappropriate and misleading Direction Sign for roundabout junction – Regulations can specify Format of sign required





Roundabout warning sign too small  
and too close to junction: Regulations can specify size,  
distance from hazard in relation to speed of traffic on approach

15/11/2013



Roundabout chevron too small, not reflective.  
Again, Regulations can specify appropriate requirements

15/11/2013









**camping**

4000 m

→ **BUINI** LEGNAMI

"ORA" →

← PIZZA al TAGLIO  
**da CICCIO**

← **TRATTORIA da Elide**

← **LOS ANGELES**

← trattoria "SANTUCCI"

**PowerTech** →

← Agriturismo **IL GIRASOLE**  
DIREZ. ASSISI di ILVEA CIANETTI  
www.il.girasole.agriturismo.com

← **RISTORANTE - PIZZERIA LA TAVOLA ROTONDA**  
TEL. 075 - 846200

← **RISTORANTE • PIZZERIA Hotel Bellavista**

← **VISCONTI** CENTRO **TIM**  
ELETTRONICA

← **Castello di Petrata**  
 Country House

← **Le Colombe**  
Agriturismo 075-846200

← **iron** →

← **UMBRIA MARKET**  
PRODOTTI TIPICI • CERRATERA

← **ARREDAMENTI SPAZIOTRE**

← **HENRY** *Club* →

**LGM** →

← **UmbriaGas**  
PACIFICI GAS AgipGas

← **DUETSPORT**  
Vendita Diretta in Fabbrica

← **IL MANIERO**  
CANTIERI IN LEGNO

← **GOMMISTA**  
In vendita pneumatici di S. Marino

← **LASA** **LAZZI** MARCONI  
PAPERI ACCIAIATI • OFFICE IN ALLUMINIO  
IN TUTTI I SERVIZI APPROFONDITI SERVIZIO

← **ABACUS HOTEL**  
\*\*\* 075.8043840

← **PERLA** ARREDAMENTI

← **UmbriaGas**  
AgipGas

← **OFFICINA RIPARAZIONI AUTO**  
EZO GAMBACORTA

← **SIR** INDUMENTI SICUREZZA SUL LAVORO

← **ARREDO INN.**  
NEGOZI - BAR - INTERNI

← **DAL CACCIATORE**

← **La Basilica**

← **HOTEL LE MUSE**

← **La Mora** AGRITURISMO

← **McDonald's**

← **ALBERGO DONNINI**  
075-846200 FRONTI BASSILICA

← **TRATTORIA DEGLI ANGELI** CON PIZZERIA BAR AL GIARDINETTO 2° PIANO - PIAZZA S. MARCO 1000

← **IL RISTORO**  
BAR - PIZZERIA - RISTORANTE - PIZZERIA

← **RESIDENCE SERENA**  
APPARTAMENTI - LICENZE - PISCINE

← **HOTEL CRISTALLO**

← **RISTORANTE DEGLI ANGELI**

← **Il Feudo** WINE BAR →

← **IL POGGIO DEGLI ANGI** →

← **COINALL**

← **Mantovani**









Spring Croft  
we make it happen

BG61 FVW







1



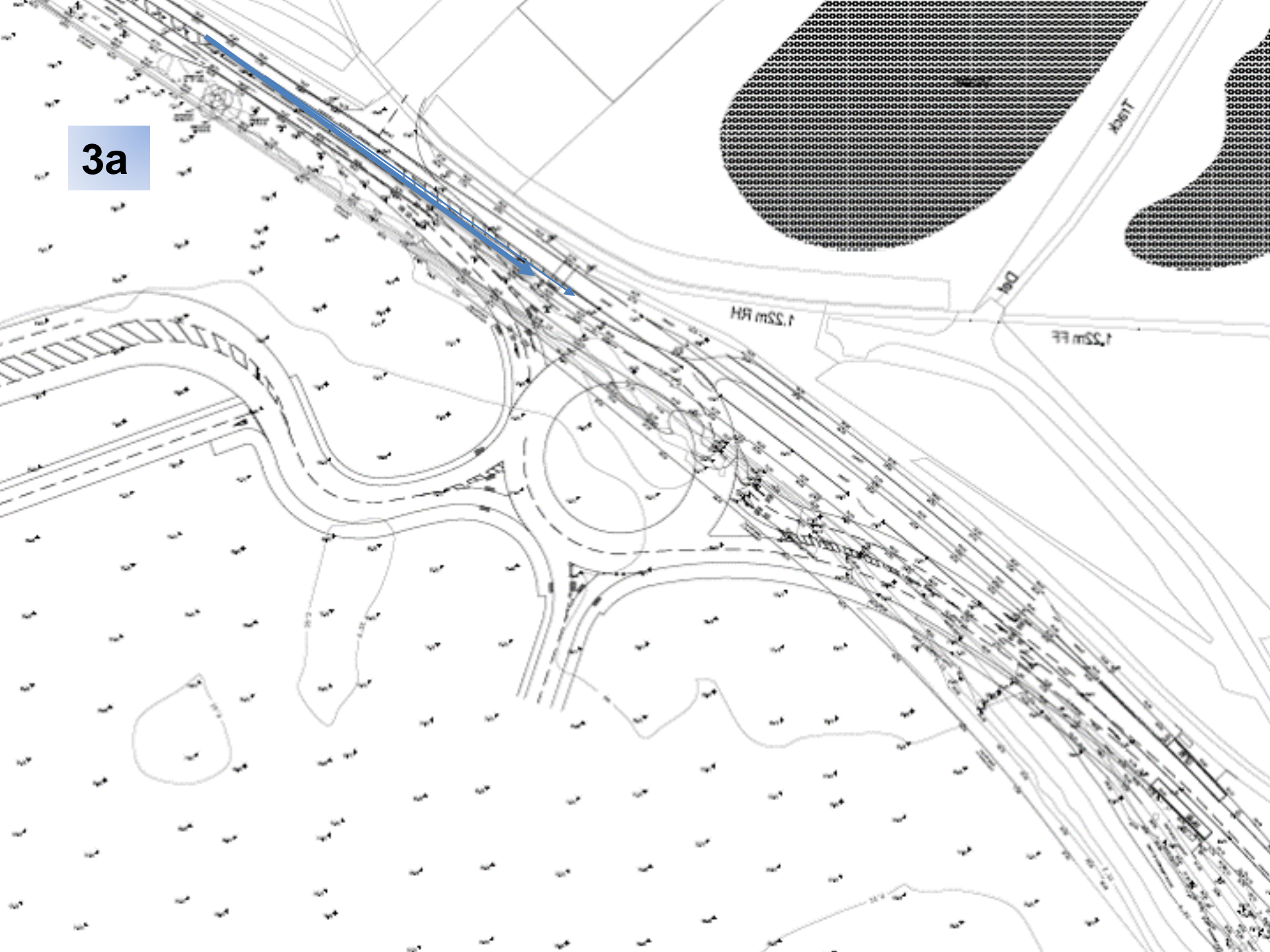
14.10.2008

2



safer roads for everyone

3a





**3b**



4

M2 10 11 ← Margit hid  
M1 M6 M7 → Petöfi hid  
200 m



5

Bentilee  
Neighbourhood  
Centre →

Humps →

30

REDUCE  
SPEED  
NOW





JINDŘICHKA  
HOTEL RESTAURACE

SUI

MILDER III  
ZANER  
KIKOV  
VCA



700 m  
McDonald's

POZOR  
JEJTE BEZPEČNĚ  
STŘEŽTE SE  
PŘED PŘEJEZDEM

KRUŠOVICE

PIZZA

LOCA

LOCA  
VEN PŘÍMA AČI

LOCA  
KROKOVANÉ  
KROKOVANÉ  
KROKOVANÉ

TAXI  
FIX  
AIRPORT CARS  
ŠKODA POJISTENÍ  
JISTINE VÁS KDEKOLIV  
LAJ 2279

BEKKA  
SPECIALTY COFFEE

POZOR



JEĎTE BEZPEČNĚ

CYKLO . PRAHA . EU

★ Heineken

★ Heineken

Shisha 100%  
EVERY DAY



★ Heineken

★ Heineken

55

oye

Loca  
VEN PARA ACA

★ Heineken

FREE  
COCKTAIL

6€



POZOR  
PŘEJÍZD  
TE BEZPEČNĚ

KRUŠOVICE



LUNCH  
OBĚDOVÉ

















TRAVEL TIME	MINS
M4 J7 MAYNOOTH	24
N4 J1 (MSO)	34



M6   
Nil aon seirbhísi ar líne ar fáil romhat  
Seirbhísi as líne romhat  
30km - 45km - 60km - 90km

M6  
W  
7.5













*e an Chláir*  
**ESBOROUGH**

**1km**







22/11/2012


















24/11/2012

**Table 5.1: Summary of public understanding of prohibitory traffic signs**

Traffic Sign	 <p data-bbox="372 586 575 682">No motor vehicles</p>	 <p data-bbox="645 586 900 629">No vehicles</p>	 <p data-bbox="958 586 1209 686">No pedestrians</p>	 <p data-bbox="1271 586 1508 682">Height restrictions</p>	 <p data-bbox="1580 586 1818 682">Weight restrictions</p>
% of respondents demonstrating correct comprehension	88%	84%	83%	94%	96%

Signs installed according to appropriate Regulations are understood by the majority of road users: UK DfT

# Road Safety Inspections

- Ordinary periodical verification of the characteristics and defects of an operational road that require maintenance work for reasons of safety
- “Safety Audit of an existing road”
- Can be undertaken using IRAP “star rating” procedures
- Requires similar independent, qualified, audit team



# Road Safety Audit workshop

- Examine the photos in small groups
  - What is it here that could hurt someone?
  - Who can be hurt?
  - What sort of collision could occur?
  - What could you do to prevent it?





safer roads for everyone

# Summary – Road Safety Management in Europe



# European Directive - EC Directive 2008/96/EC

## Application to Trans European Road Network (TERN)

### “Existing” roads

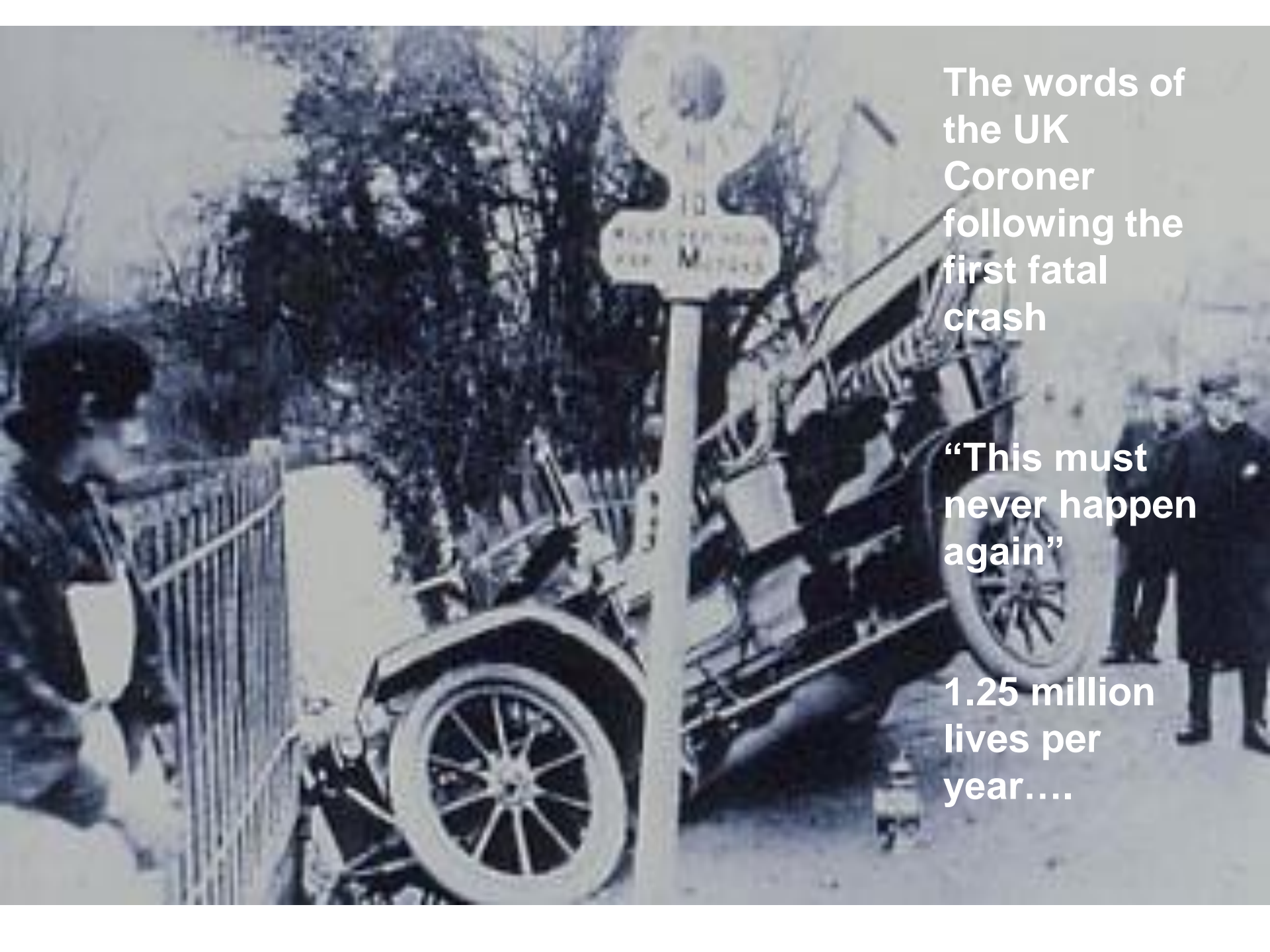
- Network Management (Collision Investigation/ Cost Benefit Analysis)
- Road Safety Inspections

### New roads and road improvements

- Road Safety Impact Assessment
- Road Safety Audit







The words of  
the UK  
Coroner  
following the  
first fatal  
crash

“This must  
never happen  
again”

1.25 million  
lives per  
year....