



## Catalogue of Design Safety Problems and Countermeasures

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# Catalogue of Design Safety Problems and Countermeasures

## Format of talk

Highway Factors – Road Design

What is Road Safety Audit?

What is Road Safety Inspection?

Purpose of Catalogue

Structure of the Catalogue

How to use the Catalogue

Examples



# Catalogue of Design Safety Problems and Countermeasures

## Highway Factors

**Geometric design**

**Visual Messages**

**Misleading Information**

**Lack of Provision**

# Catalogue of Design Safety Problems and Countermeasures

## What is Road Safety Audit?

**Safety Audit report is a formal document, describing a problem...**

- *"who can be hurt and in what way?"*

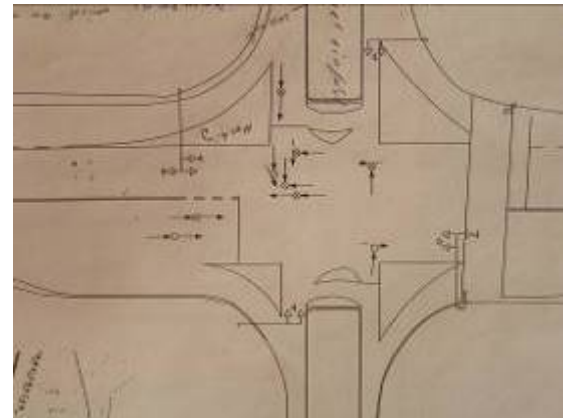
**...and a recommendation**

- *How the risk can be removed or reduced*

**Report is produced for the scheme client**

**Client decides how to respond to the recommendations**

**Important to document the Safety Audit process**



# Catalogue of Design Safety Problems and Countermeasures

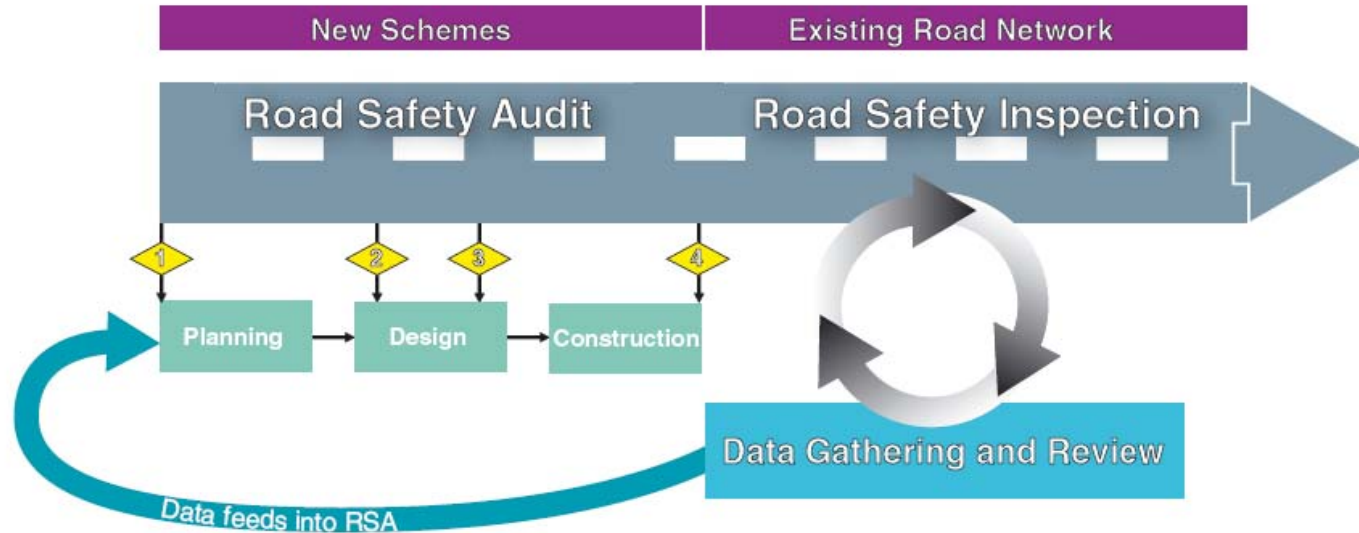
## What is Road Safety Inspection?

**A Road Safety Inspection (RSI) is an on-site systematic review of an existing road or section of road to identify hazardous conditions, faults, deficiencies that may lead to serious accidents**



# Catalogue of Design Safety Problems and Countermeasures

## Interrelationship of RSA and RSI



# Catalogue of Design Safety Problems and Countermeasures

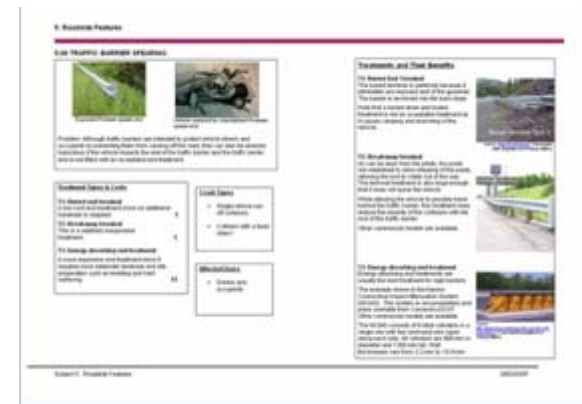
## Purpose of the Catalogue

To give a readily understood presentation of problems

To suggest a range of potential solutions

To give an indication of comparative solution costs

To facilitate prioritisation of work



# Catalogue of Design Safety Problems and Countermeasures

## Structure of the Catalogue

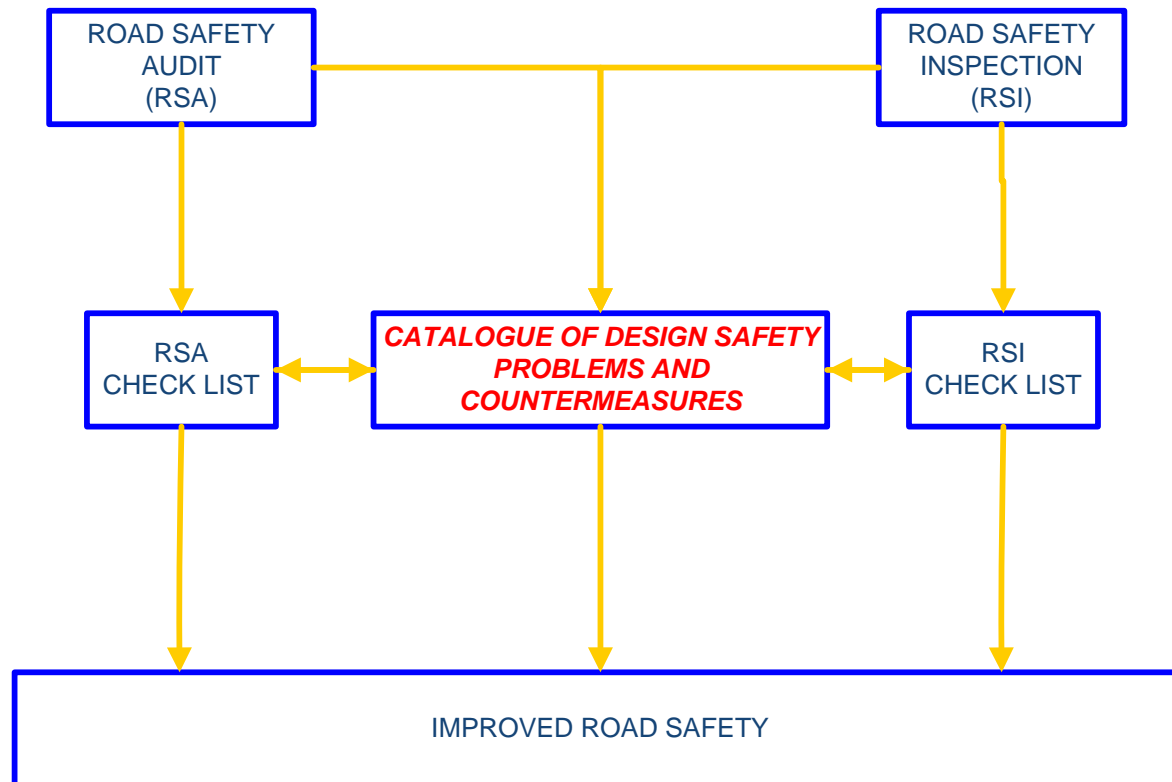
### Headings taken from RSA and RSI Checklists

- Function
- Cross Section
- Alignment
- Intersections
- Public and Private Services
- Vulnerable Road Users
- Traffic Signing, Marking and Lines
- Roadside Features



# Catalogue of Design Safety Problems and Countermeasures

## Interrelationship of Documents



# Catalogue of Design Safety Problems and Countermeasures

## How to use as part of the RSA process

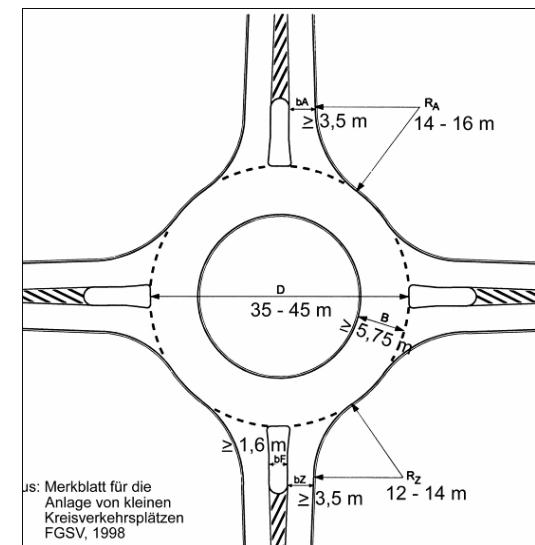
Consider the subject area (e.g. intersections)

Use examples of what can go wrong as a guide during the design process

Use indicative costs to decide on most cost-effective solution

Implement design

Monitor



# Catalogue of Design Safety Problems and Countermeasures

## How to use as part of the RSI process

Review the area/network of concern

Consider the potential accidents that could occur from the individual sections of the guidance e.g. intersections

Look at potential remedial measures

Estimate accident savings and economic benefits

Decide on remedial measures

Prioritise work

Implement remedial measures

Monitor



# Catalogue of Design Safety Problems and Countermeasures

## Potential accident savings

Accident problem	Remedial treatment	Schemes	Average cost (£)	Reduction in accidents (%)
Wet skidding accidents	Anti skid surface	34	8620	57
Loss of control on bends	Chevron signs	14	2505	43
Darkness accidents	Lighting	14	9709	21
Accidents at existing signals	Signal improvement	16	17095	22
Right turn accidents	Right turn lane	12	11849	48
Poor visibility	Visibility improvement	12	7890	27
Vehicle accidents at junctions	Junction improvement	34	18513	44
Fail to give way at junctions	New traffic signals	15	40717	67
Junction accidents	Mini roundabout	18	14769	49
Inappropriate speed on links	Speed camera	28	18236	13
Pedestrian accidents on link	Controlled crossing	73	15916	31
Pedestrian accidents on link	Refuges	65	10387	37
Pedestrian accidents at existing crossing	Crossing improvement	35	11057	41
Pedestrian accidents	Guard rail	28	6230	30
Various	Markings	43	2020	34
Various	Markings and signs	63	2537	41
Various	Package of measures	97	22099	42
Various	Resurfacing	27	13810	46
Various	Road improvement	38	15882	62
Various	Warning signs	36	553	46

# Catalogue of Design Safety Problems and Countermeasures

## Example from catalogue

Description of Problem

Potential Solutions



Comparative Cost

Affected?

Accident Type

5. Roadside Features

5.06 TRAFFIC BARRIER SPEARING

Exposed W-beam splice end

Vehicle speared by unprotected W-beam splice end

Problem: Although traffic barriers are intended to protect vehicle drivers and occupants by preventing them from running off the road, they can also be severely hazardous if the vehicle impacts the end of the traffic barrier and the traffic barrier end is not fitted with an acceptable end treatment.

**Treatment Types & Costs**

**T1: Buried end terminal**  
A low cost end treatment since no additional hardware is required. \$

**T2: Breakaway terminal**  
This is a relatively inexpensive treatment. \$

**T3: Energy absorbing end treatment**  
A more expensive end treatment since it requires more elaborate hardware and site preparation such as levelling and hard surfacing. \$\$

**Crash Types**


- Single vehicle run-off collisions
- Collision with a fixed object

**Affected Uses**

- Drivers and occupants


**Treatments and Their Benefits**

**T1: Buried End Terminal**  
The buried terminal is preferred because it eliminates any exposed end of the guardrail. The barrier is anchored into the back slope. Note that a turned down and buried treatment is not an acceptable treatment as it causes ramping and launching of the vehicle.




Buried Terminal Type 2

**T2: Breakaway terminal**  
As can be seen from the photo, the posts are weakened to allow shearing of the posts, allowing the end to rotate out of the way. The terminal treatment is also large enough that it does not spear the vehicle. While allowing the vehicle to possibly travel behind the traffic barrier, this treatment does reduce the severity of the collisions with the end of the traffic barrier. Other commercial models are available.



**T3: Energy absorbing end treatment**  
Energy absorbing end treatments are usually the best treatment for rigid barriers. The example shown is the Narrow Connecticut Impact Attenuation System (NCIAS). The system is non-proprietary and plans available from Connecticut DOT. Other commercial models are available. The NCIAS consists of 8 steel cylinders in a single row with two anchored wire ropes along each side. All cylinders are 900 mm in diameter and 1200 mm tall. Wall thicknesses vary from 3.2 mm to 15.9 mm.



Subject 5: Roadside Features

28/02/2007

# Catalogue of Design Safety Problems and Countermeasures

## Example from catalogue cont'd

### Description of Problem



Exposed W-beam spade end



Vehicle speared by unprotected W-beam spade end

Problem: Although traffic barriers are intended to protect vehicle drivers and occupants by preventing them from running off the road, they can also be severely hazardous if the vehicle impacts the end of the traffic barrier and the traffic barrier end is not fitted with an acceptable end treatment.

# Catalogue of Design Safety Problems and Countermeasures

## Example from catalogue cont'd

### Potential Solutions

#### Treatments and Their Benefits

##### **T1: Buried End Terminal**

The buried terminal is preferred because it eliminates any exposed end of the guardrail. The barrier is anchored into the back slope.

Note that a turned down and buried treatment is not an acceptable treatment as it causes ramping and launching of the vehicle.



Source: [www.wedot.wa.gov](http://www.wedot.wa.gov) (Washington State Department of Transportation)

##### **T2: Breakaway terminal**

As can be seen from the photo, the posts are weakened to allow shearing of the posts, allowing the end to rotate out of the way. The terminal treatment is also large enough that it does not spear the vehicle.

While allowing the vehicle to possibly travel behind the traffic barrier, this treatment does reduce the severity of the collisions with the end of the traffic barrier.

Other commercial models are available.



##### **T3: Energy absorbing end treatment**

Energy absorbing end treatments are usually the best treatment for rigid barriers.

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Source: <http://www.ct.gov/ctdot/ncias/ncias.asp?ap=1387&cs=23953> (Connecticut Department of Transportation)

# Catalogue of Design Safety Problems and Countermeasures

## Example from catalogue cont'd

### Treatment Types & Costs

#### **T1: Buried end terminal**

A low cost end treatment since no additional hardware is required. \$

#### **T2: Breakaway terminal**

This is a relatively inexpensive treatment. \$

#### **T3: Energy absorbing end treatment**

A more expensive end treatment since it requires more elaborate hardware and site preparation such as levelling and hard surfacing. \$\$

### Crash Types

- Single vehicle run-off collisions
- Collision with a fixed object

### Affected Users

- Drivers and occupants

Accident Type

Affected?

Comparative Cost



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Thank you all very much for your attention

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